The 9th

ANNUAL REPORT

of the

WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER

Montana Agricultural Experiment Station

Conrad, Montana

1986

Submitted by

Dr. Gregory D. Kushnak, Superintendent & Crop Scientist

MAES Research Report

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1986 Research Center Activities

The Western Triangle Research Center received a large share of budget cuts in 1986. In addition to the standard cuts received by all state agencies/departments, two positions were left vacant at Conrad. These were the Soil Scientist position, and its associated technician. In efforts to provide research in the soils area, the remaining staff took on some of the soils work in addition to the crops project. After weeding out some experiments, we managed to "squeak" through the season to provide good research data. Grain variety work was increased somewhat by adding irrigated trials, while only a portion of the alternate crops work was carried out. The soils work consisted primarily of fertilizer placement trials, using 2 types of drills. These trials addressed only a few of the many questions pertaining to fertilizer placement (see list, page 47).

The winter months were extra busy with the construction of a variable row space, deep fertilizer banding, no-till drill; which was used for fertilizer placement studies this summer. The drill was built by Ron Thaut, who is on the Research Center Staff. The design and capabilities of the drill are described on pages 45-48, of this report; and the fertilizer placement results presented on pages 49-52. The total cost of materials for the drill was approximately $6000, which was granted by the Fertilizer Check-off Committee and the Montana Wheat Research & Marketing Committee.

In addition to the "homemade" drill, a commercially manufactured no-till drill was obtained for cooperative use among the 3 Research Centers at Conrad, Havre and Moccasin. The drill is a 10-foot wide 'Yielder' model USDA III, and was modified for experimental plot use. The Yielder company provided $38,000 toward the purchase of the drill, which was matched by $20,000 from the Wheat Research & Marketing Committee, and $15,640 from the Montana Agri. Experiment Station.

Another winter project was the construction of a sign for the Research Center entrance. Considerable money was saved by building the sign in our own shop, and the quality is very professional. The sign was constructed and routed by Research Center staff members Larry Christiaens and Ron Thaut.

Grant funds were used to purchase a "wind-shielded" sprayer boom to allow spraying adjacent to sensitive crops. The need to spray grain adjacent to young trees or oilseed crops, and to spray chem-fallow adjacent to grain were two situations which motivated this project. Considerable time was spent during the winter months modifying the boom to accomodate plot layouts.

On June 25, the Research Center hosted a weed school for Triangle Area farmers and ranchers. Special demonstration plots were planted for the school, which was conducted by the Triangle Area County Agents. Coordinators were Teton County Agent Walt Adams, and Extension Weed Specialist Jim Nelson.

On July 1, the Research Center hosted the Montana Agr. Experiment Station summer research conference. The conference rotates to a different location each summer, and allows agricultural researchers from other parts of Montana to see and discuss research at various locations of the state.

Special tours were held at the Research Center on April 19 for a scout troop; May 14 for agricultural students from Lakeland College, Vermillion, Alberta; July 2 for the Toole County Soil Conservation District supervisors; and July 10 for Triangle Area Soil Conservation Service personnel.

Off station research plot tours were conducted, in cooperation with Triangle Area County Agents and the Soil Conservation Service, at Floweree (July 8), the Knees (July 8), Chester (July 9), Cut Bank (July 22), and Dupuyer (August 13). A Research Center field day was held July 15, with approximately 100 farmers and ranchers in attendance Topics of the tours included grain varieties, grass species, fertilizer placement/row spacing, no-till, weeds, and insects. The locations of off-station tours are often rotated each year, and there is usually a Research Center field day every other year.

Research Center staff during 1986 included Dr. Greg Kushnak, Superintendent; Research Technicians Ron Thaut and Larry Christiaens; and Gladys Dunahoo, secretary (half time).

The Advisory Committee held a meeting on March 5, 1986. MAES Director Dr. Jim Welsh was present, and explained the need for holding the soils position vacant at Conrad during these times of budget cuts.

Following is a list of 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 Gettal, Power, Teton Co.	1980-85

(continued)

Re-appointed through 1985

Gary Iverson, Sunburst, Toole Co.

New appointment through 1985

Ted Neuman, Vaughn, Cascade Co.
Bill McLean, Brady, Chouteau Co.

New appointment through 1986

Leif Larson, Choteau, Teton Co.

New appointment through 1987

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.
Bill Richter, Choteau, CES Representative (ex-officio)

New appointment through 1988

Mark Grubb, Pondera Co.

New appointment through 1989

Dave Gettal, Power, Teton Co.

Climatic summary for the 1986 calendar year at the Western Triangle Research Center, Conrad, MT.

	1986 Month												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total or average
Precipitation (inches)	.18	.48	.87	.87	2.15	1.72	.74	.33	4.38	.40	.34	.13	12.59
Mean Temperature (°F)	33.9	16.9	40.7	42.2	50.9	64.7	65.0	65.8	50.9	48.3	24.6	29.6	44.5

Last killing frost in spring *----------May 16 (32°)

First killing frost in fall *----------October 3 (28°)

Frost free period----------139 days

Maximum summer temperature----------August 19 (93°)

Minimum winter temperature----------February 20 (-24°)

* In this summary, 32°F is considered killing frost.

Soil moisture probe depth = 42" on fallow (or 7" available water); 42" on stubble (or 7" available water).

Summary of climatic data by months for the 1985-86 crop year (September thru August) at the Western Triangle Agricultural Research Center, Conrad, MT.

	Sept 1985	Oct 1985	Nov 1985	Dec 1985	Jan 1986	Feb 1986	Mar 1986	Apr 1986	May 1986	June 1986	July 1986	Aug 1986	Total or avg.
Precipitation (inches)	4.95	.77	.73	.17	.18	.48	.87	.87	2.15	1.72	.74	.33	13.9
Mean Temperature (°F)	46.4	40.1	15.0	23.9	33.9	16.9	40.7	42.2	50.9	64.7	65.0	65.8	42.1

Last killing frost in spring 1986 *----------May 16 (32°)

First killing frost in fall 1986 *----------October 3 (28°)

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* In this summary, 32°F is considered a killing frost.

Soil moisture probe depth = 42" on fallow (or 7" available water); 42" on stubble (or 7" available water).

TITLE: Winter Wheat Variety Investigations

YEAR: 1986

LOCATION: Western Triangle Research Center, Conrad, Montana

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

Winter wheat variety test plots were grown at 6 locations during 1986, which included Conrad (Research Center), Chester, The Knees, Floweree, Sun River and Eden. The trials at Conrad and Floweree were no-till seeded on chemical fallow and recrop, respectively. The other trials were grown on tillage fallow. All locations had good stands and winter survival, in spite of later than normal planting dates. Soil moisture and rainfall patterns differed among locations, which may have contributed to the difference in how some varieties ranked from one location to the next (Tables 1-6). Some of the varieties which yielded high have either low or unknown winterhardiness levels and should be grown with caution.

The Conrad and Floweree locations showed moderate sawfly damage for most varieties. Varieties that escaped damage fairly well were: Norwin, Rocky, Centurk, Archer, Hawk, Bighorn, Thunderbird, and Wing. This is probably because these varieties reached boot stage before sawfly emergence in the spring. Sawflys prefer to lay eggs in plants prior to the boot stage. Therefore, wheat varieties that head later will be more vulnerable. On the other hand, an early heading variety does not always guarantee escape from sawflys. It depends upon the year.

Table 1. Winter wheat Variety trial grown on no-till chem fallow at the Western Triangle Research Center, Conrad, 1986.

Variety	Plant Height inches	Yield bu/a	Test wt. lbs/bu	Protein %
Neeley	37	84.0	63.1	
Hawk	32	81.6	65.0	
MT 84268	32	77.0	64.1	
Hybritech QT524	34	76.2	62.4	
MT 80122	34	75.6	62.0	
Centurk	36	73.3	62.7	
MT 84458	30	73.0	64.8	
MT 8030	33	72.8	64.8	
MT 84165	35	72.5	63.6	
MT 80203	35	71.4	60.8	
Nugaines (soft white)	29	71.3	56.1	
Archer	30	71.0	62.6	
MT 7951	33	70.9	62.9	
Thunderbird	33	70.3	65.5	
Cree	39	70.0	61.5	
MT 8039	34	69.7	59.9	
Rocky	36	69.4	62.4	
Redwin	39	69.2	62.4	
MT 8003	39	68.9	61.5	
Wing	37	68.4	65.0	
Bighorn	30	68.4	64.1	
MT 84496	36	68.4	62.7	
Hybritech QT515	33	67.8	62.7	
MT 7811 (Hrd White)	35	67.4	62.9	
Winridge	38	67.3	55.5	
MT 79123	28	66.9	60.6	
MT 79121	28	66.7	61.0	
Norwin	26	66.6	62.4	
MT 81139	32	64.6	63.8	
MT 79125	30	64.5	60.0	
Winalta	37	64.2	61.4	
Warrior	39	63.9	63.8	
Citation	28	63.7	63.8	
MT 84059	34	62.5	64.1	
Cheyenne	37	61.7	62.3	
Rosebud	39	60.5	61.8	

continued

Table 1. continued. (Winter wheat varieties, Conrad, cont.)

Variety	Plant Height inches	Yield bu/a	Test wt lbs/bu	Protein %
Agassiz	43	60.2	64.1	
Norstar	43	56.7	60.3	
Roughrider	37	51.6	60.7	
Froid	44	49.2	62.1	

Location: Research center, N. of Conrad
Date seeded: October 2, 1985
Seeding conditions: no-till chem-fallow; seed depth 1½ inches; moisture probe 36".
Emergence date: October 30, 1985
Fertilizer: 100# 11-53-0 with seed + 40 N topdress.
Winter injury: none
Sawfly lodging: moderate; except fair to good escape from damage for Norwin, Rocky, Centurk, Archer, Hawk, Bighorn, Thunderbird, and Wing. Possibly due to earlier boot stage of these varieties.
Harvest date: August 5, 1986

Table 2. Winter wheat variety trial grown near Chester, 1986.
Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad.

Variety	Plant hgt. in.	Yield bu/a	Test wt.	Spring survival class 1/
Centurk	29	44.7	58.8	2
Cheyenne	27	43.8	61.2	3
Neeley	24	43.1	59.2	4
Hawk	20	41.4	58.4	2
MT 8003 (Redw. Sel.)	23	40.4	60.0	4
Rocky	24	40.4	58.9	2
MT 8030	22	40.0	58.1	
Norstar	28	39.8	60.0	5
Redwin	23	39.6	61.2	4
Warrior	23	39.6	58.1	4
Bighorn	20	38.9	59.5	2-3
Winalta	23	38.6	60.1	4
MT 80122	23	37.7	60.7	
Agassiz	23	37.6	59.1	5
Rosebud 2/	22	37.2	57.7	
Cree	23	37.1	61.0	3
Teton Sel.	26	36.0	59.3	
MT 8039	23	35.5	55.8	
Wing	25	35.4	59.5	
Winridge	25	34.5	55.5	3
Thunderbird	25	34.1	59.8	
Norwin	17	33.8	59.8	4-5

Cooperator & location: Mike Violet, 10 miles south of Chester.
Date seeded: September 30, 1985.
Date Harvested: July 23, 1986.
Previous crop: Fallow
Fertilizer: 11-51-0 actual with seed.
Moisture probe depth at seeding: 21 inches.

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

2/ discontinued

Table 3. Winter wheat variety trial grown at the Knees east of Brady, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad.

Variety	Plant hgt. in.	Yield bu/a	Test wt. lbs/bu	Spring survival class 1/
MT 80122	30	56.3	61.1	
Wing	29	54.9	60.0	
Hawk	29	52.3	58.8	2
MT 8030	30	51.7	59.5	
Bighorn	25	51.4	60.0	2-3
Warrior	33	51.1	61.2	4
MT 8003 (Redw. Sel.)	33	50.4	61.2	4
Rocky	32	50.0	60.9	2
Thunderbird	30	49.8	60.7	
Winridge	30	48.9	59.6	3
MT 8039	31	48.8	58.8	
Centurk	31	48.2	60.2	2
Rosebud 2/	30	47.9	61.2	
Redwin	31	47.4	61.7	4
Agassiz	35	46.4	61.2	5
Neeley	30	46.1	60.6	4
Cree	29	44.3	62.3	3
Cheyenne	31	43.3	61.5	3
Norstar	35	43.1	61.2	5
Norwin	23	42.9	60.5	4-5
Winalta	33	41.6	61.8	4
Teton Sel.	35	31.9	59.9	

Cooperator & location: Dan Picard, 30 miles east of Brady.
Date seeded: October 1, 1985
Date harvested: July 31, 1986
Previous crop: Fallow
Fertilizer: 11-51-0 actual with the seed and 50# AA-N.
Moisture probe depth at seeding : 36 inches

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

2/ discontinued

Table 4. Winter wheat no-till variety trial grown near Floweree, Chouteau County, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, and Mont. Co-op Ext. Service.

Variety	Plant hgt. in.	Yield bu/a	Test wt.	Spring survival class 1/
MT 8003	38	63.1	61.9	4
Neeley	36	55.7	62.5	4
Hybritech (NH 1229)	40	55.5	60.3	
Archer	30	54.8	56.7	2
Ram	35	54.7	59.3	
Winridge	38	53.4	61.1	3
Cheyenne	37	52.9	62.4	3
Cree	42	52.3	62.0	3
Centurk	37	51.6	62.4	2
Thunderbird	36	50.8	61.2	
Rocky	37	50.2	61.9	2
Hawk	30	50.0	61.7	2
Vona	29	49.9	61.8	1
Norwin	24	47.6	61.2	4-5
SR 5221	28	47.5	61.0	2
Warrior	37	46.2	61.4	4
Redwin	37	45.1	61.4	4
Wing	33	43.7	62.3	
Norstar	45	42.7	61.8	5
Agassiz	44	42.1	61.5	5
Winalta	42	41.0	61.9	4

Cooperator & location: Rick Rominger, Floweree.
Date seeded: October 21, 1985, no-till.
Date harvested: August 12, 1986
Previous crop: Spring wheat
Fertilizer: 6-26-0 actual with seed + 60# AN-N top dress
1/ Spring survival class 5 = best, 1 = very low; based on several years of observation.

Table 5. Winter wheat variety trial grown near Sun River, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, and Mont. Co-op Ext. Service.

Variety	Plant hgt. in.	Yield bu/a	Test wt.	Spring survival class 1/
Hawk	22	40.9	58.0	2
Archer	22	40.7	55.0	2
Cree	27	36.7	61.0	3
Neeley	25	35.8	57.7	4
Wing	25	35.4	60.1	
Cheyenne	26	35.0	58.5	3
Centurk	25	34.5	58.8	2
Hybrittech	26	34.4	58.3	
Ram	23	34.0	56.5	
Rocky	25	33.5	59.3	2
Winalta	28	33.5	60.9	4
MT 8003 (Redw. Sel.)	26	33.2	60.0	4
Warrior	27	32.0	58.9	4
SR 5221	23	31.7	57.4	2
Daws (soft white)	20	30.5	55.1	1
Agassiz	28	30.5	60.1	5
Norwin	18	30.3	59.5	4
Norstar	28	30.3	59.0	5
Redwin	25	29.0	60.7	4
Winridge	25	25.1	56.5	3

Cooperator & location: Chuck Merja, 2 miles southeast of Sun River.
Date seeded: October 4, 1985
Date harvested: July 30, 1986
Previous crop: Fallow
Fertilizer: 6-26-0 actual with seed + 50# AA-N.
1/ Spring survival class 5=best, 1=very low; based on several years of observation.

Table 6. Winter wheat variety trial grown near Eden, Cascade County, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, and Mont. Co-op Ext. Service.

Variety	Plant hgt. in.	Yield bu/a	Test wt.	Spring survival class 1/
Winridge	29	39.8	62.2	3
Vona	23	33.2	63.8	1
MT 8003	25	30.2	62.9	4
Neeley	23	29.3	63.2	4
Archer	23	29.3	62.0	2
Cree	27	29.1	63.1	3
Hawk	23	29.0	62.7	2
Agassiz	30	28.5	63.0	5
Cheyenne	27	28.3	62.9	3
Wing	25	27.9	63.8	
Warrior	27	27.8	62.5	4
Norwin	21	27.3	63.6	4-5
Ram	24	26.9	62.2	
Hybritech (NH 1229)	25	26.0	62.1	
Norstar	31	25.3	62.9	5
Thunderbird	25	24.8	62.9	
Winalta	27	23.7	63.3	4
Redwin	25	22.4	63.4	4
Centurk	25	21.9	62.8	2
Rocky	25	21.6	62.8	2
SR 5221	21	18.5	61.0	2

Cooperator & location: Tom Lorang, Eden.
Date seeded: October 22, 1985
Date harvested: August 12, 1986
Previous crop: Fallow
Fertilizer: 6-26-0 actual with seed
1/ Spring survival class 5 = best, 1 = very low; based on several years of observation.

TITLE: Spring Wheat, Durum, and Triticale Variety Investigations.

YEAR: 1986

LOCATION: Western Triangle Research Center, Conrad, MT.

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

Dryland spring wheat, durum, and triticale variety trials were grown near Conrad, Cut Bank, Whitlash, Choteau, Floweree, and Great Falls; and irrigated trials at Conrad and Fairfield. Data for the various locations are presented in Tables 7-17.

The triticale varieties, Carman and Welsh, ranked among the higher yielding red wheat varieties on a pounds/acre basis. Test weights for triticale ran approximately 10 pounds/bu less than for wheat. Carman has shorter straw, earlier maturity, and higher yield than Welsh. Carman's maturity, however, was slightly later than for Newana spring wheat.

The soft white wheats, Owens and Waverly, generally ranked high among the red wheats at most locations. Owens was earlier to mature and generally higher yielding than Waverly. The maturity of Waverly was later than any of the red wheats, with the exception of being about equal to McKay.

Sawfly resistant varieties were generally the highest yielders of the red wheats in the Conrad irrigated and dryland trials; and at Cut Bank and Choteau. Varieties with sawfly resistance included Fortuna, Leader, Lew; and the semidwarfs Glenman and Westbred Rambo. Of these, Leader was almost consistently the lowest yielder, and Lew the highest. Cutless (ND600), a sawfly resistant variety from North Dakota, was not included in the Montana tests. North Dakota trials indicate Cutless to yield slightly higher than Fortuna, but less than Glenman; has similar maturity as Lew, and lodges worse than Fortuna. MT 7926, an experimental sawfly resistant line, was among the highest yielders at the Conrad location. MT 7926 is under reselection in efforts to correct its shatter problem.

Table 7. Dryland spring wheat and durum trial north of Conrad, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test weight lbs/bu
MT 7926 *	64.7	61.7
Copper	56.9	61.9
MT 8321	55.3	61.2
Lew *	55.0	61.3
MT 8533	54.4	61.7
MT 8320	53.2	62.0
Laker durum	53.1	62.2
Fortuna *	53.0	61.7
Pondera	52.6	62.3
Westbred Rambo *	52.4	61.6
Glenman *	52.3	61.1
MT 8336	52.2	63.4
MT 8447	51.9	61.3
MT 8402	51.7	62.3
ND 606	51.6	61.4
Newana	50.9	60.5
MT 8446	50.5	62.6
Medora durum	50.4	63.0
Pioneer 2369	50.3	62.7
Kodiak	50.2	59.6
NK 751	49.9	61.0
Success	49.4	60.8
Wheaton	49.0	60.3
MT 8424	48.9	62.3
MT 8561	48.5	59.9
Leader *	48.4	61.4
MT 8522	48.4	61.2
MT 8423	48.3	61.0
Stoa	48.2	60.2
MT 8515	48.0	62.2
MT 8537	48.0	62.5
MT 8407	47.5	61.2
Monroe durum	46.9	61.7
Crosby durum	46.3	61.7
MT 8434	46.2	62.2
MT 8327	44.9	60.5

continued

Table 7. continued.

MT 8319	44.7	61.9
MT 8363	44.3	60.2
MT 8520	43.7	61.3
Treasure	43.4	58.0
MT 8529	42.8	63.4
Ward durum	42.4	61.7
Thatcher	41.3	60.9
Bronze Chief	39.4	61.2
MT 8429	39.4	60.3
MT 8304	39.2	61.4
MT 8401	39.2	62.2
MT 8508	36.3	62.1
MT 8550	33.2	60.9

Location : Station, 10 miles north of Conrad.
Seeding date : April 8, 1986, no-till
Soil moisture probe depth at seeding : 42" +
Fertilizer : 40# actual N. broadcast, + 100#. 11-51-0 with the seed
Previous crop : chemical fallow
* Sawfly resistant varieties
Harvest date : August 14, 1986

Table 8. Irrigated spring wheat and durum variety trial north of Conrad 1986. Montana Agr Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
Lew *	35	84.1	64.1	
MT 7926 *	36	83.2	63.5	
Glenman *	31	82.9	63.1	
ND 606	36	82.4	62.0	
MT 8321	32	82.2	63.0	
Treasure	31	82.2	57.5	
MT 8320	32	82.0	63.8	
MT 8533	30	80.7	62.6	
Laker durum	29	79.9	63.6	
MT 8515	33	77.6	63.6	
Fortuna *	38	77.0	64.1	
Copper	27	76.7	61.7	
Westbred Rambo *	29	76.3	62.0	
MT 8336	30	75.8	64.0	
MT 8522	33	75.5	62.5	
MT 8537	30	75.1	63.2	
MT 8319	32	74.8	63.6	
MT 8446	28	74.6	63.6	
Success	34	73.6	62.4	
Pioneer 2369	33	72.8	62.7	
MT 8561	37	72.5	61.7	
Stoa	32	71.8	61.9	
Kodiak	19	71.3	59.8	
NK 751	25	70.9	63.4	
Newana	28	69.2	62.1	
Crosby durum	32	68.3	64.1	
MT 8424	26	68.2	63.1	
Ward durum	32	66.9	63.4	
Wheaton	27	66.9	64.1	
Monroe durum	30	66.7	63.9	
MT 8529	32	66.6	64.1	
Medora durum	31	66.4	63.7	
MT 8447	25	66.2	62.9	
MT 8363	29	65.9	62.2	
MT 8407	33	64.6	62.2	
Pondera	29	63.9	63.6	

continued

Table 8. continued.

MT 8402	26	63.0	63.8
MT 8327	29	62.5	62.1
MT 8550	32	62.4	62.1
MT 8423	28	62.2	63.7
Leader *	32	61.7	63.1
Thatcher	35	61.0	61.4
MT 8520	29	59.5	62.9
MT 8429	31	58.2	62.3
MT 8304	26	57.2	62.4
MT 8401	28	56.6	63.4
MT 8508	32	54.3	62.3
MT 8434	26	50.3	63.4
Bronze Chief	24	48.9	62.5

Location : Station, 10 miles north of Conrad
Seeding date : April 9, 1986, no-till
Fertilizer : 40# N actual topdressed, 100# 11-51-0 with the seed
Previous crop : chemical fallow
* Sawfly resistant varieties:
Harvest date : August 19, 1986

Table 9. Dryland Durum variety trial grown north of Conrad, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
PI 497927	26	73.6	63.2	
Cal/Ed	26	71.0	62.1	
D 82136	26	69.3	62.6	
PI 1497926	26	69.2	63.4	
D 8261	27	68.7	62.8	
D 8263	28	68.1	62.8	
D 81183	27	67.9	60.5	
Lloyd	26	66.6	60.3	
D 8193	34	63.3	62.9	
D 8279	27	62.6	61.2	
D 8269	28	62.4	62.2	
Laker	27	62.0	61.7	
Medora	34	60.2	62.7	
D 81151	35	58.4	60.5	
D 8191	34	58.4	61.2	
Ward	35	56.8	61.1	
D 8172	35	56.2	60.3	
D 8291	24	56.1	58.3	
Vic	36	56.0	62.1	
D 81154	34	56.0	61.8	
D 8016	32	55.8	59.8	
Rugby	34	55.6	61.4	
Monroe	36	55.6	61.9	
D 8194	31	54.8	62.6	
FA 883323	36	54.7	62.0	
Sceptre	30	54.6	61.2	
Ed/Ward	35	54.5	62.3	
D 8012	35	53.4	62.1	
D 8019	34	52.1	61.3	
Mindum	39	42.4	59.7	

Location : Station
Seeding date : April 8, 1986
Soil moisture probe depth at seeding : 42" +
Fertilizer : 40# actual N + 100# 11-51-0 with the seed
Previous crop : fallow
Harvest date : August 19, 1986

Note: Durums were also included in the dryland and irrigated spring wheat trials, tables 7 thru 15.

Table 10. Spring wheat and triticale variety trial no-till seeded in paired rows under recrop conditions, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
Spring Wheat				
Newana	27	41.4	60.2	
Glenman *	27	40.4	59.1	
Fortuna *	34	40.2	61.0	
Kodiak	17	39.6	57.5	
Pondera	25	39.2	60.4	
Lew *	32	38.5	61.5	
Len	26	37.9	59.6	
Leader *	31	36.4	60.0	
Owens (white)	27	36.3	60.0	
Wheaton	25	36.1	58.0	
Waverly (white)	25	34.8	59.1	
Rambo *	26	34.2	61.1	
Alex	31	33.9	60.7	
McKay	26	33.3	58.1	
Success	28	32.8	58.9	
Marshall	25	32.2	58.8	
Thatcher	32	31.1	57.9	
Westbred 906R	26	30.1	60.0	
Stoa	28	29.7	59.6	
NK 751	25	29.5	58.1	
Bronze Chief	22	27.4	58.3	
Challenger	26	27.0	60.5	
Triticale				
Welsh	34	46.3 1/	50.6	
Carman	31	41.8 1/	50.2	

Location : Station
Seeded : April 25, 1986 no-till
Harvest : August 20, 1986
Previous crop : spring wheat
Row Spacing : 5 x 15 pair row
Soil moisture depth at seeding : 42" (Scobey series clay loam)
Precipitation, seeding to physiol mature : 5.8"
Fertilizer : 80 N + 30 P_2O_5 actual
1/ Triticale yields based on 50 lb/bu test weight
* Sawfly resistant varieties

Table 11. Spring wheat, Durum, and Triticale Variety Trial North of Cut Bank, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
Spring Wheat				
Westbred 906R	29	32.0	58.4	
Fortuna *	32	31.6	58.8	
Wheaton	28	30.9	57.6	
Lew *	32	29.9	59.6	
Kodiak	18	29.4	53.0	
Glenman *	28	29.1	56.7	
Owens (white)	28	28.6	58.4	
Waverly (white)	26	28.1	54.3	
Marshall	25	27.9	58.8	
Pondera	28	26.1	60.5	
NK 751	25	25.9	55.7	
Newana	27	25.9	60.4	
Alex	32	25.8	60.4	
Challenger	27	25.7	60.0	
Thatcher	32	24.9	58.3	
Success	29	24.7	58.9	
Len	28	23.9	58.4	
Leader *	31	23.3	58.7	
Bronze Chief	26	23.1	56.4	
Stoa	31	23.0	57.8	
McKay	28	22.7	57.9	
Westbred Rambo *	27	22.3	58.7	
Triticale				
Carman	33	36.7 1/	48.1	
Welsh	35	29.6 1/	45.9	
Durum				
Medora	31	27.5	60.5	
Ward	33	27.3	59.8	
Vic	35	27.0	60.5	
Laker	29	26.7	60.1	
Monroe	34	26.3	59.9	
Rolette	35	25.8	62.5	
Lloyd	25	25.0	59.9	
Cando	25	24.7	60.3	

continued

Table 11. continued

Cooperator & Location: Don Bradley, north of Cut Bank
Seed Date : May 19, 1986
Soil moisture probe depth at seeding : 42" +
Fertilizer : 100# 11-51-0 with the seed
Previous crop : fallow
* Sawfly resistant varieties .
Harvest date : September 3, 1986
1/Triticale yields based on 50 lb/bu test weight

Table 12. Spring wheat, Durum, and Triticale variety trial on fallow near Whitlash, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
Spring Wheat				
Glenman *	24	49.9	59.6	
Len	25	47.8	60.1	
Waverly (white)	23	46.4	58.7	
Wheaton	23	45.4	60.3	
Pondera	23	44.6	61.3	
NK 751	23	44.6	60.2	
Newana	22	44.5	60.6	
Westbred Rambo *	25	43.9	60.1	
Success	25	43.1	59.9	
Owens (white)	22	43.0	58.7	
Kodiak	16	42.7	58.5	
Westbred 906R	22	41.6	60.2	
Challenger	22	40.2	62.2	
Fortuna *	28	39.7	60.7	
Marshall	22	39.7	59.0	
Lew *	28	39.3	60.5	
Leader *	27	38.8	60.0	
McKay	24	38.8	57.1	
Alex	27	37.9	60.0	
Thatcher	31	36.5	59.6	
Stoa	24	34.6	60.8	
Bronze Chief	22	33.1	58.9	
Triticale				
Carman	29	45.6 1/	50.8	
Welsh	31	40.9 1/	47.8	
Durum				
Lloyd	24	48.5	60.3	
Cando	23	46.2	61.8	
Laker	26	45.4	60.5	
Medora	28	39.9	61.4	
Ward	29	39.0	61.3	
Monroe	27	37.9	61.8	
Rolette	27	34.1	61.4	
Vic	32	31.2	60.1	

continued

Table 12. continued

Cooperator & Location : Robert Parsell Jr., west of Whitlash
Seed date : April 29, 1986
Soil moisture probe depth at seeding : 42"
Fertilizer : 60# N. actual topdressed + 100# 11-51-0 with the seed
Previous crop : fallow
* Sawfly resistant varieties
Harvest date : August 21, 1986
1/ Triticale yields based on 50 lb/bu test weight

Table 13. Spring wheat, durum and triticale variety trial on no-till recrop near Whitlash, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
Spring Wheat				
Wheaton	23	36.4	60.1	
Kodiak	18	35.7	59.4	
Glenman *	25	35.2	60.0	
Lew *	29	34.7	60.5	
Len	24	34.4	60.3	
Pondera	24	33.7	61.0	
Success	24	31.2	60.4	
Marshall	21	30.9	59.2	
Fortuna *	28	30.7	60.8	
Newana	24	30.4	60.4	
Owens (white)	21	30.2	60.5	
Westbred Rambo *	20	30.0	60.7	
McKay	24	29.9	58.5	
Alex	28	28.5	60.2	
Leader *	28	28.1	60.3	
Thatcher	29	27.6	60.1	
NK 751	22	27.2	60.2	
Waverly (white)	22	27.0	58.5	
Westbred 906R	23	25.7	60.0	
Challenger	23	23.7	61.2	
Bronze Chief	21	23.1	59.8	
Stoa	25	22.7	60.2	
Triticale				
Carman	27	40.9 1/	50.0	
Welsh	34	34.8 1/	47.3	
Durum				
Lloyd	22	35.5	60.1	
Cando	24	29.6	61.2	
Laker	24	28.0	60.0	
Ward	28	27.5	60.8	
Medora	26	26.1	61.2	
Vic	29	20.5	60.0	
Rolette	27	20.0	61.2	
Monroe	25	19.4	60.5	

continued

Table 13. continued

Cooperator & location : Robert Parsell Jr., west of Whitlash
Seed date : April 29, 1986
Soil moisture probe depth at seeding : 42"
Fertilizer : 50# actual N. broadcast, + 100# 11-51-0 with seed
Previous crop : wheat
* Sawfly resistant varieties:
Harvest date : August 21, 1986
1/ Triticale yields based on 50 lb/bu test weight

Table 14. Spring wheat, durum, and triticale variety trial near Choteau, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
Spring Wheat				
Owens (white)	26	39.2	57.8	
Waverly (white)	24	35.7	57.6	
Lew*	31	35.6	58.1	
Westbred Rambo*	25	34.5	63.1	
Stoa	29	34.3	62.2	
Pondera	25	33.6	62.8	
Wheaton	25	31.5	62.5	
Fortuna*	30	30.4	63.1	
Leader*	29	29.9	62.5	
Westbred 906R	25	28.0	61.9	
McKay	25	27.2	58.4	
NK 751	24	26.8	60.7	
Thatcher	30	26.7	61.0	
Success	25	26.0	63.1	
Alex	28	25.8	61.5	
Len	24	25.0	63.1	
Newana	24	24.4	59.2	
Glenman*	24	23.7	60.9	
Bronze Chief	23	22.9	62.4	
Marshall	21	22.4	63.1	
Kodiak	16	21.3	60.3	
Challenger	24	20.2	63.1	
Triticale				
Carman	33	40.0 1/	51.0	
Welsh	35	39.0 1/	49.2	
Durum				
Medora	26	32.2	64.5	
Ward	28	29.8	64.1	
Lloyd	23	29.3	63.1	
Laker	26	27.5	62.6	
Cando	22	27.2	65.0	
Monroe	29	26.9	62.7	
Vic	30	24.0	62.9	
Rolette	29	22.8	63.5	

Table 14. Spring wheat, durum, and triticale varieties continued.

Cooperator & location: Herb Corey, N. E. of Choteau.
Seed date: April 3, 1986, no spring tillage.
Soil moisture probe: 36"
Fertilizer: 100# 11-51-0
Previous crop: fallow
* Sawfly resistant varieties
Harvest date August 6; sawfly lodging just beginning for all but resistant varieties.
1/ Triticale yields based on 50 lb/bu test weight

Table 15. Irrigated spring wheat, durum, and triticale variety trial at Fairfield, 1986. Montana Agr, Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
Spring Wheat				
Owens (white)	31	91.5	59.1	
Waverly (white)	30	88.2	58.6	
Marshall	29	87.2	60.2	
Wheaton	30	85.8	60.7	
Success	34	85.8	61.3	
McKay	29	84.3	59.8	
Newana	31	84.2	61.4	
NK 751	29	83.6	61.1	
Westbred Rambo *	30	83.4	61.0	
Glenman *	31	82.3	60.1	
Len	27	81.2	60.3	
Westbred 906R	29	80.5	60.6	
Pondera	29	80.1	60.0	
Lew *	35	79.9	62.7	
Alex	34	77.1	61.4	
Stoa	34	76.4	61.1	
Fortuna *	35	75.9	60.0	
Thatcher	37	73.8	59.3	
Challenger	29	73.4	61.2	
Kodiak	19	71.1	58.8	
Leader *	35	70.8	62.0	
Bronze Chief	26	66.4	58.1	
Germains W-444	26	57.8	61.4	
Triticale				
Carman	34	91.9 1/	51.1	
Welsh	37	91.7 1/	48.4	
Durum				
Lloyd	27	94.4	61.4	
Cando	26	92.5	62.4	
Medora	37	91.3	61.8	
Laker	31	90.2	61.0	
Ward	33	81.9	61.8	
Vic	39	78.4	60.7	
Monroe	30	71.6	60.9	
Rolette	35	65.6	61.9	

continued

Table 15 . Irrigated spring wheat, durum, and triticale varieties continued.

Cooperator & location : Al Meyer, north of Fairfield
Seeding date : April 7, 1986
Fertilizer : 100-51-0 actual worked in
Previous crop : fallow
* Sawfly resistant varieties
Harvest date : August 18, 1986
1/ Triticale yields based on 50 lb/bu test weight

Table 16. Spring wheat and triticale variety trial grown on recrop near Floweree, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
Spring Wheat				
NK751	27	48.8	58.1	
Westbred 906R	27	45.5	60.5	
Pondera	27	43.2	61.7	
Bronze Chief	25	42.8	59.5	
Butte	32	42.5	60.2	
Glenman *	28	40.9	60.0	
Lew *	33	40.3	61.4	
McKay	27	40.0	56.5	
Fortuna *	34	39.6	60.5	
Success	27	38.2	59.7	
Stoa	31	37.9	60.0	
Leader *	34	37.6	60.4	
Newana	27	35.2	61.3	
Kodiak	17	19.9	55.8	
Triticale				
Carman	34	49.3 1/	49.5	
Welsh	38	43.2 1/	47.4	

Cooperator & location : Rick Rominger, Floweree
Seeding date : April 18, 1986
Soil moisture probe depth at seeding : 42"
Fertilizer : 60# actual N topdressed + 30 P_2O_5 with the seed
Previous crop : winterwheat
* Sawfly resistant varieties
Harvest date : August 12, 1986
1/ Triticale yields based on 50 lb/bu test weight

Table 17. Spring wheat and triticale trial grown near Sun River 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Protein
Spring Wheat				
Wheaton	25	42.8	58.8	
Owens (white)	27	40.8	57.6	
Fortuna *	34	40.2	59.0	
Stoa	30	40.0	58.5	
Len	26	39.7	59.6	
Westbred 906R	20	39.4	57.8	
Pondera	27	39.0	59.1	
Marshall	27	38.9	58.1	
Newana	25	38.8	57.5	
Butte	28	38.5	60.2	
Waverly (white)	27	37.8	56.2	
Glenman *	25	37.7	55.3	
McKay	28	37.4	57.9	
Challenger	24	37.2	59.3	
Alex	29	36.8	59.8	
Success	22	36.5	57.1	
NK751	21	33.6	54.1	
Lew *	30	32.8	59.0	
Leader *	22	32.3	59.9	
Bronze Chief	20	30.8	57.3	
Thatcher	32	28.4	58.1	
Kodiak	14	13.7	53.5	
Triticale				
Welsh	29	36.5 1/	44.0	
Carman	26	35.6 1/	49.0	

Cooperator & location : Chuck Merja, southeast of Sun River
Seeding date : April 21, 1986
Fertilizer : 6-26-0 actual with seed + 50# AA-N
Previous crop : fallow
* Sawfly resistant varieties
Harvest date : August 6, 1986
1/ Triticale yields based on 50 lb/bu test weight

TITLE: Barley Investigations

YEAR: 1986

LOCATION: Western Triangle Research Center, Conrad

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

Dryland barley variety trials were grown near Conrad, Cut Bank, Whitlash, Choteau, Floweree, and Sun River; and irrigated trials at Conrad and Fairfield. Data for the various locations are presented in tables 18-26.

The abundant soil moisture of 1986 was a contrast to that of 1985; and drastically shifted the ranking of 'Bowman' barley. This early maturing drought tolerant variety was the top yielder during the drought of 1985, but was among the lowest yielders in 1986; which suggests the variety is unpredictable, and narrowly adapted.

The varieties Gallatin, Hector and Lewis ranked high in both contrasting years; suggesting these to be widely adapted and stable producers. Gallatin was recently developed and released as a 2-row feed barley by the USDA/Montana Agr. Experiment Station. Clark ranked about medium at most locations during both years.

Two varieties, Triumph and Columbia, were grown only at the Fairfield irrigated location; and were the top yielders in that trial. Triumph is grown in Europe as a 2-row malt barley; and is very late to mature, requiring irrigation and a long growing season. Columbia is a 6-row feed variety with short stiff straw.

Klages and Premier were grown only at the Conrad and Fairfield locations. Premier was generally higher yielding than Klages, and both were late to mature.

Table 18. Dryland barley nursery grown near Conrad, 1986. Montana Agr. Exp. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Plant height inches	Yield bu/a	Test weight lb/bu	% Plump	% Thin	% Protein
Fleet	25	111.7	55.3	92	3	
MT 328202	33	106.9	52.3	98	1	
MT 83592	29	106.5	52.3	84	6	
Lewis	33	106.3	54.3	93	2	
MT 83518	30	105.7	53.9	91	4	
MT 83422	28	104.5	54.1	91	3	
MT 83533	28	101.5	54.0	89	4	
Summit	33	101.3	54.5	75	8	
Gallatin	29	101.2	54.3	89	3	
MT 83491	31	100.5	53.0	76	9	
MT 831598	29	99.6	53.9	95	2	
Vanderhave UDH	31	99.6	53.4	89	3	
MT 83435	28	98.2	53.5	95	2	
Spirit	31	98.0	53.7	86	5	
MT 81616	27	98.0	51.1	81	6	
Kimberly	32	97.1	53.2	83	5	
MT 81192	32	96.8	55.0	94	3	
Menuet	28	96.3	55.4	93	2	
Steptoe	30	96.2	47.2	92	2	
MT 4126	30	95.8	53.5	85	5	
MT 83424	27	95.8	55.7	92	3	
Piston	28	95.8	53.4	86	4	
Hector	33	95.8	54.3	89	4	
Clark	30	95.7	55.1	89	4	
Bellona	29	95.5	52.7	93	2	
MT 140523	31	95.5	52.8	82	7	
MT 32442	36	95.2	54.3	93	2	
MT 81502	29	94.9	53.8	76	11	
Purcell	29	94.6	54.0	85	5	
MT 81619	28	94.3	52.6	81	6	
Premier	27	93.7	51.2	62	16	
UD 405282	25	92.8	55.7	87	3	
MT 41279	28	92.8	54.0	90	3	
MT 328203	31	92.7	48.2	97	1	
WB 48138	33	92.4	52.3	81	6	
MT 83444	31	91.6	52.1	88	4	

(continued)

Table 18. continued.

Variety	Plant height inches	Yield bu/a	Test weight lb/bu	% Plump	% Thin	% Protein
MT 81161	31	91.5	51.4	79	7	
VD 404382	28	91.4	53.9	85	3	
MT 831616	29	91.3	52.8	93	2	
Edfron	28	90.7	53.5	84	4	
Klages	29	90.1	51.9	51	19	
VD 301-81	25	89.4	54.7	93	2	
Karla	33	89.1	50.3	83	5	
Westbred Revere	33	87.7	53.5	72	11	
Betzes	32	87.5	52.2	85	5	
Shabet	31	87.3	51.0	77	5	
VD 415082	29	86.7	52.6	83	4	
BA 4038	33	86.6	52.1	84	6	
Piroline	28	86.4	54.7	91	2	
MT 138575	28	85.7	53.4	96	2	
Compana	28	85.7	50.9	92	3	
BA 529	33	85.6	53.4	83	6	
Robust	36	84.9	52.8	95	2	
MT 81143	31	82.6	55.7	96	1	
Bowman	31	82.3	54.3	97	1	
Hazen	33	80.2	51.4	95	1	
Morex	34	74.2	52.5	93	2	
Wanubet	32	73.3	55.8	57	10	
Wanubet MI	29	72.8	54.3	17	32	
Nova	27	66.9	55.2	92	3	
Ershabet	30	64.6	53.6	94	2	
Wanupana	27	63.0	56.4	93	2	
Prowashonupana	27	62.7	51.1	73	6	
Washonupana	28	49.9	48.7	45	46	

Cooperator & location : Station - 10 miles north of Conrad
Seeding date : April 8, 1986
Fertilizer : 40# actual N broadcast + 100# 11-51-0 with the seed
Previous crop : Chemical fallow
Harvest date : August 14, 1986

Table 19. Irrigated barley trial grown near Conrad, 1986, Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test weight lb/bu	% Plump	% Thin	% Protein
~~CS-1~~ Columbia	129.7	49.2	97	1	
Steptoe	129.7	48.5	97	1	
MT 83422	120.2	54.4	97	2	
Kimberly	119.0	52.6	93	3	
VD 02481	115.9	54.7	97	1	
MT 83435	114.4	54.1	96	2	
BA 4038	113.2	52.1	95	2	
MT 328202	112.7	51.7	97	1	
Summit	112.0	54.0	93	3	
MT 328203	111.1	50.7	98	1	
MT 83592	110.2	52.9	92	3	
MT 83533	108.9	51.9	93	3	
Fleet	108.7	53.0	96	1	
Cebeco 8444	108.2	54.0	98	1	
MT 83424	107.9	53.2	97	1	
MT 4126	107.6	53.0	97	1	
MT 32442	107.5	51.0	95	2	
Bellona	107.3	54.1	98	1	
MT 83444	107.2	53.5	94	3	
Hector	107.0	52.4	92	4	
Lewis	106.9	53.4	95	2	
Menuet	106.6	53.9	96	2	
MT 831598	105.3	50.9	95	2	
Karla	105.2	49.9	96	2	
Shabet	104.8	52.0	94	2	
MT 83491	104.7	53.1	95	2	
MT 41279	104.7	53.3	95	2	
MT 831616	103.8	51.1	94	3	
MT 81502	103.2	53.3	96	1	
MT 81616	103.0	50.5	92	3	
Betzes	102.5	51.6			
Spirit	102.1	52.3	93	3	
MT 81619	102.1	51.0	88	5	
VD 415082	101.5	52.6	97	1	
VD 405282	100.9	53.9	97	2	
Ingrid	100.4	52.6	91	3	

(continued)

Table 19. continued.

Variety	Yield bu/a	Test weight lb/bu	% Plump	% Thin	% Protein
CB 8331	99.7	54.1	97	1	
MT 81161	99.5	52.3	95	2	
Piston	98.7	52.8	93	3	
Busch Ag 529	98.5	53.4	97	1	
Gallatin	98.2	53.6	94	3	
MT 81192	97.5	53.1	94	2	
MT 83518	97.4	53.1	94	3	
MT 140523	94.9	53.1	96	2	
Clark	94.9	52.6	92	4	
MT 81143	93.8	52.8	95	2	
VD 403582	93.8	53.8	97	1	
MT 138575	93.7	53.1	95	2	
Bowman	93.3	53.2	98	1	
Klages	93.3	52.1	87	5	
Premier	92.1	51.8	90	4	
Compana	87.4	51.6	97	1	
Purcell	85.0	52.6	93	3	
VD 404382	84.7	52.8	95	2	
Hazen	82.8	51.3	98	1	
Piroline	79.9	53.4	92	2	
Wanubet 080	78.1	53.8	71	7	
Wanubet M1	76.8	50.9	30	21	
Prowashonupana	67.9	50.6	69	10	
BZ 584-40	66.3	48.8	97	1	
Robust	66.3	50.8	94	3	
Wanupana	62.2	52.2	89	4	
Morex	61.3	51.1	95	2	
Washonupana	56.6	44.9	52	41	

Cooperator & location : Station, 10 miles north of Conrad
Seeding date : April 9, 1986
Fertilizer : 40# N actual topdressed + 100# 11-51-0 with the seed
Previous crop : Chemical fallow
Harvest date : August 19, 1986

Table 20. Barley variety trial north of Cut Bank, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Plump	% Thin	% Protein
Steptoe	26	54.0	40.1	76	8	
Hector	27	52.2	53.7	77	7	
Lewis	27	50.7	46.9	60	15	
Harrington	27	50.4	46.1	77	6	
Unitan	31	49.4	41.6	70	7	
MT 81619	26	49.4	44.7	52	20	
Kimberly	26	49.4	46.9	54	16	
Piroline	27	48.6	48.5	54	4	
Clark	27	48.0	44.9	70	9	
Robust	32	47.5	46.1	77	5	
MT 81616	27	46.4	44.7	68	10	
Gallatin	28	45.7	46.8	71	7	
Bowman	27	43.1	44.8	90	3	
Hazen	32	37.5	43.0	82	5	
Morex	34	34.5	46.0	77	5	
Karla	31	32.4	43.6	52	16	

Cooperator & location : Don Bradley, north of Cut Bank
Seeding date : May 19, 1986
Soil moisture probe depth at seeding : 42" +
Fertilizer : 100# 11-51-0 with the seed
Previous crop : Fallow
Harvest date : September 3, 1986

Table 21. Barley variety trial grown near Whitlash on fallow, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Plump	% Thin	% Protein
Clark	23	64.1	50.8	64	18	
Gallatin	22	63.1	50.7	55	24	
Hector	24	62.4	50.5	55	22	
Harrington	23	62.3	49.8	56	20	
Karla	24	61.9	47.2	52	23	
Lewis	23	61.9	51.6	62	18	
Bowman	24	60.0	51.1	72	10	
Piroline	23	59.7	50.9	46	28	
MT 81619	22	58.3	48.8	51	26	
Morex	25	58.1	48.6	61	17	
Kimberly	22	57.4	50.2	47	29	
Robust	23	57.2	49.4	58	14	
MT 81616	23	56.4	49.2	59	19	
Steptoe	20	55.5	46.0	70	14	
Hazen	23	55.2	47.2	69	13	
Unitan	22	53.9	46.1	48	24	

Cooperator & location : Robert Parsell Jr., west of Whitlash
Seeding date : April 29, 1986
Soil moisture probe depth at seeding : 42"
Fertilizer : 60# N Actual topdressed + 100# 11-51-0 with seed
Previous crop : fallow
Harvest date : August 21, 1986

Table 22. Barley variety trial grown near Whitlash on no-till recrop, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT

Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Plump	% Thin	% Protein
Piroline	24	53.7	50.1	53	27	
Gallatin	22	52.1	49.2	70	12	
Harrington	20	51.0	49.6	66	14	
Kimberly	24	50.0	48.2	57	23	
Unitan	21	49.4	44.8	74	12	
Bowman	22	49.1	50.1	52	23	
Hector	24	49.0	50.3	50	27	
Hazen	23	48.7	47.8	45	35	
MT 81616	23	48.5	47.5	73	13	
Morex	25	46.6	49.1	61	23	
Robust	26	45.8	49.5	60	18	
Lewis	21	45.6	50.2	47	26	
Clark	20	44.8	48.6	67	13	
Karla	25	43.2	45.9	65	18	
MT 81619	23	40.5	48.0	55	23	
Steptoe	20	31.7	44.4	68	15	

Cooperator & location : Robert Parsell Jr, west of Whitlash
Seeding date : April 29, 1986
Soil moisture probe depth at seeding : 42"
Fertilizer : 50# actual N. broadcast + 100# 11-51-0 with seed
Previous crop : wheat
Harvest date : August 21, 1986

Table 23. Barley variety trial grown near Choteau, 1986, Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Plump	% Thin	% Protein
MT 81616	22	60.4	53.6	93	2	
Kimberly	23	58.1	54.5	93	1	
MT 81619	21	56.9	53.4	92	2	
Hector	21	56.2	54.2	94	1	
Lewis	20	54.7	54.7	96	1	
Clark	20	53.5	54.2	91	2	
Gallatin	20	52.5	54.0	93	2	
Steptoe	21	50.6	48.1	92	3	
Morex	26	50.0	53.6	92	2	
Harrington	20	48.9	55.0	92	1	
Hazen	25	47.2	52.1	96	1	
Unitan	24	46.3	49.6	89	4	
Karla	23	46.0	52.3	90	2	
Piroline	23	45.0	55.2	91	2	
Robust	24	44.7	53.0	93	1	
Bowman	20	42.1	55.0	97	1	

Cooperator & location : Herb Corey, N.E. of Choteau
Seeding date : April 3, 1986
Soil moisture probe depth at seeding : 36"
Fertilizer : 100# 11-51-0 with the seed
Previous crop : fallow
Harvest date : August 6, 1986

Table 24. Irrigated barley variety trial grown near Fairfield, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Plump	% Thin	% Protein
Triumph	26	132.8	54.1	87	6	
Steptoe	26	128.7	48.7	86	6	
Columbia	27	128.2	50.4	90	4	
MT 81616	30	125.9	54.5	85	6	
Spirit	30	122.9	54.6	91	3	
Piroline	31	122.0	54.7	80	9	
Premier	30	122.0	54.2	84	6	
Gallatin	30	121.8	53.8	79	11	
Morex	33	121.5	53.3	91	3	
Klages	31	121.0	53.9	83	7	
Menuet	29	120.0	55.2	85	6	
Clark	32	117.7	53.8	82	9	
Lewis	28	116.0	53.8	85	8	
Hector	29	115.7	53.1	85	8	
Bellona	30	115.6	54.5	90	3	
Robust	32	115.5	54.3	94	2	
Ingrid	32	112.3	54.8	86	4	
Bowman	28	103.3	53.5	87	5	

Cooperator & location : Al Meyer, north of Fairfield
Seeding date : April 7, 1986
Fertilizer : 100# of 11-51-0 worked in
Previous crop : fallow
Harvest date : August 18, 1986

Table 25. Barley variety trial grown on recrop near Floweree, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Plump	% Thin	% Protein
MT 81616	25	64.3	51.5	86	6	
Hazen	29	61.8	52.1	85	7	
Robust	29	61.6	53.1	86	6	
MT 81619	25	55.3	51.0	88	5	
Steptoe	26	54.2	48.5	83	7	
Unitan	27	54.1	48.9	93	3	
Gallatin	27	53.8	52.6	86	4	
Morex	32	52.9	52.1	79	9	
Lewis	26	50.7	53.2	72	12	
Clark	27	49.2	51.1	84	7	
Harrington	25	45.4	51.6	93	3	
Piroline	28	44.8	52.6	74	11	
Kimberly	28	42.4	52.2	84	5	
Bowman	28	41.8	53.6	73	12	
Karla	29	39.8	50.4	88	5	
Hector	28	39.3	53.2	81	7	

Cooperator & location : Rick Rominger, Floweree
Seeding date : April 18, 1986
Soil moisture probe depth at seeding : 42"
Fertilizer : 60# actual N topdressed + 30# P_2O_5 with the seed
Previous crop : winter wheat
Harvest date : August 12, 1986

Table 26. Barley and oats variety trial grown near Sun River, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield bu/a	Test weight lbs/bu	% Plump	% Thin	% Protein
Barley						
Gallatin	24	54.3	50.1	20	42	
Piroline	20	53.7	50.4	69	10	
Steptoe	22	51.9	43.7	50	23	
Unitan	23	50.1	47.7	68	10	
Hector	27	48.3	49.7	51	25	
Karla	21	47.8	46.6	55	21	
Clark	23	46.0	49.6	29	33	
Robust	21	45.8	49.4	67	11	
Lewis	23	45.1	50.2	39	28	
Morex	21	44.0	48.3	49	26	
Bowman	22	43.2	52.2	31	39	
MT 81619	19	43.2	49.0	43	27	
Harrington	19	41.1	49.7	55	15	
MT 81616	20	39.6	48.9	53	26	
Hazen	19	37.2	47.1	66	16	
Kimberly	20	22.7	49.0	54	21	
Oats						
Otana	29	69.5	40,6			

Cooperator & location : Chuck Merja, southeast of Sun River
Seeding date : April 21, 1986
Fertilizer : 6-26-0 actual with seed + 50# AA-N
Previous Crop : fallow
Harvest date August 6, 1986

PROJECT TITLE:

Development of a variable row space, deep fertilizer banding, no-till drill.

PERSONNEL:

Gregory D. Kushnak and Ron Thaut

LOCATION:

Western Triangle Research Center, Conrad, MT.

FUNDING SOURCE:

Montana Fertilizer Check-off Committee, and Montana Wheat Research & Marketing Committee.

YEAR: 1986

OBJECTIVE:

To construct a no-till drill, capable of providing adjustable row spacings and good seed placement, for use in fertilizer deep banding placement studies.

INTRODUCTION:

It has been suggested that in no-till systems, placement of nitrogen below the soil surface is necessary to avoid large amounts of N tie-up by surface residue. It has also been claimed that root growth in cereals progresses at approximately 30° - 40° angle; and that fertilizer deep banded between the rows and below the seed is utilized more efficiently. If these claims are true, then depth of fertilizer band, seed depth, and row spacing must be precisely matched to allow root growth interception by the fertilizer band. Testing such concepts requires an adjustable row space no-till drill, equipped with adjustable deep banders.

MATERIALS:

Double disc units were used with an integral depth/packer wheel to assure depth control and proper seed placement, and capable of withstanding 450 lbs. of down pressure. The disc units were also used for the fertilizer banders. The units were of the clamp-on type, to allow rapid adjustment of opener positions on the tool bar for various row spacings. Disc type openers were preferred over the hoe type because of "rank to rank" space limitations associated with plot seeders. The disc units or modules were obtained from Acra-Plant, Inc. of Garden City, Kansas. Nine units were purchased for a total of $3582, using fertilizer check-off funds from both FY 83/84 and 84/85.

Other components of the drill, including iron, gandy, boxes, and seed cones were funded by the Montana Wheat Research & Marketing Committee, bringing the total cost to approximately $6,000. The drill is constructed on a category 2 A-frame, and consists of 6 seed openers and 3 deep banding openers; allowing 3 paired-rows to be seeded per operation. A series of gandy boxes and seed distribution cones feed the openers, allowing various combinations of nitrogen and phosphorous placement in or between the seed row. The seed cones accommodate seed sizes ranging from alfalfa to beans.

RESULTS AND DISCUSSION:

The fertilizer banders are capable of being quickly repositioned to allow fertilizer placement with the seed; below the seed; to the side of the seed; or midway between seed rows.

The adjustable seed openers allow conventional row spacings from 6 inches to 72 inches; as well as various paired-row configurations, including 6 x 10, 8 x 12, and 6 x 14. (The paired-row designations refer to the two row spacings that comprise paired-rows. For example, in the 6 x 14, the 6 is the distance between rows within a pair, while the 14 is the distance between pairs. This latter distance is sometimes referred to as the "dead space".)

The drill frame measures approximately 7 feet wide x 7 feet long x 6 feet high; and weighs 2000 pounds. The small size allows for easy transport to off-station sites, and for precision work in small plots. In the event more weight is needed for penetration into hard soils, space is provided on the edge of the frame for temporary placement of 3-foot lengths of railroad rail. The rails are removed when lifting the drill, as the tractor hydraulics are near capacity with the basic drill. The tractor is a JD 2240 rated at 50 HP. Thus far, we have not had to use the additional weights.

The drill was used successfully in 1986 to seed a no-till fertilizer placement and row spacing trial on spring wheat and barley at Conrad (reported in next section, page 49); and was also loaned to the Cooperative Extention Service to establish fertilizer placement demonstration plots near Chester. In addition to fertilizer experiments, the drill is capable of seeding variety tests involving grain, forage, oilseed, and pulse crops.

FUTURE PLANS:

Following are some questions which could be pursued with this research drill:

- N must be banded below the soil surface to avoid tie-up by microbial breakdown of surface residue in no-till systems?

- N must be banded below the soil surface to allow more rapid access of roots to fertilizer?

- Rainfall will carry N to the roots as efficiently as deep banding?

- Deep banding provides a means of incorporating materials that, when surface applied, are vulnerable to volatilization loss (such as urea) in no-till systems.

- Deep banding increases water use efficiency?

- The deep band must be 2" deeper than the seed?

- The deep band must be 2" to the side of the seed row, in addition to being 2" deeper?

- A band 2" to the side of the seed row allows quicker access of roots to fertilizer, and better yields, than a single band midway between rows?

- One band per 2 seed rows (in paired-row or conventional row space) is less costly in terms of drill cost and power requirements.

- Phosphorous in the deep band is better than with the seed?

- The phosphorous band can be anywhere or any depth, as long as it is in a concentrated band?

- Concentrating the amount of phosphorous for 2 seed rows into one band increases the availability of this nutrient in calcareous soils?

- A deep band depth of 4" may be muddy, whereas the seed depth of 1½" is dry enough for seeding. Thus, deep banding may delay seeding in wet years?

- A small amount of "starter" fertilizer (5-15%) directly with the seed is still needed, even when deep banding?

- Among paired-row systems, the 5 x 15 or 6 x 14 is better than the 7 x 13 or 8 x 12?

- Paired-row seeding causes less surface area of the soil to be disturbed, decreasing weed seed germination?

- Wild oats flourish more with broadcast nitrogen than with deep banded nitrogen?

- The paired-row dead-space allows more wild oats to flourish? (maximum dead-space for wild oat control is 12"?, 13"?, 14"?)

- Paired-rows provide too rough a ground surface for spraying, harvest, grain transport, etc?

- Most paired-row configurations will not support a windrow? (maximum deadspace = 10"?, 12"?, 14"?).

- A 15-inch paired-row system (5 x 10 or 6 x 10) is too narrow for dryland?

- 18 inch (5 x 13 or 6 x 12) and 20-inch (5 x 15 or 6 x 14) paired-row systems are to wide for irrigated?

- The paired-row environment delays senescence of the lower leaves by allowing more sunlight to penetrate the canopy?

- The paired-row environment decreases some diseases by allowing air and sunlight to remove humidity from the lower canopy?

- The paired-row environment may increase those diseases which depend on rain-caused soil splashing?

TITLE: Fertilizer placement study in standard and paired-row spacings in no-till spring wheat and barley.

YEAR: 1986

LOCATION: Western Triangle Research Center, Conrad, MT.

PERSONNEL: Gregory D. Kushnak, Ron Thaut, and Larry Christiaens

OBJECTIVES: To determine if fertilizer use efficiency in no-till systems can be increased over the conventional "N-topdress, P-with the seed" method.

INTRODUCTION: It has been suggested that the interception of a deep fertilizer band by root growth results in earlier and more efficient nutrient uptake. It was further suggested that root growth in cereals progresses at approximately 30°-40° angle; and therefore the band depth, seed depth, and lateral distance between band and seed must be matched to assure band/root interception. It is also claimed that nitrogen broadcast on the soil surface in no-till systems is excessively tied up by microbial action on the straw residue. Therefore, a study of nitrogen and phosphorous placement at several positions relative to the seed was initiated on no-till spring wheat and barley in 1986. The study included conventional-row and paired-row spacings.

MATERIALS AND METHODS: A variable row space, deep fertilizer banding, no-till plot drill was used for the study; which was designed and constructed by the Staff at the Western Triangle Research Center, Conrad. The design and capabilities of the drill are reported in the previous section (page 45).

Row space treatments included 3 spacings based on a 20-inch system: 10 x 10 conventional; and 8 x 12 and 6 x 14 paired-row. In addition, a 16-inch system in the form of a 6 x 10 paired-row was included. The paired-row designations refer to the two row spacings comprising a given paired-row configuration. The 6 x 14, for example, indicates a 6-inch space between rows within a pair, and 14 inches between pairs.

Fertilizer placement treatments included deep banded below the seed, deep banded to the side of the seed, deep banded midway between rows, phosphorous banded with the seed, and nitrogen topdress. The 3 deep band positions were subdivided for nutrient content : both N & P in the band; only N in the band, P with the seed; and only P in the band, N- topdress. Nitrogen and phosphorous were held at a constant rate of 60-53-0 lbs/acre across all treatments, except for the 2 checks. In the "side" and "below the seed" deep band treatments, there was one fertilizer band for each seed row. In the "midway" deep band treatments, only one fertilizer band was placed for every two seed rows. In the latter case, the amount of fertilizer per length of band was doubled, to maintain an equal rate of fertilizer per area among all treatments. Other details of the experiment are listed in the footnotes to the data tables 27 and 28.

RESULTS: In spring wheat there were no significant differences due to row spacing (Table 27). Deep bands in the "midway" position produced higher yields than "side" and "below the seed" positions. However, these differences were only suggestive, as none were considered statistically significant.

In barley, row spacings produced no significant differences (Table 28). Deep bands in the "side" position produced the highest yields, which is opposite the response found for spring wheat.

No attempt was made to examine the root growth patterns on the barley and wheat to ascertain their differing responses to fertilizer band positions. The test conditions did not adequately represent a typical no-till re-crop environment in that the quantity of straw residue was extremely low and soil residual N was high (approximately 40 lbs/a); both situations due to the previous year's drought. Soil moisture and precipitation during the spring of 1986 was well above normal.

Response to fertilizer banding is likely influenced by species, rainfall, quantity of surface residue, and residual nutrient levels. More years of study under various conditions will be necessary before conclusions can be drawn regarding fertilizer placement.

Table 27. Comparison of various fertilizer placement positions for no-till spring wheat in standard and pair-row configurations, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Row space 1/	Rate lbs/a actual $N-P_2O_5$	Fertilizer Position: Deep band 2/	With seed	Top-dress	Plant hgt. in.	Yield bu/a	Test wt. #/bu	1000 ker wt. gr.	% Prot.
10x10	0-0				26.0	36.1	57.7	36.7	
	0-53		P		26.8	43.7	59.0	36.6	
	60-53		P	N	26.8	49.7	59.0	34.1	
	60-53	P(midway)		N	26.8	47.3	58.2	35.9	
	60-53	N(midway)	P		26.8	48.5	57.6	34.2	
	60-53	N(2"side)	P		25.8	42.6	59.4	32.0	
	60-53	N(2"below)	P		26.8	44.7	57.8	33.0	
	60-53	NP(midway)			27.0	51.5	57.9	35.0	
	60-53	NP(2"side)			25.8	46.5	58.8	32.1	
	60-53	NP(2"below)			26.5	46.6	58.0	32.4	
10x10	60-53	Avg. all N deep, P seed			26.5	45.3	58.3	33.1	
10x10	60-53	Avg. all NP deep			26.4	48.2	58.2	33.2	
10x10	60-53	Avg. all N topdress			26.8	48.5	58.6	35.0	
8x12	60-53	NP(midway)			26.5	47.7	58.5	33.7	
6x14	60-53	NP(midway)			27.0	48.9	58.3	33.9	
6x10	60-53	NP(midway)			26.8	47.3	59.0	32.4	

1/ 10x10 = 10" row space for all rows; 8x12 = pair of rows 8" apart with 12" dead space between pairs; 6x14 = pair of rows 6" apart with 14" dead space between pairs; etc.

2/ All deep band positions are 2" below depth of seed. In addition, midway = between seed rows; 2" side = 2" beside the seed rows; 2" below = directly below the seed.

Location : station
Seeded : April 24, 1986; no-till, spring wheat stubble; depth 1½".
Harvest : August 11, 1986
Nitrogen & Phosphorous Source : Ammonium nitrate 34-0-0, and MAP 11-53-0.
Soil moisture probe depth at seeding date : 42" (Scobey series clay loam)
Precipitation, seeding date to physiol mature : 5.8"
Cultivar : 'Glenman' wheat

Table 28. Comparison of various fertilizer placement positions for no-till barley in standard and pair-row configurations, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Row Space 1/	Rate lbs/a actual $N-P_2O_5$	Fertilizer Position: Deep band 2/	With seed	Top-dress	Plant hgt. in.	Yield bu/a	Test wt. #/bu	% Plump	% Thin	1000 ker wt. gr.	% Prot.
10x10	0-0				23.0	59.9	51.8	86.8	4.3	44.3	
	0-53		P		22.0	66.3	51.6	81.3	5.5	43.1	
	60-53		P	N	24.8	70.3	50.1	68.5	10.8	39.9	
	60-53	P(midway)		N	25.0	73.4	49.6	64.3	12.3	37.3	
	60-53	N(midway)	P		24.0	75.7	49.2	69.0	10.8	37.7	
	60-53	N(2"side)	P		27.0	85.9	52.0	89.5	2.5	46.7	
	60-53	N(2"below)	P		28.0	79.8	51.9	86.5	4.3	44.5	
	60-53	NP(midway)			24.8	72.1	49.9	67.5	11.0	39.1	
	60-53	NP(2"side)			26.5	91.5	52.3	91.3	2.5	46.7	
	60-53	NP(2"below)			26.3	72.4	52.0	88.0	3.5	46.7	
10x10	60-53	Avg. all N deep, P seed			26.3	80.5	51.0	81.7	5.9	43.0	
10x10	60-53	Avg. all NP deep			25.9	78.7	51.4	82.3	5.7	44.2	
10x10	60-53	Avg. all N topdress			24.9	71.9	49.9	66.4	11.6	38.6	
8x12	60-53	NP(midway)			24.8	69.4	50.0	76.0	8.3	37.4	
6x14	60-53	NP(midway)			26.0	78.4	49.0	72.8	10.0	38.7	
6x10	60-53	NP(midway)			26.0	72.9	49.5	71.8	10.0	40.2	

1/ 10x10 = 10" row space for all rows; 8x12 = pair of rows 8" apart with 12" dead space between pairs; 6x14 = pair of rows 6" apart with 14" dead space between pairs; etc.

2/ All deep band positions are 2" below depth of seed. In addition, midway = between seed rows; 2" side = 2" beside the seed rows; 2" below = directly below the seed.

Location : station
Seeded : April 24, 1986; no-till, spring wheat stubble; depth 1½".
Harvest : August 7, 1986
Nitrogen & Phosphorous source : Ammonium nitrate 34-0-0, and MAP 11-53-0.
Soil moisture probe depth at seeding date : 42" (Scobey series clay loam)
Precipitation, seeding date to physiol mature : 5.8"
Cultivar : 'Clark' barley

Table 29. No-till spring wheat fertilizer placement study grown on wheat stubble near Conrad, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Fertilizer Placement Regime and Fertilizer Rate 1/	Plant height inches	Test weight lb/bu	Protein %	Grain yield bu/a
38 lbs N & 15 lbs P205 with seed; & 49 lbs N & 19 lbs P205 in the band.	28.00	59.70		48.75
28 lbs N & 9 lbs P205 with seed; & 50 lbs N & 22 lbs P205 in the band.	28.00	59.70		47.75
AN broadcast; P with seed; 80-30-0.	28.00	56.70		46.45
N and P in the band, 81-30-0.	28.00	57.40		45.72
4-5 Mesh Urea broadcast; P with seed; 80-30-0.	27.00	58.10		45.09
N in the band; P with seed; 81-30-0.	28.00	57.70		45.03
Urea broadcast; P with seed; 80-30-0.	28.00	58.60		44.57
32 lbs N & 30 lbs P205 with seed; & 45 lbs N in the band.	27.00	59.30		44.16
79 lbs N & 22 lbs P205 in band; & 2 lbs N & 9 lbs P205 with the seed.	27.00	59.10		42.55
41 lbs N & 30 lbs P205 with the seed; & 45 lbs N in the band.	27.00	56.60		41.20
Mean				45.13
LSD (0.50)				N.S.
CV%				9.45

Location : Station, north of Conrad
Seed date : April 25, 1986
Harvest date : August 20, 1986
Previous crop : spring wheat
Row spacing : 5 x 15 pair row (Yielder, model USDA III drill)
Soil moisture depth at seeding : 42" (Scobey series clay loam)
Precipitation, seeding to physiol. mature : 5.8"
Cultivar : 'Glenman' spring wheat

1/ All treatments have the same approximate N-rate of 80 lbs/a, and P_2O_5 of 30 lbs./a. The deep band is midway between rows within a pair.

Table 30. No-till spring wheat fertilizer rate study grown on wheat stubble near Conrad, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Fertilizer Rate N-P_2O_5-K_2O-S-Zn lbs/a	Plant height inches	Test weight lb/bu	% Protein	Grain Yield bu/a
88-30-25-19-0.75	27.00	59.30		48.49
88-30-0-19-0.75	26.00	59.50		47.99
81-30-0-0-0.75	25.00	57.80		45.41
88-30-25-19	27.00	60.30		45.28
81-30-25	27.00	58.80		45.07
48-15-0	26.00	59.90		44.59
129-15-0	26.00	59.20		44.56
81-30-25-0-0.75	27.00	59.00		43.91
78-15-0	26.00	59.10		43.76
132-30-0	26.00	59.80		42.65
81-30-0	27.00	58.60		42.49
45-0-0	27.00	60.20		41.28
88-30-0-19	25.00	57.60		41.13
51-30-0	27.00	59.80		39.71
6-30-0	26.00	57.60		39.63
126-0-0	25.00	57.00		39.47
3-15-0	27.00	59.30		39.13
75-0-0	25.00	58.90		38.84
0-0-0	25.00	57.80		38.03
Mean				42.71
LSD (0.05)				N.S.
CV%				9.78

Location : Station
Seed date : April 25, 1986 no-till
Harvest date : August 20, 1986
Previous crop : spring wheat
Row spacing : 5 x 15 pair row (Yielder, model USDA III drill)
Soil moisture depth at seeding : 42" (Scobey series clay loam)
Precipitation, seeding to physiol mature : 5.8"
Cultivar : 'Glenman' spring wheat

Table 31. Phosphorus fertilizer study conducted near Devon, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

P_2O_5 Applied	Plant height inches	Yield bu/a	Test weight lbs/bu	% Plump	% Thin	% Protein
Check 0# P_2O_5	37	19.1	49.3	38	24	
40# P_2O_5 Applied each year	38	18.9	48.6	31	35	
80# P_2O_5 Applied every-other year	38	24.1	49.7	50	18	
160 # P_2O_5 Applied every four years	38	23.7	49.1	36	25	

Cooperator & location : Calvin Kanning, Devon

Table 32. Winter wheat seeding rate trial grown near Conrad, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety/Seeding Rate	Yield bu/acre	Test weight lbs/bu	Plant height
Rocky			
10 seeds/sq ft	58.1	63.1	34
15 seeds/sq ft	62.9	63.4	34
20 seeds/sq ft	63.5	63.1	34
25 seeds/sq ft	65.7	63.8	35
30 seeds/sq ft	67.3	63.9	35
Redwin			
10 seeds/sq ft	48.0	61.1	36
15 seeds/sq ft	55.7	60.6	37
20 seeds/sq ft	57.8	62.4	37
25 seeds/sq ft	57.5	61.9	37
30 seeds/sq ft	60.1	62.0	37

Cooperator & location : Research Center, north of Conrad
Seeding date : October 2, 1985
Harvest date : August 5, 1986
Previous crop : no-till chem-fallow
Fertilizer : 100# 11-53-0 with the seed + 40# N topdressed

Table 33. Winter wheat seeding rate trial grown east of Brady, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Seeding Rate	Yield bu/a	Test weight lbs/bu	Plant height inches
Rocky	10 seeds/sqft	46.1	61.2	32
	15 seeds/sqft	47.3	61.2	32
	20 seeds/sqft	49.1	61.4	31
	25 seeds/sqft	51.5	61.0	33
	30 seeds/sqft	52.5	60.8	30
Redwin	10 seeds/sqft	39.0	61.6	33
	15 seeds/sqft	44.1	61.1	34
	20 seeds/sqft	43.2	62.0	35
	25 seeds/sqft	46.5	61.4	33
	30 seeds/sqft	44.9	61.7	33

Cooperator & location : Dan Picard, 30 miles east of Brady
Seeding date : October 1, 1985
Previous crop : fallow
Fertilizer : 50# AAN + 100# 11-51-0 with the seed
Harvest date : July 31, 1986

Table 34. Winter wheat seeding rate trial grown near Chester, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety/Seeding Rate	Yield bu/acre	Test weight lbs/bu	Plant height inches
Rocky			
10 Seeds/sq ft	37.2	61.0	26.5
15 seeds/sq ft	39.0	60.0	27.0
20 seeds/sq ft	36.4	59.8	25.0
25 seeds/sq ft	38.2	59.4	25.0
30 seeds/sq ft	38.3	58.9	25.0
Redwin			
10 seeds/sq ft	34.1	60.4	24.0
15 seeds/sq ft	26.4	61.0	25.0
20 seeds/sq ft	33.2	61.2	23.5
25 seeds/sq ft	37.0	61.2	24.0
30 seeds/sq ft	38.0	61.4	23.0

Cooperator & location: Mike Violet, 10 miles south of Chester
Seeding date : September 30, 1985
Harvest date : July 23, 1986
Previous crop : fallow
Fertilizer : 100# 11-51-0 with the seed

Table 35. Spring wheat and barley seeding rate trial grown near Conrad, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Seeding Rate	Yield bu/acre	Test weight lbs/bu	Plant height inches
Barley				
Clark	10 seeds/sqft	90.6	52.3	32
	15 seeds/sqft	95.0	52.4	32
	20 seeds/sqft	96.4	51.1	32
	25 seeds/sqft	92.8	50.3	32
	30 seeds/sqft	92.9	50.6	31
Wheat				
Glenman	10 seeds/sqft	62.3	58.6	32
	15 seeds/sqft	63.2	58.1	32
	20 seeds/sqft	63.1	58.8	32
	25 seeds/sqft	64.1	61.1	32
	30 seeds/sqft	64.1	60.6	31

Cooperator & location : Research Center
Seeding Date : April, 1986
Fertilizer : 40# actual N worked in, + 100# 11-51-0 with the seed
Previous crop : no-till chem-fallow
Harvest date : August 19, 1986

Table 36. Spring wheat and barley seeding rate trial grown on recrop near Whitlash, 1986. Montana Agr, Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Seeding Rate	Yield bu/acre	Test weight lbs/bu	Plant height inches	% Plump	% Thin
Barley						
Clark	10 seeds/sqft	40.0	48.2		61	22
	15 seeds/sqft	47.8	48.3		60	23
	20 seeds/sqft	49.4	47.6		58	22
	25 seeds/sqft	54.4	47.9		53	26
	30 seeds/sqft	47.8	48.6		56	25
Wheat						
Glenman	10 seeds/sqft	32.4	51.1			
	15 seeds/sqft	35.1	55.5			
	20 seeds/sqft	36.1	55.6			
	25 seeds/sqft	36.9	56.0			
	30 seeds/sqft	34.7	56.0			

Cooperator & location : Robert Parcell, Jr.
Seeding date : April 4, 1986
Seeded into no-till recrop
Previous crop : Wheat
Fertilizer : 60# N topdressed + 100# 11-51-0 with the seed
Harvest date : August 21, 1986

Table 37. Winter wheat seed depth trial grown near Conrad, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Seed Depth (inches)	Yield Bu/acre	Test weight lbs/bu	Plant height
1.5	60.7	63.2	34
2.0	58.9	63.4	33
2.5	36.0	62.8	32
3.0	31.5	62.8	33
3.5	29.4	62.4	34
4.0	34.2	62.9	33

Cooperator & location: Research Center, north of Conrad
Seeding date : October 2, 1985
Harvest date : August 5, 1986
Previous crop : no-till chem-fallow (barley stubble)
Fertilizer : 100# 11-53-0 with the seed + 40# N topdressed
Soil texture : heavy (Scobey series clay loam)

Table 38. Winter wheat seeding depth trial grown east of Brady, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Seed Depth inches	Yield bu/acre	Test weight lbs/bu	Plant height inches
1	52.0	60.3	32
1½	51.4	61.0	30
2	52.3	61.4	31
2½	47.5	61.7	32
3	43.8	61.7	31
3½	41.1	63.0	31

Cooperator & location : Dan Picard, 30 miles east of Brady
Seeding date : October 1, 1985
Previous crop : fallow
Fertilizer : 50# AAN + 100# 11-51-0 with the seed
Harvest date : July 1, 1986

Table 39. Winter wheat seeding depth trial grown near Chester, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Seed Depth inches	Yield bu/acre	Test weight lbs/bu	Plant height inches
1	38.5	59.8	26
1½	33.8	59.2	23
2	36.5	58.3	-
2½	31.5	59.0	-
3	24.6	57.1	22
3½	32.5	59.9	25

Cooperator & location : Mike Violet, 10 miles south of Chester
Seeding date : September 30, 1986
Harvest date : July 23, 1986
Previous crop : fallow
Fertilizer : 100# 11-51-0 with the seed
Soil texture : medium

Table 40. Spring wheat seed size trial grown north of Conrad, 1986. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Treatment 1/ (seed size)	Plant height inches	Yield bu/a	Test weight lbs/bu
Kodiak	small 10.75 *	18.8	64.8	57.7
	medium 10.21 *	19.0	66.2	57.5
	large 14.54 *	19.8	70.1	57.4
	control 9.76 *	19.0	64.0	56.9
Pondera	small 9.36 *	31.8	66.1	61.9
	medium 25.27	32.0	71.5	61.5
	large 19.28 *	32.5	69.4	61.8
	control 16.20*	32.5	71.1	61.9

Location Station
Seeded May 1, 1986 into no-till chemical fallow; barley stubble.
Harvest date : August 20, 1986
Sawfly lodging just beginning for Pondera; Kodiak had no lodging.
Seed rate was 16 seeds per-square foot
Fertilizer : 100# 11-53-0 with the seed, + 40# N actual topdressed
* Grams of seed per 20 foot row.
1/ Treatments obtained by sieving the same seed lot of a given variety into 3 size classes, plus the unsieved control.

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

PERSONNEL: Gregory D. Kushnak, Ron Thaut, & Larry Christiaens, Western Triangle Research Center, Conrad, MT.

INTRODUCTION/OBJECTIVES:

Oilseed and pulse crops in rotation can benefit grain production (soil amelioration, pest cycle disruption, etc.). The production potential of various oilseed and pulse crops has been determined for fallow systems, under average management levels, in the Western Triangle area. This study sought to determine production potential of these crops under recrop conditions, where they will most likely be grown in rotation with grain.

Results:

Varieties of safflower, lupine, and peas were grown under recrop conditions at Dutton in 1986. The site was located on winter wheat stubble, and received two pre-seeding tillage operations. Seeding was delayed until May 30 by spring rains, which was detrimental to yields. Lupines were affected most severely by late planting, producing a top yield of only 86.4 lbs/acre (table 41). This compares to 471.0 lbs/acre obtained under the drought conditions during the previous year, and suggests that lupines are quite sensitive to seeding date. Peas were affected less severely, yielding 732 lbs/acre; which is 50% of their average performance.

Safflower yielded fairly high for the conditions, with Hartman and Rehbein the top producers at approximately 1100 lbs/acre (table 42). Low test weights among safflower varieties were a result of severe sprouting, caused by fall rains prior to harvest.

Table 41. Lupine and pea variety trial grown near Dutton, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Plant height inches	Yield 1/ lbs/a
Lupine		
Kalina	14	86.4
Nyirsegi	13	55.2
Ultra	14	53.4
Astra	14	40.0
Lucky	13	27.6
Kiev	14	15.0
Peas		
Trapper	18	732.2
Austrian	18	714.2

Cooperator & location : Frank Loch, east of Dutton
Seeding date : May 30, 1986
Previous crop : winter wheat
Fertilizer : 100# 11-51-0 with the seed
Depth of moisture probe at seeding : 42"
Insecticide : Malathion for blister beetles
Harvest date : September 8, 1986
Seeding rate : 6 seeds/square foot

1/ The less than satisfactory yields are likely a result of the late seeding date. These crops are apparantly sensitive to seeding beyond the optimum range of dates.

Table 42. Safflower variety trial grown near Dutton, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Plant height inches	Yield lbs/a	Test weight lbs/bu
Hartman	20	1158	32.0
81B 2253	22	1068	34.4
Rehbein	20	1042	34.4
S-317	22	1036	36.5
81B 3635	22	1014	30.9
S-208	21	983	36.5
81B 2653	22	982	30.6
Oleic Leed	21	949	36.8
Oker	21	936	37.3
Finch	21	928	34.4
82B 2364	22	912	34.1
82B 1983	21	887	35.6
82B 2369	22	876	31.3
81B 3697	21	852	32.0
Partial Hull 290	22	816	30.3
83B 1954	20	741	30.0
Girard	21	738	32.6
S-541	21	732	33.2

Cooperator & location : Frank Loch, east of Dutton
Seeding Date : May 30, 1986
Preseeding tillage : twice
Fertilizer : 100# 11-51-0 with the seed
Soil moisture probe at seeding : 42"
Harvest Date : October 16, 1986 - moderate sprout damage

Table 43. Peas and canary seed trial grown near Sun River, 1986. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop	Plant height inches	Yield lbs/a	Test weight lbs/bu
Canary Seed	21	1,110	
Peas		936	62.4

Cooperator & location : Chuck Merja, southeast of Sun River.
Seeding date : April 21, 1986
Harvest date : August 6, 1986
Fertilizer : 6-26-0 actual with seed + 50# AA-N
Previous crop : Fallow

Table 44. Alfalfa Variety trial near Fairfield, 1986. Montana Agr. Expt. Sta.; Western Triangle Research Center, Conrad, MT.

Variety	Yield (Tons/Acre) * Second 1/ cutting
DK 135	1.45
Vernal	1.44
Challenger	1.39
Maxim	1.38
Onieda UR	1.37
Wrangler	1.35
Apollo II	1.34
WL 316	1.33
Arrow	1.33
Ladak 65	1.32
DK 120	1.29
Baker	1.29
532	1.29
Advantage	1.27
Commandor	1.24
Spectrum	1.22
Phytor	1.22
NY 8302	1.21
Jubilee	1.19
Decathlon	1.19
Beaver	1.18
Mohawk	1.18
526	1.13
Iroquois	1.10
Thor	1.06
Drummor	0.99

Cooperator & location : Ross Peace, north of Fairfield
Seeding date : June 28, 1984
Harvest date : August 27, 1986
Fertilizer : 100# 11-51-0 with the seed
Previous crop : Barley 1983, verticillium infected alfalfa 1982
* 12% moisture basis
1/ 1st cutting not harvested for yield