The 3rd

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of the

WESTERN TRIANGLE AGRICULTURAL RESEARCH CENTER
Montana Agricultural Experiment Station

1980

Submitted by

Gregory D. Kushnak, Superintendent

MAES Research Report #167

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STATION ACTIVITIES AND DEVELOPMENTS

1980

A nursery drill was constructed during March and April by Research Technician Ron Thaut. The drill was constructed mainly from standard farm drill components, although some parts and mechanisms were "home spun". Joe DeStaffany donated the use of his shop for the project. The drill is presently equipped with 4 lister (hoe) openers, but can be readily converted to double-disc openers for no-till operations. A mechanism will be added to accommodate various types of fertilizer experiments and a cab will be constructed to allow accurate seeding during windy conditions. The drill was successfully used this spring to seed a wide variety of crops including alfalfa, cereal grains, oilseeds, and pulse crops; and allowed seeding to be accomplished much easier and faster than with the drill we had previously used. The cost of the materials was approximately $3800.

A project to bring Tiber water to the building was initiated during June. Many problems encountered in digging the mile-long trench extended the completion date well into July, leaving us little time for research work. Budget limitations forced us to do much of the water-line work ourselves, and we hope to avoid getting involved in this much facility development work in the future. Since we do not yet have electricity to the site, we have by-passed the cistern and pressure pump and are using the water direct at very low pressure. The 1500 gallon cistern is in place and will be hooked up this spring or when electrical service is installed. Costs included $2499 for trenching; $655 for the cistern; and $702 for the PVC pipe (1" diam.).

A 6 inch concrete floor was poured in the east one-half of the building (3000 sq. ft.) to accommodate the shop area. Exterior slabs were poured at the east and south overhead doors. Total cost of this project was $7320. Plans have been drawn up for partitioning the east end of the building for the shop area. A 1000 gallon concrete septic tank was installed south of the building to service the shop facility.

All of the Research Center land west of the canal was in barley during 1979, leaving no fallow ground for 1980 nurseries. Approximately 20 acres were recropped (no-till) to barley and small grain nurseries in 1980, with the remainder summer fallowed. The field rotations are now set up so that fallow ground will be available each year for variety nurseries and other experiments.

The land east of the canal has yet to be reclaimed. This will require money for fencing and is not considered our highest priority at this time.

Canada thistle management continued, with treatments consisting of Roundup and Banvel. A good kill was noted for most thistle patches; but much work is still needed, especially along the canal.

Other activities included many extension-type presentations at growers meetings and research plot tours.

An Advisory Board meeting was held December 3, 1979, and the minutes are presented on the following page.

Some of the Board members completed their terms at the end of 1979 and elected to serve for another 3-year term. Following is a revised list of Advisory Board members:

Appointed through 1980

Wilson Hodgskiss, Choteau, Teton Co.
Don Buffington, Ledger, Liberty Co.
Jerry Swenson, Cut Bank, Glacier Co. (vice-chairman)

Appointed through 1981

Karl Ratzburg, Ledger, Toole Co.
Paul Kronebusch, Conrad, Pondera Co. (Secretary)
Joe DeStaffany, Conrad, Pondera Co. (Chairman)
Dale Vermullan, Cut Bank, Glacier Co.
Jack Baringer, Conrad, CES Representative (ex-officio)

Re-appointed through 1982

Dave Shane, Floweree, Cascade Co.
Vade Hamma, Brady, Chouteau Co.
Gary Iverson, Sunburst, Toole Co.

New appointment through 1982

Arnold Gettal, Power, Teton Co.

WESTERN TRIANGLE RESEARCH CENTER
Advisory Board Meeting

December 3, 1979

Present at the meeting were Greg Kushnak, Ronald Thaut, Jack Barieger, Joe DeStaffany, Paul Kronebusch, Gary Iverson, Wilson Hodgekiss, Jerry Swenson, and Dave Shane.

The meeting was called to order by chairman DeStaffany and the minutes of the previous meeting were read and approved.

Kushnak said that he could buy leased equipment from MSU. He bought a 350 mower for $631 but couldn't get everything that he wanted.

Kushnak stated that the evaluation of the building was set at $50,000. He said that it cost $21,000 for the moving of the building to the foundation which the mover had built at the new station site.

Kushnak said that of the $80,000 budgeted for the year, $25,000 had been set aside for the building, foundation and the moving. He said the footing and foundation were poured in September and the building had been moved by October. He went on to discuss the problems encountered in the moving process.

Kushnak reported that $8,000 was received from the crop on the land this past year. He said that this amount ill be taken out of next year's budget.

Kushnak next listed the equipment that he has on hand and indicated that he needs a protein tester. He then showed some slides of equipment, the building and it's being moved and a number of plots from this past year. He showed the board the site plan for the land and building. He also said that he has been working on building plans for an office and lab. He discussed the possibility of getting a new building or maybe a used trailer from Bozeman that could be put inside the main building.

We next discussed security for the site. Kushnak indicated some of the possible systems that he had looked into and we discussed how much of a problem security might get to be.

Kushnak stated that next year's program might be split about 50-50 between the station and off-station plots. He plans to work more at the station site to get it organized and will try to streamline the off-station plots to save time and travel.

We discussed that the position for another assistant is still in the budget and maybe lost if it isn't filled soon. It was thought that a person with a soils background would be most useful.

Jerry Swenson moved and Gary Iverson seconded the motion to look into hiring another assistant with a soils background. Motion carried.

The next item of business was reappointments to the advisory board. Four members having two year terms are up for reappointment. Two members, Gary Iverson and Dave Shane, both agreed to serve again. Richard Page and Vade Hamma have declined to serve again and must be replaced.

The position of chairman has a one year term and so must be reelected. Chairman DeStaffany agreed to take the position for another year and was reelected unanimously. Jerry Swenson was then elected vice-chairman and Paul Kronebusch was reelected secretary.

We then discussed adding more people to the advisory board and the number of meetings that would be needed in the future.

Kushnak said that only one meeting a year would probably be all that would be needed now that things were getting organized.

After discussing names of possible members, Jerry Swenson moved and Wilson Hodgekiss seconded the motion to name Pete Ekegren, Ron Marony, Jim Newman and Brent Gaylord to the advosory board. Their terms of membership are to be

drawn when they attend the next meeting. Motion carried.

Kushnak said that he didn't know when the next meeting would be called. He said that a tour of plots might be held during the summer some time.

There being no further business the meeting was adjourned a 4:05 PM.

Paul Kronebusch
Secretary

Capital equipment purchased during 1980:

1.	Farm tractor, 80 HP diesel, John Deere 2940	$15,962
2.	Front-end loader for model 2940 tractor, John Deere model 148, 84" bucket	$2,800
3.	Forage plot harvester, Rem 1980 model 9H	$3,625
4.	Rear 3 pt. hitch tractor blade, Woods model RB 850, 8'	$750
5.	Pre-cast concrete water cistern, Fagenstrom 1500 gal.	$680
6.	Pressure pump for water system, Peabody model SP7-30916	$340
7.	Copier, 3M model 217	$359
8.	Electric typewriter, Smith Corona, model 8000	$463
9.	Pre-cast concrete septic tank, Fagenstrom 1000 gal.	$410

1980
RESEARCH ACTIVITIES

Acknowledgements: Research trials during 1980 were conducted in cooperation with the USDA-SEA and Plant and Soil Science Department at MSU; and the Cooperative Extension Service. The County Agents were very helpful in lining up cooperators for test plot sites, and in the seeding and harvest of plots. Special thanks is extended to the landowners who provided land for test plots and to Ron Thaut, Research Technician, for his invaluable assistance in conducting research and compiling data for the contents of this report.

1980 Test Plots: Growing conditions for 1980 consisted of a dry previous fall, resulting in poor or late emergence of winter wheat on no-till recrop. Spring conditions were dry until May 24, when the first significant moisture was received ($3\frac{1}{2}$"). During April, moist soil under standing stubble at the Research Center was 18" and 24" deep on the knolls and low spots, respectively. In "flex-crop" systems, one would probably decide not to recrop with this amount of available soil moisture. Summertime precipitation, however, was above normal and recropping was successful in most cases.

All test plots on the Research Center were grown on barley stubble (no-till), and stands were thin or uneven due to dry seedbed conditions. Off station testing continued at a slightly reduced level from the previous year, covering approximately 17 locations.

A list of the 1980 test plots and their locations is presented in Table 1.

Table 1. Research plots grown in the Western Triangle during 1980.

Crop	Experiment	County	Cooperator & Location
Winter Wheat	Intrastate Varieties	Pondera	Station
	Varieties	Teton	Dave Stevens
	Varieties	Toole	Karl Ratzburg, Ledger
	Nitrogen & Sulfur Rates	Teton	Pearson Bros.
	Quality Drill Strips	Pondera	Station
	Wireworm Control	Pondera	Station
Spring Wheat	Advanced Yield Varieties	Pondera	Station
	Quality Drill Strips	Pondera	Station
	Private Varieties	Pondera	Station
	Varieties	Toole	Ray Tomsheck, Ethridge
	Varieties	Glacier	Al Hansen, Cut Bank
	Varieties	Teton	Bert Corey, Choteau
	Varieties	Teton	Sonny Harrell, Fairfield
	N & P Rates	Glacier	Al Hansen, Cut Bank
	Soil Fumigation	Pondera	Don Keil, Conrad
	Till-plant vs. no-till, Hoelon vs. Fargo	Pondera	Conrad High School Vo-Ag & CES
Barley	Quality Drill Strips, Irr.	Teton	Neal Johnson
	Intrastate Varieties	Pondera	Station
	Western Dryland Regional	Pondera	Station
	Western Spring Regional	Pondera	Station
	Varieties	Glacier	Al Hansen, Cut Bank
	Varieties	Toole	Ray Tomsheck, Ethridge
	Varieties, Irrigated	Teton	Neal Johnson
	Varieties	Teton	Bert Corey, Choteau
	Soil Fumigation	Pondera	Station; & Don Keil, Conrad
Pulses	Faba & Soybeans, peas, lentils	Glacier	Al Hansen, Cut Bank
	Faba & Soybeans, peas, lentils	Toole	Ray Tomsheck, Ethridge
	Faba & Soybeans, peas, lentils	Teton	Frank Lock, Dutton

Table 1. (Continued)

Crop	Experiment	County	Cooperator & Location
Oilseeds	Several Crops & Varieties	Glacier	Al Hansen, Cut Bank
	Several Crops & Varieties	Toole	Ray Tomsheck, Ethridge
	Several Crops & Varieties	Teton	Frank Loch, Dutton
Forages	Sulfur Rates - Alfalfa	Pondera	Joe Broesder, Dupuyer
	Grass Species	Pondera	Pond. Co. Range Group, Dupuyer
	Alfalfa Varieties	Teton	Bill Jones, Bynum
	Grass Pasture Fertilizer	Teton	Bud Olson, Choteau
Weeds	Roundup on Faba Beans	Pondera	Don Kronebusch, Conrad
	Hoelon Rates on Sunflowers	Pondera	Station

TITLE: Winter Wheat Investigations

YEAR: 1980

LOCATION: Western Triangle Agricultural Research Center, Conrad, Montana

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

VARIETIES

Winter wheat variety trials were located near Dutton, Ledger, and on station at Conrad in 1980. Seedbed moisture was very low at all 3 locations, resulting in late fall emergence at Dutton and Ledger. The Intrastate nursery on station was no-till seeded on barley stubble and emergence was delayed until spring. Stand density for Centurk was very low at all 3 locations (much lower than all other varieties). This suggested the possibility of poor seed, since all 3 nurseries had a common seed source.

Station: On the station, stands for the Intrastate nursery were thin, and in some cases not uniform. Therefore, significant yield differences were not detectable. Stem breakage from sawflys was noted for all varieties, with varying degrees of severity (Table 2). The very low yields were attributed to spring emergence, thin stands, low soil nitrate level, and sawfly damage. A 5-year summary of winter wheat varieties grown in Pondera County is presented in Table 3.

Ledger: At this location, stand densities were good for all varieties but Centurk. Yields tended to be higher for the later maturing varieties, probably due to lack of abundant precipitation until later in the growing season (Table 4). A 3-year summary of winter wheat varieties grown at this location is presented in Table 5.

Dutton: This nursery was heavily (but uniformly) infested with wild oats; and yields were undoubtedly much less than potential (Table 6). Most varieties were starting to kernel-shatter at 18% moisture (time of harvest), and head-shattering was noted for Norstar. The shattering may have been associated with the late precipitation pattern, and subsequent larger head and kernel size. The only varieties not shattering were Redwin, MT77077, Centurk-78, and Lindon.

WIREWORM STUDY

Wireworms (Coleoptera: Elateridae) are capable of causing tremendous losses in cereal grains. In other states, stands increased 50% and yields increased up to 400% when controls were applied under epidemic conditions. However, chronic losses also occur, with annual average losses in untreated areas estimated to be 4.8 bushels/acre.

During field investigations in 1979, wireworms were found in all fields inspected in the north central "Golden Triangle". Populations were estimated to be 13,000 wireworms/acre. One grower stated he felt his wireworm treatment was as imporant as his fertilizer treatment.

A study was initiated in cooperation with Dr. Wendell Morrill, M.S.U. Biology Dept., to: determine wireworm mortality resulting from Lindane seed treatment; correlate wheat stand densities with wireworm population densities; and to correlate wheat yields with wireworm population densities. Seed treatments consisted of:

Table 4. Winter wheat variety trial grown on dryland fallow northeast of Ledger, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Variety	Yield	Test weight #/bu	Plant height	% Protein
Winalta	70.2	60.3	37	12.0
Redwin	66.7	59.6	35	14.0
Lindon	66.5	59.6	27	13.0
Roughrider	63.3	59.6	36	12.5
Cheyenne	62.6	58.2	35	14.1
Centurk 78	62.0	58.5	31	11.4
MT 77077	61.5	57.4	34	12.4
Sundance	61.1	59.0	38	10.9
Trapper	60.5	59.0	36	13.2
Warrior	59.8	58.7	33	11.7
Norstar	59.8	59.6	42	13.6
Froid	58.6	58.1	37	12.9
Hiplains	58.4	58.3	33	12.5
Rocky	58.1	59.5	31	11.6
Crest	57.1	55.4	28	13.2
Winoka	57.0	61.0	38	12.0
Teton	53.4	58.2	40	13.0
Centurk	33.3*	55.0	30	13.1
Experimental Means:	59.4	58.6	34.5	12.6

Cooperator & plot location: Karl Ratzburg, Ledger; Toole Co. T30N, R2E, Sec. 6
Seed Date: 20 September 1979
Harvest Date: 20 August 1980
Previous Crop: Fallow
Fertilizer: 18-46-0 with seed + 34AN topdress

* Centurk had poor germination and very thin stands.

Table 5. Three-year summary for winter wheat varieties grown northeast of Ledger in Toole County, 1978-1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	3-year comparable average			
	Yield	Test wt.	Height	% Protein
Sundance	60.1	60.7	39	10.6
MT 77077	58.5	60.1	35	10.5
Centurk	57.8	60.8	33	11.6
Norstar	57.7	62.1	42	11.4
Cheyenne	56.7	62.1	37	11.8
Hiplains	56.5	61.8	33	11.5
Warrior	56.2	61.8	35	11.2
Redwin	55.9	61.7	34	12.7
Winalta	55.6	63.0	38	11.2
Froid	54.5	61.5	40	11.6
Trapper	54.4	61.9	37	11.7
Winoka	54.0	63.2	39	11.3
Crest	53.2	60.7	30	11.8
Roughrider	52.0	62.3	35	12.1
Lindon	47.3	62.5	27	12.0

Location, All years: Karl Ratzburg's, northeast of Ledger.

Checks for comparable average: Cheyenne & Winalta.

Table 6. Winter wheat variety trial grown on dryland fallow east of Dutton, 1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a.	Test wt.	Plant height	% Protein
Lindon	44.9	59.5	30	8.1
MT 77077	44.5	55.7	35	9.0
Rocky	43.6	58.3	35	8.4
Centurk 78	41.9	57.9	34	8.7
Sundance	41.3	56.7	41	9.0
Winalta	40.9	59.4	39	9.3
Hiplains	39.4	56.9	35	8.9
Redwin	38.3	57.3	35	9.3
Winoka	37.7	58.8	40	8.9
Trapper	37.0	57.7	38	8.8
Warrior	36.8	57.6	35	8.7
Roughrider	36.0	58.3	40	9.4
Teton	36.0	57.4	44	8.8
Norstar	35.2	57.6	41	8.8
Cheyenne	35.1	56.9	37	8.8
Froid	34.3	58.8	42	8.7
Crest	32.9	57.7	33	8.9
Centurk	27.3*	56.2	35	9.4
Experimental Means:	38.0	57.7	37.2	8.88

Cooperator & plot location: Dave Stevens, Dutton; Teton Co.
Seed Date: 21 Sept. 1979.
Harvest Date: 12 Aug. 1980
Previous Crop: Fallow
Fertilizer: 18-46-0 with seed.

* Centurk had poor germination & very thin stands.

Table 7. Effect of Lindane seed treatment on yield of winter wheat grown on dryland recrop, 1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Treatment 1/	Yield bu/a	Test wt.	Stand density (June 7)
Check	16.5	56.4	1x
Lindane 1 oz.	20.0	58.4	2x
Lindane 2 oz.	19.2	59.5	2x

1/ Rates are quantities of 18.75% a.i. Lindane seed treater per bushel. The 2 ounce rate is the standard rate.

Location: Research center, Conrad, MT.
Variety: Roughrider
Date Seeded: 22 Sept. 1979, no-till into barley stubble.
Fertilizer: none.

Table 8. Effect of fertilizer rates on dryland winter wheat south of Choteau, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

#/a Actual* N-P_2O_5-K_2O-S	Yield bu/a	Test wt.	% Protein
11-28-0-0	28.8	61.5	10.9
29-28-0-0	31.5	61.8	12.6
48-50-22-0	32.6	61.5	12.6
57-50-22-0	36.0	61.0	13.3
66-50-22-0	39.0	60.8	14.0
66-28-22-0	37.5	61.1	12.8
66-50-22-7	36.7	60.6	13.8
66-50-22-15	36.9	60.7	13.7
76-50-22-0	36.7	60.8	14.1

Cooperator and location: Pearson Bros. Corp., Fairfield; Teton Co.
Variety: Winalta
Previous crop: Fallow
Fertilizer sources: Ammonium-nitrate; triple super phosphate; potassium chloride; potassium sulfate; gypsum.
Treatments topdressed April 15.

TITLE: Spring Wheat Investigations

YEAR: 1980

LOCATION: Western Triangle Agricultural Research Center, Conrad, Montana.

PERSONNEL: Gregory D. Kushnak and Ron Thaut, Research Center, Conrad; F.H. McNeal, SEA, Bozeman.

The nursery at the Research Center near Conrad was no-till seeded into barley stubble with limited soil moisture; resulting in thin stands and relatively low yields. Nurseries at Cut Bank, Ethridge, and Choteau were grown on fallow. As in previous years, yields at Choteau were influenced considerably by sawfly damage.

The trial at Fairfield was grown on alfalfa ground and was originally intended to be irrigated. No irrigation water was applied, but fairly high yields were obtained due to above normal precipitation.

Fieldwin (a white wheat), Wampum, Newana, and Solar were among the top yielding varieties at all locations; and Prodax, Marberg, and Pondera ranked high at 3 of the locations. These ratings are consistant with data from the previous year and suggest that the above mentioned varieties have a wide-yield adaptation for the Triangle Area. The early maturing variety Butte yielded relatively low at all locations.

Spelt yielded less than the higher yielding spring wheat varieties (in lbs./acre) at each location. Yields of '419' Triticale were less than most spring wheat varieties; except at Fairfield, where Triticale was the highest yielding entry. 'Welsh' Triticale was tested at only one location (Choteau), and outyielded the '419' variety by 29%. 'Welsh' had shorter straw and was earlier to mature than '419'. In comparison to adjacent barley nurseries, yields of spelt and Triticale averaged approximately 30% less than barley.

Drill strips: Spring wheat quality drill strips for 1980 consisted of 4 entries: MT 7620; MT 7648; MT 7834; and Fortuna.

Cut Bank Fertilizer Trial: Several rates of nitrogen at 2 levels of phosphorus were applied to Lew spring wheat grown on "double-summerfallow". Soil residual NO_3 is usually quite high under double-fallow conditions; and as expected from this type of rotation, no yield response to nitrogen was detected (Table 20). Percent protein increased slightly as nitrogen rates increased to 60 lbs./acre. There was no response to P_2O_5.

Soil Fumigation: This trial was conducted on wheat and barley for crop disease control, and is discussed in the "Barley Investigations" section of this report (page 34).

NO-TILL SEEDING & WILD OAT CONTROL

Cooperators involved in this experiment included: Jack Baringer, Pondera CES; Dan Keil, Tri-Angle Ag Supply; Conrad High School Vo-Ag Dept.; Monsanto Co.; and Western Triangle Research Center.

The trial was conducted under irrigated conditions, on continuous cropped Fortuna spring wheat. Four treatments were employed to compare "pre-seeding tillage" vs. "no-till" seeding; and Far-go vs. Hoelon wild oat herbicides in each seeding system.

Far-go (granular) was applied to standing stubble during the winter (Feb. 6). In the spring, the pre-seeding tillage treatments received 2 operations (shovels followed by discing). The no-till treatments received one pre-seeding Roundup application at $\frac{1}{2}$ quart/a. to control volunteer. All four treatments received a post-emergence application of MCPA (3-pts.) which provided fairly good Canada thistle suppression. The Hoelon treatments were applied quite late, when the wild oats were in the 5-leaf stage. The wild oat density was over 60 plts/sq. ft.

Results: Yields of the no-till treatments were considerably higher than for the pre-seeding tillage treatments (Table 21). Moisture loss from pre-seeding tillage was likely a contributing factor. The no-till treatments matured one week later, and therefore, took fuller advantage of the growing season. It is also possible that the incorporation of stubble from pre-seeding tillage tied up a greater quantity of nitrogen. A soil test was not available to substantiate this.

Wild oat control was poor to fair in the Far-go treatments; probably due to delayed incorporation in the pre-seeding tillage treatment, and lack of incorporation in the no-till treatment. A complete wild oat kill was obtained from the Hoelon treatments. However, the difference in wild oat control between Far-go and Hoelon was not reflected in yields. This was probably a result of too late an application of Hoelon, whereby the very dense wild oat stand already caused considerable crop damage. The Far-go treatments, although not completely effective, initiated wild oat control earlier in the crop's growth stage. These comparisons show the importance of timely wild oat control. The Hoelon treatments should have been applied in the 1- to 3-leaf stage.

Table 9. Advanced Yield spring wheat variety trial grown on dryland recrop at the Western Triangle Research Center, Conrad, MT. 1980.

Variety		Yield bu/a	Test weight	Plant height	% protein
17425	Fieldwin (white)	34.9	59.5	28	8.0
17691	Wampum	33.9	58.9	25	9.0
Ag 1	Solar	33.5	59.6	24	8.9
MT 7810	--	33.1	60.7	26	9.7
NK	Prodax	32.3	60.0	24	9.9
13333	Wells (durum)	32.2	60.7	30	9.7
MT 7746	Kronstad 5-gallo	31.5	59.7	23	9.9
MT 7926	--	31.2	60.9	30	9.3
MT 7819	--	31.1	59.7	29	9.7
17430	Newana	30.9	61.6	25	10.1
13986	Era	30.4	59.3	24	9.0
17829	Marberg	30.2	59.0	25	9.9
17328	Pondera	30.0	60.2	25	10.3
17791	James	29.8	59.7	27	10.7
13596	Fortuna	29.8	59.4	31	10.0
17438	Cando (durum)	29.6	60.1	24	9.6
MT 7838	--	29.5	60.5	25	10.1
10003	Thatcher	29.5	59.5	31	10.5
17681	Butte	29.4	61.1	29	9.7
MT 7648	--	29.4	59.6	24	10.7
15892	Ward (durum)	29.3	60.6	30	10.5
17790	Len (ND453)	29.3	59.1	25	10.3
MT 7834	--	29.2	58.3	25	9.9
17282	Crosby	29.1	60.0	29	10.6
MT 7620	--	28.8	58.8	26	9.6
17286	Tioga	28.6	59.0	31	10.8
MH 70170	Waldron/Era	28.5	59.7	22	9.9
MT 7836	--	27.9	46.3	25	10.4
17429	Lew	27.8	60.0	29	10.2
15930	Olaf	27.2	59.4	25	10.3
15326	Rolette (durum)	26.6	59.2	27	10.2
MT 7881	--	25.5	59.4	25	10.0
MT 781	--	24.3	59.3	32	10.5
--	Spelt	44.9	40.3	30	9.5
Experimental Means:		30.3	58.8	27	9.9

Seed date: 28 April 1980
Harvest date: 25 August 1980
Previous crop: Barley
No-till seeded.

Table 9a. Private variety spring wheat and triticale trial grown on dryland recrop at the Western Triangle Research Center, Conrad, MT. 1980.

No.	Variety	Brand	Yield bu/a	Test wt.	Plant hgt.	% protein
--	Solar	Agsco	33.5	59.6	24	8.9
--	Prodax	N. King	32.3	60.0	24	9.9
NA 7664	HS 7664	NAPB	31.4	58.2	24	9.4
NK 2631	75S2631	N. King	30.9	57.3	24	9.9
13986	Era	--	30.4	59.3	24	9.0
NK 55114	NK 711	N. King	29.4	61.0	23	10.2
NA 18374	HS 74183	NAPB	28.3	57.9	24	9.5
Ag 2634	Walera 1/	Agsco	27.8	58.0	23	8.7
NK 2634	75S2634	N. King	27.7	57.7	22	9.0
WS 108	MP 108	W. Seeds	25.5	60.6	23	11.0
		- Triticale -				
TR7	IA-IRA-Bui	CYMMYT	41.0*	46.6	30	8.5
TR1	Navojoa	CYMMYT	37.8*	49.8	27	8.9
TR6	Mapache	CYMMYT	33.5*	48.8	29	9.4
--	Spelt	--	44.9	40.3	31	9.5
Experimental Means:			32.5	55.4	25.1	9.4

1/ Walera = Waldron/Era

* 41.0 bu = 1909 lbs/a; 37.8 bu = 1882 lbs/a; 33.5 bu = 1635 lbs/a; 44.9 bu = 1811 lbs/a.

Seed date: 28 April 1980
Harvest date: 25 August 1980
Previous crop: Barley

Table 10. Five-year averages for yield, test weight, height, and protein of spring wheat varieties grown in Pondera county, 1976-1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Variety	Yield	5-year comparable average Test wt.	Plant hgt.	% protein
Fieldwin	42.3	61.1	29	10.6
Wampum	38.6	60.1	29	11.9
Crosby durum	35.9	61.4	33	13.9
Butte	35.1	62.0	32	13.1
Wells durum	34.8	61.5	34	12.8
Marberg	34.7	59.7	27	13.5
Newana	34.4	61.5	27	13.0
Pondera	34.3	61.2	27	13.5
Len	34.3	60.0	28	14.0
Ward durum	33.8	61.1	33	14.1
Prodax	33.7	59.1	26	14.0
James	33.4	61.0	29	12.9
Lew	32.8	61.0	31	13.4
Olaf	32.2	60.0	28	13.6
Rolette	32.1	62.0	32	14.6
Fortuna	31.2	60.7	32	13.9
Tioga	31.1	60.2	32	14.1
Thatcher	30.8	59.7	33	14.0

1976 Charles Skorupa, 11 mi. east of Conrad
1977 Jim Sheble, 5 mi. northwest of Valier
1978 Phil Broesder, 13 mi. west of Conrad
1979/80 Agr. Research Center, north of Conrad
Checks for comparable average: Newana & Fortuna

Table 11. Spring wheat variety trial grown on dryland north of Cut Bank, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wts.	Plant hgt.	% protein
Fieldwin (white)	79.8	58.7	33	11.6
Wampum	73.9	57.5	34	12.3
Solar	70.8	58.7	31	13.1
Prodax	69.5	55.9	31	14.2
Newana	68.7	58.8	31	14.0
Fortuna	66.1	59.1	39	13.8
Olaf	66.0	56.4	31	14.2
Len	65.1	55.8	33	14.3
Lew	63.0	58.7	40	14.5
Pondera	62.9	60.4	31	14.4
Ward (durum)	62.8	59.5	42	15.5
Butte	62.0	59.7	37	14.5
Marberg	61.4	59.0	32	13.4
Thatcher	57.1	56.7	40	14.5
Rolette (durum)	53.5	61.2	37	15.8
Cando (durum)	52.4	57.7	26	12.9
Triticale (419)	54.7	45.2	46	12.8
Spelt	54.9	39.5	39	13.4
Experimental Means:	63.6	56.6	35.2	13.8

Cooperator & location: Bud Hansen, Cut Bank; Glacier Co. T35N, R9W, Sec. 4
Seed date: 24 April 1980
Harvest date: 9 Sept. 1980
Previous crop: Double fallow
Fertilizer: 11-51-0

Table 12. Two-year summary for spring wheat varieties grown north of Cut Bank, 1979-1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	2-year average Test wt.	Plant hgt.	% protein
Solar	57.0	59.3	29	12.9
Wampum	54.9	58.6	32	13.1
Fieldwin (white)	54.1	59.1	30	12.1
Prodax	52.2	57.8	29	14.2
Len	49.8	58.5	31	14.9
Marberg	49.1	59.9	30	14.6
Pondera	48.8	61.0	30	15.0
Newana	48.7	59.3	29	14.7
Olaf	48.6	58.3	29	14.7
Lew	46.2	59.7	37	15.2
Butte	44.9	60.1	35	14.4
Thatcher	44.6	58.4	38	15.6
Fortuna	44.2	59.2	36	14.8
Ward durum	42.1	59.0	37	16.4
Rolette durum	37.1	60.6	36	16.3
Triticale - 419	51.2	45.2	43	12.4
Spelt	59.1	39.8	36	13.8

Locations: 1979 - Jerry Swenson; 1980 - Bud Hansen.

Table 13. Spring wheat variety trial grown on dryland near Ethridge, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt.	Sawfly damage 0-9	% protein
Newana	51.9	59.6	31	2	12.4
Fieldwin	50.9	58.7	31	1	10.9
Prodax	49.9	56.2	32	4	13.0
Solar	49.8	58.3	31	1	12.6
Cando (durum)	47.4	60.3	28	0	12.8
Wampum	45.1	57.0	34	1	11.7
Len	44.7	60.2	33	2	13.0
Olaf	44.2	58.6	32	3	13.0
Pondera	43.2	59.1	32	1	13.8
Fortuna	43.1	59.8	39	1	13.0
Marberg	43.0	58.3	31	1	12.7
Lew	40.2	60.0	39	1	13.6
Rolette	39.5	61.5	40	5	14.0
Ward (durum)	36.9	58.2	40	1	13.7
Butte	29.2	59.3	36	7	13.7
Thatcher	28.1	57.6	40	2	14.3
Triticale #419	47.2	43.7	45	0	12.4
Spelt	48.5	35.0	41	0	14.1
Experimental Means:	43.5	56.7	35.3	1.8	13.0

Cooperator & location: Ray Tomsheck, Ethridge; Toole Co. T32N, R4W, Sec. 1.
Seed date: 23 April 1980
Harvest date: 20 August 1980
Previous crop: Fallow
Fertilizer: 11-48-0 with seed.

Table 14. Two-year summary for spring wheat varieties grown on dryland near Ethridge, 1979-1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	2-year average Test wt.	Plant hgt.	% protein
Newana	48.2	59.1	29	13.1
Fieldwin	47.6	57.9	28	11.1
Solar	47.0	58.3	30	12.9
Marberg	43.1	58.3	28	13.4
Wampum	43.0	55.7	32	12.7
Pondera	42.9	59.0	30	14.2
Fortuna	42.9	59.6	35	13.7
Olaf	42.1	58.0	30	13.6
Prodax	42.0	55.5	29	13.4
Len	41.6	59.0	31	14.3
Lew	41.1	59.9	34	14.2
Rolette	37.4	61.2	35	15.4
Ward	36.9	58.9	36	15.0
Butte	33.7	59.0	34	14.0
Thatcher	32.4	57.9	37	14.6
Triticale -419	47.7	44.1	42	12.9
Spelt	52.3	36.4	37	14.8

Location, both years: Ray Tomsheck farm.

Table 15. Spring wheat variety trial grown on dryland east of Choteau, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt.	% protein	Sawfly damage 0-9
Fieldwin (white)	51.1	53.9	33	8.5	1
Solar	48.8	53.9	30	9.3	2
Marberg	47.7	58.8	33	10.6	1
Pondera	45.6	57.2	33	11.0	1
Lew	45.1	58.6	36	11.0	0
Newana	44.4	55.3	31	10.8	4
Wampum	42.9	54.5	34	9.3	6
Fortuna	41.1	61.2	36	10.8	0
Rolette (durum)	40.4	62.2	35	11.1	1
Cando (durum)	38.9	59.2	28	10.4	0
Len	38.7	56.2	33	10.8	6
Ward (durum)	38.3	57.9	36	11.2	1
Prodax	38.1	51.3	31	10.8	4
Olaf	36.8	55.7	32	11.5	8
Thatcher	34.8	56.5	38	11.3	5
Butte	27.2	59.4	36	10.9	9
Triticale welsh	65.3	46.6	37	9.9	0
Triticale 419	60.0	39.4	46	7.9	0
Spelt	73.4	40.2	40	9.3	0
Experimental Means:	45.2	54.6	34.6	10.3	2.6

Cooperator & location: Bert Corey, Choteau; Teton Co. T25N, R2W, Sec. 30
Seed date: 22 April 1980
Harvest date: 14 August 1980
Previous crop: Fallow
Fertilizer (actual #/a): 11-48-0.

Table 16. Three-year summary for spring wheat varieties grown near Choteau, 1978-1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	3-year comparable average Test wt.	Plant hgt.	% protein
Solar	42.5	56.8	28	11.7
Fieldwin (white)	42.2	57.3	29	10.0
Lew	40.1	60.5	33	13.3
Marberg	38.8	58.7	29	12.8
Wampum	37.0	56.6	30	11.7
Pondera	36.8	59.3	29	12.7
Fortuna	36.0	60.5	33	13.7
Newana	35.6	58.4	27	12.9
Ward durum	34.7	59.9	34	14.0
Prodax	34.6	55.2	28	12.9
Len	34.0	58.3	30	13.3
Rolette durum	33.7	62.2	32	14.3
Olaf	32.8	58.0	29	13.5
Thatcher	31.8	57.8	34	14.1
Butte	24.8	59.8	33	13.0
Welsh Triticale	46.2	48.1	34	12.0
419 Triticale	48.8	43.8	42	11.1
Spelt	50.5	40.5	36	12.5

Location, all years: Bert Corey's, east of Choteau.

Table 17. Spring wheat variety trial grown on dryland near Fairfield, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt.	% protein
Newana	61.5	59.9	28	14.0
Fieldwin (white)	60.0	57.4	29	12.3
Marberg	58.3	60.3	28	13.4
Wampum	58.1	57.8	32	13.7
Solar	57.6	57.6	27	13.4
Pondera	56.1	60.8	29	14.6
Fortuna	55.2	58.9	34	14.8
Lew	53.7	60.1	35	15.0
Olaf	52.5	57.4	27	14.8
Butte	52.4	59.2	34	14.2
Prodax	50.3	55.2	27	15.1
Cando (durum)	49.9	58.8	25	16.0
Len	49.6	56.9	29	15.3
Ward (durum)	48.2	59.5	34	16.0
Rolette(durum)	47.9	60.4	29	16.9
Thatcher	47.0	58.5	36	14.7
Triticale(419)	83.9	47.9	40	14.0
Spelt	69.8	41.8	34	15.2
Urquie (white)	58.6	60.9	30	12.6
Experimental Means:	56.3	57.3	30.9	14.5

Cooperator & location: Sonny Harrell, Fairfield; Teton Co.
Seed date: 1 May 1980
Harvest date: 4 Sept. 1980
Previous crop: Alfalfa

Table 18. Two-year summary for spring wheat varieties grown near Fairfield, 1979-1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	2-year average Test wt.	Plant hgt.	% protein
Solar	61.5	55.3	29	13.3
Newana	60.4	58.1	29	13.3
Fieldwin (white)	59.9	54.5	28	11.7
Wampum	59.2	56.7	32	12.9
Marberg	59.0	58.4	30	14.2
Olaf	54.9	55.6	29	14.4
Butte	54.4	58.9	34	15.0
Len	53.0	58.3	30	14.6
Pondera	51.2	60.0	30	14.5
Prodax	50.1	53.9	28	14.0
Lew	50.6	59.5	33	14.8
Ward durum	50.0	57.7	35	15.3
Rolette durum	47.7	59.3	32	16.1
Fortuna	47.0	58.4	30	15.5
Triticale 419	71.1	47.4	36	13.9
Spelt	73.8	40.6	35	15.3

Locations: Dennis McComber 1979; Sonny Harrell 1980.

Table 19. Recommended spring wheat varieties for district 5 of Montana. 1/

Variety	Plant Type 2/	Year	Recommended Use
Fortuna	ST	1966	Dryland in sawfly areas
Newana	SD	1976	Dryland or irrigated
Olaf	SD	1974	Dryland or irrigated
Thatcher	ST	1934	Dryland or irrigated
Pondera	SD	1980	Dryland or irrigated
Marberg	SD	1980	Dryland or irrigated
Rolette durum	ST	1976	Dryland or irrigated
Ward durum	ST	1974	Dryland
Crosby durum	ST	1979	Dryland*

1/ District 5 includes the Triangle area.
2/ ST - standard height; SD - semidwarf
* Straw too weak for irrigation.

Table 20. Nitrogen and phosphorus rates on dryland spring wheat grown north of Cut Bank, 1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

lbs/a Actual $N-P_2O_5-K_2O$	Yield bu/a	Test wt.	% protein
0-0-0	58.6	60.1	13.7
30-0-0	55.3	59.6	14.2
60-0-0	54.3	59.1	15.5
11-51-0	59.1	59.6	14.0
41-51-0	54.9	58.6	14.8
71-51-0	57.0	57.9	15.4

Cooperator & location: Bud Hansen, Cut Bank; Glacier Co. T35N, R9W, Sec. 4.
Seed date: 24 April 1980
Harvest date: 9 Sept. 1980
Previous crop: double fallow (2 yrs.).
Fertilizer source: Ammonium nitrate (34-0-0), & MAP (11-51-0).
Variety: Lew spring wheat.
Phosphorus applied with seed.
Ammonium nitrate broadcast May 29.

Table 21. Comparison of preseeding tillage vs. no-till seeding of irrigated spring wheat grown on recrop under two wild oat control regimes. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Treatment	Yield bu/a	Test wt.	Plant hgt. (in)	W. oat control %	Maturity date
Hoelon w. oat control					
Pre-plant tillage	45.8	60.6	37	100	Aug. 28
No-till seeding	63.7	58.1	40	100	Sept. 4
Far-go w. oat control					
Pre-plant tillage	45.5	55.9	41	60	Aug. 28
No-till seeding	73.7	56.4	39	60	Sept. 4

Cooperators & location: Conrad HS Vo-Ag Dept.; Jack Baringer, CES; Dan Keil, Tri-Angle Ag. Supply. Vo-Ag field lab, Conrad.

Sequence of events:

Far-go granules (15 #/a) applied to standing stubble Feb. 6; non-incorporated.
Tillage plots received 2 cultivations: shovels followed by discing.
No-till plots received 0.5 qt/a Roundup prior to seeding for volunteer control.
Fortuna spring wheat seeded across all plots.
Hoelon plots sprayed at 4-5 leaf stage of w. oats (w. oat density = 60/ft.)
MCPA (3 pts/a) applied to all plots for post-emergence weed control (provided fair Canada thistle suppression).

TITLE: Barley Investigations

YEAR: 1980

LOCATION: Western Triangle Research Center, Conrad, MT.

PERSONNEL: Gregory D. Kushnak and Ron Thaut, Research Center, Conrad; E. A. Hockett, SEA, and R. F. Eslick, MUS, Bozeman.

Barley variety trials were seeded at 5 locations in the Western Triangle during 1980. The nursery at Ethridge was hailed out, and the nurseries grown on recrop at the Research Center had uneven stands and were not harvested. Data for the remaining locations are presented in the following tables: Cut Bank, Tables 22-23; Choteau, Tables 24-25; and Fairfield irrigated, Table 26. All locations received above normal precipitation.

Testing continued on three Hector/Klages lines (MT 547123, MT 547234, and MT 547354) in efforts to improve the agronomic characteristics of Klages. These lines were earlier to mature and higher yielding than Klages at each location; and one of the lines (MT 547234) will be released as a feed barley for commercial production in 1981. The name of the new release will be "Clark". Malting status for each line is pending lab results.

SOIL FUMIGATION STUDY

Many soil borne diseases and insects, known and unknown, are a potential deterrent to successful continuous cropping systems. Breeding crop varieties for resistance to a large number of pests is a very difficult and long-term task. To provide a possible alternative, a chemical method of broad spectrum soil borne pest control was investigated. The study involved the use of soil fumigation with Methyl Bromide gas (Dowfume MC-2); and was conducted in cooperation with Dr. David Sands and Dr. Wendell Morrill, M. S. U. Depts. of Plant Pathology and Biology, respectively.

Two fields suspected of having a high incidence of plant pathogens were selected for the study. The first field, located on station, was in dryland barley during 1979; and fumigation treatments were applied the same fall, after harvest. Barley was seeded on the treatments in the spring of 1980 and grown under dryland conditions.

The second field, located on Don Keil's farm north of Conrad, was in grass during 1978 and irrigated spring wheat during 1979. The spring wheat was adequately fertilized, but showed severe leaf yellowing and other abnormal colorations. Yields were far below potential. Samples submitted to the M. S. U. pathology lab failed to produce a conclusive diagnosis. Fumigation treatments were applied to this field during the spring of 1980, with subplots consisting of irrigated spring wheat and barley.

Results: The dryland barley trial on station was not fertilized and yields of both treatments were low. However, there was a 72% yield increase from the fumigation treatment over the check (Table 27). There was also drastic differences in plant height and percent protein between the two treatments; in favor of fumigation. No attempt was made to identify the organisms causing yield suppression in the check. There is a remote possibility that pathogens were not the cause; but rather a massive die-off of organisms in the fumigated treatment, with a concomittant release of nitrogen previously tied up in those organisms. This was suggested by the large difference in percent protein between the two treatments. Unfortunately, soil nitrate tests were not conducted.

The irrigated spring wheat and barley trial on Keil's showed no yield or protein response to fumigation (Table 28). Nitrogen fertilizer application to this field was well over 100 lbs./acre (actual); and therefore, any soil nitrate differences that may have been caused by fumigation were probably masked. No disease symptoms or other visual characteristics were observed in the check plots that would set them apart from the fumigated treatments. All plots appeared healthy.

Due to the lack of soil test and pathogen population information, the results cannot conclusively show that pathogens were a problem under these test conditions; but do indicate that soil fumigation can result in drastic yield responses in some instances. In 1978, a 20% yield increase resulted from soil fumigation in irrigated barley at Fairfield (cf. 1978 Ann. Rept. MAES West. Tri. Res. Ctr.). There is a need to follow up on these studies, with close attention to soil nitrates and soil borne pathogens before and after treatment. Feasibility of Methyl Bromide application must also be improved, perhaps by the development of different carriers and formulations, before this pest control method can be utilized on a practical basis.

Table 22. Barley variety trial grown on dryland fallow north of Cut Bank, 1980. Montana Agr. Expt. Station, Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt.	% plump	% thin	% protein
MT 31972 Klgs/Smt	89.8	47.1	33	75	8	13.8
Summit	86.5	47.1	31	37	29	15.1
Steptoe	85.8	39.2	37	70	11	15.1
Piroline	84.5	48.9	34	82	5	14.0
Hector	83.5	45.0	37	65	12	15.0
Clark (MT 547234)	81.3	46.5	37	79	7	14.1
Shabet	80.7	41.6	32	35	32	14.8
MT 547123	77.9	46.4	36	68	12	14.0
Menuet	72.4	48.5	27	66	11	16.2
Morex	72.4	42.7	36	47	19	12.8
Compana	70.8	43.2	31	83	5	15.3
Klages	69.8	44.9	33	49	18	15.1
Unitan	69.7	37.7	37	38	28	14.4
MT 547234 (Hct/Klg)	69.5	43.7	34	60	17	13.4
Larker	41.4	41.5	38	44	24	15.4
Experimental Means:	75.9	44.3	34.2	59.9	15.8	14.6

Cooperator & location: Bud Hansen, Cut Bank; Glacier Co. T35N, R9W, Sec. 4
Seed date: 24 April 1980
Harvest date: 9 Sept. 1980
Previous crop: Double fallow.
Fertilizer: 11-51-0

Table 23. Two-year summary for barley varieties grown on dryland north of Cut Bank, 1979-1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt.	% plump	% thin	% protein
Summit	76.6	48.2	30	64	17	13.7
Steptoe	76.3	40.4	33	80	8	12.3
Piroline	73.9	48.6	31	85	5	14.3
Hector	73.9	47.2	32	78	8	14.0
Shabet	73.3	44.2	31	59	20	14.7
Unitan	69.0	40.2	34	63	17	13.5
Morex	64.4	44.5	34	69	12	13.1
Compana	63.9	44.6	30	89	4	15.0
Klages	59.7	46.5	31	70	11	14.7
Larker	50.5	42.4	35	65	15	14.7

Locations: Jerry Swenson 1979; Bud Hansen 1980.

Table 24. Barley variety trial grown on dryland fallow east of Choteau, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt.	% plump	% thin	% protein
Steptoe	83.9	46.4	31	96	1	8.5
Compana	76.0	48.7	33	97	1	10.3
MT 547354 (Hct/Klg)	75.8	50.4	30	96	4	9.1
MT 547123 (Hct/Klg)	75.5	50.1	32	95	2	8.7
Shabet	74.9	50.8	36	98	1	8.7
Unitan	74.8	46.7	32	90	4	8.8
Piroline	74.2	51.9	36	97	1	9.5
Menuet	73.6	51.6	28	98	1	9.2
Klgs/Summit	73.3	51.2	35	98	1	9.6
Klages	71.9	49.7	37	95	1	10.2
Summit	71.5	51.4	32	95	2	9.3
Hector	69.6	51.0	36	96	1	9.5
Clark (MT 547234)	67.5	51.0	32	97	1	8.8
Larker	63.1	48.5	38	92	2	9.7
Morex	62.4	48.5	39	84	3	8.9
Experimental Means:	72.5	49.9	32.8	94.9	1.7	9.3

Cooperator & location: Bert Corey, Choteau; Teton Co. T25N, R2W, Sec. 30.
Seed date: 22 April 1980.
Harvest date: 14 August 1980.
Previous crop: Fallow
Fertilizer (actual #/a): 11-48-0 with seed.

C.V. 1 (s/mean): 13.5
C.V. 2 (s of mean/mean): 7.79
LSD (.10): 13.63

Table 25. Four-year summary for barley varieties grown on dryland east of Choteau, 1977-1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Four-year average Plant hgt.	% plump	% thin	% protein
Steptoe	69.5	45.7	29	92	3	11.0
Hector	67.5	51.5	31	88	4	12.4
Unitan	66.2	46.2	32	82	6	11.4
Shabet	66.1	49.2	31	82	5	12.0
Summit	65.0	51.1	29	77	9	12.2
Compana	63.0	48.4	28	91	3	12.9
Piroline	62.6	51.3	30	85	3	12.6
Klages	59.6	50.4	30	83	6	12.7
Morex	56.8	48.5	33	80	4	12.6
Larker	55.2	48.8	33	82	6	13.2

Location, all years: Bert Corey's, east of Choteau.

Table 26. Barley variety trial grown under irrigation near Power, 1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Variety	Yield bu/a	Test wt.	Plant hgt.	% plump	% thin	% protein
Steptoe	114.5	45.3	33	94	2	10.5
Unitan	109.7	44.3	40	85	5	9.6
Shabet	101.2	49.1	36	88	3	10.5
Hector	97.6	50.4	34	91	3	10.7
MT 547123 (Hct/Klg)	97.2	49.7	33	92	4	11.2
Larker	95.1	46.9	39	89	3	10.8
Piroline	94.5	51.9	39	96	1	10.9
MT 547354 (Hct/Klg)	93.9	49.5	32	91	3	11.1
Elrose	93.5	50.8	37	91	3	9.6
MT 547234 Clark	91.1	49.6	33	93	3	10.4
Summit	86.2	49.9	36	84	5	9.5
Klages	84.8	48.7	35	89	4	9.8
Morex	81.5	46.5	40	78	7	10.3
Menuet	80.5	51.2	33	94	3	9.9
Compana	78.6	47.5	33	92	4	10.4
Experimental Means:	93.3	48.8	35.5	89.8	3.5	103.5

Cooperator & location: Neal Johnson, Power; Teton Co.
Seed date: 21 April 1980
Harvest date: 14 August 1980.
Previous crop: Barley
Fertilizer: 94-34-30-20

C.V. 1 (s/mean): 7.84
C.V. 2 (s of mean/mean): 4.52
LSD (.05): 12.28
LSD (.10): 10.19

Table 26a. Recommended spring barley varieties for Montana.

Cultivar	Year	Areas and use recommended**
Compana	1941	Dryland in all district except 1; feed
Unitan	1959	Irrigated and dryland in all districts; feed
Ingrid	1963	Irrigated land in districts 1 and 3; feed
Piroline	1967	Irrigated land in all districts except 6; and dryland in all districts; feed and malting
Erbet	1971	Irrigated and dryland in all districts where early maturity is desirable; feed
Shabet	1971	Irrigated or dryland in higher rainfall areas in all districts; malting and feed
Steptoe	1973	Irrigated and dryland in all districts; feed
Hector	1974	Dryland in all districts except 1; feed
Vireo*	1974	Irrigated land or dryland in higher rainfall areas in all districts; feed
Georgie*	1974	Irrigated land or dryland in higher rainfall areas in all districts; feed
Lud*	1975	Irrigated land in all districts; feed
Summit*	1975	Irrigated and dryland in all districts; feed
Purcell	1976	Irrigated and dryland in District 1
Stepford*	1977	Irrigated and dryland in all districts; hay
Horseford		Dryland in all districts except 3; hay
Menuet*	1979	Irrigated or dryland in higher rainfall areas with long growing season; feed
Clark	1981	Dryland all districts; feed

* Private variety and protected under the Plant Variety Protection Act.

** District 1 Northwestern Montana
District 2 Southwestern Montana
District 3 Southeastern Montana
District 4 Central Montana, including Cascade County
District 5 Northern Montana, including Triangle Area
District 6 Northeastern Montana

Table 27. Effect of soil fumigation on yield and protein of barley grown on dryland recrop, 1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Treatment	Yield bu/a	Height in.	% protein
Check	19.9	22	10.8
Fumigated*	34.3	31	14.5

Location: Station
Date fumigated: September 1979
Date seeded: 28 April 1980; piroline barley
Previous crop: barley
* Soil fumigated with Dowfume MC-2 fumigant (Methyl Bromide 98%; Chloropicrin 2%).
Rate = 3 lbs/200 sq. ft.
Exposure time under plastic = 4 days.

Table 28. Effect of soil fumigation on barley and spring wheat grown under irrigation north of Conrad, 1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Treatment*	Yield bu/a	Test wt.	% protein
Barley			
non-fumigated	109.0	46.4	13.3
fumigated	105.4	47.8	13.6
Spr. wheat			
non-fumigated	83.3	60.5	14.2
fumigated	80.8	56.4	13.8

Cooperator & location: Don Keil, north of Conrad.
Date fumigated: 6 May 1980
Seed date: 14 May 1980
Previous crop: irrigated spr. wheat.
* Soil fumigated with Dowfume MC-2 fumigant (Methyl Bromide 98%; Chloropicrin 2%).
Rate = 3 lbs/200 sq. ft.
Exposure time under plastic = 4 days.
Varieties: Klages barley; Lew spring wheat.

TITLE: Pulse Crop Investigations

YEAR: 1980

LOCATION: Western Triangle Research Center, Conrad, Montana.

PERSONNEL: Greg Kushnak and Ron Thaut, Research Center, Conrad.

The performance of several protein (pulse) crops for the Triangle area was investigated during the last three years (1978-1980) in efforts to find a suitable alternative crop for rotational purposes. Fababeans, soybeans, field peas, and lentils were among the crops tested, and data for the various locations are presented in Tables 29 - 36.

Fababeans: Fababean yields averaged approximately 1350 lbs/acre across all locations over the 3-year period; which, at current prices ($8/cwt), does not compete favorably against wheat or barley in terms of income per acre. The Dutton location was an exception, where fababean yields averaged approximately 2000 lbs/acre.

Agronomically, fababeans have shown some good and bad points. They appear to be well adapted to the cool growing season of the Western Triangle area. Frost tolerance is comparable to that of barley, and the maturity period is short enough for most dryland locations in the Triangle. Lodging resistance is excellent, and plant height on dryland is sufficient for harvesting during years of above-average precipitation.

On the bad side, fababeans shatter readily, and must be swathed early (lower 2-3 pods turning black). In dry years, the plants are very short and difficult to harvest. It is suggested that fababean production in the Triangle area be limited to irrigated conditions, or dryland areas receiving 17 inches or more of annual rainfall. Sprinkler irrigation is difficult to apply later in the season, when the crop needs it the most, because the very tall growth hampers pipe moving operations. Flood irrigation would probably be the most feasible method to achieve the maximum yield potential (4000-5000 lbs./a.).

Soybeans: Attempts to obtain yield data from soybeans were unsuccessful during the past two years. Cold spring soil temperatures reduced germination in 1979; and rabbits destroyed the plots at each location in 1980. The varieties tested, BD-21117 and Maple Presto, are from Canada; and are reportedly early enough to mature for some areas of Alberta.

Field Peas: Austrian winter peas (spring seeded) averaged approximately 1700 lbs/acre over all locations and appeared to have a more stable and higher yield potential than fababeans for dryland conditions. The peas were frost tolerant and much more shatter resistant than fababeans. The only undesirable trait observed was the prostrate growth habit, and harvest operations would probably require the use of a lifter attachment on the cutter bar.

Lentils: Lentil yields averaged 1300 lbs/acre, but year-to-year variation was high. The crop was more sensitive to weed competition than peas or fababeans. Weed control in lentils has been difficult to achieve as herbicides available for this crop are limited. Plant heights were considered too short (12"-15") for conventional harvesting machinery. Lentils shatter readily and should be swathed. This could be a problem in the Triangle area; as the swaths are fluffy and vulnerable to wind.

Summary: Each of the above-mentioned crops has limitations to dryland production in the Triangle area. Weed control is a big problem, especially for perennial weeds. Chemicals available for these crops do not control many of the problem weeds encountered. Due to their higher tolerance to dry conditions, Austrian peas appear to offer the best potential for success as an annual pulse crop in rotation with grain. Fababeans are too sensitive to moisture stress, and would probably have to be grown on fallow; and only in areas of higher annual rainfall (17"). Lentils often have good market potential, but harvesting and weed control would be very difficult.

Table 29. Pulse crop varieties grown on dryland north of Cut Bank, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Crop & Variety	Yield #/a	Test weight #/bu	Height (inches) Lowest pod	Highest pod	Plant tip	Maturity date
Fababeans						
Ackerperle	1375	68.1	10	22	32	10 Sept.
Bell	1219	60.2	16	29	35	19 Sept.
Diana	972	61.2	9	24	32	12 Sept.
Petite	648	67.2	9	15	24	1 Sept.
Austrian W. Peas						
Fenn	1869	61.4	prostrate growth			3 Sept.
Lentils						
Laird	909	54.3	0	14	14	22 Aug.
Eston	546	68.2	0	12	12	15 Aug.

Cooperator & location: Al Hansen, Cut Bank; Glacier Co. T35N, R9W, Sec. 4
Seed treatment: Fababeans inoculated with Fababean Bacterial Inoculant.
Fertilizer: 11-48-0 with seed.
Seed date: 24 April 1980
Seed rate: Beans 1.5 seeds/sq. ft.; peas 3.5/sq. ft.; lentils 3.5/sq. ft.
Row space: 12 inches
Growing season precipitation: above normal

Table 30. Two-year summary for fababeans and Austrian peas grown on dryland north of Cut Bank, 1979-1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

	Two-year average					
			Height (inches)			
Crop & Variety	Yield (lbs/a)	Test wt.	Lowest pod	Highest pod	Plant tip	Maturity date
Fababeans						
Ackerperle	1253	66.9	10	20	27	Sept. 10
Diana	918	63.7	9	19	27	Sept. 12
Petite	645	65.7	5	11	17	Sept. 1
Austrian Peas						
Fenn	1656	62.7	prostrate growth			Sept. 3

Table 31. Pulse crop varieties grown on dryland near Ethridge, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Crop	Variety	Yield #/a	Test weight #/bu	Height (inches) Lowest pod	Highest pod	Plant tip	Maturity date
Fababeans	Bell	1609	69.1	17	26	39	29 Aug.
	Diana	1524	63.1	10	22	35	19 Aug.
	Petite	1446	62.4	4	15	19	10 Aug.
	Ackerperle	1375	67.2	10	21	35	20 Aug.
	Kron. Sel.	1291	67.2	14	25	38	28 Aug.
Austrian W. Peas	Fenn	1615	62.2	prostrate growth			20 Aug.
Lentils	Eston	1759	62.1	0	13	13	9 Aug.
	Laird	1717	61.2	0	16	16	15 Aug.
Soybeans	BD-21117	lost to rabbits					
	Maple Presto	lost to rabbits					
Adzuki Beans*	P.I. 293446	failed to germinate					

Cooperator & location: Ray Tomsheck, Ethridge; Toole Co. T32N, R4W, Sec. 1.
Herbicide: Tolban, 1 qt./a. preplant incorporated.
Seed treatment: Fababean bacterial inoculant, Fababeans only.
Fertilizer: 11-48-0 with seed.
Seed date: 23 April 1980; (soybeans & Adzuki 29 May).
Seed rate: 1.5 seeds/sq. ft. for beans; 2.5 seeds/sq. ft. for peas; 3.5 seed/sq. ft. for lentils.
Row space: 12 inches
Lentils too short for conventional harvest machinery.

* Vigna unguiculata

Table 32. Two-year summary for fababeans, Austrian peas, and lentils grown on dryland at Ethridge, 1979-1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

	Two-year average					
			Height (inches)			
Crop & Variety	Yield (lbs/a)	Test wt.	Lowest pod	Highest pod	Plant tip	Maturity date
Fababeans						
Diana	1442	64.7	9	19	30	Aug. 19
Petite	1228	63.4	4	13	19	Aug. 12
Ackerperle	1207	66.5	9	17	30	Aug. 22
Austrian Peas						
Fenn	1828	63.1	(prostrate growth)			Aug. 19
Lentils						
Laird	1454	58.8	0	15	15	Aug. 21

Table 33. Pulse crop varieties grown on dryland near Dutton, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Crop & Variety	Yield #/a	Test weight #/bu	Height (inches) Lowest pod	Highest pod	Plant tip	Maturity date
Fababeans						
Ackerperle	2425	64.3	15	27	39	15 Aug.
Diana	2221	66.2	15	30	40	15 Aug.
Petite	1609	63.2	9	16	24	6 Aug.
Austrian W. Peas						
Fenn	2292	60.0	prostrate growth			2 Aug.
Soybeans*						
BD-21117	lost to rabbits					
Maple Presto	lost to rabbits					
Lentils						
Laird	1476	60.4	8	17	18	4 Aug.
Eston	1431	60.5	7	14	15	30 July

Cooperator & location: Frank Loch, Dutton; Teton Co. T24N, R2E, Sec. 12.
Seed treatment: Fababean Bacterial Inoculant, Fababeans only.
Fertilizer: 11-48-0 with seed (100#).
Seed date: 25 April 1980 (soybeans 5 June).
Seed rate: Beans 1.5 seed/sq. ft.; peas 2.5 seed/sq. ft.; lentils 3.5 seeds/sq. ft.
Row space: 12 inches

Table 34. Three-year summary for fababeans grown on dryland near Dutton, 1978-1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

	Three-year average					
			Height (inches)			
Variety	Yield (lbs/a)	Test wt.	Lowest pod	Highest pod	Plant tip	Maturity date
Ackerperle	2141	64.2	11	21	31	Aug. 15
Diana	1999	65.6	12	26	32	Aug. 15
Petite	1604	64.0	6	14	20	Aug. 6

Table 35. Three-year yield summary of fababeans & Austrian peas grown at 12 dryland locations in the Triangle Area, 1978-1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

	Variety & Yield (#/acre)			
	Fababeans			Aust. Peas
Year & location	Diana	Ackerperle	Petite	Fenn
1978 Dutton	2675	2925	2200	--
Conrad*	1628	1250	1430	--
Chinook	1402	1089	--	--
Chester	778	832	--	--
1979 Dutton	1101	1074	1002	804
Ethridge	1359	1038	999	2040
Cut Bank	864	1131	642	1443
Sunburst	909	1056	1053	1566
Galata	661	627	--	--
1980 Dutton	2221	2425	1609	2292
Ethridge	1524	1375	1446	1615
Cut Bank	972	1375	648	1869
Average (all years)	1341	1350	--	--
Average (1979-1980 excluding Galata)	1279	1353	1057	1661

* Recrop at Conrad

Table 36. Three-year summary for height, maturity, protein, and test weight of Austrian Peas & Fababeans grown at 12 dryland locations* in the Triangle Area, 1978-1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Crop & Variety	Height (inches) Lowest pod	Height (inches) Plant tip	Maturity (days) 1/	% protein	Test weight
Fababeans					
Diana	9	28	121	31.8	65.0
Ackerperle	9	28	122	29.6	65.6
Petite	5	18	112	30.1	64.2
Austrian Peas					
Fenn	prostrate growth		117	--	63.0

* See Table 35 for locations involved.

1/ Figures apply to the crop left standing until ripe. Approximately 10 days could be subtracted if the crop were swathed.

TITLE: Oilseed Investigations

YEAR: 1980

LOCATION: Western Triangle Research Center

PERSONNEL: Greg Kushnak and Ron Thaut, Research Center, Conrad; Jerry Bergman, Research Center, Sidney, MT.

Sunflowers, safflower, crambe, rape, mustard, and flax were evaluated at several dryland locations in the Western Triangle over a 3-year period from 1978-1980. The locations represented various lengths and thermal units of growing season. Data for 1980, as well as 3-year summaries, are presented in the following tables: Cut Bank, Table 37; Cut Bank and Sunburst (3-years), Table 38; Ethridge, Table 39; Galata and Ethridge (2-years), Table 40; and Dutton, Tables 41-42.

The earlier maturing, adapted varieties of sunflowers produced good yields at all location/years, ranging from 1000 lbs./acre to over 2400 lbs./acre. Plant populations of approximately 15,000 plts./acre appeared to be satisfactory for dryland production in the Triangle area. A sharp reduction in head size and yield occurred when populations exceeded 18,000 plts./acre. Oil contents averaged 45%, ranging from 37% to 53%. There was little difference in oil content among locations.

Sunflowers are well adapted to most of the Triangle area, including the cooler season locations. They have shown exceptional drought tolerance and should, therefore, fit quite well into grain rotations involving continuous-crop or flex-crop systems.

Safflower produced high yields at some locations, but was very sensitive to growing season length and temperature. Oil contents were well below market standards during the cool season of 1978, and a complete failure to produce seed was noted at Cut Bank during 1980. Until earlier maturing varieties are made available, safflower production should be considered high risk in the western and northern portions of the Triangle area.

Yields of mustard, rape, and crambe ranged from 600 to over 2000 lbs./acre in harvested trials. Some trials were unsuccessful, as these crops were more sensitive to environmental influences. Some of the problems encountered were: flea beetles; high susceptibility to herbicide drift; insufficient seedbed moisture for shallow seeding; hot, dry conditions during bloom stage, and shattering. Crambe was much more tolerant to flea beetles than mustard and rape and appeared less sensitive to dry conditions. However, markets for crambe are very limited at this time.

Table 37. Oilseed crop varieties grown on dryland north of Cut Bank, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Crop/Variety*	Yield #/a	Test weight #/bu	Plant height in.	Maturity date 1/	% oil
Sunflower					
MF 700-0M	1569	23.6	46	Sept. 29	44.8
CG 205	1479	23.1	45	Sept. 26	44.5
CG 204	1395	23.1	46	Sept. 28	41.9
894	1347	21.7	47	Sept. 29	42.1
4W-1100-C	1269	22.5	45	Sept. 29	42.7
4W-1100C-503	867	21.1	45	Sept. 29	42.1
4W-900	690	23.6	45	Sept. 29	43.6
Safflower**	no seed development				-
Crambe	1056	25.0	35	Sept. 15	-
Rape					
Candle	1376	51.2	37	Sept. 2	-
Yellow Mustard					
Yellow-2	1629	54.7	42	Sept. 9	-
Brown Mustard					
Culbertson	1839	54.1	43	Sept. 11	-
Oriental Mustard	1974	53.6	42	Sept. 11	-

Cooperator & location: Al Hansen, Cut Bank; Glacier Co. T35N, R9W, Sec. 4
Fertilizer: 11-48-0 with seed
Seed date: 24 April 1980.
Seed rate: Sunflowers 15000 plts/acre; Rape, brown & orient. mustard 8 #/a; yellow mustard 15 #/a; safflower 6 seeds/sq. ft.
Row space: Sunflowers 24"; other crops 12".
Growing season precipitation: above normal.

* 894 = USDA; MF = Master Farmer; CG - Cargill; 4W = Four Winds

** Safflower varieties grown: Rehbein; Hartman; Sidwill; S-208; US-10; Partial Hull. Average safflower height = 27 inches.

1/ Foliage black; back of heads yellow (sunflowers).

Table 38. Three-year summary for oilseed crops grown in the northern portions of Glacier and Toole counties, 1978-1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

	Yield in location/year (#/a) *						
Crop/Variety	SNB 1978	CTB 1978	SNB 1979	CTB 1979	CTB 1980	Average test weight	1/ Avg. % oil
Sunflower							
894	1081	1005	1125	1101	1347	24.9	43.1
MF 700-OM	1332	1285	925	1047	1569	26.1	43.0
CG 204	--	--	1110	1038	1395	25.4	45.5
CG 205	--	--	1761	963	1479	26.4	49.2
Mustard							
Yellow	1078	753	--	1002	1629	53.7	28.9
Oriental	958	876	--	--	1974	51.9	38.7
Brown	908	942	--	966	1839	52.3	32.9
Rape	1142	900	--	594	1376	48.6	41.1
Safflower	--	--	1136	744	0	25.4	28.5
Crambe	--	--	1719	633	1056	24.0	29.9
Flax	--	--	777	--	--	52.8	41.5

* CTB = north of Cut Bank; SNB = east of Sunburst.

1/ Range for sunflower oil % = 37.6 - 53.1 ; Averages for oil include 1977.

Table 39. Oilseed crop varieties grown on dryland near Ethridge, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Crop/Variety	Yield #/a	Test weight #/bu	Plant height inches	Maturity date	% oil
Sunflower	lost to herbicide drift				-
Safflower					
Rehbein	1128	38.2	32	Oct. 8	29.6
Sidwill	1092	37.5	34	Oct. 8	28.1
US-10	921	37.4	32	Oct. 8	33.6
S-208	888	37.3	32	Oct. 8	35.5
Hartman	867	33.5	31	Oct. 10	30.9
Partial Hull	708	31.5	30	Oct. 8	37.0
Crambe	1464	23.7	44	Aug. 20	-
Rape					
Candle	804	53.3	28	Aug. 5	-
Brown Mustard					
Culbertson	1464	54.0	45	Aug. 20	-
Oriental Mustard					
Culbertson	2124	52.1	40	Aug. 20	-
Yellow Mustard					
Yellow-2	1062	55.3	41	Aug. 17	-
Flax					
Noralta	768	52.1	26	Aug. 22	-

Cooperator & location: Ray Tomsheck, Ethridge; Toole Co. T32N, R4W, Sec. 1.
Herbicide: Tolban, 1 qt./a. preplant incorporated.
Fertilizer: Flax, 5-24-0 with seed; other crops, 11-48-0.
Seed date: 23 April 1980.
Seed rate: Sunflowers 15000 plts./acre; Rape, brown & orient. mustard 8 #/a; yellow mustard 15 #/a; Flax 40 #/a; Safflower 6 seeds/sq. ft.
Row space: Sunflowers 24"; other crops 12".

Table 40. Two-year summary for oilseed crops grown in the southern portion of Toole County, 1979-1980. Montana Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	Yield in location/year (#/a) Galata 1979	Ethridge 1979	Ethridge 1980	Avg. Test wt.	Avg. % oil
Sunflower					
894	1634	1382	--	27.6	48.2
MF 700-0M	--	1488	--	27.0	44.7
CG 204	1182	1265	--	28.6	45.3
CG 205	2094	1774	--	30.0	49.2
Mustard					
Yellow	--	1221	1062	54.8	28.0
Oriental	--	1245	2124	51.2	37.8
Brown	--	1152	1464	52.1	35.5
Rape	--	885	804	49.8	37.7
Safflower	--	1008	1128	39.9	30.0
Crambe	--	1269	1464	21.5	27.7
Flax	--	984	768	53.2	41.8

1/ % oil includes 1977 + Pondera Co.

Table 41. Oilseed crop varieties grown on dryland near Dutton, 1980. Montana Agr. Expt. Station, Western Triangle Research Center, Conrad, MT.

Crop/Variety	Yield #/a	Test weight #/bu	Plant height inches	Maturity date	% oil
Sunflower					
MF 700-OM	2025	28.2	54	Sept. 10	48.3
CG 205	2008	30.3	51	Sept. 8	52.8
4W-1100-503	1941	28.4	52	Sept. 10	50.6
894	1883	29.1	50	Sept. 10	50.6
CG 204	1877	27.0	50	Sept. 10	49.9
4W-1100-C	1857	28.9	54	Sept. 10	53.6
4W-900	1769	28.9	49	Sept. 10	49.1
Safflower					
Sidwill	2655	42.5	36	Oct. 1	35.0
Hartman	2490	38.9	35	Oct. 4	40.1
S-208	2211	43.0	34	Oct. 1	41.6
Rehbein	2079	42.8	34	Oct. 1	36.3
US-10	1887	42.6	32	Oct. 1	37.0
Partial Hull	1632	39.0	31	Oct. 1	44.2
Crambe	1449	24.0	37	Aug. 12	-
Flax					
Noralta	993	54.0	24	Aug. 17	-
Yellow Mustard					
Yellow-2	855	55.3	40	Aug. 8	-
Brown Mustard					
Culbertson	1464	52.3	47	Aug. 10	-
Oriental Mustard					
Culbertson	1446	52.3	46	Aug. 12	-
Rape					
Candle	1400	51.6	33	Aug. 1	-

Cooperator & location: Frank Loch, Dutton; Teton Co. T24N, R2E, Sec. 12.
Fertilizer: Flax 50# 11-48-0 with seed; other crops 100# 11-48-0.
Seed date: 25 April 1980.
Seed rate: Sunflowers 15000 plts/acre; Rape, brown & oriental mustard 8 #/a; Yellow mustard 15 #/a; Flax 40 #/a; Safflower 6 seeds/sq. ft.
Row space: Sunflowers 24"; other crops 12".

* CG = Cargill; MF = Master Farmer; 4W = Four Winds.

Table 42. Three-year summary for oilseed crops grown near Dutton, MT., 1978-1980. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT.

Crop/Variety	1978	1979	1980	Avg. Test wt.	1/ Avg. % oil
Sunflower					
894	2046	1449	1883	29.4	49.5
MF 700-0M	2462	1503	2025	27.8	47.1
CG 204	--	1248	1877	25.9	48.3
CG 205	--	2190	2008	29.4	50.8
Mustard					
Yellow	1555	--	855	54.8	28.4
Oriental	1918	--	1446	52.3	37.4
Brown	1318	--	1464	52.5	34.9
Rape	1172	--	1400	50.4	39.4
Safflower	--	1272	2655	42.8	31.1
Crambe	--	--	1449	24.4	35.4
Flax	--	1002	993	53.1	42.4

1/ Safflower oil % ranged from 18.6% to 42.1%; sunflower oil % remained stable over the 3-year period.

TITLE: Evaluation of Roundup herbicide for weed control in emerged fababeans.

YEAR: 1980

LOCATION: Western Triangle Research Center, Conrad, MT.

PERSONNEL: Greg Kushnak and Ron Thaut, Agr. Research Center, Conrad, MT.; Don & Paul Kronebusch, Conrad, MT.

Introduction: This study arose out of a past experience whereby we mistakenly allowed Roundup spray to drift onto a fababean nursery, and observed no crop injury. This opened the questions "how tolerant are fababeans to Roundup?" and "could we control annual grassy weeds and perennial weeds in emerged fababeans with Roundup?" In addition, the wet conditions during the Spring of 1979 caused many growers to abandon the idea of using soil incorporated herbicides for fababeans. Subsequently, some bean fields became heavily infested with wild oats and other weeds later in the season; and emergency treatments were being sought. In the Spring of 1979, four rates of Roundup, ranging from 0.5 to 3 qts/acre, were applied to fababeans; and the results indicated that fababeans could tolerate only the lowest rate (0.5 qts/a). Even the 0.5 qt. rate, however, reduced plant height and number of beans considerably; and it was not certain if the use of Roundup at such a low rate would control weeds enough to compensate for the crop damage incurred.

During the Spring of 1980, a field of irrigated fababeans heavily invested with wild oats, wild mustard, and kochia was selected for further study. Treatments consisted of two dates of the 0.5 qt/acre rate to determine if the net benefits were positive and to determine if date of application was associated with level of crop damage. The first treatment involved application when the beans were 3-inches tall (June 7); and the second treatment was applied at the 6-inch growth stage (June 14).

Results: Complete control of wild oats, mustard, and kochia was obtained with the 0.5 qt/acre Roundup rate within each treatment date. Canada thistle (approx. 6" tall at spraying time) were burned down by the treatments and recovered very slowly during the season.

The early treatment stunted the crop considerably, delayed flowering and maturity, and caused yellowing of the leaves (Table 43). The later treatment (6" stage) did not affect plant color, reduced plant height only slightly; and did not delay flowering or maturity. Number of pods per plant was reduced for both treatments. The later treatment yielded twice as much as the early treatment, indicating that crop growth stage during application is critical.

There was no yield difference between the late treatment and the non-treated check, indicating that the benefits of weed control broke even in compensating for crop injury due to Roundup. The beans competed with the heavy weed growth much better than originally anticipated; and Roundup application would not have been necessary to save the crop in this case.

Table 43: Effect of Roundup herbicide on two growth stages of irrigated fababeans. Mont. Agr. Expt. Sta., Western Triangle Research Center, Conrad, MT. 1980.

Fababean growth stage at application	Plant condition (July 7)	Plant condition (Sept. 29)	Seed weight gr/1000	Yield lbs/acre
3" Tall	5" Tall light green no flowers root nodules present	25" Tall normal green 9 pds/plant pod height 5"-15"	300	1149
6" Tall	15" Tall normal green flowering root nodules present	30" Tall normal green 8 pods/plant pod height 7"-19"	390	2396
Check (non-sprayed)	20" Tall normal green flowering root nodules present	56" Tall normal green 12 pods/plant pod height 14"-48"	250	2400

Cooperators & location: Don & Paul Kronebusch, N. of Conrad.
Seeding date: 17 May 1980.
Spray dates: 3" growth stage - June 7; 6" growth stage - June 14.
Rate: 1 pint Roundup/acre. Volume: 20 gal. water.
Harvest date: September 29, 1980.
Fertilizer: 50 lbs. 18-46-0.
Previous crop: Irrigated barley.
Rainfall & irrigation: 2.07" pre-season + 3.0" May + 2.82" June + 0.38" July + 1.45" August + 3.5" irrigation July 16 = 13.22" total.
Weeds: Complete kill on kochia, mustards & wild oats; Canada thistle 6" tall at spraying time, tops burned down with little recovery.

TITLE: Fertilizer Rates on Irrigated Alfalfa

YEAR & DURATION: 1980 (1979 through 1981)

LOCATION: Western Triangle Research Center, Conrad, MT.

PERSONNEL: Greg Kushnak and Ron Thaut, Research Center, Conrad, MT.

Procedures: Several rates of P_2O_5 and sulfur were applied to a second year stand of irrigated alfalfa. Checks included a zero treatment and one nitrogen rate. Root samples were examined for nodules during both harvest dates. Pre-inoculated seed was used to establish the stand, but the viability of the inoculant was in question. Other details regarding sources, dates, etc. are presented in the footnotes to Table 44.

1979 Results: The number and size of nodules were very small in all treatments, but a slight trend toward increased nodulation was noted for sulfur treatments of 60 #/a and above. This increase was not considered significant.

Dry matter yields increased 0.4 T/a with 200 #/a of P_2O_5; and 0.72 T/a with 400 #/a of P_2O_5 (Table 44). Potassium increased yield by 0.81 T/a when phosphorus and sulfur were held at 200 and 60 #/a, respectively.

Nitrogen at 150 #/a increased yield by 0.45 T/a when phosphorus and potassium were held at 200 and 60 #/a, respectively. This treatment combination produced the highest yield in the experiment, followed by the 400 #/a rate of P_2O_5.

Sulfur provided no positive yield effect during the first year.

1980 Results: Dry matter yields increased 0.5 T/a with 200 #/a of P_2O_5 (Table 44). These increases were similar to those obtained the previous year, indicating the presence of residual P_2O_5 from the initial treatment.

Yield increases due to potassium and nitrogen dropped considerably from the previous year, indicating most of the applied amounts of these elements were utilized during the first harvest year. In as much as the form of sulfur used was slow to become plant-available, yield increases from sulfur did not occur until the second year (1980).

The data indicate that nitrogen, phosphorus, potassium and sulfur are limiting under these conditions; and suggest that most emphasis should be placed on nitrogen and phosphorus. It is likely that proper seed inoculation would reduce or eliminate the need for applied nitrogen, since soil pH was compatible to rhizobia.

Table 46. Mechanical renovation of rangeland west of Valier, 1975-1980. Pondera Co-op Ext. Service.

Year	Yield (lbs/acre) in treatment 1/			
	Check	1	2	3
1977	127	109	143	126
1978	962	1472	1878	2185
1979	910	1080	1080	1195
1980 Forbs	192 (29%)	564 (29%)	276 (20%)	168 (8%)
1980 Grasses	480 (71%)	1356 (71%)	1104 (80%)	1897 (92%)
1980 Total	672	1920	1380	2065
Average (4-year)	668	1145	1120	1392

Cooperator: Wally Bradley, Valier.
Project leader: Jack Baringer, Pondera CES.
1/ Treatment numbers indicate number of times worked with a chisel plow. Each cultivation was in a different direction. Cultivations were 3 inches deep with 3" spikes on 12 inch centers.
Date cultivated: October 9, 1975.
1980 Harvest date: 3rd week of July.