FORTYFOURTH ANNUAL REPORT
1992

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

4570 Montana 35
Kalispell, MT 59901

Prepared by

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758 MISCELLANEOUS AND PULSE CROP INVESTIGATIONS

DISTRIBUTION OF THE 1992 NORTHWESTERN AGRICULTURAL RESEARCH CENTER REPORT

COPIES

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1 Agricultural Stabilization and Conservation, Kalispell

1 Flathead Chapter Future Farmers of America

1 Soil Conservation Service, Kalispell

5 Feed Mills

Co-op Supply, Inc., Ronan
Equity Supply Co., Kalispell
Farmers Union Ex., Kalispell
Westland Seeds, Inc., Ronan
Lake Glacier View Farm, Ronan

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
Leon E. Welty - Supt. & Prof. Agronomy (Began January 1973)	19
Robert N. Stougaard - Assistant Professor, Weed Science (Began November 1991)	1
Todd K. Keener - Ag Research Spec. II (Began March 1978)	14
Gary R. Haaven - Ag Research Spec. I (Began April 1982)	10
Louise S. Prestbye - Ag Research Spec. I (Began May 1983)	9
Elaine M. Sprenger - Secretary II (Began August 1990)	2
Christopher M. Steele - Farmer (Began February 1991)	1
Vern R. Stewart - Professor Emeritus	

Part Time Employees:

Patrick Gyles (June 15 through August 21)

Stephen Andree (July 9 through July 17)

Student Employees:

Gail Sharp (April 7 through December 31)

David Alzner (May 11 through August 21)

Helen Hedstrom (May 18 through August 5)

Steve Jensen (May 18 through August 21)

Ann Hedstrom (July 8 through August 5)

GENERAL FARM 751

The General Farm Project (751) supports all research projects. This includes items purchased and used in the total research program. The following were purchased in 1992:

Wisconsin engine for Almaco - replacement engine	$2,946.00
2 Computers	$4,690.00
Kubota Tiller	$ 575.00 (w/trade in)
Laser Jet Printer	$1,425.00
Irrigation Wheel Line	$6,050.00
Copier	$1,835.00
TOTAL.....	$16,096.00

PHYSICAL PLANT 752

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

ACTIVITIES 1992

Date	Activity	Who	Where
1/14	Hay Growers Conference	Welty	Bozeman
1/15	Mint Industry Research Council Meeting	Stougaard	Las Vegas
1/23	Advisory Committee Meeting - NWARC & WARC	Welty Stougaard	Missoula
1/27-31	Planning Conference	Welty Stougaard	Bozeman
2/3	Wild Oat Seminar	Stougaard	Power
2/4	Wild Oat Seminar	Stougaard	Ft. Benton
2/5	Wild Oat Seminar	Stougaard	Great Falls
2/6	Wild Oat Seminar	Stougaard	Cutbank
2/7	Wild Oat Seminar	Stougaard	Conrad
2/11	Western Montana Mint Growers Meeting	Welty Stougaard	Kalispell
2/12	Producer & Equity Supply Meeting	Stougaard	Kalispell
2/13	Mint Research Meeting	Welty Stougaard	NWARC
2/27	Hay Producers Meeting	Welty	Kalispell
3/2	Budget Meeting	Welty Stougaard	Bozeman
3/11	Western Society Weed Science	Stougaard	Salt Lake
3/11	Sustainable Agriculture	Welty	Corvallis
4/9	Hay Growers	Welty	Kalispell
4/15	Cayuse Prairie Students Tour	Welty Stougaard	NWARC
4/24	Eastside Grange	Welty	Creston
4/29	Rotary Tour-visiting Frenchmen	Welty Stougaard	NWARC
5/8	Flathead Leadership Meeting	Welty	Creston
5/19	WRCC-69 Committee	Stougaard	Portland
6/12	MAES Advisory Council	Welty Stougaard	NWARC
6/16	Flathead High Teachers Tour	Welty	NWARC
6/20	Amish Producers Meeting	Welty	Rexford
7/16	Field Day	Welty Stougaard	NWARC
7/21-22	PNW Forage Workers Meeting	Welty	Sun Valley
7/22	Summer Conference	Stougaard	Miles City
7/29	Mint Producers Tour	Welty Stougaard	NWARC
8/4	Air Stream Tourist Tour	Welty	NWARC

ACTIVITIES 1992 - continued

Date	Activity	Who	Where
8/20	Budget Meeting	Welty	Bozeman
8/20	Australian Visitor Tour	Stougaard	NWARC
9/8-9	Superintendents Meeting	Welty	Lewistown
9/29	MAES Budget Recision Meeting	Welty	Kalispell
10/15	Advisory Committee Meeting	Welty	Missoula
10/18	Legislative Meeting	Welty	Creston
10/18	Mint Certification Meeting	Welty	Creston
10/19	Swan River Students - Tour	Welty	NWARC
10/20	Mint Research Meeting	Welty	NWARC
10/29	Western Canola Development Meeting	Stougaard	Missoula
11/2	American Society of Agronomy	Stougaard	St. Paul
12/1-2	Research Center Staff Conference	Welty	Great Falls
12/7-8	MT AgResearch Advisory Board Meeting	Welty	Bozeman
12/11	Advisory Committee Meeting	Welty	Missoula
12/14	Flathead Conservation District Meeting	Welty	Kalispell

CLIMATOLOGICAL DATA
NORTHWESTERN AGRICULTURAL RESEARCH CENTER
Kalispell, MT

Northwestern Agricultural Research Center climatological data is recorded and sent to the 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 1991/92 growing season differed from previous weather data in monthly precipitation averages, higher average temperatures, a shorter frost-free period, and fewer snow cover days.

Total precipitation for the 1991/92 season was 18.35 inches, 1.3 inches below the long time average. September and October precipitation were 50% and 55% of normal, respectively, which contributed to dry soil profiles for winter wheat. Most wheat was in the 4 leaf stage going into the winter and suffered very little winter kill. Precipitation levels were 150% of normal in November but fell short of the long term average in every month until June. Even though March, April and May precipitation was below average the rainfall was timely so that spring grain development was normal. Abundant precipitation in June and July aided heading and late crop growth. Dry weather in August provided excellent harvest conditions.

Mean temperatures for the growing season were higher than the long term average. Higher temperatures were experienced during the mild winter months of December, January, and February which may explain the very low levels of winter kill in wheat. Early spring temperatures were also above average in March, April and May and aided in many fields being seeded early. No extreme temperatures occurred during July or August that may have effected heading.

Although the frost-free period for 1991/92 was 14 days shorter than average the mild winter and cooperative weather during harvest provided area farmers with an excellent growing season. There was very little lodging and sprouting in harvested grain this year.

With only 23 days of continuous snow cover (Jan 5-27th) there was low incidence of TCK dwarf bunt. There was a total of 53 snow cover days throughout the season. The last snow to accumulate on the Experiment Station was on March 2 (1").

Cereal diseases were not a serious threat in spring or winter grains. Low levels of leaf rust were observed late in the season on some spring wheat varieties. TCK dwarf bunt was observed only in test areas that had been inoculated for that disease.

Following is a list of tables giving a complete description of the weather for the crop year (September 1991 through August 1992) and 1992 (January through December).

Table 1. Summary of climatic data by months for 1991-92 crop year (September through August) and averages for the period 1949-92 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, 1992. (Average)

Table 3. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1992. (Maximum)

Table 4. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1992. (Minimum)

Table 5. Summary of precipitation records at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1992.

Table 6. Precipitation by day for crop year September 1, 1991 through August 31, 1992, Northwestern Agricultural Research Center, Kalispell, MT.

Table 7. Frost free period at the Northwestern Agricultural Research Center from 1950 through 1992.

Table 8. Temperature extremes at the Northwestern Agricultural Research Center, Kalispell, MT from 1950-1992.

Table 9. Summary of temperature records at the Northwestern Agricultural Research Center, January 1950 through December 1992.

Table 10. Summary of precipitation records at the Northwestern Agricultural Research Center, Kalispell, MT, January 1950 through December 1992.

Table 1. Summary of climatic data by months for 1991-92 crop year (September thru August) and averages for the period 1949-92 at the Northwestern Agricultural Research Center, Kalispell, MT.

ITEM	Sept. 1991	Oct. 1991	Nov. 1991	Dec. 1991	Jan. 1992	Feb. 1992	Mar. 1992	Apr. 1992	May 1992	June 1992	July 1992	Aug. 1992	Total or Average
Precipitation (inches)													
Current Year	0.80	0.75	2.26	0.58	1.17	0.61	0.83	1.18	1.65	5.34	2.24	0.94	18.35
Avg. 1949 to 1991-92	1.59	1.36	1.50	1.63	1.49	1.16	1.17	1.39	2.31	2.88	1.57	1.60	19.65
Mean Temperature (F)													
Current Year	54.4	40.6	32.1	29.3	28.7	34.5	39.7	45.1	53.5	55.5	61.2	61.8	44.7
Avg. 1949 to 1991-92	53.5	43.2	32.7	25.5	22.3	27.9	33.8	43.3	51.6	58.4	64.0	63.0	43.3
Last killing frost in spring													
1992					May 17 (30 degrees F)								
Avg. 1949-92					May 25								
First killing frost in fall													
1992					August 24 (32 degrees F)								
Avg. 1949-92					September 14								
Frost Free Period													
1992					99 days								
Avg. 1949-92					113 days								
Maximum summer temperature					93 degrees F on August 15, 1992								
Minimum winter temperature					-5 degrees F on November 2, 1991								

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, 1992.

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
1990-91	59.1	41.9	36.1	16.5	18.3	34.6	32.8	42.4	50.3	55.1	64.0	65.2	43.0
1991-92	54.4	40.6	32.1	29.3	28.7	34.5	39.7	45.1	53.5	55.5	61.2	61.8	44.7
MEAN	53.5	43.2	32.7	25.5	22.3	27.9	33.8	43.3	51.6	58.4	64.0	63.0	43.3

Mean temperature for all years = 43.3

Table 3. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1992.

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
1990-91	77.9	53.0	43.8	24.1	25.6	42.5	41.6	54.0	61.7	65.5	78.2	81.6	54.1
1991-92	70.9	56.1	38.6	33.7	35.1	42.7	52.7	57.7	67.7	67.8	73.1	78.0	56.2
MEAN	68.6	55.4	40.2	32.2	29.8	36.3	43.6	55.1	64.8	71.8	80.0	79.5	54.8

Mean temperature for all years = 54.8

Table 4. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1992.

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
1990-91	40.4	30.9	28.4	8.8	11.0	26.6	24.0	30.8	39.0	44.7	49.8	48.8	31.9
1991-92	37.9	25.1	25.6	25.0	22.4	26.3	26.8	32.6	39.2	43.2	49.3	45.7	33.3
MEAN	38.5	31.1	25.0	18.8	15.3	19.5	24.0	31.4	38.5	45.0	47.9	46.6	31.8

Mean temperature for all years = 31.8

Table 5. Summary of precipitation records at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1992.

	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
1990-91	T	2.32	1.37	2.60	1.41	0.41	0.72	1.21	2.72	5.36	0.77	1.15	20.04
1991-92	0.80	0.75	2.26	0.58	1.17	0.61	0.83	1.18	1.65	5.34	2.24	0.94	18.35
MEAN	1.59	1.35	1.50	1.63	1.49	1.16	1.17	1.39	2.31	2.88	1.57	1.60	19.64

Mean precipitation for all crop years = 19.64

Table 6. Precipitation by day for crop year, September 1, 1991 through August 31 1992. Northwestern Agricultural Research Center, Kalispell, MT.

DATE	SEPT. 1991	OCT. 1991	NOV. 1991	DEC. 1991	JAN. 1992	FEB. 1992	MAR. 1992	APR. 1992	MAY 1992	JUNE 1992	JULY 1992	AUG. 1992
1				0.04					0.13		0.09	
2				0.12								
3				0.06							0.08	
4			0.06	0.04							0.15	
5			0.37							0.01	0.02	
6			0.53		0.01			0.08			0.15	
7				0.05	0.17			0.09			0.01	
8	0.02			0.03	0.01		0.03	0.01			0.12	0.26
9	0.25		0.24			0.04			0.13		0.35	
10				0.12				0.07			0.13	
11									0.08		0.18	
12					0.12			0.06	0.01	0.41	0.05	
13			0.13	0.06	0.07			0.01		0.78	0.01	
14	0.21				0.04	0.12		0.17		0.72		
15												
16	0.03				0.20				0.05	0.03		
17	0.04	0.01					0.35	0.38		1.15		
18			0.01				0.22			0.25		
19			0.04	0.01		0.10	0.13	0.12	0.02			
20			0.04			0.12	0.08					
21		0.03	0.05			0.13	0.01		0.50			
22	0.17	0.01	0.01	0.04		0.09		0.10				0.62
23					0.15						0.11	0.05
24		0.04	0.05	0.01	0.23	0.01					0.79	0.01
25		0.10	0.11									
26		0.28	0.16							0.01		
27		0.20							0.43	0.06		
28		0.08			0.12		0.01		0.04	0.12		
29	0.08		0.26		0.05				0.12	0.12		
30			0.20					0.09	0.14	1.68		
31			T									
TOTAL	0.80	0.75	2.26	0.58	1.17	0.61	0.83	1.18	1.65	5.34	2.24	0.94

Table 7. Frost free period at the Northwestern Agricultural Research Center from 1950 thru 1992.

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
1991	May 27	32	Sept. 19	32	115
1992	May 17	30	Aug. 24	32	99
Mean for years	May 31	31	Sept. 14	30	113

Table 8. Temperature extremes at the Northwestern Agricultural Research Center, Kalispell, MT from 1950–1992.

	MINIMUM		MAXIMUM	
YEAR	DATE	TEMPERATURE DEGREES F	DATE	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. 31	− 4	July 27	95
1988	Jan. 6	−17	July 22, Aug. 6	92
1989	Feb. 4, 5	−20	Aug. 1	96
1990	Dec. 30	−33	Aug. 16	94
1991	Jan. 2, 3	−11	Aug. 10	92
1992	Jan. 20	10	Aug. 15	93

Table 9. Summary of temperature records at the Northwestern Agricultural Research Center January 1950 through December 1992.

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
1991	18.3	34.6	32.8	42.4	50.3	55.1	64.0	65.2	54.4	40.6	32.1	29.3	43.3
1992	28.7	34.5	39.7	45.1	53.5	55.5	61.2	61.8	51.1	44.7	33.1	19.4	44.0
MEAN	21.8	27.3	33.8	43.3	51.6	58.4	64.0	63.0	53.5	43.4	32.6	25.3	43.2

Table 10. Summary of precipitation records at the Northwestern Agricultural Research Center, Kalispell, MT, January 1950 thru December 1992.

	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
1991	1.41	0.41	0.72	1.21	2.72	5.36	0.77	1.15	0.80	0.75	2.26	0.58	18.14
1992	1.17	0.61	0.83	1.18	1.65	5.34	2.24	0.94	1.21	1.07	2.37	1.53	20.14
MEAN	1.46	1.14	1.17	1.39	2.31	2.88	1.57	1.60	1.60	1.35	1.52	1.65	19.62

PROJECT TITLE: Economic Thresholds for Wild Oat in Small Grains (Kalispell location).

PROJECT LEADER: Bruce Maxwell, P&SS, MSU, Bozeman, MT

PROJECT PERSONNEL: Ed Davis, CARC, Moccasin, MT.
Bob Stougaard, NWARC, Kalispell, MT
Todd Keener, NWARC, Kalispell, MT.

OBJECTIVES: Identify the wild oat density (threshold) that can be tolerated without significantly decreasing small grains yields, the effect of wild oat emergence date on small grain yield reductions and to assess the impact of weed escapes on weed pressures in subsequent production years.

MATERIALS AND METHODS:

Barley was planted at O, 1/2X, 1X, and 2X the normal seeding rate (1X = 60 lb/A). Wild oat was then planted within each barley density at 0, 1, 4, 15, and 37 plants per square foot at the barley seeding date or 7 days after barley emergence. Wild oat and barley populations were monitored throughout the season. In addition to barley grain yield, wild oat and barley plant dry weight, and seed production were determined at harvest. The plots will be relocated next season and planted to barley to determine the effect of wild oat escapes on future weed pressures.

SUMMARY (Kalispell location):

Results from this season indicate that wild oat emerging with the crop causes substantially greater yield reductions as compared to the same wild oat densities planted 7 days later. Barley yields remained virtually constant over the wild oat densities established when wild oat was seeded 7 days after barley emergence. As an example, at the 1X barley seeding rate when wild oat was seeded with the barley crop, yield was 105 bu/A when no wild oat were present compared to 50 bu/A when 37 wild oat plants per square foot were established. When wild oat was seeded 7 days after barley planting, yield was 105 bu/A when no wild oat was present compared to 95 bu/A when 37 wild oat plants per square foot were seeded. These results suggest that by controlling the first flush of weeds early, weeds which emerge later will not impact yield or contribute to increased weed pressure the following year.

The effect of barley seeding density was not significant with the 1/2X and 1X seeding rates. Yields declined to the same extent as wild oat density increased with both barley populations. However, at the 2X barley density, wild oat density had only a minor impact on yield regardless of whether wild oat was seeded with the barley crop or 7 days after emergence. This suggests that by increasing barley seeding rates, the impact of wild oat can be dramatically reduced.

BARLEY POPULATION	WILD OAT POPULATION	SEEDED O DABE 1/	SEEDED 7 DABE
(LB/A)	(#/FT)	BARLEY YIELD (BU/A)	
30	0	110	110
30	1	90	105
30	4	80	105
30	15	60	100
30	37	55	95
60	0	105	105
60	1	100	100
60	4	85	90
60	15	65	105
60	37	50	95
120	0	95	105
120	1	100	100
120	4	100	100
120	15	85	95
120	37	75	100

1/ DABE: Days after barley emergence

PROJECT TITLE: Input Analysis Study

PROJECT LEADERS: Todd Keener and Bob Stougaard, NWARC, Kalispell,MT

OBJECTIVES: Evaluate the effects of delayed seedbed preparation and spring barley planting on weed population dynamics and herbicide efficacy in an attempt to optimize small grain yield while minimizing herbicide inputs.

MATERIALS AND METHODS:

Seedbeds were prepared just prior to planting spring barley on 4/8, 4/22, 5/6, and 5/21. An additional treatment consisted of planting on 5/21 with 2 prior seedbed cultivations on 4/22 and 5/21. Six herbicide treatments were applied to each planting date procedure. Herbicides consisted of Harmony Extra POST, Fargo PPI with and without Harmony Extra POST, Assert POST with and without Harmony Extra POST, and a nontreated control.

SUMMARY:

Delayed seedbed preparation and planting dates generally result in reduced weed populations. This strategy can potentially reduce or eliminate the need for herbicide inputs. At the same time, crop yield is sacrificed due to the shorter growing season and potentially unfavorable growing conditions.

Delayed seedbed preparation and barley planting significantly reduced wild oat populations and improved weed control. The response to delayed planting was most evident with the last two dates (5/6 and 5/21). Fargo and Assert both provided good wild oat control but were most effective in the later plantings.

In the absence of weed competition, small grain yields tend to decrease as planting is delayed. This has not proven to be the case in this study. With the exception of the Fargo treatments, yields increased as planting was delayed up to the 5/6 planting. There after yields dropped sharply. Barley vigor and yield are being affected by environmental conditions as it relates to delayed planting and the effects of reduced weed competition resulting from lower populations. Further investigation will be required to interpret this complex interaction.

TABLE 1. Input Analysis Study - Yields 1990-1992

Planting 1/	1990	1991	1992
Date 1	75.3	83.0	60.4
Date 2	78.8	66.4	61.6
Date 3	80.9	78.2	65.9
Date 4	81.7	76.3	48.7
Date 5	2/	80.7	52.3
LSD	NS	7.47	6.05

TABLE 2. Input Analysis Study - Wild Oats / sq. ft.

Planting	1990	1991	1992
Date 1	7.6	3.6	8.5
Date 2	2.9	8.1	4.4
Date 3	1.8	.6	1.2
Date 4	2.2	1.0	2.5
Date 5	2/	.2	1.9
LSD	NS	7.47	6.05

Table 3. Assert and Fargo % Wild Oat Control - 1992

	Date 1	Date 2	Date 3	Date 4	Date 5	MEAN
Fargo	89	93	96	84	70	87
Assert	69	71	98	97	97	87
MEAN	79	82	97	91	84	

LSD for Trtmts = 13.8 LSD for Dates 16.7

1/ Dates of planting/cultivation (1992): 1 = 4/8, 2 = 4/22, 3 = 5/6, 4 = 5/21, 5 = 4/22 & 5/21

2/ No Date 5 planting in 1990

PROJECT TITLE: Reduced Wild Oat Herbicide Rate Study

PROJECT LEADERS: Bob Stougaard, NWARC, Kalispell, MT.

PROJECT PERSONNEL: Bruce Maxwell, P&SS, MSU, Bozeman, MT.
Pete Fay, P&SS, MSU, Bozeman, MT.
Ed Davis, CARS, Moccasin, MT.
Todd Keener, NWARC, Kalispell, MT.

OBJECTIVES: To determine the effectiveness of early postemergence herbicides applications at reduced rates for control of wild oats.

MATERIALS AND METHODS:

The study was established on a Kalispell fine sandy loam soil with a pH of 7.7 and an organic matter content of 4.2 percent. Gallatin spring barley was seeded at 60 lb/A on April 14, 1992. The area was fertilized with 120 lb/A of 27/14/0 on April 20, 1992. The previous crop was spring barley. Plots were 10 by 15 feet, were replicated four times and were arranged in a randomized complete block. Assert and Hoelon were applied at their respective 1X, 1/2X, and 1/4X use rates to wild oat infested spring barley. Treatments were applied at either 1, 2, or 3 weeks after barley emergence. Hoelon was applied alone and Assert was applied with Sunit II (a non-ionic surfactant plus methylated sunflower oil blend). Applications were made with a CO_2 backpack sprayer in 20 GPA at 20 psi with 110022 flat fan nozzles. Environmental conditions were as follows:

Appln 1/	Crop Stage	W.Oat Stage	Air Temp	Soil Temp	Rel Humid.	Soil Moisture
1 WABE	1.5 lf	1.5 lf	45	50	37	Fair
2 WABE	3 lf	1-3 lf	66	70	13	Dry
3 WABE	5-7 lf	3 lf	60	64	25	Dry

1/ Application timing: 1, 2, or 3 WABE (Weeks after barley emergence)

SUMMARY:

Yields were positively correlated with percent wild oat control. Assert provided the best wild oat control and highest barley yield. There was no difference in control or yield between the 1X and 1/2X labeled rates of Assert, regardless of application timing. Control was most complete and yields highest for Assert applied 1 week after barley emergence. As application timing was delayed, wild oat control and barley yield declined. Assert at 1/4 the normal use rate applied 1 week after barley emergence provided wild oat control and barley yields comparable to the 1X use rate applied at the typical application date. This reduced rate-early application would cost about $5.00/A compared to $20.00/A for the labeled treatment.

Wild oat control with Hoelon was erratic and less complete. Weed control was most complete with applications made at 2 weeks after barley emergence. Control would be expected to decline at later applications dates due to larger and more numerous wild oat plants. This was the case for the latest application date. However the poor control at the earliest date was unexpected. The poor control from applications made 1 week after barley emergence may be

due to environmental factors.

This first years preliminary results indicate that Assert rates could be reduced at least by 1/2 regardless of application timing and that early applications result in the most consistent control and highest yields. Hoelon does not appear to have much flexibility in reducing rates. For Hoelon, environmental conditions may be more important than wild oat growth stage with respect to the level of control achieved.

REDUCED WILD OAT HERBICIDE RATE STUDY

WABE 1/	HERBICIDE	RATE	WILD OAT CONTROL	BARLEY YIELD (BU/A)
1	HOELON	1X	55	65
1	HOELON	1/2X	45	45
1	HOELON	1/4X	50	45
1	ASSERT	1X	90	80
1	ASSERT	1/2X	90	75
1	ASSERT	1/4X	90	70
2	HOELON	1X	90	85
2	HOELON	1/2X	50	40
2	HOELON	1/4X	10	35
2	ASSERT	1X	90	75
2	ASSERT	1/2X	90	75
2	ASSERT	1/4X	75	60
3	HOELON	1X	65	70
3	HOELON	1/2X	25	40
3	HOELON	1/4X	30	40
3	ASSERT	1X	80	65
3	ASSERT	1/2X	60	65
3	ASSERT	1/4X	50	45
-	NONTREATED		25	35

1/ WABE: Weeks after barley emergence

PROJECT TITLE: Hoelon Surfactant Study

PROJECT LEADERS: Bob Stougaard, NWARC, Kalispell, MT.

PROJECT PERSONNEL: Todd Keener, NWARC, Kalispell, MT.

OBJECTIVES: Evaluate the effect of Hoelon, rates and surfactants on wild oat control, and to determine if surfactants could be used with reduced rates of Hoelon without causing barley injury and maintaining acceptable wild oat control at the same time.

MATERIALS AND METHODS:

The study was established on a Kalispell fine sandy loam, with a pH of 7.7 and organic matter content of 4.2. Gallatin spring barley was seeded at 60 lb/A on April 14, 1992. The area was fertilized with 120 lb/A of 27/14/0 on April 20, 1992. The previous crop was spring barley. Plots were 10 by 15 ft, were replicated 3 times and were arranged in a randomized complete block. Hoelon was applied at the 1X, 1/2X, and 1/4X use rates at 1 and 2 weeks after barley emergence (WABE). These treatments were either applied alone or in combination with a non-ionic surfactant (R-11) or a non-ionic surfactant plus methylated sunflower blend (Sunit II). Applications were made with a CO^2 sprayer in 20 GPA at 20 psi with 110022 flat fan nozzles. Environmental conditions were as follows:

APPLN	CROP STAGE	W.OAT STAGE	AIR TEMP	SOIL TEMP	REL. HUMID	SOIL MOISTURE
1 WABE	1.5 lf	1-1.5lf	45	50	37	Fair
2 WABE	3 lf	1-3 lf	66	70	13	Good

Evaluations were taken on 6/1/92 and 6/25/92 with plots being harvested on 8/22/92 from a 60 sq ft area.

SUMMARY:

Results were erratic with applications made 1 week after barley emergence. Surfactants did not provide any clear advantage compared to Hoelon alone. The one exception was that it appeared that wild oat control and barley yield did not decline as dramatically at the reduced rates when surfactants were included.

Weed and crop responses were more obvious when the same treatments were made 2 weeks after barley emergence. Wild oat control and barley yield were improved when either R-11 or Sunit-II were applied with Hoelon. This response was again most apparent at the lower rates. Of the two surfactants, Sunit-II increased control and yield the most. The 1/4X rate of Hoelon plus Sunit-II provided control and yields comparable to the 1X rate without surfactants. Sunit-II also resulted in the greatest degree of crop injury. Injury was initially severe at the 1X and 1/2X rates of Hoelon when applied with Sunit-II. Although injury was noticeable, these same treatments produced the highest barley yields.

This first years preliminary results indicate that Hoelon rates can be reduced when applied with Sunit-II and maintain acceptable wild oat control and barley yields. This research should be repeated to determine the consistency of these treatments, especially in light of the crop injury observed.

Table 1. Hoelon Surfactant Study on Spring Barley. Northwestern Agricultural Research Center, Kalispell, MT.

Trtmnt Name	Rate Lb ai	1/ WABE	BARLEY YIELD BU/A 8-22-92 94 DAA	BARLEY % INJURY 6-1-92 30 DAA	BARLEY % INJURY 6-25-92 55 DAA	WILD OAT % CONTROL 6-25-92 55 DAA
HOELON	1.0	1	101.8	20	3	86
HOELON	.50	1	77.0	7	13	72
HOELON	.25	1	72.6	3	0	53
HOELON R-11	1.0 1 Qt	1	75.1	7	5	70
HOELON R-11	.5 1 Qt	1	81.3	3	0	62
HOELON R-11	.25 1 Qt	1	73.9	15	3	67
HOELON SUN-IT	1.0 .25% V/V	1	75.2	22	8	85
HOELON SUN-IT	.50 .25% V/V	1	59.2	12	2	73
HOELON SUN-IT	.25 .25% V/V	1	69.6	10	3	60
HOELON	1.0	2	89.4	27	10	85
HOELON	.50	2	78.4	10	0	72
HOELON	.25	2	63.3	13	2	53
HOELON R-11	1.0 1 Qt	2	89.1	30	13	92
HOELON R-11	.50 1 Qt	2	81.5	12	3	70

Cont'd on page 2

Table 1 (Cont'd). Hoelon Surfactant Study on Spring Barley.

Trtmnt Name	Rate Lb ai	Grow Stg	BARLEY YIELD BU/A	BARLEY % INJURY	BARLEY % INJURY	WILD OAT % CONTROL
HOELON R-11	.25 1 Qt	2	71.8	23	3	70
HOELON SUN-IT	1.0 .25% V/V	2	87.9	78	60	98
HOELON SUN-IT	.50 .25% V/V	2	91.2	50	28	98
HOELON SUN-IT	.25 .25% V/V	2	83.2	20	12	82
UNTREATED	--	--	49.2	2	0	33
UNTREATED	--	--	49.3	7	0	50
P VALUE =			.048	.000	.000	.068
LSD (.05) =			28.2	17	13	36

1/ WABE = Weeks after barley emergence
2/ AVEFA = Wild oat (Avena fatua) Letters are a WSSA-approved computer code from Composite List of Weeds

PROJECT TITLE: Broadleaf Surfactant Study

PROJECT LEADERS: Bob Stougaard, NWARC, Kalispell, MT

PROJECT PERSONNEL: Todd Keener, NWARC, Kalispell, MT.

OBJECTIVES: Evaluate the sulfonylurea herbicides Harmony Extra and Express in combination with 2,4-D, and/or Banvel for possible enhanced broadleaf weed control when applied in tank mix with Cayuse and/or R-11 surfactant.

RESULTS:

This study was established to determine if broadleaf weed control in small grains could be enhanced with the addition of surfactants to standard herbicide treatments. The core treatments consisted of reduced rates of Harmony Extra and Express applied alone or in combination with 2,4-D or 2,4-D plus Banvel. These treatments were applied without a surfactant or tank-mixed with a non-ionic surfactant (R-11) or a non-ionic surfactant plus a UAN liquid fertilizer mixture (R-11 plus Cayuse) at different concentrations. Banvel plus 2,4-D was included as a standard and was tank-mixed with the same surfactant combinations. Treatments were applied late when spring barley was 12 inches tall and fully tillered. Wild buckwheat was the dominant weed species present and was 3-5 inches tall.

The research plots were established in a Bearpaw spring barley field that had been seeded at 60 lbs/A on March 31, 1992. The experiment was a randomized complete block design with three replications. Plots were 10'X 15'. Seed bed preparation included spring discing, cultivation and then packing with a Brillion. Fertilizer applied at seeding was 191 lb/A of 27/14/0. The previous crop grown in this field was Gallatin spring barley that had been planted on April 12, 1991. The yield for that year was 63 bu/A with a test weight of 53 lb/bu. Fertilizer had been applied at seeding (210 lbs 27/14/0). Previous herbicides had been Harmony Extra at .6 oz prod/A. Soil type for test area is a Kalispell fine sandy loam with a pH of 7.7 and OM of 3.3%. Soil texture is 60% sand, 30% silt, and 10% clay.

Application data was as follows:

Date May 27, 1992

Air temp: 60 F Soil temp: 58 F Rel Hum.: 62%
Soil moisture: top - wet, subsoil - wet
Crop stage at appln: 11-13", fully tillered
Weed stages at appln:
Wild buckwheat [POLCO(Poygonum convolvulus)] 3-5", many lvs
Lambsquarter (Chenopodium album) 5-7"
Henbit (Lamium amplexicauli) 3-5"
Russian thistle (Salsola iberica) 3" diameter
Tansey mustard (Descurainia sophia) 3" tall

SUMMARY:

The effect of surfactants on wild buckwheat control varied among herbicides. Wild buckwheat control was improved by additions of surfactants for treatments which included Harmony Extra. Control was 70% for Harmony Extra alone compared to 90% when R-11 plus Cayuse were added at the highest concentration. The same trends were observed for 2,4-D plus Banvel treatments. Weed control with treatments which included Express did not responded to the additions of surfactants. Spring barley yields were erratic, probably due to the late application timing. As such, the effect of these treatments in reducing weed competition or causing crop injury can not be accurately assessed. It appears that surfactant effects vary with the herbicide in question.

Table 1. Agronomic data from the Broadleaf Surfactant Herbicide trial located on the NWARC, Kalispel, MT in 1992.

TREATMENT	RATE AI/A	YIELD BU/A	% CROP INJURY	% STAND REDUCT.	% CONTROL W BUCKWHT
1. Harmony Extra	.23 oz	53	0	4	68
2,4-D LV4	.25 lb				
2. Harmony Extra	.23 oz	73	7	8	73
2,4-D LV4	.25 lb				
Banvel	.125 lb				
3. 2,4-D LV4	.375 lb	62	2	12	66
Banvel	.125 lb				
4. Express	.125 oz	72	0	7	49
2,4-D LV4	.25 lb				
5. Express	.125 oz	37	5	13	83
2,4-D LV4	.25 lb				
Banvel	.125 lb				
6. Harmony Extra	.23 oz	44	2	10	85
2,4-D LV4	.25 lb				
R-11	.25% v/v				
7. Harmony Extra	.23 oz	39	3	15	86
2,4-D LV4	.25 lb				
Banvel	.125 lb				
R-11	.25% v/v				
8. 2,4-D LV4	.375 lb	38	0	13	83
Banvel	.156 lb				
R-11	.5% v/v				
9. Express	.125 oz	53	0	3	56
2,4-D LV4	.25 lb				
R-11	.25% v/v				
10.Express	.125 oz	54	0	13	65
2,4-D LV4	.25 lb				
Banvel	.156 lb				
R-11	.25% v/v				
11.Harnomy Extra	.23 oz	49	0	7	83
2,4-D LV4	.25 lb				
Cayuse	.25% v/v				
R-11	.25% v/v				
12.Harmony Extra	.23 oz	51	2	7	88
2,4-D LV	.25 lb				
Banvel	.125 lb				
Cayuse	.25% v/v				
R-11	.25% v/v				
13.2,4-D LV	.375 lb	49	8	13	83
Banvel	.156 lb				
Cayuse	.25% v/v				
R-11	.25% v/v				

Cont'd on page 2

P-VALUE =	.136	.017	.335	.000
LSD(0.05 by t)=	22.8	7.03	11.0	14.7

Table 1. (Cont'd). Broadleaf Surfactant Herbicide Trial, NWARC.

TREATMENT	RATE AI/A	YIELD BU/A	% CROP INJURY	% STAND REDUCT.	% CONTROL W BUCKWHT
14.Express	.125 oz	52	2	12	73
2,4-D LV4	.25 lb				
Cayuse	.25% v/v				
R-11	.25% v/v				
15.Express	.125 oz	51	5	17	84
2,4-D LV	.25 lb				
Banvel	.156 lb				
Cayuse	.5% v/v				
R-11	.25% v/v				
16.Harmony Extra	.23 oz	55	0	10	91
2,4-D LV	.25 lb				
Cayuse	.5% v/v				
R-11	.25% v/v				
17.Harmony Extr	.23 oz	53	2	13	92
2,4-D LV	.25 lb				
Banvel	.125 lb				
Cayuse	.5% v/v				
R-11	.25% v/v				
18.2,4-D LV	.375 lb	57	12	18	85
Banvel	.156 lb				
Cayuse	.5% v/v				
R-11	.25% v/v				
19.Express	.125 oz	52	0	10	53
2,4-D LV4	.25 lb				
Cayuse	.5% v/v				
R-11	.25% v/v				
20.Express	.125 oz	38	10	13	89
2,4-D LV4	.25 lb				
Banvel	.156 lb				
Cayuse	.5% v/v				
R-11	.25% v/v				
21.Untreated	--------	61	0	5	0
P-VALUE =		.136	.017	.335	.000
LSD(0.05 by t)=		22.8	7.03	11.0	14.7

PROJECT TITLE: Assert Tank-Mix Antagonism Study

PROJECT LEADER: Bob Stougaard, NWARC, Kalispell, MT

PROJECT PERSONNEL: Todd Keener, NWARC, Kalispell, MT

OBJECTIVE: This study was established to compare Assert formulations, rates and combinations for the control of wild oat in spring barley and to determine if wild oat control would be affected by tank-mixed applications of Assert with standard broadleaf herbicides.

MATERIALS AND METHODS:

The study was established on a Kalispell fine sandy loam, with a pH of 7.7 and organic matter content of 4.2. The area was fertilized with 120 lb/A of 27/14/0 on April 20, 1992. The previous crop was spring barley. Plots were 10 by 15 ft, were replicated 3 times and were arranged in a randomized complete block. Gallatin spring barley was seeded at 60 lb/A on April 14, 1992. Assert was applied at different rates alone or in combination with MCPA ester, Bronate, Curtail M, and Harmony Extra plus MCPA ester. Treatments were applied to wild oat infested spring barley approximately 3 weeks after barley emergence. Herbicides were applied on May 13, 1992, when the crop was in the 3 to 5 leaf stage and the majority of wild oat were at the 3 leaf stage (20% 2 lf, 60% 3 lf, 20 at 4 lf). Average wild oat density was 27/sq ft. Applications were made with a CO_2 backpack sprayer in 20 GPA at 20 psi with 11002 flat fan nozzles. Environmental conditions at application were as follows:

Air Temp: 66, Soil Temp: 65, Rel Hum: 7%, Soil Moisture: good

Evaluations were taken on 6/1, 6/25, and 8/11/1992 with plots being harvested on 8/12/1992 from a 60 sq ft area.

SUMMARY:

The majority of treatments provided excellent control of wild oat and all treatments provided yields greater than the nontreated control. Poorest control was observed with the following treatments:
Assert 67SG 0.23 + Avenge 2ASU 0.5
Assert 67SG 0.38 + Bronate 0.5
Assert 67SG 0.23 + Harmony Extra 0.5 oz + MCPA 0.25
Assert 67SG 0.38 + Harmony Extra 0.5 oz + MCPA 0.25

The lowest Assert rates provided the same degree of control as the highest rates, which lends support to the observations obtained in other research related to reduced rates of wild oat herbicides. Some antagonism was observed in this experiment. Wild oat control was reduced 10 to 20% when Assert was tank-mixed with either Bronate or Harmony Extra plus MCPA.

Table 1. Summary of agronomic data from the Assert Herbicide Trial. Northwestern Agricultural Research Center, Kalispell, MT.

Treatment	Rate lb ai/A	Surf 1/	% Crop Injury 6-1	% Crop Injury 6-25	% AVEFA Control2/ 6-1	% AVEFA Control2/ 6-25	% AVEFA Control2/ 8-1	Yield bu/A
Assert 2.5	.47	NIS	12	8	87	100	92	83
Assert 2.5	.38	NIS	10	5	88	100	93	80
Assert 2.5	.31	NIS	10	8	82	100	86	75
Assert 67SG	.47	NIS	12	3	83	100	90	80
Assert 67SG	.38	NIS	12	3	82	100	81	83
Assert 67SG	.31	NIS	17	12	80	100	86	70
Assert 67SG Avenge 2ASU	.23 .50	NIS	13	18	88	90	47	66
Assert 67SG	.47	SUN	13	12	88	97	93	72
Assert 67SG	.38	SUN	15	12	88	100	82	74
Assert 67SG	.31	SUN	7	3	87	100	92	84
Assert 67SG Avenge 2ASU	.23 .50	SUN	10	3	83	100	82	83
Assert 67SG MCPA ester	.38 .50	NIS	10	3	85	100	95	83
Assert 67SG Bronate	.38 .50	NIS	13	12	82	100	51	72
Assert 67SG Curtail M	.38 2 pt	NIS	10	13	80	100	81	70
Assert 67SG Harm Extra MCPA ester	.38 .5 oz .25	NIS	13	7	83	100	80	78

Table 1. (Cont'd) Assert Herbicide Study - 1992

Treatment Rate lb ai/A	Surf 1/	% Crop Injury 6-1	% Crop Injury 6-25	% AVEFA Control2/ 6-1	% AVEFA Control2/ 6-25	% AVEFA Control2/ 8-1	Yield bu/A
Assert 67SG .23 Harm Extra .5 oz MCPA ester .25	NIS	18	10	77	100	40	66
Assert 67SG .38 Harm Extra .5 oz MCPA ester .25	NIS	20	20	87	100	71	72
UNTREATED CHECK		0	0	0	0	0	36
LSD (.05)=		12.1	18.8	9.92	7.00	29.9	24.4
P VALUE		.375	.610	.000	.000	.000	.088

1/ Surf: Surfactants used were R-11 at 2 pt A (NIS) and Sun-IT II at 2 pt/A (SUN)

2/ % Wild Oat Control. AVEFA is WSSA-approved computer code from Composite List of Weeds for wild oat (Avena fatua).

PROJECT TITLE: Forage Grass Establishment Study

PROJECT LEADER: Bob Stougaard, NWARC, Kalispell, MT.

PROJECT PERSONNEL: Todd Kenner, NWARC, Kalsipell, MT.

OBJECTIVE: To evaluate the potential of Pursuit for forage grass establishment.

MATERIALS AND METHODS:

Three forage grass species (Orchardgrass, Regar meadow bromegrass, and Garrison creeping foxtail) were dormant seeded October 21, 1992. Pursuit was applied at 4 rates, at 3 different application timings, to these forage grass species to determine the optimum rate and growth stage that would maximize forage grass safety for specific grass species and afford acceptable weed control at the same time. Pursuit treatments were applied postemergence at 2 week intervals on 4/20/92, 5/7/92, and 5/21/92. Applications were made with a CO_2 backpack sprayer in 20 GPA at 20 psi with 11002 flat fan nozzles. Pennycress was the dominant weed species present, with lesser amounts of common bedstraw and common lambsquarters. Application data was as follows:

Appln.	Date	-----Stage of Growth----				Air	Soil	Rel	Soil
		GRASS	THLAR	GALAP	CHEAL	Temp	Temp	Hum.	Moisture
Post 1	4/20	3 lf	1"	1/2"	1/2"	60	58	22	Fair
Post 2	5/7	1-3 t	1-3"	1-3"	2-3"	75	72	13	Dry
Post 3	5/21	3-5 t	12"	5-7"	3-5"	55	52	33	Wet

THLAR = Field Pennycress (Thlaspi arvense), GALAP = Common bedstraw (Galium aparine), CHEAL = Common lambsquarters (Chenopodiun album)

SUMMARY:

The three grass species responded similarly to the Pursuit treatments. Forage grass tolerance to Pursuit increased as applications were delayed as reflected in forage grass yields and percent stand establishment values. Grass yields increased as Pursuit rates increased up to a point. The highest rate generally reduced grass stands and yields. Of the grasses evaluated, Orchardgrass produced the greatest amount of hay, followed by Regar meadow bromegrass, and Garrison creeping foxtail respectively.

Pennycress control was excellent, with all treatments providing greater than 90% control regardless of rate or application date. Bedstraw control tended to be more complete with the later applications. Early applications controlled those plants present at application, but bedstraw continued to emerge throughout the season, resulting in poorer overall control. In contrast, lambsquarters control was better with the earlier applications, due to the smaller weed size.

Table 1. Forage Grass Establishment Study - ORCHARDGRASS DATA

Treatment	Rate lb ai/A	Timing 1/	Grs Wt gm/ft	Brdlf Wt gm/ft	% Stand	Percent Control 2/ THLAR	GALAP	CHEAL
Untreated	---	Post1	89	17	81	50	37	52
Pursuit	.02	Post1	108	28	90	95	66	75
Pursuit	.03	Post1	125	33	89	95	67	69
Pursuit	.06	Post1	69	19	82	97	71	86
Untreated	---	Post2	88	14	90	30	41	37
Pursuit	.02	Post2	92	12	86	96	64	67
Pursuit	.03	Post2	108	9	92	97	60	66
Pursuit	.06	Post2	94	18	84	100	77	76
Untreated	---	Post3	94	49	92	42	35	25
Pursuit	.02	Post3	106	18	90	100	81	75
Pursuit	.03	Post3	115	14	95	84	76	62
Pursuit	.06	Post3	127	56	79	100	92	79
	L S D		38.7	99.6	12.7	17.7	25.9	20.3

1/ Timing: Post1 = 1-3 leaf (4/20/92), Post2 = 1-3 tiller (5/7/92), Post3 = 3-5 tiller (5/21/92)

2/ Percent Control: WSSA-approved weed codes for Field pennycress - THLAR (Thlaspi arvense), Common bedstraw - GALPA (Galium aparine) and Common Lambsquarters - CHEAL (Chenopodium album).

Table 1 (Cont'd) . Forage Grass Establishment Study - REGAR BROMEGRASS DATA

Treatment	Rate lb ai/A	Timing 1/	Grs Wt gm/ft	Brdlf Wt gm/ft	% Stand	Percent Control 2/ THLAR	GALAP	CHEAL
Untreated	---	Post1	59	40	67	25	17	52
Pursuit	.02	Post1	57	52	62	97	50	66
Pursuit	.03	Post1	78	17	69	95	66	75
Pursuit	.06	Post1	42	18	62	*99	80	85
Untreated	---	Post2	31	65	65	35	0	35
Pursuit	.02	Post2	40	66	65	92	50	62
Pursuit	.03	Post2	69	51	70	97	45	62
Pursuit	.06	Post2	50	71	64	100	54	64
Untreated	---	Post3	46	45	67	40	21	47
Pursuit	.02	Post3	61	32	69	100	71	57
Pursuit	.03	Post3	39	51	72	100	76	57
Pursuit	.06	Post3	70	43	64	100	92	76
	L S D		38.7	99.6	12.7	17.7	25.9	20.3

1/ Timing: Post1 = 1-3 leaf (4/20/92), Post2 = 1-3 tiller (5/7/92), Post3 = 3-5 tiller (5/21/92)

2/ Percent Control: WSSA-approved weed codes for Field pennycress - THLAR (Thlaspi arvense), Common bedstraw - GALPA (Galium aparine) and Common Lambsquarters - CHEAL (Chenopodium album).

Table 1 (Cont'd). Grass Establishment Study - GARRISON FOXTAIL DATA

Treatment	Rate lb ai/A	Timing 1/	Grs Wt gm/ft	Brdlf Wt gm/ft	% Stand	Percent Control 2/ THLAR	GALAP	CHEAL
Untreated	---	Post1	49	58	69	35	34	20
Pursuit	.02	Post1	37	82	62	90	56	67
Pursuit	.03	Post1	26	20	60	99	67	82
Pursuit	.06	Post1	24	31	50	94	77	80
Untreated	---	Post2	24	39	61	70	16	37
Pursuit	.02	Post2	43	56	70	96	35	50
Pursuit	.03	Post2	63	32	67	100	67	77
Pursuit	.06	Post2	36	16	64	97	66	72
Untreated	---	Post3	25	47	62	29	19	40
Pursuit	.02	Post3	43	36	67	100	46	46
Pursuit	.03	Post3	53	29	65	100	84	69
Pursuit	.06	Post3	33	115	66	100	95	80
	L S D		38.7	99.6	12.7	17.7	25.9	20.3

1/ Timing: Post1 = 1-3 leaf (4/20/92), Post2 = 1-3 tiller (5/7/92), Post3 = 3-5 tiller (5/21/92)

2/ Percent Control: WSSA-approved weed codes for Field pennycress - THLAR (Thlaspi arvense), Common bedstraw - GALPA (Galium aparine) and Common Lambsquarters - CHEAL (Chenopodium album).

PROJECT TITLE: Wild Oat Management for Baby Peppermint

PROJECT LEADER: Bob Stougaard, NWARC, Kalispell, MT.

PROJECT PERSONNEL: Todd Keener, NWARC, Kalispell, MT

OBJECTIVE: To evaluate herbicides, rates and application timings for the control of wild oat during mint establishment. Specifically, to determine if the addition of a PRE grass herbicide to a POST grass herbicide would provide extended wild oat control.

MATERIALS AND METHODS:

The study was established on a Kalispell fine sandy loam soil with a pH of 7.7 and an organic matter content of 4.2 percent that had previously been in barley and had a history of intense wild oat pressure. The area was fertilized and Black Mitcham peppermint roots were planted in 22 inch rows, 2 inches deep, at 1000 lb/A on April 7, 1992. The area was then irrigated and fertilized throughout the season.

Herbicides were applied with a CO^2 backpack sprayer calibrated to deliver 20 GPA at 20 psi. Treatments were replicated 3 times in a randomized complete block design. Plot dimensions were 10 by 15 ft. Application data was as follows:

Application type	PRE	POST
Date	4/17	5/4
Air Temp	47 F	77 F
Soil Temp	47 F	80 F
Wind	2-4 MPH	3-5 MPH
Rel Hum.	58	15
Soil Moisture	Good	Good
Weed Stage	NA	W. Oat: 2-3 lf

Treatments were evaluated on June 3, 1992 for percent wild oat control and crop injury. Mint and wild oat yields were determined on August 18, 1992 by harvesting two, 1 sq ft quadrates in each plot.

SUMMARY:

Wild oat control was poor with all of the PRE treatments at the June rating. As a result, there was no benefit in adding a PRE grass herbicide to the POST treatments. Of the POST treatments evaluated, control was poorest with Poast. All other POST treatments provided excellent control initially. Control declined with all treatments as the season progressed. This was due to additional flushes of wild oat resulting from the high wild oat seed bank populations, lack of activity from the PRE treatments and abundant moisture. Beacon alone or in combination did demonstrate residual control of wild oat as reflected in the wild oat biomass measurements. However, Beacon caused unacceptable injury to the baby mint, resulting in the highest crop injury ratings and the lowest mint yields. Accent also caused significant crop injury. The results of this study indicate that there is no effective PRE herbicide for wild oat control. Wild oat management in baby mint will require at least two applications of a POST grass material with Assure II being a better candidate then Poast for wild oat control.

Table 1. Agronomic data from the peppermint wild oat study on the Northwestern Agricultural Research Center.

Treatment 1/	Rate Lb ai/A	Appln.	MINT LBS/A	WILD OAT LBS/A	AVEFA %CONTRL	CROP INJURY
Sinbar	.4	Pre	4118	15060	48	14
Sinbar	.8	Pre	3245	13810	50	11
Prowl	.75	Pre	1404	12290	13	0
Prowl	1.5	Pre	611	12870	30	4
Mon 13211	.25	Pre	5575	14370	54	9
Mon 13211	.50	Pre	3966	10710	60	0
Assure II + NIS	.021	Post	5688	12020	92	6
Assure II + NIS	.043	Post	5142	15520	96	14
Poast + COC	.093	Post	3875	14090	58	9
Poast + COC	.187	Post	4839	10720	79	10
Accent + NIS	.015	Post	2935	8204	88	40
Accent + NIS	.030	Post	5510	9397	93	33
Beacon + NIS	.015	Post	779	16110	94	85
Beacon + NIS	.030	Post	796	9507	99	98
Prowl Assure II+ NIS	.75 .021	Post	4108	8599	78	11
Mon 13211 Assure II+ NIS	.25 .021	Post	4046	8601	89	14
Prowl Poast + COC	.75 .093	Post	4630	23590	90	21
Mon 13211 Poast + COC	.25 .093	Post	5714	12290	82	13
Prowl Accent + NIS	.75 .030	Post	2834	12010	94	38
Mon 13211 Accent + NIS	.25 .030	Post	3736	19940	95	53
Prowl Beacon + NIS	.75 .030	Post	91	8712	99	97
Mon 13211 Beacon + NIS	.25 .030	Post	373	4284	99	98
Untreated	----	----	3279	16170	21	0
P-VALUE	=		.126	.1229	.00	.00
LSD(0.05 by t)=			4329	9809	22	16

1/ COC = Crop oil concentrate 1 QT/A, Surf = Non-ionic Surfactant .25% v/v

2/ AVEFA = WSSA-approved weed code for wild oat (Avena fatua)

PROJECT TITLE: Reduced Rate Postemergence Study on Peppermint.

PROJECT LEADER: Bob Stougaard, NWARC, Kalispell, MT.

PROJECT PERSONNEL: Todd Keener, NWARC, Kalispell, MT.
Jim Beuchle - cooperator

OBJECTIVE: To evaluate reduced rate postemergence herbicides for weed control and crop injury in established and baby Black Mitcham peppermint.

MATERIALS AND METHODS:

The established stand was in the third year of production and was located on a Creston silt loam soil with a pH of 7.5 and an organic matter content of 3.7 percent. The new planting was located on a Kalispell fine sandy loam soil with a pH of 7.7 and an organic matter content of 4.2 percent and had previously been in barley. The area was fertilized and Black Mitcham roots were planted in 22 inch rows, 2 inches deep on April 7, 1992 at a rate of 1000 lb/A. The area was then packed with a Brillon packer. The area was treated with 0.38 lb ai/A Sinbar May 8, 1992.

Herbicide applications at both sites were made with a CO^2 backpack sprayer at 20 psi and a carrier volume of 20 GPA. Treatments were replicated 3 times. Plot dimensions were 10 by 10 and 10 by 15 ft at the established and baby mint sites respectively. Application data was as follows:

	Established Mint	Baby Mint
Application Date	5/22/92	6/10/92
Air Temp	64 F	77 F
Soil Temp	62 F	80 F
Wind	0	3-5 MPH
Soil Moisture	V Good	Good
Weed Stage	Bedstraw 6-12"	R. Thistle 3"
	Prickly Lettuce 8-12"	

SUMMARY:

Herbicide applications at the established mint site were delayed until a uniform weed stand developed. This resulted in excessive growth, with the majority of the weeds being 10 inches tall. Few treatments were effective in controlling the heavy weed population present. Bedstraw was the dominant weed species at this site. The best bedstraw control was obtained with a 3-way combination of Sinbar + Basagran + Tough at the highest rate. Although the infestation of prickly lettuce was erratic, several treatments provided good control. Treatments which provided better than 90% prickly lettuce control included the high rates of Sinbar + Basagran, and Sinbar + Basagran + Gramoxone. None of the treatments caused significant crop injury to the established mint. In contrast, several treatments resulted in noticeable injury at the baby mint site. Injury was most noticeable with treatments that included Gramoxone. In comparison, similar treatments which included Tough, had no significant crop injury. Greatest injury occurred with the Sinbar + Gramoxone combinations. Basagran + Gramoxone and Sinbar + Basagran + Gramoxone also cause injury, but to a lesser degree. It appears that the addition of Basagran reduces the injury potential of Gramoxone to baby mint.

Table 1. Agronomic data from the Sinbar Reduced Rate Study on established and baby mint in 1992.

Treatment	Rate lb ai/A	Surf 1/	Baby Mint % Crop Injury	Baby Mint Yield Lbs/A	Estabished Mint % Crop Injury	Estabished Mint % Weed Control LACSE	Estabished Mint % Weed Control GALAP 2/
Sinbar	.2	S	1	6275	0	60	17
Sinbar	.4	S	7	6275	0	17	45
Basagran	.25	C	1	5443	0	30	40
Basagran	.50	C	2	5368	0	43	52
Sinbar + Basagran	.20 .25	C	1	5443	0	78	23
Sinbar + Basagran	.20 .50	C	0	5670	0	68	58
Sinbar + Basagran	.40 .25	C	0	4082	0	93	28
Sinbar + Basagran	.40 .50	C	1	4536	0	92	57
Sinbar + Tough	.20 .45	S	3	6199	0	63	47
Sinbar + Tough	.40 .45	S	0	5443	0	90	35
Basagran + Tough	.25 .45	C	2	5594	0	70	40
Basagran + Tough	.50 .45	C	0	5292	0	87	32
Sinbar + Basagran + Tough	.20 .25 .45	C	2	4612	0	78	58
Sinbar + Basagran + Tough	.20 .50 .45	C	2	5141	2	60	68
Sinbar + Basagran + Tough	.40 .25 .45	C	7	5065	0	63	83
P-Value			.000	.192	.574	.540	.161
LSD (.05)			9.6	1966	3.8	57	44

(Cont'd on next page)

Table 1. (Cont'd)

Treatment	Rate lb ai/A	Surf 1/	Baby Mint % Crop Injury	Baby Mint Yield Lbs/A	Estabished Mint % Crop Injury	Estabished Mint % Weed Control 2/ LACSE	Estabished Mint % Weed Control 2/ GALAP
Sinbar + Basagran + Tough	.40 .50 .45	C	3	4007	3	77	52
Sinbar + Gramoxone	.20 .09	S	47	4460	3	37	13
Sinbar + Gramoxone	.40 .09	S	67	4007	3	63	58
Basagran + Gramoxone	.25 .09	C	38	5141	0	83	17
Basagran + Gramoxone	.50 .09	C	30	4763	3	77	53
Sinbar + Basagran + Gramoxone	.20 .25 .09	C	37	4990	0	60	30
Sinbar + Basagran + Gramoxone	.20 .50 .09	C	20	3402	0	60	27
Sinbar + Basagran + Gramoxone	.40 .25 .09	C	25	3629	0	82	55
Sinbar + Basagran + Gramoxone	.40 .50 .09	C	20	4460	0	92	75
Non-treated	---	-	0	4536	0	60	50
P-Value			.000	.192	.574	.540	.161
LSD (.05)			9.6	1966	3.8	57	44

1/ S = non-ionic surfactant at .25% v/v (1 qt/ 100 gals)
C = crop oil concentrate at 2 pts/A

2/ % Weed control: WSSA-approved weed codes for Prickly lettuce - LACSE (Lactuca serriola), Common bedstraw - GALAP (Galium aparine).

PROJECT TITLE: Pursuit Rate and Application Timing Study on Lentils

PROJECT LEADER: Bob Stougaard, NWARC, Kalispell, MT.

PROJECT PERSONNEL: Todd Keener, NWARC, Kalispell, MT.

OBJECTIVE: To evaluate lentil crop tolerance to preemergence, and postemergence applications of Pursuit.

MATERIALS AND METHODS:

On April 20, 1992 Chilean lentils were planted at 60 lb/A in a Kalispell fine sandy loam (pH 7.7 and OM 4.2%). No fertilizer was applied to the test area. The previous crop in 1991 was spring barley. Plots were 10' by 15', were replicated four times and were arranged in a randomized complete block. Pursuit was applied at three rates preemergence, as well as early and late postemergence. Sencor was included as a standard treatment. Application data was as follows:

Appln	Date	Air Temp	Soil Temp	Rel. Humid	Soil Moist.	Crop Stage
Pre	4/27	62	60	18	Good	N/A
PostA	5/14	90	80	5	Dry	2 node
PostB	5/21	50	48	20	V.Good	3-5 node

Weed stages:

Appln	Wild oat (AVEFA)	Vol Canola (BRSNA)
Pre	1 lf	----
PostA	1 1/2 lf	----
PostB	4-5 lf	1-2 "

SUMMARY:

No injury was observed with preemergence treatments, regardless of the rate used. Crop injury, as reflected in crop height, increased as applications were delayed and as rates increased. Although visual injury was noted, there were no differences in yield among any of the treatments.

Table 2. Agronomic data from the Pursuit Lentil Herbicide Study grown on the Northwestern Agricultural Research Center, Kalispell, MT.

Treatment	Appln Type 1/	Rate Lb ai	% Crop Injury	Percent Control 2/ AVEFA	BRSNA	Yield Lbs/A
Pursuit	Pre	.046	3	51	98	2290
Pursuit	Pre	.031	5	65	95	2090
Pursuit	Pre	.015	3	51	85	2147
Pursuit	Post A	.046	20	61	100	2548
Pursuit	Post A	.031	19	64	95	2390
Pursuit	Post A	.015	6	78	100	2442
Pursuit	Post B	.046	41	88	99	2178
Pursuit	Post B	.031	31	66	100	2189
Pursuit	Post B	.015	19	81	98	2162
Sencor	Pre	.38	3	55	99	2390
Sencor	Post	.25	8	71	100	2333
Untreated	___	___	5	70	60	2077
P VALUE			.0000	.6291	.0002	.4401
LSD (.05)			12.48	.8280	4.334	1.037

1/ Appln Type; Pre = pre emergence 4/27/92
Post A = early post emergence 5/14/92
Post B = post emergence 5/21/92

2/ % Weed control: Letters are a WSSA-approved computer code from Composite List of Weeds.
AVEFA = Wild oat (Avena fatua)
BRSNA = Volunteer canola (Brassica napus)

PROJECT TITLE: Postemergence Herbicide Study on Lentils.

PROJECT LEADER: Bob Stougaard, NWARC, Kalispell, MT.

PROJECT PERSONNEL: Todd Keener, NWARC, Kalispell, MT.

OBJECTIVE: To evaluate new as well as registered herbicides for crop tolerance and weed control in lentils.

MATERIALS AND METHODS:

On April 20, 1992 Chilean lentils were planted at 60 lb/A in a Kalispell fine sandy loam (pH 7.7 and OM 4.2%). No fertilizer was applied to the test area. The previous crop in 1991 was spring barley. Plots were 10' by 15', were replicated four times and were arranged in a randomized complete block. Basagran, Sencor, and Tough were applied with and without 28% UAN, alone or as 2-way tank mix combinations. Applications were made with a CO_2 backpack sprayer in 20 GPA at 20 psi with 11002 flat fan nozzles. Application data was as follows:

Appln	Date	Air Temp	Soil Temp	Rel. Humid	Soil Moist.	Crop Stage
Post	6/1	69	65	37	Fair	7 "

Weed stages:	Appln	Wild oat (AVEFA)	Lambqtr. (CHEAL)
	PostA	5 "	3 - 5"

SUMMARY:

Of the single herbicide applications, Basagran caused the greatest degree of crop injury (60%), followed by Sencor (20%) and Tough (10%). The addition of 28% UAN did not increase the amount of injury. Of the tank-mixed treatments, Basagran combinations caused the most injury (75%). Tough plus Sencor caused significant injury (35%), but it was the safest tank mix combination. Common lambsquarters was the dominant weed species present. Lambsquarters control was most complete with tank mix combinations of Sencor.

Table 1. Agronomic data from the Basagran Lentil Herbicide Study conducted on the NWARC, Kalispell, MT.

Treatment	Rate Lb ai/A	% Crop Injury	Percent Control /1 CHEAL	AVEFA	Yield Lb/A
Basagran	.25	50	47	96	1127
Basagran + UAN 28 % 2/	.25	70	53	47	1004
Sencor	.15	18	75	87	1154
Sencor + UAN 28%	.15	19	85	89	1021
Tough	.23	10	40	90	798
Tough + UAN 28%	.23	9	48	77	977
Basagran + Sencor	.25 .15	75	93	86	1163
Basagran + Sencor + UAN 28%	.25 .15	75	90	83	1313
Basagran + Tough	.25 .23	75	83	63	1399
Basagran + Tough + UAN 28%	.25 .23	82	95	84	1534
Tough + Sencor	.23 .15	38	90	86	1314
Tough + Sencor + UAN 28%	.23 .15	32	90	90	1534
Nontreated	--	3	33	80	1019
P VALUE		.000	.019	.004	.595
LSD(0.05 by t)=		9.92	41.1	20.3	751

1/ % Weed Control: Weed codes are WSSA-approved computer code from Composite List of Weeds.
CHEAL = Lambsquarter (Chenopodium album)
AVEFA = Wild oat (Avena fatua)

2/ UAN 28% liquid nitrogen added at 1 gallon/A rate

PROJECT TITLE: Herbicide Tolerance Study on Canola

PROJECT PERSONNEL: Pete Fay, P&SS, MSU, Bozeman, MT.
Ed Davis, CARC, Moccasin, MT.
Bob Stougaard, NWARC, Kalispell, MT.
Todd Keener, NWARC, Kalispell, MT.

OBJECTIVE: To evaluate various herbicides for potential use in canola.

MATERIALS AND METHODS:

The canola variety IMC-01 was seeded on April 20, 1992 to the test area at 7 lb/A (PLS). Included with the seed was a mixture of spring barley and wheat to contribute to the volunteer weed spectrum. The area was fertilized on 4/23/92 to achieve 70 lb/A N, 30 lb/A P_2O_5, and 30 lb/A sulfur. Plots were 10 by 15 ft, were replicated three times and were arranged in a randomized complete block. Soil type for the test area was a Kalispell fine sandy loam, with a pH of 7.7 and organic content of 4.2%. Twelve treatment were applied preplant incorporated on April 16 and twenty treatments were applied postemergence on May 12 when canola was in the 4 - 5 leaf stage. The weed population consisted mainly of wild oat, with few broadleaf weeds present. Applications were made with a CO_2 backpack sprayer in 20 GPA at 20 psi with 11002 flat fan nozzles. Application data was as follows:

Appln	Date	Stage of Growth		Air	Soil	Rel	Soil
		Canola	AVEFA	Temp	Temp	Humid	Moisture
PPI	4/16	NA	NA	60	57	20	Dry
Post	5/12	cot-2lf	2.5lf	60	60	10	Dry

Harvest was taken from a 60 sq ft area using a Hege 125B plot combine on 8/14.

SUMMARY:

Of the preplant incorporated treatments, injury was greatest for Eptam and Sonolan. Treflan, Prowl, BAS-514 and Fargo did not cause noticeable crop damage. None of these treatments provided acceptable wild oat control. Of the postemergence herbicides, injury was most severe with Banvel, Tordon, Tough, and Stinger. Broadleaf pressure was minor, so the effect of these treatments on broadleaf weed control can not be determined. Fusilade provided the most complete wild oat control of all the herbicides evaluated.

Table 1. Agronomic data from the Canola Herbicide Study conducted at NWARC in Kalispell,MT.

Treatment	Rate Lb ai/A	Appn	% Crop Injury	% Control AVEFA 1/	Yield Lb/A
Treflan	0.75	PPI	0	37	1009
Treflan	1.00	PPI	0	40	1344
Sonalan	0.75	PPI	5	53	1355
Sonalan	1.00	PPI	3	68	1681
Prowl	0.75	PPI	0	42	1361
Prowl	1.00	PPI	0	38	1388
Eptam	3.00	PPI	47	67	898
Eptam	4.00	PPI	18	80	1533
Fargo	1.00	PPI	0	20	1307
Fargo	1.50	PPI	0	23	976
Bas 514	0.25	PPI	0	10	827
Bas 514	0.375	PPI	0	0	580
Poast + COC	0.187 1 qt/A	Post	12	74	1011
Poast + COC	0.370 1 qt/A	Post	8	92	1425
Fusilade 2000 + COC	0.125 1 qt/A	Post	3	99	1705
Fusilade 2000 + COC	0.187 1 qt/A	Post	10	96	1309
Assure + COC	0.100 1:100	Post	0	99	1653
Assure + COC	0.150 1:100	Post	3	100	1359
Whip + COC	0.10 1 qt/A	Post	7	82	1158
Whip + COC	0.15 1 qt/A	Post	8	73	1155
Poast + Fusilade 2000 COC	0.14 0.093 1 qt/A	Post	7	94	1371
Mustar + NIS	0.013 0.25 %	Post	8	47	905

(Cont'd)

Table 1 (Cont'd). Canola Herbicide Study

Treatment	Rate Lb ai/A	Appn	% Crop Injury	% Control AVEFA 1/	Yield Lb/A
Mustar + NIS	0.026 0.25 %	Post	7	67	1207
Pyridate	0.93	Post	18	15	159
Pyridate	1.3	Post	28	15	465
Stinger	0.187	Post	5	0	323
Stinger	0.25	Post	17	0	291
Banvel	0.06	Post	20	7	537
Tordon	0.03	Post	30	0	264
Nontreated			0	10	657
P-Value			.002	.000	.000
LSD (0.05 by t)=			20	26	722

1. % Weed Control: Weed codes are WSSA-approved computer code from Composite List of Weeds.
AVEFA = Wild Oat (Avena fatua)

PROJECT TITLE: Poast Rate and Timing Study on Canola

PROJECT PERSONNEL: Pete Fay, P&SS, MSU, Bozeman, MT.
Ed Davis, CARC, Moccasin, MT.
Bob Stougaard, NWARC, Kalispell, MT.
Todd Keener, NWARC, Kalispell, MT.

OBJECTIVE: To establish the optimum Poast rate and application timing for wild oat control in canola.

MATERIALS AND METHODS:

The canola variety IMC-01 was seeded on April 20, 1992 to the test area at 7 lb/A (PLS). Included with the seed was a mixture of spring barley and wheat to contribute to the volunteer weed spectrum. The area was fertilized on 4/23/92 to achieve 70 lb/A N, 30 lb/A P_2O_5, and 30 lb/A sulfur. Plots were 10 by 15 ft, were replicated three times and were arranged in a randomized complete block. Soil type for the test area was a Kalispell fine sandy loam, with a pH of 7.7 and organic content of 4.2%. Poast was applied at two rates and three wild oat growth stages (3, 5, and 7 leaf stage of growth). Applications were made with a CO_2 backpack sprayer in 20 GPA at 20 psi with 11002 flat fan nozzles. All treatments included the surfactant Dash. Application data was as follows:

Appln	Date	Stage of Growth		Air	Soil	Rel	Soil
		Canola	AVEFA	Temp	Temp	Humid	Moisture
Post1	5/12	cot-2lf	2.5	60	60	10	Dry
Post2	5/21	4 lf	4-5lf	50	48	40	Wet
Post3	5/27	4-6lf	7 lf	68	65	58	Wet

Harvest was taken from a 60 sq ft area using a Hege 125B plot combine.

SUMMARY:

Control was most complete with the earliest applications. Control increased as rates increased regardless of application timing. All herbicide treatments produced canola yields greater than the nontreated check.

Table 1. Agronomic data from the Poast Rate and Timing Study on Canola conducted at the NWARC in Kalispell, MT.

Treatment	Rate lb ai/A	Appln 1/	% Crop Injury	% AVEFA Control 2/	Yield lb/A
Poast	.187	Post1	0	78	1675
Poast	.375	Post1	0	97	1778
Poast	.187	Post2	0	40	1452
Poast	.375	Post2	0	88	1898
Poast	.187	Post3	5	43	1155
Poast	.375	Post3	17	47	1392
Check	----	-----	0	0	687
		P-Value	.2345	.000	.008
		LSD(.05)	15.4	16.6	579

1/ Appln: Post1 = 3 leaf wild oat, Post2 = 5 leaf wild oat
Post3 = 7 leaf wild oat

2/ % AVEFA Control, AVEFA is WSSA-approved weed code for wild oat (Avena fatua).

PROJECT TITLE: Evaluation of Ally for the Control of Sulfur Cinquefoil

PROJECT LEADER: Bob Stougaard, NWARC, Kalispell, MT.

PROJECT PERSONNEL: Todd Keener, NWARC, Kalispell, MT.

OBJECTIVE: This study was established near Hot Springs, MT to evaluate Ally alone or in combination with 2,4-D and/or Tordon for the control of sulfur cinquefoil.

MATERIAL AND METHODS:

The test site was established in native rangeland with 90 % of the vegetation consisting of sulfur cinquefoil and the remainder comprised of downy brome, crested wheatgrass and western salsify. Treatments were applied on June 5, 1992 when the majority of plants were 12-14 inches in height and at the 25 % bloom stage. Treatments were applied with a backpack sprayer equipped to deliver 20 GPA at 20 psi with 11002 flat fan nozzles. Plots were 10 by 15 ft and treatments were replicated 3 times. Environmental conditions were as follows:

Wind: 3-5 MPH, Air Temp: 70 F, Soil Temp: 68 F, Soil Moisture: Dry, Rel Hum. 2%

SUMMARY:

At the July rating, all herbicide treatments afforded some degree of control relative to the nontreated check. However there were no significant differences between any of the herbicide treatments. The greatest degree of control was obtained with Tordon + 2,4-D. Treatment differences were more apparent at the September evaluation. The September control evaluations represent the degree of regrowth observed for the various treatments.

There appeared to be antagonism between Ally and 2,4-D. This was especially evident at the 0.03 lb/A rate of Ally alone compared to similar rates mixed with 2,4-D. Ally at 0.03 lb/A provided 90% control. When mixed with 2,4-D control was reduced to approximately 53 %. A similar response was observed with Ally at 0.015 lb/A. When combined with 2,4-D control was reduced or remained the same. This was also the case when Tordon was included. Ally at 0.015 lb/A + Tordon at 0.25 lb/A afforded 80 % control. When 2,4-D was added to the combination, control was reduced to 40 %. When the Tordon rate was doubled to 0.5 lb/A, the effects of antagonism were over come. At the very least it appears that the addition of 2,4-D does not improve control and evidence suggests that control can actually be reduced.

Additional studies should be conducted to verify the apparent antagonism between Ally and 2,4-D on sulfur cinquefoil. Additional application timings should also be investigated. Spring or especially fall applications during the rosette stage might provide better control and allow for more economical use rates.

Table 1. Agronomic data from the Sulfur Cinquefoil Study located in Sanders County, Montana. 1992

Treatment 1/	Rate Lb ai/A	% PTLRC 7/2/92	Control 2/ 9/21/92
Ally + NIS .25%	.015	31.7	58.3
Ally + NIS .25%	.030	38.3	90.0
Ally + NIS .25%	.060	36.7	91.7
Ally + Tordon + NIS.25%	.015 .25	43.3	80.0
Ally + Tordon + NIS .25%	.015 .50	41.7	91.7
Ally + 2,4-D + NIS.125%	.015 .25	53.3	26.7
Ally + 2,4-D + NIS.125%	.015 .50	66.7	51.7
Ally + 2,4-D + NIS.125%	.030 .25	63.3	58.3
Ally + 2,4-D + NIS.125%	.030 .50	51.7	48.3
Ally + Tordon + 2,4-D + NIS.125%	.015 .25 .25	61.7	40.0
Ally + Tordon + 2,4-D + NIS.125%	.015 .50 .25	61.7	93.3
Tordon	.25	45.0	58.3
Tordon	.50	48.3	83.3
2,4-D	1.0	63.3	56.7
Tordon + 2,4-D	.25 1.0	70.0	90.0
Nontreated	----	0	16.7
Nontreated	----	0	18.3
	P-Value	.0000	.0000
	LSD .05	11.74	25.57

1/ NIS = non-ionic surfactant R-11 (90% active)
.25% and .125% indicate added at % spray volume
2/ % Weed Control, PTLRA is the WSSA-approved weed code for Sulfur Cinquefoil (Potentilla recta)

YEAR/PROJECT: 1992/755 1980 INTRASTATE ALFALFA YIELD TRIAL – DRYLAND

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

This was the 13th season of production for this nursery. Plots were harvested 6/2, 7/6 and 8/4/92. Total forage yields for 1992 ranged from 1.40 tons/acre for 'Raidor' to 4.02 tons/acre for 'Ladak–65'. Mean yield for 1992 was 3.03 tons/acre. Total yields over the 13 years since establishment ranged from 40.92 tons/acre for 'Marathon' to 55.06 tons/acre for Ladak–65 which had yields above the mean for 11 of the 13 years.

VARIETY	STAND	6/2/92	7/6/92	8/4/92	TOTAL
	%	YIELD (t/a)			
Ladak–65	97	2.22	1.00	0.79	4.02
Spredor II	95	2.19	0.93	0.72	3.83
Perry	90	1.87	0.94	0.74	3.55
Armor	87	1.67	0.90	0.83	3.39
Baker	93	1.75	0.84	0.72	3.31
Ranger	83	1.53	0.85	0.87	3.25
WL 220	90	1.50	0.89	0.85	3.24
Vancor	83	1.41	1.15	0.67	3.23
Cascade	77	1.43	0.86	0.91	3.20
Vernal	80	1.63	0.88	0.66	3.17
Classic	82	1.56	0.79	0.62	2.97
Super 721	85	1.46	0.73	0.73	2.92
Anchor	75	1.40	0.76	0.70	2.85
Spectrum	70	1.28	0.72	0.75	2.76
Thor	62	1.09	0.59	0.63	2.31
Marathon	37	1.09	0.53	0.52	2.14
Raidor	28	0.67	0.37	0.37	1.40
Means	77	1.51	0.81	0.71	3.03
LSD(0.05)	16	0.31	0.30	0.27	0.66
P–VALUE	0.00	0.00	0.00	0.04	0.00
CV(s/mean)	12.2	12.5	22.4	22.5	13.2

1980 INTRASTATE ALFALFA YIELD TRIAL – DRYLAND

VARIETY	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	TOTAL
							t/a							
LADAK–65	1.48	4.29	2.81	3.31	3.19	4.76	4.26	5.74	5.08	5.40	4.28	6.44	4.02	55.06
VANCOR	1.81	4.48	2.51	2.98	3.41	5.59	4.44	5.82	4.54	4.73	4.15	4.59	3.23	52.28
ARMOR	1.79	4.14	2.34	2.91	3.12	5.36	4.49	6.04	4.83	4.84	4.13	5.49	3.40	52.88
BAKER	1.81	4.07	2.30	2.61	3.01	5.04	4.26	6.20	4.66	4.96	4.61	5.87	3.31	52.71
ANCHOR	1.70	4.53	2.68	2.65	3.05	5.04	4.56	5.63	4.39	4.34	3.42	4.40	2.85	49.24
PERRY	1.67	4.06	2.38	2.43	3.18	4.79	3.86	5.24	4.79	4.98	4.54	5.75	3.55	51.22
CASCADE	1.86	3.90	2.42	2.67	3.09	5.52	4.24	5.61	4.15	4.44	3.98	5.42	3.20	50.50
SPREDOR II	1.52	4.74	2.48	3.19	3.55	5.22	4.28	5.28	3.85	4.37	3.37	5.64	3.83	51.32
SUPER 721	1.45	3.99	2.44	2.85	3.00	5.35	4.21	5.36	4.70	4.56	3.79	4.82	2.92	49.44
THOR	1.99	4.73	2.75	2.71	3.32	5.17	4.42	5.36	3.85	3.83	3.33	3.92	2.31	47.69
SPECTRUM	1.80	4.63	2.69	2.80	3.07	4.93	3.93	5.47	4.28	3.95	3.57	4.64	2.76	48.52
WL 220	1.69	4.02	2.01	2.46	3.40	4.99	4.06	5.48	4.26	4.44	3.96	5.01	3.25	49.03
CLASSIC	1.74	3.78	2.05	2.83	2.81	4.84	4.09	5.29	4.60	4.37	4.03	5.15	2.97	48.55
VERNAL	1.79	4.09	2.62	2.32	2.97	4.82	4.03	5.28	4.17	4.38	3.36	4.93	3.17	47.93
RAIDOR	1.84	4.40	2.40	2.86	3.33	5.43	3.93	4.99	3.35	3.50	2.55	2.79	1.40	42.77
RANGER	1.34	3.38	2.32	2.34	2.41	4.20	3.50	4.69	4.05	4.06	3.86	5.35	3.25	44.75
MARATHON	1.66	4.07	2.39	2.44	2.86	4.52	3.53	4.83	3.27	3.39	2.60	3.22	2.14	40.92
Mean	1.70	4.19	2.45	2.73	3.10	5.03	4.12	5.43	4.28	4.38	3.74	4.91	3.03	49.11
LSD(0.05)		0.49	0.72	0.61	0.92	1.26	0.86	0.83	0.86	0.85	0.87	1.10	0.66	
P–VALUE		0.00	0.73	0.08	0.78	0.78	0.49	0.06	0.01	0.00	0.00	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	13.5	13.2	
Precip(in)	23.6	23.7	18.2	21.0	19.9	17.6	23.2	22.0	13.9	23.4	26.5	20.0	18.4	

FERTILIZER: Spring 1980 – P_2O_5 – 132 lbs/a
Fall 1981 – P_2O_5 – 52 lbs/a
Spring 1984 – P_2O_5 – 90 lbs/a
K_2O – 50 lbs/a
S – 40 lbs/a
Fall 1986 – P_2O_5 – 88 lbs/a
K_2O – 120 lbs/a
S – 50 lbs/a
Fall 1989 – P_2O_5 – 132 lbs/a
K_2O – 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: 1992/755 1988 INTRASTATE ALFALFA YIELD TRIAL – DRYLAND

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

Twenty alfalfa cultivars, with fall dormancy ratings from 1–4 and Verticillium wilt resistance ratings from S–R, were seeded 5/4/88. The plots were harvested 6/1, 7/4 and 8/3/92. The top yielding variety was 'Premier', with 5.38 tons/acre. Thirteen other varieties had yields statistically similar to Premier's. The check varieties 'Vernal', 'Thor' and 'Ladak–65' had significantly lower yields than all the other varieties. These varieties have fall dormancy ratings of 1–4, but they are the only varieties with no vert wilt resistance.

Total yields for 1988–1992 averaged 25.45 tons/acre. 'DK–125' was the highest yielder, with a total production of 28.13 tons/acre, and Ladak–65 was the lowest, with 22.04 tons/acre. Vernal and Ladak–65 had significantly lower yields than all the other cultivars. Although these varieties are very winter–hardy, they do not have the disease resistance of the others.

VARIETY	MTNO	FD[1/]	VW[2/]	6/1/92	7/4/92	8/3/92	TOTAL
				----Total Dry Matter Yield (t/a)----			
Premier	201	4	R	1.86	1.26	2.27	5.38
Pioneer 5432	193	4	R	1.98	1.23	2.14	5.34
DK–125	203	3	R	1.93	1.28	2.13	5.34
Sure	195	3	R	1.91	1.29	2.02	5.21
Garst–636	202	2	R	1.93	1.20	2.07	5.20
Legend	199	4	R	1.91	1.21	2.03	5.15
WL–316	144	4	R	1.91	1.23	1.98	5.13
AgriBoss	194	3	MR	1.95	1.19	1.97	5.11
ICB–34	191	4	LR	1.86	1.21	1.96	5.02
Vista–661	198	3	MR	1.86	1.18	1.97	5.00
Vista–663	197	3	MR	1.91	1.13	1.96	5.00
Arrow	192	3	R	1.85	1.14	2.01	4.99
WL–225	184	2	R	1.91	1.11	1.94	4.96
Kingstar	200	3	R	1.70	1.14	2.08	4.92
Edge	196	4	R	1.86	1.14	1.88	4.87
Sparta	174	3	R	1.86	1.09	1.89	4.84
Wrangler	146	2	LR	1.95	1.09	1.78	4.83
Vernal	8	2	--	1.73	1.06	1.75	4.53
Thor	1	4	--	1.82	1.11	1.59	4.51
Ladak–65	2	1–2	S	1.88	0.90	1.49	4.26
Mean				1.88	1.16	1.94	4.98
LSD(0.05)				0.15	0.14	0.29	0.51
P–VALUE				0.05	0.00	0.00	0.00
CV(s/mean)				5.6	8.3	10.4	7.2

1/ Fall dormancy rating
2/Verticillium wilt resistance

1988 INTRASTATE ALFALFA YIELD TRIAL – DRYLAND

VARIETY	MTNO	FD[1/]	VW[2/]	1988	1989	1990	1991	1992	TOTAL
				t/a					
DK–125	203	3	R	2.18	5.86	7.28	7.47	5.34	28.13
Vista–663	197	3	MR	2.16	5.94	7.03	7.80	5.00	27.92
Legend	199	4	R	2.10	5.73	6.73	7.43	5.15	27.14
Edge	196	4	R	2.28	5.58	6.57	7.47	4.87	26.76
Sure	195	3	R	2.07	5.67	6.34	7.28	5.21	26.57
Arrow	192	3	R	2.01	5.18	6.52	7.41	4.99	26.11
Sparta	174	3	R	1.90	5.59	6.35	7.31	4.84	25.99
Garst–636	202	2	R	1.96	5.37	6.13	7.24	5.20	25.90
Pioneer 5432	193	4	R	1.82	5.20	5.98	7.30	5.34	25.64
Vista–661	198	3	MR	1.98	5.61	6.02	6.91	5.00	25.52
Premier	201	4	R	1.87	4.81	6.03	7.30	5.39	25.39
AgriBoss	194	3	MR	1.90	5.37	5.69	7.20	5.12	25.28
ICB–34	191	4	LR	1.90	5.15	5.97	7.09	5.01	25.12
Thor	1	4	––	1.94	5.51	6.10	6.90	4.52	24.97
Wrangler	146	2	LR	2.06	5.54	5.58	6.88	4.83	24.88
WL–316	144	4	R	2.03	4.89	5.71	7.01	5.12	24.76
WL–225	184	2	R	1.88	4.99	5.68	6.83	4.96	24.34
Kingstar	200	3	R	2.03	4.86	5.11	6.82	4.92	23.73
Vernal	8	2	––	1.88	5.30	4.74	6.29	4.54	22.74
Ladak–65	2	1–2	––	2.10	5.00	4.68	6.00	4.27	22.04
Mean				2.00	5.36	6.01	7.10	4.98	25.45
LSD(0.05)				0.34	0.51	0.52	0.60	0.51	1.64
P–VALUE				0.45	0.00	0.00	0.00	0.00	0.00
CV(s/mean)				11.9	6.8	6.2	5.9	7.2	4.6

1/ Fall dormancy rating
'2/Vert wilt resistance

Seeding date: 5/4/88
Fertilizer: Spring 1988 – P_2O_5 – 176 lbs/a
Pesticides: 10/26/89 – Sencor – 1 lb AI/a

YEAR/PROJECT: 1992/755 1988 INTRASTATE ALFALFA YIELD TRIAL – IRRIGATED

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

The plots were harvested once, on 6/8/92. The study was then terminated and the nursery plowed down. There was considerable overlap in significant differences among the varieties. 'Vista–661', 'Premier', 'WL–225' and 'Vista–663' (with fall dormancy ratings of 2–4 and vert wilt resistance of MR–R) yielded significantly more forage than 'ICB–34', 'Vernal', 'Legend' and 'AgriBoss'(FD 2–4, VW none to MR). Correlation analysis among FD and VW ratings, %vert wilt (visual estimate) and yield revealed no correlations significant at the $P<0.05$ level. FD rating was actually more closely correlated with yield ($r=-0.30$, $P=0.19$) than was VW resistance rating ($r=0.25$, $P=0.30$).

VARIETY	MTNO	FD[1/]	VW[2/]	VERT WILT %	STAND %	6/8/92 YIELD t/a
Vista–661	198	3	MR	35	93	2.85
Premier	201	4	R	25	96	2.71
WL–225	184	2	R	31	93	2.70
Vista–663	197	3	MR	43	84	2.70
Sparta	174	3	R	34	94	2.67
DK–125	203	3	R	34	95	2.66
Garst–636	202	2	R	33	94	2.59
Ladak–65	2	1–2	S	28	89	2.58
Kingstar	200	3	R	30	86	2.53
Wrangler	146	2	LR	21	86	2.53
Arrow	192	3	R	36	94	2.48
Sure	195	3	R	34	89	2.45
Edge	196	4	R	41	89	2.41
Pioneer 5432	193	4	R	28	96	2.39
Thor	1	4	--	31	76	2.32
WL–316	144	4	R	45	93	2.28
ICB–34	191	4	LR	56	86	2.24
Vernal	8	2	--	28	86	2.18
Legend	199	4	R	23	94	2.15
AgriBoss	194	3	MR	36	85	1.99
LSD(0.05)				20	8	0.45
P–VALUE				0.18	0.00	0.02
CV(s/mean)				41.9	6.4	12.9

Seeding date: 5/3/88
Fertilizer: P_2O_5 – 176 lbs/a in 1988
Pesticide: Sencor – 1 lb AI/a – 10/26/89

[1/] Fall dormancy rating
[2/] Verticillium wilt resistance rating

YEAR/PROJECT: 1992/755 1989 INTRASTATE ALFALFA YIELD TRIAL – DRYLAND

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

Twenty–three alfalfa cultivars were seeded in an RCB design with four replications on 24 April, 1989. The nursery was harvested 4 times in 1992. Total yields for 1992 ranged from 4.38 tons/acre ('VS–775') to 5.54 tons/acre ('Fortress'). Total yields for 1989–1992 averaged 19.46 tons/acre. Pioneer '5364', Fortress and 'Arrow' yielded over 21 tons/acre over the 4–year period. These varieties have fall dormancy ratings of 3–4 and are MR–R for vert wilt resistance. 'AP–8735', VS–775 and 'Ladak–65' produced less than 18 tons/acre over this period. The relationship between higher yields and more vert wilt resistance is not as apparant under dryland as it is under irrigation.

VARIETY	MTNO	6/2/92	7/6/92	8/4/92	10/2/92	TOTAL
		Total Dry Matter Yield (t/a)				
FORTRESS	218	2.40	1.19	1.21	0.74	5.54
5364	213	2.66	1.23	1.24	0.75	5.88
ARROW	151	2.42	1.11	1.15	0.65	5.33
XAL–72	215	2.46	1.31	1.39	0.75	5.91
CIMARRON VR	211	2.19	1.08	1.06	0.69	5.02
GARST–630	205	2.57	1.25	1.26	0.76	5.84
THOR	1	2.35	1.11	1.03	0.55	5.04
WL–317	204	2.60	1.21	1.25	0.66	5.71
VS–872	210	2.48	1.12	1.06	0.56	5.21
VERNEEMA	220	2.37	1.16	1.12	0.57	5.23
GARST–636	202	2.45	1.11	1.08	0.59	5.23
MILKMAKER	208	2.36	1.17	1.16	0.58	5.26
5262	214	2.56	1.19	1.12	0.55	5.42
SABRE	216	2.37	1.03	1.00	0.49	4.88
86I–08	217	2.39	1.08	1.01	0.50	4.98
MULTIKING	219	2.31	1.11	1.06	0.50	4.98
EAGLE	212	2.18	1.04	1.01	0.50	4.73
WRANGLER	146	2.40	0.95	0.87	0.45	4.67
VERNAL	8	2.15	0.96	0.85	0.46	4.41
LADAK–65	2	2.48	0.86	0.78	0.24	4.36
APOLLO SUPREME	206	2.25	1.06	0.99	0.54	4.84
AP–8735	207	2.23	1.00	0.97	0.51	4.71
VS–775	209	2.12	0.96	0.95	0.35	4.38
Mean		2.38	1.10	1.07	0.56	5.11
LSD(0.05)		0.28	0.14	0.22	0.20	0.76
P–VALUE		0.01	0.00	0.00	0.00	0.00
CV(s/mean)		8.3	9.0	14.7	25.2	10.5

1989 INTRASTATE ALFALFA YIELD TRIAL – DRYLAND

VARIETY	MTNO	FD[1/]	VW[2/]	1989	1990	1991	1992	TOTAL
5364	213	4	MR	1.82	6.77	7.20	5.88	21.67
FORTRESS	218	4	R	2.21	6.65	7.24	5.54	21.63
ARROW	151	3	R	2.10	6.68	6.99	5.34	21.10
GARST–630	205	4	MR	1.88	6.37	6.58	5.84	20.67
VS–872	210	–	––	1.99	6.71	6.54	5.21	20.44
XAL–72	215	–	––	1.61	6.18	6.68	5.90	20.37
VERNEEMA	220	4	MR	1.86	6.56	6.44	5.23	20.08
CIMARRON VR	211	5	LR	2.02	6.29	6.65	5.02	19.97
WL–317	204	3	R	1.75	5.85	6.54	5.71	19.85
THOR	1	4	––	1.76	6.42	6.55	5.04	19.77
MILKMAKER	208	3	––	1.72	6.44	6.33	5.27	19.75
5262	214	2	LR	1.61	6.20	6.33	5.42	19.56
GARST–636	202	2	R	1.64	6.30	6.36	5.23	19.52
SABRE	216	4	HR	1.91	6.34	6.26	4.88	19.40
86I–08	217	–	HR	1.75	6.24	6.24	4.98	19.21
EAGLE	212	4	MR	1.66	6.30	6.10	4.73	18.78
APOLLO SUPREME	206	4	R	1.62	6.37	5.72	4.84	18.55
MULTIKING	219	3	HR	1.54	5.51	6.18	4.98	18.21
WRANGLER	146	2	LR	1.61	5.97	5.91	4.68	18.16
VERNAL	8	2	––	1.78	5.94	5.87	4.41	18.00
AP–8735	207	–	––	1.60	5.76	5.67	4.70	17.73
VS–775	209	–	––	1.54	6.20	5.57	4.38	17.68
LADAK–65	2	1–2	S	1.51	5.83	5.79	4.36	17.49
LSD(0.05)				0.24	0.70	0.91	0.76	2.24
P–VALUE				0.00	0.05	0.01	0.00	0.00
CV(s/mean)				9.8	8.0	10.2	10.5	8.2

[1/]Fall dormancy rating
[2/]Vert wilt resistance

YEAR/PROJECT: 1992/755 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 cultivars were seeded in an RCB design with 4 replications on 20 May,1989. Plots were harvested 4 times. Total 1992 season yields were highest for 'XAL–72', 'Garst–636', Pioneer '5262', 'Garst–630', Pioneer'5364', 'Multiking', 'Sabre' and 'AP–8735'. Except for 'AP–8765', these cultivars are rated LR–HR for vert wilt and 2–4 for fall dormancy. The check varieties 'Vernal' and 'Ladak 65' and the cultivar designated 'Glean–Cycle 1' were the lowest yielding entries. These cultivars are rated 1–2 for fall dormancy, but have no vert wilt resistance. Over the 4 years from 1989–1992 'XAL–72' has had the highest total yield (23.08 t/a) and Ladak–65 has had significantly lower yield than any other variety (16.92 t/a).

				YIELD				
VARIETY	MTN	FD[1]	VW[2]	6/8	7/7	8/6	9/29	Total
				t/a				
XAL–72	215	––	––	2.59	1.78	1.41	0.45	6.22
Garst–636	202	2	R	2.61	1.62	1.27	0.44	5.93
5262	214	2	LR	2.69	1.66	1.21	0.35	5.91
Garst–630	205	4	MR	2.52	1.65	1.26	0.39	5.82
5364	213	4	MR	2.57	1.62	1.25	0.38	5.81
Multiking	219	3	R	2.48	1.66	1.26	0.38	5.78
Sabre	216	4	HR	2.51	1.53	1.26	0.41	5.71
AP–8735	207	––	––	2.47	1.60	1.25	0.39	5.70
Arrow	151	3	R	2.48	1.53	1.17	0.40	5.58
Milkmaker	208	3	S	2.46	1.53	1.20	0.39	5.57
WL–87–21	224	––	––	2.41	1.54	1.23	0.39	5.57
WL–317	204	3	R	2.51	1.50	1.20	0.35	5.55
86I–08	217	––	HR	2.40	1.58	1.21	0.34	5.53
Fortress	218	4	R	2.37	1.50	1.23	0.43	5.53
Cimarron VR	211	5	LR	2.32	1.49	1.22	0.43	5.45
Eagle	212	4	MR	2.28	1.51	1.22	0.41	5.41
Apollo Supreme	206	4	R	2.33	1.51	1.17	0.35	5.36
VS–775	209	––	––	2.29	1.48	1.11	0.33	5.20
MTV4–V1	222	––	––	2.36	1.41	1.08	0.35	5.19
NC831XMTV1–V2	223	––	––	2.23	1.47	1.15	0.34	5.19
VS–872	210	––	––	2.26	1.40	1.12	0.37	5.15
Wrangler	146	2	LR	2.41	1.37	1.05	0.31	5.13
Vernema	220	4	MR	2.13	1.46	1.15	0.36	5.09
Thor	1	4	––	2.20	1.40	1.08	0.31	4.98
WL–88–9	225	––	––	2.00	1.43	1.15	0.38	4.96
Vernal	8	2	––	2.12	1.27	1.02	0.26	4.67
Glean–Cycle 1	221	––	––	1.98	1.21	0.95	0.25	4.38
Ladak–65	2	1–2	S	2.20	1.07	0.94	0.14	4.34
LSD(0.05)				0.23	0.17	0.12	0.08	0.55
P–VALUE				0.00	0.00	0.00	0.00	0.00
CV(s/mean)				6.9	8.0	7.6	15.5	7.3

1/ Fall dormancy rating

2/ Vert wilt resistance rating

1989 INTRASTATE ALFALFA YIELD TRIAL – IRRIGATED

VARIETY	MTN	FD[1/]	VW[2/]	YIELD 1989	1990	1991	1992	TOTAL
				t/a				
XAL–72	215	––	––	2.80	6.99	7.06	6.22	23.08
5262	214	2	LR	2.94	7.04	6.95	5.91	22.84
Fortress	218	4	R	3.47	6.76	6.61	5.53	22.37
VS–775	209	––	––	3.26	7.11	6.72	5.20	22.29
5364	213	4	MR	2.89	6.61	6.80	5.82	22.11
Garst–636	202	2	R	2.85	6.67	6.61	5.93	22.06
Vernema	220	4	MR	3.38	6.72	6.78	5.10	21.98
86I–08	217	––	HR	3.06	6.62	6.59	5.53	21.79
VS–872	210	––	––	3.27	6.82	6.45	5.15	21.69
Multiking	219	3	R	2.72	6.49	6.67	5.78	21.65
Cimarron VR	211	5	LR	3.20	6.58	6.36	5.46	21.59
Arrow	151	3	R	3.08	6.50	6.38	5.58	21.53
Milkmaker	208	3	S	2.92	6.53	6.49	5.58	21.51
Garst–630	205	4	MR	3.00	6.15	6.53	5.82	21.50
Eagle	212	4	MR	2.98	6.63	6.48	5.42	21.50
WL–87–21	224	––	––	3.26	6.46	6.19	5.57	21.47
Sabre	216	4	HR	2.93	6.36	6.45	5.71	21.44
AP–8735	207	––	––	2.86	6.39	6.48	5.70	21.42
WL–317	204	3	R	2.96	6.35	6.16	5.55	21.02
Apollo Supreme	206	4	R	2.78	6.52	6.31	5.36	20.97
Thor	1	4	––	2.95	6.34	6.51	4.98	20.78
MTV4–V1	222	––	––	2.61	6.48	5.95	5.19	20.24
WL–88–9	225	––	––	2.65	6.15	6.36	4.96	20.12
NC831XMTV1–V2	223	––	––	2.33	6.32	6.25	5.19	20.08
Wrangler	146	2	LR	2.63	5.83	5.76	5.13	19.34
Glean–Cycle 1	221	––	––	2.66	6.24	5.95	4.38	19.22
Vernal	8	2	––	2.64	5.72	5.45	4.67	18.48
Ladak–65	2	1–2	S	2.45	5.18	4.94	4.35	16.92
LSD(0.05)				0.32	0.52	0.41	0.55	1.31
P–VALUE				0.00	0.00	0.00	0.00	0.00
CV(s/mean)				7.9	5.8	4.5	7.3	4.4

Seeding date: 4/20/89
Fertilizer: P_2O_5 – 176 lbs/a in 1989
Pesticide: Sencor – 1 lb AI/a – 10/26/89
Poast – 1/2 pt/a – 5/4 & 5/22/89

[1/] Fall Dormancy rating
[2/] Vert wilt resistance

YEAR/PROJECT: 1992/755 1990 INTRASTATE ALFALFA YIELD TRIAL – DRYLAND

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

Twenty alfalfa cultivars were seeded in an RCB design with 4 replications on 18 April,1990. Forage was harvested 4 times in 1992. Differences among varieties were not significant at $P<0.05$. 'DK 135' had the highest yield, with 6.81 tons/acre, while 'Runner' had the lowest yield, with 5.05 tons/acre. Differences among yields for the whole period from 1990–1992 were significant $P=0.04$. DK 135 remains the top producer, with 16.88 tons/acre. Five varieties had significantly lower yields than DK 135: 'Aggresor', 'Ladak 65', 'Wrangler', 'Wilson' and Runner.

VARIETY	MTNO	FD/1	VW/2	HARV–1 6/2/92	HARV–2 7/4/92	HARV–3 8/4/92	HARV–4 10/2/92	TOTAL
				Yield (t/a)				
Mngrn–14	226	--	--	2.86	1.47	1.73	0.88	6.93
DK 135	152	4	MR	2.89	1.38	1.60	0.93	6.81
5472	221	4	MR	2.69	1.41	1.66	0.96	6.72
Arrow	151	3	R	2.89	1.29	1.47	1.02	6.67
Allegiance	223	3	R	2.81	1.37	1.56	0.88	6.61
VS 655	230	--	--	2.89	1.33	1.35	1.00	6.57
5364	213	4	MR	2.88	1.26	1.50	0.78	6.41
WL 317	204	3	R	2.70	1.29	1.49	0.84	6.31
DK 122	224	2	R	2.76	1.26	1.41	0.84	6.28
WL 225	184	2	R	2.71	1.21	1.47	0.85	6.22
5262	214	2	LR	2.84	1.25	1.42	0.68	6.19
Ultra	229	3	R	2.83	1.21	1.31	0.78	6.12
Ladak 65	2	1–2	S	2.95	1.12	1.35	0.61	6.03
Wilson	231	6	--	2.16	1.25	1.49	1.12	6.02
Aggresor	222	4	R	2.55	1.20	1.36	0.79	5.89
Spredor II	128	1	--	2.84	1.11	1.31	0.63	5.88
Wrangler	146	2	LR	2.75	1.11	1.34	0.68	5.88
Multi–plier	227	3	R	2.65	1.22	1.24	0.70	5.82
Husky	225	3	--	2.37	1.20	1.34	0.76	5.66
Runner	228	--	--	2.49	0.91	1.32	0.33	5.05
LSD(0.05)				0.48	0.16	0.36	0.26	1.15
P–VALUE				0.15	0.00	0.46	0.00	0.26
CV(s/mean)				12.4	9.2	17.9	23.1	13.1

/1 Fall dormancy rating
/2 Vert wilt resistance

1990 INTRASTATE ALFALFA YIELD TRIAL – DRYLAND

VARIETY	MTNO	FD/1	VW/2	1990	1991	1992	TOTAL
				Yield (t/a)			
DK 135	152	4	MR	3.08	6.99	6.81	16.88
5472	221	4	MR	3.07	6.68	6.72	16.46
Mngrn–14	226	--	--	2.88	6.59	6.93	16.40
VS 655	230	--	--	3.27	6.52	6.56	16.35
5364	213	4	MR	3.00	6.75	6.41	16.16
Arrow	151	3	R	3.10	6.35	6.67	16.12
Ultra	229	3	R	3.18	6.65	6.13	15.96
Allegiance	223	3	R	3.06	6.24	6.61	15.91
DK 122	224	2	R	3.07	6.54	6.28	15.90
WL 225	184	2	R	3.10	6.16	6.23	15.48
WL 317	204	3	R	2.87	6.26	6.31	15.43
5262	214	2	LR	3.01	6.23	6.19	15.43
Multiplier	227	3	R	3.28	6.30	5.82	15.40
Husky	225	3	--	3.31	6.00	5.66	14.98
Spredor II	128	1	--	3.09	5.95	5.89	14.92
Aggresor	222	4	R	2.97	5.74	5.89	14.61
Ladak 65	2	1–2	S	2.88	5.66	6.03	14.57
Wrangler	146	2	LR	2.52	5.92	5.88	14.32
Wilson	231	6	--	2.33	5.47	6.02	13.81
Runner	228	--	--	2.74	5.16	5.05	12.94
LSD(0.05)				0.40	0.94	1.15	2.05
P–VALUE				0.00	0.03	0.26	0.04
CV(s/mean)				9.5	10.7	13.1	9.4

/1 Fall dormancy rating
/2 Vert wilt resistance

Seeded 4/18/90
Fertilizer: Fall, 1989 – 176 lbs/a P_2O_5

YEAR/PROJECT: 1992/755 1990 INTRASTATE ALFALFA YIELD TRIAL - IRRIGATED

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

Twenty alfalfa varieties were seeded in an RCB design with 4 replications on 18 April, 1990. In 1992, 'Allegiance', '5472', 'DK 135' and 'VS 655' produced over 7.9 tons/acre, significantly more than the check varieties 'Ladak 65' and 'Spredor II'. 'Husky', 'Aggresor', 'Wrangler', Ladak 65, 'WL 225', 'Runner' and 'Wilson' produced less than 7.5 tons/acre. Spredor II yielded less than 7 tons/acre. Total yields from 1990 to 1992 ranged from 17.28 tons/acre (Runner) to 20.74 tons/acre ('Ultra'). Except for 'Wrangler', which is rated LR, the 5 lowest yielding varieties have no vert wilt resistance.

VARIETY	MTNO	FD	VW	6/4	7/8	8/6	9/28	TOTAL
				Dry Matter Yield (t/a)				
Allegiance	223	3	R	3.12	1.92	1.94	1.05	8.03
5472	221	4	MR	2.91	1.91	2.04	1.12	7.99
DK 135	152	4	MR	3.13	1.82	1.91	1.11	7.97
VS 655	230	-	--	3.09	1.81	1.91	1.16	7.97
WL 317	204	3	R	2.93	1.77	1.93	1.18	7.81
Ultra	229	3	R	3.26	1.69	1.78	1.02	7.75
Multiplier	227	3	R	3.17	1.76	1.74	1.07	7.74
5364	213	4	MR	3.11	1.79	1.84	1.00	7.74
Mngrn-14	226	-	--	2.93	1.92	1.91	0.97	7.73
5262	214	2	LR	3.11	1.80	1.77	1.02	7.70
DK 122	224	2	R	3.12	1.75	1.76	1.00	7.63
Arrow	151	3	R	2.93	1.71	1.75	1.14	7.52
Husky	225	3	--	3.02	1.74	1.68	0.98	7.41
Aggresor	222	4	R	2.94	1.69	1.64	1.03	7.30
Wrangler	146	2	LR	3.10	1.54	1.58	1.07	7.30
Ladak 65	2	1-2	S	3.07	1.54	1.63	1.02	7.26
WL 225	184	2	R	2.82	1.57	1.66	1.06	7.10
Runner	228	-	--	3.10	1.60	1.54	0.85	7.09
Wilson	231	6	--	2.34	1.64	1.96	1.09	7.04
Spredor II	128	1	--	3.00	1.50	1.45	0.84	6.78
LSD(0.05)				0.25	0.14	0.19	0.23	0.69
P-VALUE				0.00	0.00	0.00	0.26	0.01
CV(s/mean)				5.1	4.9	6.3	13.2	5.5

1990 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED

VARIETY	MTNO	FD[1/]	VW[2/]	YIELD 1990	YIELD 1991	YIELD 1992	YIELD TOTAL
				t/a	t/a	t/a	t/a
Ultra	229	3	R	4.88	8.12	7.75	20.74
Multi–plier	227	3	R	4.68	8.20	7.74	20.62
DK 135	152	4	MR	4.42	8.11	7.97	20.50
VS 655	230	––	––	4.45	7.99	7.97	20.40
5472	221	4	MR	4.22	8.09	7.99	20.29
DK 122	224	––	––	4.41	7.98	7.63	20.02
5364	213	4	MR	4.21	7.89	7.74	19.84
Allegiance	223	3	R	3.85	7.89	8.03	19.77
WL 317	204	3	R	4.12	7.54	7.81	19.47
Husky	225	3	––	4.30	7.73	7.41	19.44
5262	214	2	LR	3.98	7.67	7.70	19.35
Arrow	151	3	R	4.16	7.54	7.52	19.22
Mngrn–14	226	––	––	3.54	7.92	7.73	19.19
WL 225	184	2	R	4.43	7.23	7.10	18.76
Aggresor	222	4	R	3.91	7.31	7.30	18.52
Wrangler	146	2	LR	3.54	6.80	7.30	17.64
Spredor II	128	1	––	3.86	6.95	6.78	17.59
Ladak 65	2	1–2	S	3.55	6.60	7.26	17.41
Wilson	231	6	––	3.21	7.05	7.04	17.31
Runner	228	––	––	3.67	6.52	7.09	17.28
LSD(0.05)				0.32	0.40	0.69	1.11
P–VALUE				0.00	0.00	0.01	0.00
CV(s/mean)				4.8	3.2	5.5	3.5

Seeding date: 4/18/90
Fertilizer: P_2O_5 – 176 lbs/a on 5/31/90

[1/]Fall dormancy rating
[2/]Vert wilt resistance

YEAR/PROJECT: 1992/755

1991 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – DRYLAND – 1992

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

Twenty–three alfalfa cultivars were seeded in an RCB design with 4 replications on 26 April, 1991. In 1992 differences among total season yields were not highly significant. 'Ultra', 'Magnum III', 'Ladak–65', '5364' and 'Colombo' yielded over 7.40 tons/acre. Except for Ladak 65 these varieties had vert wilt ratings of MR–HR. Ladak 65 performed much better in this dryland environment than the irrigated trial. 'Barrier', 'VS 9096', '5262' and 'Alfagraze' produced less than 6.5 tons/acre. Ultra and Magnum III had the highest 2–year yields, with 10.92 and 10.63 tons/acre, respectively. In contrast, Barrier, 'VS 9096', '5262' and 'Alfagraze' produced less than 9.00 tons/acre over the 2 years.

VARIETY	MTNO	FD[1/]	VW[2/]	HARV–1 6/1	HARV–2 7/3	HARV–3 8/3	HARV–4 9/29	TOTAL YIELD
						t/a		
Ultra	229	3	R	4.02	1.59	1.62	0.58	7.81
Magnum III	238	4	MR	3.60	1.65	1.79	0.70	7.73
Ladak–65	2	1–2	S	3.94	1.53	1.69	0.42	7.57
5364	213	4	MR	3.68	1.62	1.62	0.55	7.47
Columbo	235	3	HR	3.79	1.56	1.57	0.52	7.44
Eclipse	236	3	R	3.75	1.56	1.50	0.46	7.27
PGI–9048N	239	–	––	3.92	1.44	1.45	0.44	7.25
Perry	133	3	––	3.90	1.46	1.43	0.45	7.23
NK–90792	232	–	––	3.73	1.53	1.47	0.46	7.19
W90–VSX	242	–	––	3.71	1.52	1.49	0.47	7.18
Riley	122	4	LR	3.84	1.29	1.47	0.55	7.14
Multiking	219	3	R	3.74	1.46	1.49	0.43	7.11
XAE–92	244	–	––	3.84	1.39	1.41	0.42	7.05
2841	246	3	R	3.56	1.47	1.45	0.47	6.94
Legacy	237	4	R	3.68	1.43	1.39	0.44	6.94
UN–72	240	–	––	3.72	1.47	1.31	0.41	6.91
2833	245	3	R	3.40	1.42	1.39	0.53	6.73
Webfoot	243	3	––	3.59	1.38	1.35	0.39	6.70
Vernal	8	2	––	3.58	1.44	1.32	0.33	6.67
5262	214	2	LR	3.29	1.37	1.26	0.29	6.21
Barrier	234	–	––	3.51	1.25	1.14	0.27	6.16
VS 9096	241	–	––	3.29	1.37	1.13	0.23	6.02
Alfagraze	233	2	––	3.28	1.20	1.12	0.28	5.86
LSD(0.05)				0.48	0.30	0.36	0.21	1.19
P–VALUE				0.09	0.33	0.04	0.01	0.09
CV(s/mean)				9.3	14.7	17.9	34.8	12.1

1/ Fall dormancy rating
2/ Vert wilt resistance

1991 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – DRYLAND – 1992

VARIETY	MTNO	FD[1/]	VW[2/]	1991	1992	TOTAL
				t/a		
Ultra	229	3	R	3.11	7.81	10.92
Magnum III	238	4	MR	2.90	7.73	10.63
Columbo	235	3	HR	2.63	7.44	10.07
NK–90792	232	–	– –	2.84	7.19	10.03
5364	213	4	MR	2.53	7.47	10.00
Multiking	219	3	R	2.87	7.11	9.98
Ladak–65	2	1–2	S	2.36	7.57	9.94
PGI–9048N	239	–	– –	2.65	7.25	9.90
Eclipse	236	3	R	2.49	7.27	9.75
W90–VSX	242	–	– –	2.56	7.18	9.74
XAE–92	244	–	– –	2.67	7.05	9.73
2841	246	3	R	2.64	6.94	9.58
Legacy	237	4	R	2.62	6.94	9.56
Perry	133	3	– –	2.32	7.23	9.55
UN–72	240	–	– –	2.62	6.91	9.53
2833	245	3	R	2.76	6.73	9.49
Webfoot	243	3	– –	2.64	6.70	9.35
Riley	122	4	LR	2.19	7.14	9.33
Vernal	8	2	– –	2.33	6.67	9.00
Barrier	234	–	– –	2.44	6.16	8.59
VS 9096	241	–	– –	2.55	6.02	8.58
5262	214	2	LR	2.34	6.21	8.55
Alfagraze	233	2	– –	2.40	5.86	8.26
LSD(0.05)				0.30	1.19	0.79
P–VALUE				0.00	0.09	0.00
CV(s/mean)				8.2	12.1	4.6

1/ Fall dormancy rating
2/ Vert wilt resistance

Seeded 4/26/91
Fertilizer: 5/9/91 – 176 lbs/a P_2O_5

YEAR/PROJECT: 1992/755

1991 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED – 1992

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

Twenty–three alfalfa cultivars were seeded in an RCB design with 4 replications on 17 May, 1991. In 1992 'Legacy', Pioneer '5364' and 'Magnum III' produced over 9.4 tons/acre. These 3 varieties had Fall Dormancy ratings of "4" and vert wilt ratings of MR–R. Magnum III and 5364 had superior regrowth compared to most other varieties resulting in higher total season production. 'Riley', 'Webfoot' and 'Barrier' had the lowest yields, and were not significantly better than the check varieties 'Vernal' and 'Ladak 65'. Legacy, 5364 and Magnun III had the highest 2–year total yields, with 13.23, 12.91 and 12.80 tons/acre, respectively.

VARIETY	MTNO	FD[1/]	VW[2/]	HARV–1 6/4	HARV–2 7/8	HARV–3 8/6	HARV–4 9/28	TOTAL YIELD
				t/a				
Legacy	237	4	R	4.09	2.56	1.99	0.81	9.45
5364	213	4	MR	4.02	2.56	2.13	0.73	9.44
Magnum III	238	4	MR	3.82	2.55	2.21	0.87	9.44
W90–VSX	242	–	––	4.00	2.41	1.82	0.79	9.02
VS 9096	241	–	––	4.07	2.38	1.80	0.71	8.95
5262	214	2	LR	3.93	2.45	1.85	0.72	8.95
Columbo	235	3	HR	3.85	2.44	1.91	0.75	8.95
2841	246	3	R	3.90	2.35	1.83	0.81	8.88
NK–90792	232	–	––	3.89	2.38	1.82	0.79	8.88
PGI–9048N	239	–	––	3.98	2.38	1.77	0.71	8.83
UN–72	240	–	––	3.87	2.32	1.75	0.82	8.76
XAE–92	244	–	––	3.79	2.36	1.88	0.71	8.73
Perry	133	3	––	3.89	2.34	1.77	0.72	8.71
Ultra	229	3	R	3.50	2.45	1.88	0.79	8.62
Alfagraze	233	2	––	3.76	2.31	1.84	0.72	8.61
Multiking	219	3	R	3.63	2.38	1.86	0.74	8.61
2833	245	3	R	3.48	2.32	1.87	0.86	8.52
Eclipse	236	3	R	3.72	2.21	1.76	0.74	8.43
Riley	122	4	LR	3.82	2.14	1.75	0.67	8.38
Webfoot	243	3	––	3.35	2.30	1.83	0.79	8.27
Barrier	234	–	––	3.82	2.15	1.60	0.69	8.24
Vernal	8	2	––	3.51	2.25	1.77	0.67	8.19
Ladak–65	2	1–2	S	3.70	1.94	1.63	0.53	7.79
LSD(0.05)				0.45	0.18	0.15	0.07	0.60
P–VALUE				0.08	0.00	0.00	0.00	0.00
CV(s/mean)				8.3	5.3	5.7	7.0	4.8

1/ Fall dormancy rating
2/ Vert wilt resistance

1991 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED – 1992

VARIETY	MTNO	FD[1/]	VW[2/]	1991	1992	TOTAL
				t/a		
Legacy	237	4	R	3.78	9.45	13.23
5364	213	4	MR	3.47	9.44	12.91
Magnum III	238	4	MR	3.36	9.44	12.80
PGI–9048N	239	–	– –	3.89	8.83	12.72
W90–VSX	242	–	– –	3.70	9.02	12.71
VS 9096	241	–	– –	3.66	8.95	12.62
NK–90792	232	–	– –	3.69	8.88	12.56
Columbo	235	3	HR	3.61	8.95	12.56
UN–72	240	–	– –	3.77	8.76	12.52
Ultra	229	3	R	3.87	8.62	12.49
2841	246	3	R	3.51	8.88	12.39
2833	245	3	R	3.80	8.52	12.33
5262	214	2	LR	3.25	8.95	12.21
XAE–92	244	–	– –	3.44	8.73	12.18
Perry	133	3	– –	3.35	8.71	12.06
Alfagraze	233	2	– –	3.44	8.61	12.05
Eclipse	236	3	R	3.42	8.43	11.85
Multiking	219	3	R	3.14	8.61	11.75
Riley	122	4	LR	3.33	8.38	11.71
Webfoot	243	3	– –	3.33	8.27	11.60
Barrier	234	–	– –	3.32	8.24	11.56
Vernal	8	2	– –	3.01	8.19	11.20
Ladak–65	2	1–2	S	2.80	7.79	10.60
LSD(0.05)				0.36	0.60	0.79
P–VALUE				0.00	0.00	0.00
CV(s/mean)				7.4	4.8	4.6

1/ Fall dormancy rating
2/ Vert wilt resistance

Seeded 4/26/91
Fertilizer: 176 lbs/a P_2O_5

YEAR/PROJECT: 1992/755 1992 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL - DRYLAND - 1992

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

Twenty-five alfalfa varieties were seeded at 10 lbs/acre on 4/23/92. On 5/7/92, 200 lbs/a P_2O_5 were applied. Because of wind damage to the nursery, sections of plots were reseeded by hand where necessary on 6/4/92. Stand establishment was very good after reseeding, except for 'WI 9125' which contained alot of hard seed. Even after rescarification, emergence averaged only 50%.

'Benchmark', 'VS 907' and 'VS 904' had the highest total yields. 'Wisfall' and WI 9125 had the poorest stand establishment (81% and 43%, respectively) and also the lowest yields.

VARIETY	MTNO	FD[1]	VW[2]	HARV-1 7/30/92	HARV-2 10/2/92	TOTAL YIELD
				tons/acre		
BENCHMARK	254	3	R	2.08	1.93	4.01
VS 907	253	3	R	2.08	1.40	3.48
VS 904	261			1.84	1.57	3.41
MS 91	257			1.88	1.41	3.29
ARROW	192	3	R	1.77	1.44	3.20
4J19	248			1.90	1.23	3.13
89-31F	251			1.93	1.11	3.03
MBS 2131	259			1.86	1.15	3.02
PGI 3212	260			1.94	1.08	3.01
GUARDSMAN	252			1.83	1.17	2.99
WL 322HQ	250			1.86	1.08	2.94
PROFIT	258	2-3	R	1.82	1.09	2.91
ABI 9143	264			1.87	1.04	2.91
MILKMAKER II	266	2-3	--	1.88	1.03	2.91
AP 8950	265			1.80	1.11	2.90
5454	263	4	MR	1.74	1.15	2.89
5246	262	3	R	1.72	1.06	2.78
CROWN II	247	3	R	1.82	0.93	2.74
CLASS	249	3	R	1.66	1.03	2.68
RILEY	122	3	--	1.51	1.06	2.57
5364	213	4	MR	1.44	1.05	2.49
PERRY	133	3	--	1.39	1.09	2.48
LADAK 65	2	1	--	1.53	0.76	2.29
WI 9125	256			0.98	0.95	1.93
WISFALL	255			1.37	0.49	1.86
LSD(0.05)				0.27	0.52	0.70
P-VALUE				0.00	0.01	0.00
CV(s/mean)				11.0	32.6	17.2

1/ Fall Dormancy
2/ Vert Wilt resistance

YEAR/PROJECT: 1992/755 1992 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL - 1992 - IRRIGATED

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

Twenty-five alfalfa varieties were seeded at 10 lbs/acre on 4/24/92. The nursery was irrigated with 2.4 inches of water on 5/8, 8/12 and 8/19/92. Stand establishment was excellent except for 'WI 9125' and 'Wisfall' (70% and 81% average stands). As in the dryland trial, Wisfall had among the lowest yields, but WI 9125 yielded 0.21 t/a more than the average of all varieties for the season.

VARIETY	MTNO	FD[1/]	VW[2/]	HARV-1 7/29	HARV-2 9/29	TOTAL
				tons/acre		
VS 907	253	3	R	3.24	1.75	4.99
CROWN II	247	3	R	3.01	1.89	4.90
CLASS	249	3	R	3.06	1.80	4.86
VS 904	261			2.98	1.86	4.84
BENCHMARK	254	3	R	3.06	1.76	4.81
MS 91	257			3.00	1.80	4.79
4J19	248			3.05	1.67	4.71
PGI 3212	260			2.91	1.78	4.69
WI 9125	256			3.03	1.64	4.67
89-31F	251			2.96	1.70	4.65
PERRY	133	3	--	2.89	1.70	4.59
ARROW	192	3	R	2.76	1.71	4.46
5364	213	4	MR	2.68	1.77	4.45
MBS 2131	259			2.74	1.67	4.41
GUARDSMAN	252			2.77	1.62	4.40
AP 8950	265			2.56	1.75	4.31
5454	263	4	MR	2.69	1.55	4.24
ABI 9143	264			2.52	1.69	4.21
RILEY	122	3	--	2.60	1.57	4.17
MILKMAKER II	266	2-3	--	2.58	1.59	4.16
PROFIT	258	2-3	R	2.55	1.60	4.15
5246	262	3	R	2.58	1.49	4.06
WISFALL	255			3.13	0.91	4.04
LADAK 65	2	1	--	2.68	1.33	4.01
WL 322HQ	250			2.49	1.51	4.00
LSD(0.05)				0.24	0.15	0.28
P-VALUE				0.00	0.00	0.00
CV(s/mean)				6.0	6.6	4.4

1/ Fall Dormancy rating
2/ Verticillium wilt resistance

YEAR/PROJECT: 1992/755 ALFALFA FALL MANAGEMENT STUDY, SEEDED 1989 - DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Ray Ditterline, MSU Bozeman, Dr. Joyce Eckhoff, EARC, Sidney and Dr.Kevin Kephart, Brookings, SD

On 4/26/89 a nursery was established to study the effects of harvest timing and variety on alfalfa yield and stand. The study was designed as a split block with 4 replications. Main plots were: SC-2 (cut twice before 8/10) and SC-3 (cut 3 times before 8/10). Subplots were 10 fall harvest (FH) dates: 8/10, 8/20, 8/30, 9/10, 9/20, 9/30, 10/10, 10/20, 10/30 and an uncut plot (UC). Sub-subplots were the varieties 'NY 8142' (FD=2) and 'Pioneer 5432' (FD=4). Effects of 1990 and 1991 treatments on 1992 yields appear on the following table. In summary: SC-2 resulted in higher total 1992 yield than SC-3. Delaying the FH until 10/1 or later resulted in higher total yields the following year than harvesting earlier. Variety had no apparent effect on 1992 yields. There were no significant differences due to interaction among SC, FH and variety.

On 5/14/92, a 2'x 2'area from each plot was excavated and all plants removed. Factors affecting 1992 spring stand were: SC-2 had a higher vigor rating and root + crown dry weight than SC-3; FH between 8/20 and 10/1 had a depressing effect on vigor and shoot length; FH between 8/20 & 8/30 and 10/1 - 11/1 reduced plant number; FH of 8/30 & 10/10 - 11/1 reduced shoot dry weight; FH between 8/20 & 9/10 reduced root + crown dry weight; FH between 8/10 & 10/1 reduced root dry weight. Pioneer 5432 had higher density (plants/ sqft), shoot length and shoot dry weight than NY 8142.

Based on the yield data and the factors related to the health of the stand, it appears that harvesting after mid-August and before early October should be avoided in order to maximize stand production and persistence in alfalfa. This will allow the crop to store carbohydrates during its late summer to early fall regrowth period and enter dormancy with a healthy supply for the following season.

ALFALFA FALL MANAGEMENT STUDY – KALISPELL – 1992

Effect of number of seasonal (June–July) harvests in 1990 and 1991 on total yield in 1992:

	1992 Total Yields t/a	
2–cuttings	4.38	Difference significant
3–cuttings	3.87	by F–test.
Mean	4.13	

Effect of 1990 and 1991 fall harvest date on total yield in 1992:

Fall Harvest Date	t/a
8/10	4.32
8/20	3.61
8/30	3.34
9/10	3.61
9/20	3.94
10/1	4.26
10/10	4.43
10/17	4.66
11/1	4.62
Uncut	4.47
Mean	4.13
LSD(0.05)	0.21
P–VALUE	0.00

Effect of variety on total yield in 1992 – not significant.
Interactions – not significant.

Effect of harvest management in 1990 & 1991 on stand indicators in spring of 1992 (significant at $P<0.05$):

	Seasonal Cuttings	Fall harvest (highest scoring)	Variety
VIGOR	2 > 3	8/10,10/10 – 11/1	NS
PLANTS/SQFT	NS	8/10,9/10–9/20	'Pioneer 5432'
SHOOTS/PLANT	NS	NS	NS
SHOOT LENGTH	NS	8/10,10/10–11/1, UC	'Pioneer 5432'
SHOOT DWT	NS	8/20,9/10–10/1	'Pioneer 5432'
ROOT+CROWN (DWT)	2>3	8/10,9/20 – 11/1,UC	NS
ROOT DWT	NS	10/10–11/1	NS

YEAR/PROJECT: 1992/755: SIMULATED SHORT DURATION GRAZING STUDY

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Ray Ditterline, MSU, Bozeman and Mr.Dave Wichman, CARC, Moccasin

Five grass species were seeded in 1989 in an RCB design with 4 replications. The species were:

1) 'Reed' canarygrass (RCG)
2) 'Garrison' creeping foxtail (GCF)
3) 'Regar' meadow bromegrass (RMB)
4) 'Potomic' orchardgrass (PO)
5) 'Linn' perennial ryegrass

In 1990 each species main plot was divided into 6 subplots with the following clipping treatments:

1) Remove 33% every 7 days (7/33)
2) Remove 50% every 7 days (7/50)
3) Remove 33% every 14 days (14/33)
4) Remove 50% every 14 days (14/50)
5) Vary intensity and frequency of clipping from high to low as season progresses (GRAD)
6) Remove all topgrowth every 28 days (CHECK)

These same treatments were imposed in 1991 and 1992. The 1992 results are as follows: The 14/33 treatment (means across species) again had the highest total dry matter yield (4.38 t/a), significantly higher than all other treatments including the CHECK. RMB and PO again had the highest yields among species averaged over treatments. The interaction of species X treatment was significant. The highest yielding individual treatments were RMB 14/33 and PO 14/33. The sum of 1990 - 1992 yields was highest for the CHECK and lowest for the two 7-day treatments. RCG and LPR mean yields were significantly lower than the other 3 species' mean yields. The species x harvest treatment interaction was significant for the 3-year total yields. The highest yielding individual treatments were the RMB and PO 14/33, 14/50, GRAD and check and the GCF check.

SHORT DURATION GRAZING STUDY – KALISPELL, MT – 1992

1992 TOTAL YIELDS
SPECIES

Harvest Treatment	RCG	GCF	RMB	PO	LPR
	----------	----------	t/a ----------	----------	----------
7/33	2.48 (16)[1/]	2.89 (15)	3.51 (17)	3.69 (16)	2.24 (10)
7/50	2.64 (12)	3.03 (14)	3.70 (13)	3.50 (12)	2.89 (7)
14/33	3.46 (9)	4.46 (9)	5.93 (9)	5.60 (9)	2.48 (8)
14/50	3.02 (9)	4.03 (9)	5.01 (9)	4.63 (9)	2.71 (6)
Grad	2.94 (10)	3.75 (10)	4.65 (10)	4.74 (10)	2.14 (8)
Check	3.76 (5)	4.42 (5)	4.77 (5)	4.53 (5)	2.90 (5)
means	3.05	3.76	4.59	4.45	2.56

LSD(0.05) – species means = 0.61 **
– harvest management means = 0.18 **
– interaction = 0.80 **

1/ Total number of cuttings

TOTAL YIELDS 1990–1992
SPECIES

Harvest Treatment	RCG	GCF	RMB	PO	LPR
	----------	----------	t/a ----------	----------	----------
7/33	7.68	8.95	10.19	10.38	7.47
7/50	7.18	9.21	9.89	9.51	8.40
14/33	10.71	12.33	14.66	14.58	10.55
14/50	9.78	12.34	13.87	12.95	10.01
Grad	10.06	11.50	13.17	12.93	10.32
Check	12.03	14.31	14.42	14.98	12.57
means	9.57	11.44	12.70	12.55	9.89

LSD(0.05) – species means = 1.45 **
– harvest management means = 0.43 **
– interaction = 2.39 **

Seeding date: 4/18/89

Fertilizer: Spring 1989 – 68 lbs N/a
10/24/89 – 132 lbs P_2O_5
10/25/89 – 136 lbs N/a
Summer 1990 – 68 lbs N/a
4/12/91 – 90 lbs N + 110 lbs P_2O_5
4/16/91 – 65 lbs N/a

Pesticides: 5/22/89 – Bromoxynil – 3/8 lb AI/a

	1989–90	1990–91	1991–92
Crop year precipitation:	26.01"	20.04"	18.35"
Irrigation:	4.8"	4.8"	4.8"
Frost free period:	149 days	114 days	99 days
Initial cutting:	5/1/90	5/14/91	5/12/92
Last cutting:	10/18/90	10/7/91	9/1/92

PROJECT TITLE: Intrastate Spring Barley Evaluations

PROJECT PERSONNEL: Bob Stougaard and Todd Keener, NWARC, Kalispell
Tom Blake and Pat Hensleigh, MSU, P&SS, Bozeman

OBJECTIVE: To evaluate spring barley varieties for yield, quality and improved resistance to foliar diseases in consideration for future release to Montana grain growers.

RESULTS:

Yields averaged 104 bu/A. Baronesse again had the highest yield this year (124 bu/A) Various experimental crosses with Lewis, Menuet, Harrington, Hector, and Clark were in the top yielding entries that had 112 bu/A or greater. Bearpaw, Gallatin, and Morex yielded 112, 108, and 86 bu/A respectively. Test weights were good with the average of the sixty-four entries being 51.1 lb/bu. The test weights for Baronesse, Bearpaw, Gallatin and Morex were 51.6, 50.1, 52.2, and 49.1 lb/bu. Percent plumps, height notes, and heading dates are listed in Table 1.

FUTURE PLANS: Variety evaluations will continued to be conducted at the Northwestern Agricultural Research Center in 1993.

Table 1. Agronomic data from the Intrastate Spring Barley Nursery grown on the Northwestern Agricultural Research Center in 1992.

CI or STATE No.	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT INCHES	HEAD DATE
NS 78054	Baronesse	123.8	51.6	98	24.9	160.3
MT851195	MT41918/TR450	120.5	51.1	95	26.5	156.8
MT861596	Lewis/MT 41549	116.9	52.5	94	27.8	158.3
MT900117	Menuet/MT4126	116.8	52.0	91	24.3	161.5
H1851032	Harrington/Clark(MT851032	115.3	51.3	95	26.7	160.8
C12	Coors C12	114.9	51.9	99	29.0	163.0
MT886610	MT 81143/Lewis	114.3	52.5	96	27.0	159.4
CI 15229	Steptoe	114.2	48.0	98	27.5	155.6
MT900176	Steptoe/Robust	113.9	48.6	100	26.9	156.3
H1851195	MT41918/TR450 (MT851195 H	113.9	51.2	98	26.9	157.0
MT140523	Hector/Klages	113.1	51.6	96	25.7	158.5
MT 83435	Clark/TR450	112.7	51.5	95	25.9	159.9
MT890069	MT4126/Piroline	112.1	51.3	91	24.8	157.3
PI531228	Bearpaw	111.8	50.1	94	27.1	163.0
ND 9866	Stark	111.6	52.6	99	27.6	156.9
MT890018	Gallatin/Apex	111.5	52.1	93	23.5	159.1
MT900132	MT4126/Moravian III	111.1	52.5	98	25.8	157.4
BA 1215	2B82-8529 (BA 8529)	110.8	50.6	94	26.1	162.9
CI 15856	Lewis	110.6	52.4	97	27.2	159.4
MT890008	Fleet/Bowman	110.2	50.4	96	25.8	163.0
MT851161	MT 41918/MT 41279	109.6	51.0	96	25.3	157.1
H5851161	MT 41918/MT 41279(MT85116	109.6	50.7	94	25.1	158.1
PI491534	Gallatin	108.3	52.2	93	26.7	158.0
H6860756	Gallatin/Bellona (MT86075	107.2	52.8	98	26.4	160.9
MT900071	Hector/Bowman	107.0	52.3	97	29.4	158.3
CI 15857	Clark	106.7	50.9	95	27.1	160.3
MT887103	MT 81535/Lewis	106.6	50.1	97	23.8	159.5
CI 15478	Klages	106.2	50.9	87	27.0	162.9
H5860219	Lewis/Apex (MT860219 HR #	106.1	51.8	97	23.2	160.9
CI 15514	Hector	106.0	51.2	93	29.6	159.1
MT890128	Steptoe/Robust	105.1	47.4	96	24.6	158.2
MT900143	MT81161/Bowman	104.5	52.4	96	26.7	156.6
MT851012	Clark/WA877178	104.3	51.0	95	27.5	160.6
MT851032	Harrington/Clark	104.1	51.7	96	26.5	160.5
H6851032	Harrington/Clark(MT851032	103.5	51.5	94	25.6	161.0
MT890040	Lewis/ID91019	102.8	49.9	97	26.2	155.2
MT900011	Bowman/Bellona	102.7	51.7	96	25.0	158.0
MT 81161	Lewis//Kgs/Smt	101.0	50.4	97	25.7	157.5
WPB92 1	Medallion	100.7	48.5	88	22.8	161.3
C10	Coors C10	100.2	51.3	97	25.8	162.6
MT900111	Menuet/Bowman	100.1	51.8	99	24.6	157.5
MT860756	Gallatin/Bellona	100.1	52.3	100	25.8	160.9
MT900125	MT4126/Bowman	99.8	50.6	94	24.6	156.1
H4851224	ID810264/MT 41918(MT85122	99.4	51.3	100	25.1	162.3
MN 52	Excel	99.1	50.0	98	26.4	155.6
C13	Coors C13	98.8	51.8	98	21.3	164.1
MT900014	Bowman/ID810099	98.4	51.1	97	26.7	157.4
WPB92 2	Westford	98.0	41.4	96	32.1	160.1
MT890033	Hector/Fleet	98.0	50.5	78	19.8	156.7
H3851032	Harrington/Clark(MT851032	97.7	51.0	96	26.4	161.9
AK321214	Ack 3212/14	97.4	51.5	99	23.3	162.8
PI483127	Russell	96.6	48.7	93	26.9	154.0
C14	Coors C14	95.6	52.5	95	22.7	155.7
SK 76333	Harrington	94.7	50.5	94	26.0	160.4
MT890070	MT47219/Bowman	93.8	51.6	99	26.1	157.2

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Table 1 (Cont'd). Intrastate Spring Barley Nursery, Kalispell, MT. 1992.

CI or STATE No.	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT INCHES	HEAD DATE
MT889106	Apex/Lewis	93.6	51.1	98	26.7	156.2
2B885133	2B88-5133	93.5	51.0	98	24.6	155.4
MT890065	MT4126/Bowman	91.8	51.2	94	25.0	155.9
CI 9558	Piroline	90.8	51.9	96	26.4	156.7
MT890021	Gallatin/Piroline	90.4	52.0	94	25.8	154.8
BA 1614	BA 1614	89.6	49.5	96	27.0	156.5
BZ489-29	WPB BZ 489-29	85.9	55.5	73	19.0	163.8
CI 15773	Morex	85.8	49.1	99	30.4	154.6
MTSU 247	Shonkin	82.7	55.1	73	28.5	160.9
L.S.D.		12.8	0	0	2.29	1.84
MEAN		104.0	51.1	94.9	25.9	158.9

PROJECT TITLE: Early Yield Spring Barley Evaluations - Screening of early generation spring barley selections in cooperation with Dr. Tom Blake.

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell
Tom Blake and Pat Hensleigh, MSU, P&SS, Bozeman

OBJECTIVE: Evaluation of spring barley varieties for yield, quality and improved resistance to foliar diseases in consideration for future release to Montana grain growers.

RESULTS:

Yields averaged 100 bu/a. The same varieties (Steptoe, Morex, Klages, and Hector) grown in both 1991 and 1992 had yields that were 15 to 20 bu/A greater in 1991. Test weights were normal and averaged 50.2 lb/bu. Percent plump was higher than previous years. Heading dates were slightly earlier as a result of favorable spring temperatures and moisture. Lodging was moderate in approximately one-third of the entries. No diseases were observed in the 1992 Early Yield spring barley nursery.

SUMMARY:

Yields ranged from 76 to 126 bu/A in the Early Yield spring barley nursery where two and six row varieties averaged 100 bu/A. Lodging was recorded in two-thirds of the entries in this trial.

FUTURE PLANS: Disease resistant varieties will continue to be evaluated at Kalispell through cooperative regional variety trials.

Table 1. Agronomic data from the Early Yield Spring Barley Nursery grown on the Northwestern Agricultural Research Center in Kalispell, MT.
Planted: April 7, 1992 Harvested: August 17, 1992

CI Number	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT INCHES	HEADING DATE	LODGING INDEX 1/
CI 15229	Steptoe	126.0	46.3	97.0	31.5	163.7	.0
H5870120	Lindy/Martin (MT870120HR5	124.7	45.6	95.5	31.5	163.3	1.1
CI 15478	Klages	114.8	50.7	94.0	34.1	171.0	3.0
MT910150	MT 81143/MT 83444	114.1	51.2	95.0	31.4	166.7	.0
MT910153	MT 81143/Norbert	113.9	52.1	95.5	35.6	169.3	.0
H6860326	Lewis/TR533(MT860326 HR#6	112.4	51.7	97.0	32.1	165.7	5.6
MT910079	Columbia/MT 81616	109.0	51.0	91.0	27.6	169.0	.0
MT910032	Bowman/MT 81619	108.8	50.0	85.0	28.5	163.3	6.7
MT910183	MT138575/Lewis	108.2	51.4	94.5	33.5	166.0	.0
H2860224	Lewis/Apex (MT860224 HR#2	107.9	51.7	96.5	32.4	168.0	3.7
MT910096	Fleet/MT 81616	107.7	50.7	90.0	25.3	170.7	.0
MT910024	Bowman/MT 81143	107.7	50.3	99.0	34.4	170.0	7.3
MT910187	MT140523/Menuet	107.7	50.8	95.0	32.9	168.7	.0
MT910011	Bellona/Harrington	107.3	51.7	96.0	32.4	170.0	.0
MT910197	Norbert/MT138575	107.0	50.8	95.5	35.4	170.0	7.4
MT910001	Bedford/ID 910719	106.9	49.0	93.0	32.7	165.3	.0
MT910135	Lewis/Menuet	106.8	50.8	93.0	33.6	167.0	.0
MT910101	Fleet/MT 83424	105.5	51.6	92.5	26.0	168.0	.0
H3860224	Lewis/Apex (MT860224 HR#3	105.3	51.0	93.5	31.6	168.3	5.9
MT910171	MT 83424/MT 83444	104.6	50.5	95.0	33.7	167.7	.0
MT910173	MT 83424/MT 81616	104.5	49.5	96.5	33.6	169.7	3.9
H1860224	Lewis/Apex (MT860224 HR#1	104.3	51.3	96.5	33.7	169.0	6.5
MT910013	Bellona/Lewis	103.4	50.9	96.5	33.9	171.0	11.1
MT910176	MT 83491/Bowman	103.0	51.6	95.5	32.8	167.3	18.3
MT910170	MT 83424/MT138575	102.1	50.3	92.0	31.9	167.3	26.1
MT910167	MT 83424/Fleet	102.0	50.7	84.5	26.3	170.0	.0
MT910009	Bellona/Bowman	101.9	50.9	94.0	31.0	171.0	17.4
MT910117	Gallatin/Piston	101.7	50.8	93.0	34.0	166.3	26.3
MT910046	Bowman/MT 83592	101.4	50.5	94.5	29.9	164.0	26.6
MT910034	Bowman/MT 83422	101.1	50.9	95.5	34.9	166.7	3.7
MT910160	MT 811619/Bowman	100.1	52.3	96.5	34.8	170.0	.0
MT910121	Hector/MT138575	99.6	50.2	94.0	34.5	167.0	22.2
MT910050	Bowman/MT140523	99.2	50.4	95.0	34.0	166.3	13.9
MT910177	MT 83491/Bowman	98.5	51.6	96.5	33.6	167.0	25.7
MT910175	MT 83491/Bowman	98.1	51.4	96.0	33.9	168.3	33.1
H5860224	Lewis/Apex (MT860224 HR#5	98.0	51.0	96.5	33.2	169.3	.0
MT910020	Bowman/Bedford	97.8	44.6	65.0	31.1	164.7	10.0
MT910016	Bellona/Lewis	97.8	50.6	96.0	32.6	170.0	.0
MT910189	ND 7293/MT 81616	97.5	50.9	97.0	31.9	167.0	.0
MT910033	Bowman/MT 81619	97.5	51.1	96.5	31.1	164.0	16.7
MT910154	MT 81502/MT 81143	97.0	49.8	92.5	30.7	166.3	30.3
MT910071	Columbia/Bellona	96.6	45.5	86.5	33.9	169.0	.0
MT910029	Bowman/MT 81502	96.5	50.7	95.0	31.6	165.7	11.0
MT910099	Fleet/MT 83424	96.4	50.8	92.5	34.9	168.3	34.1

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Table 1 (Cont'd). Early Yield Spring Barley Nursery 1992.

CI Number	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT INCHES	HEADING DATE	LODGING INDEX 1/
MT910114	Gallatin/Menuet	96.2	50.6	92.5	32.8	166.3	.0
MT910174	MT 83424/MT 81616	96.1	50.5	96.5	32.8	169.3	5.2
MT910048	Bowman/MT140523	95.7	51.2	90.5	31.2	165.7	35.7
SK 76333	Harrington	95.4	50.4	95.0	33.2	169.0	12.2
MT910035	Bowman/MT 83422	95.2	50.5	89.5	34.0	167.0	16.6
MT910111	Gallatin/Fleet	94.2	50.3	87.0	28.5	167.0	.0
MT910072	Columbia/Bowman	93.4	45.4	95.0	32.4	165.0	.0
H1870105	Hazen/UT1423 (MT870105HR1	93.2	47.5	98.5	33.5	166.0	.0
MT910113	Gallatin/Heavyweight	92.8	50.6	90.0	31.0	164.7	8.3
MT910157	MT 81616/MT 81502	92.1	48.6	96.0	32.2	167.3	15.6
MT910107	Gallatin/Bowman	91.3	50.9	96.5	35.0	163.7	8.5
MT910112	Gallatin/Heavyweight	90.9	50.7	91.0	33.2	165.3	9.3
MT910118	Hazen/Karla	89.5	47.2	97.0	37.8	167.3	.0
MT910108	Gallatin/Bowman	88.7	50.1	92.0	32.3	167.0	14.8
MT910022	Bowman/Gallatin	87.5	50.7	94.0	36.5	166.7	1.5
MT910180	MT138575/Bowman	87.5	49.6	93.0	35.3	167.3	52.7
CI 15514	Hector	85.6	50.3	92.0	35.3	167.3	29.6
MT910168	MT 83424/Fleet	82.2	49.5	95.0	34.1	170.0	8.2
CI 15773	Morex	80.8	47.6	93.5	35.8	163.0	5.7
MT910084	Elrose/Gallatin	76.3	51.4	94.5	31.4	166.3	16.7
	Mean	100.1	50.2	93.5	32.6	167.3	9.7
	L.S.D.	18.6	1.02	3.93	2.52	1.98	18.1

1/ Lodging Index = Lodging Severity X Lodging Prevalence / 9

PROJECT TITLE: Uniform Northwestern Oat Nursery

YEAR/PROJECT: 1992/756

INVESTIGATORS: Bob Stougaard and Todd Keener, Northwestern Agricultural Research Center, Kalispell, MT.
Tom Blake, Plant and Soil Science, Bozeman, MT.

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

RESULTS: Sixteen varieties were evaluated this year with one variety yielding above 200 bu/A (Derby at 208 bu/A). All varieties had good yield potential with the average yield for the trial being 176 bu/A. Test weights were typical for this environment with the mean being 34.8 lb/bu. Trucker again had the highest test weight this year (38.6 lb/bu) while Otana had the highest weight among recommended varieties (36.9 lb/bu). Lodging was moderate to severe in the majority of plots with only one variety having no lodging (Agay). No disease occurances were noted in this trial.

Table 1. Agronomic data from the Uniform Northwestern Oat Nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT.
Planted: April 7, 1992 Harvested: August 27, 1992

CI OR STATE #	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT INCHES	LODGING INDEX 1/
DERBY	Derby	208.37	35.30	168.67	50.00	23.70
CI467882	Border	198.83	33.90	169.00	41.34	46.10
81Ab5792	Rio Grande	196.20	34.23	167.00	36.22	16.87
82Ab1142	Agay	193.20	34.67	170.67	34.78	.00
CI 9252	Otana	190.63	36.93	169.00	46.85	47.40
OT 308	Calibre	185.80	36.63	170.67	47.64	21.67
CI 9401	Ogle	179.60	32.63	162.67	36.88	2.23
W 82056	Robert	176.73	34.17	171.00	48.43	30.37
CI 9297	Appaloosa	175.70	32.37	170.00	41.47	61.13
CI483126	Monida	175.00	35.93	171.33	45.01	43.70
CI 8263	Cayuse	170.27	34.23	168.00	38.32	23.33
W 80474	Riel	163.10	35.07	168.33	48.95	47.47
NEWDAK	Newdak	159.43	33.20	163.00	42.52	56.67
CI 6611	Park	159.10	34.63	168.67	47.51	40.73
ND820603	Valley	147.93	35.00	168.33	40.42	59.67
SD810109	Trucker	135.90	38.57	164.33	44.75	26.67
L.S.D.		45.37	2.07	1.97	3.48	40.73

1/ Lodging index = prevalence X lodging severity divided by 9.

PROJECT TITLE: Western Regional Spring Wheat Variety Evaluations

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell, MT.
Luther Talbot, Plant and Soil Science, Bozeman, MT.

OBJECTIVE: To determine the adaptability of new and introduced spring wheat varieties grown under high moisture conditions in Montana.

RESULTS:

Yields from the 1992 Western Regional Spring Wheat Nursery were noticeably reduced from yields in previous years. None of the thirty-six entries yielded above 100 bu/A. Several varieties grown both this year and in 1991 were 10 to 40 bu/A less in this nursery. Test weights were relatively the same in comparison to other seasonal data and averaged 59.4 lb/bu. The heading date average was ten days earlier than last year, and was early compared to the long term average.

SUMMARY:

Cool, wet weather in June and July were factors that contributed to lower than normal yields this year in spring wheat. No variety yielded above 100 bu/A. Heading dates were one week to 10 days earlier than previous years.

FUTURE PLANS:

There are plans for continued evaluation of new and introduced lines of spring wheat in Montana by growing the Western Regional Spring Wheat Nursery.

Table 1. Agronomic data from the Western Regional Spring Wheat Nursery grown on the Northwestern Agricultural Research Center.
Planted: April 7, 1992 Harvested: August 28, 1992

	VARIETY	YIELD BU/A	TEST WT LB/BU	HEADING DATE	HEIGHT INCHES
CI 17904	OWENS	96.0	59.5	167.3	32.4
WA 7176	K78504/K74129-33//K7	94.5	59.2	170.0	32.9
UT 1597	WYNNE/UT78S166-2746	92.4	59.7	169.7	34.9
WA 7677	K80184/K7905769	91.8	60.7	167.3	30.8
WA 7183	WAKANZ	91.5	58.7	171.0	30.3
ID 377S	GALLO-YR'S'/AU X KAL	91.0	60.5	165.7	31.9
ID 392	OWENS/ID159	89.9	60.5	169.0	31.6
PI495916	PENAWAWA	89.2	59.9	168.3	30.8
UC 638	SERRA	88.5	59.6	164.3	28.5
OR487453	SPHWE 11	87.1	59.9	170.0	28.2
ID 410	A81515S-A/STERLING	86.8	60.1	169.3	30.6
WA 7702	NDM00011/NK751,S83-1	86.8	59.3	165.0	29.7
ML 42	SEL. ML 42	86.0	60.1	169.7	32.4
OR386306	KAUZ 'S'	84.7	60.3	165.0	24.7
ID 441	OWENS/4/FDR/MENG//81	84.0	59.2	163.3	32.0
OR487249	TAN.S/3/TI/TOB//ALD.	83.4	60.4	165.7	28.5
ID 429	ID182/FIELDWIN	83.2	60.6	163.0	32.4
CI 17903	MCKAY	83.2	58.7	168.3	31.8
OR487469	RPV/WW15/3/BJ.S/ON*2	82.3	59.6	165.7	28.7
ID 440	ID130/MAYA74-PVN'S'/	81.8	59.3	163.7	31.8
ID 408	ID232/A75120S-2214-1	80.8	57.3	169.0	29.7
OR488403	VS73.600/MRL.S/3/BOW	80.3	58.9	166.7	26.0
UT850646	UT77W1054-1777/906R	79.9	58.0	168.0	28.2
OR488189	BJY.S/4/TZPP//IRN46/	79.6	59.5	167.0	26.1
OR487255	TAN.S/PEW.S	79.5	61.5	163.7	29.7
UT 1711	UT77W1054-1777/MCKAY	79.2	59.3	170.0	35.2
OR489025	'TUI'	78.3	60.6	166.7	30.3
ID 420	A7612S-2/A75141S-2-1	78.2	59.1	169.7	29.9
OR487462	SPHRE 16	77.7	59.8	165.6	29.7
UT 1708	UT77W1054-1777/MCKAY	77.3	58.9	169.7	38.7
UT 2571	UT77W1054-1815/MCKAY	76.9	60.3	169.0	44.1
UT 1723	UT77W1054-1777/MCKAY	76.2	59.3	170.0	36.6
ID 439	ID203/ID166//906R	76.0	58.7	167.3	27.8
UC 786	YOLO'S'/YRR,CA810041	74.9	58.5	168.3	23.8
CI 4734	FEDERATION	69.3	56.8	171.0	40.0
OR487279	SPHWE9	69.2	59.0	163.7	26.3
SUNDER02	SUNSTAR 2	66.3	59.5	164.0	29.4
UC 785	STA/YRR,CA770284-0D-	64.7	58.4	164.7	21.5
NKF 8022	KLASIC	61.8	58.5	162.7	20.5
UC 784	STA/YRR,CA770284-OD-	60.0	58.6	162.7	20.6
	Mean	81.0	59.4	167.0	30.2
	L.S.D.	9.75	.58	1.51	1.73

PROJECT TITLE: Advanced Yield Spring Wheat Nursery

PROJECT PERSONNEL: Bob Stougaard and Todd Keener, NWARC, Kalispell
Luther Talbot and Susan Lanning, MSU, P&SS, Bozeman

OBJECTIVE: To determine the adaptability of new and introduced spring wheat varieties grown under high moisture conditions in Montana.

RESULTS:

Yields were reduced slightly in comparison to harvests taken from the same varieties last year. Only four varieties had yields in excess of 100 bu/A (MT 9002, Owens, Stoa, and Penawawa). Test weights were normal for the location and averaged 59.4 lb/bu. Height and heading date information are given in Table 1.

FUTURE PLANS:

There are plans for continued evaluation of new and introduced lines of spring wheat in Montana by growing the Advanced Yield Spring Wheat Nursery.

Table 1. Agronomic data from the Advanced Yield Spring Wheat Nursery grown on the Northwestern Agricultural Reseach Center.
Date planted: April 7, 1992 Harvested: August 28, 1992

VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT INCHES
MT 9002 EP-VOC-512/12/BUTTE	109.7	60.2	168	37.9
CI 17904 OWENS	106.7	58.8	168	34.0
ND 582 STOA	104.0	59.2	169	39.9
WA 6920 PENAWAWA	100.3	60.0	168	33.5
BZ684-23 BZ684-23	99.5	59.3	170	31.2
FA982220 FA 982-220	98.8	59.9	168	33.7
MT 8849 RS6880/MT7819	97.8	60.0	169	34.8
MT 9129 ALEX/MT7881	97.5	59.9	169	34.9
ND 606 AMIDON	97.1	58.9	170	42.4
MT 9153 BW574//NEWANA/FORTUNA	97.1	57.8	165	31.6
MT 9150 MT7810/3/BW559//TOB66/CNO	96.4	58.9	169	31.6
MT 9127 ALEX/MT7881	95.7	59.1	169	34.1
SWP-9521 SWP-9521	95.1	60.0	164	32.0
MT 9132 LEN/MT7819	94.3	58.3	169	31.4
MT 9151 MT7926//PI428419/BW559	94.2	58.2	163	34.3
MT 9109 GUARD//KRONSTAD'S-GALLO/M	93.5	59.7	163	33.6
CI 13596 FORTUNA	92.5	61.1	170	40.2
PI483235 GLENMAN	92.4	58.7	169	34.0
MT 9126 ALEX/MT7881	91.8	57.6	170	33.7
CI 17828 PONDERA	91.8	60.1	169	34.4
MT 9158 MEXSEL2315/LEADER	91.7	58.7	169	33.1
PH986-61 PH 986-61	91.2	58.6	164	29.3
MT 9113 PEWEE'SCM-31630/MT8065	90.6	58.8	170	31.1
MT 9122 MT8043//SELC/74-130-7	90.3	59.2	163	33.9
MT 9137 LEN/MT7819	89.6	57.9	169	34.3
C982-324 RAMBO	89.4	60.0	168	33.2
MT 9118 MT8190/4/CNO17C//KAL/BB/3	88.6	59.4	166	33.9
MT 9131 LEN/MT7819	88.3	57.8	170	35.8
MT 9157 BW574//NEWANA/FORTUNA	88.0	60.0	171	44.9
CI 17430 NEWANA	87.6	59.7	172	33.1
WB 926 WESTBRED 926	87.4	59.2	163	30.3
TR983239 TR 983-239	87.0	60.2	163	30.8
CI 17790 LEN	86.6	59.2	169	35.4
CI 10003 THATCHER	86.3	59.1	171	45.0
MT 9030 PONDERA/BUTTE	86.0	60.1	170	33.7
MT 9121 MT8043//SELC/74-130-7	85.5	59.2	163	31.9
CI 17429 LEW	84.8	61.4	171	40.9
PI486139 KLASIC	84.4	59.1	163	21.5
MT 9154 BW574//NEWANA/FORTUNA	84.1	61.2	171	41.9
CI 15930 OLAF	83.6	59.1	168	35.4
MT 8402 HI-LINE	82.5	60.3	166	30.5
MT 9117 MT8190/4/CNO17C//KAL/BB/3	82.1	59.0	169	32.9
MT 9115 CNO7C/4/KAL/BB/2/PCIS/3/M	81.2	60.0	166	33.1
MT 9159 NK715/BW559	80.9	58.7	169	39.8
ND CUT CUTLESS	78.5	59.2	167	35.2
MT 9162 MT7836/LEADER	78.4	58.0	163	30.8
MT 9160 FORTUNA/MN70170	78.2	60.0	166	41.5
MT 9161 FORTUNA/MN70170	75.9	59.9	170	43.2
BZ984326 WPB BZ 984-326	74.3	60.1	163	32.4
EXPERIMENTAL MEANS	89.99	59.36	167.66	34.74
LSD (0.05)	19.25	.73	2.15	2.55

PROJECT TITLE: Western Regional Hard Red Winter Wheat Evaluations

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell, MT.
Phil Bruckner, Plant and Soil Science, Bozeman, MT.

OBJECTIVE: To evaluate hard red winter wheat varieties for adaptability, yield, quality and disease resistance.

RESULTS:

Even though fall precipitation was less than normal, winter wheat seedlings were in good shape prior to over-wintering in the Flathead Valley. Most plants were at, or past the 4 leaf stage so very little winter-kill was experienced. Spring rain was also less than normal, yet timely so that spring grain development was stimulated. Abundant precipitation in June and July aided in late crop development while the dry weather of August provided excellent harvest conditions. Mild winter temperatures were again experienced this year from December through February which explains the low levels of winter kill. With only 23 days of continuous snow cover (Jan. 5-27th) there was low incidence of TCK dwarf bunt. Cereal diseases were not a serious factor in winter wheat. Low levels of leaf rust were observed late in the season but were not detrimental to grain yields.

Yields were slightly above average with the mean yield being 98.5 bu/A. Most varieties that were tested last year had higher yields in 1992 of 5 to 10 bu/A. Test weights were low with only four entries having weights in excess of 60 lbs/bu. Heading dates averaged approximately five days earlier. Height in this nursery did not vary from past averages. Lodging was severe in more than half of the entries and contributed to yield loss in several cultivars. No disease were observed.

SUMMARY:

Moderate temperatures and timely moisture contributed to hard red winter wheat yields that were slightly above normal. Test weights were below normal and heading dates were 5 days earlier than the long term average. The moderate winter with limited snow cover may account for the absense of TCK dwarf bunt.

FUTURE PLANS:

Continual evaluation of new and introduced lines is planned in the future through cooperative state-wide testing.

Table 1. Agronomic data from the Western Regional Hard Red Winter Wheat Nursery grown on the Northwestern Agricultural Research Center
Planted: September 25, 1991 Harvested: August 11, 1992

	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT INCHES	LODGING INDEX 1/
OR870834	VS74-709/NAC	134.1	56.9	155.5	35.9	0
ID 426	ID 77281 Hard Red	126.0	59.0	153.5	35.9	21.5
OR870859	R37/GHL121/VEE.S	124.8	59.3	152.0	36.4	0
OR861555	VS 74-709/BUC	122.5	57.5	155.5	37.4	0
UT 150	ID51022/MANNING	119.9	57.3	155.3	41.3	2.8
OR860247	GNS/LP/3/5*ATR/AGA//	119.3	59.9	149.0	33.9	0
OR860455	GOV//PCI/VEE	116.6	55.8	155.8	35.9	5.0
OR841708	CER//YMH/HYS	115.5	57.2	156.8	36.4	14.5
QT 555	HYBRITECH	115.2	59.0	150.5	35.4	1.7
OR860126	ORF1158/FDL//SNB,F1/	113.6	58.1	152.5	34.5	0
OR850513	RBS/ANZA/3/KVZ/HYS//	112.6	60.3	151.0	32.8	0
OR830282	ND/P101//BUHO	111.0	59.2	150.8	34.9	0
UT 303	1257-6/MNG	108.3	56.3	151.8	39.4	40.2
OR831134	CNO/INIA/HN7/3/CC//C	107.7	60.8	154.5	34.5	0
UT 134	WESTON/SAMSON	107.4	60.3	149.8	39.4	19.9
UT182016	CI12385/UK//CLM/3/CI	105.9	55.5	154.0	41.3	38.6
WA 7718	WTN/BEZ/CI13438/BURT	105.4	58.8	154.5	45.8	38.9
OR840157	D887-74/PEW	105.0	60.7	152.3	37.9	.8
OR 8522	VORO/MNIM,85B-839	103.8	57.2	155.0	34.9	20.0
ID 423	ID0076/3 11-60-157/W	103.2	55.5	153.0	34.5	0
WA 7658	NE 77663/WA 6815	101.8	58.3	156.3	44.3	55.6
XNH 1401	HYBRITECH	97.9	58.6	151.5	44.8	54.5
WA 7679	N823105/N8106201	95.6	58.2	156.0	44.3	54.3
ID 445	ID 77294 Hard White	95.6	58.6	154.5	44.8	71.5
WA 7680	UT122275/N7800501	89.6	57.6	155.8	45.8	63.3
CI 13844	WANSER	86.9	58.0	153.3	41.3	71.4
WA 7678	CI 14484//BNK/GNS/3/	86.4	58.1	155.3	43.3	60.6
UT 190	AG POD/WHEAT	85.2	55.7	154.3	41.8	67.6
IDHW0355	2*MC/NP824/3/LMH66/5	83.6	56.4	154.8	41.3	74.8
DS 00001	BLIZZARD S	82.2	57.2	154.5	41.8	75.2
ID 444	ID 77190 Hard Red	81.3	57.6	155.3	35.0	78.0
ID 421	A74125W-16-3-1/A7470	80.9	58.9	155.3	45.3	79.8
ID 355	MC*2/NP824/3/LMH66/5	76.1	56.2	153.5	44.3	82.6
ID 434	ATL50/4/R/R//2*CNN/3	69.3	55.6	155.5	39.9	94.0
ID 433	II-60-156/CI 14106//	67.5	55.2	153.5	46.3	95.4
CI 1442	KHARKOF	66.4	57.4	154.3	47.7	96.3
OR008718	BPR 689-71/TI	65.8	54.5	153.3	43.3	86.3
ID 443	ID 77089 Hard Red	55.2	53.6	156.0	41.3	93.5
	Mean	98.5	57.6	153.8	39.9	41.0
	L.S.D.	19.6	2.38	1.47	5.39	27.3

1/ Lodging Index = Lodging Severity X Lodging Prevalence / 9

PROJECT TITLE: Western Regional Soft White Winter Wheat Evaluations

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell, MT.
Phil Bruckner, Plant and Soil Science, Bozeman, MT.

OBJECTIVE: To evaluate soft white winter wheat varieties for adaptability, yield, quality and disease resistance.

RESULTS:

Yields were above average for soft white winter wheats. All but three entries (the long time standards of Kharkof, Elgin, and Moro) yielded above 110 bu/acre. Yields from entries grown in both 1991 and 1992 were 5-10 bushel/A higher this year. Test weights were noticeably lower. Only one entry had a weight in excess of 60 lb/bu (PB185WW1). The mean test weight was 57.1 lbs/bu. Height notes were equal to long time averages. Lodging was minimal throughout the study. The heading date average was one week earlier than last year even though the planting date was only different by two days. Vigor notes were taken on November 12, 1991 in an attempt to monitor over-wintering and plant competitiveness abilities.

SUMMARY:

Adequate moisture in the fall and spring combined with mild winter temperatures contributed to higher than normal yields for soft white winter wheat. Although yields were 5 to 10 bushel per acre the test weight for most varieties was below 60 lb/bu. Higher yields and low levels of lodging were observed in the soft white wheats whereas test weights better in the hard red winter wheat varieties.

FUTURE PLANS: Continued evaluation of new and introduced lines is planned in the future through cooperative state-wide testing.

Table 1. Agronomic data from the Western Regional Soft White Winter Wheat Nursery grown on the Northwestern Agricultural Research Center in Kalispell, MT.
Planted: September 20, 1991 Harvested: August 10, 1992

CI NO.	Variety	YIELD BU/A	Test WT LB/BU	HT (IN)	HEAD DATE	LODG.1/ INDEX	VIGOR 2/
CI 1442,	Kharkof	82.4	58.6	47.7	152	60.5	6.8
CI 11755,	Elgin	83.6	55.7	41.8	155	51.7	7.8
CI 13740,	Moro	88.1	52.9	39.4	154	42.6	7.8
CI 13968,	Nugaines	116.4	58.2	30.0	154	0	6.5
CI 17596,	Stephens	116.0	58.2	32.0	152	0	5.8
CI 17917,	Tres	127.4	57.1	36.6	155	9.2	7.8
ORF75336,	YMH/MCD/2/T.spelta/3/SU92/RDL/	140.3	58.0	33.3	152	0	6.3
WA 7529,	Kmor	125.9	57.1	31.7	155	0	6.8
OR 855,	Paha//Sel.72-330/Daws	126.9	58.7	34.2	153	4.2	8.0
WA 7621,	VPM/MS421//WA6241//Tres	125.0	53.7	33.7	155	0	7.5
ORF83115,	SPN2*/Thul III	127.7	57.7	31.7	152	0	5.8
WA 7662,	Luke/Daws//Hill 81, VH086206	126.1	57.4	30.5	156	0	6.8
WA 7663,	Marksman/Daws, VH085208	126.7	54.7	32.7	157	4.2	6.5
OR833725,	TJB842-12919/SPN	141.9	57.4	39.4	153	0	7.3
OR833765,	6720-11/MDA38/WRM	114.5	56.3	33.5	149	0	6.8
OR840815,	SMB/HN4//SPN/3/WTS//YMH/HYS	116.7	58.2	35.4	152	0	6.8
ID081277,	SPN/Nacozari 76	129.3	56.9	33.5	151	0	7.0
WA 7686,	VH082254/ORCW8313,VH089270	125.6	56.7	34.9	155	0	7.0
WA 7687,	WA 6580/Hill 81, VH086032	124.6	56.3	33.2	153	0	7.5
WA 7622,	Tyee/Roason/Tres, 9022	126.6	56.4	34.5	157	0	7.0
WA 7690,	VPM/MS951/YMH/HYS/Hill 81//WA6	122.6	57.8	35.6	155	0	7.0
WA 7691,	VPM/MS951//YMH/HYS///ID3518, 9	114.3	57.7	32.0	154	0	6.8
OR850933,	YMH/HYS/4/MRS/3/YMH//RBS/NCO	119.0	56.6	30.5	148	0	6.8
OR850594,	STEPHENS/CROW	118.5	57.1	30.5	148	0	7.0
OR851048,	STEPHENS/QUILAMAPU 8-74	117.9	55.9	34.5	155	0	6.8
OR860303,	AFG2/BUC, F1/KVF	111.1	57.1	29.2	150	0	7.0
OR087636,	Pendleton Sel, 87636	123.9	59.0	33.0	154	0	7.0
ID085153,	Sprague/Stephens	132.4	58.2	35.6	152	0	6.5
WA 7729,	WA6814/Tres, VA087002	120.1	53.4	31.5	155	0	8.0
WA 7730,	VH090077	118.5	56.2	32.0	156	0	8.3
WA 7717,	WA7690 Sib	123.1	57.2	36.9	155	1.3	8.8
WA 7695,	Daws//SU92/3*Omar-279	128.9	56.4	31.2	154	0	8.5
WA 7697,	SPN//SU92/3*Omar-279	117.6	56.6	31.0	155	0	7.3
XWH 1004,	X WH1004 Hybritech	132.2	58.6	34.0	152	0	6.3
WA 7431,	ELTAN	127.2	58.1	36.4	157	22.8	7.0
XWH 1005,	X WH1005 Hybritech	135.2	58.1	36.7	154	0	7.0
PB185WW1,	Daws/CIMMYT/PNW Bulk	122.1	60.1	35.1	153	0	7.3
OR851139,	YMH/HYS/3/EG/178383//2*YMH,F1/	129.1	59.3	38.9	155	0	7.8
OR857847,	AFG2/MAYA/MON	119.1	57.4	32.0	152	0	7.0
OR860302,	AFG2/BUC,FZ//KVZ	114.7	58.0	28.1	149	0	7.0
OR856537,	HYS/YAHA//WA4095/3/CERCO/4/69-	117.0	56.8	38.9	155	13.3	7.5
OR855350,	Pendleton Sel. OR85 HR5350	122.0	54.4	34.0	153	10.4	7.3
CI017909,	Lewjain	110.1	57.9	29.5	161	0	7.0
	Mean	20.7	57.1	34.1	153.5	5.1	7.1
	LSD .05	2.69	1.16	2.04	1.241	16.2	.767

1/ Lodging index is lodging SEVERITY X PREVALENCE / 9
2/ Vigor notes (0 = dead plants, 9 = healthy plants) on 11/12/91

PROJECT TITLE: Intrastate Winter Wheat Evaluations - Screening of early generation winter wheat lines for TCK smut and stripe rust.

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell, MT.
Phil Bruckner, Plant and Soil Science, Bozeman, MT.

OBJECTIVE: Evaluation of early generation winter wheat lines for yield, quality and disease resistance to dwarf bunt and stripe rust.

RESULTS:

Yields varied from 66 to 129 bu/A and were equal to yields taken from this nursery last year. Stephens yielded the highest while the low yielding entry was Roughrider. Test weights averaged 60.2 lb/bu for the nursery. This nursery was planted on the same date last year but was harvested 18 days earlier in 1992 due to the dry August weather. Height notes were normal for the location. Lodging was moderate in greater than 50% of the entries and presumably caused some yield loss. No cereal diseases were observed in the trial. The absence of snow cover could indicate why TCK smut was not prevalent in the trial.

SUMMARY:

The recommended varieties of Winridge and Lewjain were included in the top four yielding varieties of the Intrastate Winter Wheat Nursery with yields of 119 and 116 bu/A, respectively. The test weight for Winridge was 61.7 lb/bu while Lewjain was 58.3 lb/bu. One third of the entries yielded above 100 bu/A.

FUTURE PLANS:

Disease resistant varieties will continued to be evaluated at Kalispell through cooperative variety testing.

Table 1. Agronomic data from the Intrastate Winter Wheat Nursery grown on the Northwestern Agricultural Research Center.
Planted: September 18, 1991 Harvested: August 4, 1992

CI Number	Variety	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT INCHES	LODGING INDEX 1/
CI 17860	NEELEY	111.7	61.1	155.3	45.3	40.9
CI 17879	ROCKY	96.5	61.1	151.3	47.2	21.4
CI 17844	REDWIN	100.9	61.9	154.0	48.6	11.1
PI517194	TIBER	116.1	61.5	154.0	48.6	16.9
CI 17735	NORSTAR	86.0	59.9	156.0	51.8	43.0
CI 13670	WINALTA	66.9	59.4	153.7	53.2	52.7
CI 17439	ROUGHRIDER	65.7	59.3	154.0	50.5	51.3
CI 15075	CENTURK	84.3	59.4	150.7	49.2	48.3
PI491532	CREE	74.2	58.4	154.0	51.8	82.3
NA 0001	THUNDERBIRD	92.3	61.6	149.3	40.7	.7
CI 17727	WESTON	90.2	61.7	151.0	50.5	27.9
CI 8885	CHEYENNE	75.5	58.2	154.3	52.5	65.6
PI491533	NORWIN	95.1	60.2	155.0	29.5	0
CI 17277	SAGE	71.5	56.9	153.3	51.8	60.0
CI 13190	WARRIOR	80.7	56.8	151.3	51.2	62.3
PI478771	AGASSIZ	74.8	58.4	154.3	55.1	58.7
CI 17952	HAWK	105.1	62.5	150.7	34.1	0
MT 8039	JUDITH	104.8	60.4	151.3	44.6	1.5
QT 542	HYBRITECH 542	103.5	60.4	150.7	46.6	7.8
QT542-F2	HYBRITECH 542 F2	97.7	60.1	151.0	45.3	3.7
XNH 1486	HYBRITECH	115.2	60.3	151.0	40.0	5.6
CI 17902	WINRIDGE	115.7	61.7	155.7	46.6	3.3
ND 8002	SEWARD	93.6	60.4	156.7	48.6	32.2
ID 279	BLIZZARD	97.1	60.8	156.0	48.6	8.5
RH78W296	BIGHORN	110.4	60.5	154.3	34.1	0
PI477287	RAM	108.0	59.3	151.7	40.0	0
CI 17846	MANNING	111.5	59.8	152.3	39.0	0
CI 17940	ARCHER	99.1	59.3	152.0	35.4	0
PI518591	ARAPAHO	96.8	59.4	151.0	38.7	0
MT 8713	MSC/CTK A+//IUL	88.2	61.6	153.7	34.1	0
MT 8719	RRI/MT 6928	104.8	61.7	153.7	38.7	0
MT 88013	PMN5/WN//HP 344/FRD	73.2	59.8	149.7	47.2	24.6
MT 88017	PMN5/WN//HP 344/FRD	80.5	59.9	151.3	41.3	27.4
MT 88018	PMN5/WN//HP 344/FRD	75.2	60.1	151.3	48.6	27.8
MT 88021	PMN5/WN//HP 344/FRD	74.5	60.8	150.3	48.5	16.7
MT 88024	PMN5/WN//HP 344/FRD	84.4	60.4	151.0	44.6	0
MT 88026	PMN5/WN//HP 344/FRD	87.2	61.0	150.7	46.6	10.0
MT 88027	PMN5/WN//HP 344/FRD	81.0	60.2	151.0	44.6	26.0
MT 88028	HP340/NRS//MT7216(18	84.1	58.0	152.3	45.9	50.1
MT 88030	HP340/NRS//MT7216(18	83.4	60.6	151.7	41.3	10.4
MT 88046	PMN5/MT 77003//HP344	83.6	61.2	151.0	42.0	8.9
MT 90003	ORS-W 30-166/WRG//ID	93.7	61.4	154.3	47.2	5.6
MT 90025	MT8001/MT7673//MT781	90.0	59.6	152.7	48.6	41.4
MT 90026	ID103/WRG//MT7840/MT	93.7	61.0	152.7	48.6	1.1
MT 90027	ID103/WRG//MT7840/MT	102.1	60.9	152.3	48.6	0

Cont'd on next page

Table 1 (Cont'd). Intrastate Winter Wheat Nursery - Kalispell

CI Number	Variety	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT INCHES	LODGING INDEX 1/
S86-15	KESTREL	95.6	60.2	155.3	44.0	32.2
S86-736	S86-736	100.6	60.1	155.3	44.6	26.7
MTSF1258	LEW/TBR//RDW	97.0	61.3	152.7	47.9	11.1
MTSF1260	LEW/TBR//RDW	85.1	60.6	152.3	46.6	8.3
MTSF1569	LEW/TBR//RDW	88.5	60.3	155.0	41.3	18.3
MTSF1570	LEW/TBR//RDW	95.0	60.3	155.0	47.9	56.7
CI17909	LEWJAIN	118.7	58.3	158.0	33.5	0
MTSF2238	LEW/TBR//RDW	96.6	60.7	153.7	44.0	3.7
ID 355	MC*2/NP824/3/LMH66/5	96.9	60.0	155.3	47.9	27.5
IDHW0355	2*MC/NP824/3/LMH66/5	90.7	60.2	155.0	49.9	26.7
ID 360	ID 360	109.8	59.3	156.7	36.1	25.7
RDW(SEL)	AC READYMADE	97.3	61.1	154.3	47.9	0
PI499375	KS73164/PI94424	99.0	60.2	151.7	47.2	17.6
PI499376	LENORE/KS73164	89.2	58.3	153.0	38.7	0
PI499377	MANNING/MT7579	111.4	59.6	152.3	41.3	2.2
HILL-81	HILL-81	106.0	59.8	154.3	38.7	0
CI 17596	STEPHENS	128.8	60.2	156.7	38.1	0
CI 17419	DAWES	93.5	61.4	147.3	36.1	0
LAMAR	LAMAR	90.7	61.3	150.7	47.9	26.3
PI495594	TAM 107	101.5	60.1	146.0	37.4	0
	MEAN	94.03	60.2	152.9	44.5	19.1
	L.S.D.	18.87	1.23	1.760	2.60	33.7

1/ Lodging Index = Lodging severity X Lodging prevalence / 9.

PROJECT TITLE: Seed Treatment Dwarf Bunt Control in Winter Wheat

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell, MT.

OBJECTIVE: Evaluate Dividend seed treatment for control of TCK dwarf bunt in eight winter wheat varities.

RESULTS:

Four soft white and hard red winter wheat varieties of varying susceptibility to TCK dwarf bunt were selected for the 1991-92 trial. These eight varieties were seeded non-treated as well as treated with 1 oz Dividend per hundred weight. A research plot seeder was used to seed varieties (10/3/91) in four row plots, ten feet in length, at a rate of 60 lb / acre. Seeding depth was 3/4 - 1 inch and row spacing was 12 inches. On October 15, 1991 an inoculum solution was applied to the test area using a research plot sprayer when winter wheat was in the three leaf stage. The TCK inoculum was prepared using screenings and smut balls from infected wheat samples. One bushel of screenings was soaked in 10 gallons water for 15 minutes and then filtered twice through fine mesh cheese cloth to make the inoculum solution. The final application rate of the inoculum solution was approximately 100 gallons per acre. TCK ocular estimations were taken July 10, 1992.

There were 23 days continuous snow cover from Jan 5th - 27th. Total snow cover days were 55 for the 1991-92 winter. Previous total days of snow cover for 1990 and 1991 were 65 and 69, respectively. The environmental conditions were not favorable for TCK infection but the inoculation of the trial proved successful in introducing sufficient infection levels.

SUMMARY:

All varieties were free of dwarf bunt when treated with 1 oz Dividend per hundred weight. The highest infection levels were noted in the untreated hard red entries. Rocky and Judith had 18 and 20% infection, respectively. Yields, test weights, and heading dates did not vary between non-treated and treated entries of the same variety. Height reductions were observed in the treated entries of Luke and Judith. It appears from this trial that Dividend seed treatment may provide effective control of Dwarf Bunt in winter wheat at high infection levels.

FUTURE PLANS:

This study was re-established this fall to evaluate the consistency of these treatments.

Table 1. Agronomic data from the Seed Treatment Dwarf Bunt Study. NWARC - Kalispell, MT.

Variety	Trtmt 1/	Yield Bu/A	Test Wt Lb/Bu	Height Inches	Heading Date	% TCK 7/9 * Count	Visual
Luke	Divid. 1 oz	121.3	58.9	34.5	160	0	.1
Nugaines	Divid. 1 oz	112.2	57.4	34.5	158	0	0
Stephens	Divid. 1 oz	114.1	57.4	37.4	159	0	0
Lewjain	Divid. 1 oz	119.7	57.3	33.0	161	0	0
Judith	Divid. 1 oz	123.3	59.2	42.8	155	0	.1
Tiber	Divid. 1 oz	102.4	60.8	46.8	157	0	.1
Rocky	Divid. 1 oz	96.3	57.8	46.3	154	0	.0
Winridge	Divid. 1 oz	98.4	59.2	47.3	159	0	.0
Luke	Untreated	109.9	58.7	30.0	159	1.0	.3
Nugaines	Untreated	115.6	57.9	34.5	158	.7	1.0
Stephens	Untreated	119.0	58.8	36.0	158	.9	.4
Lewjain	Untreated	120.9	57.0	33.0	161	0	0
Judith	Untreated	118.7	58.7	40.4	156	20.0	15.0
Tiber	Untreated	111.6	61.2	45.8	158	6.9	5.8
Rocky	Untreated	91.8	58.3	45.3	154	18.4	19.8
Winridge	Untreated	109.6	60.2	46.3	160	0	0
OVERALL MEAN =		111.5	58.66	39.8	158	.039	2.76
P-VALUE TRTS =		.0012	.0000	.000	.00	.000	.000
LSD(0.05 by t)=		15.52	1.541	2.58	1.1	.059	5.07

1/ Seed treatment for treated varieties was Dividend at 1 oz/cwt

* Percent TCK = % TCK Dwarf bunt per plot. COUNT is determined by average number of infected heads per foot of row.

YEAR/PROJECT: 1992/758 LEGUME ROTATION STUDY

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
Cooperator - Dr.Mal Westcott, WARC, Corvallis

This was the third year of the 4-year rotation treatments:

1) Perennial alfalfa,yrs 1&3; barley-yr 4.
2) Continuous barley, no N added - 4 yrs.
3) Continuous barley, 45 lbs N/a - 4 yrs.
4) Continuous barley, 90 lbs/a - 4 yrs.
5) Berseem clover, 1 hay+GM - yrs 1&3; barley-yrs 2&4.
6) Berseem clover, 2 hay+GM - yrs 1&3; barley-yrs 2&4.
7) Berseem clover, 3 hay - yrs 1&3; barley - yrs 2&4.
8) Berseem+oats,1 hay + GM - yrs 1&3;barley - yrs 2&4.
9) Spring pea, GM - yrs 1&3; barley - yrs 2&4.
10) Spring pea, 1 hay + GM - yrs 1&3; barley yrs 2&4.

Herbage samples were taken from each plot at time of harvest or incorporation to be analyzed for TKN, P,K and S. Total dry matter yields were determined for each plot for each harvest and either removed or returned to the plot for incorporation.

1992 BIOMASS YIELDS
(means of 4 replications)

ROTATION CROP	Harv-1	Harv-2	Harv-3	Harv-4	TOTAL
			t/a		
Perennial Alfalfa	2.75	1.85	1.65	0.59	6.85

	Grain bu/a	Test Wt lbs/bu	%Plump	Straw t/a
Barley - 0-N	98.8	50.6	87.8	0.94
Barley - 45-N	123.6	50.3	82.5	1.12
Barley - 90-N	110.9	49.8	76.3	1.11

	Hay-1	Hay-2	Hay-3	Green Manure	Total Biomass
			t/a		
Berseem - 1H+GM	1.73			1.95	3.68
Berseem - 2H+GM	0.46	1.04		1.59	3.09
Berseem - 3H	0.62	1.09	1.66		3.37
Berseem+Oats	2.88			1.43	4.31
Spring Pea - GM				1.50	1.50
Spring Pea - Hay	1.45				1.45

YEAR/PROJECT: 1992/758 STATEWIDE LEGUME ADAPTATION TRIAL - IRRIGATED

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

Eighteen small-seeded and 19 large-seeded annual legumes were planted Apr.14, 1992. One small-seeded cultivar, an experimental black medic, was eliminated because of very poor stand establishment. Four large-seeded cultivars, 3 cowpeas and a mung bean, were also eliminated. Plots were harvested for forage one to three times, depending on regrowth. Total forage yields ranged from 0.95 to 3.60 t/a for the small-seeded cultivars and from 1.10 to 3.57 t/a for the large-seeded. Small-seeded varieties yielding at least 3.00 t/a included 'Maral Schaftal' clover, 'Multicut' berseem clover, 'Bigbee' berseem clover and a selection berseem. Large-seeded varieties yielding at least 3.00 t/a included 'Tinga' tangier flatpea, 'Chickling' vetch and Austrian winter pea.

STATEWIDE LEGUME ADAPTATION TRIAL – KALISPELL – 1992

LARGE–SEEDED	5/21/92 STAND %	7/10/92	8/12/92	9/2/92	TOTAL
		YIELD (t/a)			
Tinga tangier flatpea	92	2.68	0.81	0.08	3.57
Chickling vetch	93	2.68	0.38		3.06
Austrian winter pea	93	3.00			3.00
Hairy vetch	80	1.41	1.14	0.33	2.88
Trapper pea	88	2.81			2.81
Sirius field pea	90	2.42			2.42
Herz Freya faba bean	95	2.29			2.29
Timeless Aladin faba bean	90	2.21			2.21
Miranda yellow field pea	95	2.09			2.09
Dianna faba bean	95	2.02			2.02
Cahaba white vetch	85	1.48	0.42		1.90
Ackerperle faba bean	90	1.84			1.84
Timeless green lentil	100	1.59	0.22		1.81
UI 114 pinto bean	45	1.08	0.54		1.63
Sacramento red kidney bean	45	0.85	0.25		1.10
LSD(0.05)	16	0.38	0.69	0.16	0.58
P–VALUE	0.00	0.00	0.11	0.02	0.00
CV(s/mean)	11.2	11.3	71.7	22.8	14.8

NB: MS Pinkpea Cowpea and MS Cream Cowpea did not emerge.
VCP and Green Mung Bean had very poor stands.

SMALL–SEEDED	5/21/92 STAND %	7/10/92	8/12/92	9/2/92	TOTAL
		YIELD (t/a)			
Multicut berseem clover	90	1.28	1.69	0.64	3.60
Maral shaftal clover	85	1.44	1.50	0.34	3.28
Bigbee berseem clover	90	1.53	1.45	0.23	3.21
Selection 1 berseem clover	88	1.50	1.43	0.18	3.11
Nitro alfalfa	90	1.11	1.35	0.51	2.97
Siwa alfalfa	92	0.92	1.18	0.46	2.56
Mt.Barker sub.clover	93	0.90	1.36		2.26
Paraggio barrel medic	95	1.65	0.54		2.19
George black medic	62	1.20	0.73		1.93
Indianhead lentil	93	1.42	0.50		1.92
Ascot barrel medic	85	1.45	0.34		1.79
Borung barrel medic	92	1.27	0.28		1.55
Youchi arrowleaf clover	38	0.68	0.84		1.52
Jemalong barrel medic	90	1.09	0.37		1.46
Sava snail medic	97	1.23			1.23
Parabinga barrel medic	88	1.02			1.02
Santiago polymorpha medic	92	0.83	0.13		0.95
LSD(0.05)	9	0.24	0.29	0.16	0.36
P–VALUE	0.00	0.00	0.00	0.00	0.00
CV(s/mean)	6.2	11.9	18.7	21.9	10.1

NB: BM5 had very poor stands.

Seeding date: 4/14/92
Fertilizer: 5/7/92 – 40 lbs P2O5/a; 8 lbs N/a
Irrigation: 6/11 – 1"
7/22 – 1.2"

YEAR/PROJECT: 1992/758 WESTERN REGIONAL DRY PEA YIELD TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye

Twelve varieties of peas from the regional trial were seeded on April 10, 1992 at 160 lbs/acre. Seed had been pretreated with fungicide. Plots consisted of four 8 ft. rows with 1 ft. row spacing and 2 ft. between plots (harvest area = 40 ft^2). The experimental design was a randomized complete block with 4 replications. On May 7, 40 lbs of P_2O_5/acre and 8 lbs N/acre were applied. The peas matured and were pulled between 7/13 and 7/20. Yields ranged from 2461 lbs/acre ('Umatilla') to 3146 lbs/acre ('Trapper').

VARIETY	EMERG days[1/]	STD %	1st FLW days[2/]	1st FLW NODES	MAT days[3/]	HT in	SEED SIZE no/lb	YIELD lbs/a
Trapper	16	86	63	13	101	49	3707	3146
PS710202	16	90	56	11	97	38	2326	3042
PS810102	16	94	52	10	95	39	2036	2957
PS810434	15	94	58	13	96	41	1817	2855
Columbian	16	91	51	7	96	38	2372	2841
Latah	16	90	55	11	97	42	2317	2804
IMPCS	16	93	51	8	97	43	2294	2784
Alaska 81	16	88	54	8	98	38	2312	2782
PS810098	16	94	52	9	96	42	2244	2773
PS910045	15	94	56	13	95	34	1706	2670
PS710173	16	90	51	11	94	30	2509	2492
Umatilla	16	93	58	12	95	37	2183	2461
LSD(Ø.05)	0.61	4.6	0.8	1.5	1.5	5	182	449
P-VALUE	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.13
CV(S/MEAN)	2.7	3.5	1.0	10.0	1.1	8.2	5.5	11.1

1/ Day 16 = 4/26
2/ Day 63 = 6/12
3/ Day 101 = 7/20

YEAR/PROJECT: 1992/758 WESTERN REGIONAL LENTIL YIELD TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye

On April 10, 1992, 12 varieties of lentils were seeded at 60 lbs/acre in a randomized complete block with 4 replications. On May 7, 40 lbs of P_2O_5/acre and 8 lbs N/acre were applied. Plants matured between 98 and 118 days after seeding. At maturity (stems, leaves and seed pods mostly yellow to brown), the plants were pulled, then thrashed when dry. Average yield for 1992 was 1814 lbs/a, slightly less than for 1991 (1936 lbs/a).

VARIETY	EMERG day[1]	STD %	1st BLM day[2]	HT in	MAT day[3]	SEED SIZE no/lb	YIELD lbs/a
LC660952	15	91	58	17	106	6524	2243
Brewer	14	90	58	21	114	7126	2240
Redchief	14	90	58	20	110	8432	2210
LC660980	14	93	58	16	103	6476	1981
Palouse	15	95	59	23	114	7843	1931
LC660999	14	91	58	17	104	6346	1919
Crimson	15	89	62	17	105	13580	1917
Emerald	14	88	57	16	101	6508	1720
L6601165	15	93	57	15	98	7654	1704
Laird	14	90	66	24	115	6845	1495
Chilean 78	15	89	60	20	113	7950	1393
LC760235	15	90	68	26	118	7254	1010
LSD(0.05)	1	5	1	2	4	812	443
P-VALUE	0.69	0.12	0.00	0.00	0.00	0.00	0.00
CV(s/mean)	6.5	3.5	1.5	8.5	2.6	7.3	17.0

1/ Day 14 = 4/24
2/ Day 58 = 6/7
3/ Day 114 = 8/3

YEAR/PROJECT: 1992/758 NATIONAL WINTER CANOLA VARIETY TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Paul Raymer, Univ. of Georgia

Eighteen varieties of winter canola were seeded Aug.30, 1991 on fallow ground at 7 lbs/acre. No fertilizer was applied. Fall stand establishment was excellent, as was winter survival. The plants bloomed between May 2 and May 8,1992 and matured between July 10 and July 14. At maturity, all plants in each plot were cut and bundled and, when dry, thrashed with a plot combine.

'Cascade' produced significantly less seed than any other variety. Of the named varieties, 'Capricorn', 'Apache' and 'Glacier' had the highest seed yields.

VARIETY	10/3/91 STAND %	3/25/92 SURV %	BLOOM May	MATURITY July	HEIGHT inches	YIELD lbs/a
KWC 4212	100	98	5	13	48	5630
EN 90-9	100	94	6	14	50	5438
Capricorn	100	96	5	14	46	5315
CC349	91	93	6	14	48	5308
Apache	100	98	6	14	48	5238
ES 89-7	100	98	5	13	51	5091
17/88	100	95	6	12	50	5061
Glacier	100	100	8	13	50	5041
Ceres	100	96	5	12	49	4945
EN 90-6	100	85	7	13	49	4796
ES 89-8	100	93	7	13	49	4743
SV0506	98	98	7	12	49	4696
Bridger	100	99	4	11	52	4685
CPB 89606	100	96	6	13	52	4661
ED 91-5	98	99	6	14	51	4506
SV0525	99	96	7	12	49	4458
Humus	99	98	2	10	45	4453
Cascade	100	100	3	10	46	3785
Means	99	96	5	13	49	4881
LSD(0.05)	2.8	4.6	1.2	1.8	3.7	601.6
P-VALUE	0.00	0.00	0.00	0.00	0.01	0.00
CV(s/mean)	2.0	3.4	15.0	9.9	5.3	8.7

YEAR/PROJECT: 1992/758 INTRASTATE SPRING CANOLA YIELD TRIAL

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

Seven varieties of spring canola were planted on April 12, 1992 at 6 lbs/acre. On 5/7/92, 40 lbs P_2O_5/acre, 60 lbs N/a and 25 lbs S/acre were applied. All plants from each plot were cut and bundled when mature and thrashed with a plot combine when dry. The check variety, 'Westar', was the earliest to mature at 107 days after seeding. It was also the lowest yielding variety. 'ST-213', 'Helios', 'Legend' and 'Cyclone' had significantly higher yields than Westar.

VARIETY	EMERG [1/] day	VIGOR (0-5)	FIRST FLOWER [2/] day	HEIGHT inches	MATUR [3/] day	YIELD lbs/a
ST-213	12	4	56	46	114	2304
Helios	12	3	61	53	117	2200
Legend	13	2	62	56	117	2073
Cyclone	13	3	58	49	114	2060
Iris	13	3	62	55	117	1914
S-1450	13	3	62	54	117	1821
Westar	14	4	56	46	107	1778
Mean	13	3	60	51	115	2021
LSD(0.05)	0.9	1	2	5	1.1	246
P-VALUE	0.01	0.01	0.00	0.00	0.00	0.00
CV(s/mean)	4.9	19.8	1.8	6.8	0.7	8.2

1/ Day 12 = 4/24/92
2/ Day 56 = 6/7/92
3/ Day 114 = 8/4/92

YEAR/PROJECT: 1992/755 WINTER-SPRING FORAGE BRASSICA TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
Cooperator - Dr. Mal Westcott, WARC, Corvallis

Two varieties of winter brassica, 'Emerald' and 'Forage Star', and 2 varieties of spring brassica, 'Global' and 'Westar', were seeded at 10 lbs/a on August 22, 1991 in alternating blocks with 3 replications, with variety and harvest schedule randomized within each block. The same varieties were seeded in the remaining blocks on April 1, 1992, with variety and harvest schedule also randomized within each block. On April 3, 1992, 70 lbs N/a and 35 lbs P_2O_5/a were applied to the nursery.

Treatments in the August-seeded blocks included: Emerald and Forage Star - a fall harvest + spring/summer harvests at 4-week intervals; no fall harvest with spring/summer harvests at 4-, 6- and 8-week intervals; Global and Westar - spring/summer harvests at 6- and 8-week intervals. Treatments in the April-seeded blocks included all 4 varieties harvested at 4-, 6- and 8-week intervals.

August-seeded Emerald with a single summer harvest produced the most topgrowth, followed by the other Emerald treatments. Forage Star was the second highest producer, with no significant differences among harvest schedules. A fall harvest did not significantly affect total 1992 yields for either Emerald or Forage Star. The spring canola varieties, Global and Westar, yielded less than the winter varieties. Of the April-seeded treatments, Emerald harvested once or twice had the highest yields. Global, Emerald and Forage Star harvested at 4-week intervals and Westar harvested at 6-week intervals were next highest. Although it is designated a "winter" brassica, Emerald had the highest average yields whether it was seeded late summer or spring.

WINTER & SPRING FORAGE BRASSICA TRIAL
KALISPELL, MT 1991–92

SEEDED 8/22/91

CULTIVAR	HARVEST SCHEDULE	YIELD 11/15	5/13	6/10	7/8	7/24	8/6	TOTAL YIELD
		t/a						t/a
Emerald	F + 4–wk	0.17	1.19	2.19	1.90		0.42	5.88
Emerald	4–wk		1.48	1.99	1.89		0.50	5.87
Emerald	6–wk			4.46		2.03		6.48
Emerald	8–wk				7.77			7.77
Forage Star	F + 4–wk	0.25	2.23	1.00	0.34			3.82
Forage Star	4–wk		2.56	1.10	0.40			4.07
Forage Star	6–wk			3.98				3.98
Forage Star	8–wk				3.52			3.52
Global	6–wk			0.73		0.65		1.38
Global	8–wk				2.90			2.90
Westar	6–wk			0.25		0.80		1.05
Westar	8–wk				1.26			1.26
Mean		0.21	1.87	1.96	2.50	1.16	0.46	4.00
LSD(0.05)		0.20	0.62	0.50	0.63	1.18	0.68	0.66
P–VALUE		0.25	0.00	0.00	0.00	0.05	0.81	0.00
CV(s/m)		27.0	16.5	14.5	14.4	44.9	42.2	9.8

SEEDED 4/1/92

CULTIVAR	HARVEST SCHEDULE	YIELD 6/18	7/13	7/30	8/12	TOTAL YIELD
		t/a				t/a
Emerald	4–wk	1.86	1.43		0.85	4.14
Emerald	6–wk	1.64		3.59		5.23
Emerald	8–wk		5.00			5.00
Forage Star	4–wk	1.56	1.93		0.46	3.95
Forage Star	6–wk	1.46		2.00		3.46
Forage Star	8–wk		3.17			3.17
Global	4–wk	2.04	0.57		1.23	3.84
Global	6–wk	1.90		2.19		4.09
Global	8–wk		4.15			4.15
Westar	4–wk	1.87	0.58		1.10	3.55
Westar	6–wk	1.93		1.79		3.72
Westar	8–wk		3.34			3.34
Mean		1.78	2.52	2.39	0.91	3.97
LSD(0.05)		0.26	0.34	0.58	0.41	0.49
P–VALUE		0.00	0.00	0.00	0.01	0.00
CV(s/m)		8.3	7.6	12.1	22.6	7.3

YEAR/PROJECT: 1992/755 WINTER FORAGE BRASSICA VARIETY TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye

Five varieties of winter forage brassica - 'Premier' kale, 'Sparta' rape, 'Purple Top' turnip, 'Rondo' turnip and 'Forage Star' hybrid turnip were seeded at 12 lbs/acre on September 4, 1991. On April 3, 1992, 70 lbs N/a and 35 lbs P_2O_5/acre were applied. The brassicas were harvested 3 times in 1992, and Premier and Sparta had sufficient regrowth for a 4th harvest. Premier and Sparta bolted and flowered later than the other varieties. Purple Top and Rondo turnips produced the most forage for the first harvest, but Premier and Sparta produced the most regrowth for the rest of the summer and had the highest total season yields.

CULTIVAR	2/26/92 GREENUP (0-5)	3/20 STAND %	4/3 STAND %	BOLTING date	FIRST BLOOM date
Forage Star	4.3	78	81	4/20	4/26
Premier	2.3	95	99	5/2	5/8
Sparta	1.0	75	83	5/1	5/8
Purple Top	3.8	93	95	4/21	5/3
Rondo	4.8	84	85	4/18	4/27
Mean	3.2	85	89	4/24	5/2
LSD(0.05)	0.7	5.4	6.9	4d	3d
P-VALUE	0.00	0.00	0.00	0.00	0.00
CV(s/mean)	13.4	4.1	5.0	9.9	6.1

	YIELD				TOTAL
CULTIVAR	5/13/92	6/10/92	7/10/92	8/6/92	YIELD
	t/a				t/a
Forage Star	3.58	1.53	0.43	0.00	5.53
Premier	3.02	2.27	2.70	0.56	8.54
Sparta	1.71	2.94	2.88	0.69	8.21
Purple Top	4.29	1.45	0.86	0.00	6.60
Rondo	3.82	0.90	0.25	0.00	4.96
Mean	3.28	1.82	1.42	0.25	6.77
LSD(0.05)	0.50	0.46	0.49	0.14	1.00
P-VALUE	0.00	0.00	0.00	0.00	0.00
CV(s/mean)	9.9	16.3	22.6	37.0	9.6

YEAR/PROJECT: 1992/758 ROTATIONAL CROPS IN PEPPERMINT

Personnel: Project Leader - Leon Welty
Research Specialist - Louise Prestbye
Cooperators: Dr.Don Mathre, MSU, Bozeman
Dr. Dennis Johnson, WSU, Prosser, WA
Dr. Gerald Santo, WSU, Prosser, WA
Dr. Fred Crowe, OSU, Redmond, OR

On 21 May, 1992, microsclerotia of a local strain of Verticillium dahliae were incorporated into two fields, one with a fine sandy loam soil and one with a silty clay loam soil type. Eight rotational treatments were established on 28 May:

1. barley, grain harvested - residue, green manure
2. fallow
3. Vapam fumigant, 50 GPA
4. sorghum (high HCN), cut once - green manure
5. sorghum (high HCN), cut twice - green manure
6. marigold - green manure
7. spring rapeseed (high glucosinolate), cut once - green manure
8. spring rapeseed (high glucosinolate), cut twice on heavier soil and once on lighter soil - green manure

On September, 1992, the green manure crops were rototilled by treatment so that soil and plant debris were not moved from plot to plot.

1992 ROTATION CROP YIELDS:

Treatment	Heavy Soil	Light Soil
Sorghum - 1 cut	5.08 t/a	4.77 t/a
Sorghum - 2 cut	3.18	2.10
Rapeseed - 1 cut	5.63	2.26
Rapeseed - 2 cut	4.80	----
Marigold	4.19	3.05
Barley grain	56.1 bu/a	12.4 bu/a

YEAR/PROJECT: 1992/758 MINT HARVEST MANAGEMENT STUDY

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
Cooperator - Dr.Mal Westcott, WARC, Corvallis

'Black Mitcham' peppermint was planted 4/7/92 and irrigated at 0.73 inches/week. A total of 180 lbs/acre N fertilizer was applied over the season. Sinbar and Poast and hand weeding were used for weed control. Orthene and Dipel were used for painted lady butterfly and army cutworm control, respectively. Herbage was harvested at one-week intervals between 8/5 and 9/29/92, dried, distilled, and the oil collected for yield and quality analysis. An uncut check plot was also included to determine the effect of no topgrowth removal on root vigor in 1993.

Average dry matter yield was 3.30 t/a, with no significant differences among harvest dates. Oil content averaged 9.9 ml/kg and was highest at the 8/12 (early bloom), 9/2 (late bloom) and 9/10 (petal drop) harvests. Oil yield averaged 55.8 lbs/a and was highest on 8/12, 9/2, 9/10 and 9/16.

Date	Stage	Dry Matter tons/acre	Oil Content ml/kg	Oil Yield lbs/acre
8/5	bud	3.01	9.3	47.9
8/12	early bloom	3.44	10.3	61.0
8/19	30% bloom	3.40	9.8	57.3
8/26	70% bloom	3.41	9.1	53.4
9/2	late bloom	2.89	11.7	58.2
9/10	petal drop	3.35	10.4	59.7
9/16	mature	3.35	10.0	57.6
9/29	mature	3.57	8.3	51.2
	LSD(0.05)	NS	1.6	7.5
	P-VALUE	0.58	0.01	0.02

YEAR/PROJECT: 1992/758 CROP MANAGEMENT STUDY

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

This was the first year of a 3-year study to evaluate canola, rapeseed and spring pea as enhancers of soil nutrient availability and crop productivity in cereal rotations. Spring soil samples were collected at 0-6", 6-12", 1-2', 2-3' and 3-4' to evaluate N,P,K and S levels and nitrate-N distribution in the soil profile. First-year cropping treatments included:

1. 'R-500'(high-glucosinolate) rapeseed as seed crop
2. 'Westar'(low-glucosinolate) canola as seed crop
3. 'Latah' spring pea as hay crop (SP)
4. 'Humus'(high-glucosinolate) rapeseed as green manure (HGR)
5. 'Westar'(low-glucosinolate) canola as green manure (LCG)
6. 'Latah' spring pea as green manure
7. 25% Humus + 75% Latah as green manure
8. 50% Humus + 50% Latah as green manure
9. 75% Humus + 25% Latah as green manure
10. 25% Westar + 75% Latah as green manure
11. 50% Westar + 50% Latah as green manure
12. 75% Westar + 25% Latah as green manure
13. 'Haybet' barley as hay crop (low residue)
14. 'Gallatin' barley as grain crop (high residue)

The crops were seeded April 23,1992. Seeding rates were 6 lbs/a rapeseed and canola (pure stand), 150 lbs/a spring pea (pure stand) and 70 lbs/a barley. Each green manure treatment was cut, weighed and returned to the plot on July 2 and August 31. Species composition was determined for the first cutting brassica/pea mixtures. Haybet and Latah were harvested for hay on July 8. On August 28, grain was harvested from treatments 1, 2 and 14, and the straw was weighed and returned to the plots. Green manure and residue were incorporated in the fall.

CROP MANAGEMENT STUDY
KALISPELL, 1992

MEAN YIELDS

ROTATION TREATMENT	CROP	DATE	-----GRAIN----- TWT lbs/bu	YIELD lbs/a	STRAW YIELD lbs/a
1	R-500	8/28	45.1	796	577
2	Westar	8/28	45.1	2217	1769
14	Gallatin	8/28	44.6	2072	1176

ROTATION TREATMENT	CROP	DATE	HERBAGE YIELD lbs/a	DATE	HERBAGE YIELD lbs/a
3	Latah hay	7/8	4663		
4	Humus GM	7/2	1014	8/31	9723
5	Westar GM	7/2	3847	8/31	6845
6	Latah GM	7/2	3127		
7	HGR+SP(25:75)	7/2	3390	8/31	7359
8	HGR+SP(50:50)	7/2	3860	8/31	7701
9	HGR+SP(75:25)	7/2	2244	8/31	9070
10	LCG+SP(25:75)	7/2	4495	8/31	3824
11	LCG+SP(50:50)	7/2	4854	8/31	5010
12	LCG+SP(75:25)	7/2	4719	8/31	6553
13	Haybet hay	7/8	3370		