FORTYSIXTH ANNUAL REPORT
1994

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

4570 Montana 35
Kalispell, MT 59901

Prepared by

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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)	21
Robert N. Stougaard - Assistant Professor, Weed Science (Began November 1991)	3
Todd K. Keener - Ag Research Spec. II (Began March 1978)	16
Gary R. Haaven - Ag Research Spec. I (Began April 1982)	12
Louise S. Prestbye - Ag Research Spec. I (Began May 1983)	11
Elaine M. Scott - Administrative Support (Began August 1990)	4
James R. Bates - Farm/Ranch Hand III (began June 1993)	1.5
Vern R. Stewart - Professor Emeritus	

Part Time Employees:

Paul Ausenhus (June 7 through August 27)

Jens Christensen (May)

Sarah Gunderson (July 25 through November 30)

Holly Presnell (August 4 through September 30)

John Scott (August 4 through October 7)

Steve Voorhees (August)

Student Employees:

David Alzner (May 23 through November 30)

Corraun Bourne (May 16 through August 19)

Gail Sharp (January 1 through December 31)

Dana Wittinger (May 16 through August 19)

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 1994:

Lease John Deere 6400 tractor	$ 2,075.10
Lease John Deere 870 tractor	$ 871.78
Almaco Combine	$78,000.00

PHYSICAL PLANT 752

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

PROFESSIONAL & CLIENTELE PRESENTATIONS 1994

Date	Activity	Who	Where
1/11	Producers - Whitetop control	Stougaard	Ronan
1/13	Advisory Committee	Welty Stougaard	Missoula
1/20	MIRC	Welty	Las Vegas, NV
2/7	Mint Advisory Committee	Welty	NWARC
2/8	Alfalfa Producers - Pioneer	Welty	Kalispell
2/10	MAGPI	Welty	Whitehall
2/15	Mint Growers Association	Welty Stougaard	Kalispell
2/16	Equity Meeting-Recertification	Stougaard Keener	Kalispell
3/8	Producers	Welty Stougaard	Stevensville
3/15	West. Soc. Weed Scietists	Stougaard Keener	Couer d'alene, ID
3/22	Lentil Producers	Welty Stougaard	Kalispell
3/28	Dairy Producers	Welty Stougaard	Ronan
4/6	MSU President Malone - Tour	Welty	Kalispell
5/13	Area Business People - Tour	Welty	NWARC
5/24	Mint Oil Buyers - Tour	Welty	NWARC
6/1	FFA - Tour	Welty Stougaard	NWARC
6/13	CES Producers from Bozeman-Tour	Welty	NWARC
7/14	Adv. Comm. & Ext. Agents - Tour	Welty Stougaard	NWARC
7/19	Chemical Co. Rep. - Tour	Welty	NWARC
7/21	Mint Tour	Welty Stougaard	NWARC
7/29	MIRC Researchers	Welty	Madras, OR
8/2	Entomologists from NC - Tour	Welty	NWARC
8/4	Japanese students - Tour	Welty Stougaard	NWARC
8/11	Japanese students - Tour	Welty	NWARC
8/25	Japanese students - Tour	Welty	NWARC
9/1	Pea & Lentil Admin. - Tour	Welty	NWARC
9/5	Billings Newspaper Reporter - Tour	Welty	NWARC
9/5	Flathead Newspaper Reporter - Tour	Welty	NWARC
9/13	Flathead Biology students - Tour	Welty	NWARC
9/14	Flathead Biology students - Tour	Welty	NWARC
9/20	CES & Producers	Welty	Deer Lodge
10/3	Flathead Biology students - Tour	Welty	NWARC
10/13	Mint Adv. Committee	Welty	NWARC
10/24	Mint Adv. Committee	Welty	NWARC
10/25	Aero	Welty	Kalispell
10/26	MIRC/MMC	Welty	NWARC
11/10	PNW Forage Workers	Welty	Puyallup, WA
11/16	ASA	Welty Prestbye	Seattle, WA
11/28	Almaco Combine	Keener	Great Falls

CLIMATOLOGICAL DATA
NORTHWESTERN AGRICULTURAL RESEARCH CENTER
Kalispell, MT

The 1993-94 growing season contained both beneficial and detrimental extremes with favorable conditions having the predominant effect in the early crop stage as well as during harvest. The noted detrimental extremes for Northwest Montana this season were low precipitation combined with warmer than normal temperatures. It was a very good year for growing cereals with a few instances of crops responding negatively to low moisture amounts.

Total precipitation for the 1993-94 season was 14.62 inches, 5.09 inches (26%) below the long term average of 19.71 inches. Lower than normal precipitation received in October, November, and December of 1993, and March of 1994 put rainfall amounts almost 2" behind normal accumulations by early spring. Ample moisture in April contributed to favorable seeding conditions. Precipitation in May was 22% lower than normal while June rainfall was equal to the long term average. June was the last month with regular rainfall as July, August and September had .1, .23 and .46 inches of precipitation, respectively. Dryland soil profiles were depleted of moisture by the end of August and winter wheat seeding was delayed or facilitated with irrigation, where possible. Irrigation was constantly being moved across the perennial crops in early spring and continued into September as the warm weather persisted.

Higher than normal maximum temperatures during the season aided in establishment of early plantings and during the summer facilitated an earlier-than-normal harvest. Lower average temperatures were experienced in September and November of 1993, as well as February and June of 1994. Seven months had higher average temperatures, yet January was the only month having a dramatic increase (10.5 degrees higher, from 22.4 to 32.9 degrees). Historically, January has been the coldest month in Northwest Montana, yet in the last two years February has been the coolest. During most of that cold spell in February there were seven inches of snow cover protecting the winter wheat and perennial crops.

The frost free period for 1993-94 was 135 days, 23 days longer than the 44 year average. The last frost in the spring was on April 30 while the first frost this fall was on September 12. There were more accumulated heat units this season than have been recorded for many years. Although not setting a record for growing degree days, crop maturity and harvest were both advanced two weeks earlier than previous years. High yields were recorded for winter wheat with moderate to high yields recorded in spring grains. A few spring cultivars from the variety trials that were effected by the lack of precipitation and increased heat units had shriveled kernels, lighter test weights, and/or lower yields.

There were 94 days of snow cover during the winter. The periods of continuous snow cover were mainly in two intervals; from December 14 through January 16, and January 29 through March 3 (34 days each). The other 26 days of snow cover were intermittent cover between the days of November 11 and the last snow cover day of March 19. The greatest snow depths were; 9 inches at November 12, 7 inches at January 16, and 7 inches at February 10. The short period of continuous snow cover was influential in limiting the TCK infection that occurred at very low levels in winter wheat.

Foliar diseases were much less severe than last year. Weather was as much a factor in preventing diseases this year as it was a inducement of diseases last year. Low levels of scald and net blotch were observed on barley. Low levels of Septoria, leaf and stripe rust, and powdery mildew were observed in wheat. Lodging was a minor issue in cereal grains this year.

Following is a list of tables giving a complete description of the weather for the crop year (September 1993 through August 1994) and 1994 (January through December).

Table 1. Summary of climatic data by months for 1993-94 crop year (September through August) and averages for the period 1949-94 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, 1994. (Average)

Table 3. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1994. (Maximum)

Table 4. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1994. (Minimum)

Table 5. Summary of precipitation records at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1994.

Table 6. Precipitation by day for crop year September 1, 1992 through August 31, 1994, Northwestern Agricultural Research Center, Kalispell, MT.

Table 7. Frost free period at the Northwestern Agricultural Research Center from 1950 through 1994.

Table 8. Temperature extremes at the Northwestern Agricultural Research Center, Kalispell, MT from 1950-1994.

Table 9. Summary of temperature records at the Northwestern Agricultural Research Center, January 1950 through December 1994.

Table 10. Summary of precipitation records at the Northwestern Agricultural Research Center, Kalispell, MT, January 1950 through December 1994.

Table 11. Summary of growing degree day (GDD) data at the Northwestern Agricultural Research Center, Kalispell, MT, May 1, 1949 through October 31, 1994.

Table 1. Summary of climatic data by months for 1993–94 crop year (September thru August) and averages for the period 1949–94 at the Northwestern Agricultural Research Center, Kalispell, MT.

ITEM	Sept. 1993	Oct. 1993	Nov. 1993	Dec. 1993	Jan. 1994	Feb. 1994	Mar. 1994	Apr. 1994	May 1994	June 1994	July 1994	Aug. 1994	Total or Average
Precipitation (inches)													
Current Year	1.54	0.83	1.23	1.27	1.43	1.49	0.11	2.01	1.79	2.59	0.10	0.23	14.62
Avg. 1949 to 1993–94	1.59	1.33	1.51	1.62	1.49	1.16	1.13	1.45	2.30	2.89	1.65	1.56	19.68
Mean Temperature (F)													
Current Year	51.4	44.4	16.6	27.4	32.9	20.6	37.5	45.4	54.0	57.3	66.4	66.6	43.4
Avg. 1949 to 1993–94	53.4	43.3	32.6	25.4	22.4	27.5	33.9	43.3	51.8	58.3	63.9	63.0	43.2
Last killing frost in spring													
1994					April 30 (31 degrees F)								
Avg. 1949–94					May 24								
First killing frost in fall													
1994					September 12 (32 degrees F)								
Avg. 1949–94					September 14								
Frost Free Period													
1994					135 days								
Avg. 1949–94					112 days								
Maximum summer temperature					97 degrees F on August 15, 1994								
Minimum winter temperature					–25 degrees F on February 1, 1994								

In this summary 32 degrees is considered a killing frost.

Table 2. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1994.

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
1992–93	51.1	44.7	33.1	19.4	14.7	18.4	33.7	43.6	56.0	56.5	56.6	59.7	40.6
1993–94	51.4	44.4	25.0	27.4	32.9	20.6	37.5	45.4	54.0	57.3	66.4	63.0	43.8
MEAN	53.4	43.3	32.6	25.4	22.4	27.5	33.9	43.3	51.8	58.3	63.9	63.0	43.2

Mean temperature for all years = 43.2

Table 3. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1994.

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	52.1
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	56.1
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	57.1
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	55.3
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	53.0
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	54.0
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	54.0
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	54.0
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	55.0
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	53.0
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	53.0
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	53.5
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	56.0
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	53.0
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	54.0
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	54.0
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	56.0
1992–93	64.9	57.4	38.0	27.2	22.4	27.0	43.7	52.8	69.7	67.8	66.2	73.8	50.0
1993–94	66.6	56.8	33.5	33.3	38.9	30.2	48.9	57.4	66.7	70.5	83.0	85.0	55.0
MEAN	68.5	55.5	40.0	32.1	29.8	36.0	43.7	55.1	64.9	71.6	79.8	79.5	54.0

Mean temperature for all years = 54.7

Table 4. Summary of temperature data at the Northwestern Agricultural Research Center on crop year basis September 1, 1949 through August 31, 1994.

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
1992–93	37.4	32.0	28.1	11.6	7.0	9.8	23.8	34.5	42.3	45.2	47.0	45.6	30.4
1993–94	36.3	32.0	16.6	21.5	27.0	11.0	26.2	33.4	41.3	44.1	49.8	48.3	32.3
MEAN	38.4	31.2	24.9	18.7	15.4	19.1	24.1	31.5	38.6	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, 1994.

	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	20.95
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	23.60
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	17.50
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
1992–93	1.21	1.07	2.37	1.53	1.68	0.60	0.73	3.77	2.22	4.00	7.00	1.19	27.37
1993–94	1.54	0.83	1.23	1.27	1.43	1.49	0.11	2.01	1.79	2.59	0.10	0.23	14.63
MEAN	1.59	1.33	1.51	1.62	1.49	1.16	1.13	1.45	2.30	2.89	1.65	1.56	19.70

Mean precipitation for all crop years = 19.70

Table 6. Precipitation by day for crop year, September 1, 1993 through August 31, 1994. Northwestern Agricultural Research Center, Kalispell, MT.

DATE	SEPT. 1993	OCT. 1993	NOV. 1993	DEC. 1993	JAN. 1994	FEB. 1994	MAR. 1994	APR. 1994	MAY 1994	JUNE 1994	JULY 1994	AUG. 1994
1	0.03		0.30	0.08	0.05	0.02	T		0.09	0.25		
2	0.05			0.03	0.27						0.06	0.03
3					0.08		0.01	0.09	0.02	0.23		
4			0.03		0.08		0.06	1.06		0.39		0.11
5	0.27		T		0.06		0.02	0.25		0.19		
6								0.12				
7		0.23	0.04	T				0.20				
8		0.05		0.06	0.02	0.21				0.45		
9				0.11	0.02	0.02				0.03		
10						0.09				0.10		
11					0.01	0.20				0.05		
12	0.85				T				0.22	0.18		
13		0.15						0.05		0.10	0.04	
14		0.16		T				0.02		0.02		
15	0.11	0.05		T	0.13				0.09			0.01
16	0.05	0.10			0.01					0.06		
17		0.09	T						T	0.07		
18			0.15			0.10	T		0.20			
19				0.02		0.03	0.02		0.19			
20				T		0.16		0.07	0.37			
21				T					0.04			
22	0.18		0.60	0.03		0.19		0.02				
23		T	T	0.12		0.06		0.13				
24					0.60	0.16				0.03		
25					T	0.03						
26					0.01	0.20				0.04		
27					0.02	0.02			0.45	0.40		
28			0.03									
29			T	0.17	0.05				T			0.08
30			0.08	0.08	0.02				0.12		T	
31				0.57	T							
TOTAL	1.54	0.83	1.23	1.27	1.43	1.49	0.11	2.01	1.79	2.59	0.10	0.23

YTD 14.62

Table 7. Frost free period at the Northwestern Agricultural Research Center from 1950 thru 1994.

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
1993	May 4	32	Sept. 13	29	132
1994	April 30	31	Sept. 12	32	135
Mean for years	May 24	30	Sept. 14	30	112

Table 8. Temperature extremes at the Northwestern Agricultural Research Center, Kalispell, MT from 1950–94.

	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
1993	Feb. 18	−19	May 13	91
1994	Feb. 8	−25	Aug. 15	97

Table 9. Summary of temperature records at the Northwestern Agricultural Research Center January 1950 through December 1994.

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
1993	14.7	18.4	33.7	43.6	56.0	56.5	56.6	59.7	51.4	44.4	25.0	25.4	40.5
1994	32.9	20.6	37.5	45.4	54.0	57.3	66.4	66.6	56.3	43.3	32.5	27.1	45.0
MEAN	21.9	26.9	33.9	43.3	51.8	58.3	63.9	63.0	53.5	43.4	32.4	25.4	43.1

Table 10. Summary of precipitation records at the Northwestern Agricultural Research Center, Kalispell, MT, January 1950 thru December 1994.

	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
1993	1.68	0.60	0.73	3.77	2.22	4.00	7.00	1.19	1.54	0.83	1.23	1.27	26.06
1994	1.43	1.49	0.11	2.01	1.79	2.59	0.10	0.23	0.46	2.12	1.89	1.07	15.29
MEAN	1.49	1.16	1.13	1.45	2.30	2.89	1.65	1.56	1.57	1.36	1.52	1.63	19.72

Table 11. Summary of growing degree day (GDD) data at the Northwestern Agricultural Research
May 1, 1949 through October 31, 1994. GDD = Temp Max + Temp Min÷2 − 50
Max Temp > 86F substituted with 86; Min Temp < 50F substituted with 50

	Average growing degree days by month and year.						
YEAR	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	TOTAL
1949	314.0	356.5	467.0	499.5	322.0	57.5	2016.5
1950	208.0	308.0	459.5	465.0	314.0	97.5	1852.0
1951	223.0	251.5	488.5	411.5	212.5	33.0	1620.0
1952	243.5	309.0	458.5	472.5	358.0	199.0	2040.5
1953	194.5	252.5	503.5	455.5	336.0	172.0	1914.0
1954	270.5	255.0	473.5	387.0	248.0	61.5	1695.5
1955	165.0	364.5	439.5	502.5	263.0	103.5	1838.0
1956	282.0	351.5	491.0	437.5	316.5	98.0	1976.5
1957	312.5	350.5	509.5	466.0	366.0	60.0	2064.5
1958	427.5	398.0	504.5	553.0	295.0	136.0	2314.0
1959	187.0	370.0	499.5	417.5	211.0	68.0	1753.0
1960	202.5	380.5	563.0	383.0	334.0	132.5	1995.5
1961	248.0	479.5	537.5	548.5	190.0	99.5	2103.0
1962	201.0	367.5	454.0	438.0	326.0	86.5	1873.0
1963	265.0	335.0	468.0	508.5	378.0	150.0	2104.5
1964	219.5	324.5	484.5	357.0	208.0	88.0	1681.5
1965	222.0	328.5	488.5	453.5	126.0	173.0	1791.5
1966	306.5	291.0	495.0	445.5	375.0	97.0	2010.0
1967	255.0	354.5	538.0	545.0	444.0	101.5	2238.0
1968	207.5	348.0	497.0	407.0	243.0	57.5	1760.0
1969	293.5	338.5	460.5	503.5	306.5	38.0	1940.5
1970	281.5	391.0	472.5	474.5	196.5	72.5	1888.5
1971	259.0	263.0	434.0	553.5	217.0	100.0	1826.5
1972	228.5	348.5	425.0	505.5	226.0	87.0	1820.5
1973	259.5	320.5	515.0	497.0	266.5	106.5	1965.0
1974	152.5	390.5	476.0	432.5	314.0	179.0	1944.5
1975	180.0	283.5	563.0	362.5	290.5	77.5	1757.0
1976	251.0	247.0	463.0	400.0	347.5	119.5	1828.0
1977	184.0	419.0	431.5	428.0	224.5	93.0	1780.0
1978	131.0	348.0	442.0	375.0	243.5	145.0	1684.5
1979	225.5	368.5	484.5	510.5	362.0	163.0	2114.0
1980	268.0	290.0	438.5	361.0	254.0	151.0	1762.5
1981	209.0	210.5	445.5	517.0	312.5	73.0	1767.5
1982	195.0	369.5	402.5	473.0	282.0	66.5	1788.5
1983	259.5	315.5	358.5	510.5	229.0	98.5	1771.5
1984	162.0	294.5	511.0	511.0	214.0	108.5	1801.0
1985	294.5	347.0	562.0	394.5	162.0	67.0	1827.0
1986	247.5	456.5	363.0	529.0	152.0	86.0	1834.0
1987	287.5	404.0	434.5	388.5	352.5	154.0	2021.0
1988	218.5	397.0	449.0	503.0	276.5	197.5	2041.5
1989	178.5	350.5	516.0	388.5	276.5	80.0	1790.0
1990	165.5	296.0	485.0	459.0	417.5	75.0	1898.0
1991	175.0	243.0	464.0	499.5	312.5	170.5	1864.5
1992	277.0	410.5	375.0	441.5	223.0	140.0	1867.0
1993	301.5	273.5	260.0	383.0	249.5	114.0	1581.5
1994	261.5	315.0	512.5	529.5	361.0	82.0	2061.5
MEAN	237.0	336.2	468.8	458.4	281.2	106.9	1888.4

Montana State University

LENTIL HERBICIDE STUDY

Project Code:94-LENTHERB
Cooperator :

Location :KALISPELL
By:Bob Stougaard

Summary Comments: The purpose of this study was to compare single, split, and tank-mix applications of Pursuit and Sencor for weed control in lentils. Pursuit treatments provided 100 percent weed control. However, these same treatments resulted in approximately 40 percent crop injury and the associated yields were significantly reduced compared to the nontreated check. Sencor applied alone did not injure lentils, however weed control was less complete, especially with single preemergence or preplant incorporated applications. Of the Sencor treatments, split aplications provided the best weed control.

Montana State University

LENTIL HERBICIDE STUDY

Project Code:94-LENTHERB

Location :KALISPELL
By:Bob Stougaard

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Rate Unit	Grow Stg	Appl Code	LENTIL INJURY PERCENT 6-17-94	BUCKWHT CONTROL PERCENT 6-17-94	CLAMBQTR CONTROL PERCENT 6-17-94	PENNYCRS CONTROL PERCENT 6-17-94	LENTILS YIELD LB/A 7-25-94
1	PURSUIT	2	EC	3	oz pr/A	PPI		33	100	100	100	912
2	PURSUIT	2	EC	3	oz pr/A	PRE		57	100	100	100	830
3	PURSUIT	2	EC	1.5	oz pr/A	PPI		58	100	100	100	988
3	PURSUIT	2	EC	1.5	oz pr/A	PRE						
4	PURSUIT	2	EC	1.5	oz pr/A	PPI		43	100	100	100	1185
4	PURSUIT	2	EC	1.5	oz pr/A	POST						
5	PURSUIT	2	EC	3	oz pr/A	PPI		35	100	100	100	1054
5	SENCOR 75DF	75	DF	.375	lb pr/A	PPI						
6	PURSUIT	2	EC	3	oz pr/A	PPI		40	100	100	100	1087
6	SENCOR 75DF	75	DF	.25	lb pr/A	PPI						
7	PURSUIT	2	EC	3	oz pr/A	PPI		43	100	100	100	1228
7	SENCOR 75DF	75	DF	.12	lb pr/A	POST						
8	PURSUIT	2	EC	3	oz pr/A	PPI		40	100	100	100	1154
8	SENCOR 75DF	75	DF	.16	lb pr/A	POST						
9	SENCOR 75DF	75	DF	.375	lb pr/A	PPI		5	50	93	70	1234
10	SENCOR 75DF	75	DF	.375	lb pr/A	PRE		5	53	60	47	1168
11	SENCOR 75DF	75	DF	.187	lb pr/A	PPI		8	80	97	100	1383
11	SENCOR 75DF	75	DF	.187	lb pr/A	PRE						
12	SENCOR 75DF	75	DF	.187	lb pr/A	PPI		7	83	93	100	1160
12	SENCOR 75DF	75	DF	.187	lb pr/A	POST						
13	SENCOR 75DF	75	DF	.25	lb pr/A	PPI		3	87	95	85	1255
13	SENCOR 75DF	75	DF	.12	lb pr/A	PRE						
14	SENCOR 75DF	75	DF	.25	lb pr/A	PPI		3	87	100	97	1392
14	SENCOR 75DF	75	DF	.12	lb pr/A	POST						
15	SENCOR 75DF	75	DF	.12	lb pr/A	PPI		3	83	100	100	1377
15	SENCOR 75DF	75	DF	.12	lb pr/A	POST						
16	NONTREATED							0	0	0	0	1301
LSD (.05) =								16	23	23	22	240
Standard Dev.=								9.58696	14.0764	13.9481	13.2537	143.702
CV =								39.84	17.02	15.52	15.17	12.29
Block F								0.323	1.109	0.806	0.323	0.991
Block Prob(F)								0.7265	0.3429	0.4562	0.7263	0.3829
Treatment F								14.881	11.332	10.374	13.024	3.934
Treatment Prob(F)								0.0001	0.0001	0.0001	0.0001	0.0007

Montana State University

LENTIL HERBICIDE STUDY

Project Code:94-LENTHERB Location :KALISPELL
Cooperator : By:Bob Stougaard

Site Description

Crop: Lentils Variety: Chilean Planting Date: 4-19-94
Planting Method: Research Rate, Unit: 60 , #/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 6 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date: 4-28-94

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 15 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover: None
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance: Fall plow, spring disc and cultivate. Vibra-shank and packing prior to seedbed preparation.

Soil Description

Texture: Fine Sandy Loam % OM: 2.8 % Sand: 50 % Silt: 40 % Clay: 10
pH: 6.4 CEC: Soil Name: Kalispell FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	4-19-94	4-19-94	5-11-94			
Time of Day:	9:00 am	12:00	2:00 pm			
Application Method:	Backpack	Backpack	Backpack			
Application Timing:	PPI	Pre	Post			
Air Temp., Unit:	56 ,F	64 ,F	82 ,F	,	,	,
% Relative Humidity:	52	33	12			
Wind Velocity, Unit:	2 ,mph	1.5 ,mph	1.5 ,mph	,	,	,
Dew Presence (Y/N):	N	N	n			
Water Hardness:	N	N	n			
Soil Temp., Unit:	51 ,F	55 ,F	70 ,F	,	,	,
Soil Moisture:	Good	Good	Good			
% Cloud Cover:	99	99	0			

Weed Species	Weed Stage, Density at Application					
Lentils	na ,	na ,	2" ,	,	,	,
Wild buckwheat	na ,	na ,	1 lf,	,	,	,
Fanweed	na ,	na ,	4-6l,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	Backpack	2	flatfan	11002XR	14"	20"	10′	20	H2O	20
B.	"									
C.	"									
D.										

Montana State University

1994 WHITETOP HERBICIDE STUDY - LAKE COUNTY

Project Code:94-WHS-LAKE
Cooperator :JACK STIVERS

Location :ST. IGNATIUS
By:Bob Stougaard

Summary Comments: The purpose of this study was to evaluate herbicides for whitetop control. Herbicides were applied to a whitetop infested fallow area on April 11 when whitetop was in the rosette stage of growth. Pursuit resulted in 65 percent reduction in whitetop biomass. This occurred in spite of the absence of surfactants or crop competition. Of the herbicides currently labeled for use in alfalfa, the high rate of Velpar provided the best control and also resulted in a significant reduction in whitetop biomass.

Montana State University

1994 WHITETOP HERBICIDE STUDY - LAKE COUNTY

Project Code:94-WHS-LAKE
Cooperator :JACK STIVERS

Location :ST. IGNATIUS
By:Bob Stougaard

Trt No	Treatment Name	Form Amt	Form Rate	Rate Unit	WHITETOP %CONTROL 6-12-94	WHITETOP %CONTROL 6-29-94	WHITETOP GREEN WT LB/A 6-29-94	WHITETOP DRY WT LB/A 6-29-94
1	PURSUIT	2	EC 4	oz pr/A	73.3	75.0	1608	617
2	PURSUIT	2	EC 8	oz pr/A	80.0	78.3	1406	358
3	VELPAR	90	WP .55	lb pr/A	0.0	10.0	3578	1342
4	VELPAR	90	WP 1.11	lb pr/A	6.7	41.7	1938	682
5	KARMEX	80	DF 1.5	lb pr/A	0.0	0.0	5762	2087
6	KARMEX	80	DF 3.0	lb pr/A	0.0	0.0	6155	2258
7	SINBAR	80	DF .5	lb pr/A	0.0	3.3	4494	1672
8	SINBAR	80	DF 1.0	lb pr/A	0.0	36.7	2535	852
9	SENCOR	75	DF .5	lb pr/A	0.0	0.0	3706	1384
10	SENCOR	75	DF 1.0	lb pr/A	0.0	3.3	3610	1321
11	UNTREATED				0.0	0.0	3855	1395
LSD (.05) =					7.5	31.2	2423	935
Standard Dev.=					4.40386	18.2968	1422.38	547.139
CV =					30.28	81.05	40.48	43.09
Block F					2.461	0.057	4.922	3.368
Block Prob(F)					0.1108	0.9451	0.0183	0.0560
Treatment F					146.875	8.386	3.659	3.629
Treatment Prob(F)					0.0001	0.0001	0.0065	0.0076

Montana State University

1994 WHITETOP HERBICIDE STUDY - LAKE COUNTY

Project Code:94-WHS-LAKE Location :ST. IGNATIUS
Cooperator :JACK STIVERS By:Bob Stougaard

Site Description

Crop: FALLOW Variety: Planting Date:
Planting Method: Rate, Unit: , Depth, Unit: ,
Perennial Age, Unit: 1 , YR Row Spacing, Unit: ,
Soil Temp., Unit: , Soil Moisture: Emergence Date:

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 15 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance:

Soil Description

Texture: % OM: % Sand: % Silt: % Clay:
pH: CEC: Soil Name: Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	4-11-94					
Time of Day:	2:30 PM					
Application Method:	BACLPACK					
Application Timing:	EPOST					
Air Temp., Unit:	62 ,F	,	,	,	,	,
% Relative Humidity:	21					
Wind Velocity, Unit:	1.5 ,MPH	,	,	,	,	,
Dew Presence (Y/N):	N					
Water Hardness:	N					
Soil Temp., Unit:	58 ,F	,	,	,	,	,
Soil Moisture:	FAIR, TOP					
% Cloud Cover:	0					

Weed Species	Weed Stage, Density at Application					
WHITETOP ROSETTES	2" ,10/F	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLAT FAN	11002XR	14"	20"	10'	20	H20	20
B.										
C.										
D.										
E.										
F.										

Montana State University

IRRIGATED SPRING WHEAT PROTEIN ENHANCEMENT STUDY - 1994

Project Code:94 - SWPE Location :KALISPELL
Cooperator :WESTCOTT/ENGLE By:Bob Stougaard

Summary Comments:

The objective of this study was to evaluate the effect of nitrogen fertilizer rate and application timing on grain yield and protein content of three spring wheat varieties. Len, Newana, and Hi-Line recieved either 0, 50, 100, or 150 pounds of nitrogen per acre as a preplant incorporated treatment. An additional set of plots recieved a top-dress application of 40 pounds of nitrogen per acre at flag leaf.

The overall response to nitrogen was positive up to 100 lb/A, after which yields tended to decrease. Spring wheat yield did not respond to additional nitrogen applied at the flag leaf stage. Nitrogen response varied by variety. Len had the greatest overall yields, followed by Newana and Hi-Line respectively. Len demonstrated a positive response to nitrogen applications, regardless of application timing. Newana also demonstrated a positive response to nitrogen, but the effect was not as pronounced. Hi-Line did not respond to nitrogen, regardless of application timing.

Montana State University

IRRIGATED SPRING WHEAT PROTEIN ENHANCEMENT STUDY - 1994

Project Code:94 - SWPE Location :KALISPELL
Cooperator :WESTCOTT/ENGLE By:Bob Stougaard

Trt No	Treatment Name	WHEAT SPAD RDG % CHLOR 6-20-94	WHEAT SPAD RDG % CHLOR 7-18-94	STRAW BIOMASS GM/2FT 8-12-94	HEADS BIOMASS GM/2 FT 8-12-94	WHEAT GRAIN GM/2FT 8-17-94	TOTAL BIOMASS GM/M SQ 8-12-94	WHEAT YIELD BU/A 8-17-94	WHEAT TEST WT LB/BU 8-17-94
1	LEN 0 N PPI	46.95	45.77	66.3	106.3	75.3	8.0	55.4	58.38
2	LEN 0 N PPI 40 LB N FLAG	46.95	47.00	71.0	103.5	71.8	8.1	57.6	58.20
3	LEN 50 LBS N PPI	48.55	47.58	69.8	108.8	77.0	8.3	59.1	57.97
4	LEN 50 LBS N PPI 40 LBS N FLAG	48.55	48.10	69.8	112.0	79.0	8.5	60.3	58.60
5	LEN 100 LBS N PPI	48.55	47.88	72.3	112.0	79.0	8.6	62.9	58.63
6	LEN 100 LBS N PPI 40 LBS N FLAG	48.55	48.65	77.3	118.0	83.3	9.1	66.3	58.58
7	LEN 150 LBS N PPI	48.85	48.15	75.5	118.0	82.8	9.0	59.6	58.03
8	LEN 150 LBS N PPI 40 LBS N FLAG	48.85	47.95	62.0	99.3	69.8	7.5	60.6	58.25
9	NEWANA 0 N PPI	49.65	48.05	53.0	92.8	65.8	6.8	54.1	58.88
10	NEWANA 0 N PPI 40 LBS N FLAG	49.65	50.82	54.0	90.0	63.0	6.7	50.9	58.68
11	NEWANA 50 LBS N PPI	51.33	52.77	57.0	97.3	68.3	7.2	50.2	58.10
12	NEWANA 50 LBS N PPI 40 LBS N FLAG	51.33	50.78	60.5	104.3	73.8	7.6	54.2	58.80
13	NEWANA 100 LBS N PPI	52.13	50.32	62.8	107.3	74.8	7.9	59.2	58.45

IRRIGATED SPRING WHEAT PROTEIN ENHANCEMENT STUDY

Trt No	Treatment Name	WHEAT SPAD RDG % CHLOR 6-20-94	WHEAT SPAD RDG % CHLOR 7-18-94	STRAW BIOMASS GM/2FT 8-12-94	HEADS BIOMASS GM/2 FT 8-12-94	WHEAT GRAIN GM/2FT 8-17-94	TOTAL BIOMASS GM/M SQ 8-12-94	WHEAT YIELD BU/A 8-17-94	WHEAT TEST WT LB/BU 8-17-94
14	NEWANA 100 LBS N PPI 40 LBS N FLAG	52.13	54.20	65.8	119.8	83.3	8.6	56.3	58.17
15	NEWANA 150 LBS N PPI	52.88	52.45	60.8	113.0	80.8	8.1	59.1	59.23
16	NEWANA 150 LBS N PPI 40 LBS N FLAG	52.88	51.85	59.5	96.3	67.8	7.2	54.9	58.50
17	HI-LINE 0 N PPI	45.68	45.25	43.3	79.8	57.8	5.7	47.3	58.03
18	HI-LINE 0 N PPI 40 LBS N FLAG	45.68	47.10	50.0	90.5	62.5	6.6	43.8	57.72
19	HI-LINE 50 LBS N PPI	48.35	46.42	56.8	111.5	81.3	7.8	54.7	58.13
20	HI-LINE 50 LBS N PPI 40 LBS N FLAG	48.35	47.18	49.0	94.5	68.5	6.7	55.8	57.70
21	HI-LINE 100 LBS N PPI	48.38	48.00	52.8	96.8	68.0	7.0	45.5	57.20
22	HI-LINE 100 LBS N PPI 40 LBS N FLAG	48.38	47.77	55.3	99.8	71.3	7.2	47.8	57.45
23	HI-LINE 150 LBS N	48.75	48.82	57.8	109.5	78.0	7.8	49.2	57.83
24	HI-LINE 150 LBS N PPI 40 LBS N FLAG	48.75	48.68	58.3	112.0	82.5	7.9	50.9	57.82
LSD (.05) =		1.77	2.75	12.7	21.6	16.8	1.6	9.1	0.87
Standard Dev.=		1.25083	1.94458	8.98906	15.2482	11.8968	1.10202	6.45621	.616775
CV =		2.54	3.98	14.78	14.68	16.18	14.41	11.78	1.06
Block F		10.205	7.212	27.425	25.950	23.736	27.596	78.066	8.318
Block Prob(F)		0.0001	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Treatment F		10.407	5.536	3.780	1.810	1.529	2.317	3.129	2.372
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0310	0.0905	0.0039	0.0001	0.0031

Montana State University

IRRIGATED SPRING WHEAT PROTEIN ENHANCEMENT STUDY - 1994

Project Code:94 - SWPE Location :KALISPELL
Cooperator :WESTCOTT/ENGLE By:Bob Stougaard

Site Description

Crop: SPRING WHEAT Variety: NEWANA,LEN,HI-LINE Planting Date: 4-15-94
Planting Method: PRESSDRILL Rate, Unit: 60 , LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 6 , "
Soil Temp., Unit: 50, F Soil Moisture: TOPSOIL DRY Emergence Date: 4-23-94

Plot Width/Area, Unit: 6 , FT Plot Length, Unit: 14 , FT Reps: 4
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: Split-Plot
Field Preparation/Plot Maintenance: FALL PLOW, SPRING DISC AND VIBR-SHANK. CULTI-PACKED PROIR TO SEEDING.

Soil Description

Texture: FINE SANDY LOAM % OM: 3.3 % Sand: 60 % Silt: 30 % Clay: 10
pH: 8.0 CEC: Soil Name: KALISPELL FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.	6-24-94	1.5	"	IRR	2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions: GARY WILL SUPPLY FULL IRRIGATION RECORDS LATER

Application Information

	A	B	C	D	E	F
Application Date:	4-15-94	6-24-94				
Time of Day:						
Application Method:						
Application Timing:	INITIAL	SPLIT				
Air Temp., Unit:	,	,	,	,	,	,
% Relative Humidity:						
Wind Velocity, Unit:	,	,	,	,	,	,
Dew Presence (Y/N):						
Water Hardness:						
Soil Temp., Unit:	,	,	,	,	,	,
Soil Moisture:						
% Cloud Cover:						

Summary Comments:

INITIAL FERTILIZER APPLICATIONS MADE ON 4-15-94 PRIOR TO SEEDING. FERTILIZER WAS INCORPORATED TWICE USING KUBOTA 275 AND VIBRA-SHANK. BASE LINE FERTILIZER ALSO APPPLIED THIS DAY PREVIOIUS TO CULTIVATION (50 LB K2O, 50 LB P2O5 PER ACRE). SEEDING ACCOMPLISHED WITH RESEARCH SEEDER (ZEROMAX AT 42.0) AT 60 LB/A.

SPLIT APPLICATION OF FERTILIZER MADE ON 6-24-94

STUDY WAS IRRIGATED ON JUNE 24 (AFTER SPLIT APPLN), JULY 1, JULY 8 AND JULY 12, 1994 (FOUR HOURS ON EACH SET EQUALS .6" IRRIGATION).

Montana State University

BANVEL STUDY ON SPRING BARLEY

Project Code:94-BSB-R4 Location :KALISPELL, MT R4
Cooperator :WAYNE BELLES By:Bob Stougaard

Summary Comments:
The purpose of this study was to evaluate Banvel formulations in combination with low rates of Harmony Extra for broadleaf control in spring wheat. All treatments demonstrated excellent crop tolerance. Weed pressure was heavy and consisted of lambsquarters and field pennycress. Both Banvel formulatioins afforded the same degree of weed control and wheat yield. The addition of Harmony Extra greatly improved weed control and grain yield compared to Banvel alone. Herbicide rate did not affect weed control or yield with respect to the tank-mix combinations.

Montana State University

BANVEL STUDY ON SPRING BARLEY

Project Code:94-BSB-R4 Location :KALISPELL, MT R4
Cooperator :WAYNE BELLES By:Bob Stougaard

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Rate Unit	Grow Stg	Appl Code	LMQTRS CONTROL % 6-6-94	LMQTRRS CONTROL % 8-7-94	PENNYCRS CONTROL % 6-6-94	PENNNYCS CONTROL % 8-7-94	WHEAT CRP INJ % 6-6-94	WHEAT YIELD BU/A 8-8-94
1	UNTREATED							0.0	0.0	0.0	0.0	0.0	30.2
2	BANVEL SGF	2	SL	.0935	lb ai/A	POST	A	68.3	82.3	71.7	50.0	0.0	41.1
3	BANVEL SGF	2	SL	.125	lb ai/A	POST	A	78.3	92.7	78.3	66.0	0.0	47.1
4	SAN 845H	70	WG	.0935	lb ai/A	POST	A	71.7	78.7	73.3	53.3	0.0	39.9
5	SAN 845H	70	WG	.125	lb ai/A	POST	A	75.0	91.0	81.7	88.3	0.0	50.0
6	BANVEL SGF	2	SL	.0935	lb ai/A	POST	A	88.3	100.0	100.0	98.3	0.0	61.7
6	HARMONY EXTRA	75	DF	.15	oz pr/A	POST	A						
6	ACTIVATOR 90	1	EC	.25	% v/v	POST	A						
7	BANVEL SGF	2	SL	.0935	lb ai/A	POST	A	96.7	100.0	100.0	93.3	3.3	58.5
7	HARMONY EXTRA	75	DF	.3000	oz pr/A	POST	A						
7	ACTIVATOR 90	1	EC	.25	% v/v	POST	A						
8	BANVEL SGF	2	SL	.125	lb ai/A	POST	A	98.3	99.7	98.0	96.7	0.0	56.0
8	HARMONY EXTRA	75	DF	.15	oz pr/A	POST	A						
8	ACTIVATOR 90	1	EC	.25	% v/v	POST	A						
9	BANVEL SGF	2	SL	.125	lb ai/A	POST	A	96.7	99.7	100.0	100.0	0.0	63.5
9	HARMONY EXTRA	75	DF	.3000	oz pr/A	POST	A						
9	ACTIVATOR 90	1	EC	.25	% v/v	POST	A						
10	SAN 845H	70	WG	.0935	lb ai/A	POST	A	98.3	100.0	97.7	96.7	0.0	61.9
10	HARMMONY EXTRA	75	DF	.15	oz pr/A	POST	A						
10	ACTIVATOR 90	1	EC	.25	% v/v	POST	A						
11	SAN 845H	70	WG	.0935	lb ai/A	POST	A	100.0	99.7	99.7	96.7	0.0	61.2
11	HARMONY EXTRA	75	DF	.30	oz pr/A	POST	A						
11	ACTIVATOR 90	1	EC	.25	% v/v	POST	A						
12	SAN 845H	70	WG	.125	lb ai/A	POST	A	96.7	100.0	96.7	100.0	0.0	52.6
12	HARMONY EXTRA	75	DF	.15	oz pr/A	POST	A						
12	ACTIVATOR 90	1	EC	.25	% v/v	POST	A						
13	SAN 845H	70	WG	.125	lb ai/A	POST	A	100.0	100.0	100.0	100.0	6.7	54.6
13	HARMONY EXTRA	75	DF	.30	oz pr/A	POST	A						
13	ACTIVATOR 90	1	EC	.25	% v/v	POST	A						
LSD (.05) =								19.7	14.1	19.3	22.2	3.7	11.9
Standard Dev.=								11.6621	8.34998	11.4263	13.1464	2.21687	7.06885
CV =								14.19	9.49	13.54	16.44	288.19	13.55
Block F								4.544	3.590	3.742	2.473	1.565	1.735
Block Prob(F)								0.0212	0.0432	0.0385	0.1055	0.2296	0.1978
Treatment F								16.445	32.351	17.559	15.657	2.435	6.221
Treatment Prob(F)								0.0001	0.0001	0.0001	0.0001	0.0307	0.0001

- End of Report -

Montana State University

BANVEL STUDY ON SPRING BARLEY

Project Code:94-BSB-R4 Location :KALISPELL, MT R4
Cooperator :WAYNE BELLES By:Bob Stougaard

Site Description

Crop: SPRING WHEAT Variety: NEWANA Planting Date: 4-15-94
Planting Method: PRESSDRILL Rate, Unit: 60 , LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 6 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date:

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 15 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance: FALL PLOW, SPRING DISC AND VIBRA-SHANK, THEN CULTIPACK PRIOR TO SEEDING

Soil Description

Texture: SILT LOAM % OM: 2.8 % Sand: 40 % Silt: 50 % Clay: 10
pH: 6.2 CEC: Soil Name: CRESTON SL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	5-11-94					
Time of Day:	2:00 PM					
Application Method:	BACKPACK					
Application Timing:	POST					
Air Temp., Unit:	82 ,F	,	,	,	,	,
% Relative Humidity:	28					
Wind Velocity, Unit:	1.5 ,MPH	,	,	,	,	,
Dew Presence (Y/N):	N					
Water Hardness:	N					
Soil Temp., Unit:	70 ,F	,	,	,	,	,
Soil Moisture:	DRY TOP					
% Cloud Cover:	0					

Weed Species	Weed Stage, Density at Application					
WHEAT	5LF ,1 TR	,	,	,	,	,
	,	,	,	,	,	,
LMQTR	3 LF,10/F	,	,	,	,	,
PENNYCRESS	6 LF,9/F	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLAT FAN	11002XR	14"	20"	10'	20	H20	20
B.										

Fertilized on 4-18-94 with 200 LB/A of 26/14/0.

Montana State University

FARGO ON SPRING WHEAT

Project Code:94-FSW-R5 Location :KALISPELL, MT
Cooperator :DOUG RYERSON By:Bob Stougaard

Project Code: Fargo on Spring Wheat Location: Kalispell, MT
Cooperator: Doug Ryerson By: Bob Stougaard

Summary Comments:

The objective of this study was to evaluate spring wheat tolerance to Fargo. There was a direct relationship between Fargo rate and stand loss for all cultivars tested. With respect to stand reduction, cultivar tolerance to Fargo from most to least was:

Fortuna = Penewawa > Hi-Line > Amidon = Pondera > Border = Lew > Newana

Although stand reductions were observed, this did not necessarily result in a corresponding yield reduction. Up to a point, yields for some cultivars increased with stand reduction, possibly due to increased tillering. In terms of yield, cultivar tolerance to Fargo was:

Fortuna = Penewawa = Amidon > Hi-Line > Lew > Pondera > Border > Newana.

Montana State University

FARGO ON SPRING WHEAT

Project Code:94-FSW-R5 Location :KALISPELL, MT
Cooperator :DOUG RYERSON By:Bob Stougaard
All rates are specified as lb ai/A

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Grow Stg	Appl Code	WHEAT GWTH RED % 5-31-94	WHEAT GWTH RED % 6-17-94	YIELD BU/A 8-17-94
1	FARGO	4	EC	0	PPI	A	0.7	0.0	53.8
1	AMIDON								
9	FARGO	4	EC	1.25	PPI	A	7.7	10.0	58.3
9	AMIDON								
17	FARGO	4	EC	2.0	PPI	A	19.0	20.0	52.2
17	AMIDON								
2	FARGO	4	EC	0	PPI	A	1.7	1.3	47.5
2	LEW								
10	FARGO	4	EC	1.25	PPI	A	11.0	21.7	48.1
10	LEW								
18	FARGO	4	EC	2.0	PPI	A	26.7	30.0	42.2
18	LEW								
3	FARGO	4	EC	0	PPI	A	0.7	0.7	44.1
3	FORTUNA								
11	FARGO	4	EC	1.25	PPI	A	2.3	4.0	50.7
11	FORTUNA								
19	FARGO	4	EC	2.0	PPI	A	4.0	8.3	48.9
19	FORTUNA								
4	FARGO	4	EC	0	PPI	A	2.0	1.7	51.9
4	HI-LINE								
12	FARGO	4	EC	1.25	PPI	A	6.0	9.3	48.7
12	HI-LINE								
20	FARGO	4	EC	2.0	PPI	A	14.3	16.7	47.8
20	HI-LINE								
5	FARGO	4	EC	0	PPI	A	1.7	1.7	52.7
5	NEWANA								
13	FARGO	4	EC	1.25	PPI	A	13.7	18.3	48.5
13	NEWANA								
21	FARGO	4	EC	2.0	PPI	A	30.0	40.0	36.7
21	NEWANA								
6	FARGO	4	EC	0	PPI	A	1.7	0.7	54.5
6	PONDERA								

Montana State University

FARGO ON SPRING WHEAT

Project Code:94-FSW-R5 Location :KALISPELL, MT
Cooperator :DOUG RYERSON By:Bob Stougaard

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Grow Stg	Appl Code	WHEAT GWTH RED % 5-31-94	WHEAT GWTH RED % 6-17-94	YIELD BU/A 8-17-94
14	FARGO 14 PONDERA	4	EC	1.25	PPI	A	10.0	11.0	51.3
22	FARGO 22 PONDERA	4	EC	2.0	PPI	A	16.0	20.0	46.9
7	FARGO 7 BORDER	4	EC	0	PPI	A	4.3	6.7	46.6
15	FARGO 15 BORDER	4	EC	1.25	PPI	A	6.0	13.3	46.4
23	FARGO 23 BORDER	4	EC	2.0	PPI	A	25.7	36.7	37.6
8	FARGO 8 PENEWAWA	4	EC	0	PPI	A	0.0	0.0	51.7
16	FARGO 16 PENEWAWA	4	EC	1.25	PPI	A	9.0	7.3	57.7
24	FARGO 24 PENEWAWA	4	EC	2.0	PPI	A	11.7	8.3	55.6
LSD (.05) =							9.7	10.7	9.2
Standard Dev.=							5.85199	6.46922	5.55567
CV =							62.24	53.97	11.30
Block F							1.830	0.034	9.384
Block Prob(F)							0.1719	0.9664	0.0004
Treatment F							6.778	9.434	2.864
Treatment Prob(F)							0.0001	0.0001	0.0013

Montana State University

FARGO ON SPRING WHEAT

Project Code:94-FSW-R5 Location :KALISPELL, MT
Cooperator :DOUG RYERSON By:Bob Stougaard

Site Description

Crop: SPRING WHEAT Variety: VARIOUS Planting Date: 4-25-94
Planting Method: PLOT DRILL Rate, Unit: 60 , LB/A Depth, Unit: 2.0 , "
Perennial Age, Unit: , Row Spacing, Unit: 12 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date: 5-8-94

Plot Width/Area, Unit: 4 , FT Plot Length, Unit: 10 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance: FALL PLOW, SPRING DISC AND VIBRA-SHANK. CULTIPACKED PRIOR TO SEEDING

Soil Description

Texture: FINE SANDY LOAM % OM: 3.4 % Sand: 60 % Silt: 30 % Clay: 10
pH: 7.4 CEC: Soil Name: KALISPELL FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	4-25-94					
Time of Day:	2:30 PM					
Application Method:	BACKPACK					
Application Timing:	PPI					
Air Temp., Unit:	51 ,F	,	,	,	,	,
% Relative Humidity:	26					
Wind Velocity, Unit:	2 ,MPH	,	,	,	,	,
Dew Presence (Y/N):	N					
Water Hardness:	N					
Soil Temp., Unit:	52 ,F	,	,	,	,	,
Soil Moisture:	GOOD					
% Cloud Cover:	99					

Weed Species	Weed Stage, Density at Application					
NA	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLAT FAN	11002XR	14"	20"	10'	20	H2O	20
B.										

Disced on 4-25-94. Packed twice, Fargo sprayed, PPI twice, and then packed again. Seeded with Research seeder like a variety nursery. Fertilizer applied on 5-24-94 (200 lb/A of 24/14/0).

Montana State University
AVENGE STUDY IN SPRING WHEAT (NEWANA)

Project Code:94-AVENGE

Location :KALISPELL
By:Bob Stougaard

Summary Comments: The objective of this study was to compare the efficacy of Avenge AS and SG formulations for wild oat control in spring wheat. All herbicides treatments afforded excellent control of wild oat by the end of the season and treatment differences were minor. Although no differences were observed with respect to wild oat control, the SG formulation was hard to mix and required about 30 seconds of agitation. Problems may arise with chemical injection systems or with low gallonage sprayers.

Montana State University
AVENGE STUDY IN SPRING WHEAT (NEWANA)

Project Code: 4-AVENGE

Location: Kalispell
By: Bob Stougaard

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Rate Unit	Grow Stg	Appl Code	WHEAT CROP INJ % 6-6-94	WILD OAT CONTROL % 6-6-94	WHEAT CROP INJ % 8-7-94	WILD OAT CONTROL % 8-7-94	WHEAT YIELD BU/A 8-28-94
1	NONTREATED							0.0	0.0	0.0	0.0	32.0
2	AVENGE	2	AS	1	lb ai/A			10.0	66.7	15.0	98.0	35.7
2	NIS			1	% v/v							
3	AVENGE	64	SG	1	lb ai/A			6.7	53.3	3.3	95.3	38.8
3	NIS			.5	% v/v							
4	AVENGE	64	SG	1	lb ai/A			6.7	33.3	6.7	93.3	35.7
4	SUN-IT II	1		1	qt pr/A							
5	ASSERT	2.5	LC	.23	lb ai/A			5.0	30.0	5.0	97.7	39.9
5	AVENGE	64	SG	.5	lb ai/A							
5	NIS			.5	% v/v							
6	ASSERT	2.5	LC	.23	lb ai/A			0.0	18.3	1.7	99.3	43.5
6	AVENGE	64	SG	.5	lb ai/A							
6	SUN-IT II	1		1	qt pr/A							
7	AVENGE	64	SG	1	lb ai/A			5.0	16.7	0.0	95.3	38.4
7	HARMONY EXTRA	75	DF	.5	oz pr/A							
7	MCPA	3.7	EC	.25	lb ai/A							
7	NIS			.5	% v/v							
8	HOELON	3	EC	1	lb ai/A			8.3	63.3	6.7	97.7	43.8
LSD (.05) =								6.5	18.6	10.2	2.5	5.7
Standard Dev.=								3.70006	10.6416	5.83758	1.45570	3.27596
CV =								71.04	30.22	121.83	1.72	8.52
Block F								5.783	0.727	4.249	3.854	7.902
Block Prob(F)								0.0148	0.5009	0.0361	0.0464	0.0050
Treatment F								2.859	15.168	2.127	1658.820	4.500
Treatment Prob(F)								0.0448	0.0001	0.1087	0.0001	0.0081

Montana State University

AVENGE STUDY IN SPRING WHEAT (NEWANA)

Project Code:94-AVENGE Location :KALISPELL
By:Bob Stougaard

Site Description

Crop: SPRING WHEAT Variety: NEWANA Planting Date: 4-25-94
Planting Method: PRESSDRILL Rate, Unit: 60 , LB/A Depth, Unit: 1 , "
Perennial Age, Unit: , Row Spacing, Unit: 7 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date: 5-8-94

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 18.3 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance: FALL PLOW, SPRING DISC AND CULTIVATE. PACKED TWICE AND THEN SEEDED WITH INTERNATIONAL DOUBLE DISC DISC PRESS DRILL.

Soil Description

Texture: SILT LOAM % OM: 3.0 % Sand: 40 % Silt: 50 % Clay: 10
pH: 7.5 CEC: Soil Name: CRESTON SL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.	4-28-94	.25	"	IRR	2.	4-29-94	.50	"	IRR
3.	5-3-94	.625	"	IRR	4.	5-9-94	.25	"	IRR
5.	5-10-94	.75	"	IRR	6.				
7.					8.				

Overall Moisture Conditions: GOOD SPRING MOISTURE, NO MOISTURE AFTER JULY 7TH

Application Information

	A	B	C	D	E	F
Application Date:	5-25-94					
Time of Day:	2:00 PM					
Application Method:	BACKPACK					
Application Timing:	POST,TILR					
Air Temp., Unit:	85 ,F	,	,	,	,	,
% Relative Humidity:	23					
Wind Velocity, Unit:	.5 ,MPH	,	,	,	,	,
Dew Presence (Y/N):	N					
Water Hardness:	N					
Soil Temp., Unit:	80 ,F	,	,	,	,	,
Soil Moisture:	DRY					
% Cloud Cover:	0					

Weed Species	Weed Stage, Density at Application					
WILD OAT	3 LF,TLRD	,	,	,	,	,
SP WHEAT	5-7L,1TLR	,	,	,	,	,
GREEN FOXTAIL	2 LF,TLRD	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLATFAN	11002XR	14 "	20"	10'	20	H20	20
B.										
C.										
D.										

Montana State University

BLACKSHAW IMAZAMETHABENZ STUDY

Project Code:94-BIS-R3 Location :KALISPELL, MT
Cooperator :BLACKSHAW, BOB By:Bob Stougaard

Summary Comments: The purpose of this study was to evaluate the rate response of Assert for wild oat control and to determine if reduced rates were a viable option for spring wheat production. Assert was aplied at the 3 leaf stage of wild oat at 6 different rates ranging from 50 to 400 g ai/ha.

Use rates of 150 g ai/ha were required before significant reductions in wild oat biomass or seed productioin were observed. The 150 g ai/ha rate was also required before spring wheat yields were improved compared to the nontreated check. Although further increases in herbicide rate reduced wild oat biomass and seed production, spring wheat yield was not affected.

Montana State University

BLACKSHAW IMAZAMETHABENZ STUDY - SUMMARY

Project Code:94-BIS-R3
Cooperator :BOB BLACKSHAW

Location: KALISPELL, MT
By: Bob Stougaard

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Rate Unit	Grow Stg	Appl Code	WILD OAT DRY WT g/M 2 6-23-94	WILD OAT DRY WT g/M 2 7-18-94	WILD OAT SEED CNT # /M 2 7-18-94	WILD OAT CONTROL PERCENT 6-23-94	WILD OAT CONTROL PERCENT 8-7-94	SPWHEAT YIELD KG/HA 8-17-94	SPWHEAT TEST WT g/L 8-17-94
1	ASSERT	2.5	EC	50	g ai/ha	3-LF	A	176.1	378.8	9850	10.0	43.3	2645	767
1	NIS	1	EC	.25	% v/v	3-LF	A							
2	ASSERT	2.5	EC	100	g ai/ha	3-LF	A	116.1	357.2	8940	30.0	58.3	2856	767
2	NIS	1	EC	.25	% v/v	3-LF	A							
3	ASSERT	2.5	EC	150	g ai/ha	3-LF	A	102.0	256.9	7076	35.0	56.7	3219	787
3	NIS	1	EC	.25	% v/v	3-LF	A							
4	ASSERT	2.5	EC	200	g ai/ha	3-LF	A	84.6	224.6	6596	31.7	65.0	3520	780
4	NIS	1	EC	.25	% v/v	3-LF	A							
5	ASSERT	2.5	EC	300	g ai/ha	3-LF	A	92.6	180.4	4656	51.7	82.3	3641	770
5	NIS	1	EC	.25	% v/v	3-LF	A							
6	ASSERT	2.5	EC	400	g ai/ha	3-LF	A	83.7	126.6	3185	76.0	86.7	3632	773
6	NIS	1	EC	.25	% v/v	3-LF	A							
7	UNTREATED							228.9	421.7	11410	0.0	0.0	2584	787
LSD (.05) =								76.7	101.2	2534	17.9	8.4	556	29
Standard Dev.=								43.0845	56.8557	1424.3	10.0491	4.70899	312.506	16.3785
CV =								34.12	20.45	19.28	30.02	8.40	9.90	2.11
Block F								2.951	0.947	0.276	2.117	5.259	5.296	3.568
Block Prob(F)								0.0907	0.4152	0.7638	0.1632	0.0229	0.0225	0.0608
Treatment F								4.952	11.264	12.445	18.957	113.130	6.540	0.858
Treatment Prob(F)								0.0090	0.0003	0.0002	0.0001	0.0001	0.0030	0.5512

Montana State University

BLACKSHAW IMAZAMETHABENZ STUDY

Project Code:94-BIS-R3 Location :KALISPELL, MT
Cooperator :BLACKSHAW, BOB By:Bob Stougaard

Site Description

Crop: SPRING WHEAT Variety: NEWANA Planting Date: 4-26-94
Planting Method: PRESS DRIL Rate, Unit: 60 , LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 7 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date:

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 18.3 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover: None
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance: Fall plow, spring disc, cultivation and packing

Soil Description

Texture: Silt Loam % OM: 3.0 % Sand: 40 % Silt: 50 % Clay: 10
pH: 7.1 CEC: Soil Name: Creston SL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions: Normal through June, very dry July through Sept.

Application Information

	A	B	C	D	E	F
Application Date:	5-26-94					
Time of Day:	4:30 PM					
Application Method:	Backpack					
Application Timing:	Post					
Air Temp., Unit:	78 ,F	,	,	,	,	,
% Relative Humidity:	17					
Wind Velocity, Unit:	3 5 ,MPH	,	,	,	,	,
Dew Presence (Y/N):	N					
Water Hardness:	N					
Soil Temp., Unit	22 C					
Soil Moisture	Very Good					
% Cloud Cover	10%					

Weed Species	Weed Stg,	Density
WILD OAT	3 LF,	10/F
SPRING WHEAT	4 LF,	25/F

Application Equipment		- Nozzles -			Boom			
Sprayer type	Speed	Type	Size	Height	Spacing	Width	GPA	Carrier	PSI
Backpack	2.0	Flat Fan	11002	14"	20"	10'	20	H2O	20

Wild oats were seeded to the plot area on 4-26-94 to insure a uniform population.

Montana State University

BLACKSHAW ACHIEVE STUDY

Project Code:94-BAS-R3 Location :KALISPELL,MT
Cooperator :BOB BLACKSHAW By:Bob Stougaard

Summary Comments: The purpose of the study was to evaluate the rate response of Achieve for wild oat control and to determine the optimal use rate for spring wheat production. Achieve was applied at the 3 leaf stage of wild oat at 6 different rates ranging from 25 to 200 g ai/ha.

The lowest rate evaluated provided greater than 70% wild oat control and significantly reduced wild oat biomass and seed production compared to the nontreated check. Use rates of 50 g ai/ha were required before spring wheat yields were improved. Although further increases in herbicide rate reduced wild oat biomass and seed production, spring wheat yield was not affected.

Montana State University

BLACKSHAW ACHIEVE STUDY - SUMMARY

Project Code:94-BAS-R3
Cooperator :BOB BLACKSHAW

Location: Kalispell, MT
By: Bob Stougaard

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Rate Unit	Grow Stg	Appl Code	WILD OAT DRY WT g/M 2 6-23-94	WILD OAT DRY WT g/M 2 7-18-94	WILD OAT SEED CNT # /M 2 7-18-94	WILD OAT CONTROL PERCENT 6-23-94	WILD OAT CONTROL PERCENT 8-7-94	SPWHEAT YIELD KG/HA 8-17-94	SPWHEAT TEST WT g/L 8-17-94
1	ACHIEVE	40	WG	25	g ai/ha	3-LF	A	52.1	164.9	3154	71.7	76.7	2687	770
1	TF 8035	1	EC	.25	% v/v	3-LF	A							
2	ACHIEVE	40	WG	50	g ai/ha	3-LF	A	36.9	156.5	2805	76.7	80.0	3212	790
2	TF 8035	1	EC	.25	% v/v	3-LF	A							
3	ACHIEVE	40	WG	75	g ai/ha	3-LF	A	27.6	44.2	991	85.0	92.0	3340	793
3	TF 8035	1	EC	.25	% v/v	3-LF	A							
4	ACHIEVE	40	WG	100	g ai/ha	3-LF	A	13.8	16.8	400	95.3	96.3	3450	777
4	TF 8035	1	EC	.25	% v/v	3-LF	A							
5	ACHIEVE	40	WG	150	g ai/ha	3-LF	A	10.6	6.0	118	98.0	97.7	3437	783
5	TF 8035	1	EC	.25	% v/v	3-LF	A							
6	ACHIEVE	40	WG	200	g ai/ha	3-LF	A	18.4	1.2	19	98.0	99.0	3650	787
6	TF 8035	1	EC	.25	% v/v	3-LF	A							
7	UNTREATED							171.1	407.4	7120	0.0	0.0	2345	777
LSD (.05) =								39.5	162.9	2370	7.6	7.5	578	22
Standard Dev.=								22.2105	91.5785	1332.18	4.29470	4.23609	324.895	12.5673
CV =								47.07	80.44	63.84	5.73	5.47	10.28	1.61
Block F								0.865	2.903	3.481	2.024	0.353	23.925	5.186
Block Prob(F)								0.4456	0.0937	0.0642	0.1748	0.7097	0.0001	0.0238
Treatment F								19.406	7.704	11.039	195.460	207.501	6.272	1.317
Treatment Prob(F)								0.0001	0.0015	0.0003	0.0001	0.0001	0.0035	0.3218

Montana State University

BLACKSHAW ACHIEVE STUDY

Project Code:94-BAS-R3 Location :KALISPELL,MT
Cooperator :BOB BLACKSHAW By:Bob Stougaard

Site Description

Crop: SPRING WHEAT Variety: NEWANA Planting Date: 4-25-94
Planting Method: PRESS DRIL Rate, Unit: 60 , LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 7 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date:

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 18.3 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover: None
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance: Fall plow, spring disc, cultivation and packing

Soil Description

Texture: Silt Loam % OM: 3.0 % Sand: 40 % Silt: 50 % Clay: 10
pH: 7.1 CEC: Soil Name: Creston SL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions: Normal through June, very dry July through Sept.

Application Information

	A	B	C	D	E	F
Application Date:	5-26-94					
Time of Day:	4:30 PM					
Application Method:	Backpack					
Application Timing:	Post					
Air Temp., Unit:	78 ,F	,	,	,	,	,
% Relative Humidity:	17					
Wind Velocity, Unit:	3 5 ,MPH	,	,	,	,	,
Dew Presence (Y/N):	N					
Water Hardness:	N					
Soil Temp., Unit:	72 ,F	,	,	,	,	,
Soil Moisture:	DRY TOP					
% Cloud Cover:	10					

Weed Species	Weed Stage, Density at Application					
WILD OAT	3 LF,10/F	,	,	,	,	,
SPRING WHEAT	4 LF,25/F	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLAT FAN	11002XR	14"	20"	10'	20	H20	20
B.										

Wild oats were seeded to the plot area on 4-26-94 to insure a uniform weed population.

Montana State University

ACHIEVE TANK MIX STUDY

Project Code:94 ATMS
Cooperator :KURT VOLKER ICI

Location :KALISPELL
By:Bob Stougaard

Summary Comments:
The objective of this study was to evaluate wild oat control and crop tolerance with Achieve in combination with several broadleaf herbicides. With few exceptions, Achieve provided excellent wild oat control and demonstrated good crop tolerance. However, antagonism was very pronounced when applied with 2,4-D. Wild oat plants were not killed, but the phenological development was delayed by several weeks relative to the nontreated control. This suppression appears to have greatly reduced wild oat competition in that the associated yields were comparable to the other Achieve treatments. A certain level of antagonism was also noted when Achieve was mixed with MCPA and Harmony Extra. Wild oats emerged on 5-2-94.

Montana State University

ACHIEVE TANK MIX STUDY

Project Code:94 ATMS
Cooperator :KURT VOLKER ICI

Location :KALISPELL
By:Bob Stougaard

Trt No	Treatment Name	Form Amt	Form Ds	Fm Rate	Rate Unit	Grow Stg	Appl Code	BARLEY CROP INJ % 6-6-94	WILD OAT CONTROL % 7-15-94	WILD OAT CONTROL % 8-7-94	BARLEY YIELD BU/A 8-13-94
1	ACHIEVE	40	WG	.18	lb ai/A	POST	A	3.3	98.0	97.3	101.9
1	TF8035			.5	% v/v	POST	A				
2	ACHIEVE	40	WG	.18	lb ai/A	POST	A	0.0	99.3	98.0	113.4
2	TF80035			.5	% v/v	POST	A				
2	BRONATE	4	EC	1.5	pt pr/A	POST	A				
3	ACHIEVE	40	WG	.18	lb ai/A	POST	A	0.0	95.7	97.0	114.1
3	TF8035			.5	lb ai/A	POST	A				
3	BUCTRIL	2	EC	2	pt pr/A	POST	A				
4	ACHIEVE	40	WG	.18	lb ai/A	POST	A	3.3	58.3	62.7	101.2
4	TF8035			.5	% v/v	POST	A				
4	2,4-D ESTER	3.8	EC	.5	lb ai/A	POST	A				
5	ACHIEVE	40	WG	.18	lb ai/A	POST	A	0.0	90.3	89.0	109.3
5	TF8035			.5	% v/v	POST	A				
5	MCPA ESTER	3.7	EC	.5	lb ai/A	POST	A				
6	ACHIEVE	40	WG	.18	lb ai/A	POST	A	0.0	94.7	95.3	127.5
6	TF8035			.5	% v/v	POST	A				
6	BANVEL SGF	2	EC	.37	pt pr/A	POST	A				
7	ACHIEVE	40	WG	.18	lb ai/A	POST	A	0.0	86.3	89.0	110.9
7	TF8035			.5	% v/v	POST	A				
7	HARMONY EXTRA	75	DF	.5	oz pr/A	POST	A				
8	HOELON	3	EC	1	lb ai/A	POST	A	5.0	95.7	93.0	127.1
9	ASSERT	2.5	EC	.46	lb ai/A	POST	A	0.0	94.7	92.0	113.1
9	NIS	1	EC	.25	% v/v	POST	A				
10	AVENGE	2	EC	1	lb ai/A	POST	A	6.7	90.7	86.7	101.3
10	NIS			1	% v/v	POST	A				
11	NONTREATED							0.0	0.0	0.0	63.4
LSD (.05) =								5.3	9.5	8.3	16.5
Standard Dev.=								3.11400	5.58543	4.86328	9.66639
CV =								186.84	6.80	5.94	8.99
Block F								0.313	0.770	0.119	21.884
Block Prob(F)								0.7351	0.4761	0.8883	0.0001
Treatment F								1.891	83.644	105.686	9.530
Treatment Prob(F)								0.1082	0.0001	0.0001	0.0001

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ACHIEVE TANK MIX STUDY

Project Code:94 ATMS Location :KALISPELL
Cooperator :KURT VOLKER ICI By:Bob Stougaard

Site Description

Crop: SPRING BARLEY Variety: GALLATIN Planting Date: 4-21-94
Planting Method: PRESSDRILL Rate, Unit: 60 , LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 6 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date: 5-4-94

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 18.3 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance: FALL PLOW, SPRING DISC AND VIBRA SHANK. CULTI-PACK PRIOR TO SEEDING

Soil Description

Texture: FINE SANDY LOAM % OM: 4.2 % Sand: 60 % Silt: 30 % Clay: 10
pH: 7.2 CEC: Soil Name: KALISPELL FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions: GOOD SPRING MOISTURE, NO RAIN AFTER JULY 13TH

Application Information

	A	B	C	D	E	F
Application Date:	5-25-94					
Time of Day:	2:30 PM					
Application Method:	BACKPACK					
Application Timing:	POST					
Air Temp., Unit:	85 ,F	,	,	,	,	,
% Relative Humidity:	23					
Wind Velocity, Unit:	1 ,MPH	,	,	,	,	,
Dew Presence (Y/N):	N					
Water Hardness:	N					
Soil Temp., Unit:	72 ,F	,	,	,	,	,
Soil Moisture:	GOOD					
% Cloud Cover:	0					

Weed Species	Weed Stage, Density at Application					
WILD OAT	3 LF,	,	,	,	,	,
BARLEY	1 TL,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLAT FAN	11002XR	14"	20"	10'	20	H20	20
B.										
C.										
D.										
E.										
F.										

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WILD OAT CONTROL IN BARLEY WITH REDUCED RATES - 1994

Project Code:94-WORR
Cooperator :B. MAXWELL

Location: Kalispell, MT
By:Bob Stougaard

Summary Comments: The purpose of this study was to determine if Hoelon or Assert use rates could be reduced if applications were made early to small wild oats. Wild oat control was the least complete when applications were made at 2 weeks after barley emmergence, indicating that control is more strongly influenced by climatic factors than wild oat growth stage. Indications are that minimum daily temperatures below 40 degrees F reduced herbicide activity.

Of the herbicides evaluated, Assert provided the most consistent wild oat control. Half rates of Assert generally provided acceptable weed control and produced barley yield similar to that of the full rates. Although percent control declines somewhat, yield aren't adversly affected. The sublethal rates appear to retard wild oat growth and development, allowing the barley crop to gain an early season competitive advantage over the weed. Wild oat heading was delayed up to 5 days compared to the checks when reduced rates of Assert were applied. This effect was most evident with the earliest applications.

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WILD OAT CONTROL IN BARLEY WITH REDUCED RATES - 1994

Project Code:94-WORR Location: Kalispell, MT By:Bob Stougaard

Trt No	Treatment Name	Form	Amt	Rate	Lb ai/A	Grow Stg	WILD OAT CONTROL PERCENT 8-7-94	WILD OAT HEADING JULIAN	BARLEY INJURY PERCENT 6-6-94	YIELD BU/A BARLEY
1	HOELON	3	EC	1		1WABE	86	193	5	129.6
2	HOELON	3	EC	.5		1WABE	70	192	1	110.5
3	HOELON	3	EC	.25		1WABE	38	192	1	74.7
4	ASSERT	2.5	EC	.46		1WABE	91	194	6	129.2
4	Activator-90	80	EC	.25		1WABE				
5	ASSERT	2.5	EC	.23		1WABE	89	195	3	128.1
5	Activator-90	80	EC	.25		1WABE				
6	ASSERT	2.5	EC	.11		1WABE	75	195	1	114.5
6	Activator-90	80	EC	.25		1WABE				
7	HOELON	3	EC	1		2WABE	95	192	8	137.8
8	HOELON	3	EC	.5		2WABE	73	192	1	106.6
9	HOELON	3	EC	.25		2WABE	26	191	0	75.0
10	ASSERT	2.5	EC	.46		2WABE	87	191	5	133.7
10	Activator-90	80	EC	.25		2WABE				
11	ASSERT	2.5	EC	.23		2WABE	82	192	1	119.6
11	Activator-90	80	EC	.25		2WABE				
12	ASSERT	2.5	EC	.11		2WABE	46	192	0	91.7
12	Activator-90	80	EC	.25		2WABE				
13	HOELON	3	EC	1		3WABE	98	192	18	144.4
14	HOELON	3	EC	.5		3WABE	96	192	9	130.6
15	HOELON	3	EC	.25		3WABE	83	191	6	116.5
16	ASSERT	2.5	EC	.46		3WABE	99	192	9	144.5
16	Activator-90	80	EC	.25		3WABE				
17	ASSERT	2.5	EC	.23		3WABE	95	193	10	128.3
17	Activator-90	80	EC	.25		3WABE				
18	ASSERT	2.5	EC	.11		3WABE	82	192	8	102.1
18	Activator-90	80	EC	.25		3WABE				
19	WEEDY CHECK						0	191	0	65.3
	LSD (.05) =						16	2	6	17.1
	Standard Dev.=						11.6637	1.33211	3.92889	12.0684
	CV =						15.74	0.69	81.81	10.51
	Treatment Prob(F)						0.0001	0.0005	0.0001	0.0001

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WILD OAT CONTROL IN BARLEY WITH REDUCED RATES - 1994

Project Code:94-WORR Location: Kalispell, MT
Cooperator :B. MAXWELL By:Bob Stougaard

Site Description

Crop: SPRING BARLEY Variety: GALLATIN Planting Date: 4-21-94
Planting Method: PRESSDRILL Rate, Unit: 60 , LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 6 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date:

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 18.3 , FT Reps: 4
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance: FALL PLOW, SPRING DISC AND CULTIVATE. PACKING PRIOR TO SEEDBED PREP

Soil Description

Texture: FINE SANDY LOAM % OM: 4.2 % Sand: 50 % Silt: 40 % Clay: 10
pH: 7.7 CEC: Soil Name: KALISPELL FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	5-11-94	5-18-94	5-25-94			
Time of Day:	11:00 AM	12:00	11:30			
Application Method:	BACKPACK	BACKPACK	BACKPACK			
Application Timing:	1 WABE	2 WABE	3 WAABE			
Air Temp., Unit:	64 ,F	63 ,F	78 ,F	,	,	,
% Relative Humidity:	20	38	38			
Wind Velocity, Unit:	0 ,,	2 ,MPH	0 ,MPH	,	,	,
Dew Presence (Y/N):	N	N	N			
Water Hardness:	N	N	N			
Soil Temp., Unit:	62 ,F	56 ,F	54 ,F	,	,	,
Soil Moisture:	GOOD	GOOD	GOOD			
% Cloud Cover:	0	50	0			

Weed Species	Weed Stage, Density at Application					
WILD OATS	1.5L,	2.5L,	3.5L,	,	,	,
BARLEY	2 L ,	4 L ,	2 TL,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLAT FAN	11002XR	14"	20"	10'	20	H20	20
B.	"									
C.	"									
D.										
E.										
F.										

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WILD OAT PREEMERGENCE HERBICIDE EVALUATION

Project Code:94-WOPHE-R3

Location :KALISPELL, MT

By:Bob Stougaard

Summary Comments:

Early applications of postemergence wild oat herbicides are generally more consistent than delayed applications. In addition, controlling wild oats early minimizes the time that wild oats compete with the crop. One concern is that early applications may not control later emerging wild oats. Although later emerging wild oats may not significantly impact grain yield, the seed produced can increase the weed seed bank reserves and make for more problems in the future. If a postemergence herbicide also had soil activity, later emerging wild oats would not be a concern. The objective of this study was to determine to what extent Assert and Hoelon could provide preemergence control of wild oat.

The greatest wild oat biomass reduction and highest yield was obtained from Assert at 1.5 pt/A. Assert at the 0.75 pt/A rate also reduced wild oat biomass and increased spring wheat yield by 10 Bu/A compared to the nontreated. Although Hoelon at 2.66 pt/A reduced wild oat biomass, there was not a corresponding yield increase. These results indicate that Assert has the greatest preemergence activity of the two herbicides tested.

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WILD OAT PREEMERGENCE HERBICIDE EVALUATION

Project Code:94-WOPHE-R3 Location :KALISPELL, MT
By:Bob Stougaard

All rates are specified as pt pr/A

Trt No	Treatment Name	Form Amt	Rate	Grow Stg	WILD OAT GMS/3FT GREEN WT 7-1-94	WILD OAT CONTROL PERCENT 7-16-94	WHEAT YIELD BU/A 8-17-94
1	ASSERT	2.5 EC	1.50	PRE	43.7	87	48.2
2	ASSERT	2.5 EC	.75	PRE	149.0	55	43.7
3	HOELON	3 EC	2.66	PRE	124.0	30	31.4
4	HOELON	3 EC	1.33	PRE	173.3	17	32.5
5	NONTREATED				174.7	0	31.5
LSD (.05) =					86.4	29	7.1
Standard Dev.=					45.885	15.6301	3.75244
CV =					34.52	41.50	10.02

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WILD OAT PREEMERGENCE HERBICIDE EVALUATION

Project Code:94-WOPHE-R3 Location : KALISPELL, MT
By:Bob Stougaard

Site Description

Crop: SPRING WHEAT Variety: NEWANA Planting Date: 4-26-94
Planting Method: PRESSDRILL Rate, Unit: 60 , LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 7 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date: 5-7-94

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 15 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance: FALL PLOW, SPRING DISC AND CULTIVATE. CULTI-PACK PRIOR TO SEEDING

Soil Description

Texture: FINE SANDY LOAM % OM: 2.7 % Sand: 60 % Silt: 30 % Clay: 10
pH: 7.5 CEC: Soil Name: KALISPELL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	5-2-94					
Time of Day:	9:00 AM					
Application Method:	BACKPACK					
Application Timing:	PRE					
Air Temp., Unit:	51 ,F	,	,	,	,	,
% Relative Humidity:	30					
Wind Velocity, Unit:	2 ,MPH	,	,	,	,	,
Dew Presence (Y/N):	N					
Water Hardness:	N					
Soil Temp., Unit:	49 ,F	,	,	,	,	,
Soil Moisture:	DAMP					
% Cloud Cover:	10					

Weed Species	Weed Stage, Density at Application					
NA	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLAT FAN	11002XR	14"	20"	10'	20	H20	20
B.										
C.										

Wild oats seeded on 4-26-94. Plot area irrigated prior to PRE treatments and during the growing season.

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EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Project Code:Densitiy by Rate Recrop Location :KALISPELL - R8
By:Bob Stougaard

Summary Comments: The purpose of this study was to measure the change in weed seed bank populations resulting from different levels of weed control. There was good agreement between populations present this season and the level of control obtained in the previous year. Highest wild oat populations were present in plots which had received Assert the previous year. Plots that had been treated with Fargo in 1993 had lower weed populations compared to Assert treated plots. Weed populations were higher than the previous years seeded populations regardless of the herbicide rate used in 1993. However the relationship between the previous years wild oat population and herbicide rates was still evident with both herbicides. The lowest populations measured this season were from plots which had been seeded to the lowest wild oat population and treated with the highest rates the previous year.

Montana State University

EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Project Code:Density by Rate Recrop Location :KALISPELL - R8
By: Bob STougaard

All rates are specified as lb ai/A

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Grow Stg	WILD OAT PLANTS NO/SQ FT 5-24-94	WILD OAT PLANTS NO/SQ FT AVGQUAD	WILD OAT HEADS NO/SQ FT AVGQUAD	WILD OAT STRAWDWT G/SQ FT AVGQUAD	WILD OAT SEED WT G/SQ FT AVGQUAD
1	0 WILD OATS					6	5	7	14	4
1	FARGO	4	EC	0	PPI					
2	0 WILD OATS					4	5	5	9	2
2	FARGO	4	EC	.31	PPI					
3	0 WILD OATS					7	7	8	14	4
3	FARGO	4	EC	.62	PPI					
4	0 WILD OATS					4	4	5	9	2
4	FARGO	4	EC	1.25	PPI					
5	0 WILD OATS					4	4	4	9	3
5	ASSERT	2.5	EC	0	POST					
6	0 WILD OATS					8	6	8	16	5
6	ASSERT	2.5	EC	.11	POST					
6	NIS	80	EC	.25	POST					
7	0 WILD OATS					7	6	9	15	5
7	ASSERT	2.5	EC	.23	POST					
7	NIS	80	EC	.25	POST					
8	0 WILD OATS					9	8	8	9	2
8	ASSERT	2.5	EC	.46	POST					
8	NIS	80	EC	.25	POST					
9	15 WILD OATS					54	40	42	35	10
9	FARGO	4	EC	0	PPI					
10	15 WILD OATS					29	27	28	31	9
10	FARGO	4	EC	.31	PPI					
11	15 WILD OATS					19	20	22	31	9
11	FARGO	4	EC	.62	PPI					
12	15 WILD OATS					15	13	15	23	7
12	FARGO	4	EC	1.25	PPI					
13	15 WILD OATS					78	62	62	45	12
13	ASSERT	2.5	EC	0	POST					
14	15 WILD OATS					48	39	42	37	11
14	ASSERT	2.5	EC	.11	POST					
14	NIS	80	EC	.25	POST					
15	15 WILD OATS					29	23	25	29	8
15	ASSERT	2.5	EC	.23	POST					
15	NIS	80	EC	.25	POST					
16	15 WILD OATS					11	11	11	18	5
16	ASSERT	2.5	EC	.46	POST					
16	NIS	80	EC	.25	POST					

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EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Trt No	Treatment Name	Form Amt	Rate lb ai	Grow Stg	WILD OAT PLANTS NO/SQ FT 5-24-94	WILD OAT PLANTS NO/SQ FT AVGQUAD	WILD OAT HEADS NO/SQ FT AVGQUAD	WILD OAT STRAWDWT G/SQ FT AVGQUAD	WILD OAT SEED WT G/SQ FT AVGQUAD
17	25 WILD OATS				78	57	63	36	10
17	FARGO	4	EC 0	PPI					
18	25 WILD OATS				56	51	52	46	13
18	FARGO	4	EC .31	PPI					
19	25 WILD OATS				21	18	19	28	9
19	FARGO	4	EC .62	PPI					
20	25 WILD OATS				11	10	14	22	7
20	FARGO	4	EC 1.25	PPI					
21	25 WILD OATS				58	45	51	44	13
21	ASSERT	2.5	EC 0	POST					
22	25 WILD OATS				65	61	58	39	12
22	ASSERT	2.5	EC .11	POST					
22	NIS	80	EC .25	POST					
23	25 WILD OATS				33	30	32	42	12
23	ASSERT	2.5	EC .23	POST					
23	NIS	80	EC .25	POST					
24	25 WILD OATS				18	15	15	18	5
24	ASSERT	2.5	EC .46	POST					
24	NIS	80	EC .25	POST					
25	45 WILD OATS				80	78	73	41	11
25	FARGO	4	EC 0	PPI					
26	45 WILD OATS				44	38	41	41	12
26	FARGO	4	EC .31	PPI					
27	45 WILD OATS				35	30	35	46	15
27	FARGO	4	EC .62	PPI					
28	45 WILD OATS				17	16	19	26	8
28	FARGO	4	EC 1.25	PPI					
29	45 WILD OATS				120	61	63	43	12
29	ASSERT	2.5	EC 0	POST					
30	45 WILD OATS				68	55	59	47	14
30	ASSERT	2.5	EC .11	POST					
30	NIS	80	EC .25	POST					
31	45 WILD OATS				46	43	44	39	11
31	ASSERT	2.5	EC .23	POST					
31	NIS	80	EC .25	POST					
32	45 WILD OATS				32	26	28	32	10
32	ASSERT	2.5	EC .46	POST					
32	NIS	80	EC .25	POST					
LSD (.05)	=				32	18	16	11	3
Standard Dev.	=				22.9294	12.9924	11.3742	7.59850	2.47822
CV	=				66.24	45.73	37.66	26.12	29.40

Montana State University

EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Project Code: Density by Rate Recrop Location :KALISPELL - R8
By:Bob Stougaard

All rates are specified as lb ai

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Grow Stg	BARLEY HEADS NO/SQ FT AVGQUAD	BARLEY STRAWDWT G/SQ FT AVGQUAD	BARLEY SEED WT G/SQ FT AVGQUAD	YIELD BARLEY BU/A 8-8-94
1	0 WILD OATS					36	56	20	40.9
1	FARGO	4	EC	0	PPI				
2	0 WILD OATS					39	55	20	31.9
2	FARGO	4	EC	.31	PPI				
3	0 WILD OATS					36	48	18	35.5
3	FARGO	4	EC	.62	PPI				
4	0 WILD OATS					45	65	24	35.8
4	FARGO	4	EC	1.25	PPI				
5	0 WILD OATS					35	50	17	34.2
5	ASSERT	2.5	EC	0	POST				
6	0 WILD OATS					41	57	21	39.9
6	ASSERT	2.5	EC	.11	POST				
6	NIS	80	EC	.25	POST				
7	0 WILD OATS					32	47	16	34.7
7	ASSERT	2.5	EC	.23	POST				
7	NIS	80	EC	.25	POST				
8	0 WILD OATS					39	57	20	36.1
8	ASSERT	2.5	EC	.46	POST				
8	NIS	80	EC	.25	POST				
9	15 WILD OATS					21	28	10	12.6
9	FARGO	4	EC	0	PPI				
10	15 WILD OATS					22	30	11	20.5
10	FARGO	4	EC	.31	PPI				
11	15 WILD OATS					22	29	11	24.6
11	FARGO	4	EC	.62	PPI				
12	15 WILD OATS					35	43	15	26.0
12	FARGO	4	EC	1.25	PPI				
13	15 WILD OATS					17	19	6	12.5
13	ASSERT	2.5	EC	0	POST				
14	15 WILD OATS					19	24	8	12.0
14	ASSERT	2.5	EC	.11	POST				
14	NIS	80	EC	.25	POST				
15	15 WILD OATS					26	34	12	17.4
15	ASSERT	2.5	EC	.23	POST				
15	NIS	80	EC	.25	POST				
16	15 WILD OATS					33	47	17	28.5
16	ASSERT	2.5	EC	.46	POST				
16	NIS	80	EC	.25	POST				

EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Trt No	Treatment Name	Form	Amt	Fm Ds	Rate	Grow Stg	BARLEY HEADS NO/SQ FT AVGQUAD	BARLEY STRAWDWT G/SQ FT AVGQUAD	BARLEY SEED WT G/SQ FT AVGQUAD	YIELD BARLEY BU/A 8-8-94
17	25 WILD OATS						13	14	5	9.7
17	FARGO	4		EC	0	PPI				
18	25 WILD OATS						15	21	7	14.8
18	FARGO	4		EC	.31	PPI				
19	25 WILD OATS						28	36	13	27.3
19	FARGO	4		EC	.62	PPI				
20	25 WILD OATS						34	47	16	29.5
20	FARGO	4		EC	1.25	PPI				
21	25 WILD OATS						18	20	7	12.2
21	ASSERT	2.5		EC	0	POST				
22	25 WILD OATS						18	21	7	11.8
22	ASSERT	2.5		EC	.11	POST				
22	NIS	80		EC	.25	POST				
23	25 WILD OATS						30	39	14	23.7
23	ASSERT	2.5		EC	.23	POST				
23	NIS	80		EC	.25	POST				
24	25 WILD OATS						38	53	20	27.2
24	ASSERT	2.5		EC	.46	POST				
24	NIS	80		EC	.25	POST				
25	45 WILD OATS						14	18	6	9.9
25	FARGO	4		EC	0	PPI				
26	45 WILD OATS						22	29	10	12.1
26	FARGO	4		EC	.31	PPI				
27	45 WILD OATS						25	31	11	20.2
27	FARGO	4		EC	.62	PPI				
28	45 WILD OATS						33	45	17	25.1
28	FARGO	4		EC	1.25	PPI				
29	45 WILD OATS						20	26	9	12.1
29	ASSERT	2.5		EC	0	POST				
30	45 WILD OATS						14	17	6	12.1
30	ASSERT	2.5		EC	.11	POST				
30	NIS	80		EC	.25	POST				
31	45 WILD OATS						19	23	8	13.7
31	ASSERT	2.5		EC	.23	POST				
31	NIS	80		EC	.25	POST				
32	45 WILD OATS						28	35	13	24.6
32	ASSERT	2.5		EC	.46	POST				
32	NIS	80		EC	.25	POST				
LSD (.05) =							11	15	6	9.1
Standard Dev.=							7.69354	10.7367	4.37606	6.51261
CV =							28.54	29.61	34.24	28.58
Block F							0.462	0.313	0.106	0.247
Block Prob(F)							0.7096	0.8159	0.9567	0.8636
Treatment F							5.660	7.219	6.066	9.274
Treatment Prob(F)							0.0001	0.0001	0.0001	0.0001

Montana State University

EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Project Code:Densitiy by Rate Recrop Location :KALISPELL - R8
By:Bob Stougaard

Site Description

Crop: SPRING BARLEY Variety: GALLATIN Planting Date: 4-27-94
Planting Method: PRESSDRILL Rate, Unit: 60 , LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 6 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date:

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 18.3 , FT Reps: 4
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: Factorial
Field Preparation/Plot Maintenance: FALL ROTO-TILLED, SPRING DISCED AND PACKED

Soil Description

Texture: FINE SANDY LOAM % OM: 2.3 % Sand: 50 % Silt: 40 % Clay: 10
pH: 7.7 CEC: Soil Name: KALISPELL, FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.	4-28-84	.6"		IRR	2.				
3.	4-29-94	1.2"		"	4.				
5.	5-10-94	1.8"		"	6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:						
Time of Day:						
Application Method:						
Application Timing:						
Air Temp., Unit:	,	,	,	,	,	,
% Relative Humidity:						
Wind Velocity, Unit:	,	,	,	,	,	,
Dew Presence (Y/N):						
Water Hardness:						
Soil Temp., Unit:	,	,	,	,	,	,
Soil Moisture:						
% Cloud Cover:						

Weed Species	Weed Stage, Density at Application					
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.										
B.										
C.										
D.										

Montana State University

EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Project Code:Density by Rate Location :KALISPELL - R8
By:Bob Stougaard

Summary Comments: The purpose of the experiment was to compare soil and foliar applied herbicide performance across a range of weed densities in order to determine if use rates could be based on weed pressure.

In the absence of any herbicide, the highest wild oat population reduced barley yield by 25 percent. Wild oat population had a pronounced effect on Assert. As wild oat populations increased, control declined especially at the lower rates. In contrast, wild oat population had no effect on Fargo performance. There was no barley yield reduction even with the lowest rate of Fargo tested. These results indicated that weed population has a greater impact on foliar applied herbicides than soil applied products and that rates may need to be adjusted accordingly. The fact that yield loss was not observed even with the lowest rate of Fargo suggests that Fargo rates can be reduced with out sacrificing wild oat control.

Montana State University

EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Project Code:Density by Rate Location :KALISPELL - R8
By:Bob Stougaard
All rates are specified as lb ai/A

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Grow Stg	WILD OAT NO/SQ FT AVERAGE 5-25-94	WILD OAT PLANTS NO/SQ FT AVG	WILD OAT PLANTS NO/SQ FT QUAD	WILD OAT HEADS NO/SQ FT AVG	WILD OAT HEADS NO/SQ FT QUAD	WILD OAT DRY WT G/SQ FT AVG	WILD OAT DRY WT G/SQ FT QUAD	WILD OAT SEED WT G/SQ FT AVG	WILD OAT SEED WT G/SQ FT QUAD
1	0 WILD OATS					1	0		0		0		0	
1	FARGO	4	EC	0	PPI									
2	0 WILD OATS					1	0		0		0		0	
2	FARGO	4	EC	.31	PPI									
3	0 WILD OATS					1	0		0		0		0	
3	FARGO	4	EC	.62	PPI									
4	0 WILD OATS					0	0		0		0		0	
4	FARGO	4	EC	1.25	PPI									
5	0 WILD OATS					2	0		0		1		1	
5	ASSERT	2.5	EC	0	POST									
6	0 WILD OATS					0	0		0		0		0	
6	ASSERT	2.5	EC	.11	POST									
6	NIS	80	EC	.25	POST									
7	0 WILD OATS					1	1		1		0		0	
7	ASSERT	2.5	EC	.23	POST									
7	NIS	80	EC	.25	POST									
8	0 WILD OATS					1	0		1		0		0	
8	ASSERT	2.5	EC	.46	POST									
8	NIS	80	EC	.25	POST									
9	15 WILD OATS					8	8		11		9		4	
9	FARGO	4	EC	0	PPI									
10	15 WILD OATS					4	3		5		5		2	
10	FARGO	4	EC	.31	PPI									
11	15 WILD OATS					2	1		2		2		1	
11	FARGO	4	EC	.62	PPI									
12	15 WILD OATS					1	0		1		0		0	
12	FARGO	4	EC	1.25	PPI									
13	15 WILD OATS					11	8		13		16		5	
13	ASSERT	2.5	EC	0	POST									
14	15 WILD OATS					11	6		11		5		2	
14	ASSERT	2.5	EC	.11	POST									
14	NIS	80	EC	.25	POST									
15	15 WILD OATS					9	4		8		3		2	
15	ASSERT	2.5	EC	.23	POST									
15	NIS	80	EC	.25	POST									

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Grow Stg	WILD OAT NO/SQ FT AVERAGE 5-25-94	WILD OAT PLANTS NO/SQ FT AVG	WILD OAT PLANTS NO/SQ FT QUAD	WILD OAT HEADS NO/SQ FT AVG	WILD OAT HEADS NO/SQ FT QUAD	WILD OAT DRY WT G/SQ FT AVG	WILD OAT DRY WT G/SQ FT QUAD	WILD OAT SEED WT G/SQ FT AVG	WILD OAT SEED WT G/SQ FT QUAD
16	15 WILD OATS					13	3		6		2		0	
16	ASSERT	2.5	EC	.46	POST									
16	NIS	80	EC	.25	POST									
17	25 WILD OATS					13	11		17		17		6	
17	FARGO	4	EC	0	PPI									
18	25 WILD OATS					6	5		8		9		4	
18	FARGO	4	EC	.31	PPI									
19	25 WILD OATS					1	0		1		0		0	
19	FARGO	4	EC	.62	PPI									
20	25 WILD OATS					0	0		0		0		0	
20	FARGO	4	EC	1.25	PPI									
21	25 WILD OATS					15	12		20		21		7	
21	ASSERT	2.5	EC	0	POST									
22	25 WILD OATS					19	14		24		13		4	
22	ASSERT	2.5	EC	.11	POST									
22	NIS	80	EC	.25	POST									
23	25 WILD OATS					10	6		10		3		2	
23	ASSERT	2.5	EC	.23	POST									
23	NIS	80	EC	.25	POST									
24	25 WILD OATS					17	5		9		3		1	
24	ASSERT	2.5	EC	.46	POST									
24	NIS	80	EC	.25	POST									
25	45 WILD OATS					29	25		34		27		9	
25	FARGO	4	EC	0	PPI									
26	45 WILD OATS					5	4		8		8		2	
26	FARGO	4	EC	.31	PPI									
27	45 WILD OATS					2	1		2		2		1	
27	FARGO	4	EC	.62	PPI									
28	45 WILD OATS					1	1		2		2		1	
28	FARGO	4	EC	1.25	PPI									
29	45 WILD OATS					29	23		33		27		8	
29	ASSERT	2.5	EC	0	POST									
30	45 WILD OATS					31	21		31		15		4	
30	ASSERT	2.5	EC	.11	POST									
30	NIS	80	EC	.25	POST									
31	45 WILD OATS					26	17		27		10		3	
31	ASSERT	2.5	EC	.23	POST									
31	NIS	80	EC	.25	POST									
32	45 WILD OATS					36	10		19		6		1	
32	ASSERT	2.5	EC	.46	POST									
32	NIS	80	EC	.25	POST									
LSD (.05) =						8	5		8		6		2	
Standard Dev.=						5.57504	3.57194		5.42851		4.27181		1.66873	
CV =						58.54	61.45		58.79		67.17		80.91	
Block F						1.053	0.364		0.943		0.519		9.674	
Block Prob(F)						0.3729	0.7790		0.4230		0.6703		0.0001	
Treatment F						14.500	16.103		15.385		13.873		8.578	
Treatment Prob(F)						0.0001	0.0001		0.0001		0.0001		0.0001	

Montana State University

EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Project Code: Density by Rate Location :KALISPELL - R8
By:Bob Stougaard

Trt No	Treatment Name	Form Amt	Rate Lb ai	Grow Stg	BARLEY HEADS NO/SQ FT AVG QUAD	BARLEY DRY WT G/SQ FT AVG QUAD	BARLEY SEED WT G/SQ FT AVG QUAD	BARLEY YIELD BU/A 8-9-94
1	0 WILD OATS				60	102	42	69.4
1	FARGO	4	EC 0	PPI				
2	0 WILD OATS				64	115	49	68.2
2	FARGO	4	EC .31	PPI				
3	0 WILD OATS				55	90	39	63.5
3	FARGO	4	EC .62	PPI				
4	0 WILD OATS				57	96	41	67.0
4	FARGO	4	EC 1.25	PPI				
5	0 WILD OATS				55	91	38	64.4
5	ASSERT	2.5	EC 0	POST				
6	0 WILD OATS				66	111	46	72.0
6	ASSERT	2.5	EC .11	POST				
6	NIS	80	EC .25	POST				
7	0 WILD OATS				57	98	42	68.1
7	ASSERT	2.5	EC .23	POST				
7	NIS	80	EC .25	POST				
8	0 WILD OATS				59	98	43	70.3
8	ASSERT	2.5	EC .46	POST				
8	NIS	80	EC .25	POST				
9	15 WILD OATS				48	80	33	53.9
9	FARGO	4	EC 0	PPI				
10	15 WILD OATS				58	101	42	61.7
10	FARGO	4	EC .31	PPI				
11	15 WILD OATS				54	89	36	57.8
11	FARGO	4	EC .62	PPI				
12	15 WILD OATS				64	106	45	71.1
12	FARGO	4	EC 1.25	PPI				
13	15 WILD OATS				50	87	37	63.7
13	ASSERT	2.5	EC 0	POST				
14	15 WILD OATS				52	90	36	57.8
14	ASSERT	2.5	EC .11	POST				
14	NIS	80	EC .25	POST				
15	15 WILD OATS				61	104	46	69.5
15	ASSERT	2.5	EC .23	POST				
15	NIS	80	EC .25	POST				
16	15 WILD OATS				51	93	41	65.9
16	ASSERT	2.5	EC .46	POST				
16	NIS	80	EC .25	POST				

EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Grow Stg	BARLEY HEADS NO/SQ FT AVG QUAD	BARLEY DRY WT G/SQ FT AVG QUAD	BARLEY SEED WT G/SQ FT AVG QUAD	BARLEY YIELD BU/A 8-9-94
17	25 WILD OATS					44	68	28	50.0
17	FARGO	4	EC	0	PPI				
18	25 WILD OATS					57	93	40	60.5
18	FARGO	4	EC	.31	PPI				
19	25 WILD OATS					71	127	55	69.8
19	FARGO	4	EC	.62	PPI				
20	25 WILD OATS					61	103	44	70.5
20	FARGO	4	EC	1.25	PPI				
21	25 WILD OATS					47	77	33	57.8
21	ASSERT	2.5	EC	0	POST				
22	25 WILD OATS					49	82	37	59.4
22	ASSERT	2.5	EC	.11	POST				
22	NIS	80	EC	.25	POST				
23	25 WILD OATS					62	102	46	69.3
23	ASSERT	2.5	EC	.23	POST				
23	NIS	80	EC	.25	POST				
24	25 WILD OATS					62	102	45	70.9
24	ASSERT	2.5	EC	.46	POST				
24	NIS	80	EC	.25	POST				
25	45 WILD OATS					43	68	29	48.0
25	FARGO	4	EC	0	PPI				
26	45 WILD OATS					57	99	43	70.8
26	FARGO	4	EC	.31	PPI				
27	45 WILD OATS					69	119	51	75.0
27	FARGO	4	EC	.62	PPI				
28	45 WILD OATS					53	92	39	63.0
28	FARGO	4	EC	1.25	PPI				
29	45 WILD OATS					35	54	21	50.9
29	ASSERT	2.5	EC	0	POST				
30	45 WILD OATS					45	73	30	54.1
30	ASSERT	2.5	EC	.11	POST				
30	NIS	80	EC	.25	POST				
31	45 WILD OATS					43	67	29	58.3
31	ASSERT	2.5	EC	.23	POST				
31	NIS	80	EC	.25	POST				
32	45 WILD OATS					47	75	32	58.6
32	ASSERT	2.5	EC	.46	POST				
32	NIS	80	EC	.25	POST				
LSD (.05) =						11	20	9	11.8
Standard Dev.=						8.09719	14.2503	6.33886	8.44182
CV =						14.79	15.49	16.18	13.30
Block F						2.369	4.901	4.817	2.982
Block Prob(F)						0.0756	0.0033	0.0037	0.0353
Treatment F						4.219	5.199	5.415	2.915
Treatment Prob(F)						0.0001	0.0001	0.0001	0.0001

Montana State University

EVALUATION OF WILD OAT HERBICIDES, RATES AND APPLICATION TIMINGS AT SEVERAL WILD OAT DENSITIES

Project Code: Density by Rate Location :KALISPELL - R8
By:Bob Stougaard

Site Description

Crop: SPRING BARLEY Variety: GALLATIN Planting Date: 4-22-94
Planting Method: RESEARCH Rate, Unit: 60 , LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 6 , "
Soil Temp., Unit: , Soil Moisture: GOOD Emergence Date: 5-7-94

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 15 , FT Reps: 4
Site Type: R8, SOLID Seed Bed Desc.: Ground Cover: ALF ROOTS
Tillage Type: Study Design:
Field Preparation/Plot Maintenance: FALL PLOW, SPRING DISC AND CULTIVATE. PACKED PRIOR TO WILD OAT SEEDING

Soil Description

Texture: FINE SANDY LOAM % OM: 4.0 % Sand: 60 % Silt: 30 % Clay: 10
pH: 7.7 CEC: Soil Name: KALISPELL FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	5-21-94	5-26-94				
Time of Day:	2:00 PM	1:00 PM				
Application Method:	BACKPACK	BACKPACK				
Application Timing:	PPI	3 WABE				
Air Temp., Unit:	59 ,F	83 ,F	,	,	,	,
% Relative Humidity:	32	17				
Wind Velocity, Unit:	2 ,MPH	2 ,MPH	,	,	,	,
Dew Presence (Y/N):	N	N				
Water Hardness:		N				
Soil Temp., Unit:	50 ,F	72 ,F	,	,	,	,
Soil Moisture:	FAIR	DRY TOP				
% Cloud Cover:	60	0				

Weed Species	Weed Stage, Density at Application					
BARLEY	N/A ,N/A	2L1T,5"	,	,	,	,
WILD OATS	N/A ,N/A	1.5T,6"	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLAT FAN	11002VS	14"	20"	10'	20	H2O	20
B.	"									
C.										
D.										
E.										

Montana State University

LONG TERM WILD OAT ECONOMIC THRESHOLDS

Project Code:COMPLEX WILD OAT
Cooperator :Bruce Maxwell

Location :KALISPELL - R9
By:Bob Stougaard

Summary Comments: The purpose of the study was to measure the long term effects of allowing different wild oat populations to reproduce on subsequent barley yields.

A range of wild oat populations were planted during the 1993 growing season, either with the barley crop or one week later. Three barley seedings rates were then superimposed on these treatments. The two wild oat seeding dates were included to measure the reproductive abilities of late-emerging wild oat on subsequent weed populations. The three barley seeding rates were included to evaluated the effect of barley population on wild oat reproduction.

Wild oat populations were highest where wild oat had been seeded with barley in 1993, demonstrating that late emerging wild oats produced less seed compared to early emerging plants. As barley populations increased, wild oat numbers decreased. The combination of high barley populations and delayed wild oat emergence during 1993 produced the highest barley yields in 1994. However, this still resulted in at least a 3-fold increase in wild oat numbers compared to the initial 1993 seeding rate.

Montana State University

WILD OAT POPULATION STUDY - R9 1994 THRESHOLD STUDY

Project Code:94-WOP-R9 Location :KALISPELL, MT
Cooperator :BRUCE MAXWELL By:Bob Stougaard

Trt No	Treatment Name	WILD OAT PER FT2 4-29-94	WILD OAT PER FT2 5-5-94	WILD OAT PER FT2 5-13-94	WILD OAT HEADS PER FT2	TRUESEED COUNT PER FT2
1	0 BARLEY	1.2	12.2	20.0	28.5	1614
1	0 DAP					
1	0 WILD OAT					
2	0 BARLEY	4.3	66.0	113.7	84.0	1634
2	0 DAP					
2	10 WILD OAT					
3	0 BARLEY	13.7	142.2	213.5	112.8	2955
3	0 DAP					
3	40 WILD OAT					
4	0 BARLEY	6.5	80.8	144.7	89.2	1682
4	0 DAP					
4	160 WILD OAT					
5	0 BARLEY	14.0	106.5	138.7	157.5	2786
5	0 DAP					
5	400 WILD OAT					
6	1/2X BARLEY	0.5	6.5	15.8	33.0	2452
6	0 DAP					
6	0 WILD OAT					
7	1/2X BARLEY	6.5	44.8	84.3	62.5	1132
7	0 DAP					
7	10 WILD OAT					
8	1/2X BARLEY	4.0	70.5	152.8	120.0	2330
8	0 DAP					
8	40 WILD OAT					
9	1/2X BARLEY	9.8	91.8	174.0	108.3	1924
9	0 DAP					
9	160 WILD OAT					
10	1/2X BARLEY	11.2	91.5	133.3	101.0	1779
10	0 DAP					
10	400 WILD OAT					
11	1/2X BARLEY	0.7	5.0	7.5	27.5	2130
11	7 DAP					
11	0 WILD OAT					
12	1/2X BARLEY	2.5	23.2	41.7	59.7	2404
12	7 DAP					
12	10 WILD OAT					

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WILD OAT POPULATION STUDY - R9 1994 THRESHOLD STUDY

Trt No	Treatment Name	WILD OAT PER FT2 4-29-94	WILD OAT PER FT2 5-5-94	WILD OAT PER FT2 5-13-94	WILD OAT HEADS PER FT2	TRUESEED COUNT PER FT2
13	1/2X BARLEY	6.7	58.8	83.5	69.2	2141
13	7 DAP					
13	40 WILD OAT					
14	1/2X BARLEY	5.2	85.3	139.2	71.8	1222
14	7 DAP					
14	160 WILD OAT					
15	1/2XBARLEY	8.0	93.3	125.3	62.3	1022
15	7 DAP					
15	400 WILD OAT					
16	1X BARLEY	0.5	7.0	21.5	43.8	1444
16	0 DAP					
16	0 WILD OAT					
17	1X BARLEY	9.0	63.8	105.5	68.7	1950
17	0 DAP					
17	10 WILD OAT					
18	1X BARLEY	13.3	122.3	198.2	77.0	2100
18	0 DAP					
18	40 WILD OAT					
19	1X BARLEY	7.0	70.2	115.7	100.0	1807
19	0 DAP					
19	160 WILD OAT					
20	1X BARLEY	20.2	124.5	225.2	128.5	2405
20	0 DAP					
20	400 WILD OAT					
21	1X BARLEY	0.7	6.8	15.8	46.5	2211
21	7 DAP					
21	0 WILD OAT					
22	1X BARLEY	2.0	24.8	46.2	56.3	1850
22	7 DAP					
22	10 WILD OAT					
23	1X BARLEY	3.5	28.5	48.2	41.0	1602
23	7 DAP					
23	40 WILD OAT					
24	1X BARLEY	10.5	80.7	121.3	63.0	1786
24	7 DAP					
24	160 WILD OAT					
25	1X BARLEY	9.0	76.2	93.3	76.7	1977
25	7 DAP					
25	400 WILD OAT					

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WILD OAT POPULATION STUDY - R9 1994 THRESHOLD STUDY

Trt No	Treatment Name	WILD OAT PER FT2 4-29-94	WILD OAT PER FT2 5-5-94	WILD OAT PER FT2 5-13-94	WILD OAT HEADS PER FT2	TRUESEED COUNT PER FT2
26	2X BARLEY 0 DAP 0 WILD OAT	0.3	3.0	4.2	18.7	1105
27	2X BARLEY 0 DAP 10 WILD OAT	3.7	34.8	45.7	38.3	1650
28	2X BARLEY 0 DAP 40 WILD OAT	5.3	68.0	116.2	41.8	1244
29	2X BARLEY 0 DAP 160 WILD OAT	8.8	57.7	90.2	64.7	1836
30	2X BARLEY 0 DAP 400 WILD OAT	9.5	100.5	155.5	93.8	1430
31	2X BARLEY 7 DAP 0 WILD OAT	0.7	9.7	21.3	15.2	1263
32	2X BARLEY 7 DAP 10 WILD OAT	1.8	17.2	30.5	32.7	938
33	2X BARLEY 7 DAP 40 WILD OAT	3.0	19.8	43.7	32.2	936
34	2X BARLEY 7 DAP 160 WILD OAT	3.2	35.8	67.7	74.8	2057
35	2X BARLEY 7 DAP 400 WILD OAT	5.8	37.3	81.5	56.7	1534
LSD (.05) =		6.8	44.1	70.4	39.4	1085
Standard Dev.=		4.17462	27.0247	43.0900	24.1304	664.491
CV =		68.76	48.08	46.62	35.82	37.31
Block F		4.192	0.359	3.594	3.762	1.207
Block Prob(F)		0.0192	0.6996	0.0328	0.0282	0.3058
Treatment F		3.881	6.270	6.089	5.706	1.755
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0263

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WILD OAT POPULATION STUDY - R9 1994 THRESHOLD STUDY

Project Code:94-WOP-R9 Location :KALISPELL, MT
Cooperator :BRUCE MAXWELL By:Bob Stougaard

Trt No	Treatment Name	BARLEY PER FT2 5-5-94	BARLEY PER FT2 5-13-94	BARLEY PLANTS /SQ FT	BARLEY SEED WT GM/FT	YIELD BARLEY BU/A	BARLEY PLUMP PERCENT
1	0 BARLEY 0 DAP 0 WILD OAT	0.0	0.0	0.0	0.0	0.0	
2	0 BARLEY 0 DAP 10 WILD OAT	0.0	0.0	0.0	0.0	0.0	
3	0 BARLEY 0 DAP 40 WILD OAT	0.0	0.0	0.0	0.0	0.0	
4	0 BARLEY 0 DAP 160 WILD OAT	0.0	0.0	0.0	0.0	0.0	
5	0 BARLEY 0 DAP 400 WILD OAT	0.0	0.0	0.0	0.0	0.0	
6	1/2X BARLEY 0 DAP 0 WILD OAT	8.7	8.5	7.3	18.8	18.5	59
7	1/2X BARLEY 0 DAP 10 WILD OAT	11.2	7.2	5.0	2.3	4.4	79
8	1/2X BARLEY 0 DAP 40 WILD OAT	10.8	7.8	0.5	1.2	2.3	79
9	1/2X BARLEY 0 DAP 160 WILD OAT	10.8	7.3	4.0	0.5	2.6	83
10	1/2X BARLEY 0 DAP 400 WILD OAT	12.5	6.0	5.4	0.5	2.3	85
11	1/2X BARLEY 7 DAP 0 WILD OAT	7.5	7.2	5.8	13.3	26.1	51
12	1/2X BARLEY 7 DAP 10 WILD OAT	8.5	8.7	7.5	3.5	6.5	50

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WILD OAT POPULATION STUDY - R9 1994 THRESHOLD STUDY

Trt No	Treatment Name	BARLEY PER FT2 5-5-94	BARLEY PER FT2 5-13-94	BARLEY PLANTS /SQ FT	BARLEY SEED WT GM/FT	YIELD BARLEY BU/A	BARLEY PLUMP PERCENT
13	1/2X BARLEY	9.3	7.3	5.0	3.8	3.9	79
13	7 DAP						
13	40 WILD OAT						
14	1/2X BARLEY	7.3	6.3	2.5	2.7	3.2	77
14	7 DAP						
14	160 WILD OAT						
15	1/2XBARLEY	9.5	7.0	1.8	1.0	6.8	61
15	7 DAP						
15	400 WILD OAT						
16	1X BARLEY	15.3	16.0	13.5	8.0	27.5	47
16	0 DAP						
16	0 WILD OAT						
17	1X BARLEY	18.5	14.5	5.8	2.2	6.9	64
17	0 DAP						
17	10 WILD OAT						
18	1X BARLEY	15.0	11.7	6.5	3.8	7.6	74
18	0 DAP						
18	40 WILD OAT						
19	1X BARLEY	17.8	14.5	7.5	3.8	6.3	73
19	0 DAP						
19	160 WILD OAT						
20	1X BARLEY	18.2	12.5	2.3	1.7	4.2	85
20	0 DAP						
20	400 WILD OAT						
21	1X BARLEY	17.3	18.2	10.5	15.3	26.8	61
21	7 DAP						
21	0 WILD OAT						
22	1X BARLEY	16.3	15.7	9.5	6.5	11.9	61
22	7 DAP						
22	10 WILD OAT						
23	1X BARLEY	17.0	16.3	6.5	4.5	10.1	72
23	7 DAP						
23	40 WILD OAT						
24	1X BARLEY	16.2	17.8	6.5	2.7	6.1	69
24	7 DAP						
24	160 WILD OAT						
25	1X BARLEY	15.2	14.7	8.5	5.0	8.7	68
25	7 DAP						
25	400 WILD OAT						

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WILD OAT POPULATION STUDY - R9 1994 THRESHOLD STUDY

Trt No	Treatment Name	BARLEY PER FT2 5-5-94	BARLEY PER FT2 5-13-94	BARLEY PLANTS /SQ FT	BARLEY SEED WT GM/FT	YIELD BARLEY BU/A	BARLEY PLUMP PERCENT
26	2X BARLEY	29.0	29.3	18.5	23.3	48.4	61
26	0 DAP						
26	0 WILD OAT						
27	2X BARLEY	30.5	25.8	23.5	14.2	14.6	58
27	0 DAP						
27	10 WILD OAT						
28	2X BARLEY	29.2	27.7	4.5	4.0	8.8	65
28	0 DAP						
28	40 WILD OAT						
29	2X BARLEY	33.5	29.2	12.0	8.7	15.2	71
29	0 DAP						
29	160 WILD OAT						
30	2X BARLEY	27.2	25.5	6.5	6.8	7.7	78
30	0 DAP						
30	400 WILD OAT						
31	2X BARLEY	31.2	29.7	22.5	28.0	45.5	51
31	7 DAP						
31	0 WILD OAT						
32	2X BARLEY	30.8	27.7	23.0	14.3	29.5	65
32	7 DAP						
32	10 WILD OAT						
33	2X BARLEY	27.3	27.3	8.0	1.7	17.5	60
33	7 DAP						
33	40 WILD OAT						
34	2X BARLEY	30.7	29.3	15.0	10.0	15.1	67
34	7 DAP						
34	160 WILD OAT						
35	2X BARLEY	32.0	27.7	13.0	4.3	11.5	65
35	7 DAP						
35	400 WILD OAT						
LSD (.05) =		4.9	4.6	4.9	9.1	14.0	18
Standard Dev.=		2.98812	2.80202	2.90344	5.54801	8.46608	10.7133
CV =		18.53	19.45	37.90	89.76	72.97	15.95
Block F		6.128	1.896	0.002	0.331	0.799	2.935
Block Prob(F)		0.0036	0.1580	0.9985	0.7196	0.4554	0.0650
Treatment F		37.207	38.591	15.308	4.755	6.126	2.936
Treatment Prob(F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0009

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LONG TERM WILD OAT ECONOMIC THRESHOLDS

Project Code:COMPLEX WILD OAT Location :KALISPELL - R9
Cooperator :Bruce Maxwell By:Bob Stougaard

Site Description

Crop: SPRING BARLEY Variety: GALLATIN Planting Date: 4-20-94
Planting Method: RESEARCH Rate, Unit: 30,60,120 LB/A Depth, Unit: 1.5 , "
Perennial Age, Unit: , Row Spacing, Unit: 12 "
Soil Temp., Unit: , Soil Moisture: GOOD Emergence Date: 5-1-94

Plot Width/Area, Unit: 9 , FT Plot Length, Unit: 20 , FT Reps: 3
Site Type: R9, RECROP Seed Bed Desc.: MELLOW Ground Cover: STRAW 20%
Tillage Type: Study Design:
Field Preparation/Plot Maintenance: FALL AND SPRING ROTOTILLING, DISCED TWICE IN THE SPRING AND PACKED PRIOR TO SEEDING.

Soil Description

Texture: FINE SANDY LOAM % OM: 6.2 % Sand: 44 % Silt: 41 % Clay: 15
pH: 7.9 CEC: Soil Name: LOAM Fertility Level:

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PEPPERMINT WILD OAT STUDY - SONSTELLIE FARM 1994

Project Code:94-PWO-SON
Cooperator :DALE SONSTELIE
Location :DALE SONSTELIE FARM
By:Bob Stougaard

Summary Comments: Surfactant type had a pronounced effect on wild oat control, with the response being most apparent at the 3 oz rate. Of the surfactants evaluated, MSO was more effective than NIS, and wild oat control with both surfactants was improved with the addition of UAN.

Wild oat control was most complete when applied at the 4 leaf stage of wild oat. Control with the early applications may have been less complete due to low evening temperatures of 37 F preceding application. This may have stressed plants and reduced herbicide uptake. Reduced control with the last application was probably due to the greater weed biomass present relative to the earlier applications.

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PEPPERMINT WILD OAT STUDY - SONSTELLIE FARM 1994

Project Code:94-PWO-SON
Cooperator :DALE SONSTELIE

Location :DALE SONSTELIE FARM
By:Bob Stougaard

Trt No	Treatment Name	Form Amt	Rate	Rate Unit	Grow Stg	WILD OAT CONTROL PERCENT 8-9-94	WILD OAT DRY WT PERCENT 8-11-94	MINT DRY WT PERCENT 8-11-94	OIL YIELD LB/A 8-11-94
1	ASSURE II	.88 EC	3	oz pr/A	2 LEAF	0	61.9	38.1	3.5
1	ACTIVATOR 90	1 EC	.125	% v/v	2 LEAF				
2	ASSURE II	.88 EC	3	oz pr/A	2 LEAF	37	44.6	55.4	7.7
2	ACTIVATOR 90	1 EC	.125	% v/v	2 LEAF				
2	28% UAN	1 EC	2	qt pr/A	2 LEAF				
3	ASSURE II	.88 EC	3	oz pr/A	2 LEAF	81	11.4	88.6	10.0
3	MSO	1 EC	1	qt pr/A	2 LEAF				
4	ASSURE II	.88 EC	3	oz pr/A	2 LEAF	87	0.5	99.5	6.7
4	MSO	1 EC	1	qt pr/A	2 LEAF				
4	28% UAN	1 EC	2	qt pr/A	2 LEAF				
5	ASSURE II	.88 EC	7	oz pr/A	2 LEAF	50	24.2	75.8	8.7
5	ACTIVATOR 90	1 EC	.125	% v/v	2 LEAF				
6	ASSURE II	.88 EC	7	oz pr/A	2 LEAF	91	5.6	94.4	10.5
6	ACTIVATOR 90	1 EC	.125	% v/v	2 LEAF				
6	28% UAN	1 EC	2	qt pr/A	2 LEAF				
7	ASSURE II	.88 EC	7	oz pr/A	2 LEAF	93	1.5	98.5	11.4
7	MSO	1 EC	1	qt pr/A	2 LEAF				
8	ASSURE II	.88 EC	7	oz pr/A	2 LEAF	96	1.6	98.4	8.1
8	MSO	1 EC	1	qt pr/A	2 LEAF				
8	28% UAN	1 EC	2	qt pr/A	2 LEAF				
9	ASSURE II	.88 EC	3	oz pr/A	4 LEAF	20	32.8	67.2	4.5
9	ACTIVATOR 90	1 EC	.125	% v/v	4 LEAF				
10	ASSURE II	.88 EC	3	oz pr/A	4 LEAF	89	2.7	97.3	12.0
10	ACTIVATOR 90	1 EC	.125	% v/v	4 LEAF				
10	28% UAN	1 EC	2	qt pr/A	4 LEAF				
11	ASSURE II	.88 EC	3	oz pr/A	4 LEAF	94	3.2	96.8	6.3
11	MSO	1 EC	1	qt pr/A	4 LEAF				
12	ASSURE	.88 EC	3	oz pr/A	4 LEAF	97	0.0	100.0	6.1
12	MSO	1 EC	1	qt pr/A	4 LEAF				
12	28% UAN	1 EC	2	qt pr/A	4 LEAF				
13	ASSURE II	.88 EC	7	oz pr/A	4 LEAF	95	1.5	98.5	8.7
13	ACTIVATOR 90	1 EC	.125	% v/v	4 LEAF				
14	ASSURE II	.88 EC	7	oz pr/A	4 LEAF	98	2.1	97.9	4.3
14	ACTIVATOR 90	1 EC	.125	% v/v	4 LEAF				
14	28% UAN	1 EC	2	qt pr/A	4 LEAF				
15	ASSURE II	.88 EC	7	oz pr/A	4 LEAF	97	1.1	98.9	3.5
15	MSO	1 EC	1	qt pr/A	4 LEAF				
16	ASSURE II	.88 EC	7	oz pr/A	4 LEAF	98	0.0	100.0	6.8
16	MSO	1 EC	1	qt pr/A	4 LEAF				
16	28% UAN	1 EC	2	qt pr/A	4 LEAF				

Continued on next page

PEPPERMINT WILD OAT STUDY - SONSTELLIE FARM 1994

Trt No	Treatment Name	Form Amt	Rate	Rate Unit	Grow Stg	WILD OAT CONTROL PERCENT 8-9-94	WILD OAT DRY WT PERCENT 8-11-94	MINT DRY WT PERCENT 8-11-94	OIL YIELD LB/A 8-11-94
17	ASSURE II	.88 EC	3	oz pr/A	8 LEAF	7	41.7	58.3	1.7
17	ACTIVATOR 90	1 EC	.125	% v/v	8 LEAF				
18	ASSURE II	.88 EC	3	oz pr/A	8 LEAF	42	23.7	76.3	5.5
18	ACTIVATOR 90	1 EC	.125	% v/v	8 LEAF				
18	28% UAN	1 EC	2	qt pr/A	8 LEAF				
19	ASSURE II	.88 EC	3	oz pr/A	8 LEAF	72	31.5	68.5	1.8
19	MSO	1 EC	1	qt pr/A	8 LEAF				
20	ASSURE II	.88 EC	3	oz pr/A	8 LEAF	95	6.0	94.0	8.9
20	MSO	1 EC	1	qt pr/A	8 LEAF				
20	28% UAN	1 EC	2	qt pr/A	8 LEAF				
21	ASSURE II	.88 EC	7	oz pr/A	8 LEAF	85	14.7	85.3	7.6
21	ACTIVATOR 90	1 EC	.125	% v/v	8 LEAF				
22	ASSURE II	.88 EC	7	oz pr/A	8 LEAF	91	12.3	87.7	6.7
22	ACTIVATOR 90	1 EC	.125	% v/v	8 LEAF				
22	28% UAN	1 EC	2	qt pr/A	8 LEAF				
23	ASSURE II	.88 EC	7	oz pr/A	8 LEAF	98	0.8	99.2	10.9
23	MSO	1 EC	1	qt pr/A	8 LEAF				
24	ASSURE II	.88 EC	7	oz pr/A	8 LEAF	98	1.1	98.9	10.6
24	MSO	1 EC	1	qt pr/A	8 LEAF				
24	28% UAN	1 EC	2	qt pr/A	8 LEAF				
25	NONTREATED					0	58.9	41.1	1.3
LSD (.05) =						21	20.9	20.9	5.2
Standard Dev.=						12.6785	12.6716	12.6716	3.16882
CV =						17.52	82.21	14.98	45.54
Block F						1.185	2.382	2.382	10.004
Block Prob(F)						0.3145	0.1039	0.1039	0.0003
Treatment F						21.768	6.929	6.929	2.902
Treatment Prob(F)						0.0001	0.0001	0.0001	0.0012

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PEPPERMINT WILD OAT STUDY - SONSTELLIE FARM 1994

Project Code:94-PWO-SON Location :DALE SONSTELIE FARM
Cooperator :DALE SONSTELIE By:Bob Stougaard

Site Description

Crop: BABY PEPPERMINT Variety: BLACK MITCHAM Planting Date: 5-16-94
Planting Method: ROOTS Rate, Unit: 1/10A , A Depth, Unit: 3 , "
Perennial Age, Unit: 0 , YRS Row Spacing, Unit: 18 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date: 6-5-94

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 18.3 , FT Reps: 3
Site Type: SILT CLAYLOAM Seed Bed Desc.: Ground Cover: NONE
Tillage Type: PACKED Study Design: RCB
Field Preparation/Plot Maintenance: WILD OATS SEEDED WITH RESEARCH SEEDER ON 6-3-94

Soil Description

Texture: SILTY CLAY LOAM % OM: 6.0 % Sand: 40 % Silt: 40 % Clay: 20
pH: 6.5 CEC: Soil Name: SWIMS SCL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	6-20-94	6-27-94	7-3-94			
Time of Day:	11:00	11:00	9:00			
Application Method:	BACKPACK	BACKPACK	BACKPACK			
Application Timing:	2 LEAF	4 LEAF	8 LEAF			
Air Temp., Unit:	65 ,F	67 ,F	68 ,F	,	,	,
% Relative Humidity:	30	59	14			
Wind Velocity, Unit:	1 ,MPH	3 ,MPH	0 ,MPH	,	,	,
Dew Presence (Y/N):	N	N	N			
Water Hardness:	N	N	N			
Soil Temp., Unit:	60 ,F	60 ,F	60 ,F	,	,	,
Soil Moisture:	VERY GOOD	VERY GOOD	VERY GOOD			
% Cloud Cover:	50	25	0			

Weed Species	Weed Stage, Density at Application					
WILD OAT	2 LF,	5 LF,	10LF,6"	,	,	,
PEPPERMINT	.5" ,	1 " ,	4" ,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	EVEN FANS	11002XS	13"	20"	10'	20	H20	20
B.	"									
C.	"									
D.										
E.										
F.										

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MINT GRASS STUDY

Project Code:94-MNTGRASS

Location: KALISPELL
By: Bob Stougaard

Summary Comments: Herbicide injury was observed with the high rate of Assure II when applied with MSO plus 28% UAN. Similar treatments were used in other studies with no observable mint injury. The injury observed in this study was most likely due to the surfactants redissolving herbicide residues that were in the spray boom and hoses. This reconfirms the importance of cleaning spray equipment when going from crop to crop.

Excellent wild oat control was obtained with all herbicide treatments. There were no differences between herbicides, rates or surfactant types. These results suggest that wild oat is easily controlled and that lower herbicides rates should be evaluated in future studies. However the high level of control achieved might be due to the low populations present in the study. Treatment differences might be more apparent under heavier weed pressure.

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MINT GRASS STUDY

Project Code:94-MNTGRASS
Cooperator :

Location :KALISPELL
By:Bob Stougaard

Trt No	Treatment Name	Form Amt	Fm Ds	Rate	Rate Unit	MINT INJURY PERCENT 6-6-94	MINT INJURY PERCENT 6-17-94	WILD OAT CONTROL PERCENT 6-17-94	MINT GRN WT TONS/A 7-26-94
1	ASSURE II	.8	EC	3	oz ai/A	0	0	99	12.0
1	MSO	1	EC	1	qt pr/A				
2	ASSURE II	.8	EC	3	oz ai/A	0	0	99	12.3
2	MSO	1	EC	1	qt pr/A				
2	28 % UAN	1	EC	2	qt pr/A				
3	ASSURE II	.8	EC	7	oz ai/A	0	0	99	12.7
3	MSO	1	EC	1	qt pr/A				
4	ASSURE II	.8	EC	7	oz ai/A	50	40	100	10.3
4	MSO	1	EC	1	qt pr/A				
4	28 % UAN	1	EC	2	qt pr/A				
5	POAST	1.53	EC	1	pt pr/A	3	2	98	13.0
5	MSO	1	EC	1	qt pr/A				
6	POAST	1.53	EC	1	pt pr/A	0	0	99	13.0
6	MSO	1	EC	1	qt pr/A				
6	28 % UAN	1	EC	2	qt pr/A				
7	POAST	1.53	EC	2	pt pr/A	0	0	100	12.9
7	MSO	1	EC	1	qt pr/A				
8	POAST	1.53	EC	2	pt pr/A	0	0	98	12.4
8	MSO	1	EC	1	qt pr/A				
8	28 % UAN	1	EC	2	qt pr/A				
9	SELECT	2	EC	3	oz ai/A	0	0	99	12.6
9	MSO	1	EC	1	qt pr/A				
10	SELECT	2	EC	3	oz ai/A	0	0	99	14.5
10	MSO	1	EC	1	qt pr/A				
10	28 % UAN	1	EC	2	qt pr/A				
11	SELECT	2	EC	6	oz ai/A	0	0	100	12.7
11	MSO	1	EC	1	qt pr/A				
12	SELECT	2	EC	6	oz ai/A	0	0	99	13.2
12	MSO	1	EC	1	qt pr/A				
12	28 % UAN	1	EC	2	qt pr/A				
13	NONTREATED					0	0	0	11.0
LSD (.05) =						3	5	2	2.6
Standard Dev.=						1.60128	3.00482	1.18285	1.56169
CV =						39.03	93.91	1.29	12.49

Montana State University

MINT GRASS STUDY

Project Code:94-MNTGRASS Location :KALISPELL
By:Bob Stougaard

Site Description

Crop: PEPPERMINT Variety: Black Mitcham Planting Date: 4-8-94
Planting Method: Roots Rate, Unit: 1000 , #/A Depth, Unit: 3 , "
Perennial Age, Unit: 0 , yr Row Spacing, Unit: 18 , "
Soil Temp., Unit: , Soil Moisture: Good Emergence Date:

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 15 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover: None
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance:

Soil Description

Texture: Fine Sandy Loam % OM: 2.4 % Sand: 50 % Silt: 40 % Clay: 10
pH: 6.2 CEC: Soil Name: Kalispell FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions: See irrigation Schedule

Application Information

	A	B	C	D	E	F
Application Date:	5-3-94					
Time of Day:	1:00 pm					
Application Method:	Backpack					
Application Timing:	Post 8-12					
Air Temp., Unit:	78 ,F	,	,	,	,	,
% Relative Humidity:	14					
Wind Velocity, Unit:	1 ,mph	,	,	,	,	,
Dew Presence (Y/N):	N					
Water Hardness:	N					
Soil Temp., Unit:	68 ,F	,	,	,	,	,
Soil Moisture:	Irrigated					
% Cloud Cover:	25					

Weed Species	Weed Stage, Density at Application					
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BAckpack	2	flatfan	11002XR	14"	20"	10'	20	H2O	20
B.										
C.										
D.										
E.										

Montana State University

MINT HERBICIDE TOLERANCE STUDY

Project Code:MINT TOLERANCE STUDY Location :KALISPELL
By:Bob Stougaard

Summary Comments: The purpose of the study was to evalaute mint tolerance to several broadleaf herbicides. Command was the only herbicide to cause noticeable injury to mint. This was due in part to the fact that this herbicide had to be incorporated, which in turn caused a reduction in mint stand. In addition, Command temporarily caused a slight bleached appearance to a portion of the mint crop. This herbicide may have potential use in mint if the incorporation requirement can be eliminated.

Montana State University

MINT HERBICIDE TOLERANCE STUDY

Project Code:MINT TOLERANCE STUDY Location :KALISPELL
By : Bob Stougaard

Trt No	Treatment Name	Form Amt	Rate Lb ai/A	Grow Stg	MINT STND RED PERCENT 5-2-94	MINT INJURY PERCENT 5-2-94	MINT INJURY PERCENT 6-6-94	MINT YIELD TONS/A 7-26-94
1	COMMAND	4 EC	.50	DORM	62	28	13	9.8
1	BASAGRAN	4 EC	.75	POST				
1	SINBAR	80 WP	.40	POST				
1	COC	4 EC	1.0	POST				
1	28 % UAN	4 EC	4.0	POST				
2	COMMAND	4 EC	.50	DORM	53	30	7	13.1
2	BASAGRAN	4 EC	.75	POST				
2	STINGER	3 EC	.18	POST				
2	COC	4 EC	1.0	POST				
2	28 % UAN	4 EC	4.0	POST				
3	COMMAND	4 EC	.50	DORM	62	29	10	12.5
3	BASAGRAN	4 EC	.75	POST				
3	SINBAR	80 WP	.40	POST				
3	STINGER	3 EC	.18	POST				
3	COC	4 EC	1.0	POST				
3	28 % UAN	4 EC	4.0	POST				
4	GOAL	1.6 EC	.50	DORM	0	3	0	13.3
4	BASAGRAN	4 EC	.75	POST				
4	SINBAR	80 WP	.40	POST				
4	COC	4 EC	1.0	POST				
4	28 % UAN	4 EC	4.0	POST				
5	GOAL	1.6 EC	.50	DORM	0	0	0	13.3
5	BASAGRAN	4 EC	.75	POST				
5	STINGER	3 EC	.18	POST				
5	COC	4 EC	1.0	POST				
5	28 % uan	4 EC	4.0	POST				
6	GOAL	1.6 EC	.50	DORM	8	0	0	12.7
6	BASAGRAN	4 EC	.75	POST				
6	SINBAR	80 WP	.40	POST				
6	STINGER	3 EC	.18	POST				
6	COC	4 EC	1.0	POST				
6	28 % UAN	4 EC	4.0	POST				
7	KARMEX	80 DF	1.6	DORM	0	0	0	14.6
7	BASAGRAN	4 EC	.75	POST				
7	SINBAR	80 WP	.40	POST				
7	COC	4 EC	1.0	POST				
7	28 % UAN	4 EC	4.0	POST				
8	KARMEX	80 DF	1.6	DORM	0	3	0	13.6
8	BASAGRAN	4 EC	.75	POST				
8	STINGER	3 EC	.18	POST				
8	COC	4 EC	1.0	POST				
8	28 % UAN	4 EC	4.0	POST				

Montana State University

MINT HERBICIDE TOLERANCE STUDY

Project Code:MINT TOLERANCE STUDY Location :KALISPELL
By:Bob Stougaard

Trt No	Treatment Name	Form Amt	Rate	Grow Stg	MINT STND RED PERCENT 5-2-94	MINT INJURY PERCENT 5-2-94	MINT INJURY PERCENT 6-6-94	MINT YIELD TONS/A 7-26-94
9	KARMEX	80 DF	1.6	DORM	0	0	0	14.3
9	BASAGRAN	4 EC	.75	POST				
9	SINBAR	80 WP	.40	POST				
9	STINGER	3 EC	.18	POST				
9	COC	4 EC	1.0	POST				
9	28 % UAN	4 EC	4.0	POST				
10	NONTREATED				5	3	0	14.9
LSD (.05) =					14	5	5	2.3
Standard Dev.=					8.01619	2.80938	2.87067	1.34168
CV =					42.19	28.76	95.69	10.17
Block F					2.023	4.895	2.124	0.459
Block Prob(F)					0.1612	0.0201	0.1486	0.6393
Treatment F					35.971	69.376	9.393	3.483
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0116

Montana State University

MINT HERBICIDE TOLERANCE STUDY

Project Code:MINT TOLERANCE STUDY Location :KALISPELL
By:Bob Stougaard

Site Description

Crop: PEPPERMINT Variety: BLACK MITCHAM Planting Date: 4-8-94
Planting Method: ROOTS Rate, Unit: 1000 , #/A Depth, Unit: 3 , "
Perennial Age, Unit: 0 , YR Row Spacing, Unit: 18 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date:

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 15 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance:

Soil Description

Texture: Fine Sandy Loam % OM: 2.4 % Sand: 50 % Silt: 40 % Clay: 10
pH: 6.2 CEC: Soil Name: Kslidprll, FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	4-1-94	5-31-94				
Time of Day:	10:00	11:30				
Application Method:	Backpack	Backpack				
Application Timing:	Dorm	Post				
Air Temp., Unit:	60 ,f	67 ,F	,	,	,	,
% Relative Humidity:	25	43				
Wind Velocity, Unit:	2 ,MPH	0 ,MPH	,	,	,	,
Dew Presence (Y/N):	N	N				
Water Hardness:	N	N				
Soil Temp., Unit:	62 ,F	58 ,F	,	,	,	,
Soil Moisture:	Very Good	Very Good				
% Cloud Cover:	25	10				

Weed Species	Weed Stage, Density at Application				
WILD BUCKWHEAT	, 3-4",	,	,	,	,
LAMBQUARTERS	, 4-6",	,	,	,	,
TANSEY	, 3-12,	,	,	,	,
DANDELION	, 12di,	,	,	,	,
	, 8-10,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	BACKPACK	2.5	FLAT FAN	11002VS	14"	20"	10'	20	H20	20
B.										
C.										
D.										
E.										
F.										

Montana State University

MINT PGR STUDY - PLANT GROWTH REGULATOR

Project Code:94-MINTPGR Location :KALISPELL
By:Bob Stougaard

Summary Comments: The purpose of this study was to determine if plant growth regulators might have a yield enhancing effect on meristem derived peppermint. For both PGR's, the earliest applications produced the most dramatic results. Ethryl had the most obvious effect on mint growth, to the point where the response was almost herbicidal. Initial injury was severe with the earliest applications, but most symptoms diminished by harvest. Early applications of Ethryl resulted in shorter plants, a greater number of leaves retained (base/height ratio), more branching, and a greater number of leaves. However, the initial injury resulted in reduced dry weight and oil yields. Applications of PIX did not result in any morphological differences. However, mint dry weight and oil yields were slightly greater compared to the check.

Montana State University

MINT PGR STUDY - PLANT GROWTH REGULATOR

Project Code:94-MINTPGR Location :KALISPELL
By:Bob Stougaard

Trt No	Treatment Name	Form Rate	Rate Unit	Grow Stg	PEPPERMINT -----INJURY----- % 6/6	% 6/17	% 7/16	Base/HT RATIO CM 11-1-94	Mint BRANCH POINTS 11-1-94	Mint LEAF NUMBER 11-1-94	Mint DRY WT TONS/A 7-26-94	Mint OIL YLD LB/A
1	PIX	2 EC 1.5	oz ai/A	8"	5	5	0	0.46	0.067	81.20	2.9	50.2
2	PIX	2 EC 3	oz ai/A	8"	3	5	0	0.47	0.067	88.10	2.4	40.9
3	ETHRYL	2 EC 1	qt pr/A	8"	50	50	7	0.35	0.600	125.80	1.6	21.9
4	ETHRYL	2 EC 2	qt pr/A	8"	50	50	2	0.42	0.867	61.40	1.5	18.6
5	PIX	2 EC 1.5	oz ai/A	12"	0	5	0	0.39	0.000	118.87	2.4	46.6
6	PIX	2 EC 3	oz ai/A	12"	0	7	2	0.42	0.317	86.93	2.2	39.8
7	ETHRYL	2 EC 1	qt pr/A	12"	0	25	20	0.42	0.200	79.13	1.7	28.4
8	ETHRYL	2 EC 2	qt pr/A	12"	0	22	33	0.36	0.267	119.13	1.8	25.4
9	PIX	2 EC 1.5	oz ai/A	24"	0	5	2	0.45	0.167	87.57	2.4	50.3
10	PIX	2 EC 3	oz ai/A	24"	0	5	3	0.50	0.000	81.33	2.1	43.6
11	ETHRYL	2 EC 1	qt pr/A	24"	0	5	18	0.47	0.200	76.93	2.2	41.0
12	ETHRYL	2 EC 2	qt pr/A	24"	0	5	20	0.52	0.333	85.87	2.2	39.2
13	NONTREATED				0	5	0	0.49	0.000	68.40	2.3	42.0
LSD (.05) =					5	5	5	0.10	0.548	42.92	0.4	11.2
Standard Dev.=					2.941	2.724	3.100	.0573	.3254	25.469	.2088	6.667
CV =					35.30	18.32	37.79	13.03	137.22	28.53	9.78	17.77
Block F					0.519	3.712	1.867	2.067	2.546	2.058	3.125	6.893
Block Prob(F)					0.6019	0.039	0.176	.1486	.0994	.1497	.0622	.0043
Treatment F					119.40	116.6	37.33	2.590	1.838	1.819	9.949	7.458
Treatment Prob(					0.0001	.0001	.0001	.0228	.0987	.1027	.0001	.0001

Montana State University

MINT PGR STUDY - PLANT GROWTH REGULATOR

Project Code:94-MINTPGR Location :KALISPELL
By:Bob Stougaard

Site Description

Crop: PEPPERMINT Variety: Black Mitcham Planting Date: 4-8-94
Planting Method: Roots Rate, Unit: 1000 , lb/A Depth, Unit: 3 , "
Perennial Age, Unit: 0 , yr Row Spacing, Unit: 18 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date:

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 15 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance:

Soil Description

Texture: Fine Sandy Loam % OM: 2.4 % Sand: 50 % Silt: 40 % Clay: 10
pH: 6.2 CEC: Soil Name: Kalispell FSL Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Application Information

	A	B	C	D	E	F
Application Date:	5-31-94	6-13-94	7-3-94			
Time of Day:	11:00	1:30 pm	1:00 pm			
Application Method:	Backpack	Backpack	Backpack			
Application Timing:	8"	12"	24"			
Air Temp., Unit:	67 ,F	64 ,F	68 ,F	,	,	,
% Relative Humidity:	43	44	18			
Wind Velocity, Unit:	0 ,MPH	2 ,MPH	3 ,MPH	,	,	,
Dew Presence (Y/N):	N	N	N			
Water Hardness:	M	N	N			
Soil Temp., Unit:	58 ,F	64 ,F	65 ,F	,	,	,
Soil Moisture:	Very Good	Very Good	Good			
% Cloud Cover:	99	99	0			

Weed Species	Weed Stage, Density at Application					
Mint	8" ,	12" ,	24" ,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,
	,	,	,	,	,	,

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.	Backpack	2.5	Flat Fan	11002XR	14"	20"	10'	20	H2O	20
B.	"									
C.	"									
D.										
E.										
F.										

Montana State University

1994-95 LIVING MULCH STUDY IN PEPPERMINT

Project Code:95-LMS-R5 Location :KALISPELL, MT
Cooperator :MAL WESTCOTT By:Bob Stougaard

Summary Comments: The purpose of this study was to evaluate eight different crops for potential use as living mulch crops for peppermint production. Crops were seeded at either two weeks prior to mint harvest of directly after mint harvest. The first seeding was broadcast by hand to simulate an aerial application while the second planting used a conventional disk drill.

The post-harvest direct seedings produced the best stands. Aerial seedings did not establish well, possibly due to rodent or insect predation. Of the crops evaluated, winter and spring rye produced the most growth with dry weight biomass in excess of 2 and 1 tons per acre respectively. Winter and spring rape produced the least amount of growth, most likely due to competition from the mint crop.

Montana State University

1994-95 LIVING MULCH STUDY IN PEPPERMINT

Project Code:95-LMS-R5 Location :KALISPELL, MT
Cooperator :WESTCOTT By:Bob Stougaard

Trt No	Treatment Name	SEEDING DATE	MINT HEIGHT INCHES 10-19-94	MULCH HEIGHT INCHES 10-19-94	MULCH GRN CVR PERCENT 10-19-94	MULCH DRY WT LBS/A 10-24-94
9	Winter Wheat	2WK PRE	5.0	6.3	1.3	16
10	Spring Wheat	2WK PRE	4.7	10.0	3.3	89
11	Spring Rye	2WK PRE	5.7	15.7	14.3	195
12	Winter Rye	2WK PRE	4.7	6.3	4.3	146
13	Winter Rape	2WK PRE	4.0	4.3	6.0	19
14	Spring Rape	2WK PRE	4.3	4.7	4.7	30
15	Hairy Vetch	2WK PRE	5.0	5.0	22.7	147
16	Winter Peas	2WK PRE	4.0	3.7	2.7	29
17	Winter Wheat	POST HAR	4.0	5.7	38.3	677
18	Sprint Wheat	POST HAR	4.0	10.3	45.0	541
19	Spring Rye	POST HAR	5.3	16.0	68.3	2335
20	Winter Rye	POST HAR	5.0	6.7	50.0	1241
21	Winter Rape	POST HAR	3.7	2.7	7.0	120
22	Spring Rape	POST HAR	4.0	3.3	11.7	126
23	Hairy Vetch	POST HAR	3.7	3.7	28.3	514
24	Winter Peas	POST HAR	4.0	2.7	18.7	303
25	Straw		3.7	0.0	0.0	0.0
26	Nontreated		3.7	0.0	0.0	0.0
LSD (.05) =			1.8	3.4	9.3	842
Standard Dev.=			1.07659	2.04124	5.56708	504.802
CV =			24.74	34.34	30.68	123.75
Block F			1.981	3.720	2.134	1.292
Block Prob(F)			0.1535	0.0346	0.1340	0.2896
Treatment F			1.031	14.685	39.218	4.360
Treatment Prob(F)			0.4526	0.0001	0.0001	0.0003

Montana State University

1994-95 LIVING MULCH STUDY IN PEPPERMINT

Project Code:95-LMS-R5 Location :KALISPELL, MT
Cooperator :MAL WESTCOTT By:Bob Stougaard

Site Description

Crop: PEPPERMINT Variety: BLACK MMITHCAM Planting Date: 4-8-93
Planting Method: ROOTS Rate, Unit: 1000 , LB/A Depth, Unit: 3 , "
Perennial Age, Unit: 2 , YR Row Spacing, Unit: 18 , "
Soil Temp., Unit: , Soil Moisture: Emergence Date: 5-20-94

Plot Width/Area, Unit: 10 , FT Plot Length, Unit: 15 , FT Reps: 3
Site Type: Seed Bed Desc.: Ground Cover:
Tillage Type: Study Design: RCB
Field Preparation/Plot Maintenance:

Soil Description

Texture: SILT LOAM % OM: 2.8 % Sand: 40 % Silt: 50 % Clay: 10
pH: 6.4 CEC: Soil Name: CRESTON Fertility Level:

Moisture Conditions

Moisture On:	Date	Amount	Unit	Type		Date	Amount	Unit	Type
1.					2.				
3.					4.				
5.					6.				
7.					8.				

Overall Moisture Conditions:

Living Mulch Seeding Information

	2WK PRE	POST HARVEST
Seeding Date:	8-1-94	8-16-94
Seeding Method:	Aerial	Double disc
Seeding Timing:	2 WK PRE	POST HAR
Soil Moisture:	GOOD	GOOD

Seeding Rates:
Cereals 120 lb/A, Austrian Winter Peas 150 lb/A, Rape 12 lb/A
Hairy Vetch 40 lb/A

Application Equipment

	Sprayer Type	Speed MPH	Nozzle Type	Nozzle Size	Nozzle Height	Nozzle Spacing	Boom Width	GPA	Carrier	PSI
A.										
B.										
C.										
D.										
E.										
F.										

YEAR/PROJECT: 1994/755 **Perennial Forage Grass Trial - Irrigated**

PERSONNEL: Leon Welty, NWARC
Louise Prestbye, NWARC
In cooperation with Dennis Cash, MSU-Bozeman

In 1993, a trial was initiated which included two new cultivars of meadow bromegrass ('Paddock' and 'Fleet'), three cultivars of perennial ryegrass ('Greenstone', 'Dairymaster' and 'Zero Nui'), and 'Matua' prairie grass.

Matua prairie grass winterkilled. Paddock, 'Regar', and Fleet meadow bromegrasses produced significantly more forage than the ryegrasses. The ryegrasses were slow to develop in spring of 1994. Without snow cover, we doubt they will survive Montana winters. The average yield of the meadow bromegrasses was 7.78 t/a and of the ryegrasses was 5.58 t/a (Greenstone yielding more than Dairymaster or Zero Nui).

A new trial was seeded April 29, 1994. Cultivars included Greenstone, Zero Nui and 'PG65' perennial ryegrasses, Matua prairie grass, 'Gala' bromegrass and Regar meadow bromegrass.

As in the 1993 trial, Matua produced the most forage (6.68 t/a) in the seeding year, followed closely by the ryegrasses. Gala and Regar had significantly lower yields (4.25 and 3.76 t/a, respectively). Winter survival and yields in 1995 will provide a second test of adaptability of the new cultivars to local conditions.

IRRIGATED 1993 INTRASTATE GRASS STUDY
KALISPELL, 1994

SPECIES[1/]	CULTIVAR	DRY MATTER YIELD 5/23	6/29	7/23	8/17	9/29	1994 Total	'93–'94 Total
		tons/acre						
Perennial ryegrass	Greenstone	1.99	1.71	0.64	1.63	0.58	6.54	13.32
Perennial ryegrass	Dairymaster	0.93	1.89	0.51	1.54	0.53	5.39	12.01
Perennial ryegrass	Zero Nui	0.52	1.96	0.48	1.35	0.52	4.82	11.14
Meadow bromegrass	Paddock	3.33	1.42	0.98	1.62	0.57	7.91	12.90
Meadow bromegrass	Fleet	3.55	1.17	0.86	1.56	0.46	7.60	12.46
Meadow bromegrass	Regar	3.48	1.33	0.90	1.59	0.53	7.82	11.52
Mountain bromegrass	CO8005308	2.91	1.10	0.85	1.34	0.57	6.77	10.39
Pub. wheatgrass	Greenleaf	2.79	1.27	0.81	0.40	0.24	5.51	8.59
Int. wheatgrass	Oahe	2.95	1.09	0.72	0.39	0.27	5.40	8.44
MEAN		2.49	1.44	0.75	1.27	0.47	6.42	11.20
LSD(0.05)		0.38	0.30	0.13	0.18	0.10	0.70	1.10
CV(s/mean)		10.4	14.3	11.7	9.8	14.0	7.5	6.7

Seeding date: 4/28/93
Fertilizer: Fall, 1992 – 180 lbs/a P_2O_5
6/14/93 – 80 lbs/a N
3/30/94 – 102 lbs/a N; 7/1/94 – 60 lbs/a N
Irrigation: 3 applications, 2"/applic – total=6"
Crop Year Precipitation (Sept.1993–Aug.1994): 14.62 inches
Frost Free Period: 134 days

[1/] Perennial ryegrass – *Lolium perenne*
Meadow bromegrass – *B. biebersteinii*
Mountain bromegrass – *B. marginatus*
Pubescent wheatgrass – *Agropyron trichophorum*
Intermediate wheatgrass – *A. intermedium*

IRRIGATED 1994 INTRASTATE GRASS STUDY
KALISPELL, 1994

SPECIES[1/]	CULTIVAR	STAND[2/]	VIGOR[3/]	DRY MATTER YIELD 7/23	8/17	9/29	TOTAL
		%	(0–5)	tons/acre			
Perennial ryegrass	Greenstone	93	3.3	2.25	2.44	1.81	6.49
Perennial ryegrass	PG65	89	3.8	2.21	2.39	1.72	6.32
Perennial ryegrass	Zero Nui	94	4.5	2.35	1.86	1.71	5.91
Prairie grass	Matua	81	3.0	2.18	2.65	1.85	6.68
Bromegrass	Gala	90	2.0	1.02	1.86	1.37	4.25
Meadow bromegrass	Regar	84	1.5	0.93	1.86	0.97	3.76
MEAN		88	3.0	1.82	2.17	1.57	5.57
LSD(0.05)		6	1.2	0.45	0.29	0.34	0.82
CV(s/mean)		4.4	26.5	16.3	8.8	14.4	9.7

Seeding date: 4/29/94
Fertilizer: 5/20/94 – 80 lbs/a N + 180 lbs/a P_2O_5 in fall of 1992
Irrigation: 3 applications, 2"/applic – total=6"
Crop Year Precipitation (Sept.1993–Aug.1994): 14.62 inches
Frost Free Period: 134 days

[1/] Perennial ryegrass – *Lolium perenne*
Prairie grass – *Bromus unioloides* (Willd.)
Gala brome – *B.stimenius*
Meadow bromegrass – *B. biebersteinii*

[2/] *visual estimate of plot occupancy taken 5/23/94*
[3/] *0=dead; 5=high vigor – taken 6/21/94*

YEAR/PROJECT: 1994/755: **Safflower Forage Trial - Dryland**

PERSONNEL: Leon Welty, NWARC
Louise Prestbye, NWARC
In cooperation with Dr. Jerry Bergman, EARC

Safflower (*Carthamus tinctorius*) is an oilseed crop grown in Eastern Montana. Safflower requires ample heat units, and generally will not mature west of the Continental Divide. In 1992 and 1993, with early frosts and cool wet growing conditions, safflower did not produce seed in Eastern Montana. Hence, there were thousands of acres of the crop left unharvested, the majority of which were plowed down for green manure. Some producers put the crop up for hay. Quality analyses indicated protein of 11% or greater and acceptable digestibility. Also, it was purported that the cattle had no problems with the hay even though safflower resembles a thistle. Safflower meal, the byproduct after crushing the seed, has been used as a livestock feed for many years.

In 1994, several safflower cultivars were planted at Kalispell and Sidney, and harvested for forage at two different growth stages.

Dry matter yields varied from 3.1 to 5.5 T/a depending upon cultivar and harvest date. Wet chemistry quality analyses were obtained: crude protein averaged 8%, but ADF was about 30% and NDF about 40%, which is very impressive for this potential forage crop. We are confident that harvesting the crop about two weeks earlier will increase the protein to acceptable levels.

DRYLAND SAFFLOWER FORAGE TRIAL KALISPELL, MT – 1994

EARLY HARVEST

	STAND[1/] %	HARVEST date	%BLOOM at harvest	HEIGHT inches	FORAGE YIELD tons/acre	PROTEIN %	NDF %	ADF %
Morlin	91	8/5	100	32	3.10	8.6	37.6	25.7
Centennial	91	8/5	100	37	3.90	6.8	38.4	27.4
Finch	81	8/5	100	33	3.86	9.6	40.7	28.6
World Bulk	76	8/5	100	37	3.09	8.9	44.0	31.4
Hybrid 1	89	8/5	55	40	3.94	9.7	41.1	29.2
Hybrid 2	84	8/5	100	42	4.66	6.9	43.4	31.3
mean	85			37	3.76	8.4	40.9	28.9
LSD(0.05)	6			3	0.87	3.3	NS	NS
CV(s/mean)	4.5			4.9	15.6	21.5	7.5	9.4
Morlin/Pea[2/]	95	7/18	[4/]	30	2.46			
Trapper pea	90	7/18	[5/]	39	1.62	18.0	34.4	23.8

LATE HARVEST

Morlin	94	8/16	post	34	4.34	8.1	44.6	31.1
Centennial	93	8/16	post	36	4.37	7.8	43.8	30.9
Finch	89	8/16	post	37	4.21	8.5	44.4	31.3
World Bulk	86	8/16	100	43	5.14	7.5	44.8	31.5
Hybrid 1	93	8/16	100	42	4.87	8.6	44.9	32.2
Hybrid 2	87	8/16	post	44	5.51	8.6	46.4	32.9
mean	90			39	4.70	8.2	44.8	31.6
LSD(0.05)	4			3	NS	NS	NS	NS
CV(s/mean)	2.7			5.4	18.1	14.7	5.2	5.1
Morlin/Pea[3/]	97	7/18	[4/]	33	2.66			
Trapper pea	93	7/18	[5/]	44	1.76			

Planting date: 4/25/94
Seeding rate: 43 lbs/a
Fertilizer – 70 lbs N/a + 30 lbs P_2O_5 /a
Frost free period: 134 days
Crop year precipitation: 14.62 inches

[1/]Evaluated 5/3/94
[2/] 44% pea
[3/] 65% pea
[4/]peas – immature
[5/]soft dough

YEAR/PROJECT: 1994/755 **1994 Montana Uniform Cereal Forage Trial - Dryland**

PERSONNEL: Leon Welty, NWARC
Louise Prestbye, NWARC
In cooperation with Dave Wichman, CARC

Oat and barley cultivars were planted on April 18 and harvested for forage at the clear juice to soft dough growth stages between July 8 and 15. The plots were fertilized with 70 lbs. N/a and 35 lbs P_2O_5/a in the spring. Haybet barley produced 4.66 t/a, significantly more than Horsford and Westford barleys and Stampede and Celestia oats. The crop year precipitation in 1994 was 12.75 inches less than in 1993. Stampede and Westford produced more forage than Haybet during the cool, wet season of 1993.

CULTIVAR	EMERGENCE *day*[1/]	STAND *%*	HEADING *day*[1/]	HARVEST *date*	HEIGHT *inches*	GROWTH STAGE	YIELD *tons/a*
Otana oats	12	94	70	7/11	49	m[2/]	4.27
Celesia oats	11	93	71	7/11	47	cj	3.92
Monida oats	12	94	71	7/11	46	lm	4.24
Stampede oats	12	90	81	7/15	36	j	4.00
Horsford barley	10	95	61	7/8	42	tm	4.01
Westford barley	9	96	69	7/8	43	cj	4.15
Haybet barley	8	96	67	7/8	41	tm	4.66
Bz 591−57 barley	10	98	61	7/8	34	lm	3.84
FR 588−241 barley	10	84	70	7/8	35	m	3.34
MT910207 barley	9	98	62	7/8	42	sd	4.39
MT910208 barley	9	89	62	7/8	42	sd	4.41
MT 910209 barley	9	93	64	7/8	44	sd	4.21
Mean	10	93	67		42		4.12
LSD(0.05)	1	5	1		2		0.50
CV(s/mean)	3.6	3.5	1.4		3.3		8.4

Planting date: 4/18/94
Seeding rates: oats − 54 lbs/a; barley − 77 lbs/a
[1/] Days after planting
Day 12 = 4/30
Day 70 = 6/27
[2/] cj=clear juice; j=juice; lm=light milk; m=milk; tm=thick milk; sd=soft dough

YEAR/PROJECT: 1994/755: INTRASTATE ALFALFA YIELD TRIALS - DRYLAND & IRRIGATED

PERSONNEL: Leon Welty, NWARC
Louise Prestbye, NWARC
In cooperation with Robert Dunn and Dr. Ray Ditterline, MSU Bozeman

From 1991 to 1994, alfalfa nurseries were established at Kalispell to compare forage production of varieties under both dryland and irrigated conditions. The varieties ranged from 1 (most dormant) to 4 in fall dormancy ratings and from susceptible to highly resistant to *Verticillium* wilt.

The trials were seeded at 10 lbs/acre in late April after being fertilized with 44 lbs N and 208 lbs P_2O_5/acre the previous fall. Sethoxydim was generally used for grass control and either bromoxynil or 2,4-DB was used for broadleaf control in the seeding year. If winter annuals (e.g. dandelions) became a problem, metribuzin was used for control. Experimental design was a randomized complete block with 4 replicates.

The dryland nursery seeded in 1994 was harvested once because of lack of regrowth due to the unusually hot, dry summer. The 1994 irrigated nursery was harvested twice. Both the 1991-seeded trials were harvested twice and then plowed down. The 1993 dryland trial and the 1992 and 1993 irrigated trials received 3 harvests, but the 1992 dryland trial had insufficient regrowth for a third cutting. We used an ALMACO plot harvester, set to leave a 3-inch stubble. The alfalfa was at the pre- to mid-bloom stage when harvested.

Crop year precipitation in 1994 was only 14.62 inches, compared to an average of 19.68 inches. Only 6.72 inches fell between April and August, 68% of the average for this period. The frost-free period in 1993 was 134 days (average - 112 days), with 2062 growing degree days (GDD) from May to October, 1994 (average - 1888 GDD). This represents 30% more GDD than last year's cool, very wet growing season. Average 1994 yield for the 1992 dryland trial was 40% less than its yield in 1993, while the average yield of the irrigated trial was 41% higher than in 1993.

1991 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED – 1994

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield		
			Harvest–1	Harvest–2	Total
			t/a	*t/a*	*t/a*
Viking 1	2	HR	2.35	2.85	5.19
Magnum III	4	MR	2.36	2.68	5.04
Ultra	3	R	2.32	2.57	4.89
Columbo	3	HR	2.12	2.77	4.89
5246	3	R	2.20	2.67	4.87
W90–VSX	––	––	2.17	2.70	4.87
More	––	––	2.26	2.48	4.73
5364	4	MR	2.22	2.48	4.70
VS 9096	––	––	2.07	2.56	4.62
Legacy	4	R	2.14	2.46	4.61
UN–72	––	––	2.09	2.50	4.59
2841	3	R	2.09	2.44	4.53
Eclipse	3	R	2.05	2.47	4.52
Barrier	––	––	1.99	2.50	4.49
5262	2	LR	2.08	2.34	4.41
Alfagraze	2	––	2.03	2.35	4.38
Ladak 65	1–2	S	2.05	2.16	4.22
Webfoot	3	––	1.87	2.29	4.16
Multiking	3	R	1.90	2.21	4.11
Perry	3	––	1.90	2.20	4.10
Vernal	2	––	1.94	2.05	3.98
2833	3	R	1.61	2.20	3.80
Riley	4	LR	1.71	2.03	3.73
MEAN			2.06	2.43	4.50
LSD(0.05)			0.21	0.24	0.37
P–VALUE			0.00	0.00	0.00
CV(s/mean)			7.4	6.9	5.8

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

Harvest–1: 6/16/94
Harvest–2: 8/10/94

1991 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield 1991 t/a	1992 t/a	1993 t/a	1994 t/a	TOTAL t/a
Magnum III	4	MR	3.37	7.38	6.19	5.04	21.98
Viking 1	2	HR	3.69	6.90	5.73	5.19	21.51
5364	4	MR	3.47	7.32	6.01	4.70	21.50
Legacy	4	R	3.78	7.34	5.53	4.61	21.25
Columbo	3	HR	3.61	6.96	5.65	4.89	21.11
Ultra	3	R	3.87	6.77	5.55	4.89	21.08
W90–VSX	––	––	3.69	7.00	5.37	4.87	20.93
More	––	––	3.89	6.83	5.40	4.73	20.85
UN–72	––	––	3.77	6.80	5.50	4.59	20.66
5246	3	R	3.44	6.78	5.53	4.87	20.62
VS 9096	––	––	3.66	6.91	5.28	4.62	20.46
2841	3	R	3.51	6.90	5.24	4.53	20.18
5262	2	LR	3.25	6.95	5.42	4.41	20.04
Eclipse	3	R	3.43	6.53	5.35	4.52	19.83
Alfagraze	2	––	3.43	6.68	5.19	4.38	19.68
Multiking	3	R	3.14	6.72	5.51	4.11	19.47
2833	3	R	3.80	6.69	4.95	3.80	19.24
Webfoot	3	––	3.33	6.49	5.15	4.16	19.13
Perry	3	––	3.35	6.75	4.83	4.10	19.02
Barrier	––	––	3.32	6.35	4.78	4.49	18.94
Riley	4	LR	3.33	6.45	4.84	3.73	18.35
Vernal	2	––	3.01	6.37	4.77	3.98	18.13
Ladak–65	1–2	S	2.81	5.94	4.50	4.22	17.46
MEAN			3.47	6.77	5.31	4.50	20.06
LSD(0.05)			0.36	0.43	0.47	0.37	1.14
P–VALUE			0.00	0.00	0.00	0.00	0.00
CV(s/mean)			7.4	4.5	6.3	5.8	4.0

Seeding date: 5/17/91

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

1991 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – DRYLAND – 1994

VARIETY	FD[1/]	VD[2/]	------Dry Matter Yield------ Harvest–1	Harvest–2	TOTAL
			t/a	*t/a*	*t/a*
Columbo	3	HR	2.74	2.69	5.43
Magnum III	4	MR	2.70	2.62	5.32
W90–VSX	––	––	2.63	2.57	5.21
More	––	––	2.84	2.36	5.20
Ultra	3	R	2.77	2.39	5.16
5364	4	MR	2.65	2.47	5.12
Legacy	4	R	2.60	2.41	5.02
Vernal	2	––	2.59	2.41	5.00
Perry	3	––	2.65	2.33	4.98
Webfoot	3	––	2.48	2.38	4.86
Riley	4	LR	2.42	2.43	4.86
Ladak–65	1–2	S	2.57	2.26	4.83
Viking 1	2	HR	2.47	2.36	4.83
5262	2	LR	2.54	2.26	4.80
Alfagraze	2	––	2.46	2.30	4.76
UN–72	––	––	2.61	2.15	4.76
5246	3	R	2.46	2.23	4.69
2841	3	R	2.43	2.26	4.69
Eclipse	3	R	2.47	2.19	4.66
Barrier	––	––	2.41	2.18	4.58
VSA 9096	––	––	2.41	2.15	4.56
Multiking	3	R	2.35	2.17	4.53
2833	3	R	2.30	2.19	4.49
MEAN			2.55	2.34	4.88
LSD(0.05)			0.24	0.43	0.62
P–VALUE			0.00	0.50	0.15
CV(s/mean)			5.9	11.3	7.8

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

Harvest–1: 6/17/94 – early bloom
Harvest–2: 8/10/94

1991 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – DRYLAND

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield 1991	1992	1993	1994	TOTAL
			t/a	*t/a*	*t/a*	*t/a*	*t/a*
Magnum III	4	MR	2.90	5.76	6.98	5.32	20.96
Ultra	3	R	3.11	5.71	6.77	5.16	20.76
More	--	--	2.65	5.25	7.00	5.20	20.10
Columbo	3	HR	2.63	5.45	6.74	5.43	20.24
W90-VSX	--	--	2.56	5.25	6.72	5.21	19.74
5364	4	MR	2.53	5.51	6.42	5.12	19.59
Viking 1	2	HR	2.84	5.25	6.36	4.83	19.28
Multiking 1	3	R	2.87	5.18	6.34	4.53	18.91
2841	3	R	2.64	5.08	6.53	4.69	18.94
Eclipse	3	R	2.49	5.31	6.38	4.66	18.83
Legacy	4	R	2.62	5.04	6.33	5.02	19.01
UN-72	--	--	2.62	5.02	6.24	4.76	18.64
Ladak-65	1-2	S	2.36	5.51	5.94	4.83	18.65
2833	3	R	2.62	4.95	6.24	4.49	18.29
Perry	3	--	2.32	5.24	6.24	4.98	18.78
Webfoot	3	--	2.64	4.86	6.14	4.86	18.50
Riley	4	LR	2.19	5.18	6.11	4.86	18.34
5246	3	R	2.67	4.56	6.24	4.69	18.17
Vernal	2	--	2.33	4.83	5.80	5.00	17.96
5262	2	LR	2.34	4.51	6.11	4.80	17.76
Barrier	--	--	2.44	4.40	5.89	4.58	17.31
Alfagraze	2	--	2.40	4.21	6.03	4.76	17.40
VS 9096	--	--	2.55	4.34	5.74	4.56	17.19
MEAN			2.58	5.06	6.32	4.88	18.84
LSD(0.05)			0.30	0.98	0.67	0.62	2.12
P-VALUE			0.00	0.09	0.01	0.15	0.01
CV(s/mean)			8.2	13.7	7.5	7.8	6.9

Seeding date: 4/26/91

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

1992 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED – 1994

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield Harvest–1	Harvest–2	Harvest–3	Total
			t/a	*t/a*	*t/a*	*t/a*
MBS 2131	––	––	2.47	2.33	2.18	6.97
WL 323	4	R	2.33	2.21	2.29	6.83
Crown II	3	R	2.40	2.13	2.22	6.75
DK 133	4	R	2.31	2.19	2.25	6.75
PGI 3212	––	––	2.40	2.26	2.00	6.66
Benchmark	3	R	2.31	2.10	2.25	6.66
Arrow	3	R	2.46	2.16	2.04	6.65
5454	4	MR	2.36	2.26	1.98	6.59
5364	4	MR	2.46	2.20	1.93	6.59
Guardsman	––	––	2.36	2.23	2.00	6.59
Achieva	3	R	2.29	2.13	2.16	6.57
4J19	––	––	2.33	2.19	2.02	6.53
Class	3	R	2.21	2.09	2.15	6.45
WI 9125	––	––	2.49	1.92	2.03	6.44
5246	3	R	2.43	2.07	1.92	6.42
Webfoot MPR	3	––	2.20	2.14	2.03	6.37
Perry	3	––	2.40	2.01	1.94	6.35
WL 322HQ	4	R	2.26	2.05	2.00	6.31
Profit	2	R	2.23	2.03	1.95	6.20
Ladak 65	1	––	2.46	1.97	1.66	6.08
AP 8950	––	––	1.99	2.12	1.97	6.07
ABI 9143	––	––	2.16	1.98	1.91	6.04
Milkmaker II	2	––	2.12	1.98	1.87	5.97
Riley	4	LR	2.09	1.86	1.85	5.80
Wisfall	––	––	2.80	1.39	1.25	5.43
MEAN			2.33	2.08	1.99	6.40
LSD(0.05)			0.22	0.16	0.19	0.45
P–VALUE			0.00	0.00	0.00	0.00
CV(s/mean)			6.7	5.4	6.7	5.0

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

Harvest–1: 6/16/94 – early bloom
Harvest–2: 7/24/94 – early bloom
Harvest–3: 9/28/94 – mid–bloom

1992 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield 1992 t/a	1993 t/a	1994 t/a	TOTAL t/a
DK 133	4	R	4.84	4.94	6.75	16.52
Achieva	3	R	4.99	4.87	6.57	16.42
Crown II	3	R	4.89	4.71	6.75	16.35
Benchmark	3	R	4.81	4.82	6.66	16.29
WL 323	4	R	4.66	4.74	6.83	16.22
Class	3	R	4.87	4.85	6.45	16.17
4J19	--	--	4.71	4.79	6.53	16.03
PGI 3212	--	--	4.69	4.65	6.66	15.99
5364	4	MR	4.45	4.92	6.59	15.96
MBS 2131	--	--	4.41	4.58	6.97	15.95
Webfoot MPR	3	--	4.79	4.76	6.37	15.92
5454	4	MR	4.24	5.03	6.59	15.86
Guardsman	--	--	4.39	4.79	6.59	15.77
Arrow	3	R	4.46	4.61	6.65	15.73
Perry	3	--	4.59	4.29	6.35	15.23
5246	3	R	4.07	4.63	6.42	15.12
WI 9125	--	--	4.67	3.95	6.44	15.06
AP 8950	--	--	4.31	4.58	6.07	14.96
Profit	2	R	4.15	4.36	6.20	14.70
ABI 9143	--	--	4.21	4.41	6.04	14.66
WL 322HQ	4	R	4.00	4.32	6.31	14.63
Milkmaker II	2	--	4.16	4.38	5.97	14.51
Riley	4	LR	4.17	4.02	5.80	13.99
Ladak 65	1	--	4.01	3.68	6.08	13.77
Wisfall	--	--	4.04	3.50	5.43	12.97
MEAN			4.46	4.53	6.40	15.39
LSD(0.05)			0.28	0.26	0.45	0.73
P–VALUE			0.00	0.00	0.00	0.00
CV(s/mean)			4.4	4.0	5.0	3.4

Seeding date: 4/24/92

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

1992 INTRASTATE ALFALFA TRIAL
KALISPELL – DRYLAND – 1994

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield Harvest–1	Dry Matter Yield Harvest–2	Dry Matter Yield TOTAL
			t/a	*t/a*	*t/a*
4J19	--	--	2.50	1.67	4.17
WL 323	4	R	2.55	1.53	4.08
5364	4	MR	2.43	1.61	4.04
Benchmark	3	R	2.38	1.57	3.96
Guardsman	--	--	2.44	1.45	3.88
Profit	2	R	2.35	1.49	3.84
5454	4	MR	2.35	1.45	3.79
Achieva	3	R	2.32	1.47	3.79
Arrow	3	R	2.31	1.47	3.77
WL 322HQ	4	R	2.32	1.45	3.77
PGI 3212	--	--	2.33	1.36	3.69
Crown II	3	R	2.43	1.26	3.69
5246	3	R	2.36	1.32	3.68
Webfoot MPR	3	--	2.26	1.37	3.63
MBS 2131	--	--	2.22	1.35	3.57
ABI 9143	--	--	2.17	1.34	3.51
WI 9125	--	--	2.20	1.30	3.50
DK 133	4	R	2.06	1.37	3.43
Class	3	R	2.13	1.25	3.38
Ladak 65	1	--	2.26	1.08	3.34
Milkmaker II	2	--	2.10	1.10	3.20
AP 8950	--	--	1.88	1.31	3.19
Perry	3	--	2.04	1.12	3.16
Riley	4	LR	2.04	1.10	3.14
Wisfall	--	--	2.50	0.57	3.07
MEAN			2.28	1.33	3.61
LSD(0.05)			0.28	0.58	0.79
P–VALUE			0.00	0.45	0.33
CV(s/mean)			8.8	30.5	15.5

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

1st harvest – 6/16/94 – early bloom
2nd harvest – 7/22/94 – early bloom

1992 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – DRYLAND

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield 1992	1993	1994	TOTAL
			t/a	*t/a*	*t/a*	*t/a*
Benchmark	3	R	4.01	6.52	3.96	14.49
4J19	–	–	3.13	6.77	4.17	14.06
Achieva	3	R	3.48	6.72	3.79	13.99
WL 323	4	R	3.03	6.69	4.08	13.80
Guardsman	–	–	2.99	6.64	3.88	13.51
Webfoot MPR	3	–	3.29	6.29	3.63	13.21
Arrow	3	R	3.20	6.15	3.77	13.12
PGI 3212	–	–	3.01	6.38	3.69	13.08
5454	4	MR	2.89	6.36	3.79	13.05
DK 133	4	R	3.41	5.97	3.43	12.81
Profit	2	R	2.91	6.00	3.84	12.75
WL 322HQ	4	R	2.94	6.03	3.77	12.74
MBS 2131	–	–	3.02	6.04	3.57	12.63
5246	3	R	2.78	6.17	3.68	12.63
Crown II	3	R	2.74	6.01	3.69	12.44
Milkmaker II	2	– –	2.91	6.27	3.20	12.37
ABI 9143	–	–	2.91	5.92	3.51	12.33
5364	4	MR	2.49	5.61	4.04	12.14
Class	3	R	2.68	5.75	3.38	11.81
AP 8950	–	–	2.90	5.62	3.19	11.71
Riley	4	LR	2.57	5.65	3.14	11.36
Perry	3	– –	2.48	5.00	3.16	10.64
Ladak 65	1	– –	2.29	4.83	3.34	10.45
WI 9125	–	–	1.93	4.89	3.50	10.32
Wisfall	–	–	1.86	4.87	3.07	9.79
MEAN			2.87	5.97	3.61	12.45
LSD(0.05)			0.70	0.74	0.79	2.16
P–VALUE			0.00	0.00	0.45	0.00
CV (s/mean)			17.2	8.8	15.5	12.3

Seeding date: 4/23/92

[1/] *Fall Dormancy rating*
[2/] *Vert Wilt resistance*

1993 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED – 1994

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield			Total
			Harvest–1	Harvest–2	Harvest–3	
			t/a	*t/a*	*t/a*	t/a
AS–K94	––	––	2.84	2.17	2.30	7.31
WISYN–C	––	––	2.73	2.04	2.34	7.10
ICI 631	––	––	2.59	2.24	2.13	6.96
Venture	––	––	2.55	2.15	2.16	6.86
5454	4	MR	2.55	2.15	2.16	6.86
Vernema	4	MR	2.58	2.17	2.11	6.86
Dart	3	R	2.63	2.06	2.13	6.82
5364	4	MR	2.66	2.02	2.11	6.79
Perry	3	––	2.61	1.93	2.20	6.73
Dawn	––	––	2.52	2.02	2.18	6.73
W6040	––	––	2.59	2.02	2.11	6.72
Wrangler	2	LR	2.60	2.01	2.08	6.69
Profit	2	R	2.53	2.05	2.07	6.65
Apollo Supreme	4	R	2.53	2.02	2.08	6.62
AP 8950	––	––	2.38	2.09	2.11	6.58
Dominator	––	––	2.44	2.01	2.06	6.51
ABI 9143	––	––	2.44	1.96	1.99	6.39
Ladak 65	1	––	2.62	1.78	1.66	6.06
Spredor 3	––	––	2.61	1.80	1.56	5.97
MEAN			2.58	2.04	2.08	6.69
LSD(0.05)			0.12	0.11	0.12	0.24
P–VALUE			0.00	0.00	0.00	0.00
CV(s/mean)			3.2	3.8	4.1	2.5

Seeding date: 4/22/93

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

1st harvest – 6/17/94 – prebloom
2nd harvest – 7/23/94 – early bloom
3rd harvest – 9/26/94 – midbloom

1993 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield 1993 t/a	Dry Matter Yield 1994 t/a	Dry Matter Yield Total t/a
AS–K94	--	--	3.74	7.31	11.05
ICI 631	--	--	3.39	6.96	10.35
WISYN–C	--	--	3.24	7.10	10.34
Vernema	4	MR	3.48	6.86	10.34
Venture	--	--	3.36	6.86	10.22
W6040	--	--	3.38	6.72	10.10
Dart	3	R	3.21	6.82	10.03
AP 8950	--	--	3.38	6.58	9.96
Profit	2	R	3.30	6.65	9.95
5364	4	MR	3.14	6.79	9.93
Dawn	--	--	3.20	6.73	9.93
5454	4	MR	3.06	6.86	9.92
Perry	3	--	3.03	6.73	9.76
Wrangler	2	LR	3.06	6.69	9.75
Apollo Supreme	4	R	3.07	6.62	9.69
ABI 9143	--	--	3.24	6.39	9.63
Dominator	--	--	3.05	6.51	9.56
Ladak 65	1	--	2.87	6.06	8.93
Spredor 3	--	--	2.87	5.97	8.84
MEAN			3.21	6.69	9.91
LSD(0.05)			0.28	0.24	0.43
P–VALUE			0.00	0.00	0.00
CV(s/mean)			6.1	2.5	3.1

Seeding date: 4/22/93

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

1993 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – DRYLAND – 1994

VARIETY	FD[1/]	VW[2/]	Dry Matter Yield Harvest–1 t/a	Harvest–2 t/a	Harvest–3 t/a	TOTAL t/a
5364	4	MR	2.60	1.92	1.62	6.13
5454	4	MR	2.54	1.93	1.65	6.12
AS–K94	––	––	2.58	1.97	1.46	6.00
Apollo Supreme	4	R	2.48	1.90	1.55	5.93
ICI 631	––	––	2.41	2.01	1.51	5.92
W6040	––	––	2.52	1.98	1.39	5.89
WISYN–C	––	––	2.50	1.89	1.42	5.80
Profit	2	R	2.42	1.86	1.49	5.77
ABI 9143	––	––	2.33	1.83	1.51	5.66
Dominator	––	––	2.28	1.83	1.48	5.59
Dawn	––	––	2.36	1.80	1.43	5.59
Vernema	4	MR	2.36	1.88	1.36	5.59
Venture	––	––	2.34	1.80	1.35	5.48
Dart	3	R	2.34	1.80	1.35	5.48
AP 8950	––	––	2.01	1.82	1.41	5.23
Wrangler	2	LR	2.29	1.68	1.25	5.22
Perry	3	––	2.30	1.61	1.28	5.19
Spredor 3	––	––	2.41	1.54	0.98	4.92
Ladak 65	1	––	2.37	1.50	1.01	4.87
MEAN			2.39	1.82	1.39	5.60
LSD(0.05)			0.15	0.17	0.21	0.44
P–VALUE			0.00	0.00	0.00	0.00
CV(s/mean)			4.5	6.6	10.7	5.6

Seeding date: 4/22/93

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

1st harvest – 6/17/94 – prebloom
2nd harvest – 7/23/94 – early bloom
3rd harvest – 9/29/94 – midbloom

1993 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – DRYLAND

VARIETY	FD[1/]	VW[2/]	----Dry Matter Yield--- 1993	1994	TOTAL
			t/a	*t/a*	*t/a*
AS–K94	--	--	2.63	6.00	8.63
5454	4	MR	2.47	6.12	8.59
W6040	--	--	2.69	5.89	8.58
ICI 631	--	--	2.63	5.92	8.55
5364	4	MR	2.38	6.13	8.51
Apollo Supreme	4	R	2.52	5.93	8.45
WISYN–C	--	--	2.61	5.80	8.41
Profit	2	R	2.43	5.77	8.20
Dawn	--	--	2.58	5.59	8.17
Vernema	4	MR	2.56	5.59	8.15
ABI 9143	--	--	2.49	5.66	8.15
Venture	--	--	2.63	5.48	8.11
Dominator	--	--	2.47	5.59	8.06
Dart	3	R	2.43	5.48	7.91
AP 8950	--	--	2.53	5.23	7.76
Perry	3	--	2.19	5.19	7.38
Wrangler	2	LR	2.08	5.22	7.30
Spredor 3	--	--	2.02	4.92	6.94
Ladak 65	1	--	1.94	4.87	6.81
MEAN			2.44	5.60	8.03
LSD(0.05)			0.31	0.44	0.65
P–VALUE			0.00	0.00	0.00
CV(s/mean)			8.9	5.6	5.7

Seeding date: 4/22/93

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

1994 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – IRRIGATED

VARIETY	MTNo	FD[1/]	VW[2/]	Dry Matter Yield Harvest–1	Dry Matter Yield Harvest–2	Dry Matter Yield TOTAL
				t/a	*t/a*	*t/a*
Vernema	220	4	MR	1.67	2.10	3.76
MS9304	294	--	--	1.64	2.02	3.65
ZX 9344	279	--	--	1.62	2.00	3.63
3B50	289	--	--	1.58	2.04	3.62
Reward	276	4	R	1.63	1.99	3.62
5262	214	2	LR	1.56	2.03	3.59
WL–323	251	4	R	1.54	2.02	3.57
Perry	133	3	--	1.58	1.98	3.55
STI–94	292	--	--	1.51	2.03	3.54
Avalanche	282	--	--	1.56	1.95	3.51
Pasture Plus	277	--	--	1.55	1.95	3.50
ZC 9030	278	--	--	1.53	1.97	3.50
PGI 9047	275	--	--	1.54	1.96	3.49
Wrangler	146	2	LR	1.52	1.96	3.48
MS9301	293	--	--	1.51	1.95	3.47
Dividend	291	--	--	1.49	1.96	3.45
91–12	283	--	--	1.52	1.91	3.43
330	287	--	--	1.51	1.91	3.42
ABI 9033	280	--	--	1.62	1.78	3.40
5454	263	4	MR	1.46	1.91	3.37
Magnum III–Wet	285	3	MR	1.53	1.84	3.36
ABI 923AA	281	--	--	1.48	1.87	3.35
Hygain	284	--	--	1.44	1.91	3.35
Rushmore	286	--	--	1.47	1.87	3.33
Ladak 65	2	1	--	1.55	1.78	3.32
Legendairy	288	--	--	1.46	1.84	3.30
4J12	290	--	--	1.43	1.76	3.20
MEAN				1.54	1.94	3.47
LSD(0.05)				0.14	0.23	0.32
P–VALUE				0.09	NS	NS
CV(s/mean)				6.6	8.3	6.5

Seeding date: 4/27/94

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

1st harvest – 7/22/94 – early bloom
2nd harvest – 9/26/94 – prebloom

1994 INTRASTATE ALFALFA YIELD TRIAL
KALISPELL – DRYLAND

VARIETY	MTNo	FD[1/]	VW[2/]	Dry Matter Yield Harvest–1
				t/a
ZX 9344	279	--	--	1.57
ABI 923AA	281	--	--	1.50
Legendairy	288	--	--	1.47
91–12	283	--	--	1.43
WL–323	251	4	R	1.43
4J12	290	--	--	1.40
Wrangler	146	2	LR	1.37
Hygain	284	--	--	1.36
STI–94	292	--	--	1.35
Magnum III–Wet	285	3	MR	1.33
ABI 9033	280	--	--	1.33
Ladak 65	2	1	--	1.32
Avalanche	282	--	--	1.29
Pasture Plus	277	--	--	1.27
Rushmore	286	--	--	1.26
ZC 9030	278	--	--	1.25
Reward	276	4	R	1.25
PGI 9047	275	--	--	1.24
Vernema	220	4	MR	1.24
3B50	289	--	--	1.24
Dividend	291	--	--	1.21
MS9304	294	--	--	1.20
MS9301	293	--	--	1.20
5262	214	2	LR	1.20
5454	263	4	MR	1.18
Perry	133	3	--	1.17
330	287	--	--	1.16
MEAN				1.30
LSD(0.05)				0.36
P–VALUE				NS
CV(s/mean)				19.7

Seeding date: 4/21/94

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

1st harvest – 7/22/94

PROJECT TITLE: Intrastate Spring Barley Evaluations

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell, MT
Tom Blake/Pat Hensleigh, Plant and Soil Science,
Bozeman, MT.

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 were depressed from long term averages for this nursery due to the location of the trial. Poor soil drainage during the first of the season stunted growth in the majority of the test area. The majority of agronomic readings were reduced due to this influence. Yields ranged from 50.0 to 138.3 bu/A with nineteen of the sixty-four entries yielding above 100 bu/A. MT 920027 had the highest yield (138.3 bu/A) with Steptoe having the next highest yield (120.3 bu/A). Steptoe again had one of the lowest test weights (50.4 lb/bu). The average yield for the nursery was 90.7 bu/A while the mean test weight was 52.6 lb/bu. Test weights ranged from 50.1 to 54.3 lb/bu.

SUMMARY: Poor field location contributed to low yields and percent plumps in the Intrastate Spring Barley Nursery.

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

Table 1. Agronomic data from the Intrastate Spring Barley Nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT.
Planted: April 23, 1994 Harvested: August 18, 1994

	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT INCHES	HEADING DATE
MT920027	Heartland/ID910719	138.3	51.7	92.0	34.8	172.0
CI 15229	Steptoe	120.3	50.4	98.0	32.1	173.3
MT890008	Fleet/Bowman	120.2	52.7	96.3	30.8	178.0
H5870120	Lindy/Martin (MT870120HR5	111.5	50.1	97.3	31.5	172.7
MT920072	MT 81161/MT 83518	111.4	52.1	95.0	34.1	175.0
90014-DH	WPB 90014-DH	111.2	50.3	92.3	22.3	179.0
MT890070	MT47219/Bowman	109.2	54.1	97.7	38.1	170.3
MT920070	MT 81161/MT 83518	107.3	53.6	96.0	32.1	173.7
H1851195	MT41918/TR450 (MT851195 H	105.6	52.4	98.3	34.1	173.3
C16	Coors C16	105.0	51.0	93.3	32.8	176.7
MT890128	Steptoe/Robust	104.9	51.9	94.3	28.2	172.7
MT920201	MT 83435/MT 81161	104.4	52.7	97.0	34.1	175.0
CI 15478	Klages	103.8	52.3	96.0	34.1	176.7
MT920167	MT140523/MT 83435	103.3	53.5	92.3	33.5	175.0
H5860219	Lewis/Apex (MT860219 HR #	102.9	52.5	96.0	28.9	175.3
MT920163	MT 83424/MT 81161	102.1	53.6	97.3	30.2	175.0
MT920208	MT 83435/MT 81502	101.6	53.3	98.0	31.5	173.3
H6860756	Gallatin/Bellona (MT86075	100.4	52.9	98.3	32.2	175.7
BA 1215	2B82-8529 (BA 8529)	100.0	51.8	94.7	33.5	175.0
DA587170	WPB DA 587-170	97.8	50.5	95.7	26.3	176.0
MT920053	MT 81143/MT140523	97.4	53.3	95.7	32.2	174.3
MT920047	MT 81143/MT 81161	94.6	52.1	96.0	31.5	172.0
C14	Coors C14	94.3	53.7	96.3	24.9	171.7
MT920234	MT 83491/MT 81161	94.0	52.8	96.0	32.8	176.0
MT900176	Steptoe/Robust	93.0	50.7	97.7	30.8	174.0
ND 9866	Stark	91.5	54.0	97.3	33.5	172.0
H2860224	Lewis/Apex (MT860224 HR#2	91.2	52.7	98.0	28.9	174.7
MT886610	MT 81143/Lewis	91.1	53.8	96.3	31.5	173.3
H3860224	Lewis/Apex (MT860224 HR#3	90.5	52.6	95.7	28.9	175.3
MT910167	MT 83424/Fleet	90.3	52.7	83.3	23.6	174.7
MT920071	MT 81161/MT 83518	89.4	52.6	94.0	32.1	173.7
MT920207	MT 83435/MT 81502	89.4	54.3	98.0	30.8	174.3
MT860756	Gallatin/Bellona	88.9	53.1	98.0	29.1	174.3
MT920024	Harrington/MT 83592	88.8	53.2	95.7	30.1	175.3
SK 76333	Harrington	87.9	52.9	96.3	29.5	175.7
MT889106	Apex/Lewis	87.6	53.9	97.3	32.8	170.0
CI 15856	Lewis	87.3	53.9	95.7	30.1	174.0
2B894311	BA 2B89-4311	86.6	51.5	90.0	30.1	178.0
CI 15514	Hector	86.5	53.6	96.3	33.5	173.3
MT910150	MT 81143/MT 83444	86.2	53.5	95.0	29.5	172.7
BU585-82	WPB BU 585-82	85.3	50.3	97.3	20.3	175.3
MT890018	Gallatin/Apex	85.0	53.0	97.3	28.2	174.7
MT920059	MT 81143/VD403582	84.9	53.7	96.0	32.8	174.0
H5851161	MT 41918/MT 41279(MT85116	83.5	53.2	95.3	28.2	174.7
BA 1202	BA 1202	83.2	52.8	97.7	30.8	176.3
MT920041	MT 81143/MT 81161	82.2	52.9	96.3	32.1	173.7
PI491534	Gallatin	82.1	52.9	94.0	31.5	175.7
MT861596	Lewis/MT 41549	81.9	53.8	93.3	30.2	174.7
MT910160	MT 81619/Bowman	81.8	53.6	96.0	30.8	175.3
H3851032	Harrington/Clark(MT851032	81.7	53.3	96.7	30.8	175.7
MT851195	MT41918/TR450	80.0	53.1	97.0	30.8	173.3
21140523	MT140523 HR21	80.0	53.7	96.3	26.3	174.7
863847/7	Baronesse/Arena	79.7	50.3	96.0	30.2	175.3
MT920129	MT 83422/MT 81143	79.4	52.8	93.0	28.9	175.7
C93 1	Galena	79.2	50.6	93.0	26.9	179.0
MT900111	Menuet/Bowman	78.6	53.2	97.5	31.5	171.7
MT920161	MT 83424/MT 81161	74.3	53.4	96.3	25.6	173.7
MT920073	MT 81161/MT 83518	73.7	52.3	96.7	30.2	174.3
C93 2	IdaGold	73.4	50.2	93.3	20.3	180.0
MT920064	MT 81161/MT 83422	72.3	53.3	97.0	28.9	175.3
MT140523	Hector/Klages	66.3	53.4	95.0	25.6	174.3
NS 78054	Baronesse	65.4	52.8	94.0	21.6	175.3
BZ489-29	Merlin	55.3	54.1	79.0	18.4	178.0
WPB94 4	Sissi	50.0	50.5	94.7	21.0	175.3
	MEAN	90.7	52.6	95.4	29.6	174.7
	LSD (.05)	36.9	.98	4.18	6.75	1.83

PROJECT TITLE: Early Yield Spring Barley Evaluation - Screening of early generation spring barely selections.

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell, MT
Tom Blake/Pat Hensleigh, Plant and Soil Science,
Bozeman, MT.

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 were high and ranged from 77.2 to 145.4 bu/A with all but two of the sixty-four entries yielding above 100 bu/A. Steptoe had the highest yield (145.4 bu/A) with the average yield for the nursery being 113.7 bu/A.

SUMMARY: Lodging was moderate in approximately half of the plots and there was a general absence of any disease pressure this year. Yields were excellent and percent plump values ranged from 98 to 100% for most entries.

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

Table 1. Agronomic data from the Early Yield Spring Barley Nursery grown on the Northwestern Agricultural Research Center in Kalsipell, MT.
Planted: April 23, 1994 Harvested: August 18, 1994

	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT (IN)	HEADING DATE	LODGING INDEX 1/
CI 15229	Steptoe	145.4	50.2	96	37.4	172.3	.0
MT930204	MT851195/Bowman	128.8	54.2	99	38.1	172.0	4.6
MT930016	Blenheim/Clark	128.6	52.6	84	27.6	175.3	.0
MT930038	Blenheim/MT 81616	128.4	52.9	97	28.9	177.3	.0
SK 76333	Harrington	127.2	54.5	97	36.8	174.7	.0
MT930169	MT851012/Bowman	124.9	53.9	97	37.4	175.0	.0
MT930218	MT851195/MT851031	124.2	53.6	98	36.8	174.0	.0
MT930192	MT851032/Lewis	122.3	55.2	97	36.8	173.3	13.0
MT930025	Blenheim/Harrington	122.1	54.3	96	38.1	175.3	.0
MT930037	Blenheim/MT 81616	122.1	52.5	90	27.6	178.7	8.3
MT930072	Clark/Bowman	121.7	54.1	98	39.4	170.0	3.7
MT930189	MT851012/MT 81616	120.9	54.3	97	37.4	172.7	4.4
MT930048	Bowman/MT 81616	120.8	55.1	98	39.4	174.3	5.6
MT930097	Gallatin/Bowman	120.8	54.7	97	32.2	168.3	3.7
MT930013	Berolina/Gallatin	119.9	54.7	99	39.4	173.0	.0
MT930040	Blenheim/MT 81616	119.2	50.6	82	26.9	179.7	.0
MT930047	Bowman/MT 81616	118.6	54.2	100	38.7	171.3	.0
MT930096	Gallatin/Bowman	118.6	54.0	98	35.4	169.0	18.9
MT930121	Gimpel/Harrington	118.0	53.4	94	37.4	175.0	.0
MT930203	MT851195/Bowman	117.8	53.8	97	35.4	173.7	7.4
MT930132	MT 81143/Bowman	117.7	54.3	100	38.1	172.7	8.9
MT930010	Berolina/Gallatin	117.3	53.9	98	40.0	173.7	.0
MT930067	Bowman/MT851032	116.1	54.6	99	39.4	169.3	5.6
MT930021	Blenheim/Clark	115.8	52.6	92	30.2	178.0	.0
MT930117	Gimpel/Clark	115.4	54.2	98	35.4	173.7	.0
MT930056	Bowman/MT851005	114.5	52.4	97	38.7	171.3	7.4
PI491534	Gallatin	114.3	54.7	99	38.1	174.0	.0
MT930052	Bowman/MT851005	114.3	53.6	99	40.0	172.7	.0
MT920147	MT 83424/Elrose	114.2	53.5	98	34.8	174.3	.0
MT930029	Blenheim/Harrington	113.5	53.6	98	40.7	174.7	.0
MT930039	Blenheim/MT 81616	113.4	51.6	96	38.1	175.7	.0
MT920180	MT 83424/ND 7691	113.1	54.0	98	34.8	172.7	.0
MT930135	MT 81143/Bowman	113.0	54.2	98	36.1	173.0	.0
MT930177	MT851012/MT 81616	112.9	53.9	98	36.1	169.7	.0
MT930004	Berolina/Gallatin	112.7	53.9	98	39.4	175.0	5.6
MT920179	MT 83424/ND 7691	112.7	52.8	98	34.8	172.3	.0
MT930069	Bowman/MT851032	112.0	54.1	97	38.1	170.0	5.6
MT930190	MT851012/MT 81616	111.7	52.6	97	36.8	169.7	.0
MT930194	MT851032/Lewis	111.3	54.6	98	38.1	174.0	.0
MT930076	Clark/Bowman	111.3	54.7	98	36.1	171.7	8.9
MT930091	Gallatin/Bowman	110.6	54.6	96	38.1	169.3	.0
MT930070	Bowman/MT851032	110.0	54.2	99	38.7	169.3	1.9
MT930063	Bowman/MT851031	109.7	53.6	100	38.7	172.7	.0
MT930136	MT 81143/Bowman	109.3	54.9	100	36.1	171.0	.0
MT930181	MT851012/MT 81616	109.3	52.7	99	34.1	171.3	.0
MT920018	Harrington/MT 83518	109.2	53.9	98	36.8	174.3	.0
MT930155	MT 83435/Bowman	108.9	54.5	98	39.4	173.0	.0
MT930059	Bowman/MT851031	108.4	55.5	100	38.1	171.0	.0
MT930050	Bowman/MT851005	107.0	54.7	99	36.8	170.3	3.3
MT930041	Blenheim/MT 81616	107.0	53.2	95	38.7	175.3	.0
MT930092	Gallatin/Bowman	106.7	54.2	98	38.1	171.7	.0
MT930133	MT 81143/Bowman	106.6	55.1	97	36.8	172.7	.0
MT930051	Bowman/MT851005	106.3	54.2	98	38.1	171.7	.0
MT930187	MT851012/MT 81616	106.3	53.3	99	36.1	171.0	.0
MT930027	Blenheim/Harrington	105.3	52.6	100	36.8	175.0	2.8

(Cont'd)

Table 1 (Cont'd). Agronomic data from the Early Yield Spring Barley Nursery

VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT (IN)	HEADING DATE	LODGING INDEX 1/
MT930065 Bowman/MT851032	105.0	53.6	100	38.1	170.0	5.6
MT930049 Bowman/MT 81616	104.9	54.6	99	36.8	170.0	.0
MT930071 Bowman/MT851032	104.8	54.4	100	34.8	170.3	.0
MT920205 MT 83435/MT 81161	104.3	52.7	98	38.1	174.0	.0
MT930095 Gallatin/Bowman	103.9	54.2	99	36.8	171.3	3.8
MT930066 Bowman/MT851032	103.4	54.4	99	38.1	170.0	2.8
MT930068 Bowman/MT851032	102.7	54.0	99	37.4	169.7	.0
MT930156 MT 83435/Bowman	99.8	54.3	100	34.1	172.3	.0
MT920123 MT 83422/MT 81143	77.2	53.3	98	37.4	174.0	.0
MEAN	113.7			36.6	172.7	2.1
LSD (0.05)	21.19			2.70	1.52	9.4

1/ Lodging Index = Prevalence X Severity divided by 9.

PROJECT TITLE: Uniform Northwestern Oat Nursery

INVESTIGATORS: Bob Stougaard and Todd Keener, NWARC, Kalispell, MT
Tom Blake/Pat Hensleigh, Plant and Soil Science,
Bozeman, MT

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

RESULTS: All varieties yielded well with the nursery average being 186.32 bu/A. Ajay, a new variety release and MT recommended variety, did not perform as well as in the past eight years. 90AB1322 is a promising short oat variety with excellent yield potential. Test weights were good considering late summer environmental conditions. The highest test weight was recorded in the variety Otana (38.37 lb/bu). Calibre and Riel also had the high test weights as well as very good yields. The highest yielding entry, Monida, had a test weight of 34.8 lb/bu.

SUMMARY: Four varieties had yields above 200 bu/A and all sixteen entries yielded above 150 bu/A.

FUTURE PLANS:

There are plans for continued evaluation of new and introduced lines of oat in Montana by growing the Uniform Oat Nursery.

Table 1. Agronomic data from the Statewide Uniform Oat Nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT.
Planted: April 14, 1994 Harvested: August 22, 1994

	VARIETY	YIELD BU/A	TEST WT LB/BU	HEADING DATE	HEIGHT INCHES
CI483126	Monida	214.29	34.80	174.67	41.34
90AB1322	80Ab988/Monida	205.11	35.27	177.33	36.09
OT 308	Calibre	204.95	38.07	175.67	48.56
W 80474	Riel	200.58	38.13	175.33	45.93
DERBY	Derby	198.64	36.43	176.00	47.90
CI 9252	Otana	196.83	38.37	175.00	47.24
CI467882	Border	192.62	32.80	178.33	40.68
CI 9297	Appaloosa	192.12	33.47	179.00	38.06
W 82056	Robert	185.71	36.83	177.00	43.96
CI 8263	Cayuse	184.90	32.67	175.67	41.34
81AB5792	Rio Grande	178.47	34.70	175.67	36.75
82AB1142	Ajay	178.15	34.60	175.67	30.84
ND820603	Valley	177.84	37.53	175.33	38.06
CI 6611	Park	177.28	35.83	176.67	48.56
NEWDAK	Newdak	177.00	35.23	174.00	40.68
CI 9401	Ogle	173.91	34.33	175.67	38.06
SD820045	Settler	161.60	37.47	174.67	41.99
PI548769	Troy	153.67	36.70	175.67	47.90
	MEAN	186.32	35.74	175.96	41.86
	LSD (0.05)	24.52	1.81	3.41	4.73

PROJECT TITLE: Western Regional Spring Wheat Variety Evaluations

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

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

RESULTS : Yields were very high this year and were reduced in a only a few varieties. The average yield was 89.7 bu/A compared to 62 bu/A last year. OR 488372, ID 456, Serra, ID 377S, and FM 5702 were the high yielding varieties with yields above 100 bu/a.

SUMMARY: Excellent weather conditions contributed to early heading and harvest yet some varieties were effected by the warm, dry July and August conditions and had shriveled kernels and lower test weights. The mean test weight was 56.63 lb/bu with the highest being 59.7 lb/bu from ID 463.

FUTURE PLANS: Continue evaluation of new lines of spring wheat in Northwestern 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 in Kalispell, MT.
Planted: April 13, 1994 Harvested: August 22, 1994

	VARIETY	YIELD BU/A	TEST WT LB/BU	HEADING DATE	HEIGHT INCHES
OR488372	VEE.S/BOW.S	111.03	58.70	175.00	32.15
ID 456	ID184/ID187//TREASURE,A84	107.75	58.40	172.33	34.12
UC 638	SERRA	107.38	56.70	171.33	31.50
ID 377S	GALLO-YR'S'/AU X KAL-BB//	104.55	58.90	172.00	34.78
FM 5702	NW CONSORTIUM,FM005702	101.73	58.20	168.00	26.25
PI566595	WADUAL 94	99.30	56.90	173.00	37.40
SDM 405	CENTENIAL 2*/FIELDWIN (SU	99.28	57.70	175.00	32.15
OR487410	CORVALLIS SEL.4870410	98.87	57.00	174.00	34.12
PI566596	ALPOWA	97.03	54.90	173.33	32.81
OR895181	PFAU.S/VEE#5.S,OR4895181	95.33	56.30	174.33	32.81
CI 17903	MCKAY	94.18	56.50	173.67	33.46
NKF 8022	KLASIC	91.25	58.00	168.00	26.25
PI574538	WAWAWAI	90.93	59.00	174.67	36.09
FM 8631	NW CONSORTIUM,FM008631	90.83	57.20	169.33	25.59
ID 429	ID182/FIELDWIN	90.72	58.70	171.33	34.78
OR895207	KASYON.S,OR4895207	90.53	55.30	174.33	29.53
ID 450	TONICHI,S/2*STERLING,ID71	90.07	55.40	173.67	32.15
UT 2464	UT 78S 147-209/906R	88.32	56.00	175.33	35.43
OR895224	CORVALLIS SEL.4895224	87.87	53.70	175.33	29.53
ID 448	A771084S-B/ID246	87.15	55.00	176.33	32.15
OR487374	CORVALLIS SEL.4870374	85.98	54.40	170.00	25.59
UT 1175	UT78S166-2746/906-R	85.55	54.60	174.67	37.40
UT 1146	UT78S166-2746/906-R	85.20	56.20	173.67	35.43
ID 439	ID203/ID166//906R	84.47	57.00	172.67	30.84
ID 463	ID203/ID166//WPB906R,ID85	83.28	59.70	168.67	30.18
ID 452	VANDAL/3/WA6291/PRODAX//B	82.73	58.60	176.00	30.84
SDM 406	CENTENIAL 2*/FIELDWIN (SU	81.08	57.50	173.67	32.15
UT 1117	UT78S116-2746/906R	80.73	56.90	175.33	37.40
CI 4734	FEDERATION	80.19	55.40	174.67	43.31
PI495916	PENAWAWA	79.08	52.70	173.67	32.15
UT850646	UT77W1054-1777/906R	78.75	56.00	174.33	30.18
SUNDER02	SUNSTAR 2	78.30	56.70	172.00	31.50
ML 42	SEL. ML 42	76.73	55.70	175.67	33.46
ID 462	ID203/ID166//WPB906R,ID85	75.85	56.60	172.33	32.81
UT 1597	WYNNE/UT78S166-2746	75.73	55.40	174.67	36.09
	MEAN	89.65		173.21	32.64
	LSD (0.05)	22.22		1.12	1.87

PROJECT TITLE: Advanced Yield Spring Wheat Variety Evaluations

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell,MT.
Luther Talbert and Susan Lanning, 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 were similar in both spring wheat nurseries this year. Good yields were harvested from the majority of entries. The average yield was 91.55 bu/A compared to 90 bu/A last year. Test weights were slightly reduced and some entries were more prone to kernel shrivel than others. The mean test weight for the nursery was 59.9 lb/bu with the high test weight of 62.3 lb/bu from the variety MT 9311. Heading dates were later than normal and offer a contrast to the early harvest dates of the spring wheat trials. The mean heading date being on June 26.

SUMMARY: Excellent weather conditions contributed to an early harvest yet some varieties were effected by the warm, dry July and August conditions and had shriveled kernels and lower test weights. Owens, Penawawa, Vanna Newana, and MT 9328 were the top producing varieties with yields above 100 bu/a. Spring wheat maturity was advanced by two weeks due to warm, dry weather conditions in July and August.

FUTURE PLANS: There are plans to continue 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 Advanced Yield Spring Wheat Nursery grown on the Northwestern Agricultural Research Center in Kalispell, MT.
Planted: April 14, 1994 Harvested: August 23, 1994

	VARIETY	YIELD BU/A	TEST WT LB/BU	HEADING DATE	HEIGHT INCHES
CI 17904	OWENS	111.57	58.30	177.33	34.12
WA 6920	PENAWAWA	111.12	58.40	175.67	33.46
BZ684-23	VANNA	106.47	59.30	177.00	36.75
CI 17430	NEWANA	101.25	59.70	178.00	33.46
MT 9328	MT7810/MT7926	101.08	59.20	176.33	38.06
MT 9311	MT7819/(OLAF/LEW)	99.80	62.30	179.00	38.06
MT 9265	MT8452/MN73167	98.70	61.40	177.33	34.78
PH986-61	WESTBRED 936	98.23	59.00	173.00	29.53
C982-324	RAMBO	98.13	59.20	176.67	32.15
MT 9332	MT7810/MT7926	97.55	61.10	175.00	38.71
ND 606	AMIDON	97.15	60.50	177.33	41.99
MT 9257	MT7810/MT8402	97.03	60.40	176.67	31.50
MT 9341	NEWANA//PND/MT8195	95.78	58.50	178.67	40.03
MT 9333	MT7810/MT7926	95.03	61.10	178.67	38.06
CI 17429	LEW	94.38	62.20	179.33	45.28
BZ990516	BZ990516	93.37	60.40	175.33	32.15
MT 9373	LEW/PND	93.27	59.70	178.00	32.81
WBEXPRES	WESTBRED EXPRESS	93.23	59.40	174.33	25.59
PI483235	GLENMAN	92.35	60.10	178.00	34.78
MT 9340	NEWANA//PND/MT8195	92.22	59.30	179.33	40.03
BZ984326	BORDER	91.97	60.80	174.00	34.78
MT 9325	MT7810/MT7926	91.68	60.30	179.00	40.68
MT 9339	MT7810/(SU73/LEW)	91.38	60.20	179.33	38.06
CI 13596	FORTUNA	91.32	61.40	177.00	43.31
MT 9360	LEW/PND	91.15	59.80	175.67	38.06
TR983239	FERGUS	90.08	61.10	173.00	32.15
WB 926	WESTBRED 926	89.47	58.20	173.00	30.84
MT 9309	MT7819/(OLAF/LEW)	89.10	59.50	177.33	42.65
MT 9321	MT7810/MT7926	88.95	60.60	179.67	41.34
MT 9324	MT7810/MT7926	88.60	59.20	180.00	41.34
MT 9336	MT7810/(SU73/LEW)	88.10	59.10	176.00	34.12
ND 582	STOA	88.03	60.30	176.00	42.65
MT 9323	MT7810/MT7926	87.50	61.00	177.33	37.40
MT 9209	MEXSEL2315/MT7736//MT747/	87.37	59.40	175.00	40.03
MT 9322	MT7810/MT7926	87.32	60.50	180.67	40.68
MT 9313	MT7810/MT7926	87.28	59.80	181.00	39.37
MT 9307	MT8339/3/FTA//NK715/BW559	86.88	61.40	177.67	43.96
CI 17790	LEN	86.78	60.20	176.33	34.78
CI 17828	PONDERA	85.97	61.20	175.33	33.46
PI574642	MCNEAL	85.85	60.10	176.00	34.12
MT 9303	MT8313/(CI15838/MT7418//P	85.33	59.70	175.67	41.34
PI549275	HI-LINE	84.80	59.10	175.00	31.50
ND CUT	CUTLESS	84.50	61.60	175.67	39.37
CI 10003	THATCHER	84.00	60.40	177.00	47.24
MT 9315	MT7810/MT7926	83.90	58.90	178.67	40.03
ND 677	ND622*2/CUTLESS	83.28	61.20	177.00	39.37
MT 9354	MT7810/(SU73/LEW)	80.62	59.60	177.33	36.09
MT 9327	MT7819/(OLAF/LEW)	79.05	62.80	179.00	39.37
MT 9302	MT8313/(CI15838/MT7418//P	78.00	59.60	175.33	36.09
	MEAN	91.55		176.96	37.25
	LSD (0.05)	13.99		2.21	3.58

PROJECT TITLE: Western Regional Hard Red Winter Wheat Evaluation

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

OBJECTIVE: To evaluate hard red winter wheats for adaptability, yield, quality and disease resistance for Northwestern Montana.

RESULTS: Yields were significantly higher than long term averages due to favorable environmental conditions in both winter and early spring. The warm, dry conditions that were experienced in July and August enhanced maturity and greatly aided harvest of all cereals. The average yield was 111.31 bu/A with the low yield being 73.82 bu/A (Kharkof) and the highest 136.63 bu/A (UT 182064). Test weights were also benefited from the good growing environment during the 1994 season. The mean test weight was 60.11 lb/bu and the high was 62.20 lb/bu (ID 453).

SUMMARY: Although lodging and disease pressure were minimal in this year's nursery, several varieties appear to have excellent yield potential for this region of the state.

FUTURE PLANS: To continue evaluation of the Western Regional Hard Red Winter Wheat nursery for promising winter wheat cultivars adapted for Northwest Montana.

Table 1. Agronomic data from the Western Regional Hard Red Winter Wheat Nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT.
Planted: September 28, 1993 Harvested: August 5, 1994

VARIETY		YIELD BU/A	TEST WT LB/BU	HEADING DATE	HEIGHT INCHES
UT182064	CI12385/UK//CLM/3/CI13837	136.63	59.67	156.33	40.68
WA 7678	CI 14484//BNK/GNS/3/	135.15	62.10	159.33	49.87
SDM211HW	SUNDERMAN HW BULK CROSS S	129.20	61.13	155.00	35.43
WA 7679	N823105/N8106201	127.47	61.27	162.33	47.24
ID 390	II-60-157/WSR//II-60-155/	127.32	59.70	159.33	36.75
OR870834	VS74-709/NAC	126.32	59.53	160.33	34.12
SDM212HR	SUNDERMAN HR BULK CROSS S	125.02	54.73	158.00	29.53
WA 7771	LIND SEL PENDING	124.87	60.43	162.00	48.56
UT944158	UT1461-185/ID 281	124.03	60.17	161.33	41.34
OR871144	WU=JIN-1/YOMH*7/LOV10	122.60	59.50	158.33	35.43
ID 467	A76327W-2-3T-5P/A7457W-13	122.48	59.30	160.33	36.09
UT956121	MNG/TXGH2875	120.50	55.93	163.00	40.68
UT942149	MNG/ID 281	119.50	59.60	162.67	42.65
IDHW0355	2*MC/NP824/3/LMH66/5	117.73	61.30	159.33	48.56
ID 426	ID 77281 Hard Red	117.50	59.97	159.33	36.09
ID 447	RGR/3/II-60-156/CI14	116.40	60.50	160.33	34.12
XNH 1486	HYBRITECH	113.47	61.27	154.33	40.68
XNH 1605	HYBRITECH XNH 1605 HYBRID	112.97	61.57	155.67	41.34
WA 7757	PI173467/GNS//WSR/3/	112.32	60.73	160.67	45.93
OR 2619	NZT/BEZ1//ALD,F1/4/F	109.80	61.20	158.33	34.78
OR880017	S148/PCHS//SPN	109.68	60.20	157.00	37.40
OR889128	WPM/MOS 83-11-4-8//PEW	109.23	57.60	156.67	33.46
UT 150	ID51022/MANNING	106.47	56.60	159.67	41.34
OR889176	TJB368-251/BUC	106.07	58.03	161.67	32.81
SDM206W	SUNDERMAN BLIZZARD R	106.03	58.80	162.00	47.24
ID 443	ID 77089 Hard Red	105.83	61.20	163.67	41.99
WA 7760	KVZ/3/BEZ//MNT/BURT/	103.17	57.90	162.67	45.93
WA 7774	LIND SEL PENDING	103.15	60.63	161.67	45.93
ID 466	II-60-155/CI14106//MC/3/I	102.88	60.97	156.67	48.56
CI 13844	WANSER	100.88	61.77	156.67	49.21
WA 7772	LIND SEL PENDING	100.87	61.30	161.67	45.28
OR850513	RBS/ANZA/3/KVZ/HYS//	100.50	61.50	156.00	32.81
ID 453	BEZ-1//CI13438/BURT/	98.83	62.20	155.67	49.21
OR851911	BNS/LP/3/5*ATR/AGA//	98.45	60.70	153.00	29.53
ID 465	A7480W-9-2/A7528RW,ID7734	98.08	61.67	157.33	47.24
WA 7761	WTN/HTN//WTN, N84091	96.70	61.57	159.33	48.56
ID 445	ID 77294 Hard White	92.98	61.20	158.00	50.52
WA 7773	LIND SEL PENDING	86.08	60.80	157.33	48.56
CI 1442	KHARKOF	73.82	60.13	159.33	53.81
	MEAN	111.31	60.11	159.03	41.78
	LSD(.05)	23.19	1.17	1.65	2.10

PROJECT TITLE: Western Regional Soft White Winter Wheat Evaluation

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

OBJECTIVE: To evaluate soft white winter wheats for adaptability, yield, quality and disease resistance for Northern Montana.

RESULTS: Yields were very high for many varieties in the Soft White Winter Wheat nursery due to favorable winter and spring environmental conditions. All but two of the forty-three entries yielded above 100 bu/A, with five varieties yielding in excess of 150 bu/A. The high yield was 153.6 bu/A (WA 7663) while the mean for the nursery was 125.3 bu/A. Lodging and disease pressure were minimal in this year's nursery.

SUMMARY: Although yields were very high this year, none of the newer cultivars produced yields significantly greater than Nugaines.

FUTURE PLANS:

We plan to discontinue this nursery due to the emphasis on varieties adapted to the drier regions of the Pacific Northwest. In it's place we will establish a soft white winter wheat nursery initiated from Bozeman.

Table 1. Agronomic data from the Western Regional Soft White Winter Wheat Nursery grown at the Northwestern Agricultural Research Center, Kalispell, MT.
Planted: September 28, 1993 Harvested: August 9, 1994

CI NO.	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT INCHES
WA 7663	Marksman/Daws, VH05208	153.6	57.9	164.0	36.8
WA 7755	Pullman Sel. VH091355	152.5	58.1	163.0	37.4
ID869015	LJN/ID80-855,ID86-09015	150.7	59.7	163.7	38.1
ID851008	Dusty/WA7433,ID85-01008	150.6	60.6	164.7	40.0
XWH 1005	X WH1005 Hybritech	150.0	59.6	161.3	38.7
XWH 1011	XWH 1011 Hybritech	149.3	59.3	161.3	40.0
OR090171	EG/PI178383//JCM/3/67-109/NGS/	146.9	58.6	162.0	34.8
WA 7768	MKS/Daws//WA07433,VH091705	144.1	60.1	163.7	33.5
OR091005	VPM/MOS421//2*TYEE/3/85C8077	143.3	59.8	158.3	34.1
WA 7769	STY(USA)/LJN/MDN,VH092066	136.0	58.5	164.7	35.4
WA 7690	VPM/MS951/YMH/Hill 81//WA6	135.9	59.5	161.3	36.1
PB83WW56	Plant Breed.1SEL PB1-83-WW-56	135.6	56.2	162.7	34.8
PB83WW59	Plant Breed.1SEL PB1-83-WW-59	131.5	59.5	161.7	38.1
XWH 1012	XWH 1012 Hybritech	132.8	58.3	162.0	38.7
WA 7752	Tres//Madsen/Tres, 9226	132.4	60.9	164.0	39.4
CI 13968	Nugaines	128.4	59.5	162.3	30.8
OR880172	HIM//KAL/BB/3/WWP7147,F1/4/D63	128.3	58.8	161.0	36.8
ORFWHS04	FW84106/Greer	127.6	55.8	160.7	34.1
OR090155	Pendleton Unknown Club Sel	126.6	58.7	159.0	38.1
OR880525	OR7946/HILL/HILL	126.5	59.6	163.7	40.0
CI 17917	Tres	126.1	62.0	163.7	36.1
XWH 1010	XWH 1010 Hybritech	126.0	59.5	159.7	39.4
WA 7770	Tres/WA7164//Tres,REA9223	125.0	59.1	163.7	35.4
WA 7686	VH02254/ORCW8313, VH089270	123.9	58.8	160.7	35.4
WA 7622	Tyee/Roason/Tres, 9022	122.5	57.7	164.7	34.1
OR090122	Pendleton Unknown Sel. OR85535	122.3	59.7	160.3	37.4
OR090133	HYS/YAHA//WA4095/3/CERCO/4/69-	121.9	59.7	164.0	39.4
ID850301	CI14563/3/RDL/SU92//KAL/B	121.5	55.9	166.0	22.3
WA 7729	WA6814/Tres, VA087002	118.9	57.4	162.3	33.5
PB83WW58	Plant Breeders 1 Sel. PB183-WW	116.9	60.2	164.0	39.4
WA 7695	Daws//SU92/3*Omar-279	115.1	58.7	161.3	31.5
OR870082	55-1744/7C//SU/RDL/3/JI/HYS/3/	115.1	60.2	159.0	33.5
WA 7697	SPN//SU92/3*Omar-279	114.9	59.7	159.3	31.5
ORFWB004	Stephens*2/SM-4	114.3	57.1	166.7	34.1
CI 13740	Moro	113.3	58.7	162.7	44.6
OR870012	HYS703/3/55-1744/7C//SU/RDL,F1	113.0	58.0	164.7	33.5
OR870337	KVZ/3/HD/ON//BB/4/YPOPF/3/RBS1	110.0	57.5	156.7	30.8
OR870831	AFG2/BUC,F1/KVZ	108.1	60.5	157.7	31.5
CI 17596	Stephens	108.0	58.4	161.3	36.1
ORFWHS02	T.Timopheevi/2*P101/2/OR7721	105.7	56.8	164.0	45.3
CI 11755	Elgin	102.8	60.4	164.0	48.6
CI 1442	Kharkof	84.8	60.6	161.3	55.8
OR090138	Pendleton Unknown Club Sel.	77.4	48.1	165.0	30.8
	OVERALL MEAN =	125.3	58.68	162.3	36.64
	LSD(0.05 by t)=	26.35	1.427	2.071	2.795

PROJECT TITLE: Intrastate Winter Wheat Evaluation

PROJECT LEADERS: Bob Stougaard and Todd Keener, NWARC, Kalispell, MT
Phil Bruckner/Jim Burg, 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: In comparison to the Western Regional Nurseries, the yields in the Intrastate Winter Wheat nursery were less. Lower yields may be attributed to a moderate infestation of Septoria, and light infection levels of stripe rust and dwarf bunt (TCK). The high yield was 126 bu/A (Yuma) while the mean for the nursery was 100.7 bu/A. Thirty of the forty-nine entries had yields in excess of 100 bu/A. Test weights were normal with less than 25% of the entries weighing below 60 lb/bu. The mean test weight was 60.8 lb/bu and the high was 62.4 lb/bu (Vona). Those varieties with test weights exceeding 62 lb/bu were Vona, Yuma, Lamar, Promontory, Weston and MTS 92055. TCK smut was observed in the nursery at very low levels and was highest in the varieties of Jules and Vista (2% TCK). Lodging was recorded in eight varieties and was most frequent in the lower yielding entries.

SUMMARY: Moderate disease pressure from Septoria and other leaf spot pathogens limited yields this year, but was not a major factor as in the season of 1993. The 1994 Septoria infection levels were thought to be a result of the high incidence of the disease last year.

FUTURE PLANS:

Disease resistant varieties will continue 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, Kalispell, MT.
Planted: September 28, 1993 Harvested: August 4, 1994

	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT INCHES	% TCK 1/	LODGING INDEX 2/	STRIPE RUST 3/	SEPTORIA 4/
C0850061	YUMA	126.0	62.1	153.7	36.1	.3	.0	M	L
CI 17860	NEELEY	124.1	61.5	158.7	43.3	.0	.0	0	L
CI 17846	MANNING	120.8	60.9	157.0	42.0	.0	.0	0	M
CI 17879	ROCKY	120.1	61.6	156.0	47.9	.7	1.9	L-M	M
XNH 1712	XNH 1712	119.1	61.2	155.0	40.0	1.0	.0	VH	0
JULES	JULES	115.2	60.6	158.7	40.0	2.3	.0	H	H
S86-736	S86-736	114.4	59.2	158.3	45.3	.5	.0	H	H
MT 8039	JUDITH	114.0	59.7	155.0	42.7	.0	.0	0	0
XNH 1643	XNH 1643	113.9	61.0	156.7	38.7	.2	.0	H	0
XNH 1654	XNH 1654	112.9	61.6	155.0	38.1	.3	.0	VH	0
CI 17441	VONA	112.5	62.4	151.7	37.4	.5	.0	0	0
CI 17902	WINRIDGE	109.6	59.4	160.7	47.9	.0	5.6	L-M	H
XNH 1609	XNH 1609	108.5	61.1	153.7	41.3	1.5	.0	M	0
PI517194	TIBER	108.1	60.8	160.0	49.9	.5	.0	L-M	M
XNH 1727	XNH 1727	107.7	60.0	154.7	42.0	1.2	.0	H	0
QT 542	HYBRITECH 542	107.6	61.3	154.7	47.2	1.5	.0	0	PLS
S86-15	KESTREL	107.1	59.9	158.7	43.3	.2	.0	0	H
MTS92042	LEW/TBR//RDW	106.7	61.1	156.7	44.6	.3	.0	H	M
CI 15075	CENTURK	104.7	60.8	155.7	45.9	.3	.0	L-M	L
PI491533	NORWIN	104.4	60.7	160.7	31.5	.2	.0	0	L-M
C0820009	LAMAR	104.4	62.1	153.3	47.2	.5	.0	M	M
PI560129	PROMONTORY	104.3	62.3	156.7	38.7	.0	.0	0	M
PI512302	BLIZZARD	103.9	60.5	161.0	47.9	.0	.0	L-M	L-M
MT 8713	RRI/MT 6928	103.3	61.9	155.7	36.8	.5	.0	0	0
CI 17727	WESTON	102.3	62.2	156.0	49.9	.0	7.3	0	0
MT 8918	MT7673/MT7115	101.6	61.4	158.7	43.3	.2	.0	0	L
MTS92055	LEW/TBR//RDW	101.5	62.0	156.3	44.0	.0	.0	0	M
BZ9W89-8	WPB BZ9W89-8	101.2	61.5	152.0	29.5	.2	.0	0	PLS
MT 91432	MT7951/WWP44394	100.8	60.5	158.3	43.3	.3	.0	H	M
WI88-275	WPB WI88-275	100.5	60.2	153.7	37.4	.3	.0	0	0-L
MTSF2238	LEW/TBR//RDW	99.7	61.3	157.0	44.6	.0	.0	L-M	L
MT 91051	ORSFTWT/FRD//MT	99.7	59.3	158.3	47.2	.2	.0	VH	0
MT 7811	FRD/WNK//MT 692	98.9	59.3	159.3	42.0	.0	.0	0	L
PI557013	MERIDIAN	97.8	59.2	161.3	36.8	.2	.0	0	L
IDHW0355	2*MC/NP824/3/LM	97.0	60.8	157.7	48.6	.7	.0	0	0
CI 17844	REDWIN	93.7	61.4	157.3	48.6	.5	.0	M	M
RDW(SEL)	AC READYMADE	93.4	60.6	158.7	49.9	.7	.0	H	PLS
MT 88046	PMN5/MT77003//H	92.9	61.8	153.7	42.0	.2	.0	M	PLS
MT 8949	RDW/FRD//RRI/(T	88.0	60.5	160.0	43.3	.5	.0	H	0
MTS92057	LEW/TBR//RDW	86.8	61.9	155.3	45.9	.3	.0	0-M	0
MT 8719	RRI/MT 6928	86.2	61.0	158.3	42.0	.2	.0	0	M
PI518591	ARAPAHO	82.8	59.2	154.0	42.7	.3	5.6	M	L
CI 17735	NORSTAR	79.3	59.3	161.0	55.1	1.7	35.6	L-M	0
PI564245	KARL 92	78.5	59.9	154.3	31.5	.2	.0	0	L
CI 17439	ROUGHRIDER	76.1	59.7	158.0	51.2	.3	10.2	M	H
CI 13670	WINALTA	74.8	60.6	158.3	49.9	.2	48.7	L-M	H
BZ9W8914	WPB BZ9W89-14	66.7	59.7	150.7	31.5	.0	.0	0	PLS
VISTA	VISTA	65.3	59.4	152.7	36.8	2.2	.0	0	0
PI478771	AGASSIZ	64.8	60.4	158.7	52.5	.2	62.2	L-M	0
	MEAN	100.7	60.8	156.7	43.0	.5	3.6	NA	NA
	LSD (.05)	21.52	.89	2.29	3.14	1.37	14.35		

1/ % TCK, ocular measure of % dwarf bunt infection per plot
2/ Lodging Index = lodging prevalence X severity divided by 9
3/ Stripe rust reactions rated on Low-Medium-High scale, VH = very high
4/ Septoria leaf spot reaction (L, M, H rating), PLS = physiological leaf spot

PROJECT TITLE: Advanced Winter Wheat Nursery

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

OBJECTIVE: Evaluation of winter wheat varieties for yield, quality and disease resistance.

RESULTS: Excellent yields were harvested from the Advanced Yield Nursery. The highest yield from the nursery was 129.6 bu/A from the variety Neely.

SUMMARY: Yields averaged 106 bu/A with the lowest yield being 67.5 bu/A from the variety Norstar. Test weights were normal also with the average test weight for the nursery being 60.99 lb/bu. The highest test weight was 62.53 lb/bu (MTS 92021). Heading dates were a few days later than normal.

FUTURE PLANS:

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

Table 1. Agronomic data from the Advanced Winter Wheat Nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT.
Planted: September 28, 1993 Harvested: August 5, 1994

VARIETY	YIELD BU/A	TEST WT LB/BU	HEADING DATE	HEIGHT INCHES
CI 17860 NEELEY	129.58	61.73	162.00	46.59
MT 8039 JUDITH	128.03	60.07	157.67	43.31
MT 9315 LNR/TBR//MT 7823/MT 7811	124.15	60.40	162.67	43.31
MTS92137 LEW/TBR//RDW	118.62	61.10	159.67	47.90
MT 9222 MT 7811/MT 7869//NWN/MT 7	118.12	60.80	158.00	45.28
MT 91192 WWP 4394/MT7811//MT7431/M	116.40	59.70	162.00	41.47
MT 9321 NWN/SMN82118//MT 7969/MT	116.30	59.77	161.00	37.40
MT 9335 MT 8095/NWN//MT 7823/SMN8	115.90	62.00	162.33	40.68
MTS92015 LEW/TBR//RDW	114.60	61.40	158.67	45.28
MT 9210 MT 80194/MT 7811//MT 8001	113.20	60.93	161.67	41.34
MT 9221 MT 7811/MT 7869//NWN/MT 7	112.20	61.23	158.33	46.59
MTS92135 LEW/TBR//RDW	111.75	62.40	158.67	43.31
MT 9206 MT693017/MT 7829//MT 7811	110.45	60.80	161.00	45.28
MTS92021 LEW/TBR//RDW	108.23	62.53	159.33	45.28
MT 9334 MT 8095/NWN//MT 7823/SMN8	107.92	60.43	159.67	38.71
MTS93047 MT88002/RDW	107.83	60.10	160.00	47.24
CI 17879 ROCKY	107.37	62.50	157.33	47.90
CI 17844 REDWIN	106.07	61.23	162.33	50.52
MT 9330 MT 8095/NWN//MT 7823/SMN8	105.90	60.50	159.00	42.65
MTS92045 LEW/TBR//RDW	105.73	61.87	158.00	44.62
MT 9307 SMN82118/TBR//NS26301/MT	105.30	61.60	160.67	51.18
MT 9316 TBR/SMN82287//MT 79111/NW	104.18	61.70	158.67	44.62
MTS92078 LEW/TBR//RDW	102.82	62.13	160.67	47.24
MT 9338 MT 8030/MT 7978//MT 7878/	102.75	60.27	160.33	42.65
MT 91366 MT7811/LOV24//MT7431/MT71	101.73	61.27	161.33	49.87
MT 9312 SMN82168/CC123922//SD 511	99.32	58.13	163.67	39.37
MT 91304 MT 7963/BBY//ODK/LCO	98.72	62.30	155.33	45.93
MT 9303 SMN82118/TBR//NS26301/MT	98.38	60.40	161.67	49.87
MTS92077 LEW/TBR//RDW	97.42	62.07	159.00	47.90
MT 9220 MT7951/NWN//MT7810/MT8003	96.37	59.80	159.00	51.18
MTSF2238 LEW/TBR//RDW	94.40	61.13	160.33	44.62
MT 9319 TBR/SMN82287//MT 79111/NW	93.48	61.70	158.67	43.96
MT 9318 TBR/SMN82287//MT 79111/NW	92.30	61.93	157.00	45.28
MT 91225 KS79H69/MT79121//FRD/NSR	91.57	60.80	157.33	49.21
MT 91429 NWN/LOV24//MT77066/MT7811	91.37	58.77	159.33	45.28
CI 17735 NORSTAR	67.48	60.13	164.00	55.77
MEAN	106.01	60.99	159.90	45.52
LSD (.05)	17.31	1.33	1.86	1.92

YEAR/PROJECT: 1994/758 Western Regional Dry Pea Yield Trial

PERSONNEL: Leon Welty, NWARC
Louise Prestbye, NWARC
In cooperation with Dr. Fred Muehlbauer, WSU

Twelve varieties of dry pea were seeded on April 15 in a randomized complete block design with four replicates. No fertilizer or irrigation were applied. Weeds were controlled by hand. At maturity (87 – 90 days after seeding), plants were pulled by hand and thrashed when dry.

Crop year precipitation (Sept. 1993 – Aug. 1994) was 5 inches below average. Rainfall for May was 78%, for June 90%, and for July 6% of average. The warm, dry weather hastened maturity by about one week compared to a normal year. Mean seed size was about 25% less and mean yield about half that of the previous year, which was unusually cool and wet. Yields ranged from 747 lbs/acre ('Trapper') to 1353 lbs/acre ('Columbian').

VARIETY	EMERGENCE	5/10 STAND	1st BLOOM		MATURITY	HEIGHT	SEED SIZE	YIELD
	days[1]	%	days[2]	nodes	days[3]	inches	no./lb	lbs/a
Alaska 81	14	85	54	8	89	35	2739	1309
Columbian	14	93	50	7	88	31	2796	1353
IMPCS	14	89	49	6	88	33	2626	1234
PS810106	14	88	54	7	88	31	2406	1167
PS010840	14	90	64	10	88	21	2980	844
PS110029	14	94	58	10	89	37	2590	1295
PS110462	13	88	57	9	88	35	2862	1218
Latah	13	91	57	9	87	37	3107	1189
Trapper	14	86	67	11	90	31	4900	747
Umatilla	14	88	60	11	87	31	2469	957
PS010603	13	91	60	12	87	32	2452	1139
PS110624	13	90	60	11	87	33	2326	1184
Mean	14	89	58	9	88	32	2854	1136
LSD(0.05)	1	5	1	1	2	4	370	290
P–VALUE	0.08	0.04	0.00	0.00	0.01	0.00	0.00	0.00
CV (s/mean)	6.4	4.0	1.2	9.5	1.2	9.5	9.0	17.8

[1] Day 14 = 4/29
[2] Day 54 = 6/8
[3] Day 89 = 7/13

Seeding date: 4/15/94
Irrigation: none
Fertilizer: none
Harvest area = 47 ft^2
Crop year precipitation: 14.6 inches
May – 1.79 inches
June – 2.59 inches
July – 0.10 inch
Last spring frost: 4/30 (31° F)
Frost free period: 134 days

YEAR/PROJECT: 1994/758 WESTERN REGIONAL LENTIL YIELD TRIAL

PERSONNEL: Leon Welty, NWARC
Louise Prestbye, NWARC
In cooperation with Dr. Fred Muehlbauer, WSU

Twelve varieties of lentil were seeded April 15 in a randomized complete block design with 4 replicates. No fertilizer or irrigation were applied. Weeds were controlled by hand. At maturity (116 – 129 days after seeding) plants were pulled by hand and thrashed when dry.

This season was much warmer and drier than 1993. Precipitation in May was 78% of average and in July was 6% of average (only 0.10 inch was recorded). Mean temperature for July was 2.5°F above average, so the lentils matured about 2 weeks earlier than normal. Vegetative growth was suppressed in 1994, with average stem height at 60% that of 1993. Seed yield was 79% higher and seed size 17% smaller than last year. Near normal rainfall in June provided for reproductive development, while warm, dry conditions during seed maturation limited size. Yields ranged from 717 lbs/acre ('Laird') to 1431 lbs/acre ('Pardina').

VARIETY	EMERGENCE days[1]	5/10 STAND %	FIRST BLOOM days[2]	MATURITY days[3]	HEIGHT inches	SEED SIZE no./lb	YIELD lbs/a
Brewer	10	85	58	93	16	8894	1124
Chilean 78	11	86	60	95	16	9146	1324
Laird	10	85	70	96	17	9128	717
Palouse	12	85	60	87	15	10910	319
Pardina	11	88	60	95	14	13360	1431
LC060144	11	90	59	94	15	8849	1266
LC260477	11	90	60	96	17	8191	1368
LC260520	11	89	59	93	15	9867	1291
LC260710	10	88	59	94	17	8426	1193
LC260740	11	91	60	93	15	9000	1012
Crimson	11	89	65	96	15	15810	1074
Redchief	10	90	58	89	15	10890	878
Mean	11	88	61	93	15	10206	1083
LSD(0.05)	1	5	1	2	2	1017	281
P–VALUE	0.00	0.15	0.00	0.00	0.04	0.00	0.00
CV (s/mean)	4.6	4.0	1.3	1.8	10.3	6.9	18.1

[1] Day 10 = 4/25
[2] Day 58 = 6/12
[3] Day 93 = 7/18

Seeding date: 4/15/94
Irrigation: none
Fertilizer: none
Harvest area = 47 ft^2
Crop year precipitation: 14.6 inches
May – 1.79 inches
June – 2.59 inches
July – 0.10 inch
Last spring frost: 4/30 (31° F)
Frost free period: 134 days

YEAR/PROJECT: 1993–94/758 NATIONAL WINTER RAPESEED VARIETY TRIAL

PERSONNEL: Leon Welty, NWARC
Louise Prestbye, NWARC
In cooperation with Dr. Paul Raymer, UGA

Ten varieties of winter canola were seeded Sept. 1, 1993. All overwintered in spite of deer grazing the nursery. Seed yields ranged from 3207 to 4081 lbs/a, similar to the average ranges we have obtained in the past. Early spring flowering for this fall planted crop helped it escape the July heat.

CULTIVAR	FALL OCCUPANCY %	WINTER SURVIVAL %	BLOOM date	MATURITY date	HEIGHT inches	YIELD lbs/acre
Liborius	93	95	5/12	7/14	48	4081
Doublol	94	93	5/11	7/14	50	3977
Bridger	88	96	5/9	7/14	47	3854
Cobra	98	95	5/11	7/13	47	3696
Ceres	98	93	5/11	7/14	48	3673
Honk	99	96	5/11	7/14	50	3610
Capricorn	97	95	5/10	7/13	47	3565
GR 89/347	97	96	5/11	7/14	46	3547
Cascade	97	98	5/9	7/13	47	3471
Olson	99	98	5/12	7/12	46	3207
Mean	96	96	5/11	7/14	48	3668
LSD(0.05)	3	4	1	2	5	505
P–VALUE	0.00	NS	0.00	NS	NS	0.06

Planting Date: 9/1/93
Seeding Rate: 7 lbs/acre
Harvest Area: 56 ft^2
Previous Crop: fallow
Fertilizer: none
Pesticides: none – hand weeded

YEAR/PROJECT: 1994/758

INTRASTATE and PACIFIC NORTHWEST SPRING CANOLA YIELD TRIALS

PERSONNEL: Leon Welty, NWARC
Louise Prestbye, NWARC
In cooperation with Dr. Jim Sims, MSU–Bozeman, and Dr. Jack Brown, UID

Twenty–five varieties were evaluated in 1994. The nursery was seeded early (4/18/94), resulting in acceptable yields. A late seeding would have drastically reduced yields because this crop will cease flowering if temperatures remain above 90° F for an extended period. Westar produced 1950 lbs/a. Four varieties produced over 2400 lbs/a: Hyola 401, Hyola XO29, Drakkar, and American 1.

INTRASTATE CANOLA YIELD TRIAL – 1994

Variety	Emergence day[1/]	Flower day	Height in	Maturity day	Yield lbs/a
LG 44	10	62	53	102	2028
LG 45	10	65	52	105	2000
Westar	13	61	53	101	1940
Tobin	10	45	48	93	1742
LG 69	10	63	46	105	1741
Mean	10	59	51	101	1890
LSD(0.05)	1	1	3	1.0	170
P–VALUE	0.00	0.00	0.00	0.00	0.01
CV(s/mean)	4.5	1.4	4.0	0.4	5.9

PACIFIC NORTHWEST CANOLA YIELD TRIAL – KALISPELL – 1994

Variety	Emergence	Bolting	Flower	Petal Drop	Maturity	Ht	Yield
	----------day[1/]----------					in	lbs/a
Hyola.401	9	49	56	66	104	49	2975
Hyola.X029	11	46	55	65	100	51	2592
Drakkar	11	56	67	71	108	54	2417
American.1	11	55	65	69	106	50	2416
LG.94.04	11	56	68	71	108	51	2387
Star	10	56	66	72	106	54	2315
Cyclone	11	54	64	69	102	51	2278
American.2	10	52	62	69	101	52	2271
Bounty	10	51	61	69	102	53	2263
LG.94.03	10	52	62	69	105	52	2256
Legend	11	50	61	69	101	49	2236
Spok	11	60	69	73	107	56	2204
Springfield	11	48	58	68	101	50	2198
Helios	12	57	68	72	104	57	2173
LG.94.07	12	52	61	69	103	48	2147
LG.94.01	11	53	64	69	102	53	1982
Profit	11	51	63	69	102	55	1982
Westar	12	52	62	68	101	51	1961
PBI.2	10	60	69	72	107	54	1878
PBI.1	10	62	70	74	108	56	1666
Mean	10	51	61	66	99	52	2230
LSD(0.05)	1	2	1	1	2	3	315
P–VALUE	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[1/] days after seeding

YEAR/PROJECT: 1994/758

TITLE: Evaluation of Mint Cultivars in the Presence and Absence of *V. dahliae*.

PERSONNEL: Leon E. Welty, NWARC
Louise S. Prestbye, NWARC

PROCEDURES:

Peppermint and spearmint cultivars were established in spring of 1994. The experiment was planted at two sites, one to be infected with *Verticillium* wilt and one to be kept free of the disease.

Nuclear plants were obtained from three different sources. Black Mitcham - stem-plug was obtained from Jan Lake, Ronan, MT. Meristem Black Mitcham, Meristem Native and Scotch spearmint were obtained from Starkels, Ronan, MT. All other entries were provided by MIRC from Don Robert's breeding program. Nuclear plants were planted on one foot centers. Each plot consisted of four rows spaced 20 inches apart, 20 feet in length. Harvest area for hay yield was 86.7 square feet. The peppermint and spearmint experiments were arranged separately in randomized complete block designs with four replications.

During the first month after planting, plots were kept moist to insure adequate establishment. Thereafter, each nursery was sprinkler irrigated to insure maximum growth. Each experimental site was fertilized with P, K and S prior to planting. Nitrogen was applied at a total rate of 170 lb/A in three separate applications throughout the growing season. No pesticides were applied to the cultivars in 1994. Weeds were controlled by hand.

Cultivars were evaluated for agronomic characteristics and disease on 8/17, 8/31, and 9/22/94. Dry matter yields were obtained at one site (where Verticillium wilt was planted fall of 1994) on Sept. 27. Approximately 20 pounds of green hay was air dried and later distilled. Samples were sent to A.M. Todd for quality analyses.

RESULTS:

Interpretation of 1994 data must be done with caution because cultivars were planted at three different dates. Legitimate comparisons can be made among Black and Murray Mitcham cultivars and experimentals since they were planted on the same date.

Initial establishment and vigor was superior for Black Mitcham-plug and

meristem spearmints because they were the first cultivars established. By August 17, all peppermint cultivars had covered the row except T-84-5, Murray and M-83-7. Stolon spread at this time was similar for all cultivars.

By August 31, all cultivars had covered the rows and stolon spread was greatest for Black Mitcham - plug, Black Mitcham - meristem, and Black Mitcham - stem. Powdery mildew was beginning to appear, particularly for Black Mitcham - meristem.

On September 22, all cultivars had powdery mildew with the Black Mitchams having the greatest incidence of the disease. Also, peppermint rust was evident on the Black Mitchams. Interestingly, Black Mitcham - meristem, which is purported to be more susceptible to rust than stem tip Black Mitcham, had the least rust of all Blacks.

Meristem spearmints were more vigorous, covered the row earlier and had more stolon spread later than stem tip spearmint. Whether this was due to planting date or the meristem process cannot be determined. Scotch spearmints had significant levels of powdery mildew on Aug. 31 and were severely infested by Sept. 22. Meristem Scotch had significantly more rust than stem-tip Scotch on Sept. 22.

Black Mitcham stem-tip - plug produced the highest oil yield of all peppermint cultivars. Black Mitcham stem tip from MIRC produced the next highest oil yield which was surprising considering the condition of the nuclear plants. Meristem Black produced substantial oil considering it was planted at least two weeks after all other cultivars.

Meristem spearmint produced more oil than stem-tip spearmint regardless of species. Again, no conclusions can be drawn because of the difference in planting date.

Oil analyses showed significant differences in quality components among cultivars. Black Mitcham was lower in menthol and higher in menthyl acetate (ester) than the other peppermint cultivars regardless of planting date. Scotch spearmint was higher than Native in total heads, limonene and carvone.

Agronomic characteristics of peppermint cultivars at Kalispell, MT on 8/17/94.

CULTIVAR	HEIGHT	ROW COVER	STOLON SPREAD
	inches	*(1–5)[1/]*	*(1–5)[2/]*
Black Mitcham – stem (plug)	18	5.0	1.0
Black Mitcham – meristem	14	4.8	2.0
Black Mitcham – stem	16	4.8	1.3
M–83–5 – stem	14	4.8	2.0
M–83–7 – stem	13	4.0	1.8
Murray Mitcham – stem	14	3.5	1.5
T–84–5 – stem	13	4.3	2.3
mean	15	4.4	1.7
LSD(0.10)	1	0.5	0.6

Agronomic characteristics of peppermint cultivars at Kalispell, MT on 8/31/94.

CULTIVAR	HEIGHT	ROW COVER	STOLON SPREAD	POWDERY MILDEW
	inches	*(1–5)[1/]*	*(1–5)[2/]*	*%*
Black Mitcham – stem (plug)	22	5.0	5.0	6.3
Black Mitcham – meristem	18	5.0	4.3	32.5
Black Mitcham – stem	19	5.0	4.3	7.5
M–83–5 – stem	18	5.0	3.0	0.0
M–83–7 – stem	17	5.0	3.5	0.0
Murray Mitcham – stem	13	5.0	3.8	0.0
T–84–5 – stem	17	5.0	4.0	0.0
mean	18	5.0	4.0	6.6
LSD(0.10)	2	0.0	0.7	17.5

Agronomic characteristics of peppermint cultivars at Kalispell, MT on 9/22/94.

CULTIVAR	HEIGHT	ROW COVER	STOLON SPREAD	RUST	POWDERY MILDEW
	inches	*(1–5)[1/]*	*(1–5)[2/]*	*%*	*%*
Black Mitcham – stem (plug)	19	5.0	5.0	23.8	75.0
Black Mitcham – meristem	19	5.0	4.5	7.5	82.5
Black Mitcham – stem	21	5.0	3.8	11.3	63.8
M–83–5 – stem	17	5.0	3.5	4.0	18.8
M–83–7 – stem	16	5.0	4.0	0.8	25.0
Murray Mitcham – stem	17	5.0	4.3	4.0	17.5
T–84–5 – stem	17	5.0	4.5	0.3	12.8
mean	18	5.0	4.2	7.4	42.2
LSD(0.10)	3	0.0	NS	7.6	20.9

[1/] 1= plot area very sparsely covered; 5= plot area totally covered.
[2/] 1= no stolon spread; 5= extensive stolon spread.

Agronomic characteristics of spearmint cultivars at Kalispell, MT on 8/17/94.

CULTIVAR	HEIGHT	ROW COVER	STOLON SPREAD
	inches	*(1–5)[1/]*	*(1–5)[2/]*
Native – stem	17	4.0	3.5
Native – meristem	20	5.0	1.0
Scotch – stem	15	3.5	4.0
Scotch – meristem	19	5.0	1.5
mean	18	4.4	2.5
LSD(0.10)	1	0.3	0.6

Agronomic characteristics of spearmint cultivars at Kalispell, MT on 8/31/94.

CULTIVAR	HEIGHT	ROW COVER	STOLON SPREAD	POWDERY MILDEW
	inches	*(1–5)[1/]*	*(1–5)[2/]*	*%*
Native – stem	19	4.8	2.5	0.0
Native – meristem	21	5.0	4.3	0.0
Scotch – stem	21	4.3	2.0	23.8
Scotch – meristem	21	5.0	3.3	38.8
mean	20	4.8	3.0	15.6
LSD(0.10)	NS	0.4	0.8	22.2

Agronomic characteristics of spearmint cultivars at Kalispell, MT on 9/22/94.

CULTIVAR	HEIGHT	ROW COVER	STOLON SPREAD	RUST	POWDERY MILDEW
	inches	*(1–5)[1/]*	*(1–5)[2/]*	*%*	*%*
Native – stem	20	5.0	3.0	0.0	0.0
Native – meristem	22	5.0	4.5	0.3	0.0
Scotch – stem	23	5.0	2.0	0.0	83.8
Scotch – meristem	22	5.0	3.8	11.3	91.3
mean	22	5.0	3.3	2.9	43.8
LSD(0.10)	2	0.0	1.1	NS	7.6

[1/] 1= plot area very sparsely covered; 5= plot area totally covered.
[2/] 1= no stolon spread; 5= extensive stolon spread.

Hay yield, oil content, and oil yield for mint cultivars at Kalispell, MT in 1994.

CULTIVAR	PLANTING DATE	BRANCH (0–5)[1]	HAY YIELD tons DM/a	OIL CONTENT ml/lb	OIL YIELD lbs/a
Peppermint					
Black Mitcham (stem – plug)	5/18	1.2	2.62	6.5	64.5
Black Mitcham (meristem – bare root)	6/13	1.5	1.76	7.1	47.8
Black Mitcham (stem – bare root)	5/26	1.3	2.30	6.7	58.2
M–83–5 (stem – bare root)	5/26	3.0	1.65	7.4	46.2
M–83–7 (stem – bare root)	5/26	2.1	1.32	7.8	38.7
Murray Mitcham (stem – bare root)	5/26	2.0	1.47	5.5	30.6
T–84–5 (stem – bare root)	5/26	2.0	1.54	7.1	40.6
mean		1.9	1.81	6.8	46.6
LSD(0.10)		1.0	0.38	0.7	11.1
Spearmint					
Native (meristem – bare root)	5/18	1.8	3.93	3.1	46.0
Native (stem – bare root)	5/26	1.9	2.75	2.9	30.0
Scotch (meristem – bare root)	5/18	1.9	2.11	5.5	44.1
Scotch (stem – bare root)	5/26	2.5	1.84	4.4	30.9
mean		2.0	3.34	3.0	38.0
LSD(0.10)		NS	0.27	0.5	5.5

All cultivars harvested on Sept. 27.

[1] *0=no branching; 5=extensive (long & numerous) branches*
Based on average of all shoots in sample

Oil quality components for mint cultivars at Kalispell, MT in 1994.

CULTIVAR	HEADS	MENTHOL	MENTHO-FURAN	ESTER	MENTHONE	PULEGONE
			%			
Peppermint						
Black Mitcham (stem – plug)	9.5	48.1	2.5	15.4	4.5	0.0
Black Mitcham (meristem – bare root)	8.6	48.5	3.0	17.2	4.2	0.0
Black Mitcham (stem – bare root)	10.6	48.1	2.7	13.3	5.8	0.0
M–83–5 (stem – bare root)	10.2	51.3	2.5	11.9	6.0	0.0
M–83–7 (stem – bare root)	9.7	50.8	3.0	12.0	6.5	0.0
Murray Mitcham (stem – bare root)	10.1	50.8	2.2	12.4	6.0	0.0
T–84–5 (stem – bare root)	9.8	51.6	3.2	11.9	6.5	0.0
mean	9.8	49.9	2.7	13.4	5.6	0.0
LSD(0.10)	0.7	1.1	0.2	0.9	0.7	0.0

	HEADS	LIMONENE	CARVONE
		%	
Spearmint			
Native (meristem – bare root)	18.6	7.1	37.1
Native (stem – bare root)	19.5	7.7	31.9
Scotch (meristem – bare root)	22.7	16.5	54.4
Scotch (stem – bare root)	21.2	16.2	49.0
mean	20.5	11.9	43.1
LSD(0.10)	1.8	1.4	4.5

YEAR/PROJECT: 1994/758

TITLE: Meristem 'Black Mitcham' Peppermint Double Cut Study

PERSONNEL: Leon E. Welty, Professor of Agronomy, MSU, Kalispell, MT
Louise S. Prestbye, Research Technician, MSU, Kalispell, MT

PROCEDURES: In spring of 1994, plots 10' wide by 15' long were delineated within a third year stand of meristem derived Black Mitcham peppermint (root source -Glacier Mint). Four replicates of 12 plots representing 11 double cut harvests and a single cut control were assigned in a randomized complete block design.

Harvest area was approximately 70 square feet. The area was irrigated with 0.6 to 1.6 inches per week, for a total of 18 inches over the season. In the fall of 1993, 20 lbs/a N, 104 lbs/a P_2O_5 and 120 lbs/a K_2O were applied. In 1994, 50 lbs/a S and 410 lbs/a N was applied through the sprinkler during the growing season. Sinbar was applied at 0.5 lb/a on 4/12, Poast at 2 pt/a on 4/27 and Basagran at 2 pt/a on 5/3/94. Orthene, at 0.5 lb/a, was sprayed on 8/11 for cutworm control.

Growth stage, height, and lodging were noted on the prescribed harvest dates for each plot and dry matter yields obtained. Approximately 20 pounds of green hay was air dried and later distilled. Samples were sent to A.M. Todd for quality analyses.

RESULTS: Oil yields increased as the first harvest was delayed until July 19. The breakpoint for significant oil increase occurred on July 12, which was when the meristem Black started to have significant lodging. The single harvest on Aug.1 produced oil yields which would be considered unacceptable to peppermint producers. Interestingly, after July 12 the peppermint continued to get taller and accumulate biomass without a corresponding increase in oil yield.

Plots were harvested again on Sept. 1. As expected, oil yields were greater for the earlier first harvests. The highest total oil per acre was received from the July 12 + Sept.1 harvests (99.3 lbs/a).

Harvesting on Sept. 27 for the second time resulted in a reduction in oil yield compared to the Sept. 1 harvest. We anticipated that the additional 26 days of growth would increase or at least maintain yields, but this did not occur. We don't think the reduction in oil yield from Sept.1 to Sept. 27 was the result of weather, because only 4 mild frosts were observed in

September. We think the oil yield reduction was due to leaf drop and rot resulting from lodging. The reduction was most severe for the June harvests which had the longest time for regrowth.

Oil analyses showed significant differences in quality components among first harvest dates which were related to plant maturity. The single harvest control (8/1), which had just started to bloom, was highest in heads, menthol, menthofuran and ester, and lowest in menthone. Oil from the second cuttings was generally higher in the levels of the components shown except menthone, and the 9/27 cutting was higher than the 9/1 cutting. Menthol levels of all the 9/27 treatments were similar regardless of first harvest date. Menthol levels for June and early July harvests were below what oil buyers prefer. It must be noted, however, that early harvest oil from production fields in 1994 was marketed without any price discount. This will, of course, vary with supply and demand. If oil supplies are abundant, discounts on early cut peppermint oil could be a reality.

Double cutting was very successful in 1994. However, we all know that 1994 was a good year for this practice. GDD were 9% higher in 1994 than the 46-year average. If 1994 was a perfect year for double cutting then 1993 would have been one of the worst. However, even in 1993 we obtained 8 inches of regrowth from our Aug.1 harvest. The unanswered question concerning double-cutting is the effect on peppermint vigor and stand life. This experiment will be continued so that determination can be made.

Total season hay yields from the peppermint double cut study at Kalispell, MT in 1994.

First Harvest Date	DM Yield t/a	Second Harvest Date	DM Yield t/a	Total Yield t/a	Second Harvest Date	DM Yield t/a	Total Yield t/a
6/21	2.84	9/1	2.11	4.95	9/27	2.41	5.25
6/28	3.64	9/1	2.18	5.82	9/27	2.43	6.07
7/5	3.70	9/1	1.98	5.68	9/27	2.37	6.07
7/12	4.00	9/1	1.83	5.83	9/27	2.19	6.19
7/19	4.98	9/1	1.39	6.37	9/27	1.85	6.83
8/1	4.95		--	--	9/27	1.42	6.37
LSD(0.05)	0.47		0.30	0.43		0.52	0.43

Total season oil yields from the peppermint double cut study at Kalispell, MT in 1994.

First Harvest Date	Oil Yield lbs/a	Second Harvest Date	Oil Yield lbs/a	Total Yield lbs/a	Second Harvest Date	Oil Yield lbs/a	Total Yield lbs/a
6/21	24.8	9/1	61.2	86.0	9/27	46.0	70.8
6/28	34.6	9/1	57.9	92.5	9/27	45.4	80.0
7/5	39.3	9/1	52.5	91.8	9/27	45.2	84.5
7/12	45.8	9/1	53.5	99.3	9/27	41.6	87.4
7/19	48.6	9/1	41.8	90.4	9/27	32.8	81.4
8/1	49.3		--	--	9/27	19.3	68.6
LSD(0.05)	10.9		7.5	13.9		6.8	13.9

Oil quality components from the first harvests of the peppermint double cut study at Kalispell, MT in 1994.

First Harvest Date	Heads	Menthone	Mentho–furan	Ester	Menthol	Pulegone
			%			
6/21	7.1	25.1	0.8	3.5	38.6	0.2
6/28	7.0	27.7	0.7	2.7	37.3	0.1
7/5	7.5	25.8	0.7	2.7	38.1	0.1
7/12	7.6	24.6	0.7	2.6	38.8	0.1
7/19	8.2	23.3	0.8	2.5	40.2	0.2
8/1	8.6	19.9	2.9	3.5	40.3	0.8
LSD(0.05)	0.7	2.8	0.3	0.7	2.2	0.3

Oil quality components from the 9/1 harvest of the peppermint double cut study at Kalispell, MT in 1994.

First Harvest Date	Heads	Menthone	Mentho–furan	Ester	Menthol	Pulegone
			%			
6/21	8.8	20.1	2.6	3.4	44.5	0.3
6/28	8.7	15.3	2.9	4.7	47.1	0.2
7/5	8.8	19.7	1.9	3.6	45.5	0.1
7/12	8.1	26.0	2.0	2.9	41.3	0.1
7/19	7.8	29.4	2.2	3.0	39.0	0.1
LSD(0.05)	NS	2.9	0.5	0.9	2.6	0.1

Oil quality components from the 9/27 harvest of the peppermint double cut study at Kalispell, MT in 1994.

First Harvest Date	Heads	Menthone	Mentho–furan	Ester	Menthol	Pulegone
			%			
6/21	7.7	16.0	3.3	7.2	49.9	0.0
6/28	9.8	9.2	3.1	8.4	50.0	0.0
7/5	9.1	10.8	2.6	7.9	50.4	0.0
7/12	9.6	11.1	2.3	7.8	50.2	0.0
7/19	9.0	13.3	2.2	7.3	50.0	0.0
8/1	8.8	15.0	2.2	6.9	49.5	0.0
LSD(0.05)	0.9	2.3	0.3	0.8	NS	0.0

YEAR/PROJECT: 1994/758

TITLE: Determine Feasibility of Using Rotational Crops to Reduce Pest Problems in Peppermint

PERSONNEL: Leon E. Welty, NWARC
Louise Prestbye, NWARC
Cooperators:
Dr. Don Mathre, MSU, Bozeman
Dr. Bill Grey, MSU, Bozeman

PROCEDURES: Cultures of *Verticillium dahliae* were isolated from peppermint root samples collected from several fields in the Flathead Valley in February, 1992. Sterile oat kernels were inoculated with spore suspensions from these cultures and incubated until numerous microsclerotia of the fungus were visible on the husks. Greenhouse tests on the pathogenicity of the infested kernels were positive for *V. dahliae*.

Oat kernels were ground with a coffee grinder and mixed with ground wheat in a 50:50 ratio. On 21 May, 1992, the oat kernel-wheat mixture containing the fungus was seeded at a 2-inch depth at 50 lbs/acre into two fields, one with a fine sandy loam (light) soil and one with a silty clay loam (heavy) soil. Plots were arranged in an RCB design with four replicates for the following treatments:

1. Barley - grain harvested, residue plowed
2. Fallow - hand weeded
3. Vapam fumigant - 50 GPA
4. Sorghum (high HCN), cut once, returned to plot & plowed as green manure
5. Sorghum, cut twice, returned & plowed
6. Marigold, cut once, returned & plowed
7. Winter rapeseed (high glucosinolate), cut once, returned & plowed
8. Winter rapeseed, cut twice, returned & plowed

On September 5, 1992, the green manure crops were rototilled by treatment so soil and plant debris were not moved from plot to plot.

On May 18, 1993, 'Black Mitcham' meristem foundation roots were hand planted (in one-half of each plot) in four, 17 ft. rows per plot at each site. Planting rate was one 5 gallon bucket of roots per plot. The other half of each plot was strip planted to 'Humus' rapeseed, which was harvested for yield determination on 8/30, returned to the plots and plowed down. Vapam was applied to the barley treatment plots at 100 GPA and to the fallow treatment plots at 200 GPA on 9/23/93.

Meristem Black Mitcham was planted on double green manure plots and fall 1993 Vapam plots (100 and 200 GPA) on 5/24/94. Nitrogen was applied at 100 lbs/a and P_2O_5 at 50 lbs/a on 5/4/94. Sinbar (1.2 lbs/a), Poast (1.5 pt/a + 2 pt/a Dash) and Basagran (2 pt/a + UAN) were applied 5/6/94. On 6/30/94, Tilt was applied at 10 oz/a for rust control. Additional N was applied at 70 lbs/a on 7/13, and another 40 lbs applied to the 1994 planting on 8/26.

Weed invasion was determined by visual estimate and by comparing the fresh weight of all weeds hand-pulled from each whole plot on 8/8/94. The percentage of each subplot (1993 and 1994 plantings) exhibiting Vert wilt symptoms was visually estimated on 8/11 and again on 9/20/94.

RESULTS:

At the heavy soil site, the treatments which had included Vapam in either 1992 or 1993 indicated weed suppression, as did the rapeseed green manure treatments from 1992. The sorghum green manure plots had the most weeds. Marigold was intermediate in weed presence. Very few weeds were present at the light soil site. This data suggests the use of high glucosinolate rapeseed as a green manure crop to benefit weed control in a peppermint rotation scheme.

Vert wilt symptoms appeared in the second-year mint plantings by mid summer. Symptoms appeared later in the new stands. The only significant differences observable at either site were on the 9/20 observation of the 1994 planting. The Vapam treated subplots showed lower infestation than the plots which had not been fumigated. In 1993, mint plants in marigold green manure plots showed slightly less disease than the others on the light soil. There was no indication of this in the second-year stands in 1994.

Weed invasion of peppermint following rotation treatments, observed on 8/8/94.

		Heavy Soil		Light Soil
1992 Treatment	1993 Treatment	Weeds %	Weed Wet Wt lbs/a	Weeds %
Barley	Vapam–100 GPA	10.8	1335	2.3
Fallow	Vapam–200 GPA	1.8	76	1.8
Vapam–50 GPA	Humus	5.8	377	1.5
Sorghum	Humus	40.7	3369	1.0
Rapeseed	Humus	14.9	1360	0.8
Marigold	Humus	20.0	1471	1.3
	LSD(0.05)	16.4	1602	NS

V. dahliae infestation on peppermint following rotation treatments.

Heavy Soil

1992 Treatment	1993 Treatment	Symptoms – % of plot[1/] 8/11/94 '93[2/]	8/11/94 '94[3/]	9/20/94 '93[2/]	9/20/94 '94[3/]
Barley	Vapam–100 GPA	10.0	0.0	18.8	6.3
Fallow	Vapam–200 GPA	7.8	0.3	17.5	1.5
Vapam–50 GPA	Humus	7.8	0.3	16.3	8.8
Sorghum	Humus	8.9	0.0	15.1	18.8
Rapeseed	Humus	9.7	0.2	15.7	21.9
Marigold	Humus	9.0	0.0	16.3	13.8
	LSD(0.05)	NS	NS	NS	8.8

Light Soil

1992 Treatment	1993 Treatment	Symptoms – % of plot[1/] 8/11/94 '93[2/]	8/11/94 '94[3/]	9/20/94 '93[2/]	9/20/94 '94[3/]
Barley	Vapam–100	36.3	0.0	73.8	16.3
Fallow	Vapam–200	33.8	0.0	77.5	11.3
Vapam – 50 GPA	Humus	35.0	0.0	78.8	30.0
Sorghum	Humus	29.4	0.4	62.5	50.7
Marigold	Humus	27.5	1.3	62.5	30.0
Rapeseed	Humus	25.0	0.7	59.4	45.0
	LSD(0.05)	NS	NS	NS	18.1

[1/]% Vert wilt based on visual estimates
[2/] Mint planted in 1993
[3/] Mint planted in 1994