FORTYSECOND ANNUAL REPORT
1990

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

4570 Montana 35
Kalispell, MT 59901

Prepared by

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1 MSU Western Agricultural Research Center

ADMINISTRATION 750

The Administration Project at the Northwestern Agricultural Research Center includes expenses for the overall operation of the center, personnel and office equipment purchased.

Full Time Staff Members	Years in Service
Vern R. Stewart - Supt. & Prof. Agronomy (Began April 1952)	38
Leon E. Welty - Prof. Agronomy (Began January 1973)	17
Oscar Buller - Agric. Res. Tech. I (Began January 1984--retired September 1990)	6.75
Gary Haaven - Ag Research Spec. I (Began April 1982)	8
Shirley Jones - Secretary II (Began June 1989--quit Sept. 1990)	1.75
Todd Keener - Ag Research Spec. II (Began March 1978)	12
Louise Prestbye - Ag Research Spec. I (Began May 1983)	7
Elaine M. Sprenger - Secretary II (Began August 1990)	.25

Part Time Employees:

Kenneth J. Paulson (March 24 through April 6)

Christopher Steele (October 11 through December 17)

Student Employees:

David L. Roys (May 14 through September 10)

David L. Wagner (May 23 through June 4)

David C. Overstreet (June 6 through November 2)

Helen Hedstrom (June 6 through September 7)

Brandon M. Lattin (July 10 through September 14)

GENERAL FARM 751

The General Farm Project (751) supports all research projects. This includes items purchased and used in the total research program. A self-propelled, walk behind tiller was purchased April, 1990.

PHYSICAL PLANT 752

The Physical Plant Project (752) includes the maintenance of buildings and grounds at the Northwestern Agricultural Research Center.

The Crops Research Building (office and dry lab) was re-sided in 1990. Also did some remodeling and put new carpet in Residence #2.

ACTIVITIES 1990

Date	Activity	Who	Where
1/19	NWARC and WARC Advis. Comm. Meeting	Stewart Welty	Allentown
1/22	Mint Growers Meeting	Stewart Welty	Kalispell
1/24	MAES Administration Meeting	Stewart Welty	Bozeman
1/29-2/1	MAES Planning Conference	Stewart Welty	Bozeman
2/14	Equity Supply Meeting - Talk	Welty	Kalispell
3/6	County Agent Update - Talk	Stewart Welty	Ronan
4/5	SCS Personnel Meeting - Talk	Welty	Kalispell
5/2	County Agent Meeting	Stewart Welty	Allentown
6/4	SCS Conservation Tour	Welty	Missoula
6/6	Forage Prod. School - Talk	Welty	Bozeman
6/25	FFA Tour	Stewart Welty	Kalispell
7/19	Northwestern Agric. Res. Ctr. Field Day	Stewart Welty	Kalispell
7/24	Summer Conference	Stewart Welty	Sidney
7/31	County Agent Tour	Stewart Welty	Kalispell
8/8	Satellite Weather Station Meeting	Stewart Welty	Kalispell
9/4-9/5	Superintendent's Meeting	Stewart Welty	Lewistown
10/15-17	Annual Conference	Stewart Welty	Bozeman
10/20-25	ASA Meeting	Stewart Welty	San Antonio
10/30	Research Center Faculty	Stewart Welty	Kalispell
11/6	PNW Forage Conference	Welty	Moscow, ID
11/14	Advisory Committee Meetings	Stewart Welty	Missoula & Kalispell

CLIMATOLOGICAL DATA
NORTHWESTERN AGRICULTURAL RESEARCH CENTER
Kalispell, MT

Northwestern Agricultural Research Center climatological data is recorded and sent to the National Oceanic and Atmospheric Administration to be published in the Climatological Data. Daily maximum and minimum temperatures, soil temperatures at four and eight inches and precipitation are recorded. This data has been recorded since January 1949.

The 1989-90 growing season (Sept. 1989 - Aug. 1990) at the Northwestern Agricultural Research Center in Creston contained several new extremes. Total average precipitation was 26.01 inches, 6.35 inches above the mean of 19.66 inches. Several months had precipitation 50% greater than the normal averages (Oct. 71%, Nov. 152%, Mar 49%, May 61%, July 49%, and Aug. 50%). The above normal precipitation in fall helped to recharge the soil profile, aided winter wheat establishment, and provided excellent moisture for spring seedbeds. The only months with below average moisture were January (-36%), February (-16%), and June (-3%). Harvest was aided by a dry period in the first half of August but rain later in the month delayed some spring wheat and barley harvest causing slight sprouting and lodging.

The mean temperature for the season was 44 degrees (F) which was .7 degrees greater than the long term average. Mean temperatures were higher in six of the months in 1989-90 with the January mean being much warmer than previous recordings (8.3 degrees higher). January is historically the coldest month at the Northwestern Agricultural Research Center yet February and November had lower average temperatures this year. Although a warmer year on the average there was a significant cool, wet period from mid-May to mid-June. During this time several spring plantings yellowed, were slowed in growth, and displayed injury to early post emergence herbicide sprays.

The frost-free period (149 days) from May 10th to October 6th was the longest on record at the Northwestern Agricultural Research Center (37 days longer than the 41 year average).

Snow cover was scattered throughout the winter. The longest continuous snow cover was 28 days (Dec. 10, 1989 to Jan 7, 1990). Another 19 day period of continuous snow cover was Feb 12th through Mar 2, 1990. Other scattered days throughout the winter brought the total number of days with measurable snow to 69. The last snowfall was on April 10th with one inch measured. There were no hard freezes combined with wind that contributed to winter kill in winter wheat. During the lowest temperatures of the season in February there was adequate snowcover.

Slight to moderate disease levels were observed in small grain this year. Low levels of leaf rust and powdery mildew were noted in winter wheat during the late season. Dwarf bunt was moderate in some winter wheat varieties. No diseases were noted in the spring barley nurseries. Slight leaf rust symptoms were observed in scattered spring wheat varieties but occurred late in the season.

Soil temperatures were monitored September - November and May - August and did not vary for long term averages.

Following is a list of tables giving a complete description of the weather for the crop year (September 1989 through August 1990) and 1990 (January through December).

Table 1. Summary of climatic data by months for 1989-90 crop year (September through August) and averages for the period 1949-90 at the Northwestern Agricultural Research Center, Kalispell, MT.

Table 2. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1989. (Average)

Table 3. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1990. (Max.)

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Table 10. Summary of precipitation records at the Northwestern Agricultural Research Center, Kalispell, MT, January 1950 through December 1990.

Table 1. Summary of climatic data by months for 1989-90 crop year (September thru August) and averages for the period 1949-90 at the Northwestern Agricultural Research Center, Kalispell, MT.

ITEM	Sept. 1989	Oct. 1989	Nov. 1989	Dec. 1989	Jan. 1990	Feb. 1990	Mar. 1990	Apr. 1990	May 1990	June 1990	July 1990	Aug. 1990	Total or Average
Precipitation (inches)													
Current Year	1.50	2.29	3.75	1.92	0.96	1.00	1.76	1.63	3.74	2.68	2.34	2.44	26.01
Avg. 1949 to 1989-90	1.65	1.34	1.49	1.64	1.50	1.19	1.18	1.40	2.32	2.75	1.57	1.63	19.66
Mean Temperature (F)													
Current Year	52.7	42.7	35.8	25.3	30.5	24.5	34.8	45.2	49.8	57.2	65.2	64.8	44.0
Avg. 1949 to 1989-90	53.4	43.3	32.7	25.6	22.2	27.6	33.7	43.3	51.6	58.5	64.1	63.0	43.3

Last killing frost in spring

1990	May 10 (31 degrees F)
Avg. 1949-90	May 25

First killing frost in fall

1990	October 6 (24 degrees F)
Avg. 1949-90	September 14

Frost Free Period

1990	149
Avg. 1949-90	113

Maximum summer temperature — 94 degrees F on August 16, 1990

Minimum winter temperature — -10 degrees F on February 14, 1990

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 through August 31, 1990.

Average temperature by month and year
Degrees Fahrenheit

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
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	53.8	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	44.9
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	25.2	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	29.9	33.2	43.6	52.5	54.9	61.9	68.2	42.8
1971-72	49.5	40.4	34.1	22.2	17.0	27.3	38.5	40.6	51.9	59.3	61.5	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	44.1	29.3	30.8	21.0	32.3	33.6	42.7	48.0	61.5	64.8	61.6	43.6
1974-75	52.8	43.6	34.8	30.1	21.5	21.5	29.9	37.6	48.6	55.9	69.1	59.8	42.1
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	51.7	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
1979-80	56.9	46.6	30.7	33.0	16.3	29.0	32.6	47.1	54.8	56.9	63.5	58.6	43.8
1980-81	54.1	45.3	35.8	32.2	30.1	31.3	38.5	44.5	52.5	53.8	62.8	66.4	45.6
1981-82	55.3	43.2	36.0	27.0	21.6	24.5	37.5	39.4	49.8	59.8	61.1	63.0	43.2
1982-83	53.4	41.0	29.1	25.9	30.3	33.8	37.9	42.4	51.9	57.6	59.6	65.4	44.0
1983-84	50.4	42.9	36.6	11.1	27.6	32.4	38.3	42.2	48.7	56.4	65.3	64.6	43.0
1984-85	49.5	40.0	32.6	20.6	19.2	19.0	30.8	44.8	53.7	57.6	68.3	60.2	41.4
1985-86	47.8	40.8	18.6	18.3	25.4	25.6	40.6	43.8	53.7	63.9	59.9	66.1	42.0
1986-87	50.2	43.0	30.3	24.9	22.2	27.9	35.0	47.8	55.6	61.6	62.9	59.8	43.4
1987-88	56.1	43.3	35.3	25.4	20.5	30.3	37.8	45.7	51.4	60.9	63.7	63.9	44.5
1988-89	53.4	43.4	36.3	23.3	27.5	12.4	28.8	44.2	49.6	59.8	65.4	61.9	42.2
1989-90	52.7	42.7	35.8	25.3	30.5	24.5	34.8	45.2	49.8	57.2	65.2	64.8	44.0
MEAN	52.1	42.3	32.7	25.6	22.2	27.6	33.7	43.3	51.6	58.5	64.1	63.0	43.2

Mean temperature for all years = 43.0

Table 3. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1990.

Average maximum temperature by month and year
Degrees Fahrenheit

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
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	38.2	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	56.3
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	56.7
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	28.5	39.6	43.5	53.1	59.2	76.2	80.3	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
1979-80	74.1	59.5	37.8	39.2	25.2	35.9	40.8	60.4	66.9	69.0	77.0	73.2	54.9
1980-81	66.9	59.0	43.9	39.2	34.0	38.9	49.7	54.8	63.3	63.8	78.1	85.0	56.4
1981-82	70.8	54.1	44.9	34.2	29.7	33.3	45.8	50.5	62.5	74.3	75.0	80.6	54.6
1982-83	69.2	53.2	36.9	33.0	36.8	42.2	47.5	55.2	66.4	70.6	73.1	82.9	55.6
1983-84	65.1	56.0	43.7	19.9	34.6	40.8	46.8	54.2	60.4	69.1	82.8	83.3	54.7
1984-85	63.9	52.2	40.4	28.2	25.3	29.1	42.7	56.8	68.7	73.2	88.0	75.0	53.6
1985-86	60.4	51.3	26.7	25.2	34.0	36.6	51.6	55.1	66.1	78.5	73.0	84.1	53.6
1986-87	59.9	54.3	38.0	30.9	29.5	34.2	43.4	61.3	67.9	75.7	76.5	74.9	53.9
1987-88	73.5	59.9	43.0	32.6	29.0	39.3	46.1	58.5	63.8	74.1	79.5	82.6	56.8
1988-89	69.0	62.0	42.7	30.3	35.3	21.8	36.1	56.6	61.1	72.6	81.6	75.0	53.7
1989-90	68.5	54.0	42.4	30.5	36.4	33.9	44.8	57.3	60.5	68.9	79.7	79.5	54.7
MEAN	66.7	54.1	39.2	31.6	29.0	35.2	43.4	55.1	64.8	72.0	80.2	79.4	54.8

Mean temperature for all years = 54.2

Table 4. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1990.

Average minimum temperature by month and year
Degrees Fahrenheit

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
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
1959-51	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	13.5	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	46.5	29.8
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
1979-80	39.7	33.7	23.6	26.8	7.5	22.1	24.5	33.7	42.7	44.7	50.0	44.0	32.8
1980-81	41.3	31.6	27.7	25.1	26.2	23.8	27.2	34.2	41.7	43.7	47.6	47.8	34.8
1981-82	39.7	32.2	27.0	19.8	13.5	15.7	29.2	28.4	37.2	45.3	47.3	45.4	31.7
1982-83	37.6	28.8	21.4	18.7	23.7	25.3	28.4	29.5	37.5	44.7	46.1	48.0	32.5
1983-84	35.6	29.7	29.5	2.4	20.6	24.0	29.9	30.2	37.1	43.6	47.8	46.0	31.4
1984-85	35.2	27.7	24.7	13.0	13.2	9.0	18.8	32.7	38.7	42.0	48.5	45.5	29.1
1985-86	35.2	30.2	10.6	11.4	16.9	14.5	29.6	32.5	41.3	49.3	46.8	48.1	30.5
1986-87	40.5	31.6	22.6	18.8	14.9	21.6	26.6	34.2	43.3	47.4	49.4	44.7	33.0
1987-88	38.7	26.5	27.6	18.1	11.5	21.3	29.5	33.0	39.0	47.7	47.9	45.2	32.2
1988-89	38.6	32.9	29.8	16.3	19.7	2.9	21.4	31.8	38.1	46.9	49.3	48.7	31.4
1989-90	36.9	31.3	29.3	20.1	24.7	15.2	24.7	33.2	39.1	45.4	50.6	50.0	33.4
MEAN	38.4	31.4	25.1	18.8	14.7	19.1	23.9	31.4	38.4	45.0	47.9	46.5	31.7

Mean temperature for all years = 31.7

Table 5. Summary of precipitation records at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1990.

	Total precipitation in inches by month and year												
YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
1949-50	1.03	1.05	1.67	0.92	2.62	1.13	2.31	0.84	0.15	3.90	3.12	0.75	19.49
1950-51	0.52	2.30	1.16	2.48	0.94	1.29	0.62	2.32	3.77	2.26	1.03	2.86	21.55
1951-52	1.49	5.62	1.01	3.31	1.03	0.98	0.97	0.17	1.32	3.95	0.56	0.69	21.10
1952-53	0.13	0.05	0.60	0.98	1.84	1.14	0.98	2.07	2.00	3.31	T	1.62	14.72
1953-54	0.71	0.03	0.87	1.30	2.65	0.79	0.83	0.79	1.52	2.98	2.91	3.79	19.17
1954-55	1.09	0.54	1.00	0.43	1.00	1.31	0.44	0.82	1.18	1.86	3.08	0.00	12.75
1955-56	1.64	1.89	1.97	2.38	1.76	1.53	0.87	1.28	1.06	4.20	2.13	3.21	23.92
1956-57	1.16	1.10	0.53	0.96	1.47	1.14	0.75	1.22	1.75	2.51	0.52	0.78	13.89
1957-58	0.10	1.59	0.96	1.76	1.56	2.67	0.97	1.47	2.20	2.56	0.84	0.58	17.26
1958-59	1.99	1.16	2.90	2.77	1.95	1.33	0.75	1.62	4.10	1.75	T	0.91	21.23
1959-60	4.22	3.36	4.32	0.34	1.67	1.10	1.01	1.23	3.27	0.69	0.13	2.43	23.77
1960-61	0.55	1.44	1.72	1.24	0.65	1.46	1.96	2.26	4.02	1.45	0.76	0.64	18.15
1961-62	3.40	1.22	1.77	2.09	1.33	1.15	1.59	0.96	2.59	1.15	0.11	0.72	18.08
1962-63	0.58	1.85	1.31	0.91	1.69	1.21	0.85	1.07	0.57	5.00	1.44	2.10	18.58
1963-64	1.46	0.75	0.95	1.70	1.46	0.41	1.57	0.87	3.33	3.86	3.01	1.64	21.01
1964-65	2.27	0.85	1.62	3.62	2.25	0.64	0.24	2.55	0.81	2.30	1.15	4.74	23.04
1965-66	1.72	0.21	1.31	0.55	1.42	0.67	0.53	0.76	1.18	6.57	2.49	1.64	19.05
1966-67	0.79	1.34	3.33	1.68	1.50	0.62	1.27	0.99	1.30	2.53	0.02	0.01	15.38
1967-68	0.91	1.88	0.62	1.16	0.79	1.15	0.68	0.57	3.92	2.22	1.00	3.42	18.32
1968-69	4.51	2.39	1.59	3.12	3.05	0.75	0.69	1.39	1.19	5.21	0.70	0.09	24.68
1969-70	1.54	1.90	0.31	1.14	3.10	0.89	1.49	0.76	1.97	4.37	3.08	0.44	20.99
1970-71	1.79	1.38	1.75	0.99	1.84	0.77	0.69	0.58	2.45	4.42	1.31	1.11	19.08
1971-72	0.94	0.87	1.70	1.62	1.10	1.65	2.11	0.95	1.48	3.28	1.77	0.98	18.45
1972-73	1.38	1.84	0.80	2.19	0.52	0.56	0.70	0.45	1.13	2.14	0.01	0.63	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	0.62	20.35
1974-75	0.80	0.12	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	0.85	1.39	0.91	1.12	0.34	1.92	1.90	2.49	1.49	3.42	19.97
1976-77	0.96	0.62	0.73	0.86	0.83	0.71	1.40	0.41	2.90	0.52	3.60	1.50	15.04
1977-78	2.84	0.56	1.62	4.10	2.15	0.99	0.72	2.54	3.56	2.63	3.90	3.34	28.95
1978-79	1.90	0.15	0.96	0.91	1.70	1.45	0.82	2.33	2.67	1.23	0.40	1.79	16.31
1979-80	1.03	1.75	0.50	1.03	1.53	2.03	0.97	1.88	5.48	3.89	1.08	2.45	23.62
1980-81	1.20	0.83	0.78	2.58	1.81	1.85	2.17	1.75	3.86	4.70	1.17	0.96	23.66
1981-82	0.77	0.56	1.49	1.91	2.38	1.48	1.16	1.60	1.25	2.41	2.06	1.17	18.24
1982-83	2.37	0.75	1.39	1.60	0.93	0.85	1.71	2.41	1.20	2.96	3.66	1.16	20.99
1983-84	1.70	1.13	1.96	2.57	0.80	2.19	1.81	1.93	2.91	2.07	0.31	0.55	19.93
1984-85	2.15	2.25	1.40	1.29	0.31	1.28	0.90	1.31	2.81	1.89	0.35	1.62	17.56
1985-86	5.35	1.55	1.61	0.51	2.39	2.33	0.50	1.34	2.92	1.83	2.09	0.81	23.23
1986-87	3.63	0.80	1.78	0.63	0.38	0.46	3.47	1.15	1.89	1.95	4.85	0.98	21.97
1987-88	0.81	0.12	0.91	1.18	0.98	1.03	0.77	1.36	3.60	1.98	1.07	0.13	13.94
1988-89	2.30	0.62	1.39	1.69	1.39	1.48	2.29	1.09	2.70	2.05	2.70	3.69	23.39
1989-90	1.50	2.29	3.75	1.92	0.96	1.00	1.76	1.63	3.74	2.68	2.34	2.44	26.01
MEAN	1.61	1.31	1.45	1.60	1.47	1.17	1.18	1.40	2.32	2.75	1.57	1.63	19.66

Mean precipitation for all crop years = 19.66

Table 6. Precipitation by day for crop year, September 1, 1989 through August 31, 1990. Northwestern Agricultural Research Center, Kalispell, MT.

DATE	SEPT. 1989	OCT. 1989	NOV. 1989	DEC. 1989	JAN. 1990	FEB. 1990	MAR. 1990	APR. 1990	MAY 1990	JUNE 1990	JULY 1990	AUG. 1990
1		0.40				0.11				0.90		
2	0.28	0.04							0.08	0.08		
3	0.09		0.28		0.13				0.05		0.70	
4	0.13		0.67	0.08	0.03					0.16		
5			0.07	0.60	0.08		0.01			T		
6		0.14	T	0.08							0.22	
7			0.10	0.09	T					0.49	0.04	
8			0.03	0.03	0.11	T	0.17		0.06	T		
9				0.04	0.19	0.02						
10	0.03			0.24	0.02	0.08		0.07				
11		0.18	0.05	0.02		T	0.12	T		0.43		
12			1.52	0.02		0.04	0.33	0.08	0.07	0.04		
13		0.06	0.38			0.13	0.59	0.03	0.27	0.04	0.07	
14		0.07	0.09	0.07	0.01		0.08	0.34	0.08	T		
15				0.04	T			0.02				
16				T	0.10	0.40			0.33			0.22
17			0.03	0.08		0.18			T	0.17		0.12
18	0.85			T					0.03			0.04
19	0.12		0.13	0.12			T		0.13			T
20				0.20			0.34			0.02		0.24
21		0.25		0.13	0.02	0.04	0.01		0.11			0.72
22		0.53			0.10		0.11	0.10				0.45
23		T			0.03		T	0.02	0.17			0.08
24		0.41	0.10					0.10	0.03	0.03		
25			0.02					0.02	1.08	0.02	0.30	
26			0.04		0.04			0.08	0.24		0.73	0.26
27		0.06	0.21					0.15			0.28	0.23
28		0.03	0.03					0.51	0.02	0.30		
29				0.07	0.04			0.11	0.08			
30					0.06				0.89			0.08
31		0.12		0.01	T		T		0.02			T
TOTAL	1.50	2.29	3.75	1.92	0.96	1.00	1.76	1.63	3.74	2.68	2.34	2.44

Table 7. Frost free period at the Northwestern Agricultural Research Center from 1950 thru 1990.

YEAR	DATE LAST FREEZE	TEMPERATURE DEGREE 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
1980	June 4	32	Sept. 24	31	111
1981	May 5	28	Sept. 24	25	142
1982	May 30	31	Sept. 15	23	108
1983	May 15	31	Sept. 6	31	114
1984	June 2	32	Sept. 13	30	103
1985	May 13	26	Sept. 7	32	117
1986	May 16	31	Sept. 7	31	114
1987	May 22	28	Sept. 17	29	117
1988	May 3	30	Sept. 12	30	131
1989	May 21	32	Sept. 9	29	110
1990	May 10	31	Oct. 6	24	149
Mean for years	May 31	30	Sept. 14	30	113

Table 8. Temperature extremes at the Northwestern Agricultural Research Center, Kalispell, MT from 1950-1990.

YEAR	MINIMUM DATE	MINIMUM TEMPERATURE DEGREES F	MAXIMUM DATE	MAXIMUM TEMPERATURE DEGREES 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
1969	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	97
1978	Dec. 31	-31	July 16	91
1979	Jan. 1	-31	July 20	97
1980	Jan. 29	-20	July 23	92
1981	Feb. 21	-21	Aug. 26,27	97
1982	Feb. 9,10	-23	Aug. 8	91
1983	Dec. 25	-29	Aug. 8	97
1984	Jan. 18	-14	July 27	97
1985	Jan. 30	-24	July 9,11,23	94
1986	Nov. 10	- 8	May 30	93
1987	Jan. 16, Dec. 3	- 4	July 27	95
1988	Jan. 6	-17	July 22, Aug. 6	92
1989	Feb. 4, 5	-20	Aug. 1	96
1990	Feb. 14	-10	Aug. 16	94

Table 9. Summary of temperature records at the Northwestern Agricultural Research Center, January 1950 through December 1990.

AVERAGE TEMPERATURE BY MONTH AND YEAR
DEGREES FAHRENHEIT

DATE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	MEAN
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	43.0
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	38.2	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	42.3	51.4	59.4	63.0	64.9	58.7	47.4	35.8	24.0	44.2
1964	28.5	28.3	30.6	42.8	51.1	58.7	64.3	58.9	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	17.0	27.3	38.5	40.6	51.9	59.3	61.5	65.9	50.2	40.3	33.7	19.9	42.2
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	21.0	32.3	33.6	42.7	48.0	61.5	64.8	61.6	52.8	43.6	34.8	30.1	43.9
1975	21.5	21.5	29.9	37.6	48.6	55.9	69.1	59.8	52.1	42.9	35.4	27.5	41.8
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	33.0	42.9
1980	16.3	29.0	32.6	47.1	54.8	56.9	63.5	58.6	54.1	45.3	35.8	32.2	43.9
1981	30.1	31.3	38.5	44.5	52.5	53.8	62.8	66.4	55.3	43.2	36.0	27.0	45.1
1982	21.6	24.5	37.5	39.4	49.8	59.8	61.1	63.0	53.4	41.0	29.1	25.9	42.2
1983	30.3	33.8	37.9	42.4	51.9	57.6	59.6	65.4	50.4	42.9	36.6	11.1	43.3
1984	27.6	32.4	38.3	42.2	48.7	56.4	65.3	64.6	49.5	40.0	32.6	20.6	43.2
1985	19.2	19.0	30.8	44.8	53.7	57.6	68.3	60.2	47.8	40.8	18.6	18.3	39.9
1986	25.4	25.6	40.6	43.8	53.7	63.9	59.9	66.1	50.2	43.0	30.3	24.9	44.0
1987	22.2	27.9	35.0	47.8	55.6	61.6	62.9	59.8	56.1	43.2	35.3	25.4	44.4
1988	20.5	30.3	37.8	45.7	51.4	60.9	63.7	63.9	53.8	47.5	36.3	23.3	44.6
1989	27.5	12.4	28.8	44.2	49.6	59.8	65.4	61.9	52.7	42.7	35.8	25.3	42.2
1990	30.5	24.5	34.8	45.2	49.8	57.2	65.2	64.8	59.2	41.9	36.1	16.5	43.8
MEAN	22.2	27.6	33.7	43.2	51.6	58.5	64.1	63.0	53.5	43.4	32.6	25.4	43.2

Table 10. Summary of precipitation records at the Northwestern Agricultural Research Center, Kalispell, MT, January 1950 thru December 1990.

	Total Precipitation (inches) by Months and Years												
DATE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
1950	2.62	1.13	2.31	0.84	0.15	3.90	3.12	0.75	0.52	2.30	1.16	2.48	21.28
1951	0.94	1.29	0.62	2.32	3.77	2.26	1.03	2.86	1.49	5.62	1.01	3.31	26.52
1952	1.03	0.98	0.97	0.17	1.32	3.95	0.56	0.69	0.13	0.05	0.60	0.98	11.43
1953	1.84	1.14	0.98	2.07	2.00	3.31	T	1.62	0.71	0.03	0.87	1.30	15.87
1954	2.65	0.79	0.83	0.79	1.52	2.98	2.91	3.79	1.09	0.54	1.00	0.43	19.32
1955	1.00	1.31	0.44	0.82	1.18	1.86	3.08	--	1.64	1.89	1.97	2.38	17.57
1956	1.76	1.53	0.87	1.28	1.06	4.20	2.13	3.21	1.16	1.10	0.53	0.96	19.79
1957	1.47	1.14	0.75	1.22	1.75	2.51	0.52	0.78	0.10	1.59	0.96	1.76	14.55
1958	1.56	2.67	0.97	1.47	2.20	2.56	0.84	0.58	1.99	1.16	2.90	2.77	21.67
1959	1.95	1.33	0.75	1.62	4.10	1.75	T	0.91	4.22	3.36	4.32	0.34	24.65
1960	1.67	1.10	1.01	1.23	3.27	0.69	0.13	2.43	0.55	1.44	1.72	1.24	16.48
1961	0.65	1.46	1.96	2.26	4.02	1.45	0.76	0.64	3.40	1.22	1.77	2.09	21.68
1962	1.33	1.15	1.59	0.96	2.59	1.15	0.11	0.72	0.58	1.85	1.31	0.91	14.25
1963	1.69	1.21	0.85	1.07	0.57	5.00	1.44	2.10	1.46	0.75	0.95	1.70	18.79
1964	1.46	0.41	1.57	0.87	3.33	3.86	3.01	1.64	2.27	0.85	1.62	3.62	24.51
1965	2.25	0.64	0.24	2.55	0.81	2.30	1.15	4.74	1.72	0.21	1.31	0.55	18.47
1966	1.42	0.67	0.53	0.76	1.18	6.57	2.49	1.64	0.79	1.34	3.33	1.68	22.40
1967	1.50	0.62	1.27	0.99	1.30	2.53	0.02	0.01	0.91	1.88	0.62	1.16	12.81
1968	0.79	1.15	0.68	0.57	3.92	2.22	1.00	3.42	4.51	2.39	1.59	3.12	25.36
1969	3.05	0.75	0.69	1.39	1.19	5.21	0.70	0.09	1.54	1.90	0.31	1.14	17.96
1970	3.10	0.89	1.49	0.76	1.97	4.37	3.08	0.44	1.79	1.38	1.75	0.99	22.01
1971	1.84	0.77	0.69	0.58	2.45	4.42	1.31	1.11	0.94	0.87	1.70	1.62	18.30
1972	1.10	1.65	2.11	0.95	1.48	3.28	1.77	0.98	1.38	1.84	0.80	2.19	19.53
1973	0.52	0.56	0.70	0.45	1.13	2.14	0.01	0.63	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	0.62	0.80	0.12	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	0.85	1.39	20.03
1976	0.91	1.12	0.34	1.92	1.90	2.49	1.49	3.42	0.96	0.62	0.73	0.86	16.76
1977	0.83	0.71	1.40	0.41	2.90	0.52	3.60	1.50	2.84	0.56	1.62	4.10	20.99
1978	2.15	0.99	0.73	2.54	3.56	2.63	3.90	3.34	1.90	0.15	0.96	0.91	23.76
1979	1.70	1.45	0.82	2.33	2.67	1.23	0.40	1.79	1.03	1.75	0.50	1.03	16.70
1980	1.53	2.03	0.97	1.88	5.48	3.89	1.08	2.45	1.20	0.83	0.78	2.58	24.70
1981	1.81	1.85	2.17	1.75	3.86	4.70	1.17	0.96	0.77	0.56	1.49	1.91	23.00
1982	2.38	1.48	1.16	1.60	1.25	2.41	2.06	1.17	2.37	0.75	1.39	1.60	19.62
1983	0.93	0.85	1.71	2.41	1.20	2.96	3.66	1.16	1.70	1.13	1.96	2.57	22.24
1984	0.80	2.19	1.81	1.93	2.91	2.07	0.31	0.55	2.15	2.25	1.40	1.29	19.66
1985	0.31	1.28	0.90	1.31	2.81	1.89	0.35	1.62	5.35	1.55	1.61	0.51	19.49
1986	2.39	2.33	0.50	1.34	2.92	1.83	2.09	0.81	3.63	0.80	1.78	0.63	21.05
1987	0.38	0.46	3.47	1.15	1.89	1.95	4.85	0.98	0.81	0.12	0.91	1.18	18.15
1988	0.98	1.03	0.77	1.36	3.60	1.98	1.07	0.13	2.30	0.62	1.39	1.69	16.92
1989	1.39	1.48	2.29	1.09	2.70	2.05	2.70	3.69	1.50	2.29	3.75	1.92	26.85
1990	0.96	1.00	1.76	1.63	3.74	2.68	2.34	2.44	T	2.32	1.37	2.60	22.84
MEAN	1.50	1.19	1.18	1.40	2.32	2.75	1.57	1.63	1.63	1.37	1.48	1.68	

CHEMICALS USED IN HERBICIDE STUDIES 1989-90, NWARC, KALISPELL,MT

Common name	Trade name	Chemical name	Company
Imazamethabenz (AC 222,293)	Assert	m- toluic acid, 6-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-methyl ester and p-toluic acid, 2(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-methyl ester	Am. Cyanamide
Bentazon	Basagran	3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide	BASF
Bromoxynil	Buctril	3,5-dibromo-4-hydroxybenzonitrile	Rhone Poulenc
Bromoxynil + MCPA	Bronate /Brominal+	3,5-dibromo-4-hydroxybenzonitrile + [(4-chloro-o-tolyl)oxy]acetic acid	Rhone Poulenc/ Un. Carbide
Chlorsulfuruon	Glean	2-chloro-N[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide	DuPont
Clopyralid	Stinger	3,6-dichloro-2-pyridinecarboxylic acid	Dow
Clopyralid + 2,4-D	Curtail	3,6-dichloro-2-pyridinecarboxylic acid + (2,4-dichlorophenoxy)acetic acid	Dow
Clopyralid + MCPA	Curtail M	3,6-dichloro-2-pyridinecarboxylic acid [(4-chloro-o-tolyl)oxy]acetic acid	Dow
Dicamba	Banvel	3,6-dichloro-2-methoxybenzoic acid	
Diclofop-m	Hoelon	2-[4-(2,4-dichlorophenoxy)phenoxy propanoic acid	Hoechst Roussel
Difenzoquat	Avenge	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium	Am. Cyanamide
DPX-L 5300	Express	Methyl 2 [[[[N-(4-methoxy-6-methyl-1,3,5-triazin-2-yl) methylamino] carbonyl]amino]sulfonyl]benzoic acid	DuPont
DPX-R 9674	Harmony Extra	2:1 ratio of DPX-M6316 + DPX-L5300	DuPont
EPTC	Eptam	S-ethyl dipropylthiocarbamate	Stauffer/ICI
Ethalfluralin	Sonalan	N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)benzenamine	Elanco
Fenoxaprop	Puma	(+)-2-[4-[(6-chloro-2-benz-oxazoly)oxy] phenoxy]propanoic acid	Hoechst/ Roussel

Chemicals used in 1990 (Cont'd)

Common name	Trade name	Chemical name	Company
Fenoxaprop +2,4-D + MCPA	Tiller	Fenoxaprop ethyl, 2,4-Dester, and MCPA ester (see respective chemistries)	Hoechst/ Roussel
Fluazifop	Fusilade	(R)-2-[4-[[5-(triflouromethyl)-2-pyridinyl] oxy]phenoxy]propanoic acid	ICI Am.
Glyphosate	Roundup	N-(phosphonomethyl) glycine	Monsanto
Imazethapyr	Pursuit	(+)-2-[4,5-dihydro-4-methyl-4(1-methyl ethyl)-5-oxo-1H-imidazol-2-yl]-5-ehtyl -3-pyridinecarboxylic acid	Am. Cyanamide
MCPA	MCPA	[(4-chloro-o-tolyl)oxyl]acetic acid	As available
Metribuzin	Sencor or Lexone	4-amino-6-tert-butyl-3-(methylthio)-as triazin-5(4H)one	Mobay DuPont
Pyridate	Tough	O-(6-chloro-3-phenyl-4-pyridazinyl)-S- octyl carbonothioate	Agrolinz
Sethoxydim	Poast	2[(1-ethoxyimino)butyl]-5[(2-ethylthio)- propyl]-3-hydroxy-2-cyclohexen-1-one	BASF
Triallate	Fargo	S-(2,3,3-trichloro-2-propenyl)bis(1- methyl ethyl)carbamothioate	Monsanto
Trifluralin	Treflan	2,6-dinitro-N,N-dipropyl-4-(trifluoro- methyl)benzeneamine	Elanco
2,4-D	2,4-D	(2,4-dichlorophenoxy)acetic acid	Cenex
2,4-DB	2,4-DB	4-(2,4-dichlorophenoxy)butyric acid	Rhone Poulenc

PROJECT TITLE: Bedstraw weed control in Gallatin spring barley.

YEAR/PROJECT: 1990/754

INVESTIGATORS: Leader - Vern R. Stewart, Todd Keener - Research Specialist

OBJECTIVE: To evaluate timing of the herbicide applications of Assert, Bronate, and the combinations of those herbicides for control of bedstraw (Galium aparine).

SUMMARY: Yield, test weight and percent plump were not significantly different when comparing applicatons of Assert, Bronate and the combinations of those herbicides at three application dates. Bedstraw was effectively controlled by Bronate and Assert plus Bronate at all application dates.

RESULTS:

The experiment was established in a field of Gallatin spring barley. Plots 10 feet by 20 feet were laid out in a randomized complete block with four replications. Treatments were applied May 17, May 26 and June 3. Applications were made with a research-type, tractor mounted sprayer using 24.85 gpa, 8002 nozzles, and 32 PSI.

Application data:	May 17	May 26	June 3
Air temp	63 F	59 F	55 F
Soil temp	60 F	60 F	53 F
Rel Hum.	18 %	31 %	42 %
Wind (MPH)	2-4	0-3	0
Cloud cover	CLDY	Clear	CLDY
Soil moisture	Top - v good	good	dry
	Sub - v good	good	good
Crop stage:	5 lf	5-7" tillered	7-10 "
Bedstraw(25/ft2)	1/4-1/2"	1/2-1 1/2"	1-5"
Fanweed (12/ft2)	1" tall	10-12 lvs, 2"	5-8"

Similar rates of Assert and Bronate applied alone, or in combination at three application dates had no effect on yield, test weight or percent plump.

Slight crop injury was observed where Assert and Assert plus Bronate applications were made. Early height readings were significantly less in all Assert treatments as well as for the two later application dates of Assert plus Bronate. The height reductions were not seen in the later height measurements. In a similar study done last year significant height reductions were recorded as late as harvest in all treatments.

Heavy bedstraw populations were effectively controlled by Assert plus Bronate as well as Bronate alone at all three appliction dates. Assert alone failed to provide effective bedstaw control. The later application of Assert plus Bronate was least effective of the three treatment dates (90%). All applications, except Assert applied on 6/3, effectively controlled fanweed. A low level of chickweed control was observed with all herbicide applications.

In a similar study conducted last year seeding and applications were three weeks later in the season. Plant injury was greater

and there were significant differences in all components (yield, test weight and weed control) except percent plump. The study this year was initiated earlier and had better yields, good weed control and less plant injury.

Table 1. Agronomic data from the Bedstraw Herbicide Study, Mahugh farm. Kaispell, MT in 1990.
Planting date: May 8, 1990 Harvested: August 10, 1990

Treatment	Rate	Appln Date	Yield Bu/A	Test Wt Lb/Bu	% Plump	Crop /1 Injury	Height (In)6/21	Height (In)8/3
Assert	1.2 pts	5/17	124.3	52.13	96.33	.6667	25.59	38.45
Assert	1.2 pts	5/26	127.5	52.47	96.67	.3333	25.59	38.71
Assert	1.2 pts	6/3	118.8	52.23	96.33	.1667	24.15	37.14
Assert + Bronate	1.2 pts 1.5 pts	5/17	130.8	52.30	95.67	.1667	25.85	38.32
Assert + Bronate	1.2 pts 1.5 pts	5/26	136.7	52.40	95.00	.5000	25.07	38.19
Assert + Bronate	1.2 pts 1.5 pts	6/3	131.7	52.37	95.67	.6667	25.20	38.98
Bronate	1.5 pts	5/17	135.9	52.40	96.00	.0000	25.98	39.76
Bronate	1.5 pts	5/26	131.9	52.67	96.33	.5000	24.93	38.58
Bronate	1.5 pts	6/3	131.0	52.37	94.33	.1667	26.90	38.45
Check	----	---	138.5	52.97	96.00	.0000	27.43	38.32
	Mean		130.7	52.43	95.83	.3167	25.67	38.49
	F Ratio		.9809	.9228	1.038	1.030	2.439	.3890
	P Value		.4921	.5347	.4522	.4582	.0479	.9351
	CV (S/Mean)		4.611	.4674	.7241	79.04	2.382	2.740
	LSD (.05)		17.91	.7281	2.062	.7437	1.816	3.134

1/ Crop Injury: 0-10 rating, 0 = no injury, 10 = dead plants. Rated 6/12/90

Table 2. Weed control data from the Bedstraw Herbicide Study, Mahugh farm. Kaispell, MT in 1990.
Planting date: May 8, 1990 Harvested: August 10, 1990

Treatment	Rate	Date	Percent Weed Control 1/					
			BS 6/12	BS 7/12	FW 6/12	FW 7/12	CW 6/12	CW 7/12
Assert	1.2 pts	5/17	35.00	46.67	68.33	96.67	.0000	33.33
Assert	1.2 pts	5/26	15.00	30.00	37.33	100.0	.0000	31.67
Assert	1.2 pts	6/3	.0000	20.00	6.667	33.33	.0000	33.33
Assert + Bronate	1.2 pts 1.5 pts	5/17	97.67	98.67	99.33	100.0	10.00	93.33
Assert + Bronate	1.2 pts 1.5 pts	5/26	87.67	96.33	93.33	100.0	16.67	65.00
Assert + Bronate	1.2 pts 1.5 pts	6/3	61.67	90.00	71.67	100.0	.0000	50.00
Bronate	1.5 pts	5/17	95.67	93.33	98.67	100.0	33.33	66.67
Bronate	1.5 pts	5/27	94.33	98.33	99.00	100.0	33.33	66.67
Bronate	1.5 pts	6/3	61.67	98.33	66.67	100.0	.0000	66.67
Check	----	---	.0000	.0000	.0000	.0000	.0000	.0000
	Mean		54.87	67.17	64.10	83.00	9.333	50.67
	F Ratio		22.32	24.62	10.13	221.5	.7642	1.695
	P Value		.0000	.0000	.0000	.0000	.6602	.1584
	CV (S/Mean)		15.34	11.63	18.42	2.902	169.9	40.18
	LSD (.05)		25.00	23.21	35.09	7.157	47.11	60.49

1/ Percent Weed Control taken on two dates, 6/12/1990 and 7/12/1990
BS = Bedstraw (Galium aparine) FW = Fanweed (Thlaspi arvense)
CW = Chickweed (Stellaria media)

PROJECT TITLE: Combination Herbicide Study

YEAR/PROJECT: 1990/754

INVESTIGATORS: Leader - Vern R. Stewart, Todd Keener, Research Specialist

OBJECTIVE: To determine the effectiveness of broadleaf and wild oat herbicide treatments in combination for broad spectrum weed control.

RESULTS:

Newana spring wheat strips were planted April 19, 1990 using a International press-type drill with 7 inch spacing. Seed depth was 1 1/2 inches in a seedbed that had been first fall plowed, spring disced, cultivated and then packed. Herbicide plots were established perpendicular to the 12 foot grain strips. Herbicides were applied at the three leaf stage of wild oats using a research-type, tractor mounted sprayer. Plots were 10 feet by 12 feet with treatments being replicated four times in a randomized complete block design. A volume of 27.57 gpa was applied using 8002 nozzles at 32 PSI. Previous crop was spring barley. A surfactant was used at .25% v/v for imazamethabenz, fenoxaprop and DPX-R9674 while 1 pt/A was used with diclfop. A Hege plot combine was used for harvest.

Application data.

Date date:	May 22, 1990	Air temp:	50 F
Soil temp:	53 F	Wind:	0-1 mph
Soil moisture:	Top-good	Subsoil-v.good	
Rel. Humidity:	41%	Clouds:	Hazy

Crop stage: 4-5 leaf, tillering

Weed stage: Henbit (Lamium amplx.) - 2 leaves
Chickweed (Stellaria media)- 4-6 leaves
Campion (Silene latifolia)- 4 leaves
Wild oats (Avena fatua) 3 leaf

A good broadleaf and wild oat population in the test area and little disease pressure resulted in a excellent evaluation of tank mix herbicides. Stand reduction was slight in a few treatments where 2,4-D and MCPA were combined with bromoxynil or DPX-R9674. Table 1.

All combination treatments that included one of the three wild oat herbicides tested had yields significantly higher than the check. The four treatments that were equal to, or less than the check in yield were the broadleaf treatments alone. The high yield was harvested from a plot treated with bromoxynil and diclfop (92.7 bu/A). The check plot yield was 40.01 bu/A. Although yield reductions were mainly a result of wild oat competition rather than herbicide injury slight yield reductions were observed where phenoxy herbicides were tank mixed with formulated phenoxy herbicides (Tiller herbicide contains both 2,4-D and MCPA).

All three wild oat herbicides gave good to excellent wild oat control but were antagonistically effected in some tank mixes. Imazamethabenz combined with bromoxynil and/or MCPA had decreased wild oat control compared to when applied alone. Diclfop wild oat control was decreased when tank mixed with bromoxynil, 2,4-D, or with both. Fenoxaprop was the most consistent in wild oat control when tank mixed

with only slight antagonism recorded with mixtures of 2,4-D.

The four broadleaf herbicides applied alone resulted in test weights of grain that were equal to or less than the check. All other test weights were significantly higher than the check. Lodging was also severe in the plots treated only with broadleaf herbicides and not present in other treatments.

Broadleaf weed control was not greatly enhanced or antagonized by most tank mixes except where DPX-R9674 or additional phenoxy herbicides were added to the pre-package blend of fenoxaprop + 2,4-D + MCPA (Tiller herbicide).

SUMMARY:

Additional phenoxies added to formulated phenoxy herbicide treatments did cause slight decreases in yields. The addition of DPX-R9674 to diclofop, imazamethaenz, and fenoxaprop did not significantly change yield, test weight, and weed control when evaluated on Newana spring wheat. Addition of the butoxyethyl ester of 2,4-D (Weedon LV4) to fenoxaprop decreased yields and wild oat control yet gave better broadleaf weed control than the iosocty ester of 2,4-D in the formulation of fenoxaprop + MCPA + 2,4-D.

FUTURE PLANS:

The combination herbicide evaluations have been an active part of weed investigations in Kalispell but most may be absorbed into an economical weed management, maximum economic yield program next year.

Table 1. Crop injury and weed control data from the Combination Herbicide Study. NWARC, Kalispell, MT. R13

Treatment	Form.	Rate	% Std Reduction	Percent Weed Control 6/22/90 1/ CKWD	HNBT	COCKL	WOAT	% Wild Oat Control 7/3	7/13
Imazamethabenz. + .25% v/v surf	2.5 EC	.38 #	.0000	10.00	17.50	45.00	98.00	92.75	98.00
Diclofop + surf 1 pt/A	3.0 EC	.75 #	.2500	21.25	20.00	.0000	93.00	89.25	90.25
Fenoxaprop + S	.58 EC	.074 #	.8821	32.42	33.29	23.23	99.56	94.12	99.08
Fenoxaprop+MCPA+ 2,4-D	3.08 EC	.66 #	.2500	35.00	40.00	25.00	93.50	95.75	97.00
Bromoxynil	4.0 EC	.25 #	.0000	58.75	69.75	75.00	23.75	.0000	.0000
Bromoxynil + MCPA	4.0 EC 3.8 EC	.25 # .25 #	.0000	31.25	37.50	50.00	.0000	.0000	.0000
DPX-R9674 +.25% Surf	75 DF	.014#	.0000	92.75	88.50	70.00	.0000	5.000	.0000
2,4-D	3.8 EC	.5 #	.0000	43.75	62.50	52.50	.0000	.0000	.0000
Bromoxynil +diclofop + surf	4.0 EC 3.0 EC	.25 # .75 #	.0000	.0000	.0000	.0000	94.50	99.00	94.00
Bromoxynil + MCPA +diclofop + surf	4.0 EC 3.8 EC 3.0 EC	.25 # .06 # .75 #	1.250	49.50	47.00	49.75	97.50	87.75	73.75
DPX-R9674 +.25% S +diclfop + surf	75 DF 3.0 EC	.014# .75 #	.0000	87.50	88.75	98.75	91.25	93.00	86.50
2,4-D +diclfop + surf	3.8 EC 3.0 EC	.5 # .75 #	.0000	17.50	22.50	25.00	68.75	40.00	32.50
Bromoxynil + Imaza.+.25% S	4.0 EC 2.5 EC	.25 # .38 #	2.000	73.75	79.75	85.00	94.75	88.00	82.00
Bromoxynil + MCPA + Imaza.+.25% S	4.0 EC 3.8 EC 2.5 EC	.25 # .25 # .38 #	1.250	49.75	56.25	37.50	92.75	93.25	87.00
DPX-R9674 +.25% S + Imaza.+.25% S	75 DF 2.5 EC	.014# .38 #	.5000	97.50	93.75	100.0	97.50	99.25	97.00
2,4-D + Imaza.+.25% S	3.8 EC 2.5 EC	.5 # .38 #	1.000	52.50	75.00	70.00	98.00	98.75	96.50
Bromoxynil + Fenoxa + S	4.0 EC .58 EC	.25 # .074 #	.7500	25.00	25.00	35.00	97.25	96.50	96.00

- Continued -

Table 1 (Cont'd). Crop injury and weed control data from the Combination Herbicide Study. NWARC.

Treatment	Form.	Rate	% Std Reduction	--- Percent Weed Control 6/22/90 --- CKWD	HNBT	COCKL	WOAT	% Wild Oat Control 7/3	7/13
Bromoxynil + MCPA + Fenoxa + S	4.0 EC 3.8 EC .58 EC	.25 # .25 # .074 #	1.500	56.25	46.00	50.00	95.25	97.50	97.50
DPX-R9674 +.25% S + Fenoxa + S	75 DF .58 EC	.014# .074 #	1.250	92.50	93.25	87.50	97.00	96.25	94.50
2,4-D + Fenoxa + S	3.8 EC .58 EC	.5 # .074 #	2.500	42.50	65.00	52.50	89.00	94.00	88.50
Bromoxynil + Fenoxa+MCPA+ 2,4-D	4.0 EC 3.08 EC	.25 # .66 #	1.250	42.50	55.00	62.00	99.50	94.50	96.50
Bromoxynil + MCPA + Fenoxa+MCPA+ 2,4-D	4.0 EC 3.8 EC 3.08 EC	.25 # .25 # .66 #	3.000	90.00	85.25	80.00	99.00	96.75	94.75
DPX-R9674 +.25% S + Fenoxa+MCPA+ 2,4-D	75 DF 3.08 EC	.014# .66 #	2.250	99.50	97.75	100.0	98.75	92.75	90.00
2,4-D + Fenoxa+MCPA+ 2,4-D	3.8 EC 3.08 EC	.5 # .66 #	1.500	46.00	57.75	47.50	71.75	85.00	80.75
Check	----	----	.0000	.0000	.0000	.0000	.0000	.0000	.0000
OVERALL MEAN =			.8586	50.25	54.65	53.35	75.38	72.95	73.65
F-RATIO TRTS =			2.067	3.683	3.235	2.674	17.52	67.05	6.892
P-VALUE TRTS =			.0091	.0000	.0001	.0006	.0000	.0000	.0000
CV (SE/MEAN) =			73.28	31.70	30.32	34.99	11.72	6.420	22.41
LSD(0.05 by t)=			1.767	44.60	46.40	52.14	25.00	13.25	46.77

1/ Weed headings:

CKWD = chickweed (Stellaria media)
HNBT = henbit (Lamium amplexicauli)
COCKL = white cockle (Lychnis alba)
WOAT = wild oat (Avena fatua)

Table 2. Agronomic data from the Combination Herbicide Study. NWARC, Kalispell, MT in 1990

Treatment	Form	Rate lb ai/A	Yield Bu/A	Test Wt lb/Bu	Height Inches	Lodging 1/ %	Lodging 1/ Angle
Imazamethabenz + .25% surf	2.5 EC	.38 #	84.64	59.97	35.04	.0000	.0000
Diclofop + surf (1 pt/A)	3.0 EC	.75 #	72.91	59.88	34.84	.0000	.0000
Fenoxaprop + S	.58 EC	.074 #	76.58	59.97	34.84	.0000	.0000
Fenoxaprop+MCPA+ 2,4-D	3.08 EC	.66 #	80.55	60.00	34.35	.0000	.0000
Bromoxynil	4.0 EC	.25 #	43.64	57.40	35.43	52.50	5.000
Bromoxynil + MCPA	4.0 EC 3.8 EC	.25 # .25 #	27.61	51.60	34.55	83.75	7.750
DPX-R9674 +.25% S	75 DF	.014#	50.14	56.10	35.04	46.25	4.250
2,4-D	3.8 EC	.5 #	36.89	55.40	34.45	23.75	4.500
Bromoxynil +diclofop + surf	4.0 EC 3.0 EC	.25 # .75 #	92.66	60.25	35.43	.0000	.0000
Bromoxynil + MCPA +diclofop + surf	4.0 EC 3.8 EC 3.0 EC	.25 # .06 # .75 #	68.95	59.08	34.35	.0000	.0000
DPX-R9674 +.25% S +diclofop + surf	75 DF 3.0 EC	.014# .75 #	82.27	59.92	34.65	.0000	.0000
2,4-D +diclfop + surf	3.8 EC 3.0 EC	.5 # .75 #	62.35	57.95	34.84	.0000	.0000
Bromoxynil + Imaza. + .25% S	4.0 EC 2.5 EC	.25 # .38 #	70.55	59.28	34.55	.0000	.0000
Bromoxynil + MCPA + Imaza.+.25% S	4.0 EC 3.8 EC 2.5 EC	.25 # .25 # .38 #	76.53	59.08	35.04	.0000	.0000
DPX-R9674 +.25% S + Imaza.+.25% S	75 DF 2.5 EC	.014# .38 #	74.38	59.85	34.35	.0000	.0000
2,4-D + Imaza.+.25% S	3.8 EC 2.5 EC	.5 # .38 #	66.69	58.57	32.97	.0000	.0000
Bromoxynil + Fenoxa + S	4.0 EC .58 EC	.25 # .074 #	82.69	59.80	34.94	.0000	.0000

- Continued -

Table 2 (Cont'd). Agronomic data from the Combination Herbicide Study. NWARC, Kalispell.

Treatment	Form	Rate lb ai/A	Yield Bu/A	Test Wt lb/Bu	Height Inches	Lodging %	Lodging Angle
Bromoxynil + MCPA + Fenoxa + S	4.0 EC 3.8 EC .58 EC	.25 # .25 # .074 #	81.66	60.00	34.74	.0000	.0000
DPX-R9674 +.25% S + Fenoxa + S	75 DF .58 EC	.014# .074 #	73.28	59.85	34.74	.0000	.0000
2,4-D + Fenoxa + S	3.8 EC .58 EC	.5 # .074 #	64.09	59.00	33.86	.0000	.0000
Bromoxynil + Fenoxa+MCPA+ 2,4-D	4.0 EC 3.08 EC	.25 # .66 #	83.04	59.88	34.45	.0000	.0000
Bromoxynil + MCPA + Fenoxa+MCPA+ 2,4-D	4.0 EC 3.8 EC 3.08 EC	.25 # .25 # .66 #	69.86	59.62	34.15	.0000	.0000
DPX-R9674 +.25% S + Fenoxa+MCPA+ 2,4-D	75 DF 3.08 EC	.014# .66 #	73.12	59.88	33.56	.0000	.0000
2,4-D + Fenox + MCPA +2,4-D	3.8 EC	.5 #	63.03	58.67	33.66	.0000	.0000
Check	----	----	40.01	55.72	35.14	56.25	6.250
OVERALL MEAN =			67.93	58.67	34.56	10.50	1.110
F-RATIO TRTS =			8.388	14.69	1.355	10.59	11.10
P-VALUE TRTS =			.0000	.0000	.1601	.0000	.0000
CV (SE/MEAN) =			8.378	.9044	1.448	67.82	63.32
LSD(0.05 by t)=			16.04	1.496	1.411	20.07	1.981

1/ Lodging notes: % = percent of plot lodged
angle = degree of lodging, 0 = none, 9 = lodged to ground

PROJECT TITLE: Curtail/Assert Plantback Study, second year (Kalispell)

YEAR/PROJECT: 1990/754

INVESTIGATORS: Leader - Vern R. Stewart, Todd Keener - Research Specialist

OBJECTIVE: To evaluate the residual effect of both Curtail and Assert to subsequent plantings of rotational crops one year after application.

RESULTS: Eight crops were planted in strips across each of three replications that had been previously treated (on June 7, 1989) with Assert and/or Curtail. Glean was applied as a comparison residual herbicide. Barley, peas, sugar beets, alfalfa, canola, sunflower and lentils were planted with a research plot seeder on May 5. Potato plots were seeded by hand on May 31, 1991.

Crops were monitored throughout the growing season. Plant height and crop injury (by chemical residue) were recorded. Biomass assays and yields were obtained for each crop at maturity. Potato, sugar beet, pea, and sunflower yields were harvested by hand. A Hege plot combine was used to harvest barley, canola, and swathed lentils. An Almaco forage harvester was used to harvest the alfalfa plots. Harvest dates are listed below with other plot data.

Crop	Seeding Rate per acre	Harvest Date	Herbicide 1/ prod/A	Yield Sample
Barley	70 #	Sept 7	Bromox 1 pt	Grain bu/A
Canola	7 #	August 10	Stinger 2/3pt	Seed lb/A
Alfalfa	12 #	August 23	Bromqx 1 pt	Hay Tons/A
Potato	2000 #	Sept 13	Lexone .76#	Potato #/A
Sugar beets	10 #	Sept 13	Stinger 2/3pt	Biomass kg
Peas	125 #	August 1	Lexone .17#	Biomass, kg
Lentil	60 #	Sept 7	Lexone .17#	Seed, lb/A
Sunflower	5 #	Sept 4	--------	Biomass, Kg Heads only

1/ For general weed control.

Yield or biomass data obtained from each of eight crops was not significantly different when comparing treated plots with the check, except where Glean had been applied and sunflowers replanted. The crop yields and biomass were lowest in the Glean plots where barley, peas, canola, and lentils had been replanted one year after treatment. Although not statistically significant potato yields were lowest in the plots previouly treated with Curtail M and Assert plus Curtail. Growing conditions (dryland) at this test site were not comparable to those in

normal potato, sugar beet or alfalfa rotations. It is necessary to weigh data accordingly and realize further testing under high moisture, or irrigated conditions is necessary to accurately detect Assert or Curtail residual effect on these crops.

Height data (Table 2) were least for all crops in plots that had been previously treated with Glean. Significant height differences were noted in lentils, peas and canola. All other treatments did not significantly alter height of the eight crops.

Crop injury ratings (Table 3) obtained July 10, 1990 showed Glean residual affecting all crops planted back into soils treated last year.

SUMMARY:

Yield, biomass data, height, and crop injury ratings indicate no adverse effects of residual Assert or Curtail on barley, peas, sugar beets, potato, alfalfa, canola, sunflower, and lentils replanted one year after treatment at normal use rates. Further plantback testing under high moisture conditions is desirable for potato, sugar beet and alfalfa.

FUTURE PLANS:

No future plans are scheduled for this test area because the effects of chemical residue to subsequent crops planted the following year were not detected.

Table 1. Yield and biomass data from the Curtail/Assert Study plantback crops seeded one year after application. N. W. Agricultural Research Center, Kalispell, MT in 1989.

Date planted: May 4, 1990 Harvested at various dates Field R-14
Biomass yields in Kilograms, other yields given as specified.

Treatment	Prod/Acre or (ai/A)	9/7 Barley Bu/A	8/1 Peas Kg/plot	9/13 S.Beets Kg/plot	9/13 Spuds lbs/A	8/23 Alfalfa T/A	8/10 Canola lbs/A	9/4 Sunfwr Kg/plot	9/7 Lentil lbs/A
Curtail	2 pt (.58#)	43.8	2.567	3.783	702.9	2.60	899.8	10.63	197.8
Curtail	2 2/3 pt (.79#)	44.7	3.917	4.483	735.8	2.51	819.7	12.37	334.1
Curtail M	1 3/4 pt (.6#)	45.8	4.000	3.433	570.9	2.40	776.6	13.10	250.7
Curtail M	2 1/3 pt (.8#)	44.0	3.150	4.033	779.3	2.74	663.5	13.05	286.8
Assert	1.2 pt (.375#)	45.3	3.300	3.433	680.5	2.45	822.9	12.33	117.1
Assert	1.5 pt (.47#)	45.2	3.600	3.567	976.9	2.64	771.6	11.62	220.2
Assert + Curtail	1.2 pt + 2 pt (.38#+.6#)	43.7	3.050	3.200	538.0	2.67	721.1	12.65	336.5
Assert + Curtail M	1.2 pt + 1 3/4 pt (.38#+.6#)	46.0	3.283	3.517	735.8	2.53	866.1	12.23	226.0
Glean + Surf(.25%)	1/3 oz. (.25oz)	41.3	2.450	3.267	823.5	2.44	702.6	8.350	113.2
Check	--------	45.2	3.133	3.267	966.4	2.26	797.3	12.53	146.2
OVERALL MEAN =		44.59	3.245	3.598	751.0	2.52	783.8	11.89	228.9
F-RATIO TRTS =		.1164	1.254	.6527	.9774	.6538	.3140	2.429	1.247
P-VALUE TRTS =		.9993	.3242	.7517	.4946	.7509	.9671	.0487	.3276
CV (SE/MEAN) =		9.160	13.92	13.79	19.52	6.945	16.71	7.745	29.28
LSD(0.05 by t)=		12.11	1.342	1.475	435.6	.5210	389.2	2.735	199.2

Table 2. Height data from the Curtail/Assert Study plantback crops seeded one year after applications. N. W. Agricultural Research Center, Kalispell, MT. in 1989.

Date planted: May 4, 1990 Harvested on various dates. Height taken 6/26/90.

Treatment	Prod/Acre or (ai/A)	Lentil	Peas	Sunflwr	S.beets	Alf	Canola	Barley	Potato
Curtail	2 pt (.58#)	23.00	22.67	34.33	17.67	19.33	24.33	22.67	21.67
Curtail	2 2/3 pt (.79#)	27.33	25.00	35.67	17.00	20.00	24.67	24.00	23.00
Curtail M	1 3/4 pt (.6#)	27.33	26.33	38.33	16.67	18.33	23.00	22.33	21.00
Curtail M	2 1/3 pt (.8#)	27.33	25.00	32.00	16.67	17.67	23.00	22.33	19.33
Assert	1.2 pt (.375#)	26.33	24.67	31.67	13.33	19.67	24.67	24.00	17.33
Assert	1.5 pt (.47#)	27.67	25.00	32.00	16.67	17.67	24.67	22.33	20.33
Assert + Curtail	1.2 pt + 2 pt (.38#+.6#)	27.33	25.00	32.00	17.00	20.00	24.67	24.00	22.33
Assert + Curtail	1.2 pt + 1 3/4 pt (.38#+.6#)	27.33	25.00	35.67	17.00	20.00	24.67	24.00	19.33
Glean + Surf(.25%)	1/3 oz. (.25oz)	19.67	16.33	22.67	13.00	16.00	16.00	21.67	16.67
Check		25.00	26.67	34.00	17.33	18.67	24.00	24.00	20.00
OVERALL MEAN =		25.83	24.17	32.83	16.23	18.73	23.37	23.13	20.10
F-RATIO TRTS =		3.702	2.791	1.663	1.370	.6560	2.547	1.170	1.623
P-VALUE TRTS =		.0077	.0280	.1671	.2694	.7491	.0405	.3702	.1783
CV (SE/MEAN) =		5.264	7.304	9.856	8.677	8.775	7.169	3.779	7.955
LSD(0.05 by t)=		4.041	5.245	9.615	4.185	4.884	4.977	2.597	4.751

Table 3. Crop injury data from the Curtail/Assert Study plantback crops seeded one year after applications. NW. Ag. Research Center, Kalispell, MT.

Date planted: May 4, 1990 Harvested at various dates
Crop injury rated on 7/10/90; 0-10 scale, 0=no injury, 10=dead plants

Treatment	Prod/Acre or (ai/A)	Lent	Pea	Sunf	Beet	Alf	Can	Bar	Pot
Curtail	2 pt (.58#)	0	0	0	0	0	0	.7	0
Curtail	2 2/3 pt (.79#)	.2	0	0	0	0	0	0	.3
Curtail M	1 3/4 pt (.6#)	0	0	0	0	0	0	0	0
Curtail M	2 1/3 pt (.8#)	0	0	0	0	0	.2	0	1.0
Assert	1.2 pt (.375#)	0	0	0	0	0	0	0	.5
Assert	1.5 pt (.47#)	0	0	0	0	0	.5	0	.5
Assert + Curtail	1.2 pt + 2 pt (.38#+.6#)	.7	0	.3	0	0	.2	.2	0
Assert + Curtail	1.2 pt + 1 3/4 pt (.38#+.6#)	.7	0	.3	1.7	0	0	0	.3
Glean + Surf(.25%	1/3 oz. (.25oz)	4.5	5.3	4.7	5.8	6.7	6.0	1.3	2.7
Check		.3	.3	.7	.3	0	.5	.5	.3
OVERALL MEAN	=	.6333	.5667	.6000	.7833	.6667	.7333	.2667	.5667
F-RATIO TRTS	=	5.740	15.73	8.396	3.421	57.14	19.76	.8774	4.617
P-VALUE TRTS	=	.0007	.0000	.0001	.0113	.0000	.0000	.5695	.0024
CV (SE/MEAN)	=	91.29	74.66	83.23	127.6	41.83	57.10	178.5	65.55
LSD(0.05 by t)	=	1.718	1.257	1.484	2.971	.8286	1.244	1.414	1.104

PROJECT TITLE: Crop Tolerance of Three Spring Wheat and Spring Barley Varieties to Express and Express plus 2,4-D.

YEAR/PROJECT: 1990/754

INVESTIGATORS: Leader - Vern R. Stewart, Todd Keener - Research Specialist

OBJECTIVE: To evaluate three spring wheat and three spring barley varieties for crop tolerance to use rates of Express and Express plus 2,4-D.

RESULTS: Three spring barley varieties (Gallatin, Russel, Bearpaw) and three spring wheat varieties (WB 926, Newana, and Penawawa) were planted in four row plots, four feet by 10 feet using a research plot seeder. Each variety was planted at 60 lbs/acre in a block of six varieties, which was then treated with one of six herbicide treatments. Each of these treatment blocks was replicated four times in a complete randomized block, split plot design. All treatments were applied at the five leaf stage of the grain using a research plot sprayer. Where weeds were not controlled with herbicides undesirable plants were mechanically removed creating a weed free environment. A Hege plot combine was used to harvested the experiment.

In both spring wheat and spring barley there were no significant differences measured in yield, test weight, % plump (barley only), height, and heading date among treatments means. As expected there were significant differences measured between varieties in test weight, % plump, height and heading date.

SUMMARY:

Express and Express plus 2,4-D at normal use rates did not affect yield, test weight, % plump, height, and heading dates of spring barley or spring wheat varieties. There were varietal differences in test weight, % plump, height, and heading date.

FUTURE PLANS:

At this time there are no future plans for this project.

Table 1. Agronomic data from the Express Crop Tolerance Study on Spring Barley and Spring Wheat. Northwestern Agricultural Research Center, Kalispell, MT.

Yield (Bushels/Acre)

Treatment/Rate		Gallatin	Russel	Bearpaw	Mean	WB 926	Newana	Penewawa	Mean
Express	.25 oz	119.3	120.2	117.5	119.0	86.9	89.2	100.9	92.3
Express	.5 oz	131.5	126.2	116.1	124.6	97.8	95.9	95.2	96.3
Express + 2,4-D	.25 oz 4 oz	124.3	130.9	115.3	123.5	106.7	98.5	98.9	101.3
Express + 2,4-D	.25 oz 8 oz	129.1	124.6	119.0	124.2	97.9	94.1	111.4	101.1
Bronate	.375 #	127.8	118.5	119.7	122.0	100.4	89.3	100.8	96.8
Check	---	125.5	123.9	124.4	124.6	102.7	92.5	101.3	98.8
	Mean	126.3	124.0	118.7	Mean	98.7	93.2	101.4	

Differences between variety and treatment means non-significant

Test Weight (lbs/bu)

Treatment/Rate		Gallatin	Russel	Bearpaw	Mean	WB 926	Newana	Penewawa	Mean
Express	.25 oz	48.8	46.2	45.5	46.8	56.9	58.4	57.9	57.2
Express	.5 oz	48.2	45.1	45.6	46.3	57.8	59.0	56.8	57.9
Express + 2,4-D	.25 oz 4 oz	48.8	45.6	45.5	46.7	58.1	58.7	57.1	58.0
Express + 2,4-D	.25 oz 8 oz	49.3	45.9	46.9	47.4	57.5	58.7	58.0	58.1
Bronate	.375 #	49.6	46.6	46.5	47.7	58.1	58.6	58.0	58.2
Check	---	48.3	46.2	47.8	47.4	57.8	59.1	56.9	57.9
	Mean	48.8	45.9	46.3	Mean	57.7	58.7	57.4	

Differences between treatment means are non-significant
LSD (.05) between spring barley means = .7096 lb/bu (P=.0000)
LSD (.05) between spring wheat means = .4633 lb/bu (P=.0000)

Percent Plump

Treatment/Rate		Gallatin	Russel	Bearpaw	Mean
Express	.25 oz	97.8	99.0	98.0	98.3
Express	.5 oz	96.8	98.3	98.3	97.8
Express + 2,4-D	.25 oz 4 oz	97.0	98.5	98.5	98.0
Express + 2,4-D	.25 oz 8 oz	97.5	98.5	98.5	98.2
Bronate	.375 #	98.0	98.8	97.8	98.2
Check	---	97.5	98.3	98.5	98.4
	Mean	97.4	98.7	98.3	

Differences between treatment means are non-significant
LSD (.05) between variety means = .6082 (P = .0005)

Height (Inches) June 15, 1990

Treatment/Rate		Gallatin	Russel	Bearpaw	Mean	WB 926	Newana	Penewawa	Mean
Express	.25 oz	15.4	15.2	15.4	15.3	12.7	10.9	12.1	11.9
Express	.5 oz	15.8	13.3	15.3	14.8	13.0	11.4	11.6	12.0
Express + 2,4-D	.25 oz 4 oz	13.9	13.4	15.5	14.2	13.0	10.2	11.0	11.4
Express + 2,4-D	.25 oz 8 oz	14.2	13.8	15.5	14.5	13.3	10.9	11.5	11.9
Bronate	.375 #	16.2	14.7	16.1	15.7	14.7	11.3	13.1	13.0
Check	---	14.7	13.3	15.1	14.3	12.0	9.6	11.5	11.1
	Mean	15.0	13.9	15.5	Mean	13.1	10.7	11.8	

Differences between treatment means are non-significant
LSD (.05) between spring barley variety means = .5893 (P=.0000)
LSD (.05) between spring wheat variety means = .6146 (P=.0000)

Height (Inches) August 2, 1990

Treatment/Rate		Gallatin	Russel	Bearpaw	Mean	WB 926	Newana	Penewawa	Mean
Express	.25 oz	35.6	34.0	34.1	34.6	32.3	32.8	34.3	33.1
Express	.5 oz	34.7	32.5	33.3	33.5	32.7	32.7	34.5	33.3
Express + 2,4-D	.25 oz 4 oz	34.5	33.4	34.9	34.3	33.0	33.1	33.2	33.1
Express + 2,4-D	.25 oz 8 oz	33.9	32.5	33.8	33.4	32.1	32.8	32.2	32.4
Bronate	.375 #	35.7	34.7	35.0	35.2	32.1	32.9	35.3	33.4
Check	---	33.2	32.9	34.3	33.4	32.4	32.9	34.5	33.2
	Mean	33.6	33.3	34.2	Mean	32.4	32.8	34.0	

Differences between treatment means are non-significant
LSD (.05) between spring barley variety means = .9279 inches (P=.0269)
LSD (.05) between spring wheat variety means = .6143 inches (P=.0000)

Heading Date (Julian)

Treatment/Rate		Gallatin	Russel	Bearpaw	Mean	WB 926	Newana	Penewawa	Mean
Express	.25 oz	180.3	180.0	184.0	181.4	179.0	184.3	184.8	182.8
Express	.5 oz	180.3	180.0	184.0	181.4	179.0	183.5	184.8	182.4
Express + 2,4-D	.25 oz 4 oz	179.8	179.8	184.0	181.2	179.0	184.8	184.5	182.8
Express + 2,4-D	.25 oz 8 oz	180.3	180.0	183.0	181.1	179.3	185.0	184.5	182.9
Bronate	.375 #	180.5	180.0	185.0	181.8	179.0	184.3	184.5	182.6
Check	---	180.3	180.0	181.8	180.7	179.0	184.8	184.8	182.8
	Mean	180.2	180.0	183.6	Mean	179.0	184.4	184.7	

Differences between treatment means are non-significant
LSD (/05) betwwen spring barley variety means = .6772 (P=.0000)
LSD (.05) between spring wheat variety means = .3903 (P=.0000)

PROJECT TITLE: Fargo/Showdown Rate and Incorporation Study on Newana Spring Wheat

YEAR/PROJECT: 1990/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC, Kalispell, MT.

OBJECTIVE: Determine crop tolerance and evaluate incorporation methods of two triallate formulatons.

SUMMARY: A second incorporation of triallate four days after the application and first incorporation contributed to significant increases in yield, test weight, and percent wild oat control with significantly less lodging.

RESEARCH METHODS:

Two formulations of triallate were applied at two rates to a test area on 4/19/90 using a Valmar TM 240 air-granular applicator. Treatments were immediately incoporated (one-pass) after aplication using a vibra-shank field cultivator set to a depth of 2-3 inches. Half of the test plots were incorporated again, perpendicular to the previous incoporation, four days after the applications (4/23/90). The entire test area was then seeded to Newana spring wheat at 60 lbs/A using a press drill. The test area was fertilized at seeding with 200 lb/A of 29-14-0. Each plot was 40' X 40' with three replications. The test was a split-plot randomized complete block design.

A uniform application of Bronate plus Harmony Extra (1/4 lb + 3/8 oz ai/A) was applied for broadleaf weed control on 6/6/90. Yields were obtained from 144 square foot (4' X 36') subplots utilizing a Hege plot combine on 9/5/90.

RESULTS:

Significant differences were found in yield, test weight, percent wild oat control, and severity of lodging when data was compared from once incorporated versus twice incorporated plots. All treated plots had significantly higher yields, test weights and % wild oat (Avena fatua) control with much less severity and prevelance of lodging than the check plots. Plant injury was noted in all treated plots and was significantly greater in the plot treated with the high rate of Fargo. Plant injury did not vary significantly across incorporation regimes.

The significant increases noted in yield or test weight and the occurance of greatly reduced lodging can mainly be attributed to increases in percent wild oat control that was obtained by the double/delayed incorporation technique. This increase in wild oat control was significantly greater in all the double/delay incorporation treatments in comparison to the single incorporation plots.

Agronomic data demonstrated that Fargo, and especially Showdown, are more effective in spring wheat if twice incoporated by the methods used in this study. Lodging was virtually eliminated in all treated plots when triallate granules were applied and double/delay incoporated.

Table 1. Agronomic data from the Fargo/Showdown Rate and Incorporation Study on Newana Spring wheat grown on the Northwestern Agriculutural Research Center in Kalispell, MT.

YIELD (BU/A)

Treatment	Rate lb ai/A	1 X Incorp.	2X Incorp.	Treatment Means
Fargo	1.0	48.92	63.88	56.40
Fargo	1.25	50.70	76.65	63.37
Showdown	1.0	46.85	81.11	64.13
Showdown	1.25	35.90	68.68	52.29
Check	-----	5.99	9.23	7.60
Incorporation Means		37.66	59.96	

LSD (.05) between incorporation means = 43.20 bu/A (P=.0383)
LSD (.05) between treatment means = 21.66 bu/A (P=.0000)
LSD (.05) between interaction means not significant (P=.2101)

Table 2. Fargo/Showdown Rate and Incorporation Study. (Cont'd)

TEST WEIGHT (LB/BU)

Treatment	Rate lb ai/A	1 X Incorp.	2X Incorp.	Treatment Means
Fargo	1.0	59.83	60.70	60.27
Fargo	1.25	59.03	60.13	59.58
Showdown	1.0	58.20	60.87	59.53
Showdown	1.25	56.73	59.77	58.25
Check	-----	52.23	53.77	53.00
Incorporation Mean		57.21	59.05	

LSD (.05) between incorporation means = 3.29 lb/bu (P=.0328)
LSD (.05) between treatment means = 1.77 lb/bu (P=.0000)
LSD (.05) between interaction means not significant (P=.3034)

Table 3. Agronomic data from the Fargo/Showdown Rate and Incorporation Study on Newana Spring wheat grown on the Northwestern Agriculutural Research Center in Kalispell, MT.

		PLANT INJURY 1/		
Treatment	Rate lb ai/A	1 X Incorp.	2X Incorp.	Treatment Means
Fargo	1.0	.83	.67	.75
Fargo	1.25	1.17	1.50	1.33
Showdown	1.0	.50	.50	.50
Showdown	1.25	.67	.83	.75
Check	-----	0.00	0.00	0.00
Incorporation Means		.63	.70	

LSD (.05) between incorporation means not significant (P=.822)
LSD (.05) between treatment means = .996 (P=.0161)
LSD (.05) between interaction means not significant (P=.9538)

1/ Plant injury rated on 0-10 scale; 0 = no injury, 10 = dead plants

Table 4. Fargo/Showdown Rate and Incorporation Study. (Cont'd)

		% WILD OAT CONTROL 2/		
Treatment	Rate lb ai/A	1 X Incorp.	2X Incorp.	Treatment Means
Fargo	1.0	35	68	51.7
Fargo	1.25	32	74	52.8
Showdown	1.0	38	68	53.0
Showdown	1.25	33	75	54.2
Check	-----	0	0	0.0
Incorporation Means		27.7	57.0	

LSD (.05) between incorporation means = 8.48 (P=.0000)
LSD (.05) between treatment means = 22.70 (P=.0000)
LSD (.05) between interaction means not significant (P=.0747)

2/ Wild oat percent control by ocular observation

Table 5. Fargo/Showdown Rate and Incorporation Study. (Cont'd)

LODGING SEVERITY AND PREVALENCE 1/

Treatment	Rate lb ai/A	1 X Incorp.		2X Incorp.		Treatment Means	
		Sever	Prev	Sever	Prev	Sever	Prev
Fargo	1.0	2.7	5.0	0.0	0.0	1.3	2.5
Fargo	1.25	5.3	26.7	0.0	0.0	2.7	13.3
Showdown	1.0	4.0	23.3	0.0	0.0	2.0	11.7
Showdown	1.25	4.0	28.3	0.0	0.0	2.0	14.7
Check	-----	8.7	96.0	8.7	96.0	8.7	96.0
Incorporation Means		4.93	35.9	1.73	19.2		

Severity (Sever)
LSD (.05) between incorporation means = 5.87 (P=.0346)
LSD (.05) between treatment means = 5.171 (P=.0035)
LSD (.05) between interaction means not significant (P=.6112)
Prevalence (Prev)
LSD (.05) between incorporation means not significant (P=.0514)
LSD (.05) between treatment means = 34.25 (P=.0000)
LSD (.05) between interaction means not significant (P=.6254)

1/ Lodging rated by ocular observations. Severity is the degree the wheat has lodged to ground and is rated on a 1 to 9 scale. 0 = no lodging (perpendicular to ground),9 = lodged to ground. Prevalence is the percentage of plot that has lodged

PROJECT TITLE: Gromwell herbicide study in winter wheat

YEAR/PROJECT: 1990/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd Keener, Research Specialist, NWARC, Kalispell, MT.

OBJECTIVE: Evaluation of several herbicide and herbicide combinations for control of gromwell and blue mustard in winter wheat.

SUMMARY:

Several herbicides gave excellent control of gromwell and blue mustard in winter wheat which resulted in yields significantly higher than the check.

RESEARCH METHODS:

A herbicide study was established in a new seeding of Daws winter wheat that had a severe infestation of gromwell (Lithospermum arvense) and a moderate population of blue mustard (Chorispora tenella). Treatments were applied post emmergence using a research-type, tractor mounted sprayer. A Hege combine was used to harvest the study. Plots were 10' by 25' with four replications in a randomized complete block design. Application data and weed rating information can be seen in Table 3.

RESULTS:

Minor indications of winter wheat injury were apparent in thinned plots or reduced plant growth in the phenoxy treatments. Plant injury was sustained through the season in the Bromoxynil + DPX-R9674 treeatments. Uniform growth was observed for all other treatments at grain maturity.

Control of gromwell and blue mustard was detected soon after application with treatments of bromoxynil, and combinations with bromoxynil. The sulfonylureas, having a slower mode of action, did not effectively control gromwell and blue mustard until the last rating (5/19/90). No antagonism was observed with the bromoxynil plus sulfonylurea tank mixes. Increased activity of bromoxynil in control of gromwell and blue mustard was seen with increased rates. Clopyralid, dicamba and the phenoxies alone gave poor broadleaf control.

Effective broadleaf weed control in several treatments resulted in yields that were significantly greater than the check (table 1). Bromoxynil, the sulfonyl ureas, metribuzin and combinations of the sulfonylureas plus bromoxynil were among those treatments. The yields from plots treated with the phenoxy herbicides (2,4-D and MCPA) were depressed in most treatments, indicating possible plant injury. The low yields from clopyralid, dicamba, and imazamethabenz applications is related to the poor broadleaf weed control.

Test weights were lowest in the check as a result of weed competition. Height was greatest in the check and lower in all treated plots, an indication of plant responses to each of the herbicide treatments.

Table 1. Agronomic data for the gromwell herbicide study in winter wheat, Polson, MT. in 1990.

Treatment	Form.	Rate lb ai/A	Yield Bu/A	Test Wt lb/bu	Height Inches
Check	----	----	40.25	57.95	35.24
Bromoxynil	2 EC	.187	51.04	58.88	32.48
Bromoxynil	2 EC	.375	51.74	58.90	31.30
Bromoxynil + DPX-L5300 + S	2 EC 75 WP	.187 .008	53.27	59.45	32.58
Bromoxynil + MCPA	2 EC 2 EC	.187 .187	53.55	59.88	32.58
Bromoxynil + MCPA	2 EC 2 EC	.375 .375	47.55	59.08	31.30
Bromoxynil DPX-R9674 + S	2 EC 75 WP	.187 .008	57.49	58.22	31.79
Bromoxynil DPX-R9674 + S	2 EC 75 WP	.187 .016	52.81	59.15	31.10
DPX-R9674 + S + MCPA ester	75 WP 4 EC	.016 .24	50.37	58.78	31.10
MCPA ester	4 EC	.75	43.15	59.25	30.71
2,4-D ester	4 EC	.5	43.39	59.73	30.51
DPX-R9674 + S	75 WP	.016	54.85	59.00	33.07
DPX-L5300 + S	75 WP	.016	53.33	58.63	32.09
Clopyralid	3.0 EC	.09	37.51	58.53	31.40
Clopyralid + 2,4-D	2.38 EC	2.7 pt.form	40.98	58.92	30.61
Clopyralid + MCPA	2.77 EC	2.3 pt form	48.79	59.22	32.38
Clopyralid + dicamba	3.0 EC 4 EC	.09 .125	31.09	58.63	30.51
Dicamba	4 EC	.125	41.14	59.05	33.46
Imezamethabenz	2.5 EC	1.5	40.29	58.53	31.89
Metribuzin	75 DF	.375	53.03	59.35	32.87
OVERALL MEAN =			47.28	58.95	31.95
F-RATIO TRTS =			5.827**	1.114	1.502
CV (SE/MEAN) =			6.190	.7590	3.020
LSD(0.05 by t)=			8.288	1.267	2.733

Table 2. Agronomic data from the gromwell herbicide study in winter wheat, Polson, MT 1990.

Treatment	Form.	Rate ai/A	Crop Injury 1/ 4/23	Crop Injury 1/ 5/16	% Gromwell Control 4/23	% Gromwell Control 5/16	% Bluemst Control 4/23	% Bluemst Control 5/16
Check	----	----	.0000	.0000	.0000	.0000	.0000	.0000
Bromoxynil	2 EC	.187	.0000	.0000	62.50	77.75	55.00	89.75
Bromoxynil	2 EC	.375	.0000	.0000	46.00	96.25	47.50	98.75
Bromoxynil + DPX-L5300 + S	2 EC 75 WP	.187 .008	.1000	.1250	42.50	97.50	37.50	99.75
Bromoxynil + MCPA	2 EC 2 EC	.187 .187	.0000	.0000	52.50	85.00	52.50	93.75
Bromoxynil + MCPA	2 EC 2 EC	.375 .375	.0000	.2500	40.00	95.30	50.00	97.50
Bromoxynil DPX-R9674 + S	2 EC 75 WP	.187 .008	.0000	.0000	47.50	97.25	45.00	97.00
Bromoxynil DPX-R9674 + S	2 EC 75 WP	.187 .016	.2500	.3750	50.00	99.75	32.50	100.0
DPX-R9674 + S + MCPA ester	75 WP 4 EC	.016 .24	.0000	.1250	.0000	98.50	10.00	97.25
MCPA ester	4 EC	.75	.0000	.0000	2.500	33.25	5.000	56.25
2,4-D ester	4 EC	.5	.0000	.2500	5.000	51.25	20.00	61.25
DPX-R9674 + S	75 WP	.016	.2500	.2500	.0000	90.50	.0000	95.75
DPX-L5300 +S	75 WP	.016	.1000	.1250	.0000	98.50	.0000	97.50
Clopyralid	3.0 EC	.09	.0000	.1250	.0000	7.500	.0000	23.75
Clopyralid + 2,4-D	2.38 EC	2.7 pt.form	.2500	.1250	.0000	17.50	.0000	56.25
Clopyralid + MCPA	2.77 EC	2.3 pt form	.0000	.0000	.0000	12.50	5.000	37.50
Clopyralid + dicamba	3.0 EC 4 EC	.09 .125	.0000	.0000	2.500	12.50	2.500	18.75
Dicamba	4 EC	.125	.0000	.0000	.0000	3.750	.0000	.0000
Imezamethabenz	2.5 EC	1.5	.0000	.1250	.0000	22.50	.0000	36.25
tribuzin	75 DF	.375	.0000	.2500	.0000	98.00	.0000	98.75
	OVERALL MEAN =		.47-01	.1063	17.55	58.81	18.13	67.79
	F-RATIO TRTS =		.7945	.8380	5.199	15.43	3.258	14.20
	CV (SE/MEAN) =		218.3	119.9	59.63	17.27	66.57	14.25
	LSD(0.05 by t)=		.3070	.3609	30.98	28.76	35.71	27.35

1/ Crop injury:
0-10 rating,
0 = no injury
10 = dead plant

Table 3. Application and weed score information, gromwell herbicide study in winter wheat, Polson, MT 1990

Date planted: September 22, 1989 Harvested: August 7, 1990

Application and rating data:

Type Application: Post Date: 4/18/90
Air temp: 56 F Soil Temp: 52 F
Rel Hum: 35% Cloud cover: clear
Wind: 0-5mph, SE Soil Moisture: good
Crop stage : 4-5 leaf, 2cd tiller, 5-8" tall.
Surfactant (+ S) added to all sulfonylurea treatments at .25% v/v

Weed stages: Purple mustard, seed to 6", mostly 2-3"
Gromwell, 1-5", mostly 3"
other weeds present : wild buckwheat, sow-thistle, chickweed, and false flax.

Type sprayer: Research plot sprayer, 27.57 gpa, 8002 nozzles, 32 psi, 2.64 mph speed, 17-19" height.
Plot size 10' X 25'

Rating information:

Evaluation 1 Date: 4/23/90 By: TKK/VRS
Scale: Injury 0-10, 0 + no injury, 10 = dead plants
% control = percentage of weeds controlled
Crop stage: 5-8", fully tillered

Weed	Stage	Density
1. Blue mustard	5-8" flwring	3-5/sq ft
2. Gromwell	2-5" flwring	1-3/sq ft

Evaluation 2 Date: 5/16/90 By: TKK
Scale: Injury 0-10, 0 + no injury, 10 = dead plants
% control = percentage of weeds controlled
Crop stage: 12-15"

Weed	Stage	Density
1. Blue mustard	8-10"	15-20/sq ft
2. Gromwell	10-12"	12/ sq ft

PROJECT TITLE: Canola Herbicide Evaluations

YEAR/PROJECT: 1990/754

INVESTIGATORS: Leader - Vern R. Stewart, Todd Keener - Research Specialist

OBJECTIVE: Evaluate preplant and post emmergence herbicides in spring canola for crop tolerance and weed control.

RESEARCH METHODS:

Six herbicide treatments were evaluated on Tolbin spring canola for crop tolerance and weed control. Two herbicides (trifluralin and ethalfluralin) were applied pre plant incorporated (PPI) while other treatments (DPX - A7881, clopyralid, sethoxydim, and pyridate) were post emmergence (POST) applications. PPI treatments were applied May 7, 1990 and twice incorporated with a roto-tiller. POST applications were applied June 14, 1990, approximately 1 month after canola emmergence. All applications were made using a tractor-mounted, research type sprayer. Canola was seeded in 12 foot strips using a research seeder and 10' herbicide plots were established across the strips. At harvest 3' swaths were cut through each plot and set aside to dry. After drying the harvest samples were then threshed with a Hege combine.

Application data

Type:	PPI	POST
Date:	5/7/90	6/14/90
Air temp (F)	40	65
Soil temp (F)	49	60
Rel Humid. %	35	20
Wind (mph)	3-5	3
Sky	Cldy	Clear
Topsoil moist.	Fair	V. good
Subsoil Moist.	V. good	V. good
Crop Stage	N/A	6-8 leaf

Canola emmerged on 5/15/90

RESULTS:

Slight crop injury and stand thinning were observed with ethalfluralin but was not noted later in the season. Plant counts taken June 25, 1990 did not show significant reduction in plant numbers for PPI treated plots versus the check. Plant numbers were lowest in plots treated with pyridate and ethalfluralin plus clopyralid. Height was significantly reduced in plots treated with ethalfluralin plus DPX-A7881, ethalfluralin plus clopyralid, pyridate, and pyridate plus clopyralid. Initial injury to canola was seen with POST applications of clopyralid to plots previously treated with ethalfluralin as well as the post emmergence pyridate applications. Height notes taken later in the season (June 2, 1990) showed differences between treated and non-treated plots as non-significant. Wild oats (Avena fatua) were partially controlled by ethalfluralin, trifluralin, and sethoxydim. The PPI applications of ethalfluralin and trifluralin gave equal wild oat control as POST applications of sethoxydim. Yields were affected, in part, by wild oat competition as well as reactions to herbicide applications. Clopyralid and

pyridate treated plots had the lowest yields of herbicide treatments as a result of chemical injury. All other treatments had yields equal to, or greater than, the check plot. A significantly higher yield was harvested from plots with trifluralin (PPI) plus clopyralid (POST). In this study canola tolerated trifluralin, ethalfluralin, DPX-A7881, sethoxydim, and light rates of clopyralid.

PROJECT TITLE: Reduced Rates of Wild Oat Herbicides on Gallatin Spring Barley

YEAR/PROJECT: 1990/754

INVESTIGATORS: Leader - Vern R. Stewart, Todd Keener - Research Specialist

OBJECTIVE: Evaluation of reduced rates of wild oat herbicides for effective control of wild oats.

RESEARCH METHODS:

Herbicide plots were established in a seeding of Gallatin spring barley that had a moderate infestation of wild oats (Avena fatua). Plots were 10' X 20' and replicated four times in a randomized complete block design. Herbicides were applied post emmergence using a research, tractor-mounted sprayer when the barley was in the five leaf stage and the wild oats were in the 3-5 leaf stage. A light rain shower occurred 3 hours after herbicide applications. Harvest samples were taken August 16, 1990 using a Hege plot combine.

Application data:

Date: 5/29/90	Air temp 60 F	Soil temp 63 F
Rel Humid. 52%	Wind 0-2 MPH	Cloudy
Top soil - moist	Sub soil- moist	
Barley - 5 leaf to tillering	Wild Oats - 3 to 5 leaf	

RESULTS:

Noticeable discoloration occurred in spring barley with applications of diclofop and fenoxaprop at normal rates and reduced rates with ammonium sulfate. No significant differences were found in yield, test weights and height among herbicide treatments. Percent plumps were very low in the check due to the wild oat competition and lodging. All herbicide treatments, except fenoxaprop and the high rate of diclofop, had higher percent plumps than the check. Spring barley showed additional crop reaction to fenoxaprop resulting in percent plumps that were equal to the check. Although slight height reductions were noted in diclofop and fenoxaprop plots on June 4th, there were no significant differences noted at harvest.

Percent wild oat control was equal when using reduced rates of diclofop and fenoxaprop plus ammonium sulfate (2 % by weight) as compared to applications of those herbicides at normal rates (.73 and .074 # ai/A respectively). Imazamethabenz had better percent wild oat control at reduced rates while difenzoquat wild oat control was less at reduced rates with ammonium sulfate. As these are only first year observations more research is needed before effective use of reduced rates can be substantiated and recommended. Continued evaluations of reduced herbicide rates is planned in the future.

Table 1. Agronomic data from the preplant and post emergence herbicide applications to canola. Northwestern Agicultural Research Center, Kalispell, MT. in 1990. Field R-13

Treatment	Rate lb ai/A	Appln.	Yield lb/A	Plts/ sq ft	Height In. 6/25	Height In. 8/2	% W Oat Control
Ethalfluralin	.75 #	PPI	1230.	47.67	6.594	29.82	77.50
Trifluralin	1.0 #	PPI	1114.	51.33	8.071	28.44	80.00
DPX-A7881 + .25% surf	.016 #	POST	1012.	46.33	8.268	27.85	42.50
Clopyralid	.1875#	POST	967.7	49.00	11.32	32.87	5.000
Clopyralid + 2 pt/A C.O.C.	.1875#	POST	889.0	46.67	9.744	29.23	.0000
Ethalfluralin + DPX-A7881 + .25% surf	.75 # .016 #	PPI POST	1238.	48.00	7.283	29.92	91.25
Ethalfluralin + Clopyralid	.75 # .1875#	PPI POST	1256.	40.00	4.823	21.26	74.25
Trifluralin + DPX-A7881 + .25% surf	1.0 # .016 #	PPI POST	1216.	41.00	8.169	29.13	86.50
Trifluralin + Clopyralid	1.0 # .1875#	PPI POST	1487.	48.33	8.760	30.51	93.00
Sethoxydim + 1 qt COC	.28 #	POST	1214.	48.00	8.661	28.64	87.50
Sethoxydim + 2 pt COC + Clopyralid	.28# .1875#	POST POST	1305.	51.00	7.874	30.81	77.00
Pyridate	.80 #	POST	524.2	39.67	3.445	25.59	.0000
Pyridate + + Clopyralid	.80 # .1875	POST POST	668.9	47.00	4.331	28.05	.0000
Check	----	----	1186.	51.00	9.547	31.59	.0000
OVERALL MEAN =			1093.	46.79	7.635	28.84	51.04
F-RATIO TRTS =			9.597	1.789	8.051	1.852	17.82
P-VALUE TRTS =			.0000	.0764	.0000	.0650	.0000
CV (SE/MEAN) =			7.647	6.232	10.17	7.162	18.80
LSD(0.05 by t)=			239.2	8.340	2.211	5.908	27.45

PROJECT TITLE: Alfalfa Herbicide Evaluations

YEAR/PROJECT: 1990/754

INVESTIGATORS: Leader - Vern R. Stewert, Todd Keener - Research Specialists

OBJECTIVE: Evaluation of herbicide and herbicide combinations for broadleaf weed control in a new seeding of alfalfa.

RESEARCH METHODS:

A new seeding of Oneida alfalfa was planted April 25, 1990 with no pre-plant herbicides applied. On June 6, 1990 post emmergence broadleaf herbicides were applied at the two and one half trifoliate stage of alfalfa. A tractor mounted, research-type sprayer was used for herbicide applications. Plots were 10' by 20' and replicated four times in a randomized complete block design. Harvest samples were taken for each of two cuttings using an Almaco forage harvester. Percent species compositions were determined for each treatment in both harvest by taking a sub-sample of each plot, separating that sample into different plant groups (alfalfa, broadleaves and grasses) and determining percent composition by weight.

Application data: Post emmergence application of broadleaf herbicides
Date: June 6, 1990 Air temp (F) 68 Soil temp (F) 68
Rel Humid: 25% Wind (mph) 0-2 Sky: Cloudy
Topsoil moisture - very good Subsoil moisture - very good
Alfalfa stage 2 1/2 trifoliate
Weed stages: Fanweed 2-3" (Thlaspi arvense)
Shepherdspurse 1-2" (Capsella bursa-pastoris)
Chickweed seedling (Stellaria media)

RESULTS:

Herbicide treatments that gave excellent control of the three weed species evaluated (fanweed, shepherdspurse, and chickweed) were the combination treatments of imazethapyr plus 2,4-DB amine, bentazon, or bromoxynil. Any of those four herbicides alone were weak on one of the three weed species. Besides the above listed herbicide treatments, those applications effective against fanweed and sheperdspurse in a new seeding of alfalfa were bromoxynil, and bromoxynil plus either 2,4-DB or pyridate. Height was significantly reduced for most combination treatments shortly after application. Table 1. Height differences were not detected at first harvest.

None of the treatments resulted in hay yields greater than the check yet the majority of combination herbicide treatments provided higher alfalfa percentages for the first cutting. Table 2. There were no weed populations in the second cutting of alfalfa. Table 3.

Table 1. Agronomic data from the wild oat herbicide-reduced rate study, NWARC, Kalispell, MT in 1990. Field R-9.
Planted April 19, 1990 Harvested: August 16, 1990

Treatment	Rate lb ai/A	Yield Bu/A	Test Wt Lb/bu	% Plump	Height Inches	Wild Oat 7/26
Difenzoquat	1.0#	85.56	50.02	85.75	41.14	83.25
Difenzoquat + Am. sulfate	.75# + 2%	88.22	48.18	87.50	39.07	62.50
Imazamethabenz + surf.	.38#	84.09	50.50	86.50	39.86	70.00
Imazamethabenz + Am. sul. + surf	.25# +	83.41	49.70	87.00	39.37	86.75
Diclofop + surf	.75#	91.84	49.15	79.00	38.88	96.25
Diclofop + surf + Am Sulfate	.50# +	85.03	50.30	86.00	39.17	96.75
Fenoxaprop + surf.	.07#	90.04	48.40	77.00	39.86	98.25
Fenoxaprop + Am. sul.+ surf	.05# +	83.28	50.13	81.50	39.47	98.00
Check	---	80.12	47.30	73.75	40.16	.0000
OVERALL MEAN =		85.73	49.30	82.67	39.67	76.86
F-RATIO TRTS =		.7507	.9023	2.688*	1.592	12.40*
P-VALUE TRTS =		.6606	.5386	.0256	.1740	.0000
CV (SE/MEAN) =		4.951	2.376	3.725	1.384	11.66
LSD(0.05 by t)=		12.39	3.419	8.988	1.602	26.17

* Indicates statistical significance at the .05 level of probability

Ammonium sulfate applied at 2% by weight (17 lbs/ 100 gal).

Table 1. Agronomic data from the alfalfa herbicide study, Y-3, NWARC, Kalispell, MT in 1990. Planted April 25, 1990 Field Y-2

Treatment	Rate lb ai/A	PLANT INJ 1/	July 12, 1990 /2 Percent Weed Control FNWD	SPPRS	CKWD	Height (In) 6/20	7/23	Plants/ Sq Ft 6/20
Bentazon + COC	.5 #	.0000	5.000	17.50	42.50	5.46	27.76	34.88
Bromoxynil	.375 #	.0000	100.0	96.25	17.50	4.53	28.05	30.38
2,4-DB ester	.75 #	.0000	.0000	.0000	.0000	5.41	27.46	31.38
Bentazon + COC + 2,4-DB ester	.5 # .75 #	.0000	27.50	.0000	12.50	4.53	26.77	38.25
Bromoxynil + 2,4-DB ester	.25 # .75 #	.0000	97.50	95.00	20.00	4.53	27.85	28.63
Imazethapyr + + 2,4-DB amine	.063 # .75 #	.0000	100.0	98.75	93.75	4.28	28.54	32.25
Imazethapyr + + Bentazon + COC	.063 # .5 #	.0000	100.0	100.0	100.0	4.48	28.54	31.00
Bromoxynil + Imazethapyr	. 25 # .063 #	.3125	100.0	100.0	98.75	4.13	27.36	31.00
Imazethapyr	.063 #	.1250	81.25	57.50	73.75	4.48	27.26	36.13
Pyridate	1.2 #	.1250	70.00	66.25	22.50	4.53	27.46	34.63
Pyridate + Bromoxynil	.8 # .25 #	1.625	100.0	100.0	27.50	3.79	25.48	27.00
Pyridate + 2,4-DB	.8 # .75 #	.2500	85.00	73.75	15.00	4.97	26.48	28.88
Pyridate + Bentazon + COC	.8 # .5 #	.0000	86.25	87.50	62.50	4.97	28.15	33.50
Check	----	.0000	.0000	.0000	.0000	5.51	27.95	28.88
OVERALL MEAN =		.1741	68.04	63.75	41.88	4.709	32.34	27.52
F-RATIO TRTS =		8.655	28.12	32.47	9.469	2.642	2.017	.0351
P-VALUE TRTS =		.0000	.0000	.0000	.0000	.0084	.0425	.0351
CV (SE/MEAN) =		84.02	11.31	11.39	28.47	6.702	7.563	1.998
LSD(0.05 by t)=		.4184	22.01	20.76	34.10	.9024	6.996	1.573

1/ Plant injury rated on 0-10 scale; 0 = no injury, 10 = dead plants
2/ Percent weed control by ocular observation. FNWD = fanweed, SPPRS = Sheperdspurse, Chickweed = chickweed.

Table 2. First harvest data from the alfalfa herbicide study, 1990.
Planted April 25, 1990 1st Cut July 24, 1990

Treatment	Rate lb ai/A	Percent Composition 1/ Alfalfa	Brdlvs	Grass	Yield Hay	(Tons/A) Alfalfa
Bentazon + COC	.5 #	86.13	12.77	1.102	2.868	2.487
Bromoxynil	.375 #	98.47	.0375	1.498	2.508	2.467
2,4-DB ester	.75 #	82.32	17.41	.2700	2.767	2.283
Bentazon + COC + 2,4-DB ester	.5 # .75 #	86.40	13.41	.1900	2.483	2.145
Bromoxynil + 2,4-DB ester	.25 # .75 #	99.97	.0325	.0000	2.568	2.568
Imazethapyr + + 2,4-DB amine	.063 # .75 #	99.60	.4000	.0000	2.512	2.503
Imazethapyr + + Bentazon + COC	.063 # .5 #	100.0	.0000	.0000	2.515	2.515
Bromoxynil + Imazethapyr	. 25 # .063 #	100.0	.0000	.0000	2.412	2.412
Imazethapyr	.063 #	94.60	5.037	.3600	2.420	2.287
Pyridate	1.2 #	97.76	2.240	.0000	2.558	2.505
Pyridate + Bromoxynil	.8 # .25 #	99.89	.0425	.6500	2.243	2.243
Pyridate + 2,4-DB	.8 # .75 #	96.87	2.900	.2325	2.368	2.293
Pyridate + Bentazon + COC	.8 # .5 #	99.30	.7000	.0000	2.685	2.668
Check	----	85.23	13.80	.9650	2.872	2.438
OVERALL MEAN =		94.75	4.913	.3345	2.556	2.415
F-RATIO TRTS =		3.364	3.323	1.302	2.802	1.030
P-VALUE TRTS =		.0014	.0015	.2499	.0056	.4456
CV (SE/MEAN) =		3.808	71.83	128.4	4.315	5.909
LSD(0.05 by t)=		10.32	10.09	1.228	.3154	.4082

1/ Percent composition determined by hand separation of species. Green weight, in regards to total weight from the subsample determines percent composition of each species.

Table 3. Second harvest data from the alfalfa herbicide study, 1990.
Planted April 25, 1990 2cd Cut September 28, 1990

Treatment	Rate lb ai/A	--- Percent Composition 1/- Alfalfa	Brdlvs	Grass	Yield (Tons/A) Hay	Alfalfa
Bentazon + COC	.5 #	100.0	.0000	.0000	2.642	2.642
Bromoxynil	.375 #	100.0	.0000	.0000	2.193	2.193
2,4-DB ester	.75 #	100.0	.0000	.0000	2.347	2.347
Bentazon + COC + 2,4-DB ester	.5 # .75 #	100.0	.0000	.0000	2.170	2.170
Bromoxynil + 2,4-DB ester	.25 # .75 #	100.0	.0000	.0000	1.918	1.918
Imazethapyr + + 2,4-DB amine	.063 # .75 #	100.0	.0000	.0000	2.523	2.523
Imazethapyr + + Bentazon + COC	.063 # .5 #	100.0	.0000	.0000	2.520	2.520
Bromoxynil + Imazethapyr	. 25 # .063 #	100.0	.0000	.0000	2.410	2.410
Imazethapyr	.063 #	100.0	.0000	.0000	2.250	2.250
Pyridate	1.2 #	100.0	.0000	.0000	2.138	2.138
Pyridate + Bromoxynil	.8 # .25 #	100.0	.0000	.0000	1.878	1.878
Pyridate + 2;4-DB	.8 # .75 #	100.0	.0000	.0000	2.210	2.210
Pyridate + Bentazon + COC	.8 # .5 #	100.0	.0000	.0000	2.683	2.683
Check	----	100.0	.0000	.0000	2.500	2.500
OVERALL MEAN =		100.0	.0000	.0000	2.313	2.313
F-RATIO TRTS =		.0000	.0000	.0000	.6964	.6964
P-VALUE TRTS =		.0000	.0000	.0000	.7639	.7639
CV (SE/MEAN) =		.0000	.0000	.0000	12.88	12.88
LSD(0.05 by t)=		.0000	.0000	.0000	.8524	.8524

1/ Percent composition determined by hand separation of species. Green weight, in regards to total weight from the subsample determines percent composition of each species.

PROJECT TITLE: Peppermint Herbicide Study

YEAR/PROJECT: 1990/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist. Northwestern Agricultural Research Center, Kalispell, MT.

OBJECTIVES: Evaluation of post emergence herbicides for control of common groundsel (Senecio vulgaris) and bedstraw (Galium aparine) in established peppermint.

SUMMARY: Pyridate, bentazon, bromoxynil, and tank mix combinations of those herbicides provided excellent control of common groundsel. Pyridate in tank-mix combination with bromoxynil, bentazon, and clopyralid demonstrated excellent control of bedstraw but applied alone provided only fair control. Slight plant injury was observed with the majority of treatments but these symptoms and the moderate chlorosis and leaf burn caused by bromoxynil applications were not detected at mid-season.

RESEARCH METHODS: The experiment was conducted in an established field of peppermint using a randomized complete block design with three replications. Herbicide treatments were applied on June 4, 1990 using a research-type, tractor mounted sprayer. The test site was established to observe crop tolerance and herbicide action of several post emmergence treatments on a severe population of common groundsel and bedstraw in peppermint.

Crop and spray data are included in the table below:

Application data:

Date: June 4, 1990	Air temp (F): 46
Soil temp (F): 50	Rel Humid. 38%
Wind velocity: 3 - 6 mph	Wind Direct.: SSW
Sky: partly cldy	Soil Moisture: V. good

Crop and weed stages:

Peppermint: 2 - 5"

Common groundsel: seedling - 5", the majority of plants (90%) were seedlings < 1'in diameter. There were approximately 10 plants/ft2.

Bedstraw: seedling to 8" tall, mostly about 3" tall. The bedstraw population was scattered and varied throughout the study although several severe infestations where located in the test area.

Other weeds were observed yet could not be rated in the evaluation due to the low weed population. These were blue mustard (Chorispora tenella), dandelion (Taraxacum officinale), and wild pansey (Viola arvense).

RESULTS:

After the post emmergence applications of herbicides some measure of plant injury was detected in each treated plot. There was moderate chlorosis and leaf burn observed in the bromoxynil plots. The plant injury reactions to bromoxynil as well as the slight leaf burn and curl symptoms of the other treatments were not detected at mid season (the second week of July).

The majority of the June 4th herbicide applications gave excellent

groundsel control yet did not give effective bedstraw control. The groundsel seedlings were uniform in size while the bedstraw had a more varied range of growth stages.

Pyridate, bromoxynil, bentazon, and the combinations of these herbicides performed very well in controlling common groundsel. The combinations of pyridate with clopyralid, sethoxydim, and fluazifop performed equally in groundsel control. Clopyralid did not add to the groundsel weed control that was achieved with applying pyridate alone. Clopyralid applied alone had little effect on groundsel or bedstraw.

There appeared to be no atagonistic effects of groundsel control with the tank mixes that included the grass herbicides sethoxydim and fluazifop. There was antagonism toward bedstraw weed control with fluazifop or sethoxydim in combination with pyridate plus clopyralid. Weed rating data from the 1990 study suggests that clopyralid tank mixed with pyridate may be synergistic and can contribute to increased bedstraw control.

Bedstraw was effectively controlled with tank mixes of pyridate plus clopyralid, bromoxynil, and bentazon. All the broadleaf herbicides tested alone did not effectively reduce the bedstraw weed population, however pyridate did show some selectivity towards that weed with fair control.

Initial plans were to have sequential applications of fluazifop and sethoxydim for grassy weed control. The later applications were canceled due to lack of grassy weeds.

Additional Weed Observations:

Although not evaluated under test conditions the following observations were made of other weeds and possible weed control:

Pyridate + bromoxynil appears to have some selectivity to blue mustard (Chorispora tenella).

Pyridate + clopyralid or bromoxynil appeared to show fair control activity on dandelion.

Pyridate alone and combined in tank mix with clopyralid or bentazon had no herbicidal activity on wild pansey (Viola arvense).

Herbicide common and trade names with rates

Common	Trade	Form.	AI/A	Form/A
Pyridate	Tough	3.75 EC	.9 lb	1.9 pts.
Clopyralid	Stinger	3 EC	.1875 lb	.5 pt.
Bromoxynil	Buctril	2 EC	.25 lb	1 pt.
Bentazon	Basagran	4 EC	1.5 lb	1.5 pt
Sethoxydim	Poast	1.5 EC	.46 lb	2.45 pt
Fluazifop	Fusilade	1 EC	.1875 lb	1.5 pt

Table 1. Agronomic data from the 1990 Peppermint Herbicide Trial. Evans Farm, Kalispell, MT.

Treatment	Rate ai/A	Plant Injury June 1/	Phytoxicity Chlor.	Leaf Burn	2/ Leaf Curl	% Weed Control 3/ Common Groundsel	Bedstraw
Pyridate	.90 lb	.83	.00	1.3	.00	100.0	65.00
Clopyralid	.1875 lb	.83	.00	1.0	.67	38.33	.0000
Pyridate + Clopyralid	.90 lb .1875 lb	.50	.00	.33	.61	99.67	96.67
Pyridate + Clopyralid + Sethoxydim *	.90 lb .1875 lb .46 lb	.42	.00	.67	.00	95.00	33.33
Pyridate + Clopyralid + Fluazifop **	.90 lb .1875 lb .1875 lb	.83	.00	.67	.00	95.67	58.33
Pyridate + Sethoxydim *	.90 lb .46 lb	.33	.00	.67	.00	96.67	66.67
Pyridate + Fluazifop **	.90 lb .1875 lb	.42	.00	.33	.33	98.33	66.67
Clopyralid + Sethoxydim *	.1875 lb .46 lb	.50	.00	.33	.33	50.00	.0000
Clopyralid + Fluazifop **	.1875 lb .1875 lb	.33	.00	.67	.00	41.67	.0000
Pyridate + + Bromoxynil	.90 lb + .25 lb	4.0	2.0	2.0	1.3	100.0	99.67
Pyridate + + Bentazon	.90 lb + 1.5 lb	.42	.00	.67	.33	100.0	91.67
Bromoxynil	.25 lb	1.2	.33	1.0	.67	100.0	31.67
Bentazon	1.5 lb	.50	.00	.67	.00	99.33	33.33
Check	-----	.00	.00	.00	.00	.0000	.0000
OVERALL MEAN =		.791	.167	.738	.309	79.62	45.93
P-VALUE TRTS =		.000	.000	.018	.010	.0000	.0195
CV (SE/MEAN) =		33.7	53.5	41.5	77.3	7.378	50.72
LSD(0.05 by t)=		.775	.259	.891	.696	17.08	67.72

Footnotes to Table 1. 1990 Peppermint Herbicide Trial, Evans farm, Kalispell.

Plots 10' X 20', 3 reps + 1 plot buffer = .0184 A, gpa=27.57

*/ 2 pts DASH or C.O.C. per acre Amt H20/plot=1920 ml

**/ 1 % v/v C.O.C. per acre

1/ Plant Injury rated 6/21/90 on 0-9 scale, 0 = no injury, 9 = dead plants

2/ Phytotoxicity symptoms caused by treatments:
Chlor = chlorosis or yellowing of leaves
Leaf burn = Leaf necrosis
Curl = leaf curl

3/ Percent Weed control, Ocular ratings: 0 - 100%
Common groundsel (Senecio vulgaris)
Bedstraw (Galium aparine)

Test and Equipment Specifications - 1990 NWARC, Kalispell, MT.

Test	Crop	Variety	Seeded with 1/	Rate/A	Depth Seeded	Planted	Harvested
Bedstraw	spring barley	Gallatin	IH drill	60#	1"	5/8/90	8/10/90
Combo	spring wheat	Newana	Resrch drill	60#	1 1/2"	4/19/90	8/31/90
Express	spring bar/wht	6 vars.	Resrch drill	60#	1 1/2"	4/23/90	8/30/90
Fargo/Show	spring wheat	Newana	IH drill	60#	1 1/2"	4/23/90	9/5/90
Gromwell	winter wheat	Daws	Press drill	60#	1"	9/22/89	8/7/90
Canola	spring canola	Tolbin	Resrch drill	6#	1/2"	5/8/90	8/15/90
Reduced	spring barley	Gallatin	IH drill	60#	1 1/2"	4/19/90	8/16/90
Alfalfa Herb Stdy	alfalfa	Oneida	IH drill	12#	1/2"	4/25/90	6/24/90 9/28/90

1/ Equipment:

Seeders: Press drill - typical farm use press type grain drill double disc openers, 7" spacing

Resrch - Research plot drill (H and N Equip), double disc openers, 6 or 12" spacing

IH - International Harvester press type drill, double disc openers, 7" spacing

Sprayer:

Tractor-mounted, research type sprayer.
10' spray boom with compressed air. 8003 nozzles, 32 psi, approx 2.6 mph

Harvesters:

- Hege 125B plot combine, 4 foot header (grain)
- Almaco forage harvester, 4 foot cutter bar (forage)

YEAR/PROJECT: 1990/755 1980 INTRASTATE ALFALFA YIELD TRIAL - DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye

First harvest was obtained on 6/28/90. Baker, Perry, Ladak-65, Vancor, Armor, Classic, WL 220, and Spredor II had the highest yields. Spectrum, Anchor, Thor, Marathon, and Raidor had the lowest. Second harvest yields ranged from 1.71 t/a (Baker) to 0.69 t/a (Marathon). Third harvest yields ranged from 1.31 t/a (Armor) to 0.66 t/a (Spredor II). Total forage yields for 1990 ranged from 4.61 t/a for Baker to 2.55 t/a for Raidor. Total yields over the 11 years ranged from 44.60 t/a for Ladak-65 to 35.56 t/a for Marathon.

DRYLAND ALFALFA TRIAL SEEDED 1980 - KALISPELL - 1990

VARIETY	HARVEST 1 6/28/90	HARVEST 2 8/15/90	HARVEST 3 10/1/90	TOTAL
	YIELD (t/a)			
BAKER	1.68	1.71	1.22	4.61
PERRY	1.71	1.62	1.21	4.54
LADAK-65	1.69	1.48	1.11	4.28
VANCOR	1.43	1.49	1.23	4.15
Armor	1.41	1.41	1.31	4.13
CLASSIC	1.46	1.44	1.13	4.03
CASCADE	1.39	1.32	1.27	3.98
WL 220	1.48	1.26	1.22	3.96
RANGER	1.37	1.19	1.30	3.86
SUPER 721	1.28	1.22	1.29	3.79
Spectrum	1.24	1.12	1.21	3.57
ANCHOR	1.19	1.16	1.07	3.42
SPREDOR II	1.56	1.15	0.66	3.37
VERNAL	1.31	1.12	0.93	3.36
THOR	1.20	1.07	1.06	3.33
MARATHON	1.08	0.69	0.83	2.60
RAIDOR	0.97	0.74	0.84	2.55
LSD(0.05)	0.31	0.43	0.30	0.87
P-VALUE	0.00	0.00	0.00	0.00
CV(s/mean)	13.5	20.7	16.5	14.0

Pesticides: 1980 - Eptam + 2,4-DB
Fall 1984, 1986, 1987 - Sencor - 1 lb AI/a
Fall 1988 - Lexone - 0.75 lb AI/a
10/26/89 - Sencor - 1 lb AI/a

INTRASTATE ALFALFA YIELD TRIAL - SEEDED 1980
KALISPELL - DRYLAND 1980-1990 YIELDS

	YIELDS - t/a										
VARIETY	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
LADAK-65	1.48	4.29	2.81	3.31	3.19	4.76	4.26	5.74	5.08	5.40	4.28	44.60
VANCOR	1.81	4.48	2.51	2.98	3.41	5.59	4.44	5.82	4.54	4.73	4.15	44.46
ARMOR	1.79	4.14	2.34	2.91	3.12	5.36	4.49	6.04	4.83	4.84	4.13	43.99
BAKER	1.81	4.07	2.30	2.61	3.01	5.04	4.26	6.20	4.66	4.96	4.61	43.53
ANCHOR	1.70	4.53	2.68	2.65	3.05	5.04	4.56	5.63	4.39	4.34	3.42	41.99
PERRY	1.67	4.06	2.38	2.43	3.18	4.79	3.86	5.24	4.79	4.98	4.54	41.92
CASCADE	1.86	3.90	2.42	2.67	3.09	5.52	4.24	5.61	4.15	4.44	3.98	41.88
SPREDOR II	1.52	4.74	2.48	3.19	3.55	5.22	4.28	5.28	3.85	4.37	3.37	41.85
SUPER 721	1.45	3.99	2.44	2.85	3.00	5.35	4.21	5.36	4.70	4.56	3.79	41.70
THOR	1.99	4.73	2.75	2.71	3.32	5.17	4.42	5.36	3.85	3.83	3.33	41.46
SPECTRUM	1.80	4.63	2.69	2.80	3.07	4.93	3.93	5.47	4.28	3.95	3.57	41.12
WL 220	1.69	4.02	2.01	2.46	3.40	4.99	4.06	5.48	4.26	4.44	3.96	40.77
CLASSIC	1.74	3.78	2.05	2.83	2.81	4.84	4.09	5.29	4.60	4.37	4.03	40.43
VERNAL	1.79	4.09	2.62	2.32	2.97	4.82	4.03	5.28	4.17	4.38	3.36	39.83
RAIDOR	1.84	4.40	2.40	2.86	3.33	5.43	3.93	4.99	3.35	3.50	2.55	38.58
RANGER	1.34	3.38	2.32	2.34	2.41	4.20	3.50	4.69	4.05	4.06	3.86	36.15
MARATHON	1.66	4.07	2.39	2.44	2.86	4.52	3.53	4.83	3.27	3.39	2.60	35.56
LSD(0.05)		0.49	0.72	0.61	0.92	1.26	0.86	0.83	0.86	0.85	0.87	
P-VALUE		0.00	0.73	0.08	0.78	0.78	0.49	0.06	0.01	0.00	0.00	
CV(s/mean)		8.3	20.8	15.8	20.9	17.5	14.7	10.8	12.1	11.6	10.0	
Precip(in)	23.6	23.7	18.2	21.0	19.9	17.6	23.2	22.0	13.9	23.39	26.51	

FERTILIZER: Spring 1980 - P2O5 - 132 lbs/a
Fall 1981 - P2O5 - 52 lbs/a
Spring 1984 - P2O5 - 90 lbs/a
K2O - 50 lbs/a
S - 40 lbs/a
Fall 1986 - P2O5 - 88 lbs/a
K2O - 120 lbs/a
S - 50 lbs/a
Fall 1989 - P2O5 - 132 lbs/a
K2O - 120 lbs/a
S - 50 lbs/a

HERBICIDES: 1980 - Eptam + 2,4-DB
Fall 1984,1986,1987 - Sencor - 1 lb AI/a
Fall 1988 - Lexone - 0.75 lb AI/a
10/26/89 - Sencor - 1 lb AI/a

YEAR/PROJECT: 1989/755 1986 INTRASTATE ALFALFA YIELD TRIAL-IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

The nursery was harvested 6/20/90 and then plowed down. The highest yielding varieties were Centurion, Baker (with and without additional K), Verta+, Exp.339, Sparta, and NY8412. The lowest yielding varieties - Spredor II, Vernal and Thor, are not Verticillium wilt resistant.

1986 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL, IRRIGATED, 1990

VARIETY	MTNO	6/20/90 YIELD t/a
CENTURION	177	3.31
BAKER-K*	189	3.27
VERTA +	175	3.26
EXP. 339	176	3.24
SPARTA	174	3.16
BAKER	123	3.15
NY 8412	186	3.14
EXCALIBUR	178	3.08
NY 8413	187	3.06
SURPASS	181	3.02
AP 45	182	3.00
WL 316	144	2.99
WL 225	184	2.95
ELEVATION	172	2.85
LADAK 65	2	2.83
APOLLO II	183	2.83
LADAK 65-K*	190	2.80
BLAZER	173	2.76
ANSTAR	180	2.75
WL 83-2	185	2.67
THOROBRED	179	2.44
VERNAL	8	2.43
SPREDOR II	128	2.33
VERNAL-K*	188	2.33
THOR	1	2.20
LSD(0.05)		0.20
P-VALUE		0.00
CV (s/mean)		4.9

Seeding date: 4/30/86
Fertilizer: 5/15/86 - P2O5 - 180 lbs/a
* 3/25/87 - K plots - 100 lbs/a
Fall 1987 - P2O5 - 110 lbs/a
K plots- K2O- 100 lbs/a
S - 45 lbs/a
Pesticides: 4/29/86 - Eptam + 2,4 DB
7/2/86 - Imidan - 1 lb AI/a
10/20/87 - Sencor - 1 lb AI/a
10/28/88 - Lexone - .75 lbs AI/a
10/25/89 - Sencor - 1 lb AI/a

YEAR/PROJECT: 1990/755 1988 INTRASTATE ALFALFA YIELD TRIAL - IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

First harvest was cut on 6/12/90. DK-125, Legend, Sure, and Sparta had the highest yields (3.16-3.36 t/a). AgriBoss and Kingstar had the lowest yields (2.81-2.64 t/a). At second harvest DK-125, Legend, Sure, and Edge had the highest yields, while Wrangler, Ladak-65, Kingstar, and Vernal had the lowest. At fall harvest on 10/12 DK-125 and Legend again had the highest yields, while AgriBoss, Wrangler, Ladak-65, Kingstar and Vernal had the lowest. The top yielding varieties for 1990 were DK-125, Legend, and Sure. AgriBoss, Wrangler, Ladak-65, Kingstar and Vernal had the lowest yields.

Total yields for the 1988 - 1990 seasons ranged from 18.76 t/a for to DK-125 to 15.03 t/a for Ladak-65.

1988 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL - IRRIGATED - 1990

VARIETY	FALL DORMANCY	VERT WILT RESIST	YIELD 6/12/90	YIELD 8/9/90	YIELD 10/12/90	TOTAL
			t/a	t/a	t/a	t/a
DK-125	3	R	3.36	3.31	1.98	8.65
Legend	4	R	3.23	3.10	1.93	8.26
Sure	3	R	3.19	3.22	1.76	8.16
WL-316	4	R	3.13	2.92	1.65	7.69
Vista-661	3	MR	3.04	2.86	1.77	7.67
Vista-663	3	MR	3.13	2.78	1.75	7.66
Sparta	3	R	3.16	2.74	1.69	7.59
Edge	4	R	2.94	3.00	1.65	7.58
Garst-636	2	R	3.07	2.73	1.61	7.40
Premier	4	R	2.98	2.86	1.52	7.36
Pioneer 5432	4	R	3.04	2.75	1.56	7.34
Arrow	3	R	3.03	2.63	1.63	7.29
WL-225	2	R	3.02	2.57	1.60	7.19
Thor	4	--	2.97	2.69	1.52	7.17
ICB-34	4	LR	2.95	2.60	1.52	7.07
AgriBoss	3	MR	2.81	2.48	1.33	6.61
Wrangler	2	LR	3.07	2.16	1.36	6.59
Ladak-65	1-2	S	3.00	2.03	1.23	6.26
Kingstar	3	R	2.64	2.32	1.27	6.23
Vernal	2	--	2.86	2.10	1.23	6.18
LSD(0.05)			0.21	0.35	0.19	0.55
P-VALUE			0.00	0.00	0.00	0.00
CV(s/mean)			5.0	9.2	8.5	5.?

Seeding date: 5/3/88
Fertilizer: P2O5 - 176 lbs/a in 1988
Pesticide: Sencor - 1 lb AI/a - 10/26/89

INTRASTATE ALFALFA TRIAL - SEEDED 1988
KALISPELL - IRRIGATED

VARIETY	VERT W. RESIST.	1988	1989	1990	TOTAL 1988-90
		t/a			
DK-125	R	2.92	7.19	8.65	18.76
Legend	R	2.99	7.06	8.26	18.31
Sure	R	2.98	7.05	8.16	18.19
Sparta	R	2.99	6.98	7.59	17.56
Pioneer 5432	R	2.91	7.28	7.34	17.53
Vista-661	MR	2.89	6.93	7.67	17.49
WL-316	R	2.86	6.90	7.69	17.45
Edge	R	2.84	6.92	7.58	17.34
Garst-636	R	2.90	6.94	7.40	17.24
ICB-34	LR	2.86	7.27	7.07	17.20
Vista-663	MR	2.80	6.63	7.66	17.09
Thor	--	2.95	6.94	7.17	17.06
Arrow	R	2.79	6.88	7.29	16.96
Premier	R	2.72	6.81	7.36	16.89
WL-225	R	2.75	6.75	7.19	16.69
AgriBoss	MR	2.82	6.84	6.61	16.27
Wrangler	LR	2.81	6.68	6.59	16.08
Kingstar	R	2.77	6.83	6.23	15.83
Vernal	--	2.66	6.60	6.18	15.44
Ladak-65	--	2.64	6.13	6.26	15.03
LSD(0.05)		0.31	0.30	0.55	
P-VALUE		0.00	0.00	0.00	
CV(s/mean)		7.8	3.1	5.3	

Seeding date: 5/3/88
Fertilizer: 1988 - P2O5 - 176 lbs/a
Pesticides: 10/26/89 - Sencor - 1 lb AI/a

YEAR/PROJECT: 1990/755 1989 INTRASTATE ALFALFA YIELD TRIAL - DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Ray Ditterline, MSU

Twenty-three alfalfa varieties were seeded in a RCB design with four replications on 24 April, 1989. In the second year of this study, first harvest was obtained on 6/21/90. 5364, VS-872, Vernema, Thor, Apollo Supreme, Sabre, Eagle, 86I-08, 5262, VS-775, and Ladak-65 had the highest yields (3.13 - 2.79 t/a), while MF-87758, AP-8735, Vernal, Wrangler, and WL-317 had the lowest (2.25 - 2.56 t/a). There were no significant differences among second harvest yields, obtained 8/15/90. Fall harvest (10/1/90) yields ranged from 0.73 t/a (Ladak-65) to 1.12 t/a (5364), reflecting Ladak-65's poor regrowth potential. Total yields for 1990 ranged from 5.51 t/a (MF-87758) to 6.76 t/a (5364), but the differences were not quite significant (P=0.07). The average fall dormancy rating for the 11 highest yielding varieties is '4', while the 11 lowest yielding varieties average '2'. Apparantly the winter was not severe enough to favor dormancy level over regrowth ability. Vert. wilt resistance averaged 'MR' for the top yielding 12 varieties and 'LR' for the 11 lower yielding varieties, possibly indicating selection for resistance to this disease.

1989 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL - DRYLAND - 1990

VARIETY	FALL DORMANCY	VERT WILT RESIST	HARVEST-1 6/21/90	HARVEST-2 8/15/90	HARVEST-3 10/1/90	TOTAL
			Yield-t/a			
5364	4	MR	3.01	2.64	1.12	6.76
VS-872	--	--	2.80	2.80	1.11	6.71
Arrow	3	R	2.76	2.88	1.04	6.68
Fortress	4	R	2.73	2.85	1.01	6.58
Vernema	4	MR	2.87	2.71	0.98	6.55
Thor	4	--	2.79	2.60	1.04	6.42
Garst-630	4	MR	2.65	2.66	1.07	6.37
Apollo Supreme	4	R	2.97	2.53	0.87	6.37
Sabre	4	HR	3.13	2.41	0.81	6.34
XAL-72	--	--	2.68	2.60	1.06	6.34
Eagle	4	MR	2.93	2.49	0.88	6.30
Garst-636	2	R	2.72	2.74	0.85	6.30
Cimarron VR	5	LR	2.63	2.61	1.05	6.29
86I-08	--	--	2.84	2.49	0.92	6.24
5262	2	LR	2.91	2.51	0.79	6.21
VS-775	--	--	3.11	2.23	0.87	6.20
Milkmaker	3	--	2.63	2.56	0.84	6.02
WL-317	3	R	2.48	2.54	1.00	6.01
Wrangler	2	LR	2.56	2.52	0.90	5.97
Vernal	2	--	2.49	2.59	0.86	5.94
Ladak-65	1-2	S	2.79	2.32	0.73	5.83
AP-8735	--	--	2.52	2.37	0.88	5.77
MF-87758	--	--	2.25	2.34	0.92	5.51
LSD(0.05)			0.37	0.51	0.18	0.74
P-VALUE			0.00	0.67	0.00	0.07
CV(s/mean)			9.4	14.2	13.3	8.5

Seeding date: 4/24/89
Fertilizer: P2O5 - 176 lbs/a - 1989
Pesticide: Sencor - 1 lb AI/a - 10/26/89

1989 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL - DRYLAND

VARIETY	FALL DORMANCY	VERT WILT RESIST	1989	1990	TOTAL
			----------t/a----------		
5364	4	MR	3.31	6.76	10.07
VS-872	--	--	3.72	6.71	10.43
Arrow	3	R	3.40	6.68	10.08
Fortress	4	R	3.61	6.58	10.19
Vernema	4	MR	3.20	6.55	9.75
Thor	4	--	2.95	6.42	9.37
Garst-630	4	MR	3.58	6.37	9.95
Apollo Supreme	4	R	3.15	6.37	9.52
Sabre	4	HR	3.29	6.34	9.63
XAL-72	--	--	2.98	6.34	9.32
Eagle	4	MR	3.09	6.30	9.39
Garst-636	2	R	2.96	6.30	9.26
Cimarron VR	5	LR	3.43	6.29	9.72
86I-08	--	--	3.20	6.24	9.44
5262	2	LR	3.13	6.21	9.34
VS-775	--	--	3.11	6.20	9.31
Milkmaker	3	--	3.08	6.02	9.10
WL-317	3	R	3.03	6.01	9.04
Wrangler	2	LR	3.02	5.97	8.99
Vernal	2	--	3.04	5.94	8.98
Ladak-65	1-2	S	2.86	5.83	8.69
AP-8735	--	--	2.95	5.77	8.72
MF-87758	--	--	2.83	5.51	8.34
LSD(0.05)			0.36	0.74	
P-VALUE			0.01	0.07	
CV(s/mean)			8.1	8.5	

Seeding date: 4/24/89
Fertilizer: P2O5 - 176 lbs/a - 1989
Pesticide: Sencor - 1 lb AI/a - 10/26/89

YEAR/PROJECT: 1990/755 1989 INTRASTATE ALFALFA YIELD TRIAL - IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Ray Ditterline, MSU Bozeman

Twenty-eight alfalfa varieties were seeded in an RCB design with four replications on 5/20/89. First harvest of 1990 was on 6/21. VS-775, 5262, and 5364 had the highest yields (3.39 - 3.55 t/a), and AP-8735, NC831XMTV1-V2, WL-88-9, Vernal, and Ladak-65 had the lowest yields (2.93 - 2.74 t/a). Second harvest was obtained 8/15/90. Yields ranged from 2.70 t/a (XAL-72) to 1.68 t/a (Ladak-65). Fall harvest, 10/12/90, yielded from 1.11 t/a (XAL-72) to 0.73 t/a (Ladak-65). Total season yields were highest for VS-775, 5262, XAL-72, VS-872, Fortress, Vernema, Garst-636, Eagle, 86I-08, and 5364 (7.10 - 6.61 t/a). Ladak-65, with 5.18 t/a total yield, produced significantly less than any other variety. Nine of the top 14 yielding varieties had some resistance to Vert wilt, while only 4 of the lowest 14 had resistance.

1989 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL - IRRIGATED - 1990

VARIETY	FALL DORMANCY	VERT WILT RESIST	YIELD 6/21/90	YIELD 8/15/90	YIELD 10/12/90	TOTAL
			t/a			
VS-775	--	--	3.55	2.58	0.98	7.10
5262	2	LR	3.44	2.52	1.08	7.04
XAL-72	--	--	3.19	2.70	1.11	6.99
VS-872	--	--	3.28	2.50	1.04	6.82
Fortress	4	R	3.26	2.41	1.10	6.76
Vernema	4	MR	3.17	2.58	0.97	6.72
Garst-636	2	R	3.23	2.43	1.01	6.67
Eagle	4	MR	3.13	2.45	1.04	6.62
86I-08	--	HR	3.13	2.46	1.02	6.62
5364	4	MR	3.39	2.22	1.00	6.61
Cimarron VR	5	LR	3.10	2.48	1.01	6.58
Milkmaker	3	S	3.17	2.37	0.99	6.53
Apollo Supreme	4	R	3.05	2.55	0.93	6.52
Arrow	3	R	3.20	2.29	1.01	6.49
MF-87758	--	--	3.03	2.47	0.99	6.49
MTV4-V1	--	--	3.01	2.37	1.10	6.48
WL-87-21	--	--	3.06	2.48	0.92	6.46
AP-8735	--	--	2.93	2.47	1.00	6.39
Sabre	4	HR	3.07	2.21	1.08	6.36
WL-317	3	R	3.18	2.27	0.90	6.35
Thor	4	--	3.11	2.22	1.02	6.35
NC831XMTV1-V2	--	--	2.75	2.55	1.02	6.32
Glean-Cycle 1	--	--	2.77	2.50	0.98	6.24
WL-88-9	--	--	2.87	2.28	1.01	6.16
Garst-630	4	MR	3.09	2.10	0.96	6.15
Wrangler	2	LR	2.99	1.94	0.83	5.76
Vernal	2	--	2.74	2.11	0.87	5.72
Ladak-65	1-2	S	2.77	1.68	0.73	5.18
LSD(0.05)			0.21	0.40	0.06	0.52
P-VALUE			0.00	0.00	0.00	0.00
CV(s/mean)			4.7	12.0	4.7	5.8

Seeding date: 4/20/89
Fertilizer: P2O5 - 176 lbs/a in 1989
Pesticide: Sencor - 1 lb AI/a - 10/26/89

1989 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL - IRRIGATED

VARIETY	FALL DORMANCY	VERT WILT RESIST	YIELD 1989	YIELD 1990	YIELD TOTAL
			t/a	t/a	t/a
VS-775	--	--	3.26	7.10	10.36
5262	2	LR	2.94	7.04	9.98
XAL-72	--	--	2.80	6.99	9.79
VS-872	--	--	3.27	6.82	10.09
Fortress	4	R	3.47	6.76	10.23
Vernema	4	MR	3.38	6.72	10.10
Garst-636	2	R	2.85	6.67	9.52
Eagle	4	MR	2.97	6.62	9.59
86I-08	--	HR	3.06	6.62	9.68
5364	4	MR	2.88	6.61	9.49
Cimarron VR	5	LR	3.20	6.58	9.78
Milkmaker	3	S	2.92	6.53	9.45
Apollo Supreme	4	R	2.79	6.52	9.31
Arrow	3	R	3.08	6.49	9.57
MF-87758	--	--	2.72	6.49	9.21
MTV4-V1	--	--	2.62	6.48	9.10
WL-87-21	--	--	3.26	6.46	9.72
AP-8735	--	--	2.87	6.39	9.26
Sabre	4	HR	2.93	6.36	9.29
WL-317	3	R	2.96	6.35	9.31
Thor	4	--	2.95	6.35	9.30
NC831XMTV1-V2	--	--	2.33	6.32	8.65
Glean-Cycle 1	--	--	2.66	6.24	8.90
WL-88-9	--	--	2.65	6.16	8.81
Garst-630	4	MR	3.00	6.15	9.15
Wrangler	2	LR	2.63	5.76	8.39
Vernal	2	--	2.64	5.72	8.36
Ladak-65	1-2	S	2.46	5.18	7.64
LSD(0.05)			0.32	0.52	
P-VALUE			0.00	0.00	
CV(s/mean)			7.9	5.8	

Seeding date: 4/20/89
Fertilizer: P2O5 - 176 lbs/a in 1989
Pesticide: Sencor - 1 lb AI/a - 10/26/89

YEAR/PROJECT: 1990/755 1990 INTRASTATE ALFALFA YIELD TRIAL - DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

Twenty alfalfa varieties were seeded in an RCB design with four replications on 18 April, 1990. Stand establishment, as determined by counting seedlings within a 2 x 40" grid, averaged 91% with no significant differences among varieties. First harvest was obtained on 8/2/90. Husky, Arrow, and Spredor II, had the highest yields (1.82-1.79 t/a), while Runner and Wilson (1.44-1.22 t/a) had the lowest. Fall harvest was cut on 3 October. VS 655 had the highest yield (1.57 t/a), while Wrangler had the lowest (1.00 t/a). The varieties with the highest total yields for 1990 were Husky and Multi-plier (3.31 & 3.28 t/a), while Wrangler and Wilson had the lowest yields (2.52 & 2.33 t/a).

1990 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL - DRYLAND

VARIETY	FALL DORMANCY	VERT WILT RESIST	YIELD 8/2/90 t/a	YIELD 10/3/90 t/a	TOTAL t/a
Husky	3	--	1.82	1.50	3.31
Multi-plier	3	R	1.78	1.50	3.28
VS 655	--	--	1.70	1.57	3.27
Ultra	3	R	1.65	1.53	3.18
Arrow	3	R	1.79	1.32	3.10
WL 225	2	R	1.67	1.43	3.10
Spredor II	1	--	1.79	1.30	3.09
DK 135	4	MR	1.65	1.44	3.08
DK 122	--	--	1.63	1.45	3.07
5472	4	MR	1.52	1.56	3.07
Allegiance	3	R	1.64	1.43	3.06
5262	2	LR	1.66	1.35	3.01
5364	4	MR	1.64	1.36	3.00
Aggresor	4	R	1.61	1.37	2.97
Mngrn-14	--	--	1.53	1.35	2.88
Ladak 65	1-2	S	1.75	1.13	2.88
WL 317	3	R	1.62	1.25	2.87
Runner	--	--	1.44	1.30	2.74
Wrangler	2	LR	1.53	1.00	2.52
Wilson	6	--	1.22	1.11	2.33
LSD(0.05)			0.26	0.21	0.40
P-VALUE			0.01	0.00	0.00
CV(s/mean)			11.1	10.9	9.5

Seeding date: 4/18/90
Fertilizer: P2O5 - 176 lbs/a

YEAR/PROJECT: 1990/755 1990 INTRASTATE ALFALFA YIELD TRIAL - IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

Twenty alfalfa varieties were seeded in an RCB design with four replications on 18 April, 1990. Stand establishment, as determined by counting seedlings within a 2 x 40" grid, ranged from 92% (Wilson) to 100% (DK 135, DK 122, and Mngrn-14). First harvest was obtained on 8/2/90. Ultra and Multi-plier had the highest yields (2.71 & 2.45 t/a), while Wilson (1.72 t/a) had significantly lower yield than any other variety. Fall harvest was cut on 11 October. DK 135 and Multi-plier had the highest yields (2.19 & 2.23 t/a), while Wilson had the lowest (1.49 t/a). The varieties with the highest total yields for 1990 were Ultra and Multi-plier (4.88 & 4.68 t/a), while Wilson had significantly lower yields than any other variety (3.21 t/a). Husky, which was the top yielding variety in the dryland nursery, was only 7th highest under irrigation.

1990 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL - IRRIGATED

VARIETY	FALL DORMANCY	VERT WILT RESIST	STAND	YIELD 8/2/90	YIELD 10/11/90	YIELD TOTAL
			%	t/a	t/a	t/a
Ultra	3	R	98	2.71	2.16	4.88
Multi-plier	3	R	97	2.45	2.23	4.68
VS 655	--	--	98	2.31	2.14	4.45
WL 225	2	R	95	2.35	2.07	4.43
DK 135	4	MR	100	2.23	2.19	4.42
DK 122	--	--	100	2.28	2.12	4.41
Husky	3	--	95	2.23	2.07	4.30
5472	4	MR	95	2.20	2.01	4.22
5364	4	MR	98	2.26	1.95	4.21
Arrow	3	R	98	2.20	1.96	4.16
WL 317	3	R	98	2.24	1.88	4.12
5262	2	LR	97	2.22	1.76	3.98
Aggresor	4	R	97	2.06	1.85	3.91
Spredor II	1	--	95	2.06	1.80	3.86
Allegiance	3	R	97	2.13	1.72	3.85
Runner	--	--	93	1.99	1.68	3.67
Ladak 65	1-2	S	95	2.00	1.55	3.55
Wrangler	2	LR	93	2.01	1.54	3.54
Mngrn-14	--	--	100	2.00	1.54	3.54
Wilson	6	--	92	1.72	1.49	3.21
LSD(0.05)			4	0.27	0.17	0.32
P-VALUE			0.00	0.00	0.00	0.00
CV(s/mean)			2.6	7.5	5.6	4.8

Seeding date: 4/18/90
Fertilizer: P2O5 - 176 lbs/a

YEAR/PROJECT: 1990/755 BERSEEM CLOVER VARIETY TRIAL - IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye

Four varieties of berseem clover were planted 4/30/90. Plots were harvested 7/20, 8/14 and 9/19. Total yields ranged from 3.82 t/a (Multicut) to 3.07 t/a (VS 8902), but differences were not statistically significant. The only significant differences were obtained from the 8/14 harvest, with Multicut and VS 8903 yielding more than Bigbee and VS 8902.

BERSEEM VARIETY TRIAL
KALISPELL, MT - 1990

VARIETY	1st Harvest 7/20/90	2nd Harvest 8/14/90	3rd Harvest 9/19/90	Total
	t/a			
Multicut	1.16	1.39	1.27	3.82
VS 8903	1.17	1.42	1.09	3.68
Bigbee	1.40	0.86	0.97	3.23
VS 8902	1.32	0.98	0.77	3.07
LSD(0.05)	0.34	0.25	0.52	0.76
P-VALUE	0.34	0.00	0.29	0.19
CV(S/MEAN)	13.7	11.0	25.5	11.1

Seeding date: 4/30/90
Fertilizer: 5/23 - 44 lbs/a P2O5
Irrigations: 2 x 2" = 4"

YEAR/PROJECT: 1990/755 GRASS SPECIES FORAGE NURSERY-IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye

Seven species of perennial grasses were dormant seeded on 11/5/87. The nursery was harvested three times in 1990. Kenmont tall fescue and Regar meadow brome produced the most forage. Jose tall wheatgrass, Slender wheatgrass and Shoshone beardless wild rye produced the least. Highest total yield, 1988-1990, was produced by Latar orchardgrass, and lowest yield by Shoshone wild rye.

IRRIGATED GRASS STUDY - KALISPELL, 1990
SEEDED 1987

SPECIES	First Harvest 6/8/90	Second Harvest 8/6/90	Third Harvest 10/4/90	Total 1990	Total 1988-90
	YIELD (t/a)				
Latar Orchardgrass	3.26	1.38	0.96	5.59	18.67
Regar Meadow Brome	3.29	1.56	0.82	5.67	18.05
Kenmont Tall Fescue	3.71	1.79	0.90	6.39	16.96
Garrison Creeping Foxtail	2.73	1.19	0.27	4.19	11.61
Jose Tall Wheatgrass	2.38	0.89	0.25	3.51	11.14
Slender Wheatgrass	2.32	0.52	0.05	2.89	8.91
Shoshone Beardless Wild Rye	1.73	1.29	0.11	3.13	7.95
LSD(0.05)	0.44	0.25	0.23	0.74	
P-VALUE	0.00	0.00	0.00	0.00	
CV(s/mean)	10.6	13.6	32.4	11.1	

Seeding date: 11/5/87
Fertilizer: 4/6/88 - N - 70 lbs/a
5/6/88 - N - 70 lbs/a
P - 150 lbs/a
4/12/89 - N - 136 lbs/a
10/24/89 - N - 100 lbs/a
Herbicide: 8/14/89 - 2,4-D ester - 1 lb AI/a
Irrigation (1990): 4"

YEAR/PROJECT: 1990/755 EVALUATION OF TEFF (ERAGROSTIS TEF) AS A FORAGE CROP IN MONTANA.

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Joyce Eckhoff, Sidney

This study was undertaken to determine if Teff, a warm season annual grass used as a food grain in Ethiopia and a hay crop in parts of Africa, can be grown in Montana. Six lines of this species were seeded on 5/16/90 on dryland in a randomized complete block design with 4 replications. Plots consisted of 4 fifteen foot rows spaced one foot apart with 2 feet between plots. Plots were harvested for hay yield on 8/7/90 and 9/24/90. Samples of hay were saved for quality analysis.

No significant yield differences were detected among cultivars at either harvest or for total yield. First harvest yields averaged 2.23 t/a, and second harvest yields averaged 1.64 t/a.

TEFF VARIETY TRIAL - KALISPELL, MT
Seeded 1990

VARIETY	8/7/90	9/24/90	TOTAL
	---Forage Yield (t/a)---		
MT123	2.12	1.71	3.83
MT241	2.30	1.59	3.89
MT66	2.23	1.56	3.79
MT177	2.23	1.65	3.88
SD100	2.21	1.68	3.88
MT247	2.28	1.64	3.91

No significant differences by F-test (P<=0.05)

Seeding date: 5/16/90
Fertilizer: 5/23/90 - P2O5 - 44 lbs/a
N - 68 lbs/a

YEAR/PROJECT: 1989-90/755 WINTER TRITICALE FORAGE TRIAL-DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye

Triticale (X Triticosecale Wittmack, variety Jenkins), a hybrid of wheat and rye, was seeded 9/20/89 at 72 lbs/a. Half the plots were harvested twice (6/18 and 7/12) and half harvested three times (5/17, 6/18 and 7/12). Cutting twice produced 5.71 t/a total dry matter and cutting three times produced 3.41 t/a. Protein varied from 8.2% (1st harvest, 2-cut system) to 19.3% (2nd harvest, 2-cut system). Although the 3-cut system produced less total dry matter, the high protein content of the forage resulted in the same total protein yield as the 2-cut system.

WINTER TRITICALE (Variety 'Jenkins')
KALISPELL, 1989-90 DRYLAND

	HARVEST									TOTAL	
	5/17/90			6/18/90			7/12/90				
	1/ DMY t/a	2/ %P	3/ PYLD lbs/a	DMY t/a	%P	PYLD lbs/a	DMY t/a	%P	PYLD lbs/a	DMY t/a	PYLD lbs/a
3-Cut	2.13	17.3	735	0.94	17.4	324	0.34	16.4	112	3.41	1171
2-Cut				4.56	8.2	745	1.15	19.3	444	5.71	1189
LSD(0.05)										0.32	96
P-VALUE										0.00	0.61
CV(s/mean)										5.9	6.9

Seeding date: 9/20/89
Seeding rate: 72 lbs/a
Crop year precipitation: 26.51"
Fertilizer: 37 lbs N/a & 46 lbs P2O5/a
Previous crop: alfalfa

1/ Dry matter Yield
2/ % Protein
3/ Protein yield (% protein x DMY)

YEAR/PROJECT: 1989-90/755 WINTER RAPE FORAGE TRIAL - DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye

Six varieties of winter rape were seeded 8/29/89. Experimental design was a split plot with three replications consisting of two main plots (with fall harvest and without fall harvest), and six subplots (varieties) randomized within each whole plot. The fall harvest treatments were cut 11/22/89. Civastro and Polaris produced the most forage (1.06 & 0.99 t/a), followed by Purple Top, Forage Star, Emerald (0.76 - 0.69 t/a) and Premier, which had significantly lower yield (0.31 t/a) than any other variety. In the spring of 1990 all varieties but Premier in the fall harvested plots had winterkilled, while all varieties in the uncut plots survived. Premier apparently demonstrated the linkage between dormancy and winter hardiness, having produced the least fall growth and survived the winter.

Plots in the uncut fall treatment were harvested three times in 1990. At first harvest Purple Top was high yielder with 2.90 t/a, and Emerald and Polaris were lowest (1.14 & 1.10 t/a). At second harvest Premier and Emerald yielded significantly more forage than the other varieties. At third harvest Premier and Emerald again produced much more regrowth (1.62 & 1.38 t/a) than the other varieties (0.17 - 0.27 t/a). Premier and Emerald had significantly higher total season yields than the other varieties and Polaris had significantly less than any other. Premier and Emerald also had significantly higher total protein yields than the other varieties due mainly to their superior total dry matter yields. Protein content varied from 27.6% (Premier, 1st harvest) to 21.6% (Polaris, 2nd harvest).

WINTER RAPE FORAGE TRIAL 1989-90 KALISPELL, MT

TOTAL DRY MATTER YIELD

VARIETY	Harv-1 5/17/90	Harv-2 6/19/90	Harv-3 7/12/90	1990 YIELD
	t/a			
	1/	1/	1/	
Premier	1.56 (27.6)	2.25 (22.3)	1.62 (21.8)	5.43
Emerald	1.14 (25.9)	2.36 (23.2)	1.38 (24.3)	4.89
Purple Top	2.90 (21.7)	1.05 (22.8)	0.22	4.16
Forage Star	1.95 (24.0)	1.42 (21.9)	0.17	3.53
Civastro	1.62 (24.4)	1.39 (22.8)	0.27	3.28
Polaris	1.10 (25.0)	1.27 (21.6)	0.25	2.61
LSD(0.05)	0.32	0.38	0.24	0.61
P-VALUE	0.00	0.00	0.00	0.00
CV (s/mean)	10.2	12.9	20.0	8.4

1/ % protein

TOTAL PROTEIN YIELD

VARIETY	Harv-1 5/17/90	Harv-2 6/19/90	Harv-3 7/12/90	1990 YIELD
	lbs/a			
Premier	856	990	702	2548
Emerald	596	1095	674	2365
Purple Top	1258	479		1737
Forage Star	932	624		1556
Civastro	790	635		1425
Polaris	548	546		1094
LSD(0.05)	189	128		331
P-VALUE	0.00	0.00		0.00
CV (s/mean)	12.5	9.6		10.2

Planting date: 8/29/89
Herbicide: Treflan - 1/2 lb AI/a PPI - 8/21/89
Fertilizer: 44 lbs P2O5/a - 10/25/89
85 lbs N/a - spring 1990

PROJECT TITLE: Spring Barley Variety Evaluations

YEAR/PROJECT: 1990/756

INVESTIGATORS: Leaders - Vern R. Stewart and Tom Blake, Research Specialists - Todd Keener and Pat Hensleigh

OBJECTIVE: Evaluation of spring barley varieties for yield, quality and improved resistance to foliar diseases for future adaptation and release to Montana grain growers. Evaluation of new and introduced spring barley varieties in various growing conditions of western Montana.

SUMMARY:

1990 Intrastate Spring Barley -

Yields for the 1990 season were very similar to 1989 yields. The mean yield this year was 93.36 bu/A (last year 93.73 bu/A). Gallatin had a yield of 90.7 bu/A which was 12 bushels lower than 1989 and 15 bushels less than the 1987 harvest. Only thirteen varieties yielded above 100 bu/A. The variety MT 870246 was the only variety that had a significantly higher yield than Gallatin (the check variety). Test weights were better this year than in 1989 but about equal to the 1987 readings. Percent plumps were normal for this location and there was no lodging or disease. Table 1.

1990 Early Yield Trial -

Sixty four spring barley lines were evaluated under high moisture conditions during the 1990 growing season. Although foliar diseases can be moderate to severe in the Kalispell area this year there was very little disease recorded in the spring grain nurseries. This may be related to extremes in weather that we experienced in early spring and at harvest time. Yields were very good for this nursery. All but two varieties yielded above 100 bushels per acre while the highest yields were above 150 bu/A. Test weights and percent plumps were very good, averaging 50.64 lbs/bu and 94.5% respectively. Lodging did not occur until late in the season so yields were not greatly affected. Table 2.

Offstation Spring Barley -

Offstation spring barley nurseries were seeded in three locations this year.

- Ravalli County - Robert Christ farm, Hamilton, MT.

- Lake County - Starkle farms, Ronan, MT

- Ravalli Counnty - Western Agricultural Reserch Center, Corvallis, MT.

All locations were irrigated and recieved adequate rainfall during the growing season. Yields were good to excellent for the majority of entries and most varieties had average to above average test weights. Disease incidence was slight to non-existent in all areas. Lodging was

prevalent at the Hamilton and Ronan locations.

The nursery located at the Robert Christ farm in Hamilton had yields in excess of 115 bushel per acre for all varieties. The top yielding variety (BA 2601), a Bush Agriculture entry, yielded 148.4 bu/A. All test weights in the nursery, except for Steptoe, were above 50 lbs/bu. Percent plumps averaged 95.13% and lodging was prevalent in all but one variety (BA 2601). Table 3.

Yields from the nursery grown on the Starkle farm in Ronan ranged from 87.8 to 126.5 bu/A. Steptoe had the highest yield. The average test weight weight was 48.84 lbs/bu. Percent plumps were the lowest of all three locations which may be related to the high incidence of lodging. Table 4.

Yields from the nursery located on the Western Agricultural Research Center in Corvallis exceeded 100 bu/A for all entries. The three highest yields were from BA 1215, BA 1202, and BA 2601. Test weights were very good at this location with 52.38 lb/bu as the test average. Percent plump were less than would be expected from this area. Lodging was slight to moderate at the this location. Table 5.

Data giving means for all three offstation locations is in Table 6.

Table 1. Agronomic data from the Interstate Spring Barley nursery grown on the Northwestern Agricultural Research Center in 1990. Planted: March 30, 1990 Harvested: August 6, 1990 Field A2.

	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEADING DATE	HEIGHT IN
MT870246	Teton/Westbred 501	111.87a	48.70b	100.00	168.00	38.98
NS 77021	Princesse	108.56	48.70b	89.00	172.00a	29.40b
MT870070	Columbia/Lindy	108.12	47.97b	96.00	168.67	35.17
8403007	Coors AC84-030-07	108.08	50.50b	98.00	173.67a	33.99
MT140523	Hector/Klages	105.46	51.87b	93.00	170.67	37.53
MT870120	Lindy/Martin	103.88	47.70b	97.00	168.00	38.85
MT 83533	Clark/Lamont	103.79	52.13b	97.00	170.33	35.30
NS 78054	Baronesse	103.62	51.63b	90.00	172.00a	33.33b
MT886609	MT 81143/Lewis	102.13	51.90b	93.00	171.00	38.32
CI 15229	Steptoe	101.83	47.23b	96.00	167.00b	37.66
MT851145	WA 890878/MT41238	100.77	52.00b	98.00	169.33	38.85
BA854026	2B85-4026	100.29	53.83	99.00	170.00	36.61
MT861572	Lewis/MT 41549	100.15	52.40b	95.00	171.00	39.11
BA865169	2B86-5169	99.83	51.73b	96.00	172.33a	38.71
MT887509	MT 81619/Lewis	99.81	51.07b	84.00	170.00	37.27
MT851032	Harrington/Clark	99.79	51.90b	97.00	171.67	35.43
MT886601	MT 81143/Lewis	99.19	52.77b	92.00	170.33	35.96
MT851195	MT41918/TR450	98.33	51.33b	95.00	170.00	34.65
MT 83435	Clark/TR450	97.94	51.53b	91.00	171.33	35.83
MT851161	MT 41918/MT 41279	97.46	51.17b	94.00	171.00	35.04
SK 76333	Harrington	97.12	50.40b	93.00	171.67	34.25
MT888205	Steptoe/Chalky Glenn	96.98	46.97b	91.00	166.33b	38.19
MT 81161	Lewis//Kgs/Smt	96.44	51.37b	96.00	170.33	35.56
8503701	Coors DH85-037-01	96.42	52.63b	96.00	167.67	28.61b
MT860326	Lewis/TR533	96.29	52.10b	92.00	170.67	37.66
CI 15478	Klages	95.33	50.33b	91.00	173.00a	35.83
BA 1215	2B82-8529 (BA 8529)	94.44	52.27b	99.00	174.00a	34.12
MT860224	Lewis/Apex	94.00	51.17b	92.00	171.33	34.78
MT870109	ID 76871/Gallatin	93.87	53.10b	90.00	169.33	35.96
MT888010	Robust/ID 789009	93.79	50.90b	98.00	168.67	42.78a
PI531228	Bearpaw	93.19	49.97b	93.00	172.67a	35.04
MT851011	Clark/WA877178	92.69	51.87b	96.00	171.67	37.40
MT870105	Hazen/UT1423	92.21	49.30b	98.00	168.67	41.08a
CI 9558	Piroline	92.04	53.27	90.00	169.67	39.11
MN 36	Robust	91.87	51.33b	99.00	169.33	43.96a
MT860219	Lewis/Apex	90.92	48.57b	87.00	171.67	32.02
CI 15856	Lewis	90.87	51.97b	93.00	171.00	35.70
MT851005	Clark/ID810264	90.73	50.53b	97.00	170.33	35.04
PI491534	Gallatin 1/	90.71	54.20	94.00	169.67	36.75
ND 9866	ND7014/Bowman sib	90.42	53.40	99.00	169.33	36.22
MT850053	Clark/ND5976	90.23	51.60b	98.00	171.00	37.66
BA 2601	M31/High Extract Comp.	90.23	49.17b	91.00	171.00	33.60b
MT887103	MT 81535/Lewis	90.02	51.07b	96.00	170.67	33.20b
8406615	Coors AC84-066-15	89.46	51.13b	92.00	174.33a	28.48b
MT851425	MT 51549/Lewis	89.02	50.40b	94.00	171.00	35.17
MT851012	Clark/WA877178	88.75	50.30b	94.00	171.33	38.06

Cont'd on next page

Table 1 (Cont'd.) Agronomic data from the Interstate Spring Barley nursery.

VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEADING DATE	HEIGHT IN
CI 15857 Clark	88.54	50.83b	94.00	170.67	35.70
MT889102 Apex/Lewis	88.33	52.47b	99.00	166.67	37.53
PI483127 Russell	88.25	49.90b	94.00	165.67b	35.56
MT884806 Minerva Mutant/Gallatin	87.44	53.80	94.00	170.67	33.73b
MT889106 Apex/Lewis	87.15	52.10b	98.00	166.00b	36.75
MT860756 Gallatin/Bellona	85.81	52.67b	93.00	171.67	33.33b
MT886610 MT 81143/Lewis	85.35	52.47b	93.00	170.67	35.56
MT851224 ID810264/MT 41918	84.67	51.57b	99.00	171.67	34.91
AC 1798 Steffi	84.54	51.63b	99.00	173.67a	31.89b
MT881809 Columbia/Hazen	84.52	49.17b	99.00	168.00	41.86a
CI 15514 Hector	84.42	52.17b	91.00	170.33	36.35
MT887510 MT 81619/Lewis	83.08	51.30b	96.00	170.33	36.35
CI 15773 Morex	82.96	49.60b	97.00	167.00b	43.70a
MT887406 MT 81619/Chalky Glenn	82.60	48.40b	86.00	167.00b	41.21a
8500905 Coors DH85-009-05	81.88	50.27b	96.00	173.33a	27.17b
MTSU 247 Shonkin	80.54	57.17b	57.00	172.33a	36.35
8202805 Coors AC82-028-05	78.62	52.73b	94.00	172.00a	32.94b
MT861596 Lewis/MT 41549	77.35	51.73b	95.00	170.00	34.91
EXPERIMENTAL MEANS	93.36	51.21	.00	170.35	36.06
F TEST FOR VAR.	1.47**	22.20**	.00	6.81**	9.56**
C.V. 2: (S OF MEAN/MEAN)*100	6.93	.74	.00	.45	2.93
LSD (0.05)	18.10	1.06	.00	2.12	2.95

1/ Check variety
a/ Values significantly higher than the check at the .05 level
b/ Values significantly lower than the check at the .05 level
* Indicates statistical significance at the .05 level of probability
** Indicates statistical significance at the .01 level of probability

Table 2. Agronomic data from the Early Yield Spring Barley nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT in 1990. Planted: April 2, 1990 Harvested: August 15, 1990 Field Y-4.

	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEAD DATE	HT (IN)	LODGING SEVER.	LODGING PREV.
MT890008	Fleet/Bowman	153.46	50.40	98.00	176.67	35.56	.00	.00
MT890128	Steptoe/Robust	152.23	48.80	98.00	171.00	37.40	.00	.00
MT890123	Steptoe/Columbia	150.44	48.77	99.00	174.00	41.73	2.67	16.67
MT890059	Morex/ID910719	149.42	50.60	95.00	171.00	42.91	.00	.00
MT890151	Unitan/Robust	148.23	48.90	96.00	172.00	43.70	.67	30.00
MT890173	WA889278/Bowman	145.77	50.77	94.00	175.00	41.08	.00	.00
MT890145	Unitan/Robust	145.17	48.40	97.00	172.33	44.09	.00	.00
MT890040	Lewis/ID91019	143.15	51.70	94.00	170.33	39.50	.00	.00
CI 15229	Steptoe	142.50	47.50	99.00	172.67	38.32	.00	.00
MT890061	Morex/ID910719	141.33	50.47	95.00	170.67	45.14	.00	.00
CI 15478	Klages	141.02	50.47	91.00	175.33	39.63	1.33	58.00
MT890069	MT4126/Piroline	137.92	52.23	91.00	173.00	38.32	.67	8.33
MT890171	WA889278/Bowman	137.90	49.97	93.00	174.33	39.63	2.00	16.67
MT890006	Fleet/Abee	136.94	51.47	88.00	174.33	29.27	.00	.00
MT890148	Unitan/Robust	136.73	48.63	95.00	172.00	46.33	1.33	18.33
MT890060	Morex/ID910719	136.60	49.90	94.00	170.33	41.60	.00	.00
MT890033	Hector/Fleet	136.33	50.10	77.00	173.00	30.18	.00	.00
MT890014	Fleet/Menuet	136.19	50.30	70.00	175.67	27.69	.00	.00
MT890089	MT81161/Harr.	133.54	52.17	94.00	172.33	38.71	.00	.00
MT890028	Hector/Bowman	132.63	51.20	92.00	173.00	40.94	2.67	99.00
MT890172	WA889278/Bowman	131.75	50.70	93.00	174.00	40.55	.00	.00
MT890023	Gallatin/Piro	128.50	53.10	95.00	173.33	41.34	2.67	63.00
MT890082	MT41279/Teton	128.06	52.37	96.00	173.00	37.14	.67	33.00
MT890111	Robust/ID910719	127.69	50.30	95.00	172.00	46.19	.00	.00
MT890170	WA889278/Bowman	127.25	50.30	91.00	172.33	38.06	1.67	16.67
MT890022	Gallatin/Piro	126.75	54.30	95.00	173.00	41.60	1.33	58.00
MT890088	MT81161/Harrg.	126.71	51.53	96.00	172.67	39.76	.00	.00
MT890167	WA889278/Azure	126.06	48.87	98.00	173.00	41.99	.00	.00
MT890157	Unitan/Robust	126.06	48.10	97.00	171.33	44.49	.00	.00
MT890029	Hector/Bowman	125.23	51.53	90.00	172.33	41.34	2.00	64.67
MT890005	Bowman/Lewis	124.52	51.17	98.00	174.00	36.35	2.33	63.00
MT890176	WA889278/Clark	123.44	52.23	91.00	174.00	39.89	.00	.00
MT890039	Lewis/ID91019	122.83	48.70	69.00	171.33	36.22	.00	.00
MT890020	Gallatin/Piro	121.50	52.13	91.00	171.67	40.55	2.67	82.67
MT890136	Summit/Piro	120.83	50.87	93.00	174.00	41.47	5.33	66.33
MT890087	MT81161/Harr.	120.75	51.30	96.00	171.00	38.45	.67	33.00
MT890038	Lewis/ID91019	119.85	48.07	71.00	170.67	40.55	5.00	13.33
MT890031	Hector/Fleet	119.81	51.93	96.00	172.33	37.53	3.33	76.67
MT890034	Hector/Fleet	119.46	49.20	71.00	172.33	27.95	.00	.00
MT890098	Robust/Azure	118.67	46.60	57.00	172.67	37.93	4.00	99.00
MT890016	Gallatin/Apex	117.35	53.10	90.00	176.33	36.75	2.33	25.00
SK 76333	Harrington	116.44	50.73	93.00	173.00	38.19	1.33	66.00
MT890112	Robust/ID910719	116.27	50.27	98.00	173.00	46.06	1.00	8.33
MT890018	Gallatin/Apex	115.40	51.17	87.00	172.67	33.60	2.33	76.00

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Table 2 (Cont'd). Agronomic data from the Early Yield Spring Barley nursery

VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEAD DATE	HT (IN)	LODGING SEVER.	LODGING PREV.
MT890057 Morex/Columbia	115.31	50.77	97.00	172.00	46.98	.67	8.33
MT890066 MT4126/Morav III	113.71	52.23	91.00	172.67	38.45	1.33	49.67
CI 15773 Morex	113.60	51.10	99.00	171.67	48.56	.00	.00
MT890065 MT4126/Morav III	112.58	51.30	95.00	170.00	38.71	.67	33.00
MT890021 Gallatin/Piro	111.98	53.07	92.00	172.33	39.11	3.67	99.00
MT890030 Hector/Fleet	111.50	50.40	83.00	173.00	29.27	.00	.00
MT890179 WA889278/Clark	111.21	52.87	94.00	173.33	41.60	2.67	99.00
MT741232 Drought Sel. 2	111.19	51.57	90.00	173.00	38.06	2.67	58.00
CI 15514 Hector	109.67	51.70	92.00	173.33	40.81	3.00	99.00
MT890015 Gallatin/Apex	108.67	53.47	94.00	174.00	38.98	1.00	16.67
MT741394 Drought Sel. 1	107.25	49.97	84.00	171.67	34.38	1.67	16.67
MT890178 WA889278/Clark	106.90	52.03	90.00	173.00	41.21	2.33	58.00
MT890009 Fleet/Gallatin	105.81	51.50	94.00	174.33	38.19	.67	30.00
MT890070 MT47219/Bowman	104.42	51.57	95.00	172.33	38.71	1.67	63.00
MT741183 Drought Sel. 6	104.13	50.50	89.00	172.00	40.81	3.00	82.67
MT741214 Drought Sel. 4	103.17	47.77	99.00	170.67	42.78	2.67	43.33
MT741405 Drought Sel. 5	103.06	48.07	99.00	172.67	44.49	2.67	33.33
MT741456 Drought Sel. 3	102.88	48.60	100.00	171.00	43.96	2.33	10.00
MT890012 Fleet/Gallatin	97.98	49.63	83.00	173.00	30.05	.67	16.67
MT890071 MT47219/Bowman	97.71	51.33	95.00	170.33	39.24	1.67	66.00
EXPERIMENTAL MEANS	124.08	50.64	.00	172.68	39.38	1.33	30.84
F TEST FOR VAR.	4.88**	19.70**	.00	6.81**	18.04**	2.12**	3.89**
C.V. 1: (S/MEAN)*100	9.25	1.24	.00	.55	4.67	122.01	94.73
LSD (0.05)	18.55	1.01	.00	1.53	2.97	2.62	47.21

** Indicates statistical significance at the .01 level of probability

Table 3. Agronomic data from the Offstation Spring Barley Nursery grown on the Christ farm, Hamilton, MT (Ravalli Co.).
Planted: April 12, 1990 Harvested: August 8, 1990

CI/STATE NUMBER	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HT IN	- LODGING - SEVER	PREV.
BA 2601	BA 2601	148.41a	51.27b	95.33	33.60b	.00	.00
CI 15229	Steptoe	146.76a	48.63b	96.67	39.11	5.00	88.33
CO 3	Moravian 3	141.96a	52.63	94.33	34.78b	5.33	56.67
PI483127	Russell	138.49a	50.37b	94.67	38.32	1.33	10.00
BA 1202	BA 1202	136.62	53.50	98.67	39.11	3.67	64.67
CI 15478	Klages	135.57	51.67b	96.67	35.56	2.00	10.00
BA 1215	BA 1215 (BA 8529)	134.33	52.20	95.00	37.40	2.67	23.33
VD 3	Menuet	129.40	54.13	97.67	35.83	.67	3.33
CI 15856	Lewis	127.99	54.00	95.00	39.50	4.33	61.33
78Ab6871	Crystal	125.98	52.93	93.33	38.98	3.33	36.67
CI 15773	Morex	125.07	51.03b	92.00b	43.18a	6.33	71.00
CI 15857	Clark	122.61	53.87	97.67	38.19	3.00	28.33
SK 76333	Harrington	121.74	51.40b	97.00	35.30	2.33	16.67
ND 9866	ND 7014/Bowman sib	121.65	54.47	98.67	38.71	3.67	50.00
CI 10083	Ingrid	121.36	53.47	95.33	36.61	3.67	33.33
PI531228	Bearpaw	119.93	50.07b	92.00b	38.98	5.67	83.00
CI 15514	Hector	119.67	53.43	93.33	41.47	6.67	71.33
PI491534	Gallatin 1/	119.64	53.73	97.33	38.32	3.67	39.67
MT851012	Clark/WA877178	117.97	51.87	93.00	40.03	7.33	86.33
MT140523	Hector/Klages	115.66	51.33b	89.00b	38.71	5.67	63.00
EXPERIMENTAL MEANS		128.54	52.30	95.13	38.08	3.82	44.85
F TEST FOR VAR.		2.45**	5.90**	1.95	3.66**	1.56	2.13*
C.V. 2: (S OF X/X)*100		4.92	1.24	1.89	3.16	41.94	43.66
LSD (0.05)		18.10	1.86	5.16	3.45	4.58	56.06

1/ Check variety
* Indicates statistical cignificance at the .05 level of probability
** Indicates statistical significance at the .01 level of probability
a/ Values significantly greater than the check variety at the .05 level
b/ Values significantly less than the check variety at the .05 level

Table 4. Agronomic data from the Offstation Spring Barley Nursery grown on the Starkle farm in Lake County in 1990.
Planted: April 20, 1990 Harvested: August 9, 1990

CI/STATE Number	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT IN	--LODGING-- SEVER	PREV
CI 15229	Steptoe	126.54a	47.87	95.00a	36.61	.00	.00
78Ab6871	Crystal	123.58a	50.27	94.33a	37.14	1.00	3.33
ND 9866	ND 7014/Bowman	118.02a	49.53	91.67a	39.89a	1.00	3.33
BA 1202	BA 1202	117.19a	50.23	93.33a	41.47a	1.67	20.00
VD 3	Menuet	115.17a	50.57	91.67a	36.61	.67	3.33
BA 2601	BA 2601	115.15a	47.23	72.33	36.22	1.67	30.00
MT140523	Hector/Klages	114.44a	49.20	84.33a	37.80	4.67	30.00
CI 15856	Lewis	113.63a	50.43	91.00a	37.66	3.33	23.33
CI 15478	Klages	112.71a	47.23	71.33	39.50a	4.67	31.67
CO 3	Moravian 3	109.83a	48.27	79.67a	36.09	2.67	16.67
BA 1215	BA 1215 (BA 8529)	108.63a	49.43	89.67a	37.93	3.00	40.00
CI 15773	Morex	106.94a	49.97	91.67a	45.80a	.67	8.33
MT851012	Clark/WA877178	106.58a	48.60	84.67a	40.03a	4.00	76.67a
CI 15857	Clark	101.25	50.33	83.00a	38.19	5.00a	72.67
CI 15514	Hector	98.15	49.33	79.00a	37.93	4.00	89.67a
PI531228	Bearpaw	97.71	47.93	85.33a	36.75	6.33a	61.67
CI 10083	Ingrid	95.04	47.97	73.33	36.35	5.67a	79.67
aK 76333	Harrington	90.79	47.33	79.00a	37.53	5.67a	53.33
PI491534	Gallatin 1/	89.21	49.60	68.33	34.91	1.33	33.00
PI483127	Russell	87.83	45.47b	70.33	33.46	.00	.00
EXPERIMENTAL MEANS		107.42	48.84	83.45	37.89	2.85	33.83
F TEST FOR VAR.		3.68**	2.52**	6.11**4	4.18**	2.58**	3.87**
C.V. 2: (S OF X/X)*100		5.50	1.79	4.28	3.36	44.78	43.73
LSD (0.05)		16.91	2.50	10.22	3.65	3.65	42.36

1/ Check variety
* Indicates statistical cignificance at the .05 level of probability
** Indicates statistical significance at the .01 level of probability
a/ Values significantly greater than the check variety at the .05 level
b/ Values significantly less than the check variety at the .05 level

Table 5. Agronomic data from the Offstation Spring Barley nursery grown on the Western Research Center in Corvallis, MT (Ravalli Co.).
Planted: April 12, 1990 Harvested: August 8, 1990

CI/STATE NUMBER	VARIETY	YIELD BU/A	TEST WT LBS/BU	% PLUMP	HEIGHT IN	--LODGING-- SEVER	PREV.
BA 1215	BA 1215 (BA 8529)	152.40	53.47	97.33	37.01	.00	.00
BA 1202	BA 1202	151.63	53.43	99.00	40.16a	.00	.00
BA 2601	BA 2601	143.81	51.40	96.33	35.83	.00	.00
PI491534	Gallatin 1/	142.42	53.37	92.00	35.96	.00	.00
SK 76333	Harrington	141.81	53.07	97.67	36.22	1.00	6.67
PI483127	Russell	140.40	51.97	98.00	38.19	.00	.00
CI 15857	Clark	133.90	53.33	96.67	36.22	.00	.00
PI531228	Bearpaw	128.31	51.60	96.00	35.83	2.33	20.00
MT140523	Hector/Klages	126.90	53.00	88.67	36.35	.67	5.00
ND 9866	ND 7014/Bowman sib	117.81	53.90	94.33	38.19	1.33	6.67
CI 15514	Hector	116.83	53.00	89.33	35.56	2.00	16.67
CO 3	Moravian 3	115.04	53.00	86.33	34.25	.00	.00
MT851012	Clark/WA877178	112.79	51.50	87.00	37.93	3.00	30.00
CI 15229	Steptoe	111.81b	48.20b	87.00	35.96	2.67	26.67
CI 15478	Klages	111.02b	50.87b	83.67	34.51	.00	.00
CI 10083	Ingrid	110.40b	53.73	92.00	34.25	2.33	16.67
CI 15856	Lewis	108.54b	53.63	95.00	36.35	.00	.00
CI 15773	Morex	106.98b	50.27b	83.33	42.78a	1.67	33.00
VD 3	Menuet	104.06b	53.17	95.33	36.09	.00	.00
78Ab6871	Crystal	100.54b	51.60	81.33	33.86	.00	.00
EXPERIMENTAL MEANS		123.87	52.38	91.82	36.57	.85	8.07
F TEST FOR VAR.		2.47**	4.21**	1.21	3.20**	.99	.90
C.V. 2: (S OF X/X)*100		8.56	1.34	5.50	3.22	129.11	149.31
LSD (0.05)		30.36	2.01	14.45	3.37	3.14	34.48

1/ Check variety
* Indicates statistical significance at the .05 level of probability
** Indicates statistical significance at the .01 level of probability
a/ Values significantly greater than the check variety at the .05 level
b/ Values significantly less than the check variety at the .05 level

Table 6. Offstation Spring Barley Averages for the three locations grown in western Montana in 1990 (Lake and Ravalli Co.).

CI/STATE NUMBER	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HT IN	LODGING SEVER	LODGING PREV
BA 2601	BA 2601	135.8	50.0	88.0	35.2	.6	10.0
CI 15229	Steptoe	128.4	48.2	92.9	37.2	2.6	38.3
CO 3	Moravian 3	122.3	51.3	86.8	35.0	2.7	24.5
PI483127	Russell	122.2	49.3	87.7	36.7	.4	3.3
BA 1202	BA 1202	135.2	52.4	97.0	40.3	1.8	28.2
CI 15478	Klages	119.8	49.9	83.9	36.5	2.2	13.9
BA 1215	BA 1215 (BA 8529)	131.8	51.7	94.0	37.5	1.9	21.1
VD 3	Menuet	116.2	52.6	94.9	36.2	.5	2.2
CI 15856	Lewis	116.7	52.7	93.7	37.8	2.6	28.2
78Ab6871	Crystal	116.7	51.6	89.7	36.7	1.4	13.3
CI 15773	Morex	113.0	50.4	89.1	43.9	2.9	37.4
CI 15857	Clark	119.3	52.5	92.5	37.5	2.7	33.7
SK 76333	Harrington	118.1	50.6	91.2	36.4	3.0	25.6
ND 9866	ND 7014/Bowman sib	119.2	52.6	94.9	39.9	2.0	20.0
CI 10083	Ingrid	108.9	51.7	86.9	35.7	3.8	43.2
PI531228	Bearpaw	115.3	49.9	91.1	37.2	4.8	54.9
CI 15514	Hector	111.6	51.9	87.2	38.3	4.2	59.2
PI491534	Gallatin 1/	117.1	52.2	85.9	36.4	1.7	24.2
MT851012	Clark/WA877178	112.5	50.7	88.2	39.3	4.8	64.3
MT140523	Hector/Klages	119.0	51.2	87.3	37.6	3.7	32.7
EXPERIMENTAL MEANS		119.9	51.2	90.1	37.5	2.5	28.9

1/ Check variety

PROJECT TITLE: Uniform Northwestern Oat Nursery

YEAR/PROJECT: 1990/756

INVESTIGATORS: Leader - Vern R. Stewart, Todd Keener - Research Specialist

OBJECTIVE: Evaluation of new and introduced oat varieties for yield and disease resistance in Montana.

RESULTS:

The 1990 Uniform Oat Nursery results were very similar to last season. The high yield was 229.13 bu/A. Eight varieties yielded above 200 bu/A. The mean yield was 184.38 bu/A. Otana, the check variety, yielded 173.31 bu/A with seven entires having yields that were significantly greater. In comparison to Otana many varieties had lower test weights. The mean was 33.46 lb/bu and the variety Trucker had the highest at 39.03 lb/bu. No varieties are performing better that Otana and Monida in regards to yield and test weight. Little lodging occured until after mid-season when all but eleven of the 30 entries had some lodging.

Table 1. Agronomic data from the Uniform Oat Nursery grown on the Northwestern Agricultural Research Center in 1990. Field Y-4
Date planted: April 2, 1990 Harvested: August 28, 1990

STATE or CI NUMBER	VARIETY	YIELD BU/A	TEST WT LB/BU	HEADING DATE	HEIGHT IN	-- LODGING -- PREV.	SEVER
83AB3119	Cayuse/76Ab6843	229.13a	33.70b	181.67	33.66b	.00b	.00b
80Ab5807	74AB2608/Cayuse	218.32a	34.23b	180.33	41.73b	50.00	3.67
83AB3250	Cayuse/Monida	217.88a	33.90b	182.67a	36.81b	64.67	6.00
80Ab5322	Border/74Ab1956	210.79a	35.53	181.67	34.65b	.00b	.00b
80Ab988	74AB1952/74AB2608	209.76a	33.70b	180.33	32.09b	.00b	.00b
82Ab1178	74AB1952/75AB1576	208.48a	34.90b	178.00b	33.86b	8.33b	1.33
82Ab248	Cayuse/Monida	203.20a	34.20b	182.67a	36.42b	89.67	6.00
86AB664	Ogle/75Ab861	202.05	34.30b	180.33	41.34b	66.00	2.00
CI467882	Border	196.71	33.07b	182.33a	41.93b	92.67	5.33
81Ab5792	74Ab2608/Cayuse	195.71	33.47b	177.00b	38.19b	59.67	2.33
82Ab1142	74ab1952/74ab2608	194.74	33.43b	179.33b	33.66b	.00b	.00b
CI 8263	Cayuse	194.43	33.03b	180.00	42.13b	92.67	5.33
CI483126	Monida (ID 751170)	193.27	36.00	181.00	46.46	99.00	5.00
83AB3725	74Ab1952/74Ab2608	191.09	35.73	178.67b	34.45b	.00b	.00b
CI 9401	Ogle	185.87	32.80b	175.67b	39.57b	6.67b	1.33
W 80474	Riel (RL 3057/Otana)	181.75	35.27	179.67	47.44	41.33	3.00
86AB1867	81Ab5772/Ogle	180.78	35.43	174.00b	35.43b	.00b	.00b
W 78286	Dumont	178.56	35.13	180.00	45.28b	96.00	3.00
CI 9252	Otana 1/	173.31	36.90	180.67	49.41	82.67	3.67
OT 308	Calibre	172.06	35.40	180.00	48.62	96.00	4.00
W 82056	Robert (OT 212/RL 30	170.22	32.73b	181.67	44.49b	31.67b	2.00
CI 9297	Appaloosa	166.16	31.40b	181.67	42.91b	99.00	8.00a
NP871754	Ogle/OT 3215, NZ 841	165.63	29.20b	182.67a	27.56b	.00b	.00b
NP871742	Ogle/OT 32-15,Sel. N	164.19	29.70b	183.67a	25.98b	.00b	.00b
ND820603	Valley	163.26	31.20b	179.67	42.52b	33.00b	1.00
NPB88301	Ogle/OT 3215//Border	161.94	28.97b	181.00	28.54b	.00b	.00b
NPB86801	Minamax	155.79	29.20b	182.00b	27.95b	.00b	.00b
CI 6611	Park	152.70	32.73b	180.67	47.83	66.67	5.33
NPB88304	Ogle/OT 3215//Border	152.48	29.77b	180.33	26.38b	.00b	.00b
SD810109	Trucker (Moore//Dal/	141.14	39.03a	175.67b	45.87b	66.00	3.33
EXPERIMENTAL MEANS		184.38	33.47	180.17	38.44	41.39	2.39
F TEST FOR VAR.		4.74**	14.69**	27.94**	38.90**	6.55**	4.48**
C.V. 2: (S OF MEAN/MEAN)*100		5.62	1.90	.24	2.96	37.60	47.21
LSD (0.05)		29.33	1.80	1.21	3.29	44.05	3.19

1/ Check variety
** Indicates statistcal significance at the .01 level of probability
a/ Values significantly greater than the check at the .01 level
b/ Values significantly less than the check at the .01 level

PROJECT TITLE: Spring Wheat Variety Evaluations

YEAR/PROJECT: 1990/756

INVESTIGATORS: Leader - Vern R. Stewart, Todd Keener - Research Specialist

OBJECTIVE:

To determine the adaptability of new and introduced spring wheat varieties grown under high moisture conditions in Montana. Evaluation of new and introduced spring wheat varieties in various growing conditions of western Montana.

RESULTS:

Western Regional Spring Wheat -

The yields taken from the Western Regional Spring Wheat nursery were some of the highest since the 1987 harvest. The range of yields was 73.25 to 126.45 bu/A. Owens had a yield of 111.83 bu/A, which was well above the nursery mean yield of 99.96 bu/A. Test weights were normal for spring wheat this season averaging 57.56 lb/bu. The test weights were higher than those of 1989 yet much lower than those recorded in 1988. Low test weights in spring wheat, like those recorded this year, are often a result of long periods of precipitation prior to harvest. There was very little disease or lodging in this nursey.

1990 Advanced Yield Nursery -

The mean yield for this nursery was 93.48 bu/A, 16 bushels per acre less than the average last year. The yields ranged from 79.9 to 125.05 bu/A. Owens had the top yield with all the other entries having yields that were significantly lower. The second highest yield was Lloyd at 108.78 bu/A. Penawawa yielded 102.12 bu/A and had a test weight of 57.60 lb/bu. Only five of the 36 entries had yields in excess of 100 bu/A. Test weights averaged 57.98 lb/bu, which is equal to last year. Heading dates and height did not vary from the averages that have been recorded over the years.

Offstation Spring Wheat Variety Evaluation -

Offstation spring wheat nurseries were seeded in two locations this year.

- Ravalli County - Robert Christ farm, Hamilton, MT.

- Lake County - Starkle farms, Ronan, MT

All locations were irrigated and recieved adequate rainfall during the growing season. Yields were good to excellent for the majority of entries and most varieties had average test weights. Disease incidence was low or non-existent in all areas. There was no lodging at the Hamilton and Ronan nursery sites.

Ravalli County Offstation Spring Wheat -

Yields from the offstation nursery grown on the Robert Christ farm

in Hamilton ranged from 43.9 to 113.9 bu/A. Penawawa had the highest yield at this location. Owens and Stoa both had yields that were above 100 bu/A. The average test weight was 56.0 lbs/bu which was lower than expected for this area. Lew and Lancer had test weight averages less than 50 lbs/bu. There was no lodging in this nursery. A high population of wild oats was controlled by an Avenge application. Table 3.

Lake County Offstation Spring Wheat -

The nursery located at the Starkle farm in Ronan had yields in the range of 48.8 to 85.7 bu/A. The top yielding variety (Amidon), a North Dakota entry, yielded 85.7 bu/A. All test weights in the nursery were slightly less than anticipated. Amidon had the highest test weight at 59.10 lb/bu. There was no lodging in this nursery. Table 4.

Averages for both 1990 Offstation Spring Wheat locations are given in Table 5.

1990 Triticale Variety Nursery -

Yields were slightly less than the 1988 and 1989 yields and ranged from 54.95 to 77.98 bu/A (based on 60 lb/bu test weights). As last year, the varieties of Juan and Welsh had some of the highest yields. Test weights were slightly lower this year, heading dates were a little later and height averages were less than in the previous years. Table 6.

Table 1. Agronomic data from the Western Regional Spring Wheat nursery grown on the Northwestern Agricultural Research Center.
Planted: April 2, 1990 Harvested: August 31, 1990

CI/STATE NUMBER	VARIETY		TYPE 2/	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT IN
ID 405	ID228/A73262S-11682-		SW	126.45	59.80a	179.67a	38.45a
ID 409	TREASURE/ID246		SW	118.87	57.00b	178.67	35.96
UT 1601	UT78S147-125/906R		HR	115.55	58.63	178.00	34.78
UT613960	RICK/UT 78S 147-125		HR	115.15	56.83b	179.33a	36.35
ID 392	OWENS/ID159		SW	113.97	58.70	177.67	35.56
ID 408	ID232/A75120S-2214-1		SW	113.70	53.87b	178.00	33.99
ID 415	STERLING/BLISS		SW	113.50	59.40a	178.00	38.06
WA 7668	K80296/NK751		HR	113.47	58.30	178.33	38.98a
CI 17904	OWENS	1/	SW	111.83	58.30	178.00	36.09
LEWIEM05	LEWI-3M,5(F9 SEMIDWA		SW	111.78	57.77	179.33a	36.22
ORS 8427	SPSWE 9		SW	110.48	58.17	178.00	35.56
OR487400	SN64/HN4//REX/3/EDCH		HR	107.87	61.27a	177.67	33.73b
WA 7496	K7400315/PTM70S.47		SW	107.27	56.97b	178.33	31.23b
WA 7075	K73579/BORAH		HR	107.22	56.90b	177.33	34.65
UT 2534	UT78S147-209/906R		HR	106.88	58.63	177.00	37.80
OR487316	SAP SIB/MON SIB		SW	104.15	55.20b	176.00b	29.53b
WA 7183	WAKANZ		SW	103.45	55.87b	179.00	33.20b
UT 2464	UT 78S 147-209/906R		HR	103.07	59.27a	179.33a	36.61
OR487453	SPHWE 11		HW	102.48	56.47b	177.67	29.66b
UC 786	YOLO'S'/YRR,CA810041		HR	102.15	56.83b	176.00b	27.82b
LEWIEM04	LEWI-EM,4(F9SEMIDWAR		SW	102.13	58.00	178.00	35.83
UT613945	RICK/UT78S147-125		HR	102.10	56.83b	179.33a	36.35
ID 420	A7612S-2/A75141S-2-1		HR	101.73	59.47a	176.67b	30.58b
UT580646	UT77W1054-1777/906R		HR	101.45	57.20b	178.00	31.23b
WA 7176	K78504/K74129-33//K7		SW	99.53	57.03b	179.00	37.27
ID 412	A76102S-1-2/EMU'S'		HR	99.13	59.77a	176.33b	34.78
WA 6920	PENAWAWA		SW	98.30	57.50b	178.00	34.65
OR487475	AGA/6*'YR'		HR	97.25	56.00b	175.67b	24.93b
CI 17903	MCKAY		HR	94.80b	59.47a	179.00	34.12
ID 417	ID 182/FIELDWIN		SW	93.78b	59.27a	176.00b	33.73b
OR487462	SPHRE 16		HR	92.83b	57.10b	175.33b	30.71b
OR487456	CT.S		HR	88.25b	57.97	176.00b	30.71b
UC 638	SERRA		HR	87.87b	58.17	176.00b	31.76b
ID 367	A76102S-1-2/ID 134		HR	87.18b	58.43	178.00	35.43
OR487380	SPHWE 13		HW	86.92b	55.33b	175.33b	24.41b
ID 419	ID 204/ID 134		HR	85.72b	59.80a	177.67	33.60b
CI 4734	FEDERATION		SW	85.23b	54.97b	178.67	42.39a
OR487279	SPHWE9		HW	85.07b	56.83b	175.00b	27.17b
LEWIEM01	LEWI-EM,1(F9 SEMIDWA		SW	84.72b	55.50b	179.00	32.41b
OR487355	JUP/BJY.S//DOVE.S		HR	81.97b	57.13b	175.67b	31.76b
UC 784	STA/YRR,CA770284-0D-		HR	80.20b	55.93b	174.00b	25.33b
UC 785	STA/YRR,CA770284-0D-		HR	79.38b	56.27b	176.00b	24.15b
NKF 8022	KLASIC		HW	73.25b	56.80b	174.33b	26.64b
EXPERIMENTAL MEANS				99.96	57.56	177.40	33.12

Statistics on following page

Statistical data from the Western Regional Spring Wheat nursery

CI/STATE NUMBER VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT IN
EXPERIMENTAL MEANS	99.96	57.56	177.40	33.12
F TEST FOR VAR.	4.66**	33.24**	16.89**	27.09**
C.V. 2: (S OF MEAN/MEAN)*100	5.73	.47	.20	2.46
LSD (0.05)	16.12	.76	1.02	2.29

1/ Check variety
2/ TYPE = HR (Hard red), SW (Soft white), HW (Hard white)
** Indicates statistical significance at the .01 probability level
a/ Values significantly greater than the check at the .01 level
b/ Values significantly less than the check at the .01 level

Table 2. Agronomic data from the Advanced Yield Spring Wheat nursery grown on the Northwestern Agricultural Research Center in Kalispell, MT.
Planted: April 2, 1990 Harvested: August 15, 1990

CI/STATE NUMBER	VARIETY	YIELD BU/A	TEST WT LB/BU	HEADING DATE	HEIGHT IN
CI 17904	OWENS 1/	125.05	58.47	178.00	37.66
PI476211	LLOYD	108.78b	56.80b	179.67a	30.97b
MT 8289	TANAGER'S'	108.03b	58.63	175.67b	33.46b
MT 8182	YDING "S"/PCI "S"-287	103.75b	56.73b	176.33b	34.38b
WA 6920	PENAWAWA	102.12b	57.60	177.67	34.51b
ND 606	AMIDON	99.92b	58.23	178.67	43.96a
MT 8836	MT7648/ANTIZANA	99.38b	58.63	179.00	40.03a
CI 17438	CANDO	99.23b	57.87	178.33	31.36b
MT 8626	CI15838/MT7418//PONDERA	98.67b	58.30	175.67b	35.83
MT 8824	MARBERG/MT7746	96.75b	58.07	175.67b	36.75
MT 8845	MT7648/MT7746	96.68b	58.50	176.67b	36.88
CI 17282	CROSBY	96.52b	59.40	177.00	44.62a
CI 17430	NEWANA	96.43b	58.97	178.00	34.65b
MT 8841	MT7648/MT7746	95.93b	57.90	177.33	35.17b
CI 13596	FORTUNA	94.58b	57.83	176.67b	43.57a
MT 8858	MT7421/BUTTE	94.53b	58.07	178.00	36.48
WB LAKER	WestBred Laker	94.22b	57.70	180.00a	36.09
CI 17828	PONDERA	93.80b	58.47	176.00b	34.91b
MT 8849	RS6880/MT7819	93.32b	58.93	177.33	37.66
CI 15930	OLAF	92.83b	56.40b	176.33b	36.75
CI 17910	ALEX	90.47b	59.00	179.00	42.52a
PI483235	GLENMAN	89.55b	58.37	178.67	36.09
MT 8651	CI15838/MT7418//PONDERA	89.12b	58.07	177.33	35.30b
MT 8402	MT7336/SHORTANA	88.85b	58.30	175.00b	33.46b
PI478289	MONROE	88.58b	57.43	175.00b	42.26a
CI 17429	LEW	87.80b	59.30	178.33	44.49a
DT 433	MEDORA	87.08b	57.97	176.67b	44.36a
BZ984326	WPB BZ 984-326	86.02b	57.67	174.67b	35.43b
ND 582	STOA	85.93b	57.97	178.00	43.83a
C982-324	RAMBO	85.80b	57.87	177.67	32.94b
CI 17790	LEN	84.28b	57.07b	174.33b	35.30b
MT 8612	CI15838/MT7418//PONDERA	83.65b	59.07	176.00b	35.56b
MT 8833	PONDERA/ANGUS	83.40b	56.80b	175.33b	36.88
CI 10003	THATCHER	83.35b	55.57b	177.67	44.75a
PI 15892	WARD	81.07b	58.73	177.33	45.01a
PI486139	KLASIC	79.90b	56.53b	173.33b	25.85b
EXPERIMENTAL MEANS		93.48	57.98	177.01	37.49
F TEST FOR VAR.		4.03**	3.98**	14.44**	44.33**
C.V. 2: (S OF MEAN/MEAN)*100		4.82	.76	.23	1.87
LSD (0.05)		12.71	1.24	1.15	1.98

** Indicates statistical significance at the .01 level of probability
1/ Check variety
a/ Values significantly greater than the check at the .05 level
b/ Values significantly less than the check at the .05 level

Table 3. Agronomic data from the Offstation Spring Wheat Nursery grown on the Christ farm in Hamilton, MT (Ravalli Co.) in 1990.
Planted: April 12, 1990 Harvested: September 6, 1990

CI/STATE NUMBER	VARIETY	TYPE	YIELD BU/A	TEST WT LB/BU	HEIGHT IN
WA 6920	PENAWAWA	SW	113.94a	56.07	33.46
CI 17904	OWENS	SW	113.76a	58.00	35.70
ND 582	STOA	HR	101.08a	57.67	41.99a
CI 15930	OLAF	HR	95.48	57.07	36.35
CI 17828	PONDERA	HR	92.50	57.63	35.04
CI 17790	LEN	HR	89.02	57.23	35.04
CI 17430	NEWANA 1/	HR	88.29	57.67	33.73
ND 606	AMIDON	HR	86.87	56.07	44.36a
C982-324	RAMBO	HR	84.98	58.60	33.46
ND 618	GUS	HR	84.03	58.33	37.01a
WPB 926R	WESTBRED 926R	HR	80.67	57.03	30.45b
ND 626	GRANDIN	HR	77.88	58.53	36.75
WPB 906R	WESTBRED 906R	HR	77.03	57.20	29.66b
PI483235	GLENMAN	HR	74.39b	53.77b	35.96
MT 8402	MT7336/SHORTANA	HR	72.69b	56.50	32.41
CI 13596	FORTUNA	HR	71.93b	55.93	43.57a
NDCUT	CUTLESS	HR	69.32b	52.77b	38.32a
CANLANC	LANCER	HR	68.44b	49.80b	43.96a
CI 17910	ALEX	HR	60.02b	55.50	39.76a
CI 17429	LEW	HR	43.88b	48.77b	37.66a
EXPERIMENTAL MEANS			82.31	56.01	36.73
F TEST FOR VAR.			14.88**	10.75**	15.60**
C.V. 2: (S OF MEAN/MEAN)*100			5.30	1.49	2.93
LSD (0.05)			12.49	2.39	3.08

1/ Check variety
2/ TYPE = SW (Soft white), HR (Hard Red)
a/ Values significantly greater than the check at the .01 level
b/ Values significantly less thatn the check at the .01 level
** Indicates statistical significance at the .01 level of probability

Table 4. Agronomic data from the Offstation Spring Wheat nursery grown on the Starkle farm, Ronan, MT in Lake County.
Planted: April 20, 1990 Harvested: September 6, 1990

CI/STATE NUMBER	VARIETY	TYPE 2/	YIELD BU/A	TEST WT LB/BU	HEIGHT IN
ND 606	AMIDON	HR	85.72	59.10	42.39a
WPB 926R	WESTBRED 926R	HR	83.62	55.57	30.05
WPB 906R	WESTBRED 906R	HR	82.03	55.33	29.66
ND 618	GUS	HR	80.43	57.20	35.43a
MT 8402	MT7336/SHORTANA	HR	79.42	57.57	30.18
ND 582	STOA	HR	78.33	56.30	40.42a
CI 15930	OLAF	HR	78.13	56.10	34.38a
CI 17828	PONDERA	HR	74.20	57.77	31.89
ND 626	GRANDIN	HR	72.63	56.73	35.83a
CI 17910	ALEX	HR	72.43	58.20	42.65a
CI 17904	OWENS	SW	72.28	52.67b	33.33a
CI 17430	NEWANA 1/	HR	72.22	56.53	30.84
WA 6920	PENAWAWA	SW	71.70	53.17b	31.76
C982-324	RAMBO	HR	70.80	57.47	32.94
CI 17790	LEN	HR	68.67	55.13	31.63
CI 13596	FORTUNA	HR	57.42b	54.97	43.70a
CANLANC	LANCER	HR	54.72b	55.83	42.26a
PI483235	GLENMAN	HR	53.32b	53.67b	34.78a
NDCUT	CUTLESS	HR	52.05b	57.63	35.43a
CI 17429	LEW	HR	48.77b	56.70	40.94a
EXPERIMENTAL MEANS			70.44	56.18	35.52
F TEST FOR VAR.			4.75**	3.52**	31.91**
C.V. 2: (S OF X/X)*100			7.31	1.60	2.38
LSD (0.05)			14.75	2.58	2.42

1/ Check variety
2/ TYPE = HR (Hard red), SW (Soft white)
a/ Values significantly greater than the check at the .01 level
b/ Values significantly less than the check at the .01 level
** Indicates statistical significance at the .01 level of probability

Table 5. Averages for the 1990 Lake and Ravalli County Offstation Spring Wheat Nurseries.

CI/STATE NUMBER	TYPE 2/	VARIETY	YIELD BU/A	TEST WT. LB/BU	HEIGHT INCHES
CI 17429	HR	LEW	46.33	52.74	39.30
ND CUT	HR	CUTLESS	60.69	55.20	36.88
CANLANC	HR	LANCER	61.58	52.82	43.11
PI483235	HR	GLENMAN	63.86	53.72	35.37
CI 13596	HR	FORTUNA	64.68	55.45	43.64
CI 17910	HR	ALEX	66.23	56.85	41.21
ND 626	HR	GRANDIN	75.26	57.63	36.29
MT 8402	HR	MT7336/SHORTANA	76.06	57.04	31.30
C982-324	HR	RAMBO	77.89	58.04	33.20
CI 17790	HR	LEN	78.85	56.18	33.34
WPB 906R	HR	WESTBRED 906R	79.53	56.27	29.66
CI 17430	HR	NEWANA 1/	80.26	57.10	32.29
WPB 926R	HR	WESTBRED 926R	82.15	56.30	30.25
ND 618	HR	GUS	82.23	57.77	36.22
CI 17828	HR	PONDERA	83.35	57.70	33.47
ND 606	HR	AMIDON	86.30	57.59	43.38
CI 15930	HR	OLAF	86.81	56.59	35.37
ND 582	HR	STOA	89.71	56.99	41.21
WA 6920	SW	PENAWAWA	92.82	54.62	32.61
CI 17904	SW	OWENS	93.02	55.34	34.52
		Mean	76.38	56.09	36.13

1/ Check variety
2/ TYPE = HR (Hard red), SW (Soft white)

Table 6. Agronomic data from the 1990 Offstation Triticale nursery grown on the Northwestern Agricultural Research Center.
Planted: March 30, 1990 Harvested: September 4, 1990

CI/STATE NUMBER	VARIETY	YIELD BU/A 1/	TEST WT LB/BU	HEADING DATE	HEIGHT IN
TRITOT44	WAPITI	77.98	50.87	173.33	45.28
TRITJUAN	JUAN	75.57	51.97	174.00	42.65
TRITWELS	WELSH	69.42	48.27	173.00	44.23
CI 17430	NEWANA	68.50	57.73	173.00	32.55
TRITKRAM	KRAMER	68.43	46.57	170.33	38.45
TRITKARL	KARL	66.03	47.67	169.67	34.38
TRITOSUN	SUNLAND	62.57	53.80	173.00	37.66
TRITBEAG	BEAGLE 82	58.22	47.87	172.67	43.31
TRITCARM	CARMAN	57.30	47.97	172.00	43.04
TRITMARV	MARVAL	54.95	47.13	171.67	44.09
EXPERIMENTAL MEANS		65.90	49.98	172.27	40.56
F TEST FOR REPS.		11.50**	3.07*	.81	3.17*
C.V. 2: (S OF X/X)*100		6.76	.61	.30	3.86
LSD (0.05)		13.24	.90	1.52	4.65

1/ Yield determined by 60 lb/bu test weight
* Indicates statistical significance at the .05 level of probability
** Indicates statistical significance at the .01 level of probability

PROJECT TITLE: Winter Wheat Variety Evaluations

YEAR/PROJECT: 1990/756

INVESTIGATORS: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist.

OBJECTIVE: To evaluated winter wheat varieties for adaptability, yield, quality, and disease resistance.

RESULTS:

Moderate winter temperatures, ample precipitation through the season and a warm summer contributed to favorable yields in the winter wheat nurseries this year. The regional nurseries survived the winter conditions and were in excellent condition by early spring. Although there were not long periods of snow cover this year dwarf bunt (TCK) levels were moderate to high in some varieties. Excellent yields were harvested from both the Regional Hard Red and Soft White Winter wheat nurseries.

- 1990 Western Regional Hard Red Winter Wheat Nursery

With favorable weather and few disease problems the yields for this nursery were very high ranging from 127.45 bu/A to 46.23 bu/A. Six Oregon entires were the top yielding varieties in the nursery (Table 1). Test weights were good with few varieties weighing below 60 bu/A. Lodging was moderate to severe and occured in all but eight of the thirty-six varieties. Dwarf smut (TCK) was detected in all but six of the entries and was as high as 22.5% in Hybritech QT 549. Table 1.

- 1990 Western Regional Soft White Winter Wheat Nursery

Yields were very good in this nursery. The mean yield was 118.71 bu/A with all but three of the fourty entries having yields in excess of 100 bu/A. The yields of Kharkof and Elgin were depressed due to the degree of lodging and dwarf smut (TCK) infection. Dwarf smut was light throughout the nursery but was found at some level in all but five entries. Test weights were mostly above 60 lbs/bu in this trial with the average being 60.63 lb/bu. Lodging was much less in the soft white winter wheats with only eight varieties having light to moderate levels. Table 2.

- 1990 Intrastate Winter Wheat Nursery

Snow cover on winter wheat has been associated with the high incidence of dwarf smut. Although continuous snow cover was not considerable through out the winter (28 days continuous, 66 total days) there was moderate to high levels of TCK smut in the 1990 Intrastate Winter Wheat nursery. Levels were as high as 9.5% and only two varieties were found to have no smut (Blizzard and MT 8726). Sixteen varieties had levels below the 2% level . Winridge had a very slight evidence of TCK smut (.12%). Yields were good, ranging from 63 to 107 bu/A. Lodging was moderate in one third of the entries. Table 3.

Table 1. Agronomic data from the Western Regional Hard Red Winter Wheat Nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT
Planted: September 21, 1989 Harvested: August 14, 1990 Field E-4

CI/STATE NUMBER	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT INCHES	% TCK SMUT	- LODGING - SEVER	PREV
OR841708	CER//YMH/HYS	127.45	60.25	168.75	41.04	.63	.00	.00
OR840157	D887-74/PEW	125.90	62.82	166.25	42.32	.25	3.75	11.25
ORCR8602	TJB788-1089/ALDAN	118.41	61.65	161.50	33.37	1.37	.00	.00
ORCR8608	TAST/TORIM	110.23	63.28	166.75	37.89	.75	3.50	21.25
ORCR8603	M1223-3D-1D(MI76-7	106.87	60.65	162.00	40.35	2.37	.00	.00
OR 8522	VORO/MNIM,85B-839	105.48	60.73	167.25	37.89	1.50	.00	.00
UT162334	BEZ1/MNG/3/HNL//IT	103.25	61.53	168.00	40.16	.00	6.25	65.00
UT165093	ID51022/MNG	101.95	60.10	167.75	40.75	.00	2.25	15.00
OR832306	TJB368-251/BUC	101.26	60.85	165.50	38.09	6.00	.00	.00
OR830282	ND/P101//BUHO	98.70	61.95	159.75	38.19	.63	.00	.00
UT167187	WTN/MNG	98.68	61.00	163.25	36.91	.12	1.00	5.00
UT157140	HNL/USSR 2109-36	98.65	61.08	168.25	47.54	.00	9.00	67.25
ID 360	CNN/LEE*7/TF/5/SM4	94.61	60.98	168.75	39.47	1.25	1.50	7.50
OR831134	CNO/INIA/HN7/3/CC/	92.66	63.08	167.00	39.17	2.00	.00	.00
MT 8039	JUDITH	92.40	59.18	163.75	45.57	7.00	8.75	84.75
WA 7647	286011/ANDREWS	90.44	61.98	169.25	47.83	2.87	8.00	61.25
UT160719	MNG/SMS	89.80	59.93	166.75	44.59	.00	6.75	74.25
ID 355	MC*2/NP824/3/LMH66	86.85	61.18	167.00	49.41	1.25	6.75	80.00
ID 381	ABERDEEN SELN	86.39	60.03	168.00	45.57	.00	9.00	95.50
QT 542	HYBRITECH	84.84	60.90	162.50	47.15	14.00	8.50	93.25
MT 79125	UT755079/CST56//TX	84.30	59.57	167.75	45.18	4.25	7.25	77.25
ID 361	CNN//7*LEE/TF/5/SM	81.06	59.78	169.75	38.78	3.00	5.00	27.50
ID 421	A74125W-16-3-1/A74	79.95	61.48	168.50	50.30	.00	8.50	93.00
ORCR8601	FMF//CNO S/GLL	79.39	61.13	166.00	48.13	5.50	4.25	27.50
WA 7626	HARD WHITE 1987 ML	78.03	61.43	167.00	46.46	1.50	4.50	49.75
WA 7620	N7701501//V72044/C	77.74	60.60	169.25	44.59	8.75	8.50	97.00
ID 422	CNN/LEE*7/TF/5/SM4	77.26	59.10	170.00	40.65	.63	3.50	55.00
ID 364	ABERDEEN SELN	75.88	61.55	166.75	39.86	.50	.00	.00
OR008718	BFR 689-71/TI	73.11	60.18	167.75	48.92	.12	9.00	99.00
WA 7670	N7000063/K71056//N	71.75	61.25	170.50	46.95	.63	7.75	91.00
PI517194	TIBER	70.70	60.60	167.25	50.20	7.50	9.00	96.75
CI 13884	WANSER	67.75	60.87	167.50	52.46	13.00	6.75	85.00
QT 549	HYBRITECH	64.75	58.60	161.75	42.42	22.50	8.75	96.75
WA 7650	N7000063/K71056//U	62.30	60.25	167.50	51.87	.75	9.00	94.75
WA 7523	BUCHANAN	61.74	56.55	170.25	49.51	6.00	9.00	99.00
CI 1442	KARKHOF	46.23	58.85	167.75	39.57	15.75	9.00	99.00
EXPERIMENTAL MEANS		87.96	60.69	166.76	43.59	3.68	5.13	51.93
F TEST FOR VAR.		10.52**	6.63**	21.30**	8.45**	11.12**	11.30**	15.87**
C.V. 2: (S OF X/X)*100		6.39	.83	.34	3.87	43.03	20.81	19.48
LSD (0.05)		15.76	1.41	1.61	4.74	4.44	3.00	28.37

**/ Indicates statistical significance at the .01 level of probability

Table 2. Agronomic data from the Western Regional Soft White Winter Wheat nursery grown on the Northwestern Agricultural Research Center in Kalispell, MT. Field E-4
Planted: September 20, 1989 Harvested: August 13, 1990

CI/STATE NUMBER	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT IN	% TCK SMUT	- LODGING - SEVER.	PREV.
ID081277	SPN/Nacozari 76	140.63	60.43	165.75	36.81	.63	.00	.00
WA 7663	MARKSMAN/DAWS,V	138.60	58.57	169.00	39.27	.25	1.50	6.25
OSU00021	69-148/YMH/HYS	137.79	60.60	167.50	41.14	1.50	.00	.00
WA 7163	MADSEN	134.26	60.92	169.50	37.60	1.00	.00	.00
WA 7671	VPM/MS421//WA62	133.86	61.25	169.50	44.39	.37	.00	.00
WA 7662	LUKE/DAWS//HILL	133.30	61.28	168.75	34.45	.00	.00	.00
ORF75336	YMH/MCD/2/T.SPE	133.18	60.68	167.25	36.61	.88	.00	.00
WA 7529	LUKE/VH67375//V	132.01	59.70	170.50	35.14	.00	.00	.00
ORFW8311	SPN2*/Thul III	129.40	61.40	165.00	37.11	.50	.00	.00
ORCW8632	CORVALLIS SELEC	128.45	61.23	165.00	35.83	.12	.00	.00
CI 17596	STEPHENS	128.33	61.52	164.00	37.11	.63	.00	.00
OR840815	SMB/HN4//SPN/3/	127.99	62.03	164.75	39.67	1.75	.00	.00
ORFW 301	DAWS/SM4//MDM/S	124.70	60.87	163.50	35.93	.50	.00	.00
WA 7621	VPM/MS421//VH66	124.15	61.10	169.75	41.04	.25	.00	.00
WA 7527	TRES MULTILIE 8	124.00	60.83	170.25	45.18	.37	2.75	18.75
CI 17917	TRES (WA 6698	123.75	62.03	169.75	44.19	1.12	3.50	40.00
WA 7526	TRES COMPOSITE	123.65	61.38	170.00	43.01	.50	2.25	20.00
ORFW205B	FW73830-002/3/M	123.03	59.38	171.50	34.55	2.00	.00	.00
ORCW8635	CORVALLIS SELEC	121.68	60.20	167.50	37.11	1.37	.00	.00
WA 7166	HYAK	121.53	59.95	169.25	41.14	.63	.00	.00
WA 7664	LEWJAIN/WA6813,	121.25	61.45	168.25	35.24	.00	.00	.00
WA 7673	89-5 Comp. Mult	121.24	60.22	169.50	39.76	1.00	.00	.00
OR 855	PAHA//SEL 72-33	120.24	62.17	168.50	39.07	.50	.00	.00
OR830801	CORVALLIS SELEC	118.80	59.57	164.00	34.65	1.88	.00	.00
WA 7661	WA6581//BBE/AM7	118.54	59.48	171.25	34.94	.00	.00	.00
WA 7665	TYEE//CAPPELLE/	118.06	60.60	169.00	39.96	3.50	.00	.00
OR833725	CORVALLIS SEL	116.44	60.55	164.50	42.32	3.25	.00	.00
OR833765	CORVALLIS SEL	116.20	60.50	161.50	37.20	4.00	.00	.00
OSU00028	CEBECO 148//CNO	114.68	60.05	158.75	36.52	.63	.00	.00
WA 7627	WA096910, MARIS	111.91	60.45	170.75	37.50	2.25	.00	.00
CI 17419	Daws	111.69	61.28	167.75	36.81	.37	.00	.00
CI 13968	NUGAINES	111.55	62.33	167.75	34.94	3.25	.00	.00
WA 7431	Luke/BR7404434	110.46	58.78	171.75	39.27	.75	9.00	83.50
WA 7674	VH088385	109.23	61.43	171.50	35.63	1.37	.00	.00
WA 7666	VPM/MOS 951//CI	107.39	59.73	169.25	44.59	.75	.00	.00
OR832784	CORVALLIS SEL	104.06	61.25	159.25	33.96	.75	.00	.00
WA 7672	1/DT/820/OM/183	101.81	59.25	167.50	24.80	.12	.00	.00
CI 13740	MORO	83.69	59.40	168.25	46.85	.00	6.00	62.00
CI 11755	ELGIN	79.16	61.40	170.25	51.97	3.75	5.25	68.25
CI 1442	KHARKOF	67.88	60.13	168.00	51.18	21.25	9.00	96.00
EXPERIMENTAL MEANS		118.71	60.63	167.63	38.86	1.59	.98	9.87

Statistics on following page

Table 2. (Cont'd)

CI/STATE NUMBER	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT IN	% TCK SMUT	- LODGING - SEVER.	PREV.
EXPERIMENTAL MEANS		118.71	60.63	167.63	38.86	1.59	.98	9.87
F TEST FOR VARS		5.76**	8.64**	26.21**	29.90**	20.60**	13.69**	12.89**
C.V. 2: (S OF MEAN/MEAN)		5.40	.52	.37	2.34	46.64	64.55	68.81
LSD (0.05)		17.95	.89	1.74	2.55	2.08	1.77	19.02

**/ Indicates statistical significance at the .01 level of probability

Table 3. Agronomic data from the Intrastate Winter Wheat nursery grown on the Northwestern Agricultural Research Center in Kalispell, MT. Planted: September 20, 1989 Harvested: August 12, 1990 Field X-3

CI/STATE NUMBER	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT IN	% TCK SMUT	LODGING -- SEVER.	LODGING -- PREV.
MT 8039	JUDITH	107.49	62.40	162.75	44.78	3.25	.00	.00
MT 8599	CST//FRD1650/OLE	107.41	62.58	163.25	48.33	2.13	2.00	22.50
MT 88064	CST/VT 1230//ID7	105.93	61.30	168.25	47.05	.88	5.50	46.25
MT 88065	CST/VT 1230//ID7	105.21	62.98	168.75	44.49	.50	2.00	6.25
CI 17860	NEELEY	104.05	63.13	168.50	46.65	5.50	2.50	35.00
QT 549	HYBRITECH 549	102.05	62.60	161.25	44.49	4.75	.00	.00
MT 88050	PMN5/MT 77003//H	101.56	62.05	168.25	42.62	3.75	.00	.00
MT 7811	FRD/WNK//MT 692	101.21	62.55	167.75	45.57	3.25	.00	.00
RH78W296	BIGHORN	100.64	62.85	167.75	40.16	1.88	.00	.00
CI 17902	WINRIDGE	98.61	62.80	168.50	50.98	.12	2.25	12.50
MT 8706	MSC/CTK A+//IUL	96.59	61.50	161.50	42.22	.37	.00	.00
MT 8719	RRI/MT 6928	96.25	63.38	167.25	45.18	3.87	.00	.00
MT 88029	HP 340/NRS//MT 7	95.95	63.70	167.00	44.39	.88	.00	.00
ID 279	BLIZZARD	95.76	63.25	166.75	49.41	.00	.50	20.00
MT 8726	CST/VT1230//ID74	95.16	61.08	168.25	39.96	.00	2.25	7.50
QT 542	HYBRITECH 542	94.79	63.28	162.25	46.75	1.50	.00	.00
XNH 1401	HYBRITECH 1401	94.73	63.60	164.00	48.23	3.50	.00	.00
MT 8502	ID745101/LCO	94.51	62.28	166.75	43.01	4.25	.00	.00
CI 15075	CENTURK	94.43	63.50	163.25	48.33	4.63	1.25	18.75
MT 8508	CST//FRD1268/OLE	94.15	63.60	164.00	50.79	1.88	.00	.00
PI517194	TIBER	93.51	63.25	167.50	52.17	7.25	.00	.00
MT 85200	FRD/WNK//MT 692	92.95	62.10	163.25	39.47	4.88	.00	.00
MT 88038	PMN5/WN//MT 7216	92.60	62.28	166.75	50.59	9.50	2.25	21.25
MT 8713	MSC/CTK A+//IUL	92.13	62.80	165.50	38.58	2.00	.00	.00
MT 88017	PMN5/WN//HP 344/	91.85	62.15	163.50	45.96	6.00	.00	.00
MT 8709	MSC/CTK A+//IUL	90.96	62.17	167.50	38.98	3.38	.00	.00
CI 17879	ROCKY	89.61	63.25	165.75	48.82	5.25	5.25	72.50
MT 85202	FRD/WNK//MT 692	87.75	62.10	167.50	50.89	2.62	2.25	47.25
MT 88025	PMN5/WN//HP 344/	86.50	61.50	163.25	45.87	6.00	.00	.00
MT 88021	PMN5/WN//HP 344/	86.49	62.45	164.75	51.38	3.00	.00	.00
MT 88018	PMN5/WN//HP 344/	86.05	62.55	165.00	51.48	6.38	.50	18.75
PI491533	NORWIN	85.85	62.30	168.25	33.66	6.75	.00	.00
CI 17844	REDWIN	85.75	62.40	166.75	50.10	8.50	2.25	7.50
MT 88028	HP 340/NRS//MT 7	85.61	62.38	166.00	49.31	3.38	.75	24.75
MT 88012	CTK 78/MT 77003/	85.55	63.30	162.75	50.79	3.00	.00	.00
MT 88010	CTK 78/MT 77003/	84.86	63.40	164.75	50.10	1.62	.00	.00
MT 88026	PMN5/WN//HP 344/	84.84	62.38	163.75	50.20	6.00	.00	.00
MT 88019	PMN5/WN//HP 344/	84.05	62.78	164.00	50.59	3.25	.00	.00
MT 88027	PMN5/WN//HP 344/	82.70	61.85	161.75	46.95	3.00	.00	.00
ND 8212	RRI//YOGO/TPR	81.80	62.35	167.50	51.67	4.50	.75	15.00
MT 88062	CST/VT 1230//ID7	81.19	62.50	169.25	46.16	.88	6.50	40.00
MT 88024	PMN5/WN//HP 344/	81.16	61.98	163.75	45.28	8.75	.00	.00
MT 88013	PMN5/WN//HP 344/	80.45	62.17	161.50	49.61	5.00	.00	.00
MT 88014	PMN5/WN//HP 344/	80.40	62.40	167.00	51.18	6.25	1.50	43.50

Cont'd on next page

Table 3 (Cont'd). Agronomic data from the Intrastate Winter Wheat nursery

CI/STATE NUMBER	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT IN	% TCK SMUT	-- LODGING -- SEVER.	PREV.
ND 8002	SEWARD	80.31	62.73	167.75	51.87	5.75	3.00	41.25
MT 88030	HP 340/NRS//MT 7	79.54	62.20	166.50	44.78	9.50	.00	.00
MT 88046	PMN5/MT 77003//H	79.29	62.80	161.50	43.80	5.50	.00	.00
MT 88001	SMT/TD//YGSS	79.08	62.93	168.50	32.09	3.63	.00	.00
MT 88023	PMN5/WN//HP 344/	78.91	61.35	163.25	46.46	5.00	.00	.00
PI491532	CREE	78.25	62.43	168.25	53.25	1.75	5.50	79.75
CI 13670	WINALTA	77.18	62.58	167.75	54.23	5.00	3.50	87.50
MT 88035	MT 7216(LR117)/F	76.54	62.70	166.75	53.05	1.25	1.50	12.50
CI 17735	NORSTAR	76.46	62.28	169.75	56.89	9.75	7.25	85.00
MT 88057	MSB 20/CN SR303/	76.20	63.33	166.75	47.74	2.37	.00	.00
MT 88022	PMN5/WN//HP 344/	74.80	61.63	162.75	46.06	3.75	.00	.00
CI 8885	CHEYENNE	74.00	62.30	168.00	51.48	4.75	6.50	91.00
CI 17439	ROUGHRIDER	73.69	62.68	167.50	54.43	3.50	1.25	35.00
ND 8407	CTK/3/FRD*2//ND	73.23	61.23	167.75	53.15	8.25	7.75	73.75
MT 7863	FRD/WNK//CTK	70.23	62.10	163.25	57.38	2.50	.00	.00
MT 88005	WSC/YOGO//RSC/3/	69.56	61.40	167.75	54.33	.88	1.75	71.00
PI478771	AGASSIZ	68.10	62.87	168.75	55.41	2.00	.75	12.50
MT 88006	WSC/YOGO//RSC/3/	63.05	60.20	167.25	53.35	1.00	.00	.00
EXPERIMENTAL MEANS		87.25	62.47	165.85	47.79	3.87	1.27	16.91
F TEST FOR VAR.		8.67**	10.47**	18.64**	64.36**	2.05**	4.37**	5.62**
C.V. 2: (S OF MEAN/MEAN)*		4.13	.34	.33	1.35	45.44	77.23	66.25
LSD (0.05)		10.06	.60	1.55	1.80	4.91	2.75	31.26

** Indicates statistical significance at the .01 level

YEAR/PROJECT: 1990/758 DRYLAND PEA VARIETY YIELD TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Fred Muehlbauer, USDA

Twelve varieties of peas were seeded on 4/13/90 at 160 lbs/a. Seed had been pre-treated with fungicide. Plots consisted of four 12 foot rows with one foot row spacing and two feet between plots. Plots were later trimmed back to 8 feet, resulting in a harvest area of 40 square feet. The experimental design was a randomized complete block with 4 replications. PS610124 and Umatilla emerged 12 days after seeding, Trapper emerged 14 days after seedeing, and all the other varieties emerged 13 days after seeding. Stands ranged from 13 to 16 plants per square foot. IMPCS was the earliest to begin flowering, and Trapper was the latest. The number of nodes to first flower ranged from 13 on Umatilla to 8 on Columbian, PS610008, and IMPCS. Latah matured earliest and Columbian, PS610008, Alaska 81, and PS610415 matured latest. Height varied from 44 inches (IMPCS and PS310126) to 54 inches (Latah and Alaska 81). Trapper's seeds were significantly smaller than any other's, with 6258 seeds per pound. There was a 40% difference in yield between IMPCS, the highest yielding variety, and Trapper, the lowest yielding.

WESTERN REGIONAL DRY PEA YIELD TRIAL - 1990
KALISPELL, MT

VARIETY	EMERG days 1/	STAND pl/ft	1st BLOOM days 2/	NODES to 1st bloom	HEIGHT inches	MATURITY days 3/	SEED SIZE no/lb	YIELD lbs/a
IMPCS	13	14	62	8	44	96	3137	1726
Latah	13	14	67	10	54	94	3881	1666
PS610124	12	16	66	11	49	95	2975	1552
PS310126	13	15	70	12	44	96	3873	1400
PS610585	13	14	66	12	46	95	3620	1398
Columbian	13	16	63	8	47	97	3270	1346
PS610008	13	15	64	8	50	97	3991	1306
Alaska 81	13	15	64	9	54	97	3924	1218
PS610683	13	14	67	11	47	96	3383	1139
PS610415	13	15	65	9	49	97	3378	1123
Umatilla	12	14	69	13	48	96	3020	1117
Trapper	14	13	75	12	49	96	6258	1031
LSD(0.05)	1	2	1	1	4	2	681	487
P-VALUE	0.00	0.33	0.00	0.00	0.00	0.19	0.00	0.10
CV(S/MEAN)	4.1	9.5	1.0	8.3	5.6	1.5	12.7	25.3

1/ Day 13 = 4/26
2/ Day 62 = 6/14
3/ Day 96 = 7/17

Seeding date: 4/13/90
Fertilizer: 44 lbs/a P2O5 - 5/23

YEAR/PROJECT: 1990/758 DRYLAND LENTIL VARIETY YIELD TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Fred Muehlbauer, USDA

On 4/13/90, ten lentil varieties were seeded in a randomized complete block design with 4 replications. Plots consisted of four 12 foot rows spaced 1 foot apart with 2 feet between plots. After emergence, rows were trimmed back to 8 feet.

Plants emerged 11 to 13 days after planting. LC760273 and LC660819 had the best stand (19-20 plants /sq.ft.). Crimson took longer to flower than any other variety, while Redchief was the earliest. There was a 14 day range in time to maturity. LC460007 was earliest, with 102 days after seeding. Emerald was slowest to mature - 116 days. Height varied from 15 inches (LC460007) to 23 inches (Laird). All plants from each plot were pulled when they reached maturity (leaves, stems and seed pods mostly yellow to brown), and thrashed when dry. There was a great deal of overlap in yields, which ranged from 1747 lbs/a for LC760273 to 1317 lbs/a for LC660819. Laird, which was the top yielding variety in 1989 (1747 lbs/a) did not perform as well in 1990 (1322 lbs/a). LC460007 had the smallest seeds (16780/lb) and Laird, Benewah, and Palouse had the largest (6816, 7017, and 6722 seeds/lb, respectively).

WESTERN REGIONAL LENTIL YIELD TRIAL - 1990
KALISPELL, MT

VARIETY	EMERG days 1/	STAND pl/ft2	1st Bloom days 2/	HEIGHT inches	MATURITY days 3/	SEED SIZE no/lb	YIELD lbs/a
LC760273	12	19	72	17	110	11680	1747
Crimson	13	15	75	18	110	14175	1627
LC460007	13	15	71	15	102	16780	1608
Benewah	11	16	70	18	111	7017	1561
Emerald	11	15	73	22	116	8299	1462
Palouse	12	14	70	19	107	6722	1428
Rose	12	15	71	16	106	12030	1407
Redchief	11	15	69	19	107	9267	1398
Chilean 78	12	16	73	20	112	9230	1366
Brewer	12	15	70	17	107	8298	1348
Laird	12	15	74	23	112	6816	1322
LC660819	11	20	71	20	108	14120	1317
LSD(0.05)	1	2	1	3	5	1228	343
P-VALUE	0.00	0.00	0.00	0.00	0.00	0.00	0.24
CV(S/MEAN)	5.5	9.2	1.4	11.1	3.4	8.2	16.3

1/ Day 12 = 4/25
2/ Day 72 = 6/24
3/ Day 110 = 8/1

Seeding date: 4/13/90
Fertilizer: 44 lbs/a P2O5 - 5/23

YEAR/PROJECT: 1990/758 SPRING RAPESEED VARIETY TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Jim Sims, MSU

Nine varieties of spring rapeseed were planted on 4/26/89 at 7 lbs/acre. Tobin (a B. campestris variety) was first to flower on 6/18, and MLCP035 was latest on 6/30. Tobin matured on 7/20, while DSVSR126 and MCLP035 matured on 8/10. Mature heights varied from 50 inches (MLCP035) to 41 inches (Legend). All plants from each plot were cut and bundled and thrashed when dry. A harvest area of 50 sq.ft. was used to determine yields. MLCP008 produced significantly more seed than Hyola 41 and Tobin.

1990 SPRING CANOLA INTRASTATE YIELD TRIAL
Kalispell,MT

VARIETY	EMERG days 1/	5/31 VIGOR (0-5)	FIRST BLOOM days 2/	MATUR days 3/	HT in	YIELD lbs/a
MLCP008	11	2	62	105	48	2172
Westar	10	3	62	101	49	2155
DSVSR126	10	3	63	106	47	2026
Delta*	10	5	63	104	48	2005
Pactol*	11	3	63	105	46	2000
Pactol	11	2	63	105	44	1972
MLCP035	10	4	65	106	50	1944
Hyola 40	10	4	59	100	46	1890
Legend	10	3	59	103	41	1737
Hyola 41	10	4	59	98	44	1697
Tobin	10	4	53	88	42	1253
LSD(0.05)	0	1	1	2	4	475
P-VALUE	0.00	0.00	0.00	0.00	0.00	0.03
CV(s/mean)	2.1	20.4	0.9	1.5	5.4	17.3

Seeding date: 4/26/90 at 7 lbs/a
Fertilizer: 5/23/90 - 64 lbs N/a, 44 lbs P2O5/a, 20 lbs S/a

1/ Day 11 = 5/7
2/ Day 62 = 6/27
3/ Day 105 = 8/9

* used for comprehensive testing

YEAR/PROJECT: 1989-90/758 WINTER RAPESEED (CANOLA) VARIETY TRIAL - DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Dick Auld, Univ. of Idaho

Twenty-four varieties of Brassica napus (Argentine rape) and six varieties of B. campestris (Polish rape) were seeded 8/29/89. On the average, B. campestris flowered and matured about one week before B. napus. Yields of B. napus ranged from 5688 lbs/a (KWC386) to 2841 lbs/a (LEI-III). Yields of B. campestris ranged from 3430 lbs/a (SVO1532) to 2536 lbs/a (SVO1552). B. napus varieties yielding more than 4000 lbs/a included KWC386, Diadem, Glacier, Ceres, KWC158, ES-8917, ES-8918, SVO216 and KWC4. B. campestris varieties yielded from 3430 lbs/a (SVO1532) to 2536 lbs/a (SVO1552). Precipitation during the 1989-1990 crop year was over 6 inches higher than average, and the frost-free period was 37 days longer than average. In the absence of summer drought stress and with longer fall and earlier spring growth periods, B. napus varieties produced more seed than B. campestris varieties. Under dryer and colder conditions, however, the earlier flowering and maturation periods and better shatter resistance of B. campestris may be advantageous.

NATIONAL WINTER RAPESEED VARIETY TRIAL - KALISPELL,MT - 1989-90

Brassica napus

VARIETY	EMERGENCE date	STAND Fall %	STAND Spring %	FIRST FLOWER date	MATURITY date	HEIGHT in	YIELD lbs/a
KWC386	9/7	76	63	5/17	7/23	60	5688
Diadem	9/6	88	69	5/18	7/22	58	4727
Glacier	9/7	67	76	5/18	7/23	61	4558
Ceres	9/6	65	58	5/15	7/21	62	4396
KWC158	9/5	79	70	5/13	7/19	61	4277
ES-8917	9/5	93	62	5/15	7/22	60	4096
ES-8918	9/5	90	66	5/16	7/23	56	4094
SVO216	9/6	72	76	5/12	7/20	60	4076
KWC4	9/5	91	68	5/15	7/20	57	4044
Samourai	9/5	89	49	5/11	7/24	50	3850
Crystal	9/7	76	77	5/18	7/22	56	3847
SVO255	9/6	79	70	5/16	7/22	56	3801
ES-8916	9/6	81	74	5/15	7/21	55	3705
SVO506	9/5	87	86	5/16	7/22	56	3646
Bienvenu	9/5	97	75	5/9	7/21	49	3642
Cobra	9/4	93	58	5/16	7/22	60	3547
SVO508	9/5	94	63	5/13	7/21	60	3307
Bridger	9/6	78	77	5/11	7/20	60	3279
Tapidor	9/5	91	62	5/12	7/20	51	3197
Cascade	9/6	81	81	5/10	7/19	50	3087
Humus	9/5	84	74	5/9	7/18	55	3028
Aspen	9/5	89	75	5/11	7/21	52	3012
Olein	9/6	94	79	5/12	7/18	51	2876
LEI-III	9/6	67	81	5/12	7/20	57	2841
Average	9/6	83	81	5/13	7/21	143	3776
LSD(0.05)	1	12	14	2	3	6	772
P-VALUE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CV(s/mean)	13.4	10.2	14.6	9.5	9.0	6.9	14.5

Seeding date: 8/29/89
Fertilizer: Fall, 1989 - P2O5 - 44 lbs/a
Spring, 1990 - N - 85 lbs/a
Pesticides: 8/29/89 - Treflan - 0.5 lb AI/a

NATIONAL WINTER RAPESEED VARIETY TRIAL - KALISPELL,MT - 1989-90
Brassica campestris

VARIETY	EMERGENCE date /89	STAND Fall %	STAND Spring %	FIRST FLOWER date /90	MATURITY date /90	HEIGHT in	YIELD lbs/a
Ceres *	9/7	54	63	5/17	7/22	60	5763
Bienvenu *	9/7	62	68	5/11	7/22	48	4712
Tapidor *	9/7	67	66	5/12	7/21	51	4282
Cascade *	9/7	66	72	5/11	7/19	54	4105
SVO1532	9/6	56	87	5/5	7/14	63	3430
SV PER	9/5	82	95	5/4	7/11	64	3420
SVO1551	9/7	43	72	5/5	7/10	66	3089
SVO1531	9/5	74	96	5/5	7/9	62	2716
SVO1533	9/6	54	82	5/5	7/10	67	2682
SVO1552	9/6	55	82	5/5	7/10	63	2536
LSD(0.05)	1	13	11	3	3	7	761
P-VALUE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CV(s/mean)	7.2	14.3	9.9	25.3	12.5	8.5	16.0

* B. napus checks

Seeding date: 8/29/89
Fertilizer: Fall, 1989 - P2O5 - 44 lbs/a
Spring, 1990 - N - 85 lbs/a
Pesticides: 8/29/89 - Treflan - 0.5 lb AI/a

YEAR/PROJECT: 1990/758 STATEWIDE LEGUME ADAPTATION TRIAL - IRRIGATED

PERSONNEL: Leader - Leon E. Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Jim Sims, MSU

Twelve small-seeded and six large-seeded annual legume varieties were planted May 10, 1990. Plots were harvested for forage one to three times, depending on regrowth. Total forage yields ranged from 1.01 to 5.12 t/a. Varieties yielding over 3.00 t/a were Multicut and Bigbee berseem clovers, Maral Schaftal clover, Nitro alfalfa, Jemalong barrel medic and Tinga Tangier flatpea.

STATEWIDE LEGUME ADAPTATION TRIAL - KALISPELL - 1990

SPECIES	IDNO	1st Harv	2nd Harv	3rd Harv	TOTAL
		YIELD (t/a)			
Multicut Berseem Clover	33	1.79	2.06	1.27	5.12
Maral Schaftal Clover	38	2.12	1.94	0.57	4.64
Nitro Alfalfa	43	1.25	1.53	1.42	4.21
Bigbee Berseem Clover	32	1.85	1.31	0.94	4.09
Jemalong Barrel Medic	42	1.78	0.90	0.63	3.31
Tinga Tangier Flatpea	45	1.67	0.76	0.87	3.30
Comman Yellow Sweetclover	34	0.76	1.36	0.38	2.50
Mt.Barker Subterranean Clover	36	0.75	1.58	0.15	2.48
Cahaba White Vetch	51	1.54	0.49	0.26	2.30
George Black Medic	41	1.28	0.43	0.42	2.14
UI114 Pinto Bean	48	0.83	0.99	0.29	2.11
Semu-SI Feed Pea	46	2.05			2.05
Robinson Snail Medic	37	1.87			1.87
Indianhead Lentil	31	1.84			1.84
Austrian Winter Pea	40	1.74			1.74
Red Chief Lentil	47	1.18	0.22		1.40
Youchi Arrowleaf Clover	39	0.42	0.64		1.05
Paraponto Gamma Medic	35	1.01			1.01
				LSD(0.05)	0.63
				P-VALUE	0.00
				CV(s/mean)	14.5

Seeding date: 5/10/90
Fertilizer: 5/23/90 - P2O5 - 44 lbs/a
Irrigation: 2 x 2" = 4"

YEAR/PROJECT: 1988-90/758: ANNUAL FORAGE LEGUME MANAGEMENT FOR SUSTAINING NITROGEN

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Mal Westcott, WARC

'Nitro' annual alfalfa and 'Bigbee' berseem clover were managed for hay only, hay and green manure, and green manure only in 1988. The nursery was cropped to barley in 1989 to measure N contribution through crop response. When two hay harvests were taken in 1988 and the regrowth was green manured, barley yields in 1989 were maximized for each species without additional fertilizer nitrogen. In 1990 the nursery was again cropped to barley to determine residual N effects for the second year. There were no significant differences in 1990 grain yields among main effects or among the interactions between species and management in 1988.

IRRIGATED NITROGEN ECONOMY STUDY - 'NITRO' ALFALFA vs 'BIGBEE' BERSEEM CLOVER

BARLEY GRAIN YIELDS - 1990

	1988 CROP			
TREATMENT	Nitro	Bigbee	Barley	Mean
	bu/a			
GM	97.7	91.6		94.7
1 Hay + GM	98.8	92.1		95.5
2 Hay +GM	95.7	94.5		95.1
3 Hay	94.9	91.9		93.4
3 Hay + GM	93.4	98.8		96.1
0-N			92.7	
30-N			98.6	
60-N			103.9	
90-N			99.5	
120-N			96.9	
Mean	96.1	93.8	98.3	

No significant differences ($P<0.05$) between main effects or interaction means

Fertilized 4/23/90: 44 lbs P/a
5/17/90: N applied to reference plots (30, 60, 90, & 120 lbs/a)

YEAR/PROJECT: 1990/758: LEGUME ROTATION STUDY

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Mal Westcott, WARC

The first of the four-year rotation treatments were initiated in 1990. Treatments are as follows:

1) Perennial alfalfa - yrs 1-3; barley - yr 4.
2) Continous barley, no added N - 4 yrs.
3) Continous barley, 45 lbs N/a - 4 yrs.
4) Continous barley, 90 lbs N/a - 4 yrs.
5) Berseem clover, 1 forage harvest + green manure - yrs 1 & 3; barley - yrs 2 & 4.
6) Berseem clover, 2 forage harvests + gm - yrs 1 & 3; barley - yrs 2 & 4.
7) Berseem clover, 3 forage harvests, plow stubble - yrs 1 & 3; barley - yrs 2 & 4.
8) Berseem clover, intercropped with oats, 1 forage harvest + gm - yrs 1 & 3; barley - yrs 2 & 4.
9) Spring pea, gm - yrs 1 & 3; barley - yrs 2 & 4.
10) Spring pea, forage harvest, plow regrowth - yrs 1&3 barley yrs 2 & 4.

Prior to planting, soil samples were taken to 4 ft in one foot increments. Samples will be analyzed for NO3-N, NH4-N, TKN, OM, pH, P, K and S in the top foot, and NO3-N and NH4-N at the other depths.

Herbage samples were taken from each plot at harvest or incorporation to be analyzed for TKN, P, K and S. Total dry matter yields were determined for each plot at each harvest and either removed or returned to the plot for green manure plowdown. Treatment 8 yielded 4.25 t/a over the season, with 2.29 t/a removed as forage and 1.96 t/a returned to the plot and plowed under. Spring pea produced the least, with only 1.29 t/a. The barley reference plots produced 83 bu/a (3984 lbs/a) grain and 780 lbs/a straw.

NITROGEN ECONOMY STUDY, FARMER COOPERATOR, 1990

TREATMENT	DRY MATTER YIELD TOTAL	REMOVED	PLOWDOWN
	---------t/a----------		
Perennial Alfalfa	2.92	2.92	
Berseem Clover - 1 hay + gm	3.52	1.20	2.32
Berseem Clover - 2 hay + gm	3.23	2.33	0.90
Berseem Clover - 3 hay	3.46	3.46	
Berseem + Oats	4.25	2.29	1.96
Spring Pea - gm	1.29		1.29
Spring Pea - forage	1.29	1.29	
Mean	2.85		
LSD(0.05)	0.61		
P-Value	0.00		
CV(s/mean)	14.4		

Barley Reference Plot Means:
STRAW YIELD = 0.39 t/a
GRAIN YIELD = 83 bu/a

Seeding date: 5/10/90
Fertilizer: N on reference plots - 68 lbs/a
5/23/90 - P2O5 - 66 lbs/a
Irrigation: 4.20"