THIRTY-FIRST ANNUAL REPORT

1979

Research Report No. 162

Northwestern Agricultural Research Center
of the
Agricultural Experiment Station
Montana State University

1570 Montana 35
Kalispell, Montana 59901

Prepared By

Vern R. Stewart
Associate Professor of Agronomy and Superintendent

Leon E. Welty
Assistant Professor

ADMINISTRATION 750

Following is a listing of personnel which were employed in 1979. Their beginning service date is shown in parentheses.

Vern R. Stewart, Superintendent & Assoc. Professor (April 1, 1952)
Leon E. Welty, Assist. Professor (January 15, 1973)
Jeanette Calbick, Secretary (September 1, 1963)
Glenn Fulbright, Ag Res. Tech. I (January 1, 1979)
Todd Keener, Ag. Res. Tech. II (March 27, 1978)
Patrick Hensleigh, Res. Assist. in Agronomy (April 15, 1977)
Steve Soppe, Farm/Ranch Hand II (May 1979)

Those employed for the summer were:

Jim Aichlmayr (June 11 thru June 15)
Patricia Ambrose (June 11 thru September 14)
Timothy Carlson (June 12 thru September 14)
Virginia DeMars (July 31 thru September 14)
Kevin Kephart (June 11 thru October 12)
Mark Lorang (June 11 thru September 14)
Lori McPherson (June 11 thru September 14)
Debra Nelson (June 11 thru August 15)
Cynthia vonBargen (August 9 thru September 14)
Marrianna Ward (May 2 thru June 8)
Herbert Young (yard maintenance, 2 days/week throughout the summer)

Kevin Kephart has worked for us the last four summers. This year he graduated from Montana State University in Soils Science and is now waiting to be accepted into graduate school.

PHYSICAL PLANT 751

This project is the one that all improvements on buildings, lawns and roadways is charged. This year there was very little done except the general maintenance that is required each year.

A Kenmore wet/dry vaccum was purchased. It is hoped that the office floors will be easier to keep clean with this new appliance. With the fine soil blowing around it is almost impossible to keep the floors clean.

GENERAL FARM 752

This project supports all research projects such as 754 (weeds), 755 (forage), 756 (small grains) and 758 (miscellaneous crops).

Time this year was spent mainly on repairing equipment.

A 1979 Ford Model 3/4 T pickup was purchased for a total cost of $7300.

ACTIVITIES

DATE	ACTIVITY	STAFF	LOCATION
January			
4	Ag Council Meeting	Stewart	Bozeman
19	CRD Meeting	Stewart	Kalispell
	Chamber of Commerce Meeting	Stewart	Kalispell
22-24	Montana Agric. Buxiness Assoc.	Stewart	Great Falls
31	Weed Research Committee Meeting	Stewart	Bozeman
February			
5- 8	Extension Service Speaking Tour	Welty	Western Montana
6	Western Seed & Supply Meeting	Welty	Polson
13	Dryland Wheat Farm Meeting	Stewart	Kalispell
	Ag Council	Stewart	Kalispell
14	Farmers Union Agric. Chem. Meeting	Stewart	Kalispell
16	Ag Council	Stewart	Bozeman
14-16	Sod-Seeding Regional Meeting	Welty	Denver, CO
20	NW & W Agric. Advisory Committee	Stewart	Allentown
		Welty	Allentown
21	Kiwanis	Stewart	Kalispell
22	Kalispell Feed & Grain Farmers Meet.	Stewart	Kalispell
23	Ag Chamber Business Meeting	Stewart	Kalispell
26-	Planning Conference	Stewart	Bozeman
		Welty	Bozeman
March			
2	Planning Conference		
12	County Agents Up-Dating Meeting	Stewart	Ronan
		Welty	Ronan
13	Ag Council	Stewart	Kalispell
15	Meeting on Outdoor Classroom	Stewart	Kalispell
20-21	WSCS Meeting	Stewart	Boise, ID
23	Eastside Grange	Stewart	Creston
29	Rotary Club	Stewart	Kalispell
April			
12	CRD Meeting	Stewart	Kalispell
May			
5	Plant & Soil Class 302 Tour	Stewart	Creston
7- 9	Outdoor Classroom	Stewart	Kalispell Area
31	Ag Council Meeting	Stewart	Bozeman
June			
5	Symposium on Intermountain Meadows	Welty	Jackson, WY
14	Vo-Ag Teachers Tour	Stewart	Creston
		Welty	Creston

Activities (con't)

DATE	ACTIVITY	STAFF	LOCATION
July			
5	CRD Meeting	Stewart	Kalispell
10-11	Summer Staff Conference	Stewart	Havre
		Welty	Havre
14	Christmas Tree Field Day	Stewart	Kalispell Area
18	Mint Meeting	Stewart	Kalispell
19	Mint Tour	Stewart	Kalispell Area
23	Tour Washington State University Farms	Stewart	Pullman, WA
August			
6- 7	ASA Meetings	Stewart	Fort Collins, CO
		Welty	Fort Collins, CO
27	Mint Meeting	Stewart	Kalispell
September			
13	CRD Meeting	Stewart	Kalispell
14	Chamber of Commerce Tour	Stewart	Kalispell Area
20-21	Administrative Conference	Stewart	Bozeman
22	Advisory Committee Conference	Stewart	Bozeman
November			
21	CRD Meeting	Stewart	Kalispell
28	Stress Seminar	Stewart	Kalispell
29	Grain Growers Meeting	Stewart	Great Falls
December			
6	Kiwanis	Stewart	Ronan
7	Ag Council Meeting	Stewart	Bozeman

VISITORS

DATE	VISITOR	REPRESENTING	ADDRESS
January			
10	Robert Hunt	Monsanto	Great Falls
February			
8	Dan Cash	Human Resources	Kalispell
21	Phil Clarke	Farmer	Columbia Falls
March			
5	Dan Swarsin	Job Applicant	Kalispell
7	Steve Moore	Ciba Geigy	Fargo, ND
	Earl Chamberlin	Ciba Geigy	DesMoines, IA
23	Mike Dobrocke	Farmer	Columba Falls
	Steve Soppe	Job Applicant	Kalispell
	James Eller	Job Applicant	Kalispell
	Gary Iverson	Sunburst Seed Co.	Sunburst
28	Walt & Art Mangles	Farmers	Polson
30	Robert Hunt	Monsanto	Great Falls
April			
13	Bill Ambrose	Farmer	Kalispell
	Jack Yeager	Farmer	Cevercile, CA
	Dick Woodwott	Farmer	Cevercile, CA
	Jack Pmoal	Farmer	Running Springs,CA
17	Elliott Robocker	Farmer	Kalispell
18	Don Graham	WARC - Soil Scientist	Corvallis
19	Michael Smith	Student UCD	Davis, CA
25	Carl Johnson	Stauffer Chemical Co.	Billings
	Walter C. Sarver	Airline Capt.	Saxonburg, PA
27	Mr.&Mrs. Leland Cade	Montana Farmer Stockman	Billings
May			
1	Allen Zimmerman	Farmer	Kalispell
	Luke Lalum	Vo-Ag Teacher	Kalispell
2	Robert Sharp	Contractor	Kalispell
	George Hubbard	Farmer	Kalispell
3	Mr.&Mrs. Hector Spector	Farmer	Polson
14	Debbie Nelson	Job Applicant	Kalispell
	Mr. & Mrs. R. Nelson	Retired	Kalispell
	James Davis	Doctor	Honolulu, HI
15	Mary Klies	American Hoechst	Billings
	Don Lowatch	American Hoechst	New Jersey
	Tom Blincoe		Kalispell
21	Charles Jaquette	Farmer	Kalispell
	Gene Jaquette	Farmer	Kalispell
24	Clyde Pederson	Farmer	Kalispell
29-30	Mary Klies	American Hoechst	Billings
30	Gary graves	John Deere	DesMoines, IA

Visitors (con't)

DATE	VISITOR	REPRESENTING	ADDRESS
June			
4	Dave Lindsey	Equity Supply	Kalispell
	John Brown	Job Applicant	Kalispell
5	Lori Dyer	Job Applicant	Kalispell
7	Art Helland	Day Equipment	Kalispell
	John Vance		Illinois
12	Harold & Phil Clarke	Farmers	Columbia Falls
	Dan Hopper	Gulf Chemical	Cascade
	Darrell Logan	Farmer	Kalispell
13	William Tietz	President MSU	Bozeman
	John Jutila	Vice-Pres. MSU	Bozeman
	Sonny Holland	Presidents Office	Bozeman
18	Edward Littleplam	Farmer	Browning
	Herb Leighty	Cominco American	Spokane, WA
19	Roy Nordwall	Thermal Tech	Kalispell
	Harold Clarke	Farmer	Columbia Falls
20	Marylin Nelson	Teacher	Bigfork
	Mr. McHenry	Tree Grower	Kalispell
25	Larry Wittsell	Shell Development Co.	Modesto, CA
27	Don Siblerud	Part-time Farmer	Kalispell
July			
7	Mrs. Cheek	Farmer	Columbia Falls
12	Lloyd Hall	Farmer	Kalispell
	Allen Taylor	Plant & Soil Science-MSU	Bozeman
14	Kathy Stewart	Campus Crusade	SanBernardino, CA
	Diania Melville		Chenny, WA
	Phil Clarke	Farmer	Columbia Falls
17	Mary Kleis	American Hoechst	Billings
18	Mareike Reinhold	Plant Pathology-MSU	Bozeman
	Gene Sharp	Plant Pathology-MSU	Bozeman
	Jerry Stringam	Farmer	Ft. McCloud, Canada
19	Bruce Hewitt	Gustafson	Moses Lake, WA
25	Chere Crandell	Student ASU	Tuscon, AZ
	Rebecca Walcutt	Student ASU	Tuscon, AZ
	Mr.&Mrs. Tom Ramage	Arizona State University	Tuscon, AZ
30	Jesse Sparks	Farmer	Columbia Falls
	Jerry Nezats	Inventor	Kalispell
August			
2	Dean Dahlgren	Farmer	Bigfork
13	Dean Stipe	Farmer	Moise
	Dave Crawford	Farmer	Polson
	Mr.&Mrs. Clay Shelton	Stauffer Chemical Co.	Portland, OR
17	Jim Rodebush	Stauffer Chemical Co.	Swan Lake, ID
20	George Evans	Plant & Soil Science-MSU	Bozeman
21	Mr.&Mrs. Don Mucsil	Farmers	Ames, IA
	Martha Mucsil		Ames, IA
22	Greg Northcutt	Publications-MSU	Bozeman

Visitors (con't)

DATE	VISITOR	REPRESENTING	ADDRESS
September			
10	Webb Brogan	Webb's Real Estate	Lakeside
14	Charles Rhode	Wheat Breeder OSW	Pendleton, OR
	John Sheldon	Farmer	Kalispell
18	John Shield	Farmer	Kalispell
26	Howard Bowman	Plant & Soil Scienc-MSU	Bozeman
29	Clarence Lapp	Farmer	Columbia Falls
October			
1	Jim Rodebush	Stauffer Chemical	Swan Lake, ID
9	Robert Hunt	Monsanto	Great Falls
15	Gene Sharp	Plant Pathology-MSU	Bozeman
	Cahit Kanak	Exchange Student-MSU	Izmir, Turkey
	Mareike Reinhold	Plant Pathology-MSU	Bozeman
November			
8	Patty vonBargen	League of Women Voters	Kalispell

TABLE OF CONTENTS

Table of Contents (con't)

DISTRIBUTION OF THE
1979 NORTHWESTERN AGRICULTURAL RESEARCH CENTER REPORT

Copies	
2	Office of Director, Montana Agricultural Experiment Station
1	Plant and Soil Science Department - Dr. A. Hayden Ferguson
4	Research Staff at Northwestern Agricultural Research Center
	C. W. Roath Vern R. Stewart Leon E. Welty Library
11	County Extension Agents in Northwestern Montana
	Program Coordinator - James DeBree Deer Lodge - Powell - David Strufert Flathead - Darrell Fenner & Bruce McCallum Granite - Lyle Niederklein Lake - G. Edward Bratton Lincoln - Robert Wilson Mineral - Willie Huot Missoula - Gerald Marks Ravalli - G. Robert Johnson Sanders - Barry Bowles Silver Bow - Tom Groce
3	Northwest Montana Banks
	Conrad National Bank - Kalispell The First Northwestern National Bank of Kalispell Western Montana National Bank - Missoula
1	Agricultural Stabilization and Conservation - Don Hughes
1	Farmers Home Administration - Marvin Jones
1	Soil Conservation Service - Tim Wiersum
1	Federal Land Bank Association - Bernie Herman
3	Feed Mills
	Equity Supply Company - Kalispell Kalispell Feed & Grain Supply Inc. - Kalispell Western Seed and Supply Company - Charlo

CLIMATOLOGICAL DATA

Northwestern Agricultural Research Center
Kalispell, MT 59901

Since 1949 the Northwestern Agricultural Research Center has cooperated with the United States Weather Service in securing weather information. Maximum and minimum temperatures are recorded daily at 8 a.m. Soil temperatures are recorded at the depth of four and eight inches.

Summary of the 1978-79 Crop Year

There were 123 frost free days in 1979. The last killing frost occurred May 27, 1979 and the first killing frost was October 1, 1979. The mean for the period 1950-79 is 109 days.

Total precipitation for the crop year was 16.31 inches which is 2.82 inches less than the 30 year average. The mean temperature for the year was 40.9°F and this is 2.3° lower than the long term average.

Following is a brief summary for each month of the crop year.

September 1978 - Precipitation was .40 above normal, but the continual rain from the 6th of September to the 15th made harvest very difficult. A very high percentage of the grain in the valley was damaged by sprouting. We did have good moisture for fall seeding.

October 1978 - Precipitation was 1.26 inches below average. In spite of the rather dry conditions at the end of October we had excellent wheat stands in most of our plantings. The vegetative growth was not as heavy as we had in the fall of 1977.

November 1978 - Precipitation was .51 of an inch below normal. We had our first sn ow on the 9th of the month and by the end of the month we had five inches of snow on the ground. Temperatures were 5.5 degrees below the normal. The wheat was in good condition at the beginning of the month. We had our first snow cover of significance on the 19th of the month.

December 1978 - Temperatures were 7.3 degrees below average. Precipitation was also below average. Snow continued to accumulate during the month. Temperatures became extremely cold with the coldest temperature occurring the last day of the month. Our greatest snow accumulation occurred December 31 when we had 11 inches of snow on the ground.

January 1979 - This was the coldest January on record since the weather records began on the station in 1949. The mean for the month was 4.1°F which is 17.3° below normal. Precipitation was 1.70 inches which is slightly above normal. Snow continued to accumulate during this month with 20 inches on the ground on the 28th of January. The temperature did not get above freezing for 20 days. During the first 10 days of the month the minimum temperatures ran from a -10 to a -31 degrees below zero. A very cold month!

February 1979 - Precipitation levels were above normal, 2.5 inches. Mean temperatures were 2.1 degrees below normal. The greatest snow accumulation was on the 4th of February when we had 25 inches on the ground. On the 28th of the month there were 9.34 inches on the ground. It began warming up toward the end of the month when the temperature reached 44°F on the 27th.

March 1979 - Precipitation was below normal. Temperatures were slightly above. The month began with 9 inches of snow on the ground and the snow was gone by the 12th. However, we had 5 inches of snow on the ground on the 28th of March, but by the end of the month the snow was gone. Winter wheat appeared to come out from under the snow in fairly good condition.

April 1979 - Precipitation was one inch above normal. Temperatures were near normal. The precipitation occurred from the 10th until the 21st of the month and there was some snow during the month. However, by the end of the month the temperatures had reached 70 degrees.

May 1979 - Precipitation was .58 inch above normal. Temperatures were exactly the same for May as for the long term average. The majority of the precipitation fell during the first part of the month. We had 1.31 inches on the 5th, which is quite high. These May rains interfered with our seeding plans, but we were not delayed too long.

June 1979 - Precipitation was 1.59 inches below normal. Crops were in fair condition the first part of the month. With the continuing dry weather in the latter part of June winter wheat began to suffer.

July 1979 - The July precipitation was 1.02 inches below normal. We had very little shower activity during the month. The winter wheat was suffering considerably and only those fields that had sub-soil moisture appeared to be making any growth. Barley was in stress this month and generally it looked like there may be significant yield reductions.

August 1979 - Precipitation was slightly above the long term average of 1.79 in. Temperatures were slightly above average, 2 degrees. The forepart of the month had very little precipitation, however from the 15th thru the 25th we had showers. These showers did aid in the filling of spring barley but did not hinder winter wheat harvest. There was slight sprouting in some of the winter wheat that was ready for harvest, but no real damage to the wheat crop was observed.

The year of 1979 was probably the easiest harvest year that the author has had the privilage to work in since beginning employment at the research center in 1952.

The winter of 1978-79 was one of the coldest winters we have experienced. The coldest temperature occurred on December 31, 1978 and January 1, 1979 (-31°). We did have some sub-freezing weather before we had any significant amount of snow cover. Because our first snow cover occurred about mid-November and was followed by enough cold weather to inhibit or destroy germinating smut spores we did not get the high level of dwarf smut infection we had anticipated. It appears that we need a snow cover beginning the first part of November if we are to have any dwarf smut infection.

Table 1. Summary of climatic data by months for the 1978-79 crop year (September to August) and average for the period 1949-79 at the Northwestern Agricultural Research Center, Kalispell, MT.

Item	Sept. 1978	Oct. 1978	Nov. 1978	Dec. 1978	Jan. 1979	Feb. 1979	Mar. 1979	Apr. 1979	May 1979	June 1979	July 1979	Aug. 1979	Total or Average
Precipitation (inches)													
Current Year	1.90	.15	.96	.91	1.70	1.45	.82	2.33	2.67	1.23	.40	1.79	16.31
Ave. 1949 to 1978-79	1.50	1.41	1.47	1.67	1.59	1.10	1.04	1.33	2.09	2.82	1.42	1.69	19.13
Mean Temperature (F)													
Current Year	53.7	43.7	27.2	18.8	4.1	24.9	34.7	42.3	51.5	59.4	65.0	65.4	40.9
Ave. 1949 to 1978-79	53.7	43.4	32.7	26.1	21.4	28.0	33.0	42.9	51.5	58.5	64.3	63.0	43.2
Last killing frost in spring*													
1979					May 30 (31 degrees)								
Ave. 1949-79					May 27								
First killing frost in fall*													
1979					October 1 (32 degrees)								
Ave. 1949-79					September 13								
Frost free period													
1979					123 days								
Ave. 1949-79					109 days								
Maximum summer temperature					97°F on July 20, 1979								
Minimum winter temperature					31° below zero on December 31, 1978 and January 1, 1979								

* In this summary 32 degrees is considered a killing frost.

Table 2. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1979.

	Average temperature by month and year Degrees Fahrenheit												$\bar{x}$ for
Year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Year
1949-50	54.1	41.5	38.5	25.0	4.2	25.6	31.2	41.9	49.7	57.0	64.0	62.5	41.3
1950-51	43.8	45.9	31.5	29.5	20.2	27.7	27.0	42.1	50.0	54.2	64.7	60.4	42.3
1951-52	50.6	40.8	30.8	16.9	18.0	26.6	29.3	45.8	52.4	56.7	61.8	62.8	41.0
1952-53	56.0	45.5	30.4	27.6	36.0	32.9	37.2	41.2	49.5	54.6	64.3	63.1	49.9*
1953-54	56.1	46.2	37.0	31.3	21.1	31.2	29.6	40.8	52.5	54.9	63.4	60.1	43.7*
1954-55	52.9	41.5	38.8	28.8	25.7	22.1	24.5	39.1	47.7	58.8	62.7	62.2	42.1
1955-56	52.5	44.6	23.5	21.8	23.3	20.9	31.5	44.2	54.0	59.0	64.8	62.0	41.8
1956-57	55.2	44.1	30.9	28.5	10.2	23.4	33.3	43.7	55.6	59.7	65.4	62.4	42.7
1957-58	55.8	41.4	32.1	32.4	29.1	30.4	32.2	43.6	59.6	62.3	65.2	67.9	46.0*
1958-59	55.5	44.6	32.8	28.2	24.7	23.1	35.3	45.2	48.1	59.9	64.5	61.0	43.6*
1959-60	53.0	43.9	25.5	27.6	19.4	25.2	32.3	44.3	50.6	59.6	68.8	60.6	42.6
1960-61	55.0	45.2	34.4	24.9	27.8	37.0	38.3	42.0	52.6	64.7	66.2	67.8	46.3*
1961-62	49.6	42.3	28.2	23.6	17.4	25.7	30.9	47.2	51.5	58.6	62.1	62.1	41.6
1962-63	54.7	44.7	38.0	32.5	11.8	33.1	38.7	43.2	51.4	59.4	63.0	64.9	44.6*
1963-64	58.7	47.4	35.8	24.0	28.5	28.3	30.6	42.8	51.1	58.7	64.3	58.9	44.1*
1964-65	51.2	43.7	33.7	22.1	30.2	28.7	28.6	45.2	50.6	57.6	64.6	63.6	43.3
1965-66	46.4	47.6	35.0	28.8	26.3	27.7	34.5	42.9	54.3	56.0	64.5	61.7	43.8*
1966-67	59.3	43.4	33.4	30.2	31.0	33.2	32.9	40.6	52.2	59.4	66.1	67.2	45.7*
1967-68	61.0	45.9	33.8	25.1	23.3	32.8	41.2	42.0	49.8	59.0	64.6	61.3	45.0*
1968-69	53.8	42.9	33.4	19.9	13.1	24.0	29.6	47.1	53.9	58.8	62.3	63.6	41.9
1969-70	56.0	40.0	35.2	27.7	21.9	29.9	32.8	40.2	53.2	62.0	64.8	62.6	43.9*
1970-71	48.7	40.1	31.3	26.2	23.6	29.8	33.2	43.6	52.5	54.8	61.9	68.2	42.8
1971-72	49.5	40.4	34.1	22.2	17.4	27.3	38.5	40.4	52.0	59.4	61.4	65.9	42.4
1972-73	50.2	40.3	33.7	19.9	20.7	27.8	37.7	42.2	51.5	57.5	65.1	64.5	42.6
1973-74	53.3	44.2	29.3	30.9	21.2	32.4	33.6	42.8	48.0	61.6	64.8	61.6	43.6*
1974-75	52.8	43.5	35.2	30.2	22.0	21.5	29.8	37.6	48.7	55.9	69.1	59.8	42.2
1975-76	52.1	42.9	35.4	27.5	27.7	29.9	31.0	43.4	51.9	54.5	63.4	61.3	43.4*
1976-77	55.2	42.4	33.1	28.6	20.0	30.9	34.4	45.0	49.7	61.5	62.6	62.8	43.9*
1977-78	51.6	42.5	30.4	22.0	21.6	26.1	34.3	43.7	48.1	59.1	63.4	60.3	41.9
1978-79	53.7	43.7	27.2	18.8	4.1	24.9	34.7	42.3	51.5	59.4	65.0	65.4	40.9
$\bar{x}$	53.3	43.4	32.7	26.1	21.4	28.0	33.0	42.9	51.5	58.5	64.3	63.0	

Mean temperature for all years = 43.4

* Denotes years above average temperature.

Table 3. Summary of temperature data obtained at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1979.

	Average maximum temperature by month and year Degrees Fahrenheit												$\bar{x}$ for
Year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Year
1949-50	71.4	52.4	45.7	32.1	14.4	34.6	38.4	52.3	63.1	70.1	78.6	79.5	52.7
1950-51	70.9	55.8	32.2	36.3	28.7	36.6	37.3	57.9	63.2	66.6	82.4	77.0	54.2
1951-52	64.2	47.5	37.2	23.6	25.9	35.7	39.5	61.8	65.7	70.2	79.2	79.5	52.5
1952-53	73.4	62.6	40.6	33.2	41.3	39.1	46.8	51.5	62.5	66.8	83.3	79.5	56.7*
1953-54	72.3	61.0	45.6	36.7	29.1	38.4	40.0	51.0	67.2	67.0	80.1	74.4	55.2*
1954-55	66.4	53.4	45.9	34.9	31.8	31.2	33.9	48.1	60.5	74.7	76.9	82.4	53.3
1955-56	67.6	55.5	30.8	29.2	30.7	30.1	39.7	57.4	67.5	73.3	81.2	77.8	53.4
1956-57	71.0	53.7	37.6	35.5	19.0	33.2	43.3	55.3	70.2	72.4	82.1	80.0	54.4
1957-58	74.3	50.5	40.1	38.5	33.7	37.9	43.5	54.4	77.5	75.7	80.8	85.5	57.7*
1958-59	69.7	57.9	39.6	34.1	31.8	31.9	43.9	57.9	61.5	74.3	83.2	76.3	55.2*
1959-60	64.0	53.6	33.9	33.3	27.5	34.1	43.4	56.1	63.0	74.8	88.7	74.1	53.9
1960-61	72.1	57.8	41.1	29.8	35.0	43.1	48.2	51.6	65.3	82.0	83.7	86.3	58.0*
1961-62	62.3	53.3	35.1	30.4	26.0	33.4	40.5	60.7	62.7	74.2	79.2	77.5	52.9
1962-63	71.7	54.7	43.8	37.9	19.9	41.4	48.9	55.7	67.1	71.8	79.6	82.5	56.2*
1963-64	74.6	59.4	43.4	30.2	35.1	37.7	39.7	53.3	63.5	71.4	80.3	72.9	55.1*
1964-65	63.9	55.0	41.0	28.9	35.1	36.9	41.0	57.6	64.3	71.4	80.8	77.1	54.4
1965-66	57.5	61.1	42.6	35.4	31.8	35.3	45.4	54.8	69.8	69.1	81.2	78.4	55.2*
1966-67	74.9	55.1	41.1	35.8	36.7	40.9	41.3	52.6	66.0	73.3	84.8	87.2	57.5*
1967-68	78.9	55.8	41.3	30.8	31.5	40.8	52.6	54.2	63.4	72.2	82.7	75.7	56.6*
1968-69	65.9	53.1	40.6	27.3	20.8	32.5	40.9	59.5	68.7	72.0	78.9	83.0	53.6
1969-70	70.4	49.7	43.0	32.8	28.5	36.2	42.5	49.7	67.9	75.5	79.1	80.9	54.7*
1970-71	62.5	52.2	40.0	34.1	30.6	38.6	41.6	56.2	66.4	67.3	78.0	87.5	54.6
1971-72	64.2	53.1	41.2	30.9	27.1	35.9	47.9	51.7	64.7	72.4	76.9	83.3	54.1
1972-73	64.0	51.3	41.4	28.6	30.6	38.5	47.7	53.8	65.8	69.6	83.7	83.2	54.9*
1973-74	67.6	56.3	36.8	36.5	28.7	39.6	43.5	53.1	59.2	76.2	80.0	77.6	54.6
1974-75	70.9	61.4	43.2	37.4	32.0	31.5	39.4	48.1	61.2	68.5	85.5	73.0	54.3
1975-76	69.4	52.3	40.4	35.1	36.2	37.6	40.1	54.3	66.2	66.3	79.0	74.4	54.3
1976-77	73.2	57.7	42.1	36.1	28.0	39.1	42.7	60.2	61.9	77.0	76.6	77.4	56.0*
1977-78	64.7	55.4	38.5	29.4	28.8	35.5	45.5	54.3	58.1	72.6	77.5	74.2	52.9
1978-79	65.7	59.2	35.9	28.2	13.7	33.2	45.3	52.5	64.3	73.9	81.5	82.8	53.0
$\bar{x}$	68.7	55.3	40.1	32.8	29.0	36.4	42.8	54.6	65.0	72.1	80.9	79.4	

Mean temperature for all years = 54.7

* Denotes years above average.

Table 4. Summary of temperature data obtained at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1979

	Average minimum temperature by month and year Degrees Fahrenheit												
Year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	$\bar{x}$ for Year
1949-50	36.7	35.0	31.2	17.8	-6.0	16.6	23.9	31.5	36.3	43.9	49.4	45.5	30.2
1950-51	36.6	36.0	24.8	22.6	11.7	18.8	16.6	26.2	36.7	41.7	46.9	43.7	30.2
1951-52	37.0	34.0	24.4	10.1	10.0	17.4	19.1	29.8	39.1	43.1	44.3	46.1	29.5
1952-53	38.6	28.3	20.2	21.9	30.6	26.7	27.5	30.9	36.5	42.3	45.3	46.7	33.0*
1953-54	39.8	31.4	28.4	25.9	13.1	24.0	19.2	30.6	37.7	42.8	46.7	45.7	32.1*
1954-55	39.3	29.5	31.6	22.7	19.5	13.0	15.0	30.0	34.9	42.8	48.5	42.0	30.7
1955-56	37.3	33.6	16.1	14.4	15.9	11.7	23.3	30.9	40.5	44.7	48.2	46.1	30.2
1956-57	39.4	34.4	24.2	21.5	1.4	13.6	23.2	32.0	40.9	47.0	48.7	44.8	30.9
1957-58	37.2	32.3	24.1	26.2	24.5	22.8	20.9	32.8	41.7	48.8	49.5	50.3	34.3*
1958-59	41.2	31.2	26.0	22.2	17.5	14.2	26.6	32.4	34.7	45.4	45.8	45.6	31.9*
1959-60	42.0	34.1	17.0	21.8	11.2	16.3	21.1	32.4	38.1	44.3	48.8	47.0	31.2
1960-61	37.9	32.5	27.6	19.9	20.6	30.9	28.4	32.3	39.8	47.4	48.7	49.2	34.6*
1961-62	36.8	31.2	21.2	16.8	8.7	17.9	21.2	33.7	40.3	43.0	45.0	46.6	30.2
1962-63	37.6	34.6	32.2	27.1	3.7	24.7	28.4	30.6	35.7	47.0	46.4	46.9	32.9*
1963-64	42.7	35.3	28.1	17.7	21.8	18.9	21.4	32.2	38.6	46.0	48.3	44.9	33.0*
1964-65	38.4	32.3	26.4	15.3	25.3	20.4	16.2	32.7	36.9	43.8	48.4	50.0	32.2*
1965-66	35.2	34.0	27.4	22.1	20.8	20.0	23.6	30.9	38.7	42.8	47.7	45.0	32.4*
1966-67	43.6	31.7	25.6	24.6	25.3	25.5	24.5	28.6	38.4	45.4	47.4	47.2	34.0*
1967-68	43.1	35.9	26.3	19.4	15.0	24.8	29.7	29.8	36.1	45.7	46.4	46.8	33.3*
1968-69	41.7	32.6	26.1	12.5	5.4	15.4	18.2	34.6	39.0	45.5	45.7	43.5	30.0
1969-70	41.6	30.3	27.4	22.6	15.3	23.4	23.0	30.7	38.5	48.2	50.5	44.3	33.0*
1970-71	34.9	27.9	22.5	18.3	16.5	21.0	24.8	31.0	38.6	42.3	45.7	48.8	31.0
1971-72	34.7	27.6	26.9	13.5	7.7	18.6	29.0	29.0	39.2	46.3	45.8	48.5	30.6
1972-73	36.4	29.2	25.9	11.1	11.0	17.4	27.8	29.6	36.4	44.4	46.5	45.8	30.1
1973-74	38.9	32.0	21.8	25.2	13.6	25.1	23.6	32.4	36.7	46.9	49.5	45.6	32.6*
1974-75	34.7	25.7	26.3	22.9	10.9	11.5	20.4	27.1	36.1	43.3	52.7	46.2	31.6
1975-76	34.7	33.4	30.3	20.0	19.1	22.2	22.0	32.4	37.6	42.6	47.8	48.3	32.5*
1976-77	37.2	27.2	24.1	21.1	12.0	22.6	26.1	29.9	37.4	46.0	48.5	48.2	31.7*
1977-78	38.6	29.5	22.2	14.6	14.5	16.7	23.2	33.1	38.1	45.6	49.2	46.4	31.0
1978-79	41.7	28.3	18.4	9.3	-5.6	16.5	24.0	32.1	38.7	44.9	48.5	48.0	28.7
$\bar{x}$	38.5	31.7	25.2	19.4	13.7	19.6	23.1	31.1	37.9	44.8	47.7	46.5	

Mean temperature for all years = 31.7

* Denotes years above average temperature.

Table 5. Summary of precipitation records obtained at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1979

Year	Total precipitation in inches by month and year												
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Total
1949-50	1.03	1.05	1.67	.92	2.62	1.13	2.31	.84	..15	3.90	3.12	.75	19.49*
1950-51	.52	2.30	1.16	2.48	.94	1.29	.62	2.32	3.77	2.26	1.03	2.86	21.55*
1951-52	1.49	5.62	1.01	3.31	1.03	.98	.97	.17	1.32	3.95	.56	.69	21.10*
1952-53	.13	.05	.60	.98	1.84	1.14	.98	2.07	2.00	3.31	T	1.62	14.72
1953-54	.71	.03	.87	1.30	2.65	.79	.83	.79	1.52	2.98	2.91	3.79	19.17
1954-55	1.09	.54	1.00	.43	1.00	1.31	.44	.82	1.18	1.86	3.08	.00	12.75
1955-56	1.64	1.89	1.97	2.30	1.76	1.53	.87	1.28	1.06	4.20	2.13	3.21	23.92*
1956-57	1.16	1.10	.53	.96	1.47	1.14	.75	1.22	1.75	2.51	.52	.78	13.89
1957-58	.10	1.59	.96	1.76	1.56	2.67	.97	1.47	2.20	2.56	.84	.58	17.26
1958-59	1.99	1.16	2.90	2.77	1.95	1.33	.75	1.62	4.10	1.75	T	.91	21.23*
1959-60	4.22	3.36	4.32	.34	1.67	1.10	1.01	1.23	3.27	.69	.13	2.43	23.77*
1960-61	.55	1.44	1.72	1.24	.65	1.46	1.96	2.26	4.02	1.45	.76	.64	18.15
1961-62	3.40	1.22	1.77	2.09	1.33	1.15	1.59	.96	2.59	1.15	.11	.72	18.08
1962-63	.58	1.85	1.31	.91	1.69	1.21	.85	1.07	.57	5.00	1.44	2.10	18.58
1963-64	1.46	.75	.95	1.70	1.46	.41	1.57	.87	3.33	3.86	3.01	1.64	21.01*
1964-65	2.27	.85	1.62	3.62	2.25	.64	.24	2.55	.81	2.30	1.15	4.74	23.04*
1965-66	1.72	.21	1.31	.55	1.42	.67	.53	.76	1.18	6.57	2.49	1.64	19.05
1966-67	.79	1.34	3.33	1.68	1.50	.62	1.27	.99	1.30	2.53	.02	.01	15.38
1967-68	.91	1.88	.62	1.16	.79	1.15	.68	.57	3.92	2.22	1.00	3.42	18.32
1968-69	4.51	2.39	1.59	3.12	3.05	.75	.69	1.39	1.19	5.21	.70	.09	24.68*
1969-70	1.54	1.90	.31	1.14	3.10	.89	1.49	.76	1.97	4.37	3.08	.44	20.99*
1970-71	1.79	1.38	1.75	.99	1.84	.77	.69	.58	2.45	4.42	1.31	1.11	19.08
1971-72	.94	.87	1.70	1.62	1.10	1.65	2.11	.95	1.48	3.28	1.77	.98	18.45
1972-73	1.38	1.84	.80	2.19	.52	.56	.70	.45	1.13	2.14	.01	.63	12.35
1973-74	1.37	1.41	2.95	1.94	1.35	1.32	1.40	3.36	1.82	1.80	1.01	.62	20.35*
1974-75	.80	.12	1.10	1.31	1.56	1.08	1.50	1.27	1.50	1.40	1.08	4.26	16.98
1975-76	1.18	2.96	.85	1.39	.91	1.12	.34	1.92	1.90	2.49	1.49	3.42	19.97*
1976-77	.96	.62	.73	.86	.83	.71	1.40	.41	2.90	.52	3.60	1.50	15.04
1977-78	2.84	.56	1.62	4.10	2.15	.99	.73	2.54	3.56	2.63	3.90	3.34	28.96*
1978-79	1.90	.15	.96	.91	1.70	1.45	.82	2.33	2.67	1.23	.40	1.79	16.31
$\bar{x}$	1.50	1.41	1.47	1.67	1.59	1.10	1.04	1.33	2.09	2.82	1.42	1.69	

Mean percipitation for all crop years = 19.12

* Denotes years above average precipitation.

Table 6. Precipitation by day for crop year, September 1, 1978 thru August 31, 1979. Northwestern Agricultural Research Center, Kalispell, MT.

Date	Sept. 1978	Oct. 1978	Nov. 1078	Dec. 1978	Jan. 1979	Feb. 1979	Mar. 1979	Apr. 1979	May 1979	June 1979	July 1979	Aug. 1979
1	.41	.01		.22		T		.03	.02		.03	
2					.01	T	T	T	T		.18	
3			.04	.02		.08		T	.01			
4			.12	.01		.12		.01	.46			
5	.02		.02	T			.01		1.31		.17	
6	.07					.09	.03		.15	.48	T	
7	.10					.16	.07	.40				
8	.53			.04			.05	.02		.02		
9	T		.14	.17		.02						
10	.01	T			T	.02		.96	.06			
11	.04			.02	.25	.16		.03		.06	T	
12	.55			.07	.04	.18		T	.05		.01	
13	T		.03		.33	.01		.06				
14					.02			T				T
15	T			.01	.09			T				.19
16	.15				.03			.05				
17	.02				T	.12	.12	.19		.53		
18			.14	.04			T	.39				
19			.17	.02	.02	.05		.06		.14		.01
20				.01	.06	T		.06				
21		.07		.04	.40	T		.01			.01	.30
22		.02		T	.37	.21						.51
23	T		T	.02	T				.35			
24		.02			.03	.18			T			.09
25			T	.04	T							.03
26					T	T	T					
27				.04	.02	.05	.33			T		
28			.28	.14	.03	T	.08					T
29	T	.03					.06		.07		T	
30			.02				.07	.06	.17	T		
31				T					.02			.66
Total	1.90	.15	.96	.91	1.70	1.45	.82	2.33	2.67	1.23	.40	1.79

Table 7. Frost free period at the Northwestern Agricultural Research Center from 1950 thru 1979.

Year	Date Last Freeze	Temperature Degrees F	Date First Freeze	Temperature Degrees F	Frost Free Season
1950	June 10	32	Sept. 11	29	93
1951	June 1	29	Sept. 15	29	106
1952	June 14	32	Sept. 8	29	86
1953	May 23	32	Sept. 16	31	116
1954	May 29	31	Sept. 30	26	124
1955	May 25	28	Sept. 13	31	111
1956	May 3	26	Sept. 2	32	122
1957	May 23	30	Sept. 9	30	109
1958	May 14	31	Sept. 27	31	136
1959	June 11	32	Aug. 30	30	80
1960	June 18	32	Sept. 6	32	80
1961	May 6	32	Sept. 12	29	129
1962	May 30	32	Sept. 3	25	96
1963	May 22	28	Sept. 18	32	119
1964	May 25	26	Sept. 11	28	109
1965	June 7	30	Sept. 6	31	91
1966	May 18	26	Sept. 30	28	135
1967	May 26	28	Sept. 23	32	120
1968	May 20	32	Sept. 21	32	124
1969	June 13	28	Sept. 6	32	85
1970	May 11	32	Sept. 10	31	122
1971	July 7	32	Sept. 14	28	69
1972	May 4	32	Sept. 12	32	131
1973	May 22	31	Sept. 2	31	103
1974	May 18	31	Sept. 2	30	107
1975	May 25	32	Sept. 12	32	110
1976	May 21	30	Sept. 8	30	110
1977	May 16	29	Sept. 27	28	133
1978	May 23	31	Sept. 17	28	116
1979	May 30	31	Oct. 1	32	123
$\bar{x}$ for all years	May 27	30	Sept. 13	30	110

Table 8. Temperature extremes at the Northwestern Agricultural Research Center, Kalispell, MT from 1950 thru 1979.

	Minimum		Maximum	
Year	Date	Temperature Degrees F	Date	Temperature Degree F
1950	Jan. 30	-40	Aug. 31	88
1951	Jan. 28	-25	Aug. 2	92
1952	Jan. 1	-14	Aug. 31	90
1953	Jan. 6	8	July 12	97
1954	Jan. 20	-32	July 6	90
1955	Mar. 5	-20	June 22	96
1956	Feb. 16	-25	July 22	90
1957	Jan. 26	-34	July 13	91
1958	Jan. 1	2	Aug. 11	94
1959	Nov. 16	-30	July 23	96
1960	Mar. 3	-32	July 19	98
1961	Jan. 2	0	Aug. 4	100
1962	Jan. 21	-32	Aug. 16	92
1963	Jan. 30	-24	Aug. 9	94
1964	Dec. 17	-28	July 8	91
1965	Mar. 24	-10	July 31	89
1966	Mar. 4	- 7	Aug. 2, 25	91
1967	Jan. 24	2	Aug. 19	95
1968	Jan. 21	-23	July 7	94
1979	Jan. 25	-13	Aug. 24	97
1970	Jan. 15	-14	Aug. 21, 25	92
1971	Jan. 12	- 8	Aug. 6, 9	96
1972	Jan. 28	-24	Aug. 9, 10	92
1973	Jan. 11	-22	July 11	97
1974	Jan. 5	-18	June 16, 20	93
1975	Jan. 12 & Feb. 9	-16	July 12	96
1976	Feb. 5	- 4	July 27	90
1977	Dec. 31	-11	June 7	91
1978	Dec. 31	-31	July 16	91
1979	Jan. 1	-31	July 20	97

Table 9. Summary of temperature records obtained at the Northwestern Agricultural Research Center, January 1950 thru December 1979.

Date	Average Temperature by Month and Year Degrees Fahrenheit												$\bar{x}$ for Year
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1950	4.2	25.6	31.2	41.9	49.7	57.0	64.0	62.5	53.8	45.9	31.5	29.5	41.4
1951	20.2	27.7	27.0	42.1	50.0	54.2	64.7	60.4	50.6	40.8	30.8	16.9	40.5
1952	18.0	26.6	29.3	45.8	52.4	56.7	61.8	62.8	56.0	45.5	30.4	27.6	42.7
1953	36.0	32.9	37.2	41.2	49.5	54.6	64.3	63.1	56.1	46.2	37.0	31.3	45.8*
1954	21.1	31.2	29.6	40.8	52.5	54.9	63.4	60.1	52.9	41.5	38.8	28.8	42.9
1955	25.7	22.1	24.5	39.1	47.7	58.8	62.7	62.2	52.5	44.6	23.5	21.8	40.4
1956	23.3	20.9	31.5	44.2	54.0	59.0	64.8	62.0	55.2	44.1	30.9	28.5	43.2*
1957	10.2	23.4	33.3	43.7	55.6	59.7	65.4	62.4	55.8	41.4	32.1	32.4	43.0
1958	29.1	30.4	32.2	43.6	59.6	62.3	65.2	67.9	55.5	44.6	32.8	28.2	46.0*
1959	24.7	23.1	35.3	45.2	48.1	59.9	64.5	61.0	53.0	43.9	25.5	27.6	42.7
1960	19.4	25.2	32.3	44.3	50.6	59.6	68.8	60.6	55.0	45.2	34.4	24.9	43.4*
1961	27.8	37.0	38.3	42.0	52.6	64.7	66.2	67.8	49.6	42.3	28.2	23.6	45.0*
1962	17.4	25.7	30.9	47.2	51.5	58.6	62.1	62.1	54.7	44.7	38.0	32.5	43.8*
1963	11.8	33.1	38.7	43.2	51.4	59.4	63.0	64.9	58.7	47.4	35.8	24.0	44.3*
1964	28.5	28.3	30.6	42.8	51.1	58.7	64.3	59.9	51.2	43.7	33.7	22.1	42.8
1965	30.2	28.7	28.6	45.2	50.6	57.6	64.6	63.6	46.4	47.6	35.0	28.8	43.9*
1966	26.3	27.7	34.5	42.9	54.3	56.0	64.5	61.7	59.3	43.4	33.4	30.2	44.5*
1967	31.0	33.2	32.9	40.6	52.2	59.4	66.1	67.2	61.0	45.9	33.8	25.1	45.7*
1968	23.3	32.8	41.2	42.0	49.8	59.0	64.6	61.3	53.8	42.9	33.4	19.9	43.7*
1969	13.1	24.0	29.6	47.1	53.9	58.8	62.3	63.6	56.0	40.0	35.2	27.7	42.6
1970	21.9	29.9	32.8	40.2	53.2	62.0	64.8	62.6	48.7	40.1	31.3	26.2	42.8
1971	23.6	29.9	33.2	43.6	52.5	54.9	61.9	68.2	49.5	40.4	34.1	22.0	42.8
1972	17.4	27.3	38.5	40.6	51.9	59.3	61.4	65.9	52.0	40.0	33.7	19.9	42.3
1973	20.7	27.8	37.7	42.2	51.5	57.5	65.1	64.5	53.3	44.1	29.3	30.8	43.7*
1974	21.2	32.3	33.6	42.7	48.0	61.5	64.8	61.6	52.8	43.5	34.8	30.1	43.9*
1975	22.0	21.5	29.8	37.6	48.7	55.9	69.1	59.8	52.1	42.9	35.4	27.5	41.9
1976	27.7	29.9	31.0	43.4	51.9	54.5	63.4	61.3	55.2	42.4	33.1	28.6	43.5*
1977	20.0	30.9	34.4	45.0	49.7	61.5	62.6	62.8	51.7	42.5	30.4	22.0	42.8
1978	21.6	26.1	34.3	43.7	48.1	59.1	63.4	60.3	53.7	43.7	27.2	18.8	41.7
1979	4.1	24.9	34.7	42.3	51.5	59.4	65.0	65.4	56.9	46.6	30.7	26.3	42.3
$\bar{x}$	21.4	28.0	33.0	42.9	51.5	58.5	64.3	63.0	53.8	43.6	32.5	26.1	

Mean temperature for all years = 43.2

* Denotes years above average mean.

Table 10. Summary of precipitation records obtained at the Northwestern Agricultural Research Center, Kalispell, MT, January 1950 thru December 1979.

Date	Total Precipitation (inches) by Months and Years												Total for Year
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1950	2.62	1.13	2.31	.84	.15	3.90	3.12	.75	.52	2.30	1.16	2.48	21.28*
1951	.94	1.29	.62	2.32	3.77	2.26	1.03	2.86	1.49	5.62	1.01	3.31	26.52*
1952	1.03	.98	.97	.17	1.32	3.95	.56	.69	.13	.05	.60	.98	11.43
1953	1.84	1.14	.98	2.07	2.00	3.31	T	1.62	.71	.03	.87	1.30	15.87
1954	2.65	.79	.83	.79	1.52	2.98	2.91	3.79	1.09	.54	1.00	.43	19.32*
1955	1.00	1.31	.44	.82	1.18	1.86	3.08	-	1.64	1.89	1.97	2.38	17.57
1956	1.76	1.53	.87	1.28	1.06	4.20	2.13	3.21	1.16	1.10	.53	.96	19.79*
1957	1.47	1.14	.75	1.22	1.75	2.51	.52	.78	.10	1.59	.96	1.76	14.55
1958	1.56	2.67	.97	1.47	2.20	2.56	.84	.58	1.99	1.16	2.90	2.77	21.67*
1959	1.95	1.33	.75	1.62	4.10	1.75	T	.91	4.22	3.36	4.32	.34	24.65*
1960	1.67	1.10	1.01	1.23	3.27	.69	.13	2.43	.55	1.44	1.72	1.24	16.48
1961	.65	1.46	1.96	2.26	4.02	1.45	.76	.64	3.40	1.22	1.77	2.09	21.68*
1962	1.33	1.15	1.59	.96	2.59	1.15	.11	.72	.58	1.85	1.31	.91	14.25
1963	1.69	1.21	.85	1.07	.57	5.00	1.44	2.10	1.46	.75	.95	1.70	18.79
1964	1.46	.41	1.57	.87	3.33	3.86	3.01	1.64	2.27	.85	1.62	3.62	24.51*
1965	2.25	.64	.24	2.55	.81	2.30	1.15	4.74	1.72	.21	1.31	.55	18.47
1966	1.42	.67	.53	.76	1.18	6.57	2.49	1.64	.79	1.34	3.33	1.68	22.40*
1967	1.50	.62	1.27	.99	1.30	2.53	.02	.01	.91	1.88	.62	1.16	12.81
1968	.79	1.15	.68	.57	3.92	2.22	1.00	3.42	4.51	2.39	1.59	3.12	25.36*
1969	3.05	.75	.69	1.39	1.19	5.21	.70	.09	1.54	1.90	.31	1.14	17.96
1970	3.10	.89	1.49	.76	1.97	4.37	3.08	.44	1.79	1.38	1.75	.99	22.01*
1971	1.84	.77	.69	.58	2.45	4.42	1.31	1.11	.94	.87	1.70	1.62	18.30
1972	1.10	1.65	2.11	.95	1.48	3.28	1.77	.98	1.38	1.84	.80	2.19	19.53*
1973	.52	.56	.70	.45	1.13	2.14	.01	.63	1.37	1.41	2.95	1.94	13.81
1974	1.35	1.32	1.40	3.36	1.82	1.80	1.01	.62	.80	.12	1.10	1.31	16.01
1975	1.56	1.08	1.50	1.27	1.50	1.40	1.08	4.26	1.18	2.96	.85	1.39	20.03*
1976	.91	1.12	.34	1.92	1.90	2.49	1.49	3.42	.96	.62	.73	.86	16.76
1977	.83	.71	1.40	.41	2.90	.52	3.60	1.50	2.84	.56	1.62	4.10	20.99*
1978	2.15	.99	.73	2.54	3.56	2.63	3.90	3.34	1.90	.15	.96	.91	23.76*
1979	1.70	1.45	.82	2.33	2.67	1.23	.40	1.79	1.03	1.75	.50	1.03	16.70
$\bar{x}$	1.59	1.10	1.04	1.33	2.09	2.82	1.42	1.69	1.50	1.44	1.43	1.68	

Mean annual precipitation for 30 years = 19.13

* Denotes years above average.

TITLE: Chemical control of broadleaf weeds in small grains.

YEAR: 1979

LOCATION: Northwestern Agricultural Research Center and Off-Station locations, Field No's. R-9, R-13, R-15 and Clyde Pederson farm, Kalispell, MT.

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Weed Res. Comm. MAES, MT Wheat Research and Marketing Committee, Chemical Company Research and Development Representatives and Clyde Pederson.

OBJECTIVES:
1. Evaluation of several herbicides and herbicide combinations for efficacy in weed control.
2. Comparison of agronomic data between treatments.

MATERIALS AND METHODS:

Five broadleaf herbicide studies were conducted in 1979. The four tests on station were 1) The effect of broadleaf herbicides on Ingrid spring barley yields and efficacy in weed control. 2) The effects of broadleaf herbicides on Newana spring wheat yields and efficacy in weed control. 3) Herbicide evaluations for chickweed and henbit control. 4) Evaluations of wild oat and broadleaf herbicide combinations on Purcell spring barley. One study was conducted off-station for control of bedstraw. 5) Evaluations of several herbicides for control of bedstraw and the effect on yields. Herbicides used are listed in Table 1.

The studies on barley and wheat were of the same design. Ingrid barley was seeded at 80 lbs/a, Newana spring wheat 70 lbs/a in strips 12 feet. Herbicides were applied perpendicularly across each strip and were 10 feet wide giving an area of 10' x 12' (120 sq. ft.). Each treatment was replicated four times in a randomized block. The entire test area was treated with triallate to control wild oats following seeding prior to crop emergence. The remaining broadleaf herbicide studies were laid out in larger preplanted fields. Field applications were made for wild oat control in the bedstraw and chickweed/henbit studies. Only one herbicide treatment required incorporation. This was triallate plus mixtures and was incorporated twice at right angles with a spike tooth harrow. All other herbicide applications were executed at specific times corresponding to weed emergence which can be noted in the tabulated data for each study.

All herbicides were applied with a calibrated tractor mounted research type sprayer. Tests were harvested with a Hege 125B plot combine. Plot size varied but are listed for each study.

Weed species investigated in these studies were: fanweed (Thlaspi arvense L.); lambsquarter (Chenopodium album L.); silene (Silene noctiflora L.); wild oat (Avena fatua L.); wild buckwheat (Polygonum convolvulus L.); chickweed (Stellaria media L.); false flax (Camelina sativa L.); wild mustard (Brassica arvensis L.); tumble mustard (Sisymbrium attissimum L.) and bedstraw (Galium bifolium Wats.).

Chemical control of broadleaf weeds (con't)

RESULTS AND DISCUSSION:

1) The effects of broadleaf herbicides in Ingrid spring barley yields and efficacy in weed control.

All treatments provided excellent weed control on barley. In analyzing the data there were no significant differences in yields, test weight, and percent plump. Broadleaf weed control was the same for all the bromoxynil treatments. Weed pressure varied throughout the test but was as follows: Fanweed, moderate to heavy; wild buckwheat, moderate; and false flax, moderate to heavy. All other weed species were light throughout the experiment. No phytotoxicity or physiological symptoms were noted as result of chemical treatments. Table 2.

2) The effects of broadleaf herbicides on Newana spring wheat yields and efficacy in weed control.

All treatments in the broadleaf trials on spring wheat provided excellent weed control. Treatments did not vary significantly for yield and test weight. The yields did vary but not distinguishably in relation to different chemicals or different rates. Weed pressure fluctuated throughout the test. The wild buckwheat population was heavy whereas lambsquarter and false flax were moderate to light. No phytotoxicity was observed. It was noted that the new formulation of bromoxynil AxF 1054 was somewhat lower in yield than AxF 1055. Table 3.

3) Herbicide evaluations for chickweed/henbit control.

Terbutryn was found to be phytotoxic at all rates in this study. Lower rates and timing of application will be investigated next year as this compound is registered on small grain in Washington. Excellent herbicide qualities were seen in this trial with metribuzin at .125 and .25 lb/acre. Percent stand was slightly effected at the high rate but was not a determent considering this treatment was one of the highest yields. The experimental compound R40244 resulted in high yields and good herbicidal qualities at the low rate, but adversely effected yields and was phytotoxic at higher rates. Applicationn of 2,4-D LV gave poor weed control. Weed species evaluated were; common chickweed (Stellaria media L.), and henbit (Lamium amplexicaule L.). Table 4.

4) Evaluations of wild oat and broadleaf herbicide combinations on Purcell spring barley.

This broadleaf and wild oat herbicide study was conducted in a Purcell spring barley field that had been reseeded from winter wheat. The resulting barley stand was only fair and heavy weed pressure heightened the plant competition. All the treatments performed well in controlling broadleaf weeds and all but one treatment yielded significantly higher than the check. Difenzoquat + bromoxynil + MCPA (.75 + .375 + .375) appeared to be the most effective treatment when considering yields and total weed control. The higher rate of diclofop + bromoxynil (.75 + .375) was very effective in broadleaf and wild oat control. It appears that at least .75 lb/a diclofop is needed for acceptable wild oat control when weed pressure is high. Table 5.

Chemical control of broadleaf weeds (con't)

Weeds present were: fanweed (Thalspi arvense L.); tumble mustard (Sisymbrium altissimum L.); lambsquarter (Chenopodium album L.); wild mustard (Brassica kaber (D.C.)); and wild oat (Avena fatua L.).

5) Evaluations of several herbicides for control of bedstraw and the effect on yields.

A study was conducted this year on the Clyde Pederson farm to investigate several chemicals and combinations for control of bedstraw (Galium bifelium Wats.). Treatments which exhibited good weed control and resulted in very good yields were bromoxynil + MCP (.375 + .375), an experimental compound R40244 (.50), and bromoxynil + metribuzin (.375 + .375). The most effective weed control in this trial was apparent with the high rate of R40244, however yields were less than the test mean but greater than the check. Terbutryn at 1.0 lb/a delivered the highest yield yet demonstrated just fair activity against the bedstraw. The combinations of bromoxynil + dicamba resulted in good yields and fair to good weed control whereas the dicamba alone had a high yield but exhibited poor herbicide qualities. Table 6.

Table 1. Products used in these experiments.

Common Name	Trade Name or Other	Chemical Name	Company
barban	Carbyne	4-chloro-2-butynyl m-chlorocarbanilate	Gulf Chemical
bromoxynil	Bronimal Buctril	3,5-dibromo-4-hydroxybenzonitrile	Union Carbide Rhone-Poulenc
dicamba	Banvel	3,6-dichloro-o-anisic acid	Velsicol
diclofop	Hoelon	|2-4-(2,4-dichorophenoxy)phenoxy|propanoic acid	American Hoechst
difenzoquat	Avenge	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium	American Cyanamid
MCPA		|(4-chloro-o-toly)oxy|acetic acid	Amchem
metribuzin	Sencor	4-amino-6-tert-butyl-3-(methylthio)-as-triazine-5(4H)one	Mobay
profluralin	Tolban	N-(cyclopropylmethyl)-α,α,α-trifluoro-2,6-dinitro-N-propyl-p-toluidine	CIBA-Geigy
	R 40244	1-(m-trifluoremethylphenyl)-3-chlor-4-chloromethyl-2-pyrlidone	Stauffer
	SD 45328	Ananine,N-benzoyl-N-(3-chloro-4-flourophenyl)-,ethyl ester,isomer	Shell
terbutryn	Igran	2-(tert-butylamino)-4-(ethylamino)-6-(methylthio)-s-triazine	CIBA-Geigy
triallate	Fargo	S-(2,3,3-trichloroally)diisopropylthio carbamate	Monsanto
trifluralin	Treflan	α,α,α-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine	Elanco
2,4-D	2,4-D	(2,4-dichlorophenoxy)acetic acid	

Table 2. Effect of broadleaf herbicides on Ingrid barley yields and broadleaf weed control. Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. R-9.

Date seeded: May 18, 1979 Date harvested: September 6, 1979
Size of plot: 48 sq. ft.

Treatment	Rate #/A	Yield Bu/A	Test Wt. Lbs/Bu.	% Stand	% Weed Control: Wild Buckwheat	Fan-weed	Hen-bit	Lambs-quarter	False Flax
Bromoxynil 1/	.25	94.2	49.5	97.8	88	100	88	100	85
Bromoxynil 1/	.375	107.5	48.8	96.0	98	98	90	100	95
Bromoxynil 2/	.50	121.8	50.4	97.5	93	98	100	95	93
Bromoxynil 2/	.25	106.2	49.2	97.0	95	98	98	98	98
Bromoxynil 2/	.375	117.5	50.0	95.5	100	100	88	100	98
Bromoxynil 2/	.50	106.8	50.5	97.0	93	98	98	98	100
Bromoxynil 3/ + MCPA	.25 .25	107.9	50.4	96.8	95	95	85	100	90
Bromoxynil 3/ + MCPA	.375 .375	118.6	50.3	97.5	98	95	100	100	100
Bromoxynil 3/ + MCPA	.50 .50	101.5	49.5	97.5	98	100	98	100	93
Bromoxynil 4/ + MCPA	.25 .25	115.6	48.8	96.5	98	98	98	98	95
Bromoxynil 4/ + MCPA	.375 .375	116.6	50.2	97.3	100	98	95	100	98
Bromoxynil 4/ + MCPA	.50 .50	101.4	49.7	97.3	100	98	95	100	98
Bromoxynil 5/ + 2,4-D	.25 .25	88.7	49.6	96.8	100	85	78	98	88
Bromoxynil 5/ + 2,4-D	.375 .375	104.8	49.1	96.5	90	100	83	100	95
Bromoxynil 5/ + 2,4-D	.50 .50	113.9	49.5	97.5	93	100	90	100	95
Bromoxynil + metribuzin 6/	.25 .0313	109.6	50.1	98.0	95	88	83	100	100
Bromoxynil + metribuzin 6/	.25 .0625	106.0	50.4	98.3	100	83	85	100	98
Check	0	94.7	50.0	97.0	0	0	0	0	0
$\bar{x}$		107.4	49.8	97.9					
F 7/		.295NS	.6860NS	.924NS					
S.E.$\bar{x}$		16.708	.67041	1.434					
L.S.D.(.05)		47.49	1.90568	4.07735					
C.V. %		15.56	1.347	1.464					

1/ Bromoxynil 4#/gal. AxF 1050
2/ Bromoxynil 2#/gal. AxF 1045
3/ Bromoxynil + MCPA 3+3#/gal AxF 1053
4/ Bromoxynil + MCPA 2+2#/gal (Brominal plus)
5/ Bromoxynil + 2,4-D 3+3#/gal
6/ Delayed application of metribuzin, secondary roots developed (6/15/79)
7/ F - value for treatment comparison

Table 2. (con't)

APPLICATION DATA:

Date:	6/8/79	6/15/79
Air temperature:	50°F	50°F
Soil temperature:	54°F	76°F
Humidity:	80%	52%
Wind:	0-6 mph	0-calm
Volume:	25.9gpa	25.9gpa
Nozzle:	8003	8003
P.S.I.:	32	32

Soil type: Creston silt loam pH 8.0
Organic matter: 5%
Weed pressure:
Buckwheat - heavy
Fanweed - heavy
Henbit - light
Lambsquarter - heavy
False flax - moderate

Table 3. Effect of broadleaf herbicides on Newana wheat yields and broadleaf weed control. Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. R-9.

Date seeded: May 18, 1979 Date harvested: September 14, 1979
Size of plot: 48 sq. ft.

Treatment	Rate #/A	Yield Bu/A	Test Wt. Lbs/Bu.	% Stand	% Weed Control				
					Wild Buckwheat	Fan-weed	Hen-bit	Lambs-quarter	False Flax
Bromoxynil 1/	.25	51.9	62.3	93.5	90	95	95	100	98
Bromoxynil 1/	.375	57.0	62.4	94.3	88	95	97	100	100
Bromoxynil 1/	.50	56.8	62.3	91.8	90	100	100	98	98
Bromoxynil 2/	.25	66.2	61.9	95.0	98	100	90	98	100
Bromoxynil 2/	.375	62.7	62.4	94.3	93	100	93	98	98
Bromoxynil 2/	.50	67.9	62.6	95.0	98	95	98	100	93
Bromoxynil 3/ + MCPA	.25 .25	67.8	62.5	93.8	95	98	98	95	89
Bromoxynil 3/ + MCPA	.375 .375	68.6	61.8	95.0	98	98	93	98	95
Bromoxynil 3/ + MCPA	.50 .50	64.6	62.6	93.3	98	100	100	100	95
Bromoxynil 4/ + MCPA	.25 .25	67.6	61.4	94.3	95	90	83	100	93
Bromoxynil 4/ + MCPA	.375 .375	67.3	62.6	96.7	83	98	95	98	90
Bromoxynil 4/ + MCPA	.50 .50	59.7	62.4	95.3	85	100	90	100	98
Bromoxynil 5/ + 2,4-D	.25 .25	60.5	62.4	93.5	93	98	95	100	95
Bromoxynil 5/ + 2,4-D	.375 .375	57.7	61.8	95.0	93	100	100	100	95
Bromoxynil 5/ + 2,4-D	.50 .50	65.3	62.5	95.0	88	100	95	100	100
Bromoxynil + metribuzin 6/	.25 .0313	63.2	62.8	93.8	100	95	100	95	100
Bromoxynil + metribuzin 6/	.25 .0625	52.8	62.7	93.5	100	98	98	100	100
Check	0	63.2	62.2	94.7	0	0	0	0	0
$\bar{x}$		62.2	62.3	94.4					
F 7/		.650NS	.503NS	1.52NS					
S.E.$\bar{x}$		6.47	.528	.861					
L.S.D.(.05)		18.39	1.50	2.45					
C.V. %		10.40	.848	.912					

1/ Bromoxynil 4#/gal. AxF 1050
2/ Bromoxynil 2#/gal. AxF 1045
3/ Bromoxynil + MCPA 3+3#/gal. AxF 1053
4/ Bromoxynil + MCPA 2+2#/gal. (Brominal plus)
5/ Bromoxynil + 2,4-D 3+3#/gal. AxF 1054
6/ Delayed application of metribuzin, secondary roots developed (6/15/79)
7/ F - value for treatment comparison.

Table 3 . (con't)

APPLICATION DATA:

Date:	6/8/79	6/15/79
Air temperature:	50°F	50°F
Soil temperature:	54°F	76°F
Humidity:	80%	52%
Wind velocity:	0-6 mph	0-calm
Volume:	25.9 gpa	25.9 gpa
Nozzle:	8003	8003
P.S.I.	32	32

Soil Type: Creston silt loam pH 8.0
Organic matter: 5%
Weed pressure at time of spraying:

Buckwheat: heavy
Fanweed: heavy
Henbit: light
Lambsquarter: heavy
False flax: moderate

Table 4. Effects of broadleaf herbicides on spring barley yields and weed control. Testing site: Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. R-13. Ingrid barley

Date seeded: May 10, 1979 Date harvested: September 11, 1979
Size of plot: 48 sq. ft.

Treatment	Rate #/A	Yield Bu/A	Test Wt. Lbs/Bu.	% Plump	Per linear ft. Plants	Per linear ft. Tillers	% Stand	Phyto 1-10 1/	Weed Control(%) Henbit	Weed Control(%) Chickweed
Metribuzin	.0625	105.4	52.0	97	5.0	37.7	97	1.3	83	47
Metribuzin	.125	108.1	51.4	97	5.3	37.0	100	.3	100	90
Metribuzin	.25	105.0	51.8	97	6.0	30.7	95	1.3	100	100
Metribuzin	.50	84.6	50.7	97	3.3	26.3	88	2.0	67	67
R 40244	.25	100.5	51.4	96	3.3	31.7	98	2.5	100	75
R 40244	.50	83.9	50.1	96	5.0	38.3	95	3.8	100	72
R 40244	.75	65.3b	49.3	96	5.0	28.7	95	5.0	100	87
Terbutryn	1.00	25.9b	45.9	91	1.3	5.0	22	9.3	100	100
Terbutryn	1.50	-	-	-	-	-	10	10.0	100	100
Terbutryn	2.00	-	-	-	-	-	0	10.0	100	100
Terbutryn	2.50	-	-	-	-	-	0	10.0	100	100
Metribuzin + Terbutryn	.25 + 1.00	-	-	-	-	-	1	10.0	100	100
2,4-D LV	.33	93.6	52.2	97	4.3	38.3	100	.7	57	67
2,4-D LV	.50	100.6	52.0	97	5.3	43.3	100	0.0	30	40
Control	0	99.1	51.8	97	5.0	49.0	100	0.0	0	0
$\bar{x}$		94.6								
F 2/		4.50**								
S.E.$\bar{x}$		6.236								
L.S.D.(.05)		18.52								
C.V. %		6.59								

1/ Phytotoxicity scale: 0 = no phyto growth normal; 10 = dead plants
2/ F- value for treatment comparison

SPRAY DATA:

Date:	6/22/79 (all applications)
Air Temperature:	74°F
Soil Temperature:	70°F
Humidity:	36%
Wind:	0-3 mph
Volume:	25.9 gpa
Nozzle:	SS8003
P.S.I.:	32

Barley: 10-12" high, fully tillered
Henbit: 6-10 leaf stage } Heavy population of both
Chickwee: 8-10 leaf stage }

Table 5. Effects of the combination of broadleaf and wild oat herbicides on yield and weed control in Purcell barley. Northwestern Agricultrual Research Center, Kalispell, MT in 1979. Field No. R-15.

Date seeded: May 22, 1979 Date harvested: September 28, 1979 Size of plot: 48 sq. ft.

Treatment	Rate Lbs/A	Yield Bu/A	Test Wt. Lbs/Bu.	% Plump	Fan-weed[2/]	Tumble Mustard[2/]	Lambs-quarter[2/]	Wild Mustard[2/]	Wild Oats[2/]
Triallate + R 40244	1.25 + .5	47.2a	46.7	94	87	68	97	80	69
Triallate + bromoxynil + MCPA	1.25 + .375 + .375	42.8a	49.4	90	100	100	100	100	74
Diclofop + bromoxynil	.75 + .375	46.3a	47.0	96	75	93	100	97	87
Difenzoquat + bromoxynil + MCPA	.75 + .375 + .375	58.0a	46.8	93	100	100	100	100	81
Barban + bromoxynil + MCPA	.375 + .375 + .375	44.6a	46.0	87	88	98	100	93	52
Diclofop + bromoxynil	.375 + .375	39.1	48.7	94	95	98	100	90	56
Check	0.0	27.8	46.9	90	0	0	0	0	0
	$\bar{x}$	43.7							
	F[1/]	5.371**							
	S.E.$\bar{x}$	3.935							
	L.S.D.(.05)	12.13							
	C.V. %	9.012							

Growth stage at 6/20 and 6/15 application date:

Lambsquarter - 6-8 leaves
Tumble mustard - 3-5 leaves
Wild mustard - 3-5 leaves
Wild Oats - 1-3 leaves
Fanweed - 4-6 leaves
Barley - 5" tall

1/ F - value for treatment comparison.

Spray Dates:	5/23/79	6/15/79		6/20/79
Air Temperature:	80°F	50°F		64°F
Soil Temperature:	70°F	76°F		61°F
Humidity	14%	52%		36%
Wind:	0	0-calm		3-5 mph
Wolume:	25.9	7.5	25.9	25.9
Nozzles:	SS8003	SS800067	SS8003	SS8003
P.S.I.	32	45 or 32		32
CHEMICALS APPLIED:	Triallate	R 40244, Barban, Diclofop, Bromoxynil + MCPA		Difenzoquat

2/ Percent weed control
a/ Values significantly greater than the check
** Indicates statistical significance at the .01 level

Table 6. Effects of broadleaf herbicides on spring barley yields and weed control. Northwestern Agricultural Research Center and Clyde Pederson Farm cooperation in 1979.

Date seeded: May 5, 1979 Date harvested: September 10, 1979
Size of plot: 88 sq. ft.

Treatment	Rate #/A	Yield Bu/A	Test Wt. Lbs/Bu.	% Plump	Weed Control (%) Bedstraw	Henbit
R 40244	.25	81.3	53.7	98	45	93
R 40244	.50	93.2	53.1	97	80	100
R 40244	.75	87.2	54.0	98	92	100
Bromoxynil + metribuzin	.375 + .0313	83.8	53.6	98	67	100
Bromoxynil + metribuzin	.375 + .0625	87.5	53.9	96	70	93
Bromoxynil + metribuzin	.375 + .125	91.6	53.7	98	80	87
Bromoxynil + metribuzin	.375 + .25	86.2	54.0	98	68	93
Bromoxynil + metribuzin	.375 + .50	86.7	53.2	97	82	100
Terbutryn	1.0	98.4	53.3	98	64	100
Terbutryn	1.5	80.0	53.5	97	30	100
Dicamba	.0313	73.6	53.3	97	20	27
Dicamba	.0625	97.1	54.0	97	35	53
Bromoxynil + dicamba	.375 + .0313	93.1	53.9	98	70	64
Bromoxynil + dicamba	.375 + .0625	89.0	53.7	98	90	70
Bromoxynil + MCP 1/	.375 + .375	97.3	53.7	98	87	64
Check	0	81.1	54.0	97	0	0
$\bar{x}$		87.9				
F 2/		1.268NS				
S.E.$\bar{x}$		6.21140				
L.S.D. (.05)		17.92				
C.V. %		7.064				

SPRAY DATA:

Date:	6/6/79
Air Temperature:	56°F
Soil Temperature:	52°F
Humidity:	45%
Wind:	0
Volume	25.9 gpa
Nozzle	SS8003
Pressure	32 psi

1/ Bronate
2/ F - value for treatment comparison
Barley - 10-12", 5 tillers, pre joint
Bedstraw - all stages seedling to 3"
Henbit - 4-6 leaf stage

TITLE: Chemical control of wild oats (Avena fatua) in spring wheat and spring barley.

YEAR: 1979

LOCATION: Northwestern Agricultural Research Center

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Weed Research Committee MAES
Montana Wheat Research & Marketing Committee
Chemical Company Research & Development Representatives

OBJECTIVES:

1. Evaluation of herbicides and herbicide mixtures for efficacy of wild oat control spring barley and wheat.

2. To determine the effect of herbicides on these crops as it relates to yield and quality.

MATERIALS AND METHODS:

Two studies were initiated this year on station for control of wild oats in spring grains. The studies on barley and wheat were of the same design. Ingrid barley was seeded at 80 lbs/a, Newana spring wheat 70 lbs/a in strips 12 feet wide and 300 feet long. Herbicides were applied perpendicularly across each strip and were 10 feet wide giving an area of 10' x 12' (120 sq. ft.). The herbicides were applied using a research type tractor mounted sprayer. Application data and field conditions are found in the calculated data. Treatments were replicated in a randomized block design. The test areas were sprayed with bromoxynil + MCPA at .375 lbs/a for broadleaf control. The studies for wheat and barley were identical except for some chemical rates. Triallate, trifluralin and profluralin were incorporated with a spike tooth harrow following seeding, pre emergence to the crop. The remaining herbicides were applied with respect to certain growth stages (see application data). Forty-eight square feet of each plot was harvested with a Hege 125 combine.

RESULTS AND DISCUSSION:

Spring barley - Yields when analysed statistically were found to be significant. Duncan's Multiple Range Test was run to evaluate the difference between treatments. Our highest yields were obtained where we used the combination of triallate and trifluralin at 1.25 and .0625 respectively. It was noted that the two formulations of diclofop varied in yield. The 3EC formulation treatments were lower in yield than the 2.36EC. The Multiple Range Test indicated these differences were not statistically significant, but it is worthy of note that a difference did exist. The Shell product 45328 applied at the 2-3 leaf stage did not seem to injure the crop as much as that applied at the 3 leaf stage of the wild oats, however the yields were statistically significant. We can see from these yields that weed pressure was not very significant, as our check yield is one of the higher yields in the test.

Measurements made for test weight and percent plump are found to be non-significant.

Results and Discussion (con't)

The most effective wild oat control was obtained with the .375 lbs/a of diclofop 2.36EC. It also controlled the Seteria 100%. In general the diclofop treatment gave us more effective control of the wild oats and the Setaria than any other treatment in this study. The dinitroanalines generally were somewhat weak on the wild oats and from fair to poor on the control of Setaria. The Shell products gave fair control of wild oats, and rather insignificant control of Setaria. Barban gave fair control of the wild oats, little or no control of Setaria which we would have anticipated.

We did note a stand loss in the tractor tracks in the triallate plots. Table 1.

Spring wheat - Yields were found to be non-significant in this study. The yields are somewhat erratic which is indicated by our high CV. The highest yields were obtained where we used barban at .375 lbs/a (98.2 bu/a). In comparing the two formulations of diclofop we find that the 3EC yields are just slightly higher in yield than the 2.36EC yields. Triallate yields and all those containing triallate seem to be somewhat lower. In the Shell product SD45328 there is no pattern as to time of application. I think it is interesting to note on the test weights that the Shell products had the highest test weights along with barban and difenzoquat. SD45328 at .4 lbs/a applied at the 3-5 leaf stage has the highest test weight, 64.5 lbs/bu. This is a little difficult to explain because the test weights are high throughout the study and why this one is higher I don't have an explanation. The weed control pattern is very similar to that which we found in the barley with the diclofop 2.36EC giving us the best overall weed control. Stands vary somewhat, but not significantly in this particular study. Table 2.

Table 1. Effect of wild oat herbicides alone and in various combinations on Ingrid barley yield and wild oat control. Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field R-9.

Date seeded: May 18, 1979 Date harvested: September 4, 1979
Size of plot: 48 sq. ft.

Treatment	Rate #/A	Yield Bu/A	Test Wt. Lbs/Bu.	% Plump	% Control Wild Oat	% Control Setaria	% Stand
Triallate[1/]	1.25	77.7d[8/]	48.7	98.5	82.50	68.75	92.00
Triallate + profluralin[1/]	1.25 .50	93.7a-d	49.3	98.0	70.00	65.00	92.50
Triallate + profluralin[1/]	1.25 .75	76.5d	48.9	97.2	77.50	71.25	95.00
Triallate + profluralin[1/]	1.25 1.00	102.7a-d	49.1	97.2	76.25	85.00	94.50
Profluralin[1/]	.50	109.3a-c	49.6	97.7	57.50	77.50	98.25
Profluralin[1/]	.75	93.9a-d	49.4	97.7	62.50	76.25	96.25
Profluralin[1/]	1.00	91.2a-d	48.2	95.7	27.50	71.25	95.00
Triallate + trifluralin[1/]	1.25 .0625	117.7a	49.2	97.5	65.00	63.75	97.00
Triallate + trifluralin[1/]	1.25 .125	84.8b-d	48.4	97.2	55.00	58.75	94.50
Diclofop 3EC[2/]	.75	88.7b-d	49.2	97.2	87.50	91.25	95.00
Diclofop 3EC[2/]	1.00	85.7b-d	49.3	97.5	96.25	97.50	95.00
Triallate[1/] diclofop[2/]	1.25 .75	99.1a-d	49.0	98.0	96.25	100.00	92.25
Diclofop 2.36EC[2/]	.63	111.3ab	49.2	97.5	95.00	97.50	97.75
Diclofop 2.36EC[2/]	.75	104.5a-d	49.8	98.5	100.00	100.00	95.00
SD 45328[3/]	.10	99.4a-d	49.4	97.0	50.00	46.25	98.25
SD 45328[3/]	.20	82.3cd	49.6	97.2	82.50	22.50	95.00
SD 45328[3/]	.40	84.2b-d	49.3	97.2	97.50	18.75	92.50
SD 45328[6/]	.10	86.7b-d	49.1	97.7	58.75	33.75	95.00
SD 45328[6/]	.20	78.0d	48.7	97.2	57.50	20.00	93.75
SD 45328[6/]	.40	87.7b-d	49.1	98.5	85.00	23.75	92.50
Barban[4/]	.375	88.5b-d	49.3	97.7	12.50	45.00	96.50
Barban[5/]	.25+.25	87.2b-d	48.9	98.0	82.50	53.75	93.75
Difenzoquat[6/]	.75	86.5b-d	49.4	98.0	92.50	56.25	94.50
Triallate[1/] + difenzoquat[6/]	1.25 .75	94.3a-d	49.6	98.5	96.25	62.50	96.50
Check	0	106.5a-c	49.3	96.7	0.0	0.0	98.75
$\bar{x}$[7/]		92.708	49.166	97.59			
F[7/]		1.797*	.908NS	.342NS			
S.E.$\bar{x}$		8.23584	.39777	.59884			
L.S.D.(.05)		23.17795	1.11943	1.68531			
C.V. %		8.884	0.809	0.614			

1/ Post plant pre emergence incorporated. Incorporated with spike tooth harrow.
2/ Post emergence when wild oats are in the 1-3 leaf stage.
3/ Post emergence when wild oats are in the 2-3 leaf stage. Use 800067 nozzle at 45 P.S.I. same as for barban.
4/ Post emergence when wild oats are in the 2 leaf stage.
5/ Post emergence when wild oats are in the 2 leaf stage, .25 #/A, wait 10 days and make the second application of barban, use 5 gpa, 800067 nozzle, 45 P.S.I.

Table 1. (con't)

6/ Post emergence when wild oats are in the 3-5 leaf stage.
7/ F - value for treatment comparisons.
8/ Items having common letters are not significantly different from one another (Duncan's Multiple Range Test).
* Indicates statistical significance at the .05 level.
a/ Values significantly greater than the check at the .05 level.

APPLICATION DATA:	1/	2/	3/	4/	5/	6/
Date:	5/18/79	6/9/79	6/9/79	6/9/79	6/15/79	6/20/79
Temperature:	70°F	56°F	56°F	56°F	50°F	64°F
Soil temperature:	63°F	60°F	60°F	60°F	76°F	61°F
Humidity	24%	48%	48%	48%	52%	37%
Wind velocity	0-4 mph	0-3 mph	0-3 mph	0-3 mph	calm	3-5 mph
Volume	25.9gpa	25.9gpa	7.54gpa	7.54gpa	25.9gpa	7.54gpa
Nozzle size:	8003	8003	800067	800067 or	8003	800067
P.S.I.	32	32	45	45 or	32	45
Speed (mph)	2.64	2.64	2.64	2.64	2.64	2.64

Soil Type: Silt loam
Organic matter: 5%
Planting date: 5/18/79
Harvest date: 9/ 4/79

Table 2. Effect of wild oat herbicides alone and in various combinations on Newana spring wheat yield and wild oat control. Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field R-9.

Date seeded: May 15, 1979 Date harvested: September 14, 1979
Size of plot: 48 sq. ft.

Treatment	Rate #/A	Yield Bu/A	Test Wt. Lbs/Bu.	% Control Wild Oat	% Control Setaria	% Stand
Triallate[1/]	1.00	55.2	61.6	85.00	61.25	95.00
Triallate + profluralin[1/]	1.00 .50	65.9	62.3	77.50	68.75	93.75
Triallate profluralin[1/]	1.00 .50	71.0	62.0	91.25	81.25	95.00
Triallate profluralin[1/]	1.00 1.00	71.3	62.2	67.50	83.75	92.50
Profluralin[1/]	.50	73.4	62.6	46.25	65.00	93.75
Profluralin[1/]	.75	79.6	63.1	77.50	75.00	95.00
Profluralin[1/]	1.00	65.7	62.6	48.25	53.75	93.75
Triallate + trifluralin[1/]	1.00 .0625	72.3	62.8	81.25	46.25	93.75
Triallate + trifluralin[1/]	1.00 .125	72.2	62.5	53.75	45.00	93.75
Diclofop 3EC[2/]	.75	80.3	62.6	93.75	97.50	95.00
Diclofop 3EC[2/]	1.00	92.6	62.8	97.50	98.75	97.50
Triallate[1/] + diclofop 2.36EC[2/]	1.00 .75	77.3	62.8	97.50	97.50	93.75
Diclofop 2.36EC[2/]	.63	79.2	62.6	95.00	95.00	95.00
Diclofop 2.36EC[2/]	.75	72.6	62.9	100.00	100.00	93.75
SD 45328[3/]	.10	68.2	62.7	67.50	20.00	96.25
SD 45328[3/]	.20	83.1	63.2	87.50	51.25	93.75
SD 45328[3/]	.40	70.5	63.2	87.50	23.75	95.00
SD 45328[6/]	.10	68.0	62.3	77.50	36.25	93.75
SD 45328[6/]	.20	70.6	63.5	87.50	36.25	96.25
SD 45328[6/]	.40	64.3	64.5a	88.75	35.00	93.30
Barban[4/]	.375	98.2	63.3	88.75	56.25	97.50
Barban[5/]	.25+.25	60.8	62.5	82.50	45.00	96.25
Difenzoquat[6/]	.75	88.5	62.6	92.50	63.75	97.50
Triallate[1/] + difenzoquat[6/]	1.00 .75	74.3	62.4	95.00	63.75	90.00
Check	0	72.5	62.5	0.0	0.0	95.00
$\bar{x}$[7/]		73.889	62.71			
F[7/]		1.517NS	1.6645*			
S.E.$\bar{x}$		7.79347	.43567			
L.S.D.(.05)		21.93298	1.22610			
C.V. %		10.548	0.695			

1/ Post plant pre emergence incorporated. Incorporate with spike tooth harrow..
2/ Post emergence when wild oats are in the 1-3 leaf stage.
3/ Post emergence when wild oats are in the 2-3 leaf stage. Use 8.00067 nozzle at 45 P.S.I. same as for barban.
4/ Post emergence when wild oats are in the 2 leaf stage.
5/ Post emergence when wild oats are in the 2 leaf stage, .25 #/A, wait 10 days and make the second application of barban, use 5 gpa, 8.00067 nozzle, 45 P.S.I.
6/ Post emergence when wild oats are in the 3-5 leaf stage.
7/ F - value for treatment comparison.

Table 2. (con't)

* Indicates statistical significance at the .05 level.
a/ Values significantly greater than the check at the .05 level.

APPLICATION DATA:	1/	2/	3/	4/	5/	6/
Date:	5/18/79	6/9/79	6/9/79	6/9/79	6/15/79	6/20/79
Temperature	70°F	56°F	56°F	56°F	50°F	64°F
Soil Temperature	63°F	60°F	60°F	60°F	50°F	61°F
Humitidy	24%	48%	48%	48%	52%	37%
Wind velocity	0-4mph	0-3mph	0-3mph	0-3mph	calm	3-5mph
Volume	25.9gpa	25.9gpa	7.54gpa	7.54gpa	25.9gpa	7.54gpa
Nozzle size	8003	8003	800067	800067 or	8003	800067
P.S.I.	32	32	45	45 or	32	45
Speed (mph)	2.64	2.64	2.64	2.64	2.64	2.64

Soils type: silt loam
Organic matter: 5%
Planting date: 5/18/79
Harvest date: 9/14/79

TITLE: Comparison of triallate, difenzoquat, barban and diclofop for control of wild oats and Setaria sp. and their effect on the yield of Ingrid spring barley.

YEAR: 1979

LOCATION: Northwestern Agricultural Research Center, Field No. R-9

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Weed Research Committee MAES
Montana Wheat Research & Marketing Committee
Chemical Company Research & Development Representatives

OBJECTIVES:

To compare four wild oat herbicides for their effect on the control of wild oats, Setaria sp. and their effect on the yield of Ingrid barley.

MATERIALS AND METHODS:

This study was designed primarily as an extension type demonstration. Plots were 24 feet wide and 90 feet long. Each of the herbicides were applied at the recommended rate. The area was seeded with Ingrid barley at the rate of 50 lbs/a and fertilizer applied at the rate of 200 lbs of 27-14-0 per acre. The herbicides were applied with a 15 foot tractor mounted sprayer at the time prescribed by the label for each of the herbicides used. Three hundred and fifty-seven sq ft was harvested with a Hege 125 plot combine for yield determinations.

RESULTS AND DISCUSSION:

Diclofop at .75 lbs/a gave the most effective weed control. Diclofop effectively controlled Setaria sp. None of the other herbicides we used gave any control of the Sataria sp. We did note a lower amount of Sataria sp. in the check than in the other treatments. This is probably due in part to the competition from wild oats and barley. There were 14.8 wild oats per sqaure foot in the check and 1.5 in the diclofop treatment. Triallate treatments reduced the yields below the check, and gave fair control of wild oats when compared to the check.

Table 1. Comparison of Triallate, Difenzoquat, barban and diclofop for control of weeds and effect on yields in Ingrid barley. Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. R-9.

Date seeded: May 14, 1979 Date harvested: August 7, 1979
Harvest area: 357 sq. ft.

Treatment	Rate #/A	Yield Bu/A	Weed Count/sq. ft.	
			Wild Oats	Foxtail
Triallate	1.25	48.3	3.3	12.2
Barban	.375	74.9	4.3	11.2
Diclofop	.75	69.9	1.5	0.0
Difenzoquat	.75	78.4	7.7	7.8
Check	0.0	51.2	14.8	1.5

APPLICATION DATA:

Chemical:	triallate	diclofop/barban	difenzoquat
Date:	5/18/79	6/2/79	6/15/79
Air temperature:	70°F	68°F	60°F
Soil temperature:	63°F	65°F	76°F
Humidity:	24%	30%	10%
Wind velocity:	0-3 mph	0-5 mph	2-4 mph
Nozzle:	730154	800067 (barban) 730154 (diclofop)	730154
Volume/PSI	20 gpa/40	7.59 gpa/45(barban) 20 gpa/40(diclofop)	20 gpa/40
Growth stage:	post plant	1-3 leaf stage (wild oats)	5 leaf stage (wild oats)

TITLE: Time of application and incorporation of triallate and its effect on spring wheat yield.

PROJECT: Weed Investigations MS 754

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Weed Research Committee MAES
Montana Wheat Research & Marketing Committee
Chemical Company Research & Development Representatives

LOCATION: Northwestern Agricultural Research Center Field No. Y-3

OBJECTIVES:
1. To determine which tool is the most effective in the incorporation of triallate.
2. To determine the effect of the triallate on Fielder spring wheat when applied pre plant incorporated or post plant incorporated.

MATERIALS AND METHODS:

Field machinery was used to conduct this study and the following tools were used:

Treatment 1 - A Morris cultivator consisting of sweeps, rod and mulcher were used to incorporate triallate pre plant.

Treatment 2 - An International vibra shank cultivator consisting of sweeps and a mulcher were used to incorporate triallate preplant.

Treatment 3 - A spike tooth harrow which was used to incorporate the herbicide triallate after planting prior to emergence.

Triallate was applied at the rate of 1 lb/a to treatments 1 and 2 and then incorporated. The entire area was then packed with a brillion packer and Fielder wheat seeded at 60 lbs/a. Triallate was applied at the same rate for treatment 3 and incorporated with a spike tooth harrow with two harrowings with the second one at right angles to the first harrowing.

Harvest was conducted with a 13 foot International harvest combine. The area harvested for each treatment was .16 acre. Yields did not vary significantly one from the other, however the lowest yield was where we used the International vibra shank. Yields from the Morris cultivator and the spiked tooth harrow were equal. Tiller counts were the highest where we used the Morris cultivator and the least with the spike tooth harrow. Tillers per plant were greater where we used the spiked tooth harrow. Table 1.

There was not a high wild oat population in this field however we seemed to get equal control of wild oats with all techniques of incorporation.

Table 1. Evaluation of different incorporation techniques of pre and post plant applied triallate in Fielder spring wheat. Northwestern Agricultural Research Center, Kalispell, MT in 1979.

Date seeded: May 15, 1979 Date harvested: September 17, 1979
Size of plot: .16 acre

Local	Technique	Wild Oat Control	Plot Wt.#	Yield Bu/A	Per Sq. Ft. Plants	Per Sq. Ft. Tillers	Average No. Tillers/Plant
North	Morris[1/] cultivator	Very Good	1000.0	104.2	6.5	49.1	7.6
Center	Vibra Shank[2/] cultivator	Very Good	965.0	100.5	5.9	55.9	9.5
South	Spike Tooth[3/] harrow	Very Good	1000.0	104.2	5.6	57.7	10.3

APPLICATION DATA:

Date:	5/15/79
Air Temperature:	65°F
Soil Temperature:	54°F
Humidity:	30%
Wind velocity:	0
Volume:	20 gpa
Nozzles:	750134
PSI:	40

1/ Preplant incorporate with Morris Cultivator.
2/ Preplant incorporate with Vibra Shank Cultivator.
3/ Post plant pre emergence incorporate with a spike tooth harrow.

TITLE: Chemical weed control in new seedlings of alfalfa

PROJECT: Weed Investigation NS 754

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Weed Research Committee, NAES
Chemical Company Research & Development Reps.

LOCATION: Northwestern Agricultural Research Center, Field X-5

OBJECTIVE: To find a herbicide that will effectively control weeds, season long, in new legume seedings.

MATERIALS AND METHODS:

Herbicide treatments were applied prior to seeding and incorporated in rows 3-6 inches deep with a tandem disk. All materials were applied with a research type plot sprayer in aqueous solution. Herbicides used are listed in Table 1. Each plot was .82 acres (60' x 594'). Plant counts were obtained to study weed control and crop injury. Harvest samples were taken at random and analyzed for alfalfa and weed content.

The test area was irrigated three times during the growing season.

RESULTS AND DISCUSSION:

The EPTC treatment was the highest in yield with 1.2 T/A. The vernolate treatment had a yield of 1.03 T/A and the check was the lowest at .99 T/A. The percentage of weeds as related to hay was the highest in the check and the lowest in the EPTC treatment. More plants were found per square foot in the vernolate treatments and the check indicating some seeding reduction because the EPTC treatment.

The phytotoxicity was equal throughout and this probably resulted from the application of 2,4-DB as an overall general weed control following emergence of the alfalfa. We did not secure the sealing effect readings caused sometimes by the thiocarbamates.

Table 1. Products used in legume herbicide studies.

Common Name	Trade Name	Chemical Name	Company
vernolate	Vernam	S-propyl dipropylthiocarbamate	Stauffer
EPTC	Eptam	S-ethyl dipropylthiocarbamate	Stauffer

Table 2. Comparison of vernolate and EPTC for weed control and the effect on yields in a new seeding of alfalfa. Northwestern Agricultural Research Center, Kalispell, MT 1979. Field No. X-5. Plot size: .6 acre.

Treatment	Rate #/A	Yield T/A	% Alfalfa 2nd. Cut.	Alfalfa Yield T/A 2nd Cut.	% Composition 1/ 2/	3/	4/	Plants/ sq.ft.	Weeds Present/ sq. ft. 5/ 6/	7/	8/	9/	10/
Vernolate	4	2.35	93.5	.96	1.3	.9	4.3	23.2	3.4	.25	.13	.13	.13
EPTC	4	2.57	95.7	1.05	.4	1.2	2.7	21.4	1.3	.13	.25	.13	.0
Check	0	2.22	90.6	.90	.9	2.5	6.0	21.8	8.0	.25	.75	.25	.0
$\bar{x}$		2.38											
F 11/		.839											
S.E.$\bar{x}$		.056											
L.S.D.(.05)		N.S.											
C.V. %		5.25											

1/ Percent composition (2nd cutting only) Composition determined by weight.
- 2/ broadleaves
- 3/ grass
- 4/ miscellaneous

5/ Weed species
- 6/ fanweed (Thalspi arvense (L.))
- 7/ quackgrass (Agropyron repen (L.))
- 8/ pigweed (Amaranthus retroflexus (L.))
- 9/ lambsquarter (Chenopodium album (L.))
- 10/ catchfly (Silene noctiflora (L.))

11/ F - value for treatment comparison

APPLICATION DATA:

Date: 5/25/79
Nozzles: 730154
Pressure: 40 psi
Volume: 20 gpa
Wind: 0-3 mph
Chemicals incorporated immediately after application with tandem disk.
Alfalfa seeded first day after application at 10-12 lbs/a.
2,4-DB applied 6/25/79 for broadleaf control.

TITLE: Chemical control of weeds in potatoes

PROJECT: Weed Investigations MS 754

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Weed Research Committee MAES
Chemical Company Research & Development Reps.

LOCATION: Northwestern Agricultural Research Center, Field X-2

OBJECTIVES:
1. To measure effectiveness of certain herbicides for the control of weeds in potatoes.
2. To determine the effect of these herbicides on potato yields.

MATERIALS AND METHODS:

Three preplant herbicides, three pre emergence herbicides, one post emergence herbicide, and various combinations were tested on Russet Burbank potatoes. Preplant herbicides were applied and incorporated 3-6 inches deep three days prior to planting. The post plant pre emergence herbicides were applied 19 days after planting and the post emergence treatments were applied 25 days after planting when the potato plants were 3-5 inches high. All chemicals were applied with a research type tractor mounted sprayer, to 4 rows, 30 feet long (360 sq. ft.). Potatoes were planted with a 2-row Iron Age Planter. Polyram was used as seed treatment, and Di-syston at 20 lbs/a was applied as a side band treatment for insect control. One row per plot was harvested, weighed and graded to secure yield and grades of potatoes. Field observations and weed counts were taken throughout the growing season.

RESULTS AND DISCUSSION:

There were no significant differences found in yields, grades and total weights of the various treatments of potatoes in the study. The differences were not statistically significant, however we did note some differences that we feel are worthy of mention. The combination of EPTC and R40244 resulted in the highest yield in this test, with 322.9 cwt/a. This is contrasted to the lowest yield for the unweeded check, which was 228.7 cwt/a. Of interest was the yield reduction we found with diclofop. At the .75 lbs/a rate we had 310 cwt/a, and as the rate of diclofop was increased yields decreased as follows; 1 lb/a was 260 cwt/a, and 2 lbs/a was 255.3 cwt/a. The 1 lb/a and 2 lb/a rates of diclofop were lower in yield than the cultivated check. These data show that the 4 lbs/a of EPTC had more adverse effect on vigor and yield than 4 lbs/a of vernolate. Also, vernolate gave better overall weed control than the EPTC. The data showed that EPTC plus extender gave us better weed control than the EPTC alone, also less plant injury. Cycolate at 4 lbs/a was slig htly higher in yield than vernolate, however there was some very slight phyto, but the weed control was excellent. Cycolate yields were higher than EPTC, however these differences are certainly not significant. The combination of metolachlor with metribuzin increased weed control slightly, but yields were affected adversly when comparing this with metribuzin alone. R40244 alone and in combination with EPTC did not give as effective weed control as the other products used in the study.

Table 1. Chemicals used in this experiment.

Common Name	Trade Name or Other	Chemical Name	Company
cycolate	Ro-Neet	S-ethyl N-ethylthiocyclohexane carbamate	Stauffer
diclofop	Hoelon	2-|4-(2,4-dichlorophenoxy)phenoxy|propanoic acid	American Hoechst
EPTC		S-ethyl dipropylthiocarbamate	Stauffer
metribuzin	Sencor	4-amino-6-tert-butyl-3-(methythio)-as-triazin-5(4H)-one	Mobay
metolachlor	Dual	2-chloro-N-(2-ethyl-6-methyl phenyl)-N-(2-methoxy-1-methylethyl)acetamide	Ciba-Giegy
	R-40244	1-(m-trifluoremethylphenyl)-3-chlor-4-chloromethyl-2-pyrolidone	Stauffer
vernolate	Vernam	S-propyl dipropylthiocarbamate	Stauffer

Table 2. Evaluation of several herbicides on potato production and weed control. Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. X-2. Variety: Russet Burbank

Date seeded: June 4, 1979 Date harvested: October 1 & 2, 1979 Size of plot: 90 sq. ft.

Treatment	Rate #/A	Yield cwt/acre Seed	#1	#2	Culls	Total	Vigor 1-10 [5]	Weed Control (%) [6] Wild Oats Setaria sp	Pig-weed	Shepherds-purse	Lambs-quarter
EPTC + Extender [1]	4.0+1.0	186.9	92.6	6.4	3.2	289.0	10.0	96.6	93.3	93.3	93.3
EPTC + Extender [1]	4.0+ .5	134.4	116.7	8.8	10.5	270.5	9.33	96.6	93.3	93.3	100.0
EPTC [1]	4.0	121.6	102.3	6.4	18.5	248.8	9.67	73.3	90.0	86.6	100.0
Vernolate [1]	4.0	167.5	111.1	5.0	9.8	293.4	10.0	100.0	93.3	93.3	100.0
Cycolate [1]	4.0	157.0	126.4	7.2	12.1	302.7	9.33	100.0	96.6	92.7	100.0
EPTC+R40244 [2]	4.0+ .25	157.0	148.0	10.0	7.2	322.9	10.0	90.0	90.0	93.3	96.6
F 40244 [3]	.25	128.3	96.9	6.0	11.3	242.6	9.67	80.0	80.0	86.6	93.3
Diclofop [3]	.75	166.7	129.6	5.7	8.0	310.0	10.0	96.6	70.0	93.3	96.6
Diclofop [3]	1.0	143.3	99.0	4.8	15.3	262.5	9.33	96.6	96.6	90.0	96.6
Diclofop [3]	2.0	153.8	86.2	6.4	8.9	255.3	9.67	90.0	100.0	76.6	96.6
Metolachlor [4]	2.0	161.8	97.4	9.0	5.0	273.3	10.0	93.3	93.3	76.6	90.0
Metolachlor [4]	2.5	133.6	96.6	0.8	6.4	237.5	9.0	96.6	96.6	96.6	93.3
Metolachlor+ metribuzin [4]	2.0+ .5	176.3	104.7	4.8	2.4	288.2	9.0	100.0	90.0	93.3	96.6
Metolachlor+ metribuzin [4]	2.0+ .30	152.2	117.6	5.6	17.7	293.1	10.0	90.0	86.6	93.3	93.3
Metribuzin [4]	.50	161.0	126.4	10.6	5.6	303.7	10.0	86.6	90.0	86.6	96.6
Check(cultivated)	0.0	145.7	111.9	1.7	4.9	264.2	9.67	93.6	100.0	96.6	96.6
Check (weedy)	0.0	124.8	84.5	4.8	14.5	228.7	9.33	0	0	0	0
$\bar{x}$		151.30	108.76	6.12	9.49	275.67					
F [7]		.880	.680	.361	.590	.516					
S.E.$\bar{x}$		19.70	20.92	4.27	6.30	38.31					
L.S.D.(.05)		56.84	60.35	12.31	18.39	110.52					
C.V.%		13.02	19.23	69.75	67.17	13.90					

1/ Preplant incorporated
2/ Pre emergence surface
3/ Early post emergence
4/ Post plant pre emergence
5/ Vigor scale = 0-10; 0 = dead plants; 10 = excellent vigor, normal to above normal growth
6/ Weed control rated July 23, 1979, potato plants just flowering, weed canopy approximately at 4 inches
7/ F - value for treatment comparison

Table 2 . (con't)

APPLICATION DATA:

	Preplant Incorporated	Pre emergence sprays	Post emergence
Date:	6/1/79	6/20/79	6/26/79
Air temperature:	75°F	59°F	90°F
Soil temperature:	75°F	61°F	81°F
Humidity:	24%	48%	4%
Wind velocity:	2-5mph	3-6mph	3-4mph
Nozzle/PSI	8003/32	8003/32	8003/32
Volume	25.9	25.9	25.9

Cultivated checks weeded: 7/18, 8/1/79
Growth stage: potatoes just fully emerged 3-5" high at post emergence stage.

TITLE: Herbicide evaluation on fababeans

PROJECT: Weed Investigations MS 754

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Weed Research Committee MAES
Chemical Company Research & Development Representatives

LOCATION: Northwestern Agricultural Research Center, Field R-9.

OBJECTIVES:
1. To determine what herbicides would effectively control weeds in fababeans.
2. To determine the effect of the herbicide on yield.

MATERIALS AND METHODS:

Three herbicides were evaluated for weed control and their effect on the yield of fababeans. All three were applied preplant incorporated. Profluralin and metolachlor were also applied post plant pre emergence. The preplant treatments were incorporated 3-6 inches with a tandem disk immediately following application. All herbicides were applied with a research type tractor mounted sprayer on May 22, 1979. The beans were planted immediately following the preplant incorporation of herbicides. The post plant pre emergence herbicides were applied after planting. Weed scores were obtained June 28 and July 6, 1979. Five and six weeks after application, respectively.

RESULTS AND DISCUSSION:

There was considerable variation within the stands which can be attributed to incorporation and the planting techniques. The beans did not emerge as quickly in the compacted areas (tractor tracks). This appeared across all plots perpendicular to the seeded rows. This resulted then in somewhat poor stands and probably is responsible for the wide variation in yield and the excessive high C.V.

Yields ranged from 648.2 lbs/a from the check up to 1718.6 lbs/a for the metolachlor treatment at 2 lbs/a post emergence. Even with the wide spread in yield the analysis showed that the yield data were not significant, however there is some indication that we did obtain some weed control that resulted in increased fababean yields.

There was a high percent of quackgrass in the test area. There was some evidence of control of quackgrass by herbicides, however I think that was because of the erratic stand.

Setaria sp. was probably the most uniform weed in this study. We did get from poor to good control of Setaria sp. There again these results are very erratic. The metolachlor seemed to give us our best control of Setaria sp. I think it is interesting to note that the proflualin as a post emergence non incorporated seemed to give us good control of both Setaria sp. and I question that this really occurred.

In general I would rate this study as being very inconclusive and should be repeated another year.

Table 1. Chemical used in this experiment.

Common Name	Trade Name or Other	Chemical Name	Company
metolachlor	Dual	2-chloro-N-(2 ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide	Ciba-Giegy
profluralin	Tolban	N-(cyclopropylmethyl)-α,α,α-trifluoro-2,6-dinitro-N-propyl-p-toluidine	Ciba-Biegy
trifluralin	Treflan	α,α,α-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine	Elanco

Table 2. Effect of herbicides and time of application on faba bean yields and weed control. Northwestern Agricultural Research Center in 1979. Field No. R-9.

Date seeded: May 22, 1979 Date harvested: September 28, 1979
Size of plot: 16 sq. ft.

Treatment	Rate #/A	Yield Lbs/A	Weed Control (Percent) Quack-grass	Setaria	Fan-weed	False Flax	Wild Buckwheat	Henbit
Trifluralin 1/	.50	1536.5	67	65	55	51	0	88
Trifluralin 1/	.75	1262.4	78	58	30	51	100	0
Trifluralin 1/	1.0	1634.6	91	77	80	92	100	50
Profluralin 1/	.75	1706.6	40	63	50	89	50	75
Profluralin 1/	1.00	1040.4	73	12	55	30	0	0
Profluralin 1/	1.50	1298.4	9	81	35	81	100	63
Metolachlor 1/	2.00	1530.5	73	21	70	43	50	0
Metolachlor 1/	2.50	1400.5	93	59	55	0	0	75
Metolachlor 1/	3.00	992.3	76	86	25	0	0	75
Profluralin 2/	.75	1444.5	20	90	55	70	0	25
Profluralin 2/	1.00	1254.4	18	74	0	82	100	63
Profluralin 2/	1.50	1196.4	33	69	25	68	100	63
Metolachlor 2/	2.00	1718.6	49	82	80	95	0	75
Metolachlor 2/	2.50	1176.4	87	94	95	95	0	88
Metolachlor 2/	3.0	1054.4	40	81	55	73	0	88
Check	0.0	648.2	0	0	0	0	0	0

$\bar{x}$ 3/	1305.94
F 3/	.87713NS
S.E.$\bar{x}$	310.52009
L.S.D.(.05)	895.847
C.V. %	23.78

Spray Application Data:	Pre	Post
Date:	5/22/79	5/22/79
Air Temperature:	65°F	85°F
Soil Temperature:	62°F	77°F
Humidity:	27%	7%
Wind velocity:	0-3mph	0-2mph
Nozzles/PSI:	8003/32	8003/32
Volume:	25.9gpa	25.9gpa

1/ Preplant Incorporated
2/ Post plant Pre emergence
3/ F- value for variety comparison

Weed pressure throughout test: Quack - moderate; false flax - moderate; Setaria - heavy; wild buckwheat - very light; fanweed - light; henbit - light.

TITLE: Weed Control in "Sod-Seeding" Legumes

PROJECT: Weed Investigations MS 754

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Weed Research Committee, MAES
Chemical Research and Development Representatives

LOCATION: Northwestern Agricultural Research Center, Field No. P-2 and P-3.

OBJECTIVES:
1. To determine what herbicides alone and in combination will effectively control existing vegetation and subsequent germinating weeds in sod-seeding legumes.
2. To find a rate of glyphosate that will control existing vegetation and determine if a surfactant increases effectiveness of glyphosate therby enabling the use of lower rates.

MATERIAL AND METHODS:

Herbicides were applied in the spring of 1978 and 1979 to established stands of alfalfa-orchardgrass-bluegrass pasture. Plots were 10' x 30' in the combination experiment and 10' x 16' in the glyphosate rate study. All herbicides were applied with a research type tractor mounted sprayer. Broadleaf weed species in the study were predominantly sherpherdspurse (Capsella bursa-pastoris), dandelion (Taraxacum officinale), broadleaf plantain (Plantago major), and trefoil (Lotus corniculatus). Grasses studied were orchardgrass (Dactylis glomerata) and bluegrass (Poa partense). Plant and weed counts were made in the 1979 combination chemical experiment, as were plant vigor rates for alfalfa and percent occupancy. Harvests were made as required in each experiment. Composition of each plant species was determined by weight, and recorded as a percentage.

RESULTS AND DISCUSSION:

Glyphosate and other chemical 1978-79 - Observations and species separations indicated that alfalfa compositions for most of the treated plots remained the same or were higher in the second year harvests. The first harvest for the plots treated with glyphosate and buthidazole (1.5 lbs/a and .5 lbs/a) had lower levels of alfalfa due to high populations of grass. Carry over of weed suppression from previous year was excellent due in part to the competitiveness of alfalfa. The check plot contained about 30% alfalfa.

The grass percentages were slightly higher this year for most treatments and were excessive in the first harvests of the glyphosate plus buthidazole treatment (Table 1). Grassy weed pressure was reduced or remained static in later harvests.

Broadleaf populations were less in the first 1979 harvest when compared to the previous year. Broadleaf growth was accelerated after the first cut resulting in higher percentages in the second cutting and were less in the last harvest (3rd cutting).

Results and Discussion (con't)

The lowest yielding treatment was glyphosate plus buthidazole (1.5 lbs/a plus .5 lbs/a). This could in part be due to the early spring establishment of grasses in this treatment. All other treatments were similar in yields, which ranged from 6.42 to 7.07 T/A (Table 2).

Yields from the glyphosate plus EPTC treatments(1.5 lbs/a and 3.0 lbs/a) were the highest and the check the lowest. Table 2.

Glyphosate and other chemicals 1979 - Stand reductions were noted in an early observation. Glyphosate plus EPTC (1.5 lbs/a plus 3.0 lbs/a) and glyphosate plus R40244 (1.5 lbs/a plus .5 lb/a) reduced the number of alfalfa seedlings per square foot. Table 3. All treatments had less plants per square foot when a second count was made. The glyphosate-EPTC combination treatment was still significantly less in the second plant count.

Broadleaf weed populations were high in this experiment. Adequate weed control was obtained with the glyphosate plus R40244 treatment. This treatment had the greatest plant vigor, greatest plant height and stand uniformity.

All treatments had at least 92% alfalfa occupancy in the first measurement. Table 3. The occupancy percentages were reduced when measurements were made 18 days later.

Alfalfa composition was less at the first harvest, but at the second harvest all treatments execpt the check were higher in alfalfa composition. Table 4.

A high population of trefoil was noted at the first harvest in the check, and moderate levels in the glyphosate (1.5 lbs/a), and glyphosate plus napropamide (1.5 lbs/a plus 1.0 lbs/a) treatments. The populations of trefoil decreased throughout the entire test area prior to the second harvest. Table 4.

Two harvests were made during the season. The mean for the pure alfalfa was 1.07. The highest yield was obtained from the combination of glyphosate at 1.5 lb/a and R40244 at .5 lb/a. Total hay yield was .95 T/A for the check and 2.04 T/A for the glyphosate + R40244 combination. This would indicate that we did get control of unproductive species with the glyphosate + R40244 and the alfalfa did come on vigorously to give us a high yield. Table 5.

Glyphosate, surfactants, and stage of growth, 1978-1979 - In the first harvest we found that alfalfa percentages were increased with the addition to glyphosate of a surfactant at .75 lb/a and 1 lb/a rates. However, at the 2 lb/a rate there were not any differences in percentage when a surfactant was added. Higher percentages of alfalfa were obtained when the herbicides were applied at the 7-8 inch stage of growth, however these differences were not statistically significant. There were no statistically significant differences in the percentage of alfalfa between treatments, except the check. In the third harvest, percentages of alfalfa were significantly different when glyphosate was used at .75 lb/a and also the check. However, the remaining treatments were found to be non-significant. The alfalfa percentages were less at 2-3 inches than the other two stages of growth at the third harvest. Table 6.

Results and Discussion (con't)

At the first harvest we had less grass at the 7-8 inch stage of growth. The second harvest this difference was not found, however in the third harvest we found that glyphosate applied at 10-14 inches we did have a significant increase in grass percentage. Grass percentages were higher where we used glyphosate without a surfactant. Table 7.

Percentage of weeds were found to be non-significant at all stages of harvest and all treatments. Table 8.

Herbicides applied at the 7-8 inch stage of growth resulted in higher total pure alfalfa production. However, these differences were not found to be statistically significant. It is interesting to note that as the rate of glyphosate was increased without a surfactant we increased the yield of alfalfa. However, with the addition of the surfactant to the .75 lbs/a of glyphosate rate we did have a higher yield of alfalfa than we had where we used 1.0 lb/a of glyphosate. However, these differences are not statistically significant. The only differences found that were significant were the 2 lbs/a of glyphosate with the surfactant, the .75 lbs/a glyphosate which was significantly lower, and the check. Table 9.

The hay yields are fairly well correlated with the pure alfalfa stand yields except for the check. This can be attributed in part to the extremely high yield from this location, also it should be noted that there was no differences in growth stage when total hay production was measured.

Table 1. Effect of glyphosate in combination with various herbicides on second year species composition.

Herbicide	Rate # AE/ Acre	Species Composition[3] 1st Harvest 7/2/79 % Alfalfa	% Grass	% Broadleaves	2nd Harvest 8/17/79 % Alfalfa	% Grass	% Broadleaves	3rd Harvest 10/3/79 % Alfalfa	% Grass	% Broadleaves
Glyphosate	1.5	90a[4]	8c	2	95a	2b	3	98a	2b	1b
Glyphosate + EPTC[1]	1.5 3.0	95a	4c	1	92a	2b	6	94a	5b	2b
Glyphosate + R40244[2]	1.5 .5	93a	5c	2	93a	5b	2	96a	2b	2b
Glyphosate + napropamide[2]	1.5 2.0	96a	3c	1	88a	9b	3	97a	2b	1b
Glyphosate + buthidazole[2]	1.5 .5	69b	30b	1	91a	6b	5	91a	8b	2b
Glyphosate + R40244 + napropamide[2]	1.5 .5 2.0	97a	2c	1	97a	1b	2	99a	1b	1b
Glyphosate + buthidazole + napropamide[2]	1.5 .5 2.0	91a	6c	3	96a	2b	2	92a	7b	1b
Check	0	12c	85a	3	46b	48a	6	35b	60a	6a
Mean		79.5	17.8	1.8	87.3	8.9	3.7	87.5	10.7	2.0
F[5]		31.30**							18.00**	
			30.87**	2.14	7.33**	6.58**	1.31	25.07**		5.45**
S.E.$\bar{x}$		5.146	5.130	.658	6.219	6.165	1.612	4.347	4.738	.628
L.S.D.(.05)		13.172				15.781	N.S.	11.126		
			13.13	N.S.	15.919				12.138	1.608
C.V. %		6.47	28.80	35.71	7.128					
						68.98	44.10	4.97	44.46	31.92

1/ Granular EPTC, mixed with seed

2/ Tank mix

3/ Species composition determined by dry weight; hand separation of a 500 gram sample for all harvests.

4/ Treatment means in the same column followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.

5/ F - value for treatment comparison

* Indicates statistical significance at the 0.05 level.

** Indicates statistical significance at the 0.01 level.

Table 2. Effect of glyphosate in combination with various herbicides on second year yields in sod-seeded alfalfa.

Herbicide	Rate # A.E./A	Total Hay Yield, Tons/Acre[3/5/] Cutting First	Second	Third	Total	Alfalfa Yield, Tons/Acre[4/5/] Cutting First	Second	Third	Total
Glyphosate	1.5	3.61a	2.34ab	1.24a	7.19a	3.24ab	2.23ab	1.21a	6.68a
Glyphosate + EPTC[1/]	1.5 3.0	4.08a	2.14bc	1.30a	7.52a	3.88a	1.98abc	1.21a	7.07a
Glyphosate + R40244[2/]	1.5 .5	3.51a	2.48a	1.33a	7.31a	3.25ab	2.30a	1.28a	6.83a
Glyphosate + Napropamide[2/]	1.5 2.0	3.52a	2.13bc	1.32a	6.96a	3.39ab	1.87bc	1.28a	6.54ab
Glyphosate + buthidazole[2/]	1.5 .5	4.08a	1.92c	1.28a	7.28a	2.84b	1.76c	1.16a	5.76b
Glyphosate + R40244 + napropamide[2/]	1.5 .5 2.0	3.65a	2.24ab	1.16a	7.05a	3.54ab	2.18abc	1.14a	6.86a
Glyphosate + buthidazole + napropamide[2/]	1.5 .5 2.0	3.44ab	2.26ab	1.23a	6.93a	3.13ab	2.17abc	1.12a	6.42ab
Check	0	2.82b	.76d	.31b	3.90b	.31c	.37d	.13b	.81c
Mean		3.59	2.03	1.14	6.76	2.95	1.86	1.07	5.87
F[6/]		3.80**	30.93**	38.07**	24.96**	23.11**	23.59**	39.59**	704.98**
S.E.$\bar{x}$		.204	.097	.064	.235	.230	.129	.061	.24811
L.S.D.(.05)		.522	.248	.165	.602	.590	.332	.156	.63509
C.V. %		5.69	4.77	5.63	3.48	7.82	6.98	5.73	4.23

1/ Granular EPTC, mixed with seed
2/ Tank mix
3/ Total mixed hay yield (considering all components; alfalfa, grass, broadleaves, and miscellaneous).
4/ Legume hay yield (considering just alfalfa components) mean of four replications.
5/ Means in the same column followed by the same letter are not significantly different at the 0.05 probability according to Duncan's Multiple Range Test.
6/ F- value for treatment comparison.
* Indicates statistical significance at the 0.05 level.
** Indicates statistical significance at the 0.01 level.

Table 3. Effect of glyphosate in combination with various herbicides on alfalfa stand establishment and broadleaf populations.

Treatment		Alfalfa Plant Counts Plants/sq. ft.				% Occupancy of Alfalfa	
Herbicide	Rate # A.E./A	1-Count 6/25/79 3/ 4/	2-Count 7/13/79 3/ 4/	Number Broadleaves/ft² 7/23/79 5/	Alfalfa Vigor 6/ (1-10) 7/23/79	1-Count 6/25/79 3/ 4/	2-Count 7/13/79 3/ 4/
Glyphosate	1.5	52.3a	24.6ab	81.8ab	8.0	95.5a	86.0a
Glyphosate + EPTC 1/	1.5 3.0	35.3c	19.9c	61.0bc	7.0	92.3a	77.0b
Glyphosate + R40244 2/	1.5 .25	42.8bc	27.0a	15.1d	9.5	94.0a	86.0a
Glyphosate + R40244 2/	1.5 .50	36.9c	21.8bc	7.4d	8.5	92.0a	84.5a
Glyphosate + Napropamide 2/	1.5 1.0	42.6bc	24.4abc	53.7c	7.8	94.8a	85.3a
Glyphosate + Napropamide 2/	1.5 2.0	46.3ab	26.4ab	41.9c	8.8	96.0a	85.3a
Check	0	34.7c	1.3d	85.7a	0	87.8a	9.8c
Mean		41.6	20.8	49.5		93.2	73.4
F 7/		6.65**	35.50**	17.57**		.06	189.31**
S.E.$\bar{x}$		2.504	1.499	7.230		11.337	2.053
L.S.D.(.05)		6.799	4.070	19.634		N.S.	5.574
C.V. %		6.03	7.21	14.62		12.167	2.797

1/ Granular EPTC mixed with seed.
2/ Tank mix
3/ Six, three foot counts/plot; mean of four replications
4/ Treatment means in the same column followed by the same letter are not significantly different at the .05 probability level according to Duncan's Multiple Range Test.
5/ Number of broadleaves occupying a 1' square - 3 counts/plot; mean of four replications.
6/ Vigor scale (1-10) 10 = normal healthy plants; 0 = no plants or dead plants
7/ F-value for treatment comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Application Data:
Date = 6/8/79 Air Temperature = 68°F
Soil Temperature = 65°F Wind Velocity = 2-4 mph
Humidity = 33% Volume = 25.9 gpa
Nozzles = 8003 Pressure = 32 psi
Stage of growth = pasture was mowed the day before after being grazed down, 1-1½ " tall, all vegetation
Fertilizer = 200#/a 0-48-0, 9/14/79

Table 4. Effect of glyphosate in combination with various herbicides on first year species composition.

Herbicide	Rate # A.E./A	Species Composition 3/ First Harvest 8/21/79 % 4/ Alfalfa	% 4/ Grass	% Broad leaves 4/	% 4/ Trefoil	Second Harvest 10/4/79 % 4/ Alfalfa	% 4/ Grass	% Broad leaves 4/	% 4/ Trefoil
Glyphosate	1.5	52.1b	5.2b	20.6ab	22.3ab	96.0a	1.1b	3.0	-
Glyphosate + EPTC 1/	1.5 3.0	46.7b	11.2b	31.1a	11.0b	88.0a	3.6b	8.3	1.9
Glyphosate + R40244 2/	1.5 .25	79.1a	3.7b	7.5bc	9.7b	96.6a	1.3b	2.0	.2
Glyphosate + R40244 2/	1.5 .50	84.6a	10.1b	2.0c	3.3b	96.3a	2.7b	1.5	-
Glyphosate + Napropamide 2/	1.5 1.0	53.3b	13.9b	13.4bc	19.3ab	91.5a	4.1b	4.4	-
Glyphosate + Napropamide 2/	1.5 2.0	73.3a	5.7b	9.5bc	11.6b	95.4a	1.2b	3.5	-
Check	0	6.3c	34.1a	20.5ab	39.1a	30.7b	61.4a	5.0	2.9
Mean		56.5	12.0	14.9	16.6	84.9	10.8	3.9	-
F 5/		25.227**	5.18**	5.885**	3.3096**	17.34**	13.11**	1.655NS	-
S.E.$\bar{x}$		5.562	4.570	4.054	6.458	5.789	6.179	1.789	-
L.S.D. (.05)		15.101	12.225	11.008	17.536	15.718	16.777	N.S.	-
C.V. %		10.316	38.176	27.182	38.864	6.817	57.437	45.587	

1/ Granular EPTC, mixed with seed
2/ Tank mix
3/ Species composition determined on dry weight basis: hand separation of a 500 gram sample for both harvests.
4/ Treatment means in the same column followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.
5/ F- value for treatment comparison
* Indicates statistical significance at the .05 level.
** Indicates statistical significance at the .01 level.

Table 5 . Effect of glyphosate in combination with various herbicides on first year sod-seeded alfalfa yields.

Treatment		Hay Yield Tons per Acre 3/			Alfalfa Yield Tons per Acre 4/		
Herbicide	Rate # A.E./A	First Harvest	Second Harvest	Total	First Harvest	Second Harvest	Total
Glyphosate	1.5	.98c 5/	.36abc 5/	1.34c 5/	.52d 5/	.34ab 5/	.86c 5/
Glyphosate + EPTC 1/	1.5 3.0	1.12bc	.31abc	1.43c	.53d	.28bc	.81c
Glyphosate + R40244 2/	1.5 .25	1.35ab	.52ab	1.87ab	1.07ab	.50a	1.57a
Glyphosate + R40244 2/	1.5 .50	1.48a	.56a	2.04a	1.24a	.54a	1.74a
Glyphosate + Napropamide 2/	1.5 1.0	1.16bc	.42ab	1.58bc	.64cd	.38ab	1.02bc
Glyphosate + Napropamide 2/	1.5 2.0	1.21b	.47ab	1.68abc	.89bc	.45ab	1.34ab
Check	0	.79d	.16c	.95d	.05e	.08e	.13d
Mean		1.16	.40	1.56	.705	.369	1.07
F 6/		9.195**	3.448*	7.64**	20.988**	.5141**	14.47**
S.E.$\bar{x}$		.0753	.07359	.130	.087	.0679	.145
L.S.D.(.05)		.2044	.1998	.354	.2365	.1844	.393
C.V. %		.233	18.41	8.38	12.36	18.42	13.49

1/ Granular EPTC, mixed with seed
2/ Tank mix
3/ Total mixed hay yield (considering all components; grass, broadleaves, alfalfa and trefoil).
4/ Legume hay yield (considering just percent alfalfa (total plot yield), mean of four replications.
5/ Means in the same column followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test
6/ F- value for treatment comparison.
* Indicates statistical significance at the 0.05 level.
** Indicates statistical significance at the 0.01 level.

Table 6. Effect of glyphosate rate, surfactant and sod growth stage on second year percent alfalfa.

Herbicide	Rate # A.E./A	Percent Alfalfa 1/2/ First Harvest 6/29/79 Stage of Growth 2-3"	7-8"	10-14"	x 3/	Second Harvest 8/17/79 Stage of Growth 2-3"	7-8"	10-14"	x 3/	Third Harvest 10/2/79 Stage of Growth 2-3"	7-8"	10-14"	x 3/
Glyphosate	.75	32.0d	86.0a	75.0a	65.0c	68.5bc	87.0a	89.1a	81.5a	61.2b	89.8a	84.6a	78.5b
Glyphosate + Surfactant	.75	75.0abc	92.0a	76.0a	81.0ab	79.5ab	95.3a	85.0a	86.6a	87.2a	96.9a	85.4a	89.8a
Glyphosate	1.00	61.0cd	80.0a	71.0a	71.0bc	76.4abc	92.5a	91.8a	86.9a	78.7a	97.0a	88.0a	87.9ab
Glyphosate + Surfactant	1.00	69.0bc	95.0a	74.0a	79.0ab	89.3ab	88.7a	94.9a	91.0a	85.0a	93.2a	84.2a	87.4ab
Glyphosate	2.00	95.0a	92.0a	82.0a	90.0a	85.4ab	84.5a	93.4a	87.8a	91.7a	97.3a	93.0a	94.0a
Glyphosate + Surfactant	2.00	88.0ab	92.0a	88.0a	90.0a	95.5a	93.5a	95.9a	94.9a	92.5a	96.7a	95.4a	94.9a
Check	0	22.0d	23.0b	31.0b	25.0d	52.9c	70.7b	45.5b	56.3b	51.5b	56.0b	47.9b	51.8c
Mean 3/		63.0a	80.0a	71.0a		78.2a	87.5a	85.1a		78.3b	89.6a	82.6b	

1/ Dry weight basis: hand separation of 500 gram sample per harvest, mean of three replications.

2/ Treatment means within each group stage (for each harvest) followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.

3/ Treatment means averaged across growth stage and growth stage means averaged across treatments (for the same harvest) followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.

Table 7. Effect of glyphosate rate, surfactant and growth stage on second year percent grass.

Herbicide	Rate # A.E./A	Percent Grass 1/2/ First Harvest 6/29/79 Stage of Growth 2-3"	7-8"	10-14"	$\bar{x}$ 3/	Second Harvest 8/17/79 Stage of Growth 2-3"	7-8"	10-14"	$\bar{x}$ 3/	Third Harvest 10/2/79 Stage of Growth 2-3"	7-8"	10-14"	$\bar{x}$ 3/
Glyphosate	.75	66.0a	8.0b	18.0b	30.3b	29.2ab	8.4a	8.2b	15.3b	37.3a	8.7b	13.5b	19.8b
Glyphosate + Surfactant	.75	21.0bc	2.0b	22.0b	15.0bc	15.8bc	1.1a	13.9b	10.3b	10.7b	1.8b	13.1b	8.6c
Glyphosate	1.00	35.0b	14.0b	26.0b	25.1b	20.2abc	2.2a	5.1b	9.2b	19.8b	1.3b	9.4b	10.2c
Glyphosate + Surfactant	1.00	28.0bc	3.0b	21.0b	17.3bc	7.4bc	2.9a	2.6b	4.3b	13.0b	5.1b	13.4b	10.5c
Glyphosate	2.00	3.0c	1.0b	13.0b	5.8c	12.1bc	10.7a	3.0b	8.6b	6.6b	1.1b	5.7b	4.4c
Glyphosate + Surfactant	2.00	8.0bc	2.0b	1.0b	3.7c	2.8c	1.2a	.6b	1.5b	5.2b	.8b	3.5b	3.2c
Check	0	76.0a	75.0a	68.0a	73.2a	42.9a	25.3a	51.2a	39.8a	45.7a	40.8a	51.2a	45.9a
Mean 3/		34.0a	15.0b	24.0ab		18.6a	7.4a	12.1a		19.8a	8.5b	15.7b	

1/ Dry weight basis: Hand separation of 500 gram samples for each of three harvest, mean of three replications.
2/ Treatment means within each growth stage (for each harvest) followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.
3/ Treatment means averaged across growth stage and growth stage means averaged across treatments (for the same harvest) followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.

Table 8. Effect of glyphosate rate, surfactant, and growth stage on second year percent weeds.

Herbicide	Rate # A.E./A	Percent Weeds 1/2/ First Harvest 6/29/79 Stage of Growth 2-3"	7-8"	10-14"	x̄ 3/	Second Harvest 8/17/79 Stage of Growth 2-3"	7-8"	10-14"	x̄ 3/	Third Harvest 10/2/79 Stage of Growth 2-3"	7-8"	10-14"	x̄ 3/
Glyphosate	.75	2.0a	6.0a	7.0a	5.0a	2.3a	4.6a	2.7a	3.2a	1.5a	1.5a	1.9a	1.6a
Glyphosate + Surfactant	.75	4.0a	6.0a	2.0a	3.9a	4.8a	3.5a	1.1a	3.1a	2.1a	1.3a	1.5a	1.6a
Glyphosate	1.00	4.0a	6.0a	3.0a	4.3a	3.4a	4.5a	3.2a	3.7a	1.6a	1.7a	2.6a	2.0a
Glyphosate + Surfactant	1.00	2.0a	2.0a	6.0a	3.4a	3.2a	5.9a	2.5a	3.9a	2.1a	1.8a	2.4a	2.1a
Glyphosate	2.00	2.0a	4.0a	5.0a	4.7a	2.4a	4.7a	3.5a	3.6a	1.8a	1.6a	1.3a	1.6a
Glyphosate + Surfactant	2.00	4.0a	6.0a	11.0a	6.8a	1.7a	5.3a	3.5a	3.5a	2.4a	2.5a	1.1a	2.0a
Check	0	2.0a	2.0a	1.0a	1.7a	4.2a	4.0a	3.4a	3.9a	2.8a	3.2a	.9a	2.3a
Mean 3/		2.9a	4.6a	5.0a		3.1a	4.6a	2.8a		2.0a	1.9a	1.7a	

1/ Dry weight basis: hand separation of 500 gram sample for each harvest, mean of three replications.
2/ Treatment means within each growth stage (for each harvest) followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.
3/ Treatment means averaged across growth stage and growth stage means averaged across treatments (for the same harvest) followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range test.

Table 9. Effect of glyphosate rates and growth stage on second year sod-seeded alfalfa yields, total harvest.

Treatment			Alfalfa Tons/Acre[1/]			
			Stage of Growth			
Herbicide	Rate # A.E./A	Harvest	2-3"[2/]	7-8"[2/]	10-14"[2/]	x̄[3/]
Glyphosate	.75	First	.96bc	2.30a	2.34a	1.87b
		Second	1.30c	1.67b	1.88a	1.61b
		Third	.47b	.73a	.91a	.70c
		Total	2.73c	4.70c	5.13abc	4.18c
Glyphosate + Surfactant	.75	First	2.12ab	2.97a	2.08a	2.39ab
		Second	1.69abc	2.03ab	1.80a	1.84ab
		Third	.73a	.91a	.83a	.82abc
		Total	4.54b	5.91ab	4.7ac	5.05b
Glyphosate	1.00	First	2.07ab	2.46a	2.17a	2.23b
		Second	1.48bc	1.87ab	2.28a	1.88ab
		Third	.72a	.90a	.72a	.78bc
		Total	4.27b	5.23c	5.17abc	4.89b
Glyphosate + Surfactant	1.00	First	2.28a	2.55a	2.03a	2.29ab
		Second	1.74abc	1.89ab	2.03a	1.89ab
		Third	.78a	.88a	.76a	.81abc
		Total	4.80b	5.32bc	4.82bc	4.99b
Glyphosate	2.00	First	3.06a	2.14a	2.74a	2.54ab
		Second	2.05ab	1.82ab	1.80a	1.89ab
		Third	.87a	.89a	.86a	.87ab
		Total	5.98a	4.85c	5.40ab	5.30b
Glyphosate + Surfactant	2.00	First	3.08a	3.02a	2.75a	2.95a
		Second	2.29a	2.49a	1.85a	2.21a
		Third	.92a	.97a	.96a	.95a
		Total	6.29a	6.48a	5.56a	6.11a
Check	0	First	.54c	.74b	.67b	.65c
		Second	.61d	.77c	.51b	.63c
		Third	.23c	.29b	.31b	.28d
		Total	1.38d	1.80d	1.49d	1.56d
	Mean[3/]	First	2.02a	2.31a	2.11a	
		Second	1.59a	1.79a	1.74a	
		Third	.67a	.80a	.76a	
		Total	4.28a	4.90a	4.61a	

1/ Percent alfalfa x total plot yield; mean of three replications.

2/ Treatment means within each stage of growth (For the same harvest or for total yield) followed by the same letter are not significantly different at the .05 probability level according to Duncan's Multiple Range Test.

3/ Treatment means averaged across growth stages and growth stages means averaged and growth stage means averaged across treatments for the same harvest or for total harvest followed by the same letter are not significantly different at the .05 probability level according to Duncan's Multiple Range Test.

Table 10. Effect of glyphosate rates and growth stage on second year sod-control hay yields, total harvest.

Treatment			Hay Yield (T/A)[1/]			
			Stage of Growth			
Herbicide	Rate # A.E./A	Harvest	2-3"[2/]	7-8"[2/]	10-14"[2/]	$\bar{x}$[3/]
Glyphosate	.75	First	3.06a	2.66a	3.13a	2.95a
		Second	1.90a	1.91a	2.12a	1.98a
		Third	.78a	.81a	1.07a	.89a
		Total	5.74c	5.38c	6.32a	5.82b
Glyphosate + Surfactant	.75	First	2.86a	3.21a	2.89a	2.99a
		Second	2.09a	2.14a	2.12a	2.12a
		Third	.84a	.94a	.99a	.92a
		Total	5.79c	6.29b	6.00a	6.03b
Glyphosate	1.00	First	3.49a	3.40a	3.04a	3.31a
		Second	1.94a	2.00a	2.47a	2.14a
		Third	.92a	.93a	.82a	.89a
		Total	6.35b	6.33b	6.33a	6.34a
Glyphosate + Surfactant	1.00	First	3.31a	2.68a	2.80a	2.93a
		Second	1.95a	2.09a	2.15a	2.06a
		Third	.91a	.95a	.90a	.92a
		Total	6.17bc	5.72c	5.85a	5.91b
Glyphosate	2.00	First	3.23a	2.33a	3.02a	2.86a
		Second	2.42a	2.23a	1.97a	2.21a
		Third	.95a	.91a	.93a	.93a
		Total	6.60ab	5.47c	5.92a	6.00b
Glyphosate + Surfactant	2.00	First	3.58a	3.26a	3.11a	3.32a
		Second	2.40a	2.64a	1.93a	2.32a
		Third	.99a	1.00a	1.01a	1.00a
		Total	6.97a	6.90a	6.05a	6.64a
Check	0	First	2.47a	2.94a	2.34a	2.58a
		Second	1.00b	1.07b	1.15b	1.07b
		Third	.4ab	.50b	.56b	.49b
		Total	3.88d	4.51d	4.05b	4.14c
	Mean[3/]	First	3.14a	2.93a	2.90a	
		Second	1.96a	2.01a	1.99a	
		Third	.83a	.86a	.90a	
		Total	5.93a	5.80a	5.79a	

1/ Total hay harvested; mean of three replications

2/ Treatments means within each stage of growth (for the same harvest or for total yield) followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.

3/ Treatment means averaged across growth stages and growth stage means averaged across treatments for the same harvest or for total harvest followed by the same letter are not significantly different at the 0.05 probability level according to Duncan's Multiple Range Test.

TITLE: Development of sod-seeding methods for establishment of small seeded grasses and legumes.

PROJECT: Sod-Seeding MS 760

PERSONNEL: Project Leader - Leon E. Welty
Research Technician - Patrick F. Hensleigh

LOCATION: Northwestern Agricultural Research Center, Kalispell, MT Flathead, Lake, Lincoln, Granite, Missoula, Powell and Ravalli Counties.

DURATION: Indefinite

OBJECTIVES: Develop cultural and management practices for minimum-tillage establishment of small seeded grasses and legumes into pasture, range and hayland.

PROCEDURES AND RESULTS:

Twenty-six sites located in seven different western Montana counties were sprayed and seeded during the spring and summer of 1979. The locations ranged from very dry, rocky rangelands, grain stubble fields, peat meadows, irrigated pastures, and to extremely wet meadows. All sites were seeded with the John Deere Powr-till drill. The drill was modified by replacing the standard plastic packer wheels with one-half inch steel packer wheels and adding spring tension. Herbicide treatments were paraquat with surfactant at 3 pt/a and Roundup (with and without surfactant) at rates varying from 1 pt/a to 3 qt/a, depending on site. A variety of legume and grass species were seeded depending upon the particular environment.

Ladak-65, Spreador alfalfa, Russian wildrye, Pubescent wheatgrass, and crested wheatgrass were seeded on the dryland locations. Pubescent wheatgrass and Ladak-65 alfalfa established the best. Poor stands of Spreador alfalfa were due to extremely dry conditions.

Thor and Apollo alfalfa, ladino and alsike clover, orchardgrass, smooth brome, and meadow brome were seeded on the irrigated sites. Alfalfas established better than the clovers while there was no noticeable difference among the grasses.

Garrison creeping foxtail, tall fescue, reed canarygrass, ladino and alsike clover, and Apollo alfalfa were seeded on the wetland sites. Tall fescue and Reed canarygrass established very well. Garrison creeping foxtail did not establish as well as Reed canarygrass.

Based upon seeding year evaluations, 7 locations had good stand establishment, 10 fair establishment and at 9 locations stands were poor. In light of the extremely dry year, the results (above 50% success) were quite good. Some of the locations were sprayed too early which resulted in poor sod control and too much competition for the newly planted seedlings. This spring and summer we hope to evaluate all nurseries to see if the stands survived the winter.

From our on and off station research we have concluded that the following practices are essential to ensure successful sod-seeding establishment:

- The sod-seeding drill used must; 1) provide good seed to soil contact; 2) provide seeding depth control; 3) adequately firm the soil over the seed.

- Adequate chemical control of sod is essential to ensure successful seedling establishment; grazing or clipping has not been successful.

- Paraquat at 3 pt/a did not control sod as well as Roundup.

- Roundup at 2 qt/a will generally give adequate sod control.

- Apply Roundup when vegetation is actively growing and approximately 6-8 inches tall.

- Wait 2-4 weeks after Roundup application before seeding. This is particularly true if seeding in a heavy dense sod.

- On dryland locations, where moisture may be limited by the time vegetation reaches 6-8 inches in the spring, fall spraying and spring seeding can increase chances of success. Spray with Roundup at 2 qt/a in fall while vegetation is actively growing and seed in early spring.

- Evidence indicates that Roundup applied the day of or the day after frost in the fall gives excellent control of quackgrass.

- Roundup at 1 qt/a plus a non-ionic surfactant may provide adequate sod-suppression. This depends upon species being sprayed.

On several of the off station locations stand establishment was excellent but the plants were stunted and had poor vigor. Recent research has shown that decaying plants (quackgrass) give off toxins which can stunt the growth of interseeded seedlings. Delaying seeding from 2-4 weeks after spraying, especially on heavy, dense sods, may reduce toxin levels in the soil and increase seedling vigor.

TITLE: Irrigated Commercial Alfalfa Yield Trial

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Raymond Ditterline
Research Assistant - Patrick F. Hensleigh

LOCATION: Northwestern Agricultural Research Center, Kalispell, MT.

DURATION: Through 1982

OBJECTIVE: Evaluate alfalfa varieties and experimental lines for forage production in northwestern Montana.

PROCEDURES:

The nursery was seeded in field Y-6 on June 7, 1978 utilizing a randomized complete block design with four replications. Plots consisted of eight rows, 20 feet in length, spaced six inches apart. One hundred and eighty pounds per acre of P_2O_5 was braodcast prior to seeding. Thirty-two square feet was harvested from each plot on a common harvest date for all cuttings. The nursery was irrigated five times in 1978 with two inches being applied per irrigation.

RESULTS AND DISCUSSION:

Mean yields for the first, second and third harvests in 1979 were 2.34, 2.13 and 1.50 T/A dry matter, respectively (Table 1). Total mean yield for 1979 was 5.97 T/A. Thor produced more total forage than Ranger and NK MW 77-7.

Two year yield totals ranged from 6.51 T/A for NK MW 77-7 to 8.36 T/A for Honeoye (Table 2). The two year mean for the entire nursery was 3.77 T/A.

Table 1. Yield for an irrigated commercial alfalfa yield trial at Kalispell, MT in 1979.

Variety	Tons Dry Matter per Acre			
	First Harvest 6/25/79	Second Harvest 8/13/79	Third Harvest 10/9/79	Total Yield
520	2.67	2.40	1.58	6.65
Honeoye	2.60	2.34	1.56	6.50
Thor	2.70	2.10	1.57	6.37
Vernal	2.51	2.31	1.48	6.30
Iroquois	2.42	2.16	1.50	6.08
SC 400A	2.39	2.09	1.58	6.06
Anchor	2.27	2.07	1.53	5.87
Riley	2.19	2.24	1.43	5.86
SC 400	2.19	2.02	1.61	5.82
Baker	2.12	2.02	1.59	5.73
Ladak 65	2.35	2.03	1.27	5.65
Ranger	2.06	1.96	1.46	5.48
NK MW 77-7	2.01	1.94	1.28	5.23
Mean Yields	2.34	2.13	1.50	5.97
L.S.D. at .05 (T/A)	0.52	0.40	0.19	0.77

NOTE: Thor and Ladak 65 are considered to be the check varieties for the nursery.

Table 2. Summary of yields obtained from an irrigated commercial alfalfa yield trial at Kalispell, MT in 1978 and 1979.

Variety	Tons Dry Matter per Acre			
	1978	1979	Total	Mean
520	1.58	6.65	8.23	4.12
Honeoye	1.86	6.50	8.36	4.18
Thor	1.57	6.37	7.94	3.97
Vernal	1.53	6.30	7.83	3.92
Iroquois	1.91	6.08	7.99	4.00
SC 400A	1.51	6.06	7.57	3.79
Anchor	1.31	5.87	7.18	3.59
Riley	1.60	5.86	7.46	3.73
SC 400	1.91	5.82	7.73	3.87
Baker	1.56	5.73	7.29	3.65
Ladak 65	1.43	5.65	7.08	3.54
Ranger	1.34	5.48	6.82	3.41
NK MW 77-7	1.28	5.23	6.51	3.26
Mean Yields	1.57	5.97	7.54	3.77
L.S.D. at .05 (T/A)	0.36	0.77	0.90	–

NOTE: Thor and Ladak-65 are considered to be the check varieties for this nursery.

TITLE: Irrigated Commercial Alfalfa Yield Trial

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Raymond Ditterline
Research Assistant - Patrick F. Hensleigh

LOCATION: Northwestern Agricultural Research Center, Kalispell, MT

DURATION: Through 1979

OBJECTIVE: Evaluate alfalfa varieties and experimental lines for forage production in northwestern Montana.

PROCEDURES:

The nursery was seeded in field Y-4 on May 10, 1976 utilizing a randomized complete block design with four replications. Plots consisted of four rows, 20 feet in length, spaced one foot apart. Thirty-two square feet was harvested from each plot on a common harvest date for all cuttings. One hundred and eighty pounds per acre of P_2O_5 was broadcast prior to seeding in 1976. The nursery was irrigated five times in 1979 with two inches being applied per irrigation.

RESULTS AND DISCUSSION:

Number of plants/ft^2 and yield for 1979 are presented in Table 1. Four year summary yield data is presented in Table 2.

In 1976, Apollo, Thor, Vangard, Olympic and MS-4 all yielded significantly more than Ladak-65. In 1977, only Thor and MS-4 significantly out yielded Ladak-65.

In both 1976 and 1977 Apollo, Vangard, MS-4 and Olympic all had yields similar to Thor. There were no significant differences in total yield among varieties in 1978 and 1979.

Apollo, Thor, Vangard, and Olympic all yielded more than Ladak-65 over the four year period. Washoe yielded over three tons/acre less than Thor for the four year period.

Table 1. Number of plant/ft^2 and yield obtained from an irrigated commercial alfalfa yield trial, Kalispell, MT in 1979.

Variety	Number of plants/ft^2 8/29/79 [1/]	Yield (tons dry matter/acre) 1st Harvest 6/22/79	2nd Harvest 8/13/79	Total
Syn XX	9.4	2.20	1.87	4.07
Washoe	10.4	2.18	1.91	4.09
Ladak-65	11.1	2.43	1.65	4.08
Thor	14.4	2.21	1.81	4.02
Apollo	12.6	2.37	2.21	4.58
Vangard	11.3	2.38	1.96	4.34
Olympic	11.9	2.27	1.97	4.24
MS-4	13.9	2.11	2.11	4.22
Mean	11.9	2.27	1.94	4.21
L.S.D. at 0.05	4.52	0.53	0.44	0.90

1/ Obtained by digging and counting plants in a 3 ft. section; 2 counts per plot.

NOTE: Thor and Ladak-65 are considered to be the check varieties for this nursery.

Table 2. Summary of yields obtained from an irrigated commercial alfalfa nursery at Kalispell, MT in 1976, 1977, 1978 and 1979.

Variety	Tons dry matter/acre 1976	1977	1978	1979	Four Year Total	Mean
Syn XX	2.47	4.17	3.91	4.08	14.63	3.66
Washoe	1.72	3.83	3.49	4.10	13.14	3.29
Ladak-65	2.18	4.79	3.84	4.07	14.88	3.72
Thor	2.71	5.45	4.22	4.02	16.40	4.10
Apollo	2.54	5.25	4.07	4.58	16.44	4.11
Vanguard	2.80	5.19	4.12	4.34	16.45	4.11
Olympic	2.76	5.12	4.13	4.24	16.25	4.06
MS-4	2.63	5.42	4.27	4.22	16.54	4.14
Mean	2.47	4.90	4.00	4.21	15.59	3.90
L.S.D. at 9.05	.22	.62	.55	.90	1.74	

NOTE: Thor and Ladak-65 are considered to be the check varieties for this nursery.

TITLE: Alfalfa Seed Coat Trial

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Raymond Ditterline
Research Assistant - Patrick F. Hensleigh

LOCATION: Northwestern Agricultural Research Center, Kalispell, MT

DURATION: Through 1980

OBJECTIVE: Evaluate effect of seed coat and seeding method on establishment and yield of two alfalfa varieties.

PROCEDURES:

The nursery was seeded in Field Y-7 on July 19, 1979. The experimental design was a 2x2x2 factorial with four replications. Treatments were: seed coat (coated, no coat) seeding method (based upon weight, based upon number) and variety (Thor, Anchor). Plots consisted of four rows, 20 feet long spaced one foot apart. Four hundred lbs/a of 0-45-0 was broadcast prior to seeding. Seeding rates were 7 lbs/a PLS for the weight method of seeding and 30 PLS/ft^2 for the number method of seeding. Harvest area was 32 square feet. The nursery was irrigated as needed to insure adequate stands. Plant counts were taken on August 6 and August 29, 1979, and the nursery was harvested on October 10, 1979.

RESULTS AND DISCUSSION:

Number of plants/ft^2 for both plant counts and yield are presented in Table 1. There were no significant differences in number of plants/ft^2 for either plant count between the alfalfa varieties but Thor did yield significantly more than Anchor.

Seed coat and seeding method means averaged across alfalfa varieties for both plant counts and for yield are presented in Table 2. The by weight seeding method had significantly higher number of plants/ft^2 than the number of seeds/linear foot seeding method for both plant counts. When seeding by weight more non-coated seeds are planted per plot than are coated (heavier) seed. Plant counts were thus higher and there was also a significantly higher yield for the by weight than the by number seeding method.

There was significantly fewer number of plants/ft^2 for coated seed vs non-coated seed for first plant count. There was no difference in number of plants/ft^2 for the second plant count between the coated and the non-coated seed. The non-coated seed did have a significantly higher yield than the coated seed.

When the same number of seeds were planted (by number seeding method), there was no differences in number of plants/ft^2 or in yield. Thus coated seed did not improve establishment or yield in this trial.

Table 1. Effect of seed coat, seeding method and variety on establishment of alfalfa.

Alfalfa Variety	Seed Coat	Number of Plants/ft² 1st Count 1/ Seeding Method Weight	Number	Mean	2nd Count 1/ Seeding Method Weight	Number	Mean	Yield T.D.M./a 2/ Seeding Method Weight	Number	Mean
Thor	No Coat	17.4	5.8	11.6	8.2	5.6	6.9	0.93	0.46	0.69
	Coat	8.3	5.0	6.7	6.2	4.3	5.3	0.51	0.37	0.44
	Mean	12.9	5.4	9.2a	7.2	5.0	6.1a	0.72	0.41	0.57a
Anchor	No Coat	12.7	5.9	9.3	6.7	4.6	5.7	0.60	0.34	0.47
	Coat	10.4	7.2	8.8	6.2	5.4	5.8	0.60	0.35	0.47
	Mean	11.6	6.6	9.1a	6.5	5.0	5.8a	0.60	0.34	0.47b

Seeding Date: 7/19/79
Plant Count Dates: 8/6/79, 8/29/79
Seeding Rates: By weight = 7 lbs/PLS/acre
By number = 30 PLS/ft²

1/ Four 3' counts per plot; mean of four replications
2/ Variety grand means followed by the same letter do not differ at the 5% probability level according to Duncan's Multiple Range Test.

Table 2. Effect of seed coat and seeding method on establishment of alfalfa.

Seeding Method	Number of Plants/ft² 1st Count Seeding Method Weight	Number	Mean 1/	2nd Count Seeding Method Weight	Number	Mean 1/	Yield T.D.M./a Seeding Method Weight	Number	Mean 1/
No Coat	15.1	5.9	10.5a	7.5	5.1	6.3a	0.76	0.40	0.58a
Coat	9.4	6.1	7.8b	6.2	4.9	5.6a	0.56	0.36	0.46b
Mean	12.3a	6.0b		6.9a	5.0b		0.66a	0.38b	

1/ Seed coat means or seeding method means followed by the same letters do not differ at the 5% probability level according to Duncan's Multiple Range Test.

TITLE: Determination of optimum seeding rates for maximum forage yields of Regar bromegrass under irrigation and dryland.

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - Scott Cooper
Research Assistant - Patrick Hensleigh

LOCATION: Northwestern Agricultural Research Center, Kalispell, MT

DURATION: Through 1981

OBJECTIVE: Determine the optimum seeding rates of Regar bromegrass needed to produce maximum stands and yields the seeding year and thereafter.

PROCEDURES:

An irrigated and dryland nursery was seeded in field Y-5 on May 9, 1977. Regar bromegrass seeding rates were 4, 6,8, 10, 12, 14, 16 and 18 lbs/a. The experimental design was a randomized complete block with four replications. Plots consisted of four rows 20 feet in length, spaced one foot apart. Harvest area was 32 square feet. Three hundred pounds/acre 34-0-0 was applied to the irrigated nursery and two hundred pounds/acre 34-0-0 was applied to the dryland nursery on May 23,1979. The irrigated nursery was irrigated five times in 1979 with two inches being applied per irrigation.

RESULTS AND DISCUSSION:

Mean yield for the dryland nursery in 1979 was 2.29 T/A (Table 1). There were no significant differences in yield among treatments under dryland conditions in 1979. Mean yield for the irrigated nursery in 1979 was 2.74 T/A (Table 2). Chinook, under irrigated conditions, yielded significantly less than all treatments except Manchar and Regar at the six lb/a seeding rate. There were no significant yield differences among the different seeding rates of Regar.

Three year yield summaries for both the irrigated and the dryland nursery are presented in Table 3. In 1977, 1978 and 1979 under dryland conditions Regar bromegrass at the recommended seeding rate (10 lbs/a) produced the same amount of forage as Manchar bromegrass. The three year dryland nursery mean for Manchar and Regar at 10 lbs/a was 3.64 and 3.68 T/A, respectively. Under irrigated conditions Regar at 10 lbs/a produced less forage in 1977, but more forage in 1978 and 1979 than Manchar. The three year mean for Manchar was 3.50 T/A and for Regar at 10 lbs/a it was 3.82 T/A.

Regar at 10 lbs/a under dryland conditions produced the same amount of forage as Chinook in 1977 and 1979, but in 1978 Regar produced more than Chinook. Under irrigated conditions, Regar produced the same amount of forage as Chinook in 1977, however in 1978 and 1979 Regar outyielded Chinook.

The three year dryland nursery mean for Chinook orchardgrass under dryland and irrigated conditions was 3.0 and 3.0 T/A, respectively. Regar at 10 lbs/a had a three year mean of 3.68 T/A under dryland conditions and 3.82 T/A under irrigated conditions.

Table 1. Effect of seeding rate on forage yields of dryland Regar bromegrass in 1979.

Treatment		Tons Dry Matter/Acre First Harvest	Second Harvest	Total
Regar	4 lbs/a	1.90	0.64	2.54
Regar	6 lbs/a	1.85	0.61	2.46
Regar	8 lbs/a	1.70	0.58	2.28
Regar	10 lbs/a	1.75	0.67	2.42
Regar	12 lbs/a	1.75	0.59	2.34
Regar	14 lbs/a	1.63	0.68	2.31
Regar	16 lbs/a	1.82	0.60	2.42
Regar	18 lbs/a	1.56	0.64	2.20
Manchar bromegrass		1.79	0.23	2.02
Chinook orchardgrass		1.68	0.26	1.94
Harvest Dates		6/21/79	8/9/79	
Mean Yields T/A		1.74	0.55	2.29
L.S.D. at 0.05 (T/A)		0.48	0.14	0.59

Table 2. Effect of seeding rate on forage yields of irrigated Regar bromegrass in 1979.

Treatment		Tons Dry Matter/Acre First Harvest	Second Harvest	Total
Regar	4 lbs/a	2.16	0.88	3.04
Regar	6 lbs/a	1.77	0.73	2.50
Regar	8 lbs/a	2.01	0.84	2.85
Regar	10 lbs/a	2.11	0.90	3.01
Regar	12 lbs/a	1.88	0.81	2.69
Regar	14 lbs/a	1.90	0.86	2.76
Regar	16 lbs/a	2.26	0.90	3.16
Regar	18 lbs/a	2.09	0.96	3.05
Manchar bromegrass		1.92	0.49	2.41
Chinook orchardgrass		1.51	0.47	1.98
Harvest Dates		6/21/79	8/8/79	
Mean Yields T/A		1.96	0.78	2.74
L.S.D. at 0.05(T/A)		0.42	0.19	0.57

Table 3. Summary of yields for an irrigated and dryland Regar bromegrass seeding rate nursery grown at Kalispell, MT in 1977, 1978 and 1979.

Treatment	Tons Dry Matter/Acre							
	Dryland				Irrigated			
	1977	1978	1979	Mean	1977	1978	1979	Mean
Regar 4 lbs/a	2.35	5.48	2.54	3.46	3.00	5.16	3.04	3.73
Regar 6 lbs/a	2.42	5.77	2.46	3.55	3.23	4.88	2.50	3.54
Regar 8 lbs/a	2.65	5.49	2.28	3.47	3.41	4.87	2.85	3.71
Regar 10 lbs/a	2.81	5.81	2.42	3.68	3.40	5.05	3.01	3.82
Regar 12 lbs/a	2.80	5.92	2.34	3.69	3.57	4.94	2.69	3.73
Regar 14 lbs/a	2.82	5.79	2.31	3.64	3.58	4.84	2.76	3.73
Regar 16 lbs/a	3.01	5.57	2.42	3.67	3.52	4.91	3.16	3.86
Regar 18 lbs/a	3.04	5.71	2.20	3.65	3.74	4.95	3.05	3.91
Manchar bromegrass	3.14	5.76	2.02	3.64	4.37	3.73	2.41	3.50
Chinook orchardgrass	2.70	4.36	1.94	3.00	3.21	3.85	1.98	3.01
Mean Yield	2.77	5.57	2.29		3.50	4.72	2.75	
L.S.D. at 0.05(T/A)	0.48	0.72	0.59		0.49	0.68	0.57	

TITLE: Irrigated and Dryland Grass Seed Production Trial

PROJECT: Forage Investigations MS 755

PERSONNEL: Leader - Leon E. Welty
Cooperator - Loren Wiesner
Research Technician - Patrick Hensleigh

LOCATION: Northwestern Agricultural Research Center, Kalispell, MT

DURATION: 1981

OBJECTIVES: Evaluation and development of management practices for maximum grass seed production in western Montana.

PROCEDURES:

Five grass species; Regar Meadow bromegrass, Critana thickspike wheatgrass, Rosana western wheatgrass, Chinook orchardgrass and Nordan crested wheatgrass were planted on May 9, 1977. The irrigated nursery was seeded on the east end and the dryland nursery was seeded on the west end of Field Y-5. The experimental design was a split-plot design with four replications. Fertilizer rates were striped across grass species. Plots consisted of four rows twenty feet long, spaced two feet apart. Four-hundred pounds of 0-45-0 was applied to both nurseries prior to seeding and 75 lbs/a of N was applied to one-half of each plot on April 4, 1978 and on November 2, 1978. Water was applied to the irrigated nursery in the summer of 1977 to insure adequate stand establishment. Because of ample precipitation no water was applied to the irrigated nursery in 1978, but two inches were applied on June 13, 1979.

RESULTS AND DISCUSSION:

Dryland and irrigated seed yields for 1979 are presented in Table 1. Dryland and irrigated seed yields for 1978 and 1979 and two-year mean yields are presented in Table 2.

In 1978, dryland Regar produced more than irrigated Regar, however in 1979 irrigated Regar produced considerably more than dryland Regar. Seed yields for Regar under irrigated conditions were considerably higher in 1979 than in 1978. Nitrogen fertilizer did not increase seed yields of irrigated Regar in 1978. In 1979, irrigated Regar seed yields were only 170 lbs/a greater with the addition of fertilizer. Dryland non-fertilized Regar seed yields were lower in 1979 than in 1978. However, fertilization yields were the same in 1979 as in 1978.

Critana seed yields were reduced in 1979 from 1978, for both irrigated and dryland at both fertilizer levels. Fertilization did not increase seed yields under either dryland or irrigated conditions in 1978. In 1979, fertilization increased Critana seed yields by 120 lbs/a and 89 lbs/a under dryland and irrigated conditions, respectively.

Rosana seed yields were similar for both irrigated and dryland conditions in both 1978 and 1979 except for lower yields in 1979 under dryland conditions with no fertilization.

Results and Discussion (con't)

Chinook seed yields were higher under irrigated conditions than dryland conditions in both years. In 1978, fertilization increased Chinook seed yields under irrigated but not under dryland conditions. Yields were lower in 1979 than in 1978 except when fertilizer was applied under dryland conditions.

Nordan produced similar yields under all conditions in 1978. However, in 1979 yields were higher under irrigated conditions than dryland conditions. Fertilization increased yields under both dryland and irrigated conditions in 1979. Yields were higher in 1979 than in 1978 except under dryland conditions with no fertilizer application.

Table 1. Seed yield of five grasses when grown under different management systems at Kalispell in 1979.

Species	Moisture Management	Fertilizer Management	Replications I	II	III	IV	Mean Lbs/A
Rosana	Dryland	0	186.7	78.4	105.9	50.6	105.4
		75	520.3	497.7	487.3	297.8	450.8
	Irrigated	0	573.7	527.7	617.6	527.7	561.7
		75	565.6	369.8	591.7	497.8	506.2
Nordan	Dryland	0	407.8	431.8	584.7	269.9	423.6
		75	1145.4	1307.3	710.6	959.5	1030.7
	Irrigated	0	1406.2	1382.2	1772.1	911.5	1368.0
		75	2122.9	2044.9	2014.9	1733.0	1978.9
Chinook	Dryland	0	521.1	486.3	652.7	463.0	530.8
		75	902.8	1027.2	848.8	817.4	899.1
	Irrigated	0	809.3	939.7	543.3	655.2	736.9
		75	1026.9	1192.7	648.2	1127.4	998.8
Regar	Dryland	0	320.8	206.9	395.8	146.9	267.6
		75	923.5	479.7	653.6	293.8	587.7
	Irrigated	0	1271.3	1490.2	1166.3	1505.1	1358.2
		75	1541.2	1268.3	1526.1	1781.1	1529.2
Critana	Dryland	0	23.0	69.0	32.2	12.6	34.2
		75	87.6	427.8	41.6	58.8	154.0
	Irrigated	0	100.5	129.5	73.3	207.9	127.8
		75	171.9	305.8	126.0	265.9	217.4

Table 2. Seed yield of five grasses when grown under different management systems at Kalispell in 1978 and 1979.

Species	Moisture Management	Fertilizer Management	Yield lbs/acre 1978	1979	Mean
Rosana	Dryland	0	488	105	297
		75	469	451	460
	Irrigated	0	513	562	538
		75	604	506	555
Nordan	Dryland	0	854	424	639
		75	811	1031	921
	Irrigated	0	806	1368	1087
		75	739	1979	1359
Chinook	Dryland	0	712	531	622
		75	773	899	836
	Irrigated	0	1034	737	886
		75	1209	999	1104
Regar	Dryland	0	523	268	396
		75	563	588	576
	Irrigated	0	289	1358	824
		75	222	1529	876
Critana	Dryland	0	523	34	279
		75	485	154	320
	Irrigated	0	332	128	230
		75	395	217	306

NOTES: Seeded: May 9, 1977

Harvest Dates

	1978 Irrigated	1978 Dryland	1979 Irrigated	1979 Dryland	Harvest Area (Ft^2) 1978	1979
Rosana	8/ 8	8/ 8	8/14	8/14	30	48
Critana	7/31	7/31	7/25	7/25	32	48(except plot #2 = 32)
Regar	7/19	7/19	7/13	7/13	32	32
Chinook	7/14	7/14	7/ 5	7/ 6	32	32
Nordan	8/ 7	8/ 7	8/10	8/10	32	32

TITLE: Grass Evaluation Nursery

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Cooperator - John G. Scheetz
Research Assistant - Patrick F. Hensleigh

LOCATION: Northwestern Agricultural Research Center, Kalispell, MT.

DURATION: 1983

OBJECTIVE: Evaluate four accessions of bluebunch wheatgrass, 'Whitmar' beardless wheatgrass, 'Redondo' Arizona fescue and four accessions of Indian ricegrass on a dryland site.

PROCEDURES:

Ten accessions received from the Bridger Plant Materials Center were seeded on November 8, 1978 in Field No. F-1. The soil is a sandy loam and at planting the top three inches were dry. Soil was blowing at planting and intermittently after planting until adequate moisture was received ten days later. Each accession was seeded in four 150 foot rows, spaced one foot apart. Number of plants/ft^2, percent occupancy, and height was taken on June 8, 1979. Vigor, height and maturity was obtained on August 6, 1979.

RESULTS AND DISCUSSION:

Number of plants/ft^2 ranged from 3.9 for 'Whitmar' beardless wheatgrass to 19.8 for PI-236877 Indian ricegrass (Table 1). Percent occupancy ranged from 39% for 'Whitmar' to 92% for P-15597 Indian ricegrass. Height on 8/6/79 ranged from 6" for 'Redondo' Arizona fescue to 23" for 'Nespar' Indian ricegrass.

'Redondo' Arizona fescue had good stand establishment but was the least vigorous, the shortest and was still in the vegetative stage on August 8, 1979.

All accessions of Indian ricegrass had excellent stand establishment and good seed production.

'Whitmar' beardless wheatgrass had spotty stand establishment and very little seed production.

All accessions of bluebunch wheatgrass had fair stand establishment and good vigor.

Table 1. Evaluation of ten accessions of grass on a dryland site at Kalispell, MT in 1979.

	6/8/79			8/6/79		
	Ht. Ins	Plants/ ft^2 1/	%2/ Occupancy	Ht. Ins	Vigor3/	Maturity
'Whitmar' beardless wheatgrass	5	3.9	39	12	2.5	5% flowering
P-6409 bluebunch wheatgrass	6	10.1	69	16	1.0	25% flowering
PI-232127 bluebunch wheatgrass	5	6.1	55	12	2.0	1% flowering
P-737 bluebunch wheatgrass	4-5	5.5	52	13	2.5	1% flowering
P-15649 bluebunch wheatgrass	5	6.4	49	12	2.0	1% flowering
PI-236877 Indian ricegrass	6	19.8	91	20	1.5	90% seed set
'Paloma' Indian ricegrass	5-6	5.1	58	16	2.0	90% seed set
P-2575(Nespar)Indian ricegrass	6	18.5	88	23	1.0	95% seed set
P-15597 Indian ricegrass	6	18.4	92	21	1.5	85% seed set
'Redondo' Arizona fescue	3	17.3	75	6	4.0	vegetative

Planted - 11/8/78

1/ five random, 3 foot counts/species

2/ percent of squares occupied in a 3 ft. section; 20 squares/3 ft, five counts per species

3/ 0 = very vigorous; 5 = poor vigor

Ks
LEW

TITLE: Irrigated and Dryland Legume Seed Production

PROJECT: Forage Investigations MS 755

PERSONNEL: Project Leader - Leon E. Welty
Research Assistant - Patrick F. Hensleigh

LOCATION: Northwestern Agricultural Research Center, Kalispell, MT

DURATION: 1979

OBJECTIVE: Evaluate varieties of fababeans, lentils and peas for seed production under irrigated and dryland environments.

PROCEDURES:

Five varieties of fababeans, four varieties of lentils and Fenn Austrian winter peas were evaluated for use as high protein feed supplements. The dryland nursery was seeded in field R-4c on April 27, 1979 and the irrigated nursery was seeded in field R-9 on May 11, 1979. Each species was planted in a randomized complete block design. Plots consisted of four rows spaced one foot apart and twenty foot long except for the irrigated fababeans which had eight rows spaced six inches apart and twenty foot long. There were three replications with five feet between replications and two feet between plots. Fifty pounds per acre of P_2O_5 was applied to both nurseries prior to seeding. Fenn pea seeding rates were 60 lbs/a for both the irrigated and dryland nursery. Dryland seeding rates for fababean varieties were 1.5 seeds/ft^2 (12" row spacing), and 4 seeds/ft^2 (6" row spacing) for the irrigated nursery. Lentil seeding rates for both the irrigated and dryland nursery were Tekoa (60 lbs/a), Laird (59 lbs/a), WSU 511 (37 lbs/a) and Chilean (37 lbs/a). Harvest area was 32 ft^2 for both nurseries. The irrigated nursery was irrigated six times with two inches of water being applied per irrigation.

RESULTS AND DISCUSSION

Number of plants/ft^2, height, percent crude protein and yield are presented in Table 1 for the dryland nursery and in Table 2 for the irrigated nursery.

Percent crude protein for the dryland fababeans ranged from 22.6-24.4% while the irrigated fababeans ranged from 29.1-30.3% crude protein. Dryland fababean seed yields ranged from 660-1201 lbs/a and irrigated yields ranged from 3027-5141 lbs/a. Windsor, Minnesota, and Ackerperle were the highest yielding varieties under dryland conditions, while Ackerperle, Diana and Minnesota were the highest yielding under irrigated conditions. Petite yielded significantly less than all other varieties except Windsor under irrigated conditions.

Lentil seed yields ranged from 1466-1646 lbs/a under dryland conditions and from 1436-1896 lbs/a under irrigated conditions. Tekoa was the highest yielding variety under dryland conditions while Laird was the highest yielding variety under irrigated conditions. There were no significant yield differences among varieties under either dryland or irrigated conditions.

Fenn Austrian peas produced 1796 lbs/a of seed with a crude protein of 23.6% under dryland conditions. Under irrigated conditions seed yields were 869 lbs/a and percent crude protein was 23.7. The dryland peas produced twice as much as the irrigated peas. This was undoubtedly due to mildew and a heavy infestation of quackgrass on the irrigated pea plot.

Table 1. Number of plants/ft^2, height, percent crude protein and yield for a dryland legume seed production nursery at Kalispell, MT in 1979.

Entry	Number of Plants/ft^2 1/	Height Inches	% Crude Protein	Yield 2/ lbs/a
Fababeans				
Windsor	1.6	22	22.6	1201a
Ackerperle	1.5	24	23.6	1099a
Diana	1.2	22	24.3	874b
Petite	1.5	15	24.4	660c
Minnesota	1.5	25	23.6	1155a
Lentils				
Tekoa	11.1	14	-	1646a
Chilean	8.7	15	-	1493a
WSU 511	9.7	15	-	1531a
Laird	7.9	17	-	1466a
Peas				
Fenn Austrian	8.8	28	23.6	1796

Seeding Date = 4/27/79
Plant Count Date = 5/17/79
Harvest Dates = Fababeans = 8/14/79 except Petite 8/9/79
Lentils = 8/1/79 except Laird 8/9/79
Peas = 8/1/79

1/ Four 3' counts/plot, mean of three replications

2/ Fababean varieties or lentil varieties followed by the same letters do not differ at the 5% probability level according to Duncan's Multiple Range Test.

Table 2. Number of plants/ft^2, height, percent crude protein and yield for an irrigated legume seed production nursery at Kalispell, MT in 1979.

Entry	Number of Plants/ft^2 [1/]	Height Inches	% Crude Protein	Yield [2/] lbs/a
Fababeans				
Windsor	2.0	46	29.5	3027b
Ackerperle	1.6	53	29.5	5141a
Diana	1.8	54	29.1	5041a
Petite	2.2	42	30.3	3402b
Minnesota	2.0	58	29.3	4840a
Lentils				
Tekoa	8.6	23	-	1665a
Chilean	7.1	20	-	1665a
WSU 511	9.0	17	-	1436a
Laird	7.2	21	-	1896a
Peas				
Fenn Austrian	5.1	50	23.7	869

Seeding Date = 5/11/79
Plant Count Date = 6/1/79
Harvest Dates = Fababeans = 9/6/79
Lentils = 8/14/79 except Laird 8/28/79
Peas = 8/28/79

1/ Four 3' counts/plot; mean of three replications.
2/ Fababean varieties or lentil varieties followed by the same letter do not differ at the 5% probability level according to Duncan's Multiple Range Test.

TITLE: Spring Barley

PROJECT: Small Grains Investigation MS 756

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperating Agencies - Montana Agricultural Experiment Station, MSU
USDA-SEA-AR

LOCATION: Northwestern Agricultural Research Center and off-station locations.

DURATION: Indefinite

OBJECTIVES:
1. To determine the adaptability of new and introduced barley varieties in western Montana.
2. To assist in the state breeding program for the development of varieties with increased straw strength and disease resistance.

1979 EXPERIMENTS:

1. Dryland Intrastate Yield Nursery
2. Irrigated Intrastate Yield Nursery
3. Off-Station Yield Nurseries, located in:
   a) Ravalli County (Western Agricultural Research Center, Corvallis)
   b) Lake County (Lake Brothers Farm)
   c) Missoula County (Harvey Clouse Farm)
4. Pedigree Preliminary Yield, F_5-F_7
5. White Lemma and Awn Yield
6. Bonneville 2-6 Row Near Isogenic
7. Hector Klages Drill Strips

Experiments five through seven are not discussed in this report, but were conducted as a cooperative effort for R. F. Eslick, E. A. Hockett, and some of their graduate students.

RESULTS AND DISCUSSION:

1. Dryland Intrastate: Yields were down generally in this nursery compared to previous crops. Nine spring barley varieties had yields significantly lower than Purcell, the check variety. Among these were Compana, Glenn, Lud, Park and Menuet. Seven varieties had yields greater than the check but the differences were not significant. More than 50% of the entries had later heading dates and three had earlier heading dates that were significant. See Table 1.

Table 2, is a summary of two years data compiled on dryland spring barley. Piroline is used as the check. Unitan, Steptoe, Summit, and Klages have outyielded Piroline when compared in several growing seasons.

Results and Discussion (con't)

2. Irrigated Intrastate: Three varieties produced significantly higher yields than Ingrid. These varieties were UT 1009, VD 11874 and MT 54734. Following the same pattern as last year, MT 73331 (Washonupana) and MT 842148 were the lowest yielding varieties in the nursery. Test weights were lower than would have been expected for most varieties which was caused in part by lodging and sprout damage. Sixty-two percent of the varieties had earlier heading dates than Ingrid which is a late maturing variety. Table 3. Steptoe, Fairfield and Shabet had a lodging factor of 70%.

Barley scald (Rynchosporium secalis (Oud.) J.J. Davis) was severe throughout the nursery. Piroline, Summit, Menuet, Lud, and Cebeco 7523 were very susceptible to this disease. UT 1009, Steptoe, Glenn, and Unitan showed good to excellent resistance to this disease.

Glenn, and Morex showed moderate susceptibility to powdery mildew (Erysiphe graminis DC).

Table 4, gives a ten year summary of irrigated spring barley data. All entries are compared to Ingrid. Several varieties, especially those introduced after 1970, have composite yields greater than Ingrid.

3. Off-Station Yield Nurseries:

a. Ravalli County - Yields were not as high as we anticipated for Ravalli County. This can be traced to erratic stands and the high CV of this nursery attests non-uniformity within this test. The data presented indicates no statistical differences in yields between varieties. A high percentage of lodging was observed in Unitan and moderate amounts in Shabet, Hector, and Piroline. Table 5.

b. Lake County - Yields, test weights, and plumpness were lower than expectations in Lake County this year. No significant differences were found between varieties considering yields. Kimberly had the highest yield at 65.07 bu/a and Unitan the lowest at 47.37 bu/a. Four varieties had test weights significantly lower than Purcell, the check. All but one variety were significantly taller than purcell. Percent plump figures were abnormally low this year in Lake County. Low fertility could be a factor in the poor performance of this nursery. Table 6.

c. Missoula County- Excellent yields were recorded in Missoula County this year. Steptoe (109.49 bu/a) was the highest yielding entry and was significantly greater than Purcell (86.45 bu/a). Test weights were a little lower than historically found in this location. Steptoe and Unitan were significantly lower in test weight than Purcell. All the varieties had heights significantly greater than the check. Moderate lodging was observed in the variety Larker. Table 7.

Tables 8 and 9 provide data for twelve spring barley varieties grown at four locations throughout western Montana. Steptoe again this year had the highest yield over all locations (84.4 bu/a). Larker was the lowest at 71.2 bu/a. Summit produced the highest test weight average for all locations. Percent plump varied from 85.2% to 92.7% with Steptoe having a high of 92.7%. Height measurements fluctuated greatly by location with Kalispell and Missoula locations having the greatest heights for each variety.

Results and Discussion (con't)

Several varieties of spring barley with parentage from Summit, Klages, Hector, Steptoe, Erbet F_5, or Maris Mink F_5 crosses were grown this year in a pedigree preliminary trial. No significant differences were found in yields. Steptoe was used as a check. Since Steptoe characteristically has a low test weight and medium height it is not difficult to understand why 75% of the entries had significantly higher test weights and 75% of the 32 entries headed earlier and the differences found significant. Table 10.

SPRING BARLEY VARIETIES RECOMMENDED FOR WESTERN MONTANA

Six-row Type

1. Unitan - dryland and irrigated
2. Steptoe - dryland and irrigated
3. Horsford - dryland
4. Stepford - dryland and irrigated

Two-row Type

1. Cornel - high rainfall and irrigated
2. Piroline - dryland or irrigated
3. Purcell - dryland
4. Summit - dryland or irrigated
5. Georgie - irrigated and high rainfall
6. Ingrid - irrigated
7. Lud - irrigated
8. Shabet - irrigated or high rainfall
9. Ershabet - dryland or irrigated
10. Vireo - high rainfall or irrigated
11. Menuet - high rainfall or irrigated
12. Ridawn - dryland or irrigated

CHARACTERISTICS OF RECOMMENDED VARIETIES

1. Unitan
   a. Six-row
   b. High yielding ability
   c. Moderate lodging resistance
   d. Early maturity
   e. Dryland or irrigated
   f. Medium kernel size
   g. Good test weight

2. Steptoe
   a. Six-row
   b. High yielding ability
   c. Good lodging resistance
   d. Early maturity
   e. Dryland or irrigated
   f. Large kernel size
   g. Low test weight

3. Horsford
   a. Six-row
   b. Low grain yielding ability - primary use for hay
   c. Good lodging resistance
   d. Early maturity
   e. Dryland
   f. Medium kernel size
   g. Moderate test weight

Recommended Barley (con't)

4. Stepford

a. Adapted for hay production only
b. Hooded six-row
c. Large kernel size
d. Susceptible to stem rust

5. Cornel

a. Two-row type
b. High yielding ability
c. Moderate lodging resistance
d. Mid-season
e. Irrigated or dryland
f. Large kernel size
g. Good test weight

6. Piroline

a. Two-row
b. High yielding ability
c. Good lodging resistance
d. Mid-season maturity
e. Dryland or irrigated
f. Good kernel size
g. Good test weight

7. Purcell

a. Two-row
b. High yielding ability
c. Good lodging resistance
d. Mid-season maturity
e. Dryland
f. Large kernel size
g. Good test weight

8. Summit

a. Two-row
b. High yielding ability
c. Good lodging resistance
d. Mid-season maturity
e. Dryland or irrigated
f. Large kernel size
g. Good test weight

9. Georgie

a. Two-row
b. High yielding ability
c. Good lodging resistance
d. Late maturity
e. Irrigated
f. Large kernel size
g. Good test weight

Recommended Barley (con't)

10. Ingrid

a. Two-row
b. High yielding ability
c. Good lodging resistance
d. Late maturity
e. Irrigated
f. Large kernel size
g. Good test weight

11. Lud

a. Two-row
b. High yielding ability
c. Good lodging resistance
d. Late maturity
e. Irrigated
f. Large kernel size
g. Good test weight

12. Shabet

a. Two-row
b. High yielding ability
c. Moderate lodging resistance
d. Late maturity
e. Irrigated
f. Medium kernel size
g. Good test weight

13. Ershabet

a. Two-row
b. High yielding ability
c. Fair lodging resistance
d. Mid-season maturity
e. Dryland or irrigated
f. Good test weight

14. Vireo

a. Two-row
b. High yielding ability
c. High lodging resistance
d. Medium to late maturity
e. High moisture or irrigated areas
f. Good test weight

15. Menuet

a. Two-row
b. High yielding ability
c. Good lodging resistance
d. Late maturity
e. High rainfall or irrigated areas
f. Medium kernel size
g. Good test weight
h. Susceptible to leaf rust and scald

Recommended Barley (con't)

16. Ridawn

a. Two-row
b. Adapted for hay production
c. Good yielding ability
d. Good test weight
e. Dryland or irrigated

Table 1. Agronomic data from the intrastate barley yield nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. A-2, Dryland. Random block design, four replications.

Date seeded: April 19, 1979 Date harvested: August 3, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu	Heading Date	Height Inches	% Plump
MT 547276	Hector/Klages	84.68	47.85b	177.25a	29.53	84.25
MT 547354	Hector/Klages	82.79	51.60	172.50	29.72	85.25
CI 13827	Shabet	80.42	52.43	174.00a	31.99a	87.25
VD 11874	VDH 118-74	79.82	51.67	175.50a	27.95	83.50
VD 13875	VDH 138-75	78.89	50.88	174.75a	27.07	85.75
MT 547255	Hector/Klages	78.59	52.77	171.00	30.31	92.00
MT 729	Summit	78.53	53.13	173.25	29.23	85.75
CI 16181	Purcell 1/	76.93	53.32	171.75	28.44	87.00
NA 5	N2SB 405-76C	76.13	51.15	174.75a	28.94	78.75
NA 4	N2SB 325-77	75.74	51.60	174.25a	28.05	77.75
CI 15229	Steptoe	74.67	50.38	168.50b	28.15	91.00
CI 10421	Unitan	73.43	50.80	170.50	32.38a	89.25
MB 323	Klondike	73.27	51.88	172.00	30.12	72.00b
MT 547143	Hector/Klages	73.23	50.75	176.25a	28.74	80.25
VD 3375	VDH 033-75	72.81	51.75	175.00a	27.56	85.75
NK 761104	KG/ZY	72.68	52.97	175.25a	28.05	79.00
VD 27475	VDH 274-75	72.04	51.88	175.00a	27.76	72.50b
VD 22872	VDH 228-72	71.84	51.63	175.50a	25.30b	78.50
CI 15478	Klages	71.54	50.25	176.75a	29.53	81.25
VD 15472	VDH 154-72	71.45	59.27a	176.75a	26.57	76.75b
CI 15687	Kimberly	71.24	48.65b	179.25a	27.07	85.25
SK 74234	Klages/S7122(TR430)	70.04	53.88	174.00a	27.76	76.75b
MT 547123	Hector/Klages	69.73	52.52	173.25	29.13	85.75
WA 11312	6194-63/Blazer	69.55	49.02b	169.25b	27.36	75.75b
VD 25773	VDH 257-73G	69.43	52.00	174.75a	27.76	68.75b
AT 506	Fairfield	69.01	53.02	173.75a	30.12	90.50
NA 7	RPB 896-76	67.57	49.47b	175.50a	26.28	89.25
CI 9558	Piroline	67.51	53.47	172.00	29.23	89.25
CB 7523	Cebeco 7523	66.48	52.10	175.00a	26.18	88.00
MT 547234	Hector/Klages	65.68	51.95	175.25a	28.44	82.00
CI 10083	Ingrid	65.21	52.25	175.75a	29.23	79.50
CI 15514	Hector	64.88	53.35	173.75a	30.61	85.75
CI 15773	Morex	64.77	52.52	170.00	32.78a	92.75
NA 6	RPB 456-72	63.76b	51.85	173.75a	25.89	67.25b
VD 3	Menuet	63.49b	52.45	172.50	26.87	85.00
UT 1009	SDB1-1009	62.24b	49.35b	173.50	29.13	75.00b
CI 15768	Park	60.99b	51.97	170.25	34.25a	81.75
MT 726	Lud	57.44b	52.15	173.25	28.54	89.00
CI 15769	Glenn	57.25b	51.42	167.00b	30.51	90.50
MT 73331	Washonupana	53.19b	57.95a	174.00a	27.56	69.25b
MT 842148	Sermo/7*Comp SHT AWN NKD	52.91b	57.95a	173.25	26.77	71.50b
CI 5438	Compana	52.89b	52.13	172.75	26.87	93.75
	$\bar{x}$	69.64	52.13	173.63	28.66	82.52
	F 2/	3.21**	3.07**	12.08**	4.20**	4.31**
	S.E.$\bar{x}$	4.39	1.26	.70	.93	3.39
	L.S.D. (.05)	12.17	3.49	1.95	2.59	9.39
	C.V. %	6.31	2.41	.41	3.26	4.11

Table 1. (con't)

1/ Check variety
2/ F - value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Values significantly greater than the check (.05)
b/ Values significantly less than the check (.05)

Table 2. Ten year summary of yields for the spring dryland intrastate barley nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT, 1970-79.

C.I. or State No.	Variety	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Ave.	Sta. Yrs.	% Piroline
CI 10421	Unitan	86.2	78.5	88.9	62.1	75.2	62.9	101.9	55.6	94.5	73.4	77.9	10	109
CI 9558	Piroline	78.7	67.7	57.1	61.8	87.1	61.2	80.8	61.9	88.1	67.5	71.2	10	100
CI 5438	Compana	66.2	58.6	44.2	50.3	76.8	49.7	72.7	55.8	82.9	52.9	61.0	10	86
CI 13827	Shabet	73.4	68.4	62.6	61.4	84.2	43.7	87.2	56.3	88.7	80.4	70.6	10	99
CI 15514	Hector	74.0	77.5	68.1	59.4	80.8	52.1	78.5	57.1	91.4	64.9	70.4	10	99
CI 15229	Steptoe		97.9	75.9	69.1	83.2	69.0	105.8	68.1	96.6	74.7	82.3	9	117
MT 729	Summit			70.0	62.9	77.8	44.6	93.3	67.6	86.3	78.5	72.6	8	103
CI 15478	Klages				62.1	82.2	51.0	96.0	63.1	93.4	71.5	74.2	7	102
MT 726	Lud				55.3	80.9	56.3	86.4	63.5	84.1	57.4	69.1	7	95
CI 10083	Ingrid				53.6	82.0	45.4	83.5	62.3	86.6	65.2	68.4	7	94
CI 16181	Purcell	89.6	82.2	83.2				82.0	65.4	88.9	76.9	81.2	7	113
AT 506	Fairfield							87.1	52.4	79.9	69.0	72.1	4	97
NA 6	RPB 456-72							76.1	67.7	85.0	63.8	73.2	4	98
VD 3	Menuet								64.3	87.4	63.5	71.7	3	99
UT 1009	SDB1-1009									98.2	62.2	80.2	2	103
CI 15687	Kimberly									91.8	71.2	81.5	2	105
VD 22872	VDH 228-72									89.8	71.8	80.8	2	104
WA 11312	6194-63/Blazer									87.2	69.6	78.4	2	101
VD 11874	VDH 118-74									85.6	79.8	82.7	2	106
CI 15767	Park									84.2	61.0	72.6	2	93
CI 15773	Morex									83.8	64.8	74.3	2	96
MB 323	Klondike									80.5	73.3	76.9	2	99
CI 15769	Glenn									79.0	57.3	68.2	2	88
MT 842148	Sermo/7*Comp SHT AWN NKD									71.7	52.9	62.3	2	80
MT 73331	Washonupana									70.7	53.2	62.0	2	80
MT 547276	Hector/Klages										84.7	84.7	1	125
MT 547354	Hector/Klages										82.8	82.8	1	123
VD 13875	VDH 138-75										78.9	78.9	1	117
MT 547255	Hector/Klages										78.6	78.6	1	116
NA 5	N2SB 405-76C										76.1	76.1	1	113
NA 4	N2SB 325-77										75.4	75.4	1	112
MT 547143	Hector/Klages										73.2	73.2	1	108
VD 3375	VDH 033-75										72.8	72.8	1	108
NK 761104	KG/ZY										72.7	72.7	1	108

Table 2 . (con't)

C.I. or State No.	Variety	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Ave.	Sta. Yrs.	% Piroline
VD 27475	VDH 274-75										72.0	72.0	1	107
VD 15472	VDH 154-72										71.5	71.5	1	106
SK 74234	Klages/S7122 (TR 430)										70.0	70.0	1	104
MT 547123	Hector/Klages										69.7	69.7	1	103
VD 25773	VDH 257-73G										69.4	69.4	1	103
NA 7	RPB 896-76										67.6	67.6	1	100
CB 7523	Cebeco 7523										66.5	66.5	1	99
MT 547234	Hector/Klages										65.7	65.7	1	97

Table 3. Agronomic data from the intrastate barley yield nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. Y-1, Irrigated. Random block design, five replications.

Date seeded: April 26, 1979 Date harvested: September 9, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Heading Date	Plant Height	Lodging %	Lodging Sev.	Scald %	Scald Sev.	% Plump
UT 1009	SDB1-1009	136.64a	46.78	176.80b	39.29	29.0b	3.4b	0b	0.0b	98.8a
VD 11874	VDH 118-74	132.89a	51.36a	179.80	38.90	27.0b	4.4	6	0.6b	95.2a
MT 547354	Hector/Klages	128.37a	48.36	175.60b	39.29	24.0b	4.2	16	1.6	93.6
VD 13875	VDH 138-75	121.88	49.16a	180.00	37.17b	48.0	5.2	8	0.6b	96.0a
CI 15229	Steptoe	119.85	44.58	173.00b	36.77b	72.0	7.2	0b	0.0b	95.6a
VD 22872	VDH 228-72	119.70	51.70a	180.40	39.61	6.4b	1.8b	26	1.4	96.2a
CB 7523	CEBECO 7523	118.85	52.84a	179.80	37.17b	12.4b	2.2b	62a	4.0	93.6
VD 3375	VDH 033-75	118.81	50.64a	178.80b	41.34	17.0b	4.6	46	3.0	92.8
MT 547276	Hector/Klages	115.80	49.74a	180.00	42.13	14.0b	3.0b	4	0.4b	94.6a
MT 547123	Hector/Klages	115.64	50.20a	177.60b	40.00	36.0	3.8b	10	1.2	95.8a
NA 4	N25B 325-77	115.58	48.08	178.20b	38.58	24.0b	3.4b	22	2.2	93.8
MT 726	Lud	114.13	51.28a	179.80	39.29	8.8b	3.0b	74	4.6a	96.2a
VD 3	Menuet	112.64	50.54a	178.80b	39.06	14.0b	5.6	52	3.6	95.6a
CI 15773	Morex	110.85	45.66	175.20b	43.15a	73.0	5.4	6	0.6b	95.8a
MT 547143	Hector/Klages	108.31	47.06	178.20b	41.81	39.4	5.0	26	2.0	95.2a
VD 15472	VDH 154-72	107.61	47.80	180.00	37.80	39.0	6.0	14	1.0	86.6
WA 11312	6194-63/Blazer	107.35	46.82	173.00b	39.69	48.0	5.0	12	1.0	90.6
NA 6	RPB 456-72	102.61	47.28	176.80b	37.17b	42.4	5.8	12	1.2	93.6
CI 15687	Kimberly	102.12	49.08a	181.20	41.57	31.0b	4.8	10	1.0	93.6
MT 729	Summit	101.98	48.80a	179.20	40.39	27.0b	6.2	64a	4.2	90.0
NK 761104	BZ/DMN/ZY	101.42	47.08	179.40	39.21	59.0	6.4	34	2.6	88.6
CI 15769	Glenn	99.93	44.42	173.40b	40.55	70.0	7.4	0b	0.0b	97.2a
VD 25773	VDH 257-73G	97.62	47.14	180.20	38.11	32.0b	4.8	12	1.0	82.4b
CI 16181	Purcell	96.58	46.12	177.00b	38.27	44.0	5.6	38	2.2	91.8
CI 10083	Ingrid[1/]	96.12	46.20	180.40	40.00	62.0	6.8	30	2.6	89.8
NA 5	N25B 405-76C	95.76	43.92	178.60b	37.09b	86.2	8.0	14	1.8	91.0
CI 9558	Piroline	94.32	45.72	177.00b	38.19	85.0	8.0	56	4.0	91.0
CI 10421	Unitan	93.66	43.98	175.20b	42.20	69.0	5.8	2b	0.2b	92.2
AT 506	Fairfield	93.36	46.54	178.00b	40.16	78.0	7.6	20	1.4	94.4a
MB 323	Klondike	93.34	46.10	176.20b	43.62a	55.0	6.8	14	0.8b	94.8a
CI 13827	Shabet	92.64	45.30	179.20	37.01b	72.0	6.8	8	1.4	92.8
MT 547255	Hector/Klages	90.39	47.40	176.60b	40.31	59.0	6.4	26	2.0	94.8a
CI 15768	Park	87.64	44.66	176.60b	42.36	53.0	8.0	46	3.2	95.2a
CI 15514	Hector	87.28	48.30	176.80b	39.69	84.0	7.2	16	1.6	92.0
SK 74234	Klages/S7122(TR430)	86.73	43.90	177.60b	39.53	82.0	8.0	24	2.0	94.0
CI 15478	Klages	85.09	47.80	180.20	42.20	29.0b	4.0b	24	2.0	95.0a
NA 7	RPB 896-76	83.21	44.40	179.60	38.90	63.0	7.4	40	3.0	92.4
MT 547234	Hector/Klages	83.13	42.88b	177.60b	40.79	84.0	7.8	28	1.8	91.8
CI 5438	Compana	76.26	44.26	175.60b	34.96b	90.8a	6.8	44	3.0	96.4a
VD 27475	VDH 274-75	74.70	44.40	180.40	39.92	60.0	8.2	56	4.2	80.8b
MT 73331	Washonupana	65.60b	48.84a	176.40b	35.28b	93.6a	7.0	30	2.6	89.2
MT 842148	Sermo/7*COMP SHT AWN NKD	58.83b	50.86a	176.80b	35.28b	94.4a	7.8	44	3.4	89.6
	$\bar{x}$	101.08	47.33	177.88	39.38	50.89	5.8	26	1.9	92.9
	F[2/]	2.88**	7.52**	15.08**	5.29**	6.8**	3.1**	4**	4.0**	5.16**
	S.E.$\bar{x}$	10.20	.92	.55	.91	10.1	1.0	10	.6	1.60
	L.S.D.(.05)	28.28	2.56	1.51	2.52	28.0	2.7	27	1.8	4.42
	C.V. %	10.09	1.95	.31	2.31	19.85	17.1	38	33.1	1.72

Table 3 . (con't)

1/ Check variety
2/ F - value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Values significantly greater than the check (.05)
b/ Values significantly less than the check (.05)

Table 4 . Ten year summary of yields for the spring irrigated intrastate barley nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT, 1970-79.

C.I. or State No.	Variety	1969	1970	1971	1972	1973	1974	1976	1977	1978	1979	Ave.	Sta. Yrs.	% Ingrid
CI 10421	Unitan	92.1	80.0	102.9	92.6	91.9	115.3	77.0	93.8	62.6	93.7	90.2	10	99
CI 9558	Piroline	85.3	64.8	88.5	73.6	71.7	105.2	62.1	88.6	71.4	94.3	80.6	10	88
CI 10083	Ingrid	109.3	75.0	114.8	75.3	91.2	109.4	69.9	88.0	82.9	96.1	91.2	10	100
CI 5438	Compana	72.3	59.9	71.6	53.1	87.9	89.8	57.8	83.3	64.1	76.3	71.6	10	79
CI 15514	Hector	82.1	62.4	101.6	70.2	100.9	108.3	68.2	86.9	89.0	87.3	85.7	10	94
CI 13827	Shabet	80.4	67.7	93.6	69.6	81.8	115.0	67.8	90.1	74.0	92.6	83.3	10	91
CI 15229	Steptoe			116.0	111.3	97.4	145.7	92.4	105.3	104.4	119.9	111.6	8	123
MT 729	Summit				64.5	96.5	114.5	83.6	84.7	86.8	102.0	90.4	7	103
CI 16181	Purcell		61.2	106.9	84.3			82.1	98.7	106.6	96.6	90.9	7	106
CI 15478	Klages					87.0	114.8	80.7	94.0	89.8	85.1	91.9	6	103
MT 726	Lud					88.9	118.1	99.9	98.8	82.6	114.1	100.4	6	112
AT 506	Fairfield							78.3	84.0	80.1	93.4	84.0	4	100
NA 6	RPB 456-72							82.9	94.7	93.3	102.6	93.4	4	111
VD 3	Menuet								106.4	89.1	112.6	102.7	3	115
VD 15472	VDH 154-72								102.9	97.4	107.6	102.6	3	115
UT 1009	SDB1-1009									107.0	136.6	121.8	2	136
VD 11874	VDR-118-74									103.4	132.9	118.2	2	132
CI 15687	Kimberly									90.4	102.1	96.3	2	108
CI 15769	Glenn									90.5	99.9	95.2	2	106
VD 22872	VDH 228-72									99.9	119.7	109.8	2	123
CB 7523	CEBECO 7523									94.0	118.9	106.5	2	119
MB 323	Klondike									85.8	93.3	89.6	2	100
CI 15768	Park									85.8	87.6	86.7	2	97
MT 73331	Washonupana									52.3	65.6	59.0	2	66
MT 842148	Sermo / 7#Comp SHT AWN									51.8	58.8	55.3	2	62
CI 15773	Morex									74.4	110.9	92.7	2	104
WA 11312	6194-63/Blazer									94.5	107.4	101.0	2	113
MT 547143	Hector/Klages										108.3	108.3	1	113
MT 547354	Hector/Klages										128.4	128.4	1	134
NK 761104	BZ/DMN/ZY										101.4	101.4	1	106
VD 13875	VDH 138-75										121.9	121.9	1	127
VD 25773	VDH 257-73G										97.6	97.6	1	102
NA 5	N25B 405-76C										95.8	95.8	1	100
VD 3375	VDH 033-75										118.8	118.8	1	124

Table 4 . (con't)

C. I. or State No.	Variety	1969	1970	1971	1972	1973	1974	1976	1977	1978	1979	Ave.	Sta. Yrs.	% Ingrid
MT 547255	Hector/Klages										90.4	90.4	1	94
MT 54276	Hector/Klages										115.8	115.8	1	120
SK 74234	Klages/S7122 (TR 430)										86.7	86.7	1	90
NA 7	RPB 896-76										83.2	83.2	1	87
MT 547234	Hector/Klages										83.1	83.1	1	86
VD 27475	VDH 274-75										74.7	74.7	1	78
MT 547123	Hector/Klages										115.6	115.6	1	120
NA 4	4 N25B 325-77										156.6	156.6	1	163

Table 5. Agronomic data from the off station spring barley nursery grown in Ravalli County at the Western Agricultural Research Center, Corvallis, MT in 1979. Random block design, four replications.

Date seeded: May 4, 1979 Date harvested: August 28, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Height Inches	Lodging %	Lodging Sev.	% Plump
CI 13827	Shabet	82.79	49.67	29.92	25.00	1.50	81.50
CI 15514	Hector	82.54	50.63	31.00	20.00	1.25	88.25
MT 729	Summit	79.32	51.47	31.89	.00	.00	82.25
CI 15478	Klages	73.29	50.50	31.69	.00	.00	83.50
CI 9558	Piroline	73.16	51.70	31.10	20.00	1.25	91.50
AT 506	Fairfield	72.85	50.05	29.04	.00	.00	83.25
CI 15687	Kimberly	70.30	49.97	31.20	10.00	2.50	85.75
CI 10421	Unitan	69.10	46.35b	29.23	42.50	.50	86.00
CI 10648	Larker	64.68	48.37	30.51	.00	.00	87.25
CI 15229	Steptoe	64.44	44.72b	26.67	7.50	1.25	88.50
CI 16181	Purcell 1/	62.29	50.02	27.17	7.50	1.25	89.25
CI 15773	Morex	60.02	47.90	30.31	10.00	.25	82.25
	$\bar{x}$	71.23	49.28	29.98	11.88	.81	85.77
	F 2/	.63NS	5.88**	1.13NS	1.09NS	.88NS	.44NS
	S.E.$\bar{x}$	9.60	.86	1.58	12.42	.86	4.87
	L.S.D.(.05)	27.57	2.47	4.54	35.66	2.47	13.98
	C.V. %	13.48	1.74	5.28	104.61	105.97	5.68

1/ Check variety
2/ F - value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Value significantly greater than the check (.05)
b/ Value significantly less than the check (.05)

Table 6. Agronomic data from the off station spring barley nursery grown in Lake County on the Lake Brothers farm, Ronan, MT in 1979. Random block design, four replications.

Date seeded: May 9, 1979 Date harvested: August 29, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Height Inches	% Plump
CI 15687	Kimberly	65.07	46.32b	26.57a	84.25b
AT 506	Fairfield	64.22	48.32	25.49a	89.50
CI 13827	Shabet	61.13	47.00	26.97a	89.00
MT 729	Summit	60.97	48.27	23.62	82.75b
CI 15478	Klages	59.35	43.22b	27.46a	89.50
CI 15773	Morex	57.69	45.77	28.64a	89.50
CI 10648	Larker	57.11	46.63	26.77a	94.50
CI 15229	Steptoe	55.82	41.85b	22.15	92.50
CI 16181	Purcell 1/	54.75	47.60	22.93	91.25
CI 9558	Piroline	49.86	48.63	25.00a	90.25
CI 15514	Hector	48.91	47.22	25.39a	86.00
CI 10421	Unitan	47.37	43.20b	25.49a	91.00
	$\bar{x}$ 2/	56.85	46.17	25.54	89.17
	F 2/	1.12NS	29.37**	8.61**	2.59*
	S.E.$\bar{x}$	5.49	.41	.65	2.09
	L.S.D.(.05)	15.77	1.19	1.87	5.99
	C.V. %	9.66	.90	2.55	2.34

1/ Check variety
2/ F - value for variety comparison
* Indicates statistical significance at the .05 level.
** Indicates statistical significance at the .01 level.
a/ Values significantly greater than the check (.05)
b/ Values significantly less than the check (.05)

Table 7. Agronomic data from the off station spring barley nursery grown in Missoula County on the Harvey Clouse farm, Missoula, MT in 1979. Random block design, four replications.

Date seeded: May 4, 1979 Date harvested: August 28, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Height Inches	Lodging %	Lodging Sev.	% Plump
CI 15229	Steptoe	109.49a	45.07b	33.76	.00	.00	94.00
CI 15514	Hector	105.83	49.17	40.65a	5.00	1.50	89.50
MT 729	Summit	105.13	49.55	37.60a	.00	.00	85.50
CI 15773	Morex	95.64	46.25	40.85a	15.00	2.50	85.75
AT 506	Fairfield	93.75	50.25	37.80a	2.50	.75	87.00
CI 10648	Larker	91.73	48.00	41.14	22.50	2.75	92.25
CI 13827	Shabet	88.53	46.63	39.57a	10.00	1.00	83.25
CI 9558	Piroline	88.19	49.22	39.76a	.00	.00	89.25
CI 16181	Purcell 1/	86.45	48.30	35.43	.00	.00	89.50
CI 10421	Unitan	86.15	44.70b	41.34a	6.25	1.00	86.75
CI 15687	Kimberly	85.23	47.25	40.65a	2.50	.75	79.75
CI 15478	Klages	74.01	46.07	40.75a	.00	.00	83.75
	$\bar{x}$	92.51	47.54	39.11	5.31	.85	87.19
	F 2/	2.11*	3.34**	13.82**	1.29NS	1.37NS	1.52NS
	S.E.$\bar{x}$	7.03	1.00	.66	6.34	.83	3.24
	L.S.D.(.05)	20.18	2.87	1.90	18.20	2.39	9.29
	C.V. %	7.60	2.10	1.69	119.33	97.48	3.71

1/ Check variety
2/ F - value for variety comparison
* Indicates statistical significance at the .05 level.
** Indicates statistical significance at the .01 level.
a/ Value significantly greater than the check (.05)
b/ Value significantly less than the check (.05)

Table 8. Summary of yield and test weight data from irrigated spring barley nurseries grown in Lake, Missoula, Ravalli and Flathead Counties in 1979.

C.I. or State No.	Variety	Yield (bu/a) 1/	2/	3/	4/	Ave.	Test Weight (lbs/bu) 1/	2/	3/	4/	Ave.
CI 15229	Steptoe	55.8	109.5	64.4	119.9	87.4	41.9	45.1	44.7	44.6	44.1
CI 15514	Hector	48.9	105.8	82.5	87.3	81.1	47.2	49.2	50.6	48.3	48.8
MT 729	Summit	61.0	105.1	79.3	102.0	86.9	48.3	49.6	51.5	48.8	49.6
CI 15773	Morex	57.7	95.6	60.0	110.9	81.1	45.8	46.3	47.9	45.7	46.4
AT 506	Fairfield	64.2	93.8	72.9	93.4	81.1	48.3	50.3	50.1	46.5	48.8
CI 10648	Larker	57.1	91.7	64.7	-	71.2	46.6	48.0	48.4	-	47.7
CI 13827	Shabet	61.1	88.5	82.8	92.6	81.3	47.0	46.6	49.7	45.3	47.2
CI 9558	Piroline	49.9	88.2	73.2	94.3	76.4	48.6	49.2	51.7	45.7	48.8
CI 16181	Purcell	54.8	86.5	62.3	96.6	75.1	47.6	48.3	50.0	46.1	48.0
CI 10421	Unitan	47.4	86.2	69.1	93.7	74.1	43.2	44.7	46.4	44.0	44.6
CI 15687	Kimberly	65.1	85.2	70.3	102.1	80.7	46.3	47.3	50.0	49.1	48.2
CI 15478	Klages	59.4	74.0	73.3	85.1	73.0	43.2	46.1	50.5	47.8	46.9
	$\bar{x}$ 5/	56.9	92.5	71.2	98.0	79.1	46.2	47.5	49.3	46.5	47.4
	F 5/	1.12	2.11*	.63	2.88**		29.37**	3.34**	5.88**	7.52**	
	L.S.D.(.05)	15.77	20.18	27.57	28.28		1.19	2.87	2.47	2.56	
	C.V. %	9.66	7.60	13.48	10.09		.90	2.10	1.74	1.95	

Table 9. Summary of height and percent plump data from irrigated spring barley nurseries grown in Lake, Missoula, Ravalli and Flathead Counties in 1979.

C.I. or State No.	Variety	% Plump 1/	2/	3/	4/	Ave.	Height (inches) 1/	2/	3/	4/	Ave.
CI 15229	Steptoe	92.5	94.0	88.5	95.6	92.7	22.2	33.8	26.7	36.8	29.9
CI 15514	Hector	86.0	89.5	88.3	92.0	89.0	25.4	40.7	31.0	39.7	34.2
MT 729	Summit	82.8	85.5	82.3	90.0	85.2	23.6	37.6	31.9	40.4	33.4
CI 15773	Morex	89.5	85.8	82.3	95.8	88.4	28.6	40.9	30.3	43.2	35.8
AT 506	Fairfield	89.5	87.0	83.3	94.4	88.6	25.5	37.8	29.0	40.2	33.1
CI 10648	Larker	94.5	92.3	87.3	-	91.4	26.8	41.1	30.5	-	32.8
CI 13827	Shabet	89.0	83.3	81.5	92.8	86.7	27.0	39.6	29.9	37.0	33.4
CI 9558	Piroline	90.3	89.3	91.5	91.0	90.5	25.0	39.8	31.1	38.2	33.5
CI 16181	Purcell	91.3	89.3	89.3	91.8	90.4	22.9	35.4	27.2	38.3	31.0
CI 10421	Unitan	91.0	86.8	86.0	92.2	89.0	25.5	41.3	29.2	42.2	34.6
CI 15687	Kimberly	84.3	79.8	85.8	93.6	85.9	26.6	40.7	31.2	41.6	35.0
CI 15478	Klages	89.5	83.8	83.5	95.0	88.0	27.5	40.8	31.7	42.2	35.6
	$\bar{x}$ 5/	89.2	87.2	85.8	93.1	88.8	25.5	39.1	30.0	40.0	33.5
	F 5/	2.59*	1.52	.44	5.16**		8.61**	13.82**	1.13	5.29**	
	L.S.D.(.05)	5.99	9.29	13.98	4.42		1.87	1.90	5.28	2.31	
	C.V. %	2.34	3.71	5.68	1.72		2.55	1.69	5.28	2.52	

1/ Lake County - Lake Brothers
2/ Missoula County - Harvey Clouse
3/ Ravalli County - Western Agricultural Research Center
4/ Flathead County - Northwestern Agricultural Research Center
5/ F - value for variety comparison
NOTE: Purcell is considered to be the check in all nurseries.

Table 10. Agronomic data from the pedigree preliminary yield nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. A-2. Random block design, three replications.

Date seeded: April 19, 1979 Date Harvested: August 3, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Heading Date	Height Inches	% Plump
MT 729	Summit	85.74	52.97a	174.67a	29.66	82.67b
CI 15478	Klages	85.51	50.30	175.00a	30.18	86.00
MT 313104	Summit/Hector	84.03	52.87a	172.33a	30.45	88.00
MT 657399	Steptoe/Klages F6	83.11	50.13	173.67a	31.36a	96.67a
MT 31572	Klages/Summit	82.78	53.43a	171.00	29.92	91.67
MT 31624	Klages/Summit	81.76	53.97a	172.67a	29.00	94.00
MT 31272	Klages/Summit	81.17	54.30a	173.33a	29.40	87.33
MT 312590	Summit/Hector	80.07	53.17a	174.33a	31.10a	91.67
MT 31571	Klages/Summit	78.44	52.73a	173.33a	29.92	91.00
MT 31672	Klages/Summit	78.40	51.53	174.67a	30.05	88.33
MT 31579	Klages/Summit	78.17	53.37a	174.00a	27.56	87.33
MT 312620	Summit/Hector	77.90	53.40a	171.67	29.00	86.33
MT 31126	Klages/Summit	77.11	52.57a	173.67a	29.92	87.00
CI 15514	Hector	76.30	53.13a	173.67a	29.27	92.67
CI 15229	Steptoe 1/	76.19	49.97	169.67	27.69	89.67
MT 311576	Klages/Summit	75.98	53.03a	173.00a	30.71	88.67
MT 311309	Klages/Summit	75.52	52.87a	174.00a	29.27	84.00
MT 657868	Klages/Erbet F5	74.59	52.93a	168.67	27.95	84.67
MT 311031	Klages/Summit	74.42	52.80a	173.00a	29.00	91.33
MT 657969	Klages/Erbet F5	73.36	53.07a	167.00	25.20	86.33
MT 657400	Steptoe/Klages F6	73.25	52.47a	171.00	31.50a	94.00
MT 313069	Summit/Hector	73.17	53.07a	172.33a	30.97a	90.33
MT 657370	Hiproly/Steptoe F5	72.38	57.90a	176.00a	23.75b	25.67b
MT 31972	Klages/Summit	71.96	52.10a	173.67a	29.66	91.33
MT 657822	Klages/Erbet F5	71.59	52.90a	166.33	27.03	84.67
MT 311198	Klages/Summit	71.09	54.57a	173.33a	29.13	92.33
MT 657395	Steptoe/Klages F6	69.71	50.00	176.00a	30.45	[illegible]
MT 657869	Klages/Erbet F5	68.79	53.97a	166.00	27.56	88.00
MT 657389	Steptoe/Klages F6	67.06	48.47	177.33a	31.63a	96.33a
MT 657702	Steptoe/Maris Mink F5	66.61	51.77a	175.00a	27.30	94.33
MT 657694	Steptoe/Maris Mink F5	66.54	50.37	175.00a	25.72	95.67
MT 657705	Steptoe/Maris Mink F5	63.98	49.20	175.00a	25.72	94.33
	$\bar{x}$	75.52	52.48	172.82	28.97	88.09
	F 2/	1.33NS	8.39**	14.95**	3.10**	29.90**
	S.E.$\bar{x}$	4.99	.63	.71	1.11	2.20
	L.S.D. (.05)	14.12	1.78	2.01	3.13	6.23
	C.V. %	6.61	1.20	.41	3.82	2.50

1/ Check variety
2/ F - value for variety comparison
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Values significantly greater than the check (.05)
b/ Values significantly less than the check (.05)

TITLE: Spring Oats

PROJECT: Small Grains Investigations MS 756

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Feed Crops Committee MAES, MSU; USDA-SEA-AR

LOCATION: Northwestern Agricultural Research Center Field No. Y-1

DURATION: Indefinite

OBJECTIVE: To determine the adaptability of new or introduced oat varieties.

SUMMARY OF 1979 RESULTS:

Yields for the 1979 Uniform Oat Nursery were equal to last years yields. The mean yields for the two seasons differed by four bushels. Kelsey, which had the highest yield in 1978 had the lowest yield in 1979. Three varieties were significantly greater in yield than the check, Otana (Table 1). Two new entries, ID 751170 and ID 768244 yielded 179.75 bu/a and 172.24 bu/a respectively. The third variety WA 6392 yielded 174.12 bu/a, is in its second year of testing.

Several entries had significantly lower test weights than Otana. Terra had the highest test weight. Generally the test weights for the nursery were less than in 1978.

Nine varieties headed out earlier than Otana and five headed later than Otana (Table 1).

ID 768244 and ID 768346 were significantly taller than Otana.

Six of the Idaho varieties had significantly higher forage yields than Otana. Five were new entries whereas ID 742300 has been tested for three years. Cavell, Memomennee, and WA 6392 also had significantly higher forage yields than Otana.

A ten year summary of these oat varieties is given in Table 2. All entries are compared to Park, the long time check. Terra and Markton yielded less than Park.

SPRING OAT VARIETIES

SPRING OAT VARIETIES RECOMMENDED FOR WESTERN MONTANA

1. Cayuse - irrigated or dryland
2. Park - irrigated or high moisture conditions
3. Basin - dryland
4. Otana - irrigated or high moisture conditions

CHARACTERISTICS OF RECOMMENDED VARIETIES

1. Cayuse
   a. Pale green plant color, yellow kernels at maturity, developed in New York
   b. High yielding ability
   c. Low test weight
   d. Maturity - early to mid-season
   e. Very strong straw strength
   f. Resistant to Victoria blight and Helmenthosporium blight
   g. Tolerant to "red leaf" disease of oats

2. Park
   a. White, plump, short kernels, developed by Idaho and Montana
   b. High yielding ability
   c. High test weight
   d. Maturity -mid-season
   e. Strong straw strength
   f. Susceptible to Victoria blight
   g. Resistant to prevalent stem rust races

3. Basin
   a. White, short, plump kernels with occasional weak awns, developed in Montana
   b. High yielding ability
   c. High test weight
   d. Strong straw strength
   e. Maturity - mid-season
   f. Resistant to covered and loose smut
   g. Resistant to most common stem rust races (not to races 7 & 7A)
   h. Excellent oat for combining

4. Otana
   a. Kernel white and plump
   b. Dark or blue green foliage
   c. High yielding
   d. Excellent test weight
   e. Medium to strong straw
   f. Maturity - mid-season
   g. Resistant to Victoria blight

Table 1. Agronomic data from the Uniform Northwestern States Oat Nursery grown on the Northwestern Agricultural Research Center at Kalispell, MT, 1979. Random block design, three replications.

Date seeded: April 30, 1979 Date harvested: August 30, 1979 Size of plot: 16 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Heading Date	Plant Height	Forage T/A	Lodging %	Lodging Sev.	Gr/Straw Weight
ID 751170	Cayuse/Otana	179.75a	36.23	190.33	46.46	8.52a	3.33	2.00	1.95
WA 6392	Minn.II-22-220/Cayuse/	174.12a	33.50b	191.67a	44.88	10.00a	.00	.00	2.60
ID 768244	Lodi/Park	172.24a	37.70	190.33	53.94a	8.80a	.00	.00	2.19
ID 742300	Otana//Cokerx848-1-1-2/C	170.37	34.27b	191.00	44.36	8.72a	10.00	2.33	2.20
MT 1	Menomennee	167.56	38.07	190.67	49.21	8.82a	.00	.00	2.31
CI 7557	Russel	165.68	37.60	188.00	51.84	8.35	.00	.00	2.14
ID 742608	Cayuse/Otana	163.18	33.97b	191.67a	46.98	7.70	5.00	2.67	1.94
IL 732664	Brave//Tyler/EGDolon23	160.68	34.97b	183.00b	45.28	8.27	.00	.00	2.21
WA 6394	Minn.II-22-220/Cayuse	160.68	33.37b	192.67a	47.77	7.85	13.33	2.33	2.06
CI 8263	Cayuse	157.86	34.33b	188.33	42.26	8.25	.00	.00	2.19
ID 766843	K71299/3/Otana/2/Coker	155.99	35.43	187.00	43.04	9.82a	.00	.00	2.98
CI 9266	Cayuse/Orbit	151.93	35.90	189.67	45.54	8.02	10.00	2.33	2.27
ID 768346	Lodi/Cayuse	149.74	34.70b	193.33a	55.91a	9.25a	23.33	2.00	2.94
CI 5346	Basin	148.49	37.57	191.33a	50.26	7.65	.00	.00	2.22
OT 726	Random/Forward	148.17	34.83b	188.67	48.69	7.07	.00	.00	2.00
OT 719	Cavell(OT703/Glen)	145.36	36.73	186.67b	47.38	8.42a	5.00	2.67	2.56
WA 6391	Minn.II-22-220/Cayuse	144.42	31.00b	189.67	47.90	7.87	20.00	4.33	2.49
WA 6160	CI2874/Cayuse	142.23	33.93b	190.67	45.28	6.75	.00	.00	1.95
WA 6159	CI2874/Cayuse	139.73	30.87b	190.67	45.14	6.67	26.67	2.67	2.08
WA 6161	CI2874/Cayuse	139.42	32.60b	194.33a	46.72	7.15	26.67	2.67	2.19
WA 6393	Minn.II-22-220/Cayuse	137.23	32.07b	193.33a	44.62	8.07	18.33	2.67	2.72
CI 9252	Otana (63AB5280-7)1/	133.79	37.77	189.00	46.06	6.05	.00	.00	1.86
ID 768231	Lodi/Park	130.36	36.80	192.33a	51.18	8.72a	28.33	2.33	3.50
IL 751062	Coker 227//Clintford/Por	118.48	38.30	183.00b	42.26	7.80	.00	.00	3.14
OT 195	Terra	113.16	40.03a	186.33b	45.67	8.22	1.67	2.00	3.60
CI 6611	Park	111.29	35.40	191.33a	46.19	5.97	3.33	2.33	2.34
CI 9081	Random	108.47	34.57b	184.67b	41.34	6.05	.00	.00	2.32
CI 2053	Markton	107.54	36.10	187.00	46.33	5.70	10.00	2.00	2.33
CI 9297	WA 6014	99.78	32.20b	191.00	42.52	6.20	26.67	2.33	5.57
CI 8171	Kelsey	99.10	35.90	187.67	50.13	5.92	8.33	2.33	2.80
	$\bar{x}$	143.23	35.22	189.51	46.84	7.76	8.00	1.40	2.52
	F 2/	2.97**	6.59**	13.83**	1.91*	2.05**	.97NS	.84NS	.99NS
	S.E.$\bar{x}$	13.50	.88	.78	2.49	.82	10.20	1.43	.73
	L.S.D.(.05)	38.19	2.48	2.20	7.03	2.32	28.86	4.04	2.08
	C.V. %	9.43	2.49	.41	5.31	10.57	127.53	102.05	29.13

Table 1. (con't)

1/ Check variety
2/ F-value for variety comparison
a/ Value significantly greater than check at .05 level
b/ Value significantly less than check at .05 level.
* Indicates statistical significance at .05 level.
** Indicates statistical significance at .01 level.

Table 2. Summary of oat yield data from the Uniform Oat Nursery, Northwestern Agricultural Research Center, Kalispell, MT, 1970-79.

C.I. or State No.		Variety	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Ave.	Sta. Yrs.	% Park
CI	5346	Basin	148.7	177.0	144.2	114.4	181.6	143.4	71.0	122.2	119.9	148.5	137.1	10	107
CI	6611	Park	127.1	190.6	67.8	115.1	123.2	170.0	108.0	130.2	135.5	111.3	127.9	10	100
CI	8263	Cayuse	158.7	195.9	140.7	113.6	162.5	171.8	127.7	151.4	152.3	157.9	153.3	10	120
CI	2053	Markton	120.5	175.1	77.5	87.1	147.0	130.1	75.6	125.1	128.1	107.5	117.4	10	92
CI	8171	Kelsey	127.6	195.3	89.3	115.7	193.4	-	89.5	134.2	199.0	99.1	138.1	9	112
CI	9081	Random		197.7	106.9	116.5	193.0	166.9	93.5	152.2	177.1	108.5	145.8	9	114
CI	9252	Otana			142.9	127.6	183.6	180.4	142.8	162.2	122.7	133.8	149.5	8	124
CI	9297	Appaloosa (WA6014)				118.3	183.9	148.0	103.7	143.4	165.3	99.8	137.5	7	108
WA	6159	CI2874/Cayuse						162.8	96.0	156.6	131.5	139.7	137.3	5	105
WA	6160	CI2874/Cayuse						181.3	118.9	158.1	144.3	142.2	149.0	5	114
WA	6161	CI2874/Cayuse						182.4	108.9	167.9	153.1	139.4	150.3	5	115
CI	7557	Russel						150.2	102.2	126.2	141.1	165.7	137.1	5	105
OT	195	Terra							57.4	116.5	90.7	113.2	94.5	4	78
CI	9266	Corbit (Cayuse/Orbit)								174.6	135.7	151.9	154.1	3	123
ID	742300	Otana//Cokerx848-1-1-2/C								163.6	160.8	170.4	164.9	3	131
ID	742608	Cayuse/Otana								145.2	157.1	163.2	155.2	3	123
OT	726	Random/Forward									179.7	148.2	164.0	2	133
OT	719	Cavell (OT703/Glen)									175.1	145.4	160.3	2	130
WA	6393	Minn.II-22-220/Cayuse									155.4	137.3	146.4	2	119
WA	6394	Minn.II-22-220/Cayuse									151.0	160.7	155.9	2	126
WA	6391	Minn.II-22-220/Cayuse									143.1	144.4	143.8	2	116
WA	6392	Minn.II-22-220/Cayuse									140.6	174.1	157.4	2	128
ID	751170	Cayuse/Otana										179.8	179.8	1	162
ID	766843	K7/299/c/Otana/2/Coker										156.0	156.0	1	140
IL	732664	Brave//Tyler/EGDolon 23										160.7	160.7	1	144
IL	751062	Coker 227//Clintford/Por										118.5	118.5	1	106
ID	768346	Lodi/Cayuse										149.7	149.7	1	135
ID	768244	Lodi/Park										172.2	172.2	1	155
ID	768231	Lodi/Park										130.4	130.4	1	117
MT	1	Menomennee										167.6	167.6	1	151

TITLE: Spring Wheat

PROJECT: Small Grain Investigation MS 756

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Montana Agricultural Experiment Station, MSU
USDA SEA-AR
Montana Wheat Research and Marketing Committee

OBJECTIVES:
1. To determine the adaptability of new and introduced spring wheat varieties and selections.
2. To aid in the basic genetic research programs in spring wheat.

1979 Experiments:

1. Private Variety Spring Wheat Nursery
2. Western Regional Spring Wheat Nursery

RESULTS AND DISCUSSIONS:

Private Variety Spring Wheat Nursery - The yields ranged from 77.49 bu/a to 111.52 bu/a with two varieties (TR5 and Thatcher) yielding significantly less than Newana. Test weights were slightly lower than in 1978. Four varieties had test weights significantly less than Newana. Five entries headed significantly earlier than Newana, whereas WS 122 and Fielder headed significantly later. Diseases were not an important factor in the study. However, Thatcher and Prodax showed susceptibility to leaf rust.

Western Regional Spring Wheat Nursery - Yields ranged from 78.18 bu/a to 129.77 bu/a with three varieties yielding significantly more than the check, Borah. Test weights were slightly higher than in previous years. All but four varieties had a significantly later heading date than Borah. Seventy-two percent of the entries were significantly greater in height than Borah. Leaf rust was severe on UT 25943, ID 184, and ID 183, where infection levels exceeded 50%. Moderate levels of infection were observed throughout the nursery (Table 2). Powdery mildew was high throughout the nursery.

SPRING WHEAT VARIETIES RECOMMENDED FOR WESTERN MONTANA

Hard Red Varieties

1. Norana - nonirrigated and irrigated
2. Borah - nonirrigated and irrigated
3. Thatcher - dryland and irrigated
4. Fortuna - dryland
5. Newana - dryland and irrigated
6. Pondera - dryland and irrigated
7. Marberg - dryland and irrigated

Soft White Varieties

1. Fielder - nonirrigated and irrigated
2. Fieldwin - dryland and irrigated

CHARACTERISTICS OF RECOMMENDED VARIETIES

Hard Red Varieties

1. Norana

   a. Bearded variety, developed in Montana
   b. Very high yielding ability
   c. Semi-dwarf type
   d. Maturity - mid-season to late
   e. Good test weight
   f. Excellent straw strength
   g. Good shattering resistance
   h. Resistant to stem rust
   i. Resistant to lose smut
   j. Resistant to moderately resistant to stripe rust
   k. Good milling and baking quality

2. Borah

   a. Bearded variety
   b. Very high yielding ability
   c. Semi-dwarf type
   d. Medium maturity
   e. Low to fair test weight
   f. Resistant to shattering
   g. Resistant to stripe rust
   h. Susceptible to leaf rust
   i. Resistant to stem rust

3. Thatcher

   a. Beardless variety, developed in U.S.A.
   b. Fair yielding ability
   c. Medium height
   d. Early maturity
   e. Good test weight
   f. Fair to good lodging resistance
   g. Good shattering resistance
   h. Susceptible to leaf rust
   i. Resistant to stripe rust
   j. Good milling and baking quality

Recommended Spring Wheat Varieties (con't)

4. Fortuna

a. Beardless variety, developed in North Dakota
b. Good yielding ability
c. Medium to tall height
d. Medium maturity
e. High test weight
f. Poor to fair lodging resistance
g. Somewhat susceptible to shattering
h. Resistant to most common races of stem rust
i. Resistant to most common races of leaf rust
j. Fair to good milling and baking quality

5. Newana

a. High yielding ability
b. Semi-dwarf variety (short straw)
c. High test weight
d. High lodging resistance
e. Good shattering resistance
f. Resistance to stem rust
g. Moderately susceptible to leaf rust

6. Pondera

a. High yielding ability
b. Semi-dwarf variety
c. High test weight
d. Mid-season maturity
e. Resistant to stem and strip rust
f. Moderately resistant to leaf rust

7. Marberg

a. Good yielding ability
b. Semi-dwarf variety
c. Good test weight
d. Mid-season maturity
e. Resistant to stem rust
f. Moderately susceptible to leaf rust
g. Moderately resistant to stripe rust

Soft White Varieties

1. Fielder

a. Bearded variety, developed in Idaho
b. Very high yielding ability
c. Semi-dwarf type
d. Medium to late maturity
e. Fair test weight
f. Good straw strength
g. Good shattering resistance
h. Moderately resistant to stripe rust
i. Slight resistance to leaf rust

Recommended Spring Wheat Varieties (con't)

2. Fieldwin

a. High yielding ability
b. Semi-dwarf variety
c. Medium to late maturity
d. Fair test weight
e. Good straw strength
f. Good shattering resistance
g. Moderate resistance to stripe, stem and leaf rust
h. Moderate resistance to powdery mildew

Table 1. Agronomic data from the Private Variety Spring Wheat Nursery grown on the Northwestern Agricultural Research Center in 1979. Field No. Y-1. Random block design, four replications.

Date seeded: April 30, 1979 Date harvested: September 13, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Heading Date	Height Inches	Leaf Rust %	Leaf Rust Sev.
TR 4	Yoco-Resel(Triticale)	111.52	49.55b	184.50b	37.11a	.00	.00
CI 17430	Newana, MT 7156 1/	111.37	61.50	188.25	33.66	.00	.00
MT 34	Prodax	107.71	58.72b	187.50	34.45	12.50	1.00
WS 122	MP-122	107.56	61.25	190.50a	37.60a	.00	.00
NA 7664	HS 7664	106.75	60.75	187.75	35.83	.00	.00
AG 1	Solar	106.16	62.25	189.25	34.55	.00	.00
CI 17268	Fielder	105.68	61.50	189.75a	38.68a	5.00	.50
CI 13596	Fortuna	105.22	62.47	186.00b	43.80a	.00	.00
TR 1	Navojoa (Triticale)	104.32	50.27b	183.00b	34.65	.00	.00
WS 114	MP-114	101.37	61.75	187.25	29.72b	.00	.00
CI 13986	Era	100.50	61.67	189.00	33.27	.00	.00
NK 55114	75S 5511-4	99.57	62.42	188.00	35.53	.00	.00
TR 5	Maya I-Arm(Triticale	94.48b	50.40b	183.00b	35.93	.00	.00
CI 10003	Thatcher	77.49b	59.43b	186.25b	43.60a	17.50	2.25
	$\bar{x}$	102.84	58.85	187.14	36.31	2.50	.27
	F 2/	3.01**	96.75**	34.38**	20.46**	1.39NS	1.80NS
	S.E.$\bar{x}$	4.98	.50	.40	.84	4.70	.48
	L.S.D.(.05)	14.22	1.42	1.15	2.40	13.43	1.36
	C.V. %	4.84	.84	.21	2.31	187.91	177.87

1/ Check variety
2/ F - value for variety comparison
a/ Values significantly greater than the check at the .05 level
b/ Values significantly less than the check at the .05 level
** Indicates statistical significance at the .01 level

Table 2. Agronomic data from the Western Regional Spring Wheat Nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. Y-1. Random block design, four replications.

Date seeded: April 30, 1979 Date harvested: September 13, 1979 Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Heading Date	Height Inches	Leaf Rust %	Leaf Rust Sev.	Mildew %	Mildew Sev.
ID 181	A71531S-A-26-2[3/]	129.77a	61.13	183.75	35.93a	.00	.00	2.50b	.25b
ID 167	MRN/TBR 66/3/TZPP/AN3//B[2/]	123.90a	61.57	186.50a	35.83a	.00	.00	7.50b	1.00
ID 130	AB A71525S-A-38-2[3/]	123.00a	61.92	188.00a	37.50a	5.00	1.00	45.00	2.25
ID 187	A7243S-A-3-1[3/]	117.58	60.38	186.25a	36.91a	41.25a	2.25	10.00	1.25
ID 183	ID0053/A6596S-A-21-1[3/]	116.63	63.02a	187.00a	36.61a	51.25a	3.75a	57.50a	3.25a
ID 177	A7244S-B-2-1[3/]	116.26	59.75	188.25a	35.33a	2.50	.75	27.50	2.00
ID 186	A7240S-38-2[3/]	115.09	61.77	188.00a	36.81a	15.00	.50	35.00	2.00
ID 185	A7250S-A-8-1[3/]	114.75	61.37	185.75a	34.45	.00	.00	65.00a	3.25a
ID 184	A6543S-14-1-3/A6596S[3/]	114.54	62.52a	187.50a	35.63a	50.00a	2.75a	12.50	1.50
ID 144	A7136S-5-2-3[3/]	112.60	61.68	186.00a	37.01a	.00	.00	57.50a	3.50a
WA 6613	VH070954/ID 55[3/]	112.14	57.92b	189.75a	39.67a	30.00	1.75	35.00	2.25
WA 6402	CI 14482/K6202578R21[3/]	112.07	60.00	187.50a	34.55	.00	.00	62.50a	3.50a
ID 160	Peak 72/A6546S-2-2[2/]	110.11	61.05	187.75a	33.27	.00	.00	17.50	2.00
WA 6619	K 7095153/ID 55[3/]	110.05	61.00	189.50a	33.86	38.75a	1.25	15.00	.50
UT 261102	RED R68/UT 256-3-14-45-1[2/]	109.42	61.75	186.75a	36.52a	.00	.00	15.00	1.75
WA 6618	K 7105153/ID 55[3/]	109.29	62.57a	188.75a	35.14a	25.00	1.25	10.00	1.50
ID 153	Borah/3/II-60-101//TZPP[2/]	108.70	61.13	183.50	34.65	5.00	1.00	40.00	3.50a
CI 17267	Borah[1/2/]	108.22	60.77	183.75	32.28	2.50	.75	27.50	1.75
WA 6617	K 7105152/ID 56[3/]	107.56	55.42b	194.50a	34.35	15.00	1.25	42.50	2.75
WA 6307	K6901532/Era[2/]	107.49	62.50a	189.25a	32.28	.00	.00	2.50b	.25b
ID 129	AB A71523S-A-17-2[3/]	107.46	58.50b	189.00a	40.55a	22.50	.75	15.00	1.75
CI 17425	Fieldwin, ID 87[3/]	107.17	62.40a	192.00a	39.86a	.00	.00	22.50	2.25
UT 881292	Bannock/Fremont[2/]	105.85	61.47	188.00a	40.75a	.00	.00	20.00	1.25
WA 6510	K 6901495/IN 26268[2/]	105.40	61.75	188.50a	34.15	.00	.00	2.50b	.25b
UT 25910	Rogue 66/Fremont[2/]	105.30	61.05	187.00a	36.81a	45.00a	2.00	7.50b	1.25
WA 6620	N 7000315/ID65[3/]	104.63	60.45	186.00a	35.93a	.00	.00	25.00	2.00
UT 881235	Bannock/Fremont[2/]	103.48	62.65a	185.75a	47.64a	.00	.00	35.00	2.50
UT 25850	Rogue 66/Fremont[2/]	103.22	59.95	185.50a	36.32a	22.50	1.25	32.50	2.00
ID 138	Fielder/A6514S-A-102-1[3/]	102.66	62.70a	184.25	35.04a	.00	.00	78.75a	4.75a
UT 25943	Rogue 66/Fremont[2/]	101.80	60.47	187.75a	37.30a	68.75a	4.50a	15.00	1.50
UT 881404	Bannock/Fremont[2/]	99.20	60.55	185.25	46.46a	.00	.00	5.00b	.25b
WA 6615	VH070954/Fielder[3/]	99.11	62.27a	190.50a	42.62a	20.00	1.25	52.50a	3.50a
WA 6614	VH070954/ID 46[3/]	98.72	56.92b	189.00a	32.68	42.50a	2.50	40.00	3.00
UT 25776	Rogue 66/Fremont[2/]	94.97b	60.45	186.75a	36.91a	83.75a	5.25a	17.50	1.75
WA 6616	VH070954/Fielder[3/]	90.42b	63.10a	188.25a	42.62a	22.50	.75	32.50	2.00
CI 4734	Federation[3/]	78.18b	59.42b	188.25a	46.75a	2.50	1.00	90.00a	7.00a

Table 2 . (con't)

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Heading Date	Height Inches	Leaf Rust %	Leaf Rust Sev.	Mildew %	Mildew Sev.
	$\bar{x}$	107.96	60.93	187.49	37.25	16.98	1.04	29.97	2.14
	F 4/	4.28**	13.20**	14.69**	16.79**	3.14**	3.54**	12.00**	7.89**
	S.E.$\bar{x}$	4.58	.46	.59	.96	12.61	.71	6.43	.48
	L.S.D.(.05)	12.85	1.30	1.65	2.68	35.34	1.98	18.03	1.35
	C.V. %	4.25	.76	.31	2.57	74.26	67.93	21.46	22.53

1/ Check variety
2/ Hard red
3/ Soft white
4/ F - value for variety comparison
a/ Values significantly greater than the check at the .05 level
b/ Values significantly less than the check at .05 level
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Table ____. Summary of the western regional spring wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT 1971-79.

C.I. or State No.	Variety	1971	1972	1973	1974	1975	1976	1977	1979	Ave.	Sta. Yrs.	% Borah
CI 4734	Federation	51.3	65.3	69.4	69.4	40.7	38.7	73.0	78.2	60.8	8	67
CI 17267	Borah	89.2	88.3	93.1	89.5	94.4	72.8	89.6	108.2	90.6	8	100
CI 17425	Fieldwin,I87				107.2	78.6	71.9	97.9	107.2	92.5	5	102
UT 25776	Rogue 66/Fremont							92.1	95.0	93.6	2	95
UT 25850	Rogue 66/Fremont							98.6	103.2	100.9	2	102
UT 25943	Rogue 66/Fremont							92.6	101.8	97.2	2	98
ID 0129	Ab A71523S-A-17-2							100.5	107.5	104.0	2	105
ID 0130	Ab A71525S-A-38-2							109.6	123.0	116.3	2	118
ID 181	A71531S-A-26-2								129.8	129.8	1	120
ID 167	MRN/TBR 66/3/TZPP/AN3//B2								123.9	123.9	1	115
ID 187	A 7243S-A-3-1								117.6	117.6	1	109
ID 183	ID 0053/A6596S-A-21-1								116.6	116.6	1	108
ID 188	A 7244S-B-2-1								116.3	116.3	1	107
ID 186	A7240S-38-2								115.1	115.1	1	106
ID 185	A7250S-A-8-1								114.8	114.8	1	106
ID 184	A6543S-14-1-3/A6596S								114.5	114.5	1	106
ID 144	A7136S-5-2-3								112.6	112.6	1	104
WA 6613	VH070954/ID 55								112.1	112.1	1	104
WA 6402	CI 14482/K620257								112.1	112.1	1	104
ID 160	Peak 72/A65465-2-2								110.1	110.1	1	102
WA 6619	K 7105153/ID 55								110.1	110.1	1	102
UT 261102	Red R68/UT 256-3-14-45-1								109.4	109.4	1	101
WA 6618	K 7105153/ID 55								109.3	109.3	1	101
ID 153	Borah/3/II-60-101//TZPP								108.7	108.7	1	100
WA 6617	K 7105152/ID 56								107.6	107.6	1	99
WA 6307	K 6901532/Era								107.5	107.5	1	99
UT 881292	Bannock/Fremont								105.9	105.9	1	98
WA 6510	K 690149 5/MN26268								105.4	105.4	1	97
WA 6620	N 7000315/ID 65								104.6	104.6	1	97
UT 881235	Bannock/Fremont								103.5	103.5	1	96
ID 138	Fielder/A65145-S-102-1								102.7	102.7	1	95
UT 881404	Bannock/Fremont								99.2	99.2	1	92
WA 6615	VH 070954/Fielder								99.1	99.1	1	92
WA 6614	VH 070954/ID 46								98.7	98.7	1	91
WA 6616	VH 070954/Fielder								90.4	90.4	1	84

TITLE; Evaluation of the growth regulator compound 'Embark' on spring grains and established turf.

YEAR: 1979

LOCATION: Northwestern Agricultural Research Center (Field R-9)

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd Keener
Cooperators - Weed Research Committee, Montana Agricultural Experiment Station, MSU
Montana Wheat Research and Marketing Committee
3-M Company, Agricultural Chemical Division

OBJECTIVES:
1. Measure efficacy of Embark in growth suppression of established grasses.
2. To determine the effect of Embark on yield and yield components of small grains.

MATERIALS AND METHODS:

Small Grains - Mefluidide |N-2,4-dimethyl-5-|(trifluoromethyl)sulfonyl|amino|phenyl|acetamide, hereafter referred to as Embark, was applied at five rates to Ingrid spring barley and Newana spring wheat. The small grain was seeded with an international press drill with a 7-inch row spacing, 12 feet wide. The drill strips were spaced 3-feet apart. Embark treatments were applied at right angles to seeded strips. Seeding rate for barley was 80 lbs/a and for wheat 70 lbs/a. Herbicides used for weed control were triallate for wild oat control and bromoxynil + MCP combination for broadleaf control. The rate of triallate was 1.0 lb/a for wheat and 1.25 lb/a for barley. The broadleaf herbicide was .375 lb/a of both bromoxynil + MCP for broadleaf control for both wheat and barley.

Plot size was 12' x 10' or 120 sq. ft. Herbicides were applied with a tractor mounted research type sprayer. Forty-eight square feet were harvested for yield with a Hege combine. Prior to harvest, plant and tiller counts were made. Heads were selected at random (25) to be used in yield component determinations. Kernel counts and kernel weights were conducted by Gene Hockett and staff at MSU using an electronic counter.

Turf - Embark (see common and chemical name above) was applied at four rates to an established pasture containing various species. Plots were 10' x 15' (150 sq. ft.). Spraying procedures are described above and/or are included in the tabulated data. The experiments were mowed to a 3-inch height four days after application. Readings of the experiments were made four and six weeks after application. Two experiments were established. Experiment No. 1 had the following species: western wheatgrass (Agropyron smithii Rydb.); Russian wild rye (Elymus sp); and downy brome (Bromus tectorum L.). Experiment No. 2 had the following species: bluegrass (Poa pratensis L.); orchardgrass (Dactylis glomerata L.); red clover (Trifolium pratense L.); white clover (Trifolium repens L.); dandelion (Taraxacum officinale Weber); night flowering catchfly (Silene noctiflora L.) and black medic (Medicago lupulina L.).

RESULTS AND DISCUSSION:

Barley - Statistically all data obtained were found to be non-significant at the 5 percent level of probability, however it is noted that the check was the highest in yield, test weight and kernel weight. There was a general trend at the lower rates of Embark to see a reduction in kernels per head and 1000 kernel weight. Tests varied some with the lowest rate (7 gm/a) having the lowest percent plump measurement. Plants tended to decrease in height as the rate of Embark was increased. See Table 1. No physiological aberrations were observed as a result of Embark applications.

Wheat - As seen in the barley there is no statistical difference in this test. However, the check values are the highest except kernels per head. Table 2. We did not see any phytotoxicity between treatments in this test.

Turf - Test 1 (F-2) - Field measurements made four weeks after application showed good suppression of western wheatgrass and Russian wild rye at the .38 and .50 lb/a rate. However, downy bromegrass was only slightly suppressed at the same rates. Six weeks after application the western wheatgrass and Russian wild rye were fairly well suppressed at .5 lb/a rate. Flowering of all species was observed at the two lower rates four weeks after application. Normal growth appeared evident throughout the test on July 31, 1979. No color changes were noted between treatments and checks. Slight dryness and tip burning was observed in grass species at the .38 and .5 lb/a rates. Table 3.

Turf - Test 2 (Y-5) - The .5 lb/a rate caused excellent growth suppression for all plant species for about 26 days. The .38 and .5 lb/a rates were the most effective throughout the test. Dandelion and red clover were the least affected by Embark in this study. We seemed to have fairly effective growth suppression at the two higher rates for about 40 days. Later in the season normal growth appeared evident. Phytotoxicity was noted on all red clover at most rates. Table 4.

Table 1. Effects of the growth regulator compound Embark on the agronomic components of Ingrid barley, Northwestern Agricultural Research Center, Kalispell, MT, 1979. Field No. R-9.

Date seeded: May 14, 1979 Date harvested: September 7, 1979
Size of plot: 48 sq. ft.

Treatment	Rate Gms/A	Yield Bu/A	Test Wt. Lbs/Bu.	% Plump	Heading Date	Height Inches	Kernels/ head[2/]	1000 Kernel Wt.[2/]
Embark[1/]	7	63.0	47.1	96.3	199	23.0	24.6	43.9
Embark	9	83.7	48.3	96.8	199	20.8	24.8	45.1
Embark	11	69.9	47.4	97.8	199	21.8	25.3	45.7
Embark	13	67.6	48.0	97.8	199	21.1	25.2	45.2
Embark	15	79.4	48.8	97.5	200	19.8	25.1	46.3
Check	0	86.6	49.4	97.8	200	20.1	25.4	46.8
$\bar{x}$		75.02	48.14	97.29		21.08	25.06	45.47
F[3/]		1.22	.331	1.51		2.18	.143	.830
S.E.$\bar{x}$		8.64	.863	.521		.797	.784	1.115
C.V.%		11.51	1.79	.536		3.78	3.06	2.45
L.S.D.(.05)		26.02	2.60	1.57		2.40	2.36	3.36

1/ Embark (MBR 12325) is a growth regulator compound manufactured by 3M. Common name mefluidide, Chemical name N-[2,4-dimethyl-5-[[(triflouromethyl)sulfonyl]amino] phenyl] acetamide.

2/ Kernels/head and 1000 kernel weight determined by processing 25 random heads per plot.

3/ F - value for treatment comparison.

APPLICATION DATA:

Date: 6/15/79
Air Temperature: 50°F
Soil Temperature: 76°F
Humidity: 52%
Wind: 0-calm
Volume: 25.9gpa
Nozzle: 8003
PSI: 32
Grain: 4-8" high tillering

Table 2. Effects of the growth regulator compound Embark on the agronomic components of Newana spring wheat. Northwestern Agricultural Research Center, Kalispell, MT 1979. Field R-9.

Date seeded: May 14, 1979 Date harvested: September 14, 1979
Size of plot: 48 sq. ft.

Treatment	Rate Gms/A	Yield Bu/A	Test Wt. Lbs/Bu.	Height Inches	Heading Date	Tillers/ ft. of Row	Kernels/ Head	1000 Kernel Wt.[2/]
Embark[1/]	7	79.6	62.6	22.0	195	6.58	45.9	39.3
Embark	9	93.8	62.4	22.0	195	6.66	46.5	40.0
Embark	11	86.8	62.4	21.8	194	5.16	44.9	38.4
Embark	13	77.0	62.5	22.3	195	6.91	43.3	38.0
Embark	15	84.5	62.0	21.6	195	5.77	46.5	38.7
Check	0	106.2	62.8	22.4	195	5.50	46.2	40.2
$\bar{x}$		87.971		22.0		5.98	45.53	39.10
F[3/]		.691		.921		1.01	.853	1.60
S.E.$\bar{x}$		12.87		.297		.821	1.37	.700
C.V.%		14.63		1.35		13.71	3.00	1.79
L.S.D.(.05)		38.76		.895		2.47	9.04	2.11

1/ Embark (MBR 12325) is a growth regulator compound manufactured by SM. Common name - mefluidide.
2/ Kernels/head and 1000 kernel weight determined by processing 25 random heads per plot.
3/ F - value for treatment comparison.

APPLICATION DATA:

Date: 6/15/79
Air Temperature: 50°F
Soil Temperature: 76°F
Humidity: 52%
Wind: 0-calm
Volume: 25.9 gpa
Nozzle: 8003
PSI: 32
Grain: 4-8" high tillering

Table 3. Effects of the growth regulator compound Embark on growth characteristics of established pasture, Northwestern Agricultural Research Center, Kalispell, MT, 1979. Field No. F-2.

Treatment	Rate #/A	Height(Inches) grass spp. 1st 6/27	Height(Inches) grass spp. 2nd 7/11	Height(Inches) Downy brome 1st 6/27	Height(Inches) Downy brome 2nd 7/11	Phyto to grass spp.
Embark 1/	.125	5.0*	7.7	9.0*	13.7	
Embark	.25	3.8*	6.0	7.7*	12.0	Very mild dry appearance
Embark	.38	MH	6.0	7.3	12.3	Dry, slight burn at tips
Embark	.50	MH	4.3	7.3	11.0	Dry, slight burn at tips
Check	0	8.7*	11.6	10.0**	17.7	

MH = Mowed height = approximately three inches.
* = Indicates some plants within plots were flowering.
** = Indicates some plants within plots were in seeding stage.
1/ = Embark (MBR 12325) is a growth regulator compound manufactured by 3M, common name - mefluidide.

APPLICATION DATA:

Date:	6/1/79
Air Temperature:	73°F
Soil Temperature:	74°F
Humidity:	28%
Wind:	0-3 mph
Nozzle:	8003
PSI:	40
Volume	25.9
Soil Type:	Creston Silt Loam (pH 8 O.M. 5%
Plots mowed:	6/5/79 to 3" height

Grass (height at appln)		% Occupancy
Crested wheatgrass	5-6"	2% (less)
Russian wild rye	5-6"	93
Downy brome	4-5"	5

No obvious growth differences noticed 7/18/79. Treatments effect broke about 7/31/79 for the plots on an average.

Table 4. Effects of the growth regulator compound Embark on growth responses of established pasture. Northwestern Agricultural Research Center, Kalispell, MT, 1979.

Treatment	Rate #/A	Phyto[2]	Height of plant species present, 4 and 6 weeks after application[1]															
			Bluegrass		Orchard-grass		Red Clover		White Clover		Dandelion (dia.)		Spring Beauty		Silene		Black Medic	
			6/27	7/11	6/27	7/11	6/27	7/11	6/27	7/11	6/27	7/11	6/27	7/11	6/27	7/11	6/27	7/11
Embark	.125	Sl-M RC	4.0	12.3	8.0	9.0	9.0	15.3	4.3*	7.7	13.0*	10.0	1.8	4.0	NP	NP	2.7*	4.0
Embark	.25	Sl-M RC	3.7	11.7	6.0	8.3	6.7	11.7	3.7	7.7	8.7	10.3	1.3	3.7	NO	5.7	1.3	3.3
Embark	.38	Sl-M RC	MH	11.3	4.7	7.7	6.3	12.3	4.2	6.3	8.3	9.3	1.5	3.3	2.3	4.7	2.3*	4.0
Embark	.50	Sl-M RC Sld G	MH	10.7	MH	6.3	5.7	12.7	3.7	7.7	3.3	8.3	1.5	3.7	NP	NP	1.7	4.0
Check	0		7.0	15.7	13.0	13.0	10.0*	16.3	10.0*	11.3	12.0	12.7	5.0	6.3	11.0	18.0*	4.0*	7.0

1/ Weed heights taken on two dates; approx. 4 and 6 weeks after application. Weed species start at the left with most prevalent and proceed across the table as contributing less to percent occupancy.
Bluegrass 40%; orchardgrass 15%; Red clover 15%; White clover 15%; dandelion 10%; Spring beauty 2%; Silene 1.5%; Black medic 1.5%.

2/ Phytotoxicity: plant species effected were Red clover at all rates and the grass species at the .5# rate.
Sl = slight; M = moderate; RC = red clover; G = grasses; Sld = slight dryness.

* Indicates the species was flowering at time of observation.

MH - Mowed Height (approx. 3"); NP = Not Present; NO = Not Observed.

Lower rates (.125 and .25) broke about 7/4/79 and higher rates began to resume normal growth habits about one week to 10 days later (7/14/79).

APPLICATION DATA:

Date	6/1/79	Wind	0-3 mph
Air temperature	75°F	Nozzels	8003
Soil temperature	74°F	Volume	25.9 gpa
Humidity	39%	PSI	40
Soil Type	Creston silt loam pH 8 O.M. 5%		
Plots Mowed 6/5/79 to approximate 3" high			

Plant Heights at Application

Orchardgrass	6"
Bluegrass	8"
Clovers	5"
Dandelions	4"

All other species less than 4"

TITLE: Winter Wheat

PROJECT: Small Grain Investigation MS 756

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperator - G. A. Taylor
Cooperating Agencies - Montana Agricultural Experiment Station, MSU
Montana Wheat Research & Marketing Committee

LOCATION: Northwestern Agricultural Research Center and L. B. Claridge farm, Kalispell, MT.

OBJECTIVES:

1) To obtain information necessary to make varietal recommendations and evaluate new varieties and selections.

2) To obtain from a cooperative program with the USDA-SEA-AR in the Pacific northwest wheat germ plasm or varieties that have resistance to TCK smut (dwarf smut) and stripe rust.

3. To find a fungicide that will aid in the control of TCK smut.

1979 EXPERIMENTS:

1. Western Regional Hard Red Winter Wheat Nursery
   (a) Kalispell
   (b) Stillwater
2. Western Regional White Winter Wheat Nursery
   (a) Kalispell
   (b) Stillwater
3. Elite Yellow Rust Nursery
   (a) Kalispell
   (b) Stillwater
4. Fungicide study - paired plots in the western regional white winter wheat nursery
   (a) Stillwater

1979 RESULTS:

Western Regional Hard Red Winter Wheat Nursery - Kalisepll

Favorable moisture, low incidence of snow mold, and a long growing season were instrumental in higher than normal yields from the hard red winter winter wheat nursery this year. The yields ranged from 52.42 bu/a to 108.37 bu/a with ten entries yielding significantly lower than the check, Wanser. Test weights differed from the check significantly, however four were significantly less.

The occurrence of high percent survivals would testify to the low incidence of snow mold this year (see Table 1). Lodging was heavy in six entries, one of which was Kharkof. There was a moderate level of leaf rust throughout this study and some varieties such as ID 154, UT 890152 and ID 178 exhibited moderate susceptibility to it. Powdery mildew was heavy throughout the study with only one variety, Weston, showing a high level of resistance. There was no dwarf smut found in the susceptible varieties in this test, thus this season we do not have an evaluation of the resistance of the varieties grown in 1979. Table 1.

1979 Results (con't)

Western Regional Hard Red Winter Wheat Nursery - Stillwater

Yields from the Stillwater nurseries were slightly above average and ranged from 35.26 bu/a to 52.05 bu/a. Kharkof and ten other varietius had test weights significantly less than Wanser, the check. Snow mold was not a factor in survival in 1979. The stand of UT930082 was the lowest in the study at 80 %. TCK smut was not found in the susceptible varieties, thus we do not have an evaluation of the resistance of the varieties tested in 1979. Table 2.

Western Regional White Winter Wheat Nursery - Kalispell

Yields were higher than average. Nine varieties significantly out yielded McDermid which was used as the check. Luke was second in yield at 114.2 bu/a. Only four entries ID755314, Nugaines, Elgin and Kharkof had test weights above or equal to the wheat standard. Stands throughout the test were reduced by snow mold. WA 6471 and OR739401 were reduced in stands up to 49%. WA6470, WA6363, WA6581 and ID 755314 exceeded an 80% stand. TCK smut was present in the susceptible varieties at a low level, with Kharkof being the highest. It is difficult to tell from this test if the zero readings are escapes or real. OR68007 and WA6470 did not contain any smut. Powdery mildew was found at high levels throughout the nurseries. The following varieties were found to be relatively free of the disease, ID45318, OR680073, ID755314, Or68007 and McDermid. Table 3.

Western Regional White Winter Wheat Nursery - Stillwater

Yields were higher than average for white winter wheat grown at Stillwater. Four varieties, yielded significantly lower than the check and among these were Moro and Nugaines. Test weights were slightly less than normal with four varieties varying significantly from the check, McDermid. Tiller counts per foot of row showed that approximately 50% of the entries had significantly lower tiller counts than McDermid, the check.

Very little winter kill due to snow mold was observed. There was not any TCK smut in this test, so we are unable to evaluate these lines for resistance. Table 4.

Elite Yellow Rust Dwarf Smut Winter Wheat Nursery - Kalispell

Several entries in this nursery provided excellent yields, four of which were significantly greater than the check variety, Crest. Test weights were normal except for three varieties that were significantly lower than the check (see Table 5). All but two entries headed significantly later than Crest, Crest being an early maturing variety. Winter kill due to snow mold did not exceed 10% except in the case of MT77069 which had a 16% plant reduction due to the disease. Stem lodging was moderate throughout the test but was severe in the varieties Cardon, Hansel and Jeff. The incidence of leaf rust (Puccinia sp) was moderate for the test on the average but was severe in Jeff and MT77077. Several other varieties were moderately susceptible, but not significantly different from the check. Powdery mildew (Erysiphe graminis) was severe in the variety Cardon, which had a significantly higher rate of infection than Crest. Several other varieties were moderately or at least slightly susceptible to the mildew organism. Table 5.

1979 Results (con't)

Elite Yellow Rust-Dwarf Smut Winter Wheat Nursery - Stillwater

Yields were average for all varieties in this nursery at Stillwater. Test weights ran a little lower than usual with eight varieties having weights significantly lower than Crest, the check. Winter kill due to snow mold was not significant throughout the test although one variety (Cardon) had a 17.5% reduction in stand due to snow mold. Lodging was slight in this nursery. Table 6.

WINTER WHEAT VARIETIES RECOMMENDED FOR WESTERN MONTANA

Hard Red Varieties

1. Crest - dryland
2. Winalta - dryland
3. Cheyenne - dryland

Soft White Varieties

1. Luke - dryland or irrigated

CHARACTERISTICS OF RECOMMENDED VARIETIES

1. Crest
   a. Bearded variety, developed in Montana
   b. High yielding potential in dwarf smut and stripe rust areas
   c. Tall type
   d. Maturity - early to mid-season
   e. Good test weight
   f. Weak straw strength
   g. Moderate shattering resistance
   h. Resistant to stripe rust
   i. Moderate resistance to dwarf smut
   j. Susceptible to stem rust and sawfly infestation
   k. Not extremely winter hardy
   l. Adequate baking and milling quality

2. Winalta
   a. Bearded variety
   b. Fair yielding
   c. Tall type
   d. Maturity - early to mid-season
   e. Good test weight
   f. Weak straw strength
   g. Good shattering resistance
   h. Susceptible to dwarf smut and sawfly infestations
   i. Resistant to stripe rust
   j. Moderate resistance to stem rust

3. Cheyenne
   a. Bearded variety
   b. Good yielding ability
   c. Tall type
   d. Maturity - early to mid-season
   e. Good test weight
   f. Weak straw strength
   g. Susceptible to shattering
   h. Moderate resistance to stripe rust
   i. Susceptible to dwarf smut, stem rust and sawfly infestation
   j. Good milling and baking qualities

Recommended Winter Wheat Varieties (con't)

Soft White Varieties

1. Luke

a. Bearded variety
b. Good yielding ability
c. Semi-dwarf type
d. Maturity - mid-season
e. Fair test weight
f. Poor to fair straw strength
g. Resistant to shattering
h. Resistant to dwarf smut and stripe rust
i. Foot rot tolerant
j. Good baking and milling quality for cake flours

Table 1. Agronomic data from the western regional hard red winter wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field E-2. Random block design, four replications.

Date seeded: September 25, 1978 Date harvested: August 10, 1979 Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Heading Date	Height Inches	% Survival	Lodging %	Lodging Sev.	Leaf Rust %	Leaf Rust Sev.	Mildew %	Mildew Sev.
UT 89099	DM/178383//CLM/4/DM/3/UT	108.27	61.75	163.50	40.94b	94.75	7.50	1.75	25.00	3.00a	86.25	4.75
UT 930082	DM/178383//CLM/3/SCT/4/B	107.35	61.90	165.25a	48.33	94.25	.00	.00	2.50	.25	56.25	3.75
WA 6365	Koelz7941/2*McCall	100.47	61.45	167.25a	50.98	96.50	32.50	3.00	10.00	.75	63.75	3.75
WA 6582	Suwon92/6*Burt//Falco/2*	99.23	58.35b	166.50a	34.84b	95.75	.00	.00	.00	.00	57.50	3.75
ID 158	Heglar/ID5006	98.82	62.07	166.00a	45.87b	97.00	18.75	1.50	5.00	.50	76.25	4.50
WA 6364	Koelz7941/2*McCall	98.77	63.17	166.75a	47.24	96.75	12.50	1.75	.00	.00	83.75	3.75
CI 13844	Wanser 1/	97.99	62.97	164.00	48.82	97.75	.00	.00	22.50	1.25	67.50	3.50
WA 6473	14484/3/Bezo-1/Bnk1205//	94.92	57.07b	167.50a	34.74b	94.50	.00	.00	2.50	.25	37.50	3.00
ID 745520	Weston	94.39	62.67	162.00b	48.03	87.25b	20.00	3.50a	10.00	1.00	2.50b	.75b
WA 6367	Suwon92/Burt//Wanser	93.14	60.45	163.75	36.52b	96.75	.00	.00	.00	.00	94.75	7.25a
ID 178	SNR64/II-60-155//Heglar/	89.24	60.70	163.25	47.74	96.25	73.75a	5.75a	32.50	3.00a	16.25b	1.50
ID 180	Turkey/Burt//Bezostaja	88.33	61.27	166.75a	45.08b	97.25	20.00	1.75	2.50	.50	82.50	4.25
ID 176	II-60-155/CI14106//McCal	81.41	61.77	167.25a	49.61	95.75	36.25	4.50a	12.50	.50	25.00b	1.75
ID 156	RNG/5/UT/UT/4/SN/3/7*Lee	79.49	62.15	164.50	47.34	88.50b	60.00a	5.75a	.00	.00	72.50	4.25
UT 890152	DM/178383//CLM/4/DM/3/UT	78.84	56.00b	167.25a	44.49b	96.50	41.25a	4.25a	32.50	1.50	76.25	5.25
UT 927124	178383/IT//DM/3/WN/4/BUR	78.55b	61.97	165.25a	50.39	99.25	45.00a	4.25a	6.25	.50	62.50	4.50
ID 51022	Bezo//Burt/178383/3/ARK	77.41b	61.40	161.25b	50.00	99.00	20.00	1.25	.00	.00	68.75	5.75a
ID 179	A667W-46/Ranger	76.68b	61.72	167.00a	48.03	98,00	88.75a	7.25a	.00	.00	67.50	4.00
UT 927140	178383/IT//DM/3/WN/4/BUR	76.30b	62.32	164.50	50.49	97.25	36.25	3.50a	.00	.00	45.00	3.00
ID 51031	Bezo//Burt/178383/ID5011	76.04b	59.22b	164.50	50.79	98.50	40.00a	4.25a	3.75	.50	27.50b	2.50
ID 154	BSN//KO/178383/3/II-60-1	75.82b	60.32	166.75a	44.69b	97.00	54.75a	4.75a	40.00	2.00	21.25b	1.75
ID 51021	Bezo//Burt/178383/3/ARK	74.95b	61.60	161.50b	45.67b	97.75	21.25	3.00	10.00	.50	56.25	4.00
ID 157	CI14106/MC13/WRR//KO/178	71.41b	60.67	165.00	48.23	97.00	59.75a	6.00a	15.00	1.00	71.25	4.25
CI 1442	Kharkof	58.34b	59.65b	168.75a	52.07	96.25	66.25a	5.50a	7.50	.50	35.00b	2.00
ID 51032	ID5011/WA4765//ID5011	52.42b	54.90b	171.75a	50.89	96.25	78.50a	7.75a	22.50	1.25	25.00b	2.75
	$\bar{x}$	85.14	60.70	165.51	46.47	96.07	33.32	3.24	10.50	.75	55.14	3.61
	F 2/	3.97**	4.29**	33.05**	40.89**	2.55**	3.94**	3.95**	2.19**	3.39**	5.32**	3.57**
	S.E.$\bar{x}$	7.14	1.03	.41	.77	1.73	13.61	1.19	8.08	.47	10.84	.76
	L.S.D.(.05)	20.15	2.89	1.16	2.16	4.88	38.38	3.37	22.77	1.32	30.58	2.15
	C.V. %	8.39	1.69	.25	1.65	1.80	40.85	36.86	76.91	62.28	19.67	21.14

1/ Check variety

2/ F - value for variety comparison

* Indicates statistical significance at the .05 level.

a/ Values significantly greater than the check at the .05 level

b/ Values significantly less than the check at the .05 level

** Indicates statistical significance at the .01 level

Table 2. Agronomic data from the western regional hard red winter wheat nursery grown on the Lance Claridge farm, Kalispell, MT in 1979. Random block design, four replications.

Date seeded: September 28, 1978 Date harvested: August 16, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Height Inches	% Survival	Lodging %	Lodging Sev.
UT 89099	DM/178383//CLM/4/DM/3/UT	52.05	54.20b	34.25b	100.00	.00	.00
ID 158	Heglar/Id5006	50.00	56.60	27.07b	96.25	.00	.00
WA 6364	Koelz7941/2*McCall	49.87	58.50	35.53b	100.00	.00	.00
ID 745520	Weston	48.94	56.88	34.84b	100.00	2.50	2.00
UT 890152	DM/178383//CLM/4/DM/3/UT	47.87	52.25b	34.45b	100.00	.00	.00
ID 180	Turkey/Burt//Bezostaja	47.72	57.00	25.00b	97.50	.00	.00
WA 6367	Suwon 92/Burt//Wanser	47.64	53.42b	25.00b	100.00	.00	.00
WA 6582	Suwon 92/6*Burt//Falco/2*	47.30	53.85b	22.64b	96.25	.00	.00
ID 156	RNG/5/UT/UT/4/SN/3/7*Lee	47.20	56.82	34.35b	100.00	.00	.00
CI 13844	Wanser 1/	46.70	57.32	38.09	100.00	.00	.00
UT 927140	178383/IT//DM/3/WN/4/Bur	46.03	55.30	40.94a	100.00	.00	.00
WA 6473	14484/3/Bezo.1/BNK1205//	45.95	53.25b	22.44b	100.00	.00	.00
ID 178	SNR64/II-60-155//Heglar/	45.89	53.20b	25.59b	100.00	12.50	2.50
ID 154	BSN//KO/178383/3/II-60-1	45.84	55.80	22.74b	100.00	.00	.00
ID 51022	Bezo//Burt/178383/3/ARK	44.73	57.65	40.65a	100.00	12.50	2.25
ID 51021	Bezo//Burt/178383/3/ARK	44.71	57.15	39.86a	100.00	2.50	2.00
WA 6365	KOELZ7941/2*McCall	43.64	55.20	34.65b	100.00	10.00	1.50
ID 157	CI14106/MC13/WRR//KO/178	43.05	55.77	35.83b	100.00	.00	.00
ID 51031	Bezo//Burt/178383/ID5011	41.63	53.50b	38.29	100.00	.00	.00
ID 179	A667W-46/Ranger	41.25	56.07	24.11b	100.00	.00	.00
UT 927124	178383/IT//DM/3/WN/4/BUR	40.26	54.57b	40.94a	100.00	6.25	1.75
ID 176	II-60-155/CI14106//McCal	39.80	56.70	36.22b	100.00	.00	.00
UT 930082	DM/178383//CLM/3/SCT/4/B	39.71	52.77b	40.65a	80.00	.00	.00
CI 1442	Kharkof	36.16b	52.95b	40.35a	100.00	.00	.00
ID 51032	ID5011/WA4765//ID5011	35.26b	52.17b	40.16a	100.00	.00	.00
	$\bar{x}$	44.77	55.16	33.39	98.80	1.85	.48
	F 2/	2.64**	5.57**	774.52**	.95NS	1.23NS	1.25NS
	S.E.$\bar{x}$	2.62	.80	.24	4.18	3.59	.79
	L.S.D.(.05)	7.38	2.25	.69	11.79	10.12	2.24
	C.V. %	5.85	1.45	.73	4.23	193.90	165.42

1/ Check variety
2/ F - value for variety comparison
a/ Values significantly greater than the check at the .05 level
b/ Values significantly less than the check at the .05 level
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Table 3. Agronomic data from the western regional white winter wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. E-2. Random block design, four replications.

Date seeded: September 25, 1978 Date harvested: August 10, 1979 Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Heading Date	Height Inches	% Surv.	Smut[3/] Count	Leaf Rust %	Leaf Rust Sev.	Powdery Mildew %	Powdery Mildew Sev.
WA 6155	CI13431/CI7805//CI13447	114.58a	59.22	167.00a	33.27	68.00	2.25	.00	.00	86.25a	4.50a
CI 14586	Luke	114.20a	57.97	169.00a	32.58	78.50	.25	.00	.00	10.00	1.25
WA 6363	Luke/WA 5829	104.75a	58.35	169.00a	32.28	82.25	.50	.00	.00	25.00a	1.50
ID 775323	WA4765//Burt/PI178383	103.82a	57.87	165.75a	33.66	71.25	.75	.00	.00	3.75	.25
WA 6581	VD 67217/VB 67297	103.21a	59.85	168.50a	31.50	84.75	2.25	17.50	1.00	60.00a	3.50a
WA 6472	Semidwarf Multiline Club	102.87a	59.60	167.00a	32.68	79.50	1.75	30.00	2.25	55.00a	3.75a
WA 6850	CI 14484/K 691533	101.90a	59.77	166.25a	32.58	75.25	1.50	17.50	1.25	31.25	2.50a
OR 74131	Pendleton Sel. No. I-372	101.88a	59.43	165.25	37.01a	70.75	.75	5.00	.50	41.25a	3.25a
WA 6242	Luke/(VH66387, Itana	101.71a	60.63	164.75	33.96	63.75	.50	.00	.00	50.00a	2.75a
WA 6470	Luke/Norco, VH74333	100.25	56.00b	168.25a	31.30	82.75	.00	..00	.00	11.25	.75
OR 65116	Stephens	100.16	59.30	162.25b	35.24a	77.75	.75	17.50	1.00	17.50	2.00a
ID 745318	WA4765//Burt/PI178383	99.38	57.07	164.75	33.76	72.25	.25	.00	.00	.00	.00
OR 7142	Suwon 92/3 Omar//Moro	98.38	60.12	164.25	34.65	72.00	1.00	.00	.00	26.25a	1.75a
OR 7493	Pendleton Sel. No. I-607	98.17	56.55	166.00a	28.54b	61.25	.25	20.00	1.00	35.00a	2.25a
CI 14564	Hyslop	98.09	59.10	164.75	32.28	65.00	.75	5.00	.50	10.00	1.00
OR 680073	Yamhill/Hyslop	96.43	58.35	166.25a	35.93a	73.25	.25	8.75	.50	.00	.00
OR 67237	CD/Sel.101//55-1744/3/DC	96.32	59.38	165.00	35.33a	66.25	1.25	3.75	.25	11.25	1.00
CI 13740	Moro	96.32	60.62	165.50	40.94a	77.50	1.25	15.00	1.75	10.00	1.50
OR 739401	Oregon Sel. R73-9401	95.37	58.80	164.75	32.38	54.25b	1.25	16.25	1.00	25.00a	2.50a
ID 755314	WA4765/Burt/PI178383	95.22	61.32a	165.75a	43.70a	82.50	.75	.00	.00	.00	.00
OR 68007	Yamhill/Hyslop	94.36	58.68	167.00a	35.53a	67.50	.00	11.25	.75	.00	.00
OR 7147	Faro	94.22	58.77	165.00	33.17	58.75	.50	.00	.00	27.50a	2.25a
CI 11755	Elgin	94.08	61.20a	166.75a	44.29a	78.25	2.50	.00	.00	55.00a	3.25a
CI 13968	Nugaines	93.69	61.88a	164.50	31.99	67.50	2.25	12.50	1.00	22.50	1.25
ID 755312	WA4765/Burt/PI178383	91.76	58.15	166.25a	34.55	61.75	2.00	.00	.00	3.75	.25
CI 14565	McDermid[1/]	88.05	58.45	164.00	32.78	77.00	1.00	20.00	1.25	.00	.00
WA 6471	CI15923//Nord Desperz/2	87.48	59.57	166.25a	30.12b	51.25b	.50	2.50	.25	.00	.00
CI 1442	Kharkof	78.08	61.40a	163.25	47.44a	80.00	4.25a	10.00	1.25	20.00	2.25a
	$\bar{x}$	98.03	59.19	165.82	34.77	71.46	1.12	7.59	.55	22.77	1.62
	F[2/]	2.42**	2.92**	9.05**	25.59**	1.66*	2.46**	1.50NS	1.54NS	7.30**	6.09**
	S.E. $\bar{x}$	4.72	.84	.54	.86	6.91	.61	7.06	.51	8.27	.54
	L.S.D.(.05)	13.27	2.36	1.53	2.42	19.45	1.72	19.86	1.43	23.26	1.51
	C.V. %	4.81	1.42	.33	2.47	9.68	54.64	93.01	91.65	36.32	33.15

Table 3 . (con't)

1/ Check variety
2/ F - value for value comparison
a/ Values significantly greater than the check at the .05 level
b/ Values significantly less than the check at the .05 level
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level
3/ Number smutty heads/12 feet of row, approximately 300 to 400 head per 12 feet of row.

Table 4. Agronomic data from the Western Regional White winter wheat nursery grown on the Lance Claridge farm, Kalispell, MT in 1979. Random block design, four replications.

Date seeded: September 28, 1978 Date harvested: August 16, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Tiller per Ft.	% Survival
WA 6363	Luke/WA 5829	54.78	54.35	36.19b	100.00
CI 14565	McDermid 1/	54.68	52.17	44.88	100.00
CI 14564	Hyslop	54.36	52.13	40.06	100.00
OR 67237	CD/Sel.101//55-1744	53.68	54.00	35.63b	100.00
OR 74131	Pendleton Sel. No.I-372	53.57	53.25	35.44b	100.00
OR 7493	Pendleton Sel. No.I-607	52.88	51.85	37.13	100.00
OR 739401	Oregon Sel. R73-9401	52.72	52.13	39.56	100.00
OR 7147	Faro	52.69	51.77	40.25	100.00
OR 65116	Stephens	52.59	52.47	37.94	100.00
OR 7142	Suwon 92/30Mar//Moro	52.53	53.00	39.75	100.00
ID 775323	WA4765//Burt/PI 178383	52.35	49.35	34.44b	100.00
WA 6155	CI13431/CI7805//CI13447	52.30	51.57	36.94b	100.00
ID 745318	WA 4765//Burt/PI 178383	51.78	48.27b	41.81	100.00
CI 1442	Kharkof	51.29	57.15a	36.94b	100.00
WA 6850	CI 14484/K 691533	51.08	52.00	34.94b	100.00
WA 6472	Semidwarf Multiline Club	50.79	50.67	34.31b	100.00
ID 755312	WA4765/Burt/PI178383	50.79	52.17	31.88b	100.00
CI 14586	Luke	50.38	53.02	40.69	100.00
ID 755314	WA4765/Burt/PI178383	49.87	55.32a	35.31b	100.00
OR 680073	Yamhill/Hyslop	48.68	50.40	34.44b	100.00
WA 6581	VD 67217/VB 67297	48.45	53.90	34.19b	100.00
OR 68007	Yamhill/Hyslop	48.45	49.90	37.38	100.00
WA 6242	Luke/(VH66387,Itana	48.45	53.65	35.63b	100.00
CI 11755	Elgin	48.39	54.82	38.31	100.00
WA 6471	CI15923//Nord Desprez	48.04b	52.72	35.38b	100.00
CI 13968	Nugaines	48.00b	55.63a	39.63	93.75b
CI 13740	Moro	43.41b	51.70	35.50b	100.00
WA 6470	Luke/Norco, VH74333	42.48b	50.00	42.63	100.00
	$\bar{x}$	50.70	52.48	37.40	99.78
	F 2/	1.74*	3.75**	1.18NS	2.78**
	S.E.$\bar{x}$	2.31	1.03	2.76	.71
	L.S.D. (.05)	6.49	2.89	7.76	1.99
	C.V. %	4.55	1.96	7.37	.71

1/ Check variety
2/ F - value for variety comparison
a/ Values significantly greater than the check at the .05 level
b/ Values significantly less than the check at the .05 level
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Table 5. Agronomic data from the Elite Yellow Rust Smut winter wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field E-2. Random block design, four replications.

Date seeded: September 23, 1978 Date harvested: August 10, 1979 Size of plot: 32 sq. ft.

C.I. or State #	Variety	Yield Bu/A	Test Wt. Lbs/Bu.	Heading Date	Height Inches	% Survival	Lodging %	Lodging Sev.	Leaf Rust %	Leaf Rust Sev.	Mildew %	Mildew Sev.
CI 14586	Luke	115.65a	57.55b	168.50a	33.27b	93.75	.00b	.00b	6.25	.50b	12.50	1.00
MT 77090	DM/CRT	106.50a	61.13	162.50a	46.56a	91.75	.00b	.00b	23.75	1.25b	12.50	1.00
CI 14565	McDermid	104.66a	59.07b	164.50a	33.17b	97.75	.00b	.00b	7.50	.75b	27.50	1.25
MT 7579	Crest Line Row 40	103.17a	61.77	161.25	41.14	96.00	35.00	6.00	41.25	2.00	27.50	2.25
MT 77056	C61-9/WLT//CRT	99.75	59.85	167.50a	48.13a	96.50	21.25	3.25	60.00	2.50	.00	.00
MT 77077	C61-9/WLT/ /CRT	98.21	61.12	167.75a	47.34a	99.50	22.50	2.00	68.75a	2.50	7.50	.75
MT 77066	C61-9/WLT//CRT	91.74	60.80	167.75a	47.05a	96.00	22.50	3.50	46.25	1.75	41.25	3.00
MT 77068	C61-9/WLT//CRT	90.40	60.22	167.75a	46.56a	95.00	31.25	4.00	37.50	1.75	67.50	4.00a
CI 15317	Franklin	89.18	61.05	165.75a	50.49a	96.75	30.00	4.50	21.25	1.00b	17.50	.25
CI 12930	Westmont	88.23	62.32	160.50	47.05a	97.25	16.25	2.00	62.50	3.00	53.75	3.00
CI 13880	Crest 1/	85.60	61.90	161.00	43.21	97.75	33.75	4.25	31.25	3.00	30.00	1.50
MT 77069	DM/CRT	84.57	62.27	166.25a	46.65a	84.00b	47.25	5.75	55.00	2.50	5.00	.25
CI 17295	Cardon	82.50	61.22	165.00a	47.64a	98.25	82.25a	7.50	2.50	.25b	90.00a	4.00a
CI 17296	Hansel	82.33	61.93	164.75a	49.61a	98.25	78.75a	6.75	7.50	.50b	25.00	2.00
CI 17270	Jeff	81.34	62.15	164.25a	51.08a	96.00	94.50a	6.25	77.50a	3.00	38.75	2.25
MT 77079	C61-9/WLT//CRT	80.33	59.18b	167.75a	47.83a	97.50	36.25	5.25	32.50	1.75	37.50	2.50
	$\bar{x}$	92.76	60.85	165.17	45.42	95.75	34.47	3.81	36.33	1.75	30.86	1.81
	F 2/	3.32**	2.23*	48.24**	39.27**	2.13*	6.21**	4.56**	4.75**	4.65**	2.54**	2.82**
	S.E. $\bar{x}$	5.84	.91	.39	.85	2.51	11.54	1.15	10.98	.44	15.08	.76
	L.S.D.(.05)	16.64	2.59	1.10	2.43	7.14	32.87	3.27	31.28	1.26	42.95	2.16
	C.V. %	6.30	1.49	.23	1.88	2.62	33.48	30.11	30.23	25.24	48.87	41.86

1/ Check variety
2/ F - value for variety comparison
a/ Values significantly greater than the check at the .05 level
b/ Values significantly less than the check at the .05 level
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Table 6. Agronomic data from the Elite Yellow Rust Smut winter wheat nursery grown on the Lance Claridge farm, Kalispell, MT in 1979. Random block design, four replications.

Date seeded: September 28, 1978 Date harvested: August 16, 1979
Size of plot: 32 sq. ft.

C.I. or State No.	Variety	Yield Bu/A	Test Wt. Lbs/Bu	% Survival	Lodging %	Lodging Sev.
CI 14565	McDermid	38.79	52.80b	100.00	.00	.00
MT 77090	DM/CRT	38.46	53.85b	100.00	.00	.00
MT 77056	C61-9/WLT//CRT	38.40	56.20	100.00	.00	.00
CI 12930	Westmont	38.18	55.65	100.00	.00	.00
MT 77077	C61-9/WLT//CRT	37.81	54.90b	100.00	.00	.00
CI 17295	Cardon	37.21	57.05	82.50	2.50	.75
CI 14586	Luke	37.15	52.70b	100.00	.00	.00
CI 17270	Jeff	37.02	56.40	100.00	5.00	.75
MT 77066	C61-9/WLT//CRT	36.79	53.40b	96.25	.00	.00
MT 77069	DM/CRT	34.47	53.45b	100.00	.00	.00
MT 77079	C61-9/WLT//CRT	34.30	54.30b	100.00	.00	.00
MT 7579	Crest Line Row 40	34.20	56.50	97.50	6.25	.75
CI 13880	Crest 1/	34.00	56.55	100.00	.00	.00
CI 15317	Franklin	33.02	55.55	100.00	.00	.00
MT 77068	C61-9/WLT//CRT	32.96	54.35b	97.50	.00	.00
CI 17296	Hansel	32.11	56.50	100.00	.00	.00
	$\bar{x}$	35.93	55.01	98.36	.86	.14
	F 2/	1.50NS	6.96**	.97NS	.86NS	.83NS
	S.E. $\bar{x}$	1.86	.56	4.47	2.14	.33
	L.S.D.(.05)	5.29	1.59	12.73	6.08	.95
	C.V. %	5.17	1.02	4.54	248.47	236.02

1/ Check variety
2/ F - value for variety comparison
a/ Values significantly greater than the check at the .05 level
b/ Values significantly less than the check at the .05 level
* Indicates statistical significance at the .05 level
** Indicates statistical significance at the .01 level

Table 7. Ten year summary for yields for the western regional white winter wheat nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT 1970-79.

C.I. or State No.	Variety	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Ave.	Sta. Yrs.	% Nugaines
CI 1442	Kharkof	56.4	62.1	59.7	45.3	27.7	37.4	61.1	50.7	16.9	78.1	49.5	10	70
CI 11755	Elgin	74.1	73.0	70.8	50.9	59.2	42.3	67.6	57.8	21.3	94.1	61.1	10	86
CI 13740	Moro	75.4	68.3	68.5	65.6	60.3	44.0	69.8	57.0	27.8	96.3	63.3	10	89
CI 13968	Nugaines	77.6	102.8	73.0	68.5	77.9	51.8	80.2	66.0	18.9	93.7	71.0	10	100
CI 14564	Hyslop	87.3	113.1	90.1	63.1	96.3	56.8	87.7	68.3	36.9	98.1	79.8	10	112
CI 14565	McDermid	88.8	111.9	95.8	63.4	84.7	57.1	93.3	72.9	18.6	88.1	77.5	10	109
CI 17596	Stephens (OR65116)				61.6	81.2	52.3	82.1	60.6	23.4	100.2	65.9	7	101
CI 17590	Faro (OR7147)					85.4	53.5	74.9	65.2	25.4	94.2	66.4	6	103
OR 7142	Suwon 92/3*Omar//Moro,142						51.4	74.1	66.9	28.3	98.4	63.8	5	103
OR 680007	Yamhill/Hyslop							92.1	75.5	25.1	94.4	71.8	4	111
OR 67237	CD/Sel.101//55-1774/3/DC							89.9	68.8	21.4	96.3	69.1	4	107
CI 17725	WA4765/Burt/PI178383 (ID755312)							88.4	66.9	30.2	91.8	69.3	4	107
CI 17726	WA4765/Burt/PI178383 (ID755314)							86.5	60.6	29.1	95.2	67.9	4	105
OR 739401	Oregon Sel. R73-9401							83.8	66.4	15.3	95.4	65.2	4	101
WA 6242	Luke/(VH66387,Itana/CI13431)							83.2	61.7	23.5	101.7	67.5	4	104
WA 6363	Luke/WA5829								70.2	34.2	104.8	69.7	3	117
OR 74131	Pendleton Sel. No. I-372								63.2	28.4	101.9	64.5	3	108
OR 7493	Pendleton Sel. No. I-607								63.2	10.4	98.2	57.3	3	96
ID 775323	WA4755//Burt/PI 178383									28.7	103.8	66.3	2	118
ID 745318	WA4765//Burt/PI 178383									25.3	99.4	62.4	2	111
WA 6470	Luke/Norco, VH74333									29.8	100.3	65.1	2	116
WA 6471	CI15923//Nord Desprez/2									19.5	87.5	53.5	2	95
WA 6472	Semidwarf Multiline Club									30.1	102.9	66.5	2	118
CI 14586	Luke									30.0	114.2	72.1	2	128
OR 680073	Yamhill/Hyslop									29.1	96.4	62.8	2	111
WA 6155	CI13431/CI7805//CI13447										114.6	114.6	1	122
WA 6850	CI14484/K691533										101.9	101.9	1	109
WA 6581	VD67217/VB67297										103.2	103.2	1	110

Ks
VRS

TITLE: No-Till Drill Investigations

PROJECT: Small Grains Investigations MS 756

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperators - Montana Wheat Research & Marketing Committee

LOCATION: Northwestern Agricultural Research Center, Field No. F-4

OBJECTIVES:

1. Evaluate and determine which no-till drill will preform best in establishing a stand of spring barley in winter wheat stubble.

2. To compare the differences between no-till and conventional seeding methods.

MATERIALS AND METHODS:

Three no-till drills and one conventional press drill were evaluated at the Northwestern Agricultural Research Center in 1979. The no-till drills used in this study were a John Deere Powr-till 1500, 701 Melroe, and Morris Seed-Rite. The drill used for conventional methods was a 12 foot International Press drill.

The seedbed preparation for the conventional seeding was as follows: a winter wheat stubble was double disked with a tandem disk and worked with a Morris cultivator containing sweeps, rod weeder and a mulcher. Plots were laid out, 15 feet wide and approximately 180 feet long. The no-till drills were used to seed directly into the barley stubble with no removal of straw or any other preparations of any type. The width of each plot was the width of the drill with a buffer left between each treatment. Approximately three days after seeding all no-till strips were sprayed with .75 lbs/a of glyphosate. The variety of spring barley used was Ingrid and was seeded at 60 lbs/a.

During the growing season the following observations were made; vigor rating on plants, number of plants per square foot and tillers per square foot. The entire area was sprayed for broadleaf weed control using 6 ounces of bromoxynil and 6 ounces of MCPA per acre. We did apply 200 lbs 16-20-0 to this field prior to seeding. Seven hundred and twenty (720) square feet were harvested with the Hege combine. All the data was analyzed statistically using an analysis of variance method.

RESULTS AND DISCUSSION:

The only data found to be statistically significant was the yield data. The highest yielding treatment was where we seeded with the John Deere drill (85.2 bu/a) whereas the International used for conventional seeding was 74.1 bu/a.

Test weights for the no-till drills were all somewhat higher than the International drill. Explanation is not understandable. It was noted that the highest percent plump barley was obtained from the International. The Morris Seed-Rite drill had less plants per square foot. The highest number of tillurs/foot were when we used thu Melroe and the least when we used the Morris Seed-Rite.

Results and Discussion (con't)

At the end of the season there was a higher weed population with the conventional seeding than with the Morris Seed-Rite drill. Whereas, with the John Deere and the Melroe we had little or no weeds at harvest time. Plant heights varied with the plants being shorter when we used the International drill than when the Melroe and John Deere drills were used.

Rainfall after planting was not too heavy and we feel that one of the reasons we obtained the increase in yield with the no-till was due to moisture loss that occurred using the conventional tillage technique. Table 1 shows the data from this study in more detail.

Table 1. Agronomic data from the No-Till Drill Investigation Study. Northwestern Agricultural Research Center, Kalispell, MT in 1979. Field No. F-4. Ingrid barley.

Date seeded: May 11, 1979 Date harvested: August 30, 1979
Size of plot: 720 sq. ft.

Treatment	Yield Bu/A	Test Wt Lbs/Bu.	% Plump	Weeds 1/	Ht. Ins.	Per Sq. Ft. Plants	Per Sq. Ft. Tillers	Average No. Tillers/Plant
Melroe	82.7a	51.2	92	Slight	34.4	5	71	14.2
John Deere	85.2a	51.6	93	Slight	34.5	6	67	11.2
International	74.1	50.9	95	V Severe	32.6	4	62	15.5
Morris Seed-Rite	76.6	51.5	95	Moderate	33.1	5	57	11.4
$\bar{x}$	79.65				33.66	4.92	64.25	
F 2/	7.44*				1.30NS	1.21NS	.778NS	
S.E.$\bar{x}$	1.88				2.12	.518	6.79	
L.S.D.(.05)	6.52				2.89	1.79	23.53	
C.V. %	2.36				2.48	10.54	10.57	

Blanket application of glyphosate at .75 #/A was applied 5/14/79 to all plots, 3 days after seeding.

Growth stage of weeds: spring beauty - 2-3 inches
henbit - seedling to 4 leaves
volunteer grains and grasses - 1-3 inches

1/ Ocular weed observation made prior to harvest
2/ F - value for treatment comparison
a/ Values significantly greater than the check at the .05 level.
* Indicates statistical significance at .05 level

Application Data:

Air temperature:	65°F
Soil temperature:	54°F
Humidity:	30%
Wind velocity:	0
Volume:	20 gpa
Nozzle/PSI	750134/40

TITLE: Effect of Merteck LSP Fungicide on the control of TCK smut in several winter wheat varieties.

PROJECT: Small Grains investigations MS 756

YEAR: 1979

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd K. Keener
Cooperator - J. A. Hoffman
Cooperating Agencies - Montana Agricultural Experiment Station, MSU
Montana Wheat Research & Marketing Committee,
Pacific Northwest Regional Commission,
USDA-SEA-AR

LOCATION: Lance Claridge Farm, Kalispell, MT

OBJECTIVES:

1. To determine the effect of Merteck LSP Fungicide on the control of TCK smut.

2. To determine the effect of Merteck LSP on yield of various varieties of white winter wheat.

MATERIALS AND METHODS:

Using a standard western regional white winter wheat nursery we set up paired plots of treated and untreated seed. All of the seed was treated at the rate of 6 oz/bu. With this brief report we are setting down the results as analyzed with a "t" test. The plots were harvested with the Hege combine, cleaned and several measurements obtained that are shown in Table 1. It should be noted that there was no dwarf smut in 1979. This then gives us an opportunity to study the effect of the fungicide on yields.

RESULTS AND DISCUSSION:

The "t" test was run to measure the difference between the yields of wheat with seed treatment and without seed treatment. These data show that there is a significant difference in yield, with the lower yield being obtained when the seed was treated. Yield for treated seed was 45.3 bu/a for untreated 50.7 bu/a. It was noted that the greater differences between treated and untreated was generally in the Washington varieties, and less in other varieties in the test. This was noted particularly in WA6155, WA6850, WA6581. However, not all Washington varieties had this high difference.

Test weights were not affected materially by seed treatment and the overall analysis shows no significant difference in test weight.

In tiller counts we found that there was no statistical difference in this evaluation, however there are differences in some varieties. Because of seed treatment, Washington varieties WA6155, WA6850 and WA6581 had a lower tiller count. WA6242 and ID75532 had higher tiller counts when seed was treated. It appears evident our yield loss is due to reduction in tiller numbers per foot. This reduction is due to a reduction in germination. Art Dubbs[1/] found in his work the stand loss was due to lower germination of treated seed. Table 1.

1/ Personal communication.

Table 1. Agronomic data from the winter wheat comparison plot nurseries at Stillwater location, Flathead County, Montana in 1979. Northwestern Agricultural Research Center, Western Regional White Wheat Nursery, seed treated and without seed treatment.

Date seeded: September 28, 1978 Date harvested: August 16, 1979
Size of plot: 32 sq. ft.

	Yield Bu/A		Test Weight (lbs/bu)		Tiller/Foot of row	
Variety	No Seed Treatment	Seed Treatment	No Seed Treatment	Seed Treatment	No Seed Treatment	Seed Treatment
Kharkof	51.3	47.6	57.2	56.9	37.0	38.3
Elgin	48.4	46.7	54.8	54.7	38.3	37.4
Moro	43.4	39.2	51.7	50.6	35.5	33.5
Nugaines	48.0	46.9	55.6	54.5	39.7	45.6
Hyslop	54.4	45.9	52.1	51.9	40.1	37.2
McDermid	54.7	48.0	52.2	51.3	44.9	44.5
Stephens	52.6	48.9	52.5	52.6	38.0	37.2
Faro	52.7	47.9	51.8	50.6	40.3	39.1
OR 7142	52.6	49.1	53.0	52.4	38.4	38.0
WA 6242	48.5	47.8	53.7	52.7	35.7	41.1
ID 755312	50.8	46.1	52.2	51.4	31.9	37.4
ID 755314	49.9	46.0	55.3	56.0	35.3	30.2
OR 67237	53.7	48.4	54.0	53.6	35.7	35.4
OR 68007	48.5	44.8	49.9	53.0	37.4	35.2
OR 739401	52.7	47.7	52.1	51.7	39.6	38.7
WA 6363	54.8	45.9	54.4	53.5	36.2	35.2
OR 74131	53.6	51.9	53.3	53.0	35.5	36.4
OR 7493	52.9	44.9	51.9	51.6	37.2	30.0
ID 745318	51.8	48.2	48.3	51.3	41.9	35.5
ID 775323	52.4	47.6	49.4	48.5	34.5	31.0
WA 6470	42.5	43.4	50.0	50.3	42.7	41.9
WA 6471	48.0	47.1	52.7	53.3	35.4	34.2
WA 6472	50.8	47.4	50.7	51.2	34.4	35.7
OR 680073	48.7	46.4	50.4	50.3	34.5	34.8
WA 6155	52.3	31.7	51.6	52.7	37.0	33.9
WA 6850	51.1	36.2	52.0	50.6	35.0	31.0
WA 6581	48.4	31.3	53.9	53.6	34.2	29.5
Luke	50.4	44.7	53.0	51.7	40.7	36.7
t =	31.54934*		.71722 NS		1.89561 NS	

TITLE: Investigations of cropping sequences on the productivity and quality of cereal grains.

YEAR: 1979

LOCATION: Northwestern Agricultural Research Center, Agricultural Experiment Station, Kalispell, MT 59901

PERSONNEL: Leader - Vern R. Stewart
Technician - Todd Keener

OBJECTIVES:
1. To determine the most productive cropping sequence.
2. To determine the effect of cropping sequence on weed populations, fertility levels, and protein levels of wheat.
3. To determine economics of a particular cropping sequence.

PROCEDURES:

In 1972 five cropping sequences were established in plots 3.3 acres in size. This allows for the use of field equipment in all operations. Fertilizer application rates were based on soil analysis and experience over the past several years in these fields. Protein data for the crops was obtained by using the Udhe method of analysis. An economic evaluation was made of this study for an eight year period in which we subtracted only the actual cost of the fertilizer from the gross income. The value of the crop is based on the actual price of hay, wheat and barley in the month of December of the year grown.

RESULTS AND DISCUSSION:

Precipitation for the crop year of 1978-70 was 16.31 inches, which is 2.82 inches lower than the long term average at the research center. April, May and August precipitation was below average.

Sequence R-2: The yield difference which we have found in winter wheat between Sequence R-2 and R-4 in the past did not exist this year. They were very low in both sequences which was probably due to the seeding rate which was too light, insufficient precipitation in June and some winter kill due to snow mold. Yields are 30 to 40 bushel below what we would anticipate with normal rainfall. Test weights were somewhat lighter in R-4 than in R-2.

Comparing barley yields in R-2c and R-4c, we find about a six bushel increase in R-2c. This increase is probably due to plowing down the green manure crop in Sequence R-2c.

Sequence R-3: Winter wheat yields were slightly higher in this rotation than the R-2 and R-4 sequence. However, these yields were not at the level we anticipate because this sequence has been the highest yielding over the years. This sequence also has the highest dollar return per acre of any of the sequences in the study.

In 1979 we obtained one of the best alfalfa yields we have ever had in this study, 4.3 T/A. This can be attributed to the long growing season in which we were able to obtain a third cutting.

Sequence R-4: This has been discussed under the R-2 sequence.

Results and Discussion (con't):

Sequence R-5: This sequence is the second highest in dollar return of the five cropping sequences due to the addition of a legume. In 1979 the hard red winter wheat yields were equal to the soft white winter wheat yields. Alfalfa yields were higher than normal which can be attributed to the August rain and long growing season.

Sequence R-7: High weed populations, mainly quackgrass, have developed in this cropping sequence. Hard red winter wheat yields were lower than the wheat grown on fallow in the R-5 sequence. In 1979 this sequence was third in dollar return per acre, again this is attributed to the legume in the sequence. Table 1 gives the annual data for each of the cropping sequences.

Eight year economic evaluation: In these summaries we have subtracted only the cost of the fertilizer. We have sufficient records of all costs so that at the conclusion of this experiment we will make an economic analysis of total costs. The three sequences being the most productive are R-3 ($93.70/acre); R-5 ($84.17/acre) and R-7 ($80.58/acre) over the eight year period. We have found that the sequences in which we have included alfalfa have been the most productive. The great variations between the sequences in income is due to the price of the commodities. Hay prices have been fairly stable since 1973 selling for $40-$50/ton, whereas the price of small grains has varied from year to year. Complete tabulation of this data can be found in Tables 2, 3, 4, 5 and 6.

Table 1. Annual data from cropping sequence study, Northwestern Agricultural Research Center, Kalispell, MT, 1979

Field Number	Crop	Variety	N	P_2O_5	S	% Protein	Test Weight Lbs/Bu	Yield Per Acre	Price Unit Dollars	Gross Dollars	Ferti-lizer Dollars	Net per Sequence	Dollars Per Acre
		Crop Sequence - 3 years: fallow, winter wheat, spring grain, seed legume with spring grain and plow down as green manure.											
R-2a	Fallow												
R-2b	W.Wheat	Luke	79	40	28		59.1	39.8bu	3.38bu	134.52	25.37		
R-2c	S.Barley	Purcell	62	33	0		48.4	56.4bu	4.00cwt	108.29	20.24		
										242.81	45.61	197.20	65.73
		Crop Sequence - 15 years: five years legumes, winter grain, fallow alternating											
R-3a	Fallow												
R-3b	W.Wheat	Luke	79	40	28		58.0	47.2bu	3.38bu	159.53	25.37		
R-3c	Alfalfa	Thor						4.3T	50.00T	215.00			
										374.53	25.37	349.16	116.39
		Crop Sequence - 3 years: fallow, winter wheat, spring grain.											
R-4a	Fallow												
R-4b	W.Wheat	Luke	79	40	28		57.0	39.8bu	3.38bu	134.52	25.37		
R-4c	S.Barley	Purcell	59	31	0		49.0	50.4bu	4.00bu	96.77	19.18		
										231.29	44.55	186.74	62.25
		Crop Sequence - 9 years: three years legume, winter grain, fallow alternating.											
R-5a	Fallow												
R-5b	W.Wheat	Crest	32	40	28	12.5	61.7	41.1bu	3.99bu	163.99	15.35		
R-5c	Alfalfa	Thor						3.6T	50.00T	180.00			
										343.99	15.35	328.64	109.55
		Crop Sequence - Continuous cropping including a legume.											
R-7a	W.Wheat	Crest	78	40	28	12.5	59.0	28.6bu	3.99bu	114.11	25.16		
R-7b	Alfalfa	Thor						3.1T	50.00T	155.00			
R-7c	W.Wheat	Crest	78	40	28	12.5	59.0	20.5bu	3.99bu	81.79	25.16		
										350.90	50.32	300.58	100.19

Table 2. Summary data from cropping sequence study - three years, fallow, winter wheat, spring grain. Field R-2abc at the Northwestern Agricultural Research Center, Kalispell, MT 1972-79.

	1972	1973	1974	1975	1976	1977	1978	1979	$\bar{x}$	8 Yr. Ave/A
					BARLEY					
Yield Bu/A	46.9	47.8	43.8	32.3	83.4	43.0	68.3	56.4	52.7	
Fertilizer Cost	8.72	17.29	14.92	25.76	16.59	14.62	14.48	20.24	16.49	
Price/cwt	2.50	4.50	6.40	4.10	3.75	3.35	3.05	4.00	3.96	
Gross $	56.30	103.25	134.55	63.57	150.12	69.14	99.99	108.29	98.15	
Net/Acre	47.58	85.96	119.63	37.81	133.53	54.52	85.51	88.05	81.57	
					WHEAT					
Yield Bu/A	53.9	48.7	62.1	65.8	77.0	33.4	38.2	39.8	52.4	
Fertilizer Cost	6.53	13.60	26.30	30.31	33.91	21.20	23.61	25.37	22.60	
Price/bu	1.95	4.20	4.36	3.11	2.08	2.29	2.88	3.38	3.03	
Gross $	105.11	204.54	270.76	204.63	160.16	76.49	110.02	134.52	158.28	
Net/Acre	98.58	190.94	244.46	174.32	126.25	55.29	86.41	109.15	135.68	72.41

Table 3. Summary data from cropping sequence study - fifteen years, five years legume, winter grain, fallow alternating. Field R-3abc at the Northwestern Agricultural Research Center, Kalispell, MT 1972-79.

	1972	1973	1974	1975	1976	1977	1978	1979	$\bar{x}$	8 Yr. Ave/A
					ALFALFA					
Yield T/A	.6	2.7	4.2	3.3	3.0	.7	3.7	4.3	2.8	
Fertilizer Cost	7.60					15.53			2.89	
Price/Ton	25.00	45.00	40.00	45.00	50.00	50.00	45.00	50.00	43.75	
Gross $	15.00	121.50	168.00	148.50	150.00	35.00	166.50	215.00	127.38	
Net/Acre	7.40	121.50	168.00	148.50	150.00	19.47	166.50	215.00	124.48	
					WHEAT					
Yield Bu/A	56.3	58.1	60.7	64.0	53.4	58.1	76.5	47.2	59.3	
Fertilizer Cost	13.24	26.46	26.96	30.31	30.45	21.30	26.42	25.37	25.06	
Price/Bu	2.11	4.25	4.36	3.11	2.08	2.29	2.88	3.38	3.06	
Gross $	118.79	246.93	264.65	199.04	111.07	133.05	220.32	159.53	181.67	
Net/Acre	105.55	220.47	237.69	168.73	80.62	111.75	193.90	134.16	156.61	93.70

Table 4. Summary data from cropping sequence study - three years, fallow, winter grain, spring grain. Field R-4abc at the Northwestern Agricultural Research Center, Kalispell, MT, 1972-79.

	1972	1973	1974	1975	1976	1977	1978	1979	$\bar{x}$	8 Yr. Ave/A
					BARLEY					
Yield Bu/A	60.4	42.3	42.3	35.0	76.8	45.7	53.4	50.4	50.8	
Fertilizer Cost	8.71	17.29	17.26	24.47	17.97	10.44	14.65	19.18	16.24	
Price/cwt	2.50	4.50	6.40	4.15	3.75	3.35	3.05	4.00	3.96	
Gross $	72.47	88.51	129.95	69.72	138.24	73.49	78.18	96.77	93.41	
Net/Acre	63.76	71.22	112.69	45.25	120.27	63.05	63.53	77.59	77.17	
					WHEAT					
Yield Bu/A	71.5	48.6	65.2	66.7	67.7	52.5	68.7	39.8	60.1	
Fertilizer Cost	13.24	26.46	25.64	30.31	30.45	21.43	25.06	25.37	24.75	
Price/Bu	2.11	4.25	4.36	3.11	2.08	2.29	2.88	3.38	3.06	
Gross $	150.87	206.55	284.27	207.44	140.82	120.23	197.85	134.52	180.31	
Net/Acre	137.63	180.09	258.63	177.13	110.37	98.80	172.79	109.15	155.57	77.58

Table 5. Summary data from cropping sequence study - nine years, three years legumes winter wheat, fallow alternating. Field R-5abc, at the Northwestern Agricultural Research Center, Kalispell, MT 1972-79.

	1972	1973	1974	1975	1976	1977	1978	1979	$\bar{x}$	8 Yr. Ave/A
					ALFALFA					
Yield T/A	3.2	.2	4.2	3.4	.7	3.7	3.8	3.6	2.9	
Fertilizer Cost		14.58			18.93				4.19	
Price/Ton	25.00	45.00	40.00	45.00	50.00	50.00	45.00	50.00	43.75	
Gross $	80.00	9.00	168.00	153.00	35.00	185.00	171.00	180.00	122.63	
Net/Acre	80.00	- 5.58	168.00	153.00	16.07	185.00	171.00	180.00	118.44	
					WHEAT					
Yield Bu/A	62.0	41.9	39.5	56.6	48.1	50.7	30.0	41.1	46.2	
Fertilizer Cost	6.53	13.60	14.42	13.20	20.61	15.92	14.72	15.35	14.29	
Price/Bu	2.11	4.20	4.46	3.43	2.36	2.87	2.89	3.99	3.28	
Gross $	130.82	175.98	176.17	194.14	113.51	145.51	86.70	163.99	148.35	
Net/Acre	124.29	162.38	161.75	180.94	92.90	129.59	71.98	148.64	134.06	84.17

Table 6. Summary data from cropping sequence study - continuous cropping, legumes and small grains, winter and spring. Field R-7abc at the Northwestern Agricultural Research Center, Kalispell, MT 1972-79.

	1972	1973	1974	1975	1976	1977	1978	1979	$\bar{x}$	8 Yr. Ave/A
					ALFALFA					
Yield T/A	.7	.15	2.9	2.2	2.5	.5	3.4	3.1	1.9	
Fertilizer Cost		14.76				16.88			3.96	
Price/Ton	25.00	45.00	40.00	45.00	50.00	50.00	45.00	50.00	43.75	
Gross $	17.50	6.75	116.00	99.00	125.00	25.00	153.00	155.00	87.16	
Net/Acre	17.50	- 8.01	116.00	99.00	125.00	8.12	153.00	155.00	83.20	
					SPRING GRAIN					
	Wheat[1/]	Barley				Wheat[2/]	Barley	Wheat[2/]		
Yield #/A	1656	1752	2189	1512	3024	1794	3427	1716	2134	
Fertilizer Cost	10.47	16.07	16.80	24.98	16.00	23.41	14.77	25.16	18.46	
Price/Bu	1.92					2.75		3.99		
Price/Cwt	3.20	4.50	6.40	4.10	3.75	4.58	3.05	6.65	4.52	
Gross $	52.99	78.84	140.08	61.99	113.40	82.22	104.53	114.11	93.52	
Net/Acre	42.52	62.77	123.28	37.01	97.40	58.81	89.76	88.95	75.06	
		Wheat[2/]					Barley	Wheat[2/]		
Yield #/A	1590	1848	2436	1782	2622	1950	2914	1230	2047	
Fertilizer Cost	6.53	13.60	27.18	30.31	31.08	23.41	14.34	25.16	21.45	
Price/Bu	1.90	4.20	4.46	3.55	2.36	3.07		3.99	3.36	
Price/Cwt	3.17	7.00	7.43	5.92	3.93	5.12	3.05	6.65	5.28	
Gross $	50.35	129.36	181.08	105.44	103.13	99.78	88.86	81.79	104.97	
Net/Acre	43.82	115.76	153.90	75.13	72.05	76.37	74.15	56.63	83.47	80.58

1/ Spring Wheat
2/ Winter Wheat