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

ANNUAL REPORT
2002 CROP YEAR

THE ANNUAL REPORT FOR CY2002 WAS NEVER COMPILED AND PUBLISHED.

REPORTS FOR THAT YEAR ARE FILED FOR FUTURE REFERENCE.

MAXIMUM / MINIMUM TEMPERATURES BY MONTH & DAY
JANUARY 1998 - DECEMBER 2002

2002

YR	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
01	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	24	5	33	14	32	8	58	27	54	27	71	43	69	48	80	36	78	51	52	36	28	2	29	26
2	21	14	35	25	32	5	28	8	58	33	62	47	69	43	75	44	72	45	54	26	30	2	29	27
3	24	13	36	7	26	16	35	15	66	41	63	44	74	42	76	38	75	48	54	27	33	6	30	28
4	32	21	36	7	30	14	43	18	55	36	67	42	79	51	77	45	74	47	52	37	36	8	30	26
5	35	27	40	13	40	16	55	26	46	36	70	48	79	42	72	48	79	52	56	37	39	10	30	26
6	33	24	39	13	41	6	59	36	45	35	67	49	71	44	68	49	70	48	59	44	39	13	30	27
7	46	33	43	34	10	0	54	43	45	29	62	37	87	44	64	41	64	50	68	46	52	23	33	29
8	48	43	37	32	10	-9	54	35	37	29	60	39	87	54	67	44	61	45	67	34	51	25	33	29
9	46	36	35	26	35	-3	53	31	46	24	46	38	65	48	68	43	64	40	63	34	43	35	33	29
10	45	24	41	17	33	26	48	33	53	25	52	42	75	48	79	47	68	38	66	34	43	33	33	27
11	37	23	41	16	40	31	57	40	57	30	53	41	84	51	82	47	75	40	58	27	39	34	37	27
12	39	29	36	10	43	31	56	41	61	32	58	42	88	55	77	49	77	40	43	18	44	38	41	31
13	42	31	34	9	42	31	57	43	67	33	70	41	91	55	80	45	79	40	48	18	44	37	44	30
14	40	27	32	9	36	27	53	43	73	45	80	42	95	64	86	51	82	41	56	18	44	38	44	38
15	37	17	38	10	36	28	63	35	55	31	79	47	90	54	85	41	80	40	55	22	40	34	47	37
16	28	17	35	11	35	22	45	31	60	36	80	57	87	57	80	47	80	43	56	22	46	26	45	35
17	27	15	41	11	24	10	46	26	59	33	69	49	85	57	68	36	72	47	26	23	49	26	48	32
18	21	5	45	20	25	13	52	28	60	34	57	45	90	57	76	41	58	45	61	23	45	38	40	19
19	27	10	42	31	26	17	53	26	68	39	60	36	91	63	76	39	62	40	62	23	43	38	34	25
20	32	22	41	32	22	7	55	25	86	39	72	41	82	54	78	43	72	41	62	23	46	38	37	18
21	35	24	44	26	12	-7	58	27	69	47	71	43	82	48	79	48	65	30	60	24	51	35	28	17
22	33	18	46	29	22	1	50	40	48	39	73	49	83	50	71	45	60	30	57	24	42	35	31	17
23	29	19	48	24	26	1	56	30	44	32	81	57	85	53	73	41	67	31	47	13	43	37	27	13
24	36	21	25	11	37	15	41	26	48	34	74	46	85	57	78	46	69	34	44	11	39	15	26	18
25	39	36	17	-8	41	21	50	28	58	40	78	47	88	53	80	51	69	31	44	11	35	14	27	22
26	42	31	20	-4	44	30	51	34	60	44	81	51	86	60	76	46	62	32	47	13	29	15	31	23
27	33	17	20	-1	47	30	54	33	60	47	87	51	81	59	75	49	64	37	48	12	31	26	40	28
28	29	12	25	9	41	32	52	35	66	48	86	63	77	56	76	44	60	29	45	20	33	20	42	29
29	24	12			46	29	56	37	66	49	77	56	75	62	81	47	61	30	41	22	32	26	37	31
30	24	13			48	31	62	39	68	51	70	51	72	59	81	45	51	29	25	2	30	27	37	18
31	24	14			51	38			66	42			79	49	74	49			26	1			34	26
AVG	33.3	21.1	35.9	15.5	33.3	16.7	51.8	31.3	58.2	36.8	69.2	46.1	81.6	52.8	76.1	44.7	69.0	39.8						

MAXIMUM TEMPERATURE	95	MINIMUM TEMPERATURE	-9

Table 1. Summary of Climatic Data by Months for the 2001-2002 Crop Year - September 2001 - August 2002 and Averages for the Period 1949-2001 at the Northwestern Agricultural Research Center
Kalispell, Montana

ITEM	Sept. 2001	Oct. 2001	Nov. 2001	Dec. 2001	Jan. 2002	Feb. 2002	Mar. 2002	Apr. 2002	May 2002	June 2002	July 2002	Aug. 2002	Total or Average
Precipitation (inches) Current Year	0.32	1.8	1.44	0.59	1.21	1.66	1.48	0.91	2.72	2.39	1.45	1.44	2.12
Avg. 1949 to Crop Year 01	1.54	1.38	1.55	1.59	1.46	1.18	1.19	1.52	2.31	2.95	1.59	1.50	19.75
Average Temperature (F) Current Year	57.3	42.0	36.6	27.0	27.2	25.7	25.0	41.6	47.5	57.7	67.2	60.4	42.9
Mean 1949 to 1999-2000	53.7	43.0	32.6	25.4	22.6	27.6	33.7	43.1	51.6	58.1	64.0	63.0	43.2

Last killing frost in spring

Spring 2002	May 23	32°F
Avg. 1949-2001	May 22	

First killing frost in fall

Fall 2001	September 29, 32°F
Avg. 1949-2001	September 13

Frost Free Period

2001-2002	120
Avg. 1949-2002	115

Growing Degree Days (base 50):

1770 days	May 2002 - October 2002
1894.4 days	1949-2002 Average

Growing Degree Days (base 32):

4235 days	May 2002 - October 2002
3983.5	1949-2002 average not available: Base 32 GDD records initiated 2001

Table 2. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis September 1949 through August 31, 2002

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
1994-95	56.3	42.8	29.7	27.1	23.6	33.7	33.1	42.6	51.6	56.3	63.1	59.5	43.3
1995-96	54.9	41.1	34.9	26.7	17.4	24.0	29.0	43.2	46.6	58.5	65.4	62.5	42.0
1996-97	52.3	42.1	27.3	19.8	19.8	28.0	32.3	38.3	52.3	57.8	62.8	63.8	41.4
1997-98	55.6	43.7	33.0	27.9	25.1	33.0	34.9	44.5	54.1	56.0	68.4	65.6	45.2
1998-99	59.7	42.3	37.0	27.4	30.4	32.2	37.5	41.6	48.8	55.8	60.9	65.5	44.9
1999-00	51.3	42.9	38.1	31.0	25.8	26.3	36.9	43.4	50.4	56.2	63.9	63.4	44.1
2000-01	52.0	33.5	27.5	18.4	24.0	20.6	33.6	40.5	53.4	54.8	63.1	64.6	40.5
2001-02	57.3	42.0	36.6	27.0	27.2	25.7	25.0	41.6	47.5	57.7	67.2	60.4	42.9
	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
MEAN	53.7	43.0	32.6	25.4	22.6	27.6	33.7	43.1	51.6	58.1	64.0	63.0	43.2

Mean temperature for all years = 43.2

Maximum summer temperature	95 on July 14, 2002
Minimum winter temperature	-9 on March 8, 2002

In this summary 32 degrees is considered a killing frost.

Table 3. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 2002

Average maximum temperature by month and year
Degrees Fahrenheit

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
1949-50	71.4	52.4	45.7	32.1	14.4	34.6	38.4	52.3	63.1	70.1	78.6	79.5	52.7
1950-51	70.9	55.8	38.2	36.3	28.7	36.6	37.3	57.9	63.2	66.6	82.4	77.0	54.2
1951-52	64.2	47.5	37.2	23.6	25.9	35.7	39.5	61.8	65.7	70.2	79.2	79.5	52.5
1952-53	73.4	62.6	40.6	33.2	41.3	39.1	46.8	51.5	62.5	66.8	83.3	79.5	56.7
1953-54	72.3	61.0	45.6	36.7	29.1	38.4	40.0	51.0	67.2	67.0	80.1	74.4	55.2
1954-55	66.4	53.4	45.9	34.9	31.8	31.2	33.9	48.1	60.5	74.7	76.9	82.4	53.3
1955-56	67.6	55.5	30.8	29.2	30.7	30.1	39.7	57.4	67.5	73.3	81.2	77.8	53.4
1956-57	71.0	53.7	37.6	35.5	19.0	33.2	43.3	55.3	70.2	72.4	82.1	80.0	54.4
1957-58	74.3	50.5	40.1	38.5	33.7	37.9	43.5	54.4	77.5	75.7	80.8	85.5	57.7
1958-59	69.7	57.9	39.6	34.1	31.8	31.9	43.9	57.9	61.5	74.3	83.2	76.3	55.2
1959-60	64.0	53.6	33.9	33.3	27.5	34.1	43.4	56.1	63.0	74.8	88.7	74.1	53.9
1960-61	72.1	57.8	41.1	29.8	35.0	43.1	48.2	51.6	65.3	82.0	83.7	86.3	58.0
1961-62	62.3	53.3	35.1	30.4	26.0	33.4	40.5	60.7	62.7	74.2	79.2	77.5	52.9
1962-63	71.7	54.7	43.8	37.9	19.9	41.4	48.9	55.7	67.1	71.8	79.6	82.5	56.3
1963-64	74.6	59.4	43.4	30.2	35.1	37.7	39.7	53.3	63.5	71.4	80.3	72.9	55.1
1964-65	63.9	55.0	41.0	28.9	35.1	36.9	41.0	57.6	64.3	71.4	80.8	77.1	54.4
1965-66	57.5	61.1	42.6	35.4	31.8	35.3	45.4	54.8	69.8	69.1	81.2	78.4	55.2
1966-67	74.9	55.1	41.1	35.8	36.7	40.9	41.3	52.6	66.0	73.3	84.8	87.2	57.5
1967-68	78.9	55.8	41.3	30.8	31.5	40.8	52.6	54.2	63.4	72.2	82.7	75.7	56.7
1968-69	65.9	53.1	40.6	27.3	20.8	32.5	40.9	59.5	68.7	72.0	78.9	83.0	53.6
1969-70	70.4	49.7	43.0	32.8	28.5	36.2	42.5	49.7	67.9	75.5	79.1	80.9	54.7
1970-71	62.5	52.2	40.0	34.1	30.6	38.6	41.6	56.2	66.4	67.3	78.0	87.5	54.6
1971-72	64.2	53.1	41.2	30.9	27.1	35.9	47.9	51.7	64.7	72.4	76.9	83.3	54.1
1972-73	64.0	51.3	41.4	28.6	30.6	38.5	47.7	53.8	65.8	69.6	83.7	83.2	54.9
1973-74	67.6	56.3	36.8	36.5	28.5	39.6	43.5	53.1	59.2	76.2	80.3	77.6	54.6
1974-75	70.9	61.4	43.2	37.4	32.0	31.5	39.4	48.1	61.2	68.5	85.5	73.0	54.3
1975-76	69.4	52.3	40.4	35.1	36.2	37.6	40.1	54.3	66.2	66.3	79.0	74.4	54.3
1976-77	73.2	57.7	42.1	36.1	28.0	39.1	42.7	60.2	61.9	77.0	76.6	77.4	56.0
1977-78	64.7	55.4	38.5	29.4	28.8	35.5	45.5	54.3	58.1	72.6	77.5	74.2	52.9
1978-79	65.7	59.2	35.9	28.2	13.7	33.2	45.3	52.5	64.3	73.9	81.5	82.8	53.0
1979-80	74.1	59.5	37.8	39.2	25.2	35.9	40.8	60.4	66.9	69.0	77.0	73.2	54.9
1980-81	66.9	59.0	43.9	39.2	34.0	38.9	49.7	54.8	63.3	63.8	78.1	85.0	56.4
1981-82	70.8	54.1	44.9	34.2	29.7	33.3	45.8	50.5	62.5	74.3	75.0	80.6	54.6
1982-83	69.2	53.2	36.9	33.0	36.8	42.2	47.5	55.2	66.4	70.6	73.1	82.9	55.6
1983-84	65.1	56.0	43.7	19.9	34.6	40.8	46.8	54.2	60.4	69.1	82.8	83.3	54.7
1984-85	63.9	52.2	40.4	28.2	25.3	29.1	42.7	56.8	68.7	73.2	88.0	75.0	53.6
1985-86	60.4	51.3	26.7	25.2	34.0	36.6	51.6	55.1	66.1	78.5	73.0	84.1	53.6
1986-87	59.9	54.3	38.0	30.9	29.5	34.2	43.4	61.3	67.9	75.7	76.5	74.9	53.9
1987-88	73.5	59.9	43.0	32.6	29.0	39.3	46.1	58.5	63.8	74.1	79.5	82.6	56.8
1988-89	69.0	62.0	42.7	30.3	35.3	21.8	36.1	56.6	61.1	72.6	81.6	75.0	53.7
1989-90	68.5	54.0	42.4	30.5	36.4	33.9	44.8	57.3	60.5	68.9	79.7	79.5	54.7
1990-91	77.9	53.0	43.8	24.1	25.6	42.5	41.6	54.0	61.7	65.5	78.2	81.6	54.1
1991-92	70.9	56.1	38.6	33.7	35.1	42.7	52.7	57.7	67.7	67.8	73.1	78.0	56.2
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	50.9

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	55.9
1994-95	74.0	54.1	36.4	33.1	29.3	43.3	42.9	52.7	63.9	67.6	75.5	74.1	53.9
1995-96	70.0	50.4	43.0	32.2	25.3	33.1	38.7	54.1	55.1	70.5	81.0	78.1	52.6
1996-97	64.3	53.2	33.9	25.7	26.9	34.2	40.9	48.4	64.3	68.6	75.6	78.5	51.2
1997-98	68.5	53.5	42.3	33.4	32.7	41.1	43.9	56.1	67.2	65.7	82.3	82.5	5
1998-99	75.5	54.8	42.8	33.3	36.0	38.5	47.9	54.3	60.2	66.5	76.4	80.7	55.6
1999-00	67.8	55.5	46.0	35.2	32.6	35.0	44.3	55.4	62.3	69.0	80.1	81.7	55.4
2000-01	65.5	55.0	35.0	27.0	31.0	29.6	43.5	50.3	66.5	66.7	78.4	82.6	52.6
2001-02	74.7	53.9	44.9	32.2	33.3	35.9	33.3	51.8	58.2	69.2	81.6	76.1	53.8
MEAN	68.7	55.2	40.1	32.0	30.0	36.0	43.4	54.8	64.5	71.1	79.7	79.4	54.6

Mean temperature for all years = 54.6

Table 4. Summary of temperature data at the Northwestern Agricultural Research Center on crop year basi
September 1, 1949 through August 31, 2002

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
1994-95	38.6	31.6	23.0	21.1	17.9	24.2	23.4	32.5	39.3	45.1	50.8	45.0	
1995-96	39.9	31.9	26.9	21.3	9.5	14.9	19.3	32.4	38.1	46.6	49.8	46.9	31.5
1996-97	40.3	31.0	20.7	13.9	12.7	21.8	23.7	28.3	40.3	47.0	50.1	49.2	31.6
1997-98	42.8	34.0	23.7	22.4	17.6	25.0	25.9	33.0	41.1	46.3	54.5	48.8	34.6
1998-99	43.9	29.8	31.3	21.6	24.9	25.9	27.2	29.0	37.4	45.1	45.3	50.3	34.3
1999-00	34.8	30.3	30.2	24.8	19.0	17.6	29.5	31.4	38.4	43.4	47.6	45.1	32.7
2000-01	38.4	30.0	19.0	12.0	17.0	11.6	23.6	30.7	40.3	43.0	63.1	46.5	31.3
2001-02	39.9	30.1	28.3	21.9	21.1	15.5	16.7	31.3	36.8	46.1	52.8	44.7	32.1
MEAN	38.6	31.2	25.1	18.8	15.3	19.1	24.0	31.4	38.6	45.0	48.5	46.6	31.9

Mean temperature for all years = 31.9

Table 5. Summary of precipitation records at the Northwestern Agricultural Research Center on a crop year basis

Total precipitation in inches by month and year

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	TOTAL
1949-50	1.03	1.05	1.67	0.92	2.62	1.13	2.31	0.84	0.15	3.90	3.12	0.75	19.49
1950-51	0.52	2.30	1.16	2.48	0.94	1.29	0.62	2.32	3.77	2.26	1.03	2.86	21.55
1951-52	1.49	5.62	1.01	3.31	1.03	0.98	0.97	0.17	1.32	3.95	0.56	0.69	21.10
1952-53	0.13	0.05	0.60	0.98	1.84	1.14	0.98	2.07	2.00	3.31	T	1.62	14.72
1953-54	0.71	0.03	0.87	1.30	2.65	0.79	0.83	0.79	1.52	2.98	2.91	3.79	19.17
1954-55	1.09	0.54	1.00	0.43	1.00	1.31	0.44	0.82	1.18	1.86	3.08	0.00	12.75
1955-56	1.64	1.89	1.97	2.38	1.76	1.53	0.87	1.28	1.06	4.20	2.13	3.21	23.92
1956-57	1.16	1.10	0.53	0.96	1.47	1.14	0.75	1.22	1.75	2.51	0.52	0.78	13.89
1957-58	0.10	1.59	0.96	1.76	1.56	2.67	0.97	1.47	2.20	2.56	0.84	0.58	17.26
1958-59	1.99	1.16	2.90	2.77	1.95	1.33	0.75	1.62	4.10	1.75	T	0.91	21.23
1959-60	4.22	3.36	4.32	0.34	1.67	1.10	1.01	1.23	3.27	0.69	0.13	2.43	23.77
1960-61	0.55	1.44	1.72	1.24	0.65	1.46	1.96	2.26	4.02	1.45	0.76	0.64	18.15
1961-62	3.40	1.22	1.77	2.09	1.33	1.15	1.59	0.96	2.59	1.15	0.11	0.72	18.08
1962-63	0.58	1.85	1.31	0.91	1.69	1.21	0.85	1.07	0.57	5.00	1.44	2.10	18.58
1963-64	1.46	0.75	0.95	1.70	1.46	0.41	1.57	0.87	3.33	3.86	3.01	1.64	21.01
1964-65	2.27	0.85	1.62	3.62	2.25	0.64	0.24	2.55	0.81	2.30	1.15	4.74	23.04
1965-66	1.72	0.21	1.31	0.55	1.42	0.67	0.53	0.76	1.18	6.57	2.49	1.64	19.05
1966-67	0.79	1.34	3.33	1.68	1.50	0.62	1.27	0.99	1.30	2.53	0.02	0.01	15.38
1967-68	0.91	1.88	0.62	1.16	0.79	1.15	0.68	0.57	3.92	2.22	1.00	3.42	18.32
1968-69	4.51	2.39	1.59	3.12	3.05	0.75	0.69	1.39	1.19	5.21	0.70	0.09	24.68
1969-70	1.54	1.90	0.31	1.14	3.10	0.89	1.49	0.76	1.97	4.37	3.08	0.44	20.99
1970-71	1.79	1.38	1.75	0.99	1.84	0.77	0.69	0.58	2.45	4.42	1.31	1.11	19.08
1971-72	0.94	0.87	1.70	1.62	1.10	1.65	2.11	0.95	1.48	3.28	1.77	0.98	18.45
1972-73	1.38	1.84	0.80	2.19	0.52	0.56	0.70	0.45	1.13	2.14	0.01	0.63	12.35
1973-74	1.37	1.41	2.95	1.94	1.35	1.32	1.40	3.36	1.82	1.80	1.01	0.62	20.35
1974-75	0.80	0.12	1.10	1.31	1.56	1.08	1.50	1.27	1.50	1.40	1.08	4.26	16.98
1975-76	1.18	2.96	0.85	1.39	0.91	1.12	0.34	1.92	1.90	2.49	1.49	3.42	19.97
1976-77	0.96	0.62	0.73	0.86	0.83	0.71	1.40	0.41	2.90	0.52	3.60	1.50	15.04
1977-78	2.84	0.56	1.62	4.10	2.15	0.99	0.72	2.54	3.56	2.63	3.90	3.34	28.95
1978-79	1.90	0.15	0.96	0.91	1.70	1.45	0.82	2.33	2.67	1.23	0.40	1.79	16.31
1979-80	1.03	1.75	0.50	1.03	1.53	2.03	0.97	1.88	5.48	3.89	1.08	2.45	23.62
1980-81	1.20	0.83	0.78	2.58	1.81	1.85	2.17	1.75	3.86	4.70	1.17	0.96	23.66
1981-82	0.77	0.56	1.49	1.91	2.38	1.48	1.16	1.60	1.25	2.41	2.06	1.17	18.24
1982-83	2.37	0.75	1.39	1.60	0.93	0.85	1.71	2.41	1.20	2.96	3.66	1.16	20.99
1983-84	1.70	1.13	1.96	2.57	0.80	2.19	1.81	1.93	2.91	2.07	0.31	0.55	19.93
1984-85	2.15	2.25	1.40	1.29	0.31	1.28	0.90	1.31	2.81	1.89	0.35	1.62	17.56
1985-86	5.35	1.55	1.61	0.51	2.39	2.33	0.50	1.34	2.92	1.83	2.09	0.81	23.23
1986-87	3.63	0.80	1.78	0.63	0.38	0.46	3.47	1.15	1.89	1.95	4.85	0.98	21.97
1987-88	0.81	0.12	0.91	1.18	0.98	1.03	0.77	1.36	3.60	1.98	1.07	0.13	13.94
1988-89	2.30	0.62	1.39	1.69	1.39	1.48	2.29	1.09	2.70	2.05	2.70	3.69	23.39
1989-90	1.50	2.29	3.75	1.92	0.96	1.00	1.76	1.63	3.74	2.68	2.34	2.44	26.01
1990-91	T	2.32	1.37	2.60	1.41	0.41	0.72	1.21	2.72	5.36	0.77	1.15	20.04
1991-92	0.80	0.75	2.26	0.58	1.17	0.61	0.83	1.18	1.65	5.34	2.24	0.94	18.35
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	14.62
1994-95	0.46	2.12	1.89	1.07	1.17	0.90	2.33	2.25	1.44	5.63	1.91	1.47	22.64
1995-96	1.21	2.75	2.33	1.91	2.22	1.18	1.19	3.32	4.58	2.05	0.95	0.80	24.49
1996-97	2.67	1.58	3.99	3.52	1.50	1.62	1.18	1.69	2.62	3.41	0.99	1.94	26.71
1997-98	2.36	0.94	0.33	0.42	0.77	0.33	2.64	1.80	5.14	4.64	1.18	0.72	21.27
1998-99	1.48	0.71	1.11	1.47	1.05	1.18	0.90	0.55	1.32	2.74	1.63	1.93	16.07
1999-00	0.36	1.72	2.33	1.08	1.46	1.81	1.30	2.21	0.89	1.80	0.84	0.35	16.15
2000-01	1.40	1.23	0.62	1.23	0.75	1.54	1.03	2.62	0.57	3.29	0.91	0.54	15.73
2001-02	0.32	1.80	1.44	0.59	1.21	1.66	1.48	0.91	2.72	2.39	1.45	1.44	17.41
MEAN	1.54	1.38	1.55	1.59	1.46	1.18	1.19	1.52	2.31	2.95	1.59	1.50	19.75
	SEPT	OCT	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	TOTAL

Mean precipitation for all crop years = 19.75

SHORT WEATHER SUMMARY FOR CURRENT CROP YEAR: SEPTEMBER 2001 - AUGUST 2002

PRECIPITATION INFORMATION

MONTH	CURRENT YR. YR 2001-02	1949-02 AVG.	ACCUM. FOR YR.	1949-01 AVG.ACCUM.	Dev. Norm.
SEPT 2001	0.32	1.54	0.32	1.56	-1.24
OCT 2001	1.80	1.38	2.12	2.94	-0.82
NOV 2001	1.44	1.55	3.56	4.49	-0.93
DEC 2001	0.59	1.59	4.15	6.08	-1.93
JAN 2002	1.21	1.44	5.36	7.54	-2.18
FEB 2002	1.66	1.14	7.02	8.68	-1.64
MAR 2002	1.48	1.16	8.50	9.84	-1.32
APR 2002	0.91	1.52	9.41	11.43	-2.02
MAY 2002	2.72	2.31	12.13	13.74	-1.61
JUNE 2002	2.39	2.95	14.52	16.69	-2.17
JULY 2002	1.45	1.59	15.97	18.28	-2.31
AUG 2002	1.44	1.50	17.41	19.78	-2.37

TEMPERATURE EXTREMES

MONTH	MAXIMUM TEMP (F.)	MINIMUM TEMP (F.)
SEPT	84.0	30.0
OCT	74.0	20.0
NOV	58.0	19.0
DEC	44.0	11.0
JAN	48.0	5.0
FEB	48.0	-8.0
MAR	51.0	-9.0
APR	62.0	8.0
MAY	86.0	24.0
JUNE	87.0	37.0
JULY	95.0	42.0
AUG	85.0	36.0

GROWING DEGREE DAYS SUMMARY FOR 1998 - 2001

Calculated on Base 50:

Crop Year	April	May	June	July	August	Sept.	Oct.	Total	Base
1998	no data	267.5	235.5	567.5	517.0	375.5	85.5	2048.5	Base 50
1999	no data	163.5	256.5	411.5	499.5	270.0	91.0	1692.0	Base 50
2000	109.50	193.0	286.5	464.5	487.5	241.5	95.0	1782.5	Base 50
2001	65.50	260.5	262.5	454.5	500.0	370.0	80.5	1993.5	Base 50
2002	59.00	148.0	307.5	539.0	405.0	286.5	84.0	1829.0	
Mean 49-01									
Base 50	78.0	232.6	328.3	478.3	459.8	281.9	104.1	1840.8	

Calculated on Base 32: Records using base 32 initiated April 2001.

Crop Year	April	May	June	July	August	Sept.	Oct.	Total	
2001	341.0	668.0	685.0	960.0	997.0	759.5	354.0	4764.5	Base 32
2002	342.5	494.5	769.5	1075.0	879.5	679.0	337.5	4577.5	Base 32
Mean 01-02									
Base 32	341.8	581.3	727.3	1017.5	938.3	719.3	345.8	4671.0	

Table 6. Precipitation by Day for Crop Year September 2001 - August 2002
Northwest Agriculture Research Center, Kalispell Montana

DATE	SEPT. 2001	OCT. 2001	NOV. 2001	DEC. 2001	JAN. 2002	FEB. 2002	MAR. 2002	APR. 2002	MAY 2002	JUNE 2002	JULY 2002	AUG. 2002	
1			0.11			0.02	0.07	0.12	0.06	0.10			
2						T		0.13		0.12			
3				0.07	0.09								
4					0.03								
5									0.08	0.02		0.29	
6	0.04			0.09	0.09		0.18		0.16	0.10		0.11	
7	0.14			0.05	0.02		0.28		0.11			0.08	
8						0.19	0.04	0.08	0.01	0.21	0.17		
9					T	0.14	0.03			0.35	1.10		
10		T					0.01	0.15		0.08			
11		0.35		0.03			T			T			
12				0.01	0.02		0.04			0.07			
13		0.32		0.11				0.07					
14				0.03			0.03	0.24	0.01				
15							0.01						
16							0.07	T					
17			0.09					0.03					
18		T	0.05		0.10					0.26	0.04		
19		0.03		0.02	0.06		0.08			0.27			
20				T			0.57		T	0.02			
21			0.02	0.06	0.08		0.06	0.08	0.18			0.03	
22		0.11	0.05	0.02	T	0.07			1.16				
23		0.35	0.49		0.03	0.06			0.25	0.23			
24			0.45			0.26		0.01		0.03	0.05		
25		0.03				T							
26	0.01	0.17	0.04		0.18			T	0.16				
27				T	0.01	0.80	0.01		0.32			0.04	
28	0.03	T		T	T	0.12			0.12	0.14	0.09		
29	0.10	0.01	0.14	0.10					0.10	0.19			
30		0.19			0.25					0.20			
31		0.24			0.25							0.89	
													YTD
TOTAL	0.32	1.80	1.44	0.59	1.21	1.66	1.48	0.91	2.72	2.39	1.45	1.44	17.41

Table 7. Frost free period at the Northwestern Agricultural Research Center from 1950 - 2002

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
1995	May 27	32	Sept. 21	22	117
1996	May 21	31	Sept. 23	27	125
1997	May 21	32	Oct. 8	30	140
1998	May 19	31	Oct. 5	30	139
1999	June 7	30	Sept. 12	29	96
2000	June 1	32	Sept. 22	32	112
2001	May 20	30	Sept. 29	32	131
2002	May 23	32	Sept. 21	30	120
Mean for years	May 23	30	Sept. 12	29	115

Table 8. **Temperature Extremes at the Northwestern Agricultural Research Center January 1950 - August 2002**

Year	Minimum		Maximum	
	Date	Degrees Fahrenheit	Date	Degrees Fahrenheit
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
1995	Jan. 4	-11	Aug. 6	88
1996	Jan. 31	-32	July 19	91
1997	Jan. 13	-14	Aug. 4	92
1998	Jan. 12	-20	Aug. 6 & 7	92
1999	Jan. 24 & 25	2	Aug. 4	92
2000	Dec. 21	-9	July 23	96
2001	Feb. 8	-9	Aug. 18	92
2002	Mar. 8	-9	July 14	95

Table 9. Summary of Temperature Records at the Northwestern Agricultural Research Center
January 1950 - December 2002

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
1995	23.6	33.7	33.1	42.6	51.6	56.3	63.1	59.5	54.9	41.1	34.9	26.7	43.4
1996	17.4	24.0	29.0	43.2	46.6	58.5	65.4	62.5	52.3	42.1	27.3	19.8	40.7

1997	19.8	28.0	32.3	38.3	52.3	57.8	62.8	63.8	55.6	43.7	33.0	27.9	42.9
1998	25.1	33.0	34.9	44.5	54.1	56.0	68.4	65.6	59.7	42.3	37.0	27.4	45.7
1999	30.4	32.2	37.5	41.6	48.8	55.8	60.9	65.5	51.3	42.9	38.1	31.0	44.7
2000	25.8	26.3	36.9	43.4	50.4	56.2	63.9	63.4	52.0	33.5	27.5	18.4	41.5
2001	24.0	20.6	33.6	40.5	53.4	54.8	63.1	64.6	57.3	42.0	36.6	27.0	43.1
2002	27.2	27.5	25.0	41.6	47.5	57.7	67.2	60.4	54.4	32.6	30.6	28.8	41.7
MEAN	22.6	27.6	33.7	43.1	51.6	58.1	64.0	63.1	53.7	43.1	32.6	25.4	43.2

YEAR 2002 - GROWING DEGREE DAYS APRIL THROUGH OCTOBER 2002

Calculated at Both Base 50 and Base 32

April	MAX	MIN	Base 50	Base 32
1	58	27	4.0	13.0
2	28	8	0.0	0.0
3	35	15	0.0	1.5
4	43	18	0.0	5.5
5	55	26	2.5	11.5
6	59	36	4.5	15.5
7	54	43	2.0	16.5
8	54	35	2.0	12.5
9	53	31	1.5	10.5
10	48	33	0.0	8.5
11	57	40	3.5	16.5
12	56	41	3.0	16.5
13	57	43	3.5	18.0
14	53	43	1.5	16.0
15	63	35	6.5	17.0
16	45	31	0.0	6.5
17	46	26	0.0	7.0
18	52	28	1.0	10.0
19	53	26	1.5	10.5
20	55	25	2.5	11.5
21	58	27	4.0	13.0
22	50	40	0.0	13.0
23	56	30	3.0	12.0
24	41	26	0.0	4.5
25	50	28	0.0	9.0
26	51	34	0.5	10.5
27	54	33	2.0	11.5
28	52	35	1.0	11.5
29	56	37	3.0	14.5
30	62	39	6.0	18.5

AV MAX	AV MIN	AV GDD Base 50	AV GDD Base 32
51.8	30.3	59.0	342.5

May	MAX	MIN	Base 50	Base 32
1	54	27	2.0	11.0
2	58	33	4.0	13.5
3	66	41	8.0	21.5
4	55	36	2.5	13.5
5	46	36	0.0	9.0
6	45	35	0.0	8.0
7	45	29	0.0	6.5
8	37	29	0.0	2.5
9	46	24	0.0	7.0
10	53	25	1.5	10.5
11	57	30	3.5	12.5
12	61	32	5.5	14.5
13	67	33	8.5	18.0
14	73	45	11.5	27.0
15	55	31	2.5	11.5
16	60	36	5.0	16.0
17	59	33	4.5	14.0
18	60	34	5.0	15.0
19	68	39	9.0	21.5
20	86	39	18.0	30.5
21	69	47	9.5	26.0
22	48	39	0.0	11.5
23	44	32	0.0	6.0
24	48	34	0.0	9.0
25	58	40	4.0	17.0
26	60	44	5.0	20.0
27	60	47	5.0	21.5
28	66	48	8.0	25.0
29	66	49	8.0	25.5
30	68	51	9.5	27.5
31	66	42	8.0	22.0

AV MAX	AV MIN	AV GDD Base 50	AV GDD Base 32
57.9	36.8	148.0	494.5

June	MAX	MIN	Base 50	Base 32
1	71	43	10.5	25.0
2	62	47	6.0	22.5
3	63	44	6.5	21.5
4	67	42	8.5	22.5
5	70	48	10.0	27.0
6	67	49	8.5	26.0
7	62	37	6.0	17.5
8	60	39	5.0	17.5
9	46	38	0.0	10.0
10	52	42	1.0	15.0
11	53	41	1.5	15.0
12	58	42	4.0	18.0
13	70	41	10.0	23.5
14	80	42	15.0	29.0
15	79	47	14.5	31.0
16	80	57	18.5	36.5
17	69	49	9.5	27.0
18	57	45	3.5	19.0
19	60	36	5.0	16.0
20	72	41	11.0	24.5
21	71	43	10.5	25.0
22	73	49	11.5	29.0
23	81	57	19.0	37.0
24	74	46	12.0	28.0
25	78	47	14.0	30.5
26	81	51	16.0	34.0
27	87	51	18.5	36.5
28	86	63	24.5	42.5
29	77	56	16.5	34.5
30	70	51	10.5	28.5

AV MAX	AV MIN	AV GDD Base 50	AV GDD Base 32
69.2	46.1	307.5	769.5

July	MAX	MIN	Base 50	Base 32
1	69	48	9.5	26.5
2	69	43	9.5	24.0
3	74	42	12.0	26.0
4	79	51	15.0	33.0
5	79	42	14.5	28.5
6	71	44	10.5	25.5
7	87	44	18.0	33.0
8	87	54	20.0	38.0
9	65	48	7.5	24.5
10	75	48	12.5	29.5
11	84	51	17.5	35.5
12	88	55	20.5	38.5
13	91	55	20.5	38.5
14	95	64	25.0	43.0
15	90	54	20.0	38.0
16	87	57	21.5	39.5
17	85	57	21.0	39.0
18	90	57	21.5	39.5
19	91	63	24.5	42.5
20	82	54	18.0	36.0
21	82	48	16.0	33.0
22	83	50	16.5	34.5
23	85	53	19.0	37.0
24	85	57	21.0	39.0
25	88	53	19.5	37.5
26	86	60	23.0	41.0
27	81	59	20.0	38.0
28	77	56	16.5	34.5
29	75	62	18.5	36.5
30	72	59	15.5	33.5
31	79	49	14.5	32.0

AV MAX	AV MIN	AV GDD Base 50	AV GDD Base 32
81.6	52.8	539.0	1075.0

Aug	MAX	MIN	Base 50	Base 32
1	80	36	15.0	26.0
2	75	44	12.5	27.5
3	76	38	13.0	25.0
4	77	45	13.5	29.0
5	72	48	11.0	28.0
6	68	49	9.0	26.5
7	64	41	7.0	20.5
8	67	44	8.5	23.5
9	68	43	9.0	23.5
10	79	47	14.5	31.0
11	82	47	16.0	32.5
12	77	49	13.5	31.0
13	80	45	15.0	30.5
14	86	51	18.5	36.5
15	85	41	17.5	31.0
16	80	47	15.0	31.5
17	68	36	9.0	20.0
18	76	41	13.0	26.5
19	76	39	13.0	25.5
20	78	43	14.0	28.5
21	79	48	14.5	31.5
22	71	45	10.5	26.0
23	73	41	11.5	25.0
24	78	46	14.0	30.0
25	80	51	15.5	33.5
26	76	46	13.0	29.0
27	75	49	12.5	30.0
28	76	44	13.0	28.0
29	81	47	15.5	32.0
30	81	45	15.5	31.0
31	74	49	12.0	29.5

AV MAX	AV MIN	AV GDD Base 50	AV GDD Base 32
76.1	44.7	405.0	879.5

Sept	MAX	MIN	GDD	
1	78	51	14.5	32.5
2	72	45	11.0	26.5
3	75	48	12.5	29.5
4	74	47	12.0	28.5
5	79	52	15.5	33.5
6	70	48	10.0	27.0
7	64	50	7.0	25.0
8	61	45	5.5	21.0
9	64	40	7.0	20.0
10	68	38	9.0	21.0
11	75	40	12.5	25.5
12	77	40	13.5	26.5
13	79	40	14.5	27.5
14	82	41	16.0	29.5
15	80	40	15.0	28.0
16	80	43	15.0	29.5
17	72	47	11.0	27.5
18	58	45	4.0	19.5
19	62	40	6.0	19.0
20	72	41	11.0	24.5
21	65	30	7.5	16.5
22	60	30	5.0	14.0
23	67	31	8.5	17.5
24	69	34	9.5	19.5
25	69	31	9.5	18.5
26	62	32	6.0	15.0
27	64	37	7.0	18.5
28	60	29	5.0	14.0
29	61	30	5.5	14.5
30	51	29	0.5	9.5

AV MAX	AV MIN	AV GDD Base 50	AV GDD Base 32
69.0	39.8	286.5	679.0

OCT.	MAX	MIN	GDD	
1	52	36	1.0	12.0
2	54	26	2.0	11.0
3	54	27	2.0	11.0
4	52	37	1.0	12.5
5	56	37	3.0	14.5
6	59	44	4.5	19.5
7	68	46	9.0	25.0
8	67	34	8.5	18.5
9	63	34	6.5	16.5
10	66	34	8.0	18.0
11	58	27	4.0	13.0
12	43	18	0.0	5.5
13	48	18	0.0	8.0
14	56	18	3.0	12.0
15	55	22	2.5	11.5
16	56	22	3.0	12.0
17	26	23	0.0	0.0
18	61	23	5.5	14.5
19	62	23	6.0	15.0
20	62	23	6.0	15.0
21	60	24	5.0	14.0
22	57	24	3.5	12.5
23	47	13	0.0	7.5
24	44	11	0.0	6.0
25	44	11	0.0	6.0
26	47	13	0.0	7.5
27	48	12	0.0	8.0
28	45	20	0.0	6.5
29	41	22	0.0	4.5
30	25	2	0.0	0.0
31	26	1	0.0	0.0

AV MAX	AV MIN	AV GDD Base 50	AV GDD Base 32
51.7	23.4	84.0	337.5

Table 11. Summary of growing degree day (GDD) data at the Northwestern Agricultural Research Center, May 1, 1949 - October 2002. GDD = Temp Max + Temp Min:2-50 (Base 50)
Max Temp> 86°F substituted with 86; Min Temo < 50°F substituted with 50
Average growing degree days by month and year.

YEAR	APRIL	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
1995		219.5	275.0	427.5	381.5	303.5	39.0	1646.0
1996		91.5	322.0	498.0	435.5	214.5	108.5	1670.0
1997		229.0	295.5	423.0	465.5	280.5	69.5	1763.0
1998		267.5	235.5	567.5	517.0	375.5	85.5	2048.5
1999		163.5	256.5	411.5	499.5	270.0	91.0	1692.0
2000	109.5	193.0	286.5	464.5	487.5	241.5	95.0	1877.5
2001	65.5	260.5	262.5	454.5	500.0	370.0	80.5	1993.5
2002	59.0	148.0	307.5	539.0	405.0	286.5	84.0	1290.0
MEAN	78.0	235.3	334.1	478.3	459.8	282.8	103.9	1876.2

Base 50 Mean Growing Degree Days for All Years : 1876.2

Table 11A. Summary of growing degree day (GDD) data at the Northwestern Agricultural Research Center, April 1, 2001 through October 31, 2002. GDD = Temp Max + Temp Min : 2 - 32
Max Temp > 86F substituted with 86; Min Temp < 32F substituted with 32

	Average growing degree days by month and year.							
YEAR	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	TOTAL
2001	341.0	668.0	685.0	960.0	997.0	759.5	354.0	4764.5
2002	342.5	494.5	769.5	1075.0	879.5	679.0	337.5	
Average	341.8	581.3	727.3	1017.5	938.3	719.3		

Table 12. Summary of snow data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 2002: Average snow accumulation by month and year

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	TOTAL
1949-50	0.00	0.00	1.50	17.40	25.20	7.30	4.00	0.00	0.00	0.00	0.00	0.00	55.40
1950-51	0.00	0.00	4.00	7.00	15.10	14.80	7.80	10.00	T	0.00	0.00	0.00	58.70
1951-52	0.00	5.50	6.60	47.20	0.00	10.00	1.80	0.00	T	0.00	0.00	0.00	71.10
1952-53	0.00	0.00	1.00	7.00	8.40	13.10	0.00	0.00	0.00	0.00	0.00	0.00	29.50
1953-54	0.00	0.00	0.00	9.30	30.90	5.00	5.60	4.00	0.00	0.00	0.00	0.00	54.80
1954-55	0.00	0.00	2.00	2.50	16.30	13.10	4.50	0.00	0.00	0.00	0.00	0.00	38.40
1955-56	0.00	T	14.60	18.40	21.50	19.20	3.20	0.00	0.00	0.00	0.00	0.00	76.90
1956-57	0.00	1.50	2.10	3.40	20.50	15.50	0.00	0.00	0.00	0.00	0.00	0.00	43.00
1957-58	0.00	0.30	5.50	3.70	0.00	27.10	6.20	0.00	0.00	0.00	0.00	0.00	42.80
1958-59	0.00	0.00	2.10	21.50	13.70	15.10	0.00	0.00	0.00	0.00	0.00	0.00	52.40
1959-60	0.00	0.00	27.80	0.00	0.00	16.50	4.50	0.00	0.00	0.00	0.00	0.00	48.80
1960-61	0.00	0.00	1.60	13.40	5.40	1.80	0.00	0.00	0.00	0.00	0.00	0.00	22.20
1961-62	0.00	5.00	20.00	23.50	17.90	8.60	3.80	0.00	0.00	0.00	0.00	0.00	78.80
1962-63	0.00	0.00	0.00	2.70	24.70	8.60	2.00	4.00	0.00	0.00	0.00	0.00	42.00
1963-64	0.00	0.00	1.40	16.80	16.90	5.30	15.00	0.40	2.00	0.00	0.00	0.00	57.80
1964-65	0.00	T	8.10	19.30	17.20	8.00	3.40	1.50	T	0.00	0.00	0.00	57.50
1965-66	T	0.00	3.00	0.00	0.00	9.00	0.70	0.00	0.00	0.00	0.00	0.00	12.70
1966-67	0.00	0.00	19.30	12.00	7.80	6.00	9.30	0.00	0.00	0.00	0.00	0.00	54.40
1967-68	0.00	0.00	5.70	11.00	9.30	2.10	0.00	2.70	0.00	0.00	0.00	0.00	30.80
1968-69	0.00	0.00	7.50	21.00	28.80	8.70	3.00	0.00	0.00	0.00	0.00	0.00	69.00
1969-70	0.00	4.00	1.50	10.30	29.20	5.50	7.50	0.00	0.00	0.00	0.00	0.00	58.00
1970-71	T	0.00	8.50	9.50	0.00	4.00	3.50	T	0.00	0.00	0.00	0.00	25.50
1971-72	0.00	3.00	5.50	18.40	15.50	9.20	8.00	4.00	0.00	0.00	0.00	0.00	63.60
1972-73	0.50	4.50	6.00	8.30	4.50	T	T	0.00	0.00	0.00	0.00	0.00	23.80
1973-74	0.00	0.00	9.50	0.00	6.40	6.00	8.00	T	0.00	0.00	0.00	0.00	29.90
1974-75	0.00	0.00	0.00	10.00	22.70	15.75	12.70	0.00	0.00	0.00	0.00	0.00	61.15
1975-76	0.00	3.00	8.75	16.00	15.25	4.50	0.75	0.00	0.00	0.00	0.00	0.00	48.25
1976-77	0.00	0.00	1.00	5.00	13.00	2.50	11.75	2.00	0.00	0.00	0.00	0.00	35.25
1977-78	0.00	0.00	16.50	48.05	30.10	16.50	6.00	1.50	0.00	0.00	0.00	0.00	118.65
1978-79	0.00	0.00	9.60	18.85	22.35	19.78	8.12	3.10	0.00	0.00	0.00	0.00	81.80
1979-80	0.00	0.00	1.65	4.30	14.30	9.05	9.05	0.05	0.00	0.00	0.00	0.00	38.40
1980-81	0.00	0.00	0.75	9.25	6.00	8.90	3.30	0.00	1.75	0.00	0.00	0.00	29.95
1981-82	0.00	0.00	0.50	19.13	25.70	7.60	4.30	4.00	0.00	0.00	0.00	0.00	61.23
1982-83	0.00	0.00	6.25	17.15	6.40	5.20	0.75	0.00	0.00	0.00	0.00	0.00	35.75
1983-84	0.00	0.00	3.85	28.00	8.60	4.80	0.50	0.00	0.05	0.00	0.00	0.00	45.80
1984-85	0.00	10.55	3.00	17.00	4.25	16.00	5.50	1.00	0.00	0.00	0.00	0.00	57.30
1985-86	0.00	0.00	10.50	7.25	14.50	13.00	3.07	0.00	0.00	0.00	0.00	0.00	48.32
1986-87	0.00	0.00	13.50	4.25	7.00	1.50	13.50	0.00	0.00	0.00	0.00	0.00	39.75
1987-88	0.00	0.00	4.00	11.50	8.50	5.50	4.00	1.00	0.00	0.00	0.00	0.00	34.50
1988-89	0.00	0.00	9.50	15.00	9.50	18.75	6.00	0.00	0.00	0.00	0.00	0.00	58.75
1989-90	0.00	0.00	4.00	15.00	5.50	16.75	8.50	1.00	0.00	0.00	0.00	0.00	50.75
1990-91	0.00	0.00	3.75	32.75	17.00	1.00	1.50	1.00	0.00	0.00	0.00	0.00	57.00
1991-92	0.00	7.25	9.50	3.50	8.75	1.50	0.33	1.00	0.00	0.00	0.00	0.00	31.83
1992-93	0.00	0.00	4.07	23.50	15.00	9.00	1.00	0.00	0.00	0.00	0.00	0.00	52.57
1993-94	0.00	0.00	2.85	9.90	1.50	22.00	0.00	2.00	0.00	0.00	0.00	0.00	38.25
1994-95	0.00	0.50	7.27	13.20	2.04	0.00	9.25	0.50	0.00	0.00	0.00	0.00	32.76
1995-96	0.00	0.00	6.00	10.50	23.30	1.00	13.25	0.00	0.00	0.00	0.00	0.00	54.05
1996-97	0.00	1.50	37.00	42.80	12.50	21.30	11.30	2.60	0.00	0.00	0.00	0.00	129.00
1997-98	0.00	0.00	0.50	5.01	9.00	2.25	9.50	0.00	0.00	0.00	0.00	0.00	26.26
1998-99	0.00	0.00	0.75	8.00	5.00	5.19	3.25	2.75	0.00	0.00	0.00	0.00	24.94
1999-00	0.00	0.00	0.00	4.00	13.00	12.75	2.38	8.50	0.00	0.00	0.00	0.00	40.63
2000-01	0.00	0.00	4.50	14.25	8.48	19.90	4.50	14.00	0.00	0.00	0.00	0.00	65.63
2001-02	0.00	0.00	4.50	9.05	15.00	9.25	26.75	2.75	2.00	0.00	0.00	0.00	69.30
MEAN	0.01	0.88	6.39	13.69	12.82	9.64	5.33	1.42	0.11	0.00	0.00	0.00	50.29

Mean snowfall for all years = 50.29

Montana Agricultural Research Station
Northwestern Agricultural Research Center
Kalispell, Montana
2002

Mint Stolon Fungicide Study

Kalispell, 2002

Biomass - Fungicide Treated Plots
lbs fresh weight/plot

	Cultivars			
	Black Mitcham	**Murray Mitcham**	**Scotch 213**	
Fungicides				**mean**
Maxim	6.70	0.65	5.95	4.43
Quadris	6.50	1.08	5.25	4.28
Prevail	10.67	0.40	**14.25**	**8.44**
TopsMZ	7.93	1.80	9.50	6.41
TopsMZ+Gaucho	8.60	0.80	10.02	**6.47**
mean	**8.08**	0.95	**8.99**	

LSD(0.05) fungicides = 2.03
LSD(0.05) cultivar = 1.57
LSD(0.10) interaction = 3.52

Biomass - Untreated Plots
lbs fresh weight/plot

	Cultivars			
	Black Mitcham	**Murray Mitcham**	**Scotch 213**	
Fungicides				**mean**
Maxim	5.28	0.40	7.50	4.39
Quadris	5.70	0.55	8.03	4.76
Prevail	9.75	0.10	7.30	5.72
TopsMZ	5.43	1.90	6.28	4.53
TopsMZ+Gaucho	5.68	0.25	6.35	4.09
mean	6.37	0.64	7.09	

LSD(0.05) fungicides - NS
LSD(0.05) cultivar = 1.76
LSD(0.05) interaction - NS

Biomass - Treated-Untreated
lbs fresh weight/plot

	Cultivars			
	Black Mitcham	**Murray Mitcham**	**Scotch 213**	
Fungicides				**mean**
Maxim	1.43	0.25	-1.55	0.04
Quadris	0.80	0.53	-2.78	-0.48
Prevail	0.92	0.30	**6.95**	**2.72**
TopsMZ	2.50	-0.10	3.23	**1.88**
TopsMZ+Gaucho	2.93	0.55	**3.67**	**2.38**
mean	**1.71**	0.31	**1.90**	

LSD(0.05) fungicides = 2.04
LSD(0.05) cultivar = 1.58
LSD(0.05) interaction = 3.54

Montana Agricultural Research Station
Northwestern Agricultural Research Center
Kalispell, Montana
2002

Dill Planting X Nitrogen X Harvest

Dill Oil Yield (lbs/a)

	N-Rate (lbs/a)				
Planting Date	0	50	100	150	mean
4/16/2002	13.6	18.6	24.0	17.7	**18.5**
5/1/2002	8.6	9.9	11.1	11.0	10.2
5/15/2002	14.1	15.7	17.2	17.9	**16.2**
					LSD(0.10)PD=4.5
mean	12.1	**14.7**	**17.4**	**15.5**	LSD(0.10)NR=3.5

	Harvest ~days after planting				
Planting Date	120	125	130	135	mean
4/16/2002	13.6	**23.9**	**24.1**	12.4	18.5
5/1/2002	13.7	5.4	6.6	15.0	10.2
5/15/2002	**19.4**	15.5	15.0	15.0	16.2
mean	15.5	14.9	15.2	14.1	LSD(0.10)PDxHD=5.2

Day After Planting (approx.)	Appearance
120	early bud
125	green bud swelling
130	light tan
135	browning

PROJECT TITLE: Intrastate Alfalfa Yield Trials – Dryland and Irrigated

PROJECT COOPERATORS: Duane Johnson and Louise Strang, NWARC
Dennis Cash, MSU Bozeman

OBJECTIVE: Evaluate new alfalfa cultivars for yield potential in Northwest Montana in comparison with standard cultivars

RESULTS: Alfalfa varieties were planted at dryland sites in spring of 2000 and 2002 and at irrigated sites in spring of 2000, 2001, and 2002. The 2000 and 2001 trials were harvested three times and the 2002 trials were harvested twice. All were fertilized with 13 lbs/a N + 62 lbs/a P_2O_5.

The 2000 dryland trial averaged 4.74 t/a of forage dry matter for the season (Table 1). Total yield from 2000 to 2002 averaged 11.03 t/a, with 'Cooper' yielding 13.34 t/a. The new 2002 dryland trial produced an average of 1.59 t/a for its initial season, with 'HybriForce 400' producing 2.49 t/a (Table 2).

The entries in the 2000 irrigated trial averaged 9.48 t/a for the 2002 season. 'ZX9450A'. 'Millennia', and 'Masterpiece' were the leading producers. Total yield from 2000-2002 averaged 19.42 t/a (Table 3). The entries in the 2001 irrigated trial averaged 8.97 t/a for the year and 11.86 t/a for the 2 years of the study. 'DK A42-15' produced the most forage (Table 4). The first year of the 2002 irrigated trial averaged 2.75 t/a, with HybriForce 400, 'DS9809 HYB exp.', and Cooper producing over 2.9 t/a (Table 5).

Table 1. 2002 Summary of the 2000 Dryland Intrastate Alfalfa Yield Trial
Kalispell, 2002

Cultivar	6/27/2002 Harvest-1	7/30/2002 Harvest-2	10/1/2002 Harvest-3	2002 Total	2001 Total	2000 Total	Total 2000-2002	%Mean
	t/a	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*	
Cooper	**3.79**	**1.62**	**1.17**	**6.58**	5.85	0.91	**13.34**	121
Plumas	**3.74**	**1.55**	**1.14**	**6.43**	5.75	0.88	**13.05**	118
Select	**3.62**	**1.48**	**0.96**	**6.06**	5.78	**1.05**	**12.89**	117
5246	**3.59**	**1.57**	**0.86**	**6.02**	5.45	0.92	**12.38**	112
Ultra Eureka	**3.67**	**1.33**	**0.85**	**5.85**	5.52	0.90	**12.27**	111
Wrangler	**3.68**	**1.30**	**0.76**	**5.73**	5.62	0.91	**12.27**	111
Ladak 65	**3.64**	**1.28**	**0.72**	**5.63**	5.22	0.82	**11.67**	106
Shaw	**3.50**	**0.90**	0.49	**4.89**	5.52	**1.13**	**11.54**	105
ZX9450A	**3.16**	**0.98**	0.51	**4.64**	5.48	0.93	**11.05**	100
53V08	**2.76**	**1.20**	**0.79**	**4.75**	5.28	0.82	**10.85**	98
Masterpiece	**2.49**	**1.03**	**0.63**	**4.15**	5.68	0.83	10.67	97
Riley	**2.69**	**1.12**	**0.76**	**4.57**	5.18	0.90	10.65	97
631	**3.03**	**0.90**	0.34	**4.26**	4.94	0.93	10.13	92
4200	**2.51**	**1.18**	**0.68**	**4.36**	4.90	0.85	10.11	92
Millennia	2.20	0.57	0.19	2.95	5.30	**1.08**	9.33	85
WinterCrown	2.17	0.65	0.23	3.04	5.08	**1.05**	9.17	83
AmeriGraze 401+Z	2.00	0.53	0.18	2.72	5.20	0.87	8.78	80
Innovator +Z	2.02	0.49	0.10	2.61	4.86	0.85	8.32	75
mean	3.01	1.09	0.63	4.74	5.37	0.92	11.03	
LSD(0.05)	1.58	0.75	0.56	2.77	NS	0.19	2.59	
CV(s/mean) %	36.9	48.6	62.3	41.1	11.0	14.2	15.7	

Table 1. 2002 Summary of the 2000 Dryland Intrastate Alfalfa Yield Trial
Kalispell, 2002

Cultivar	6/27/2002 Harvest-1	7/30/2002 Harvest-2	10/1/2002 Harvest-3	2002 Total	2001 Total	2000 Total	Total 2000-2002	%Mean
	t/a	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*	
Cooper	**3.79**	**1.62**	**1.17**	**6.58**	5.85	0.91	**13.34**	121
Plumas	**3.74**	**1.55**	**1.14**	**6.43**	5.75	0.88	**13.05**	118
Select	**3.62**	**1.48**	**0.96**	**6.06**	5.78	**1.05**	**12.89**	117
5246	**3.59**	**1.57**	**0.86**	**6.02**	5.45	0.92	**12.38**	112
Ultra Eureka	**3.67**	**1.33**	**0.85**	**5.85**	5.52	0.90	**12.27**	111
Wrangler	**3.68**	**1.30**	**0.76**	**5.73**	5.62	0.91	**12.27**	111
Ladak 65	**3.64**	**1.28**	**0.72**	**5.63**	5.22	0.82	**11.67**	106
Shaw	**3.50**	**0.90**	0.49	**4.89**	5.52	**1.13**	**11.54**	105
ZX9450A	**3.16**	**0.98**	0.51	**4.64**	5.48	0.93	**11.05**	100
53V08	**2.76**	**1.20**	**0.79**	**4.75**	5.28	0.82	**10.85**	98
Masterpiece	**2.49**	**1.03**	**0.63**	**4.15**	5.68	0.83	10.67	97
Riley	**2.69**	**1.12**	**0.76**	**4.57**	5.18	0.90	10.65	97
631	**3.03**	**0.90**	0.34	**4.26**	4.94	0.93	10.13	92
4200	**2.51**	**1.18**	**0.68**	**4.36**	4.90	0.85	10.11	92
Millennia	2.20	0.57	0.19	2.95	5.30	**1.08**	9.33	85
WinterCrown	2.17	0.65	0.23	3.04	5.08	**1.05**	9.17	83
AmeriGraze 401+Z	2.00	0.53	0.18	2.72	5.20	0.87	8.78	80
Innovator +Z	2.02	0.49	0.10	2.61	4.86	0.85	8.32	75
mean	3.01	1.09	0.63	4.74	5.37	0.92	11.03	
LSD(0.05)	1.58	0.75	0.56	2.77	NS	0.19	2.59	
CV(s/mean) %	36.9	48.6	62.3	41.1	11.0	14.2	15.7	

Table 2. 2002 Summary of the 2002 Dryland Intrastate Alfalfa Yield Trial
Kalispell, 2002

Cultivar	Height	Stand	7/30/2002 Harvest-1	10/1/2002 Harvest-2	Total	%Mean
	in	*% of plot*	*t/a*	*t/a*	*t/a*	
HybriForce 400	25	**98**	**1.19**	**1.30**	**2.49**	156.6
6420	22	**95**	**1.17**	0.75	**1.92**	120.8
Shaw	25	94	**1.20**	0.67	**1.87**	117.6
Wrangler	24	91	**0.99**	0.86	**1.85**	116.4
WL 319HQ	22	**98**	**1.24**	0.61	**1.85**	116.4
ZD 0130 exp.	22	**100**	**0.95**	0.77	1.72	108.2
Plumas	22	**99**	**1.03**	0.65	1.68	105.7
Rebel	22	**96**	**0.92**	0.60	1.53	96.2
DS9809 HYB exp.	22	**95**	**0.88**	0.50	1.38	86.8
Rugged	22	**99**	**0.95**	0.41	1.35	84.9
FG 3R134 exp.	22	90	0.83	0.47	1.30	81.8
Cooper	22	92	0.71	0.55	1.26	79.2
Ladak 65	20	88	0.75	0.38	1.13	71.1
Ameristand 403T	20	**96**	0.74	0.28	1.01	63.5
mean	22	95	0.97	0.63	1.59	
LSD(0.05)	NS	6	0.34	0.44	0.66	
CV(s/mean) %	9.8	4.2	24.5	49.1	28.9	

Table 3. 2002 Summary of the 2000 Irrigated Intrastate Alfalfa Yield Trial
Kalispell - 2002

Cultivar	*7/1/02* Yield	*7/31/02* Yield	*10/2/02* Yield	2002 Total Yield	2001 Total Yield	2000 Total Yield	2000-02 Total Yield	%Mean
	tons DM/a							
ZX9450A	6.03	**2.82**	**1.79**	**10.63**	**8.15**	**3.05**	**21.82**	112
Millennia	5.99	**2.75**	1.57	**10.31**	**7.63**	**2.90**	**20.83**	107
Plumas	5.41	**2.87**	**1.66**	9.93	**7.77**	**3.03**	**20.72**	107
Masterpiece	5.62	**2.76**	1.62	**9.99**	**7.52**	**2.86**	**20.37**	105
Ultra	5.52	**2.69**	1.60	9.80	**7.60**	**2.87**	**20.27**	104
Select	5.38	2.65	1.58	9.60	**7.60**	**2.97**	20.17	104
Shaw	5.61	2.66	1.49	9.76	7.42	**2.84**	20.02	103
WinterCrown	5.12	**2.86**	**1.71**	9.69	**7.61**	2.65	19.95	103
631	5.25	2.64	**1.63**	9.51	**7.58**	**2.76**	19.85	102
53V08	5.25	**2.85**	1.52	9.62	7.30	2.45	19.36	100
AmeriGraze 401+Z	4.94	2.61	1.57	9.12	**7.56**	2.68	19.36	100
Innovator +Z	5.49	2.60	1.48	9.56	7.08	2.68	19.32	100
4200	5.11	**2.85**	1.53	9.48	7.18	2.59	19.25	99
Cooper	4.91	**2.68**	1.57	9.16	7.31	2.68	19.15	99
5246	5.59	2.37	1.43	9.39	6.69	2.17	18.25	94
Wrangler	4.87	2.21	1.25	8.32	6.33	2.38	17.02	88
Ladak 65	5.31	2.16	1.08	8.54	5.98	2.34	16.86	87
Riley	4.56	2.24	1.36	8.16	6.29	2.33	16.78	86
mean	5.33	2.62	1.52	9.48	7.25	2.68	19.41	
LSD(0.05)	NS	0.20	0.17	0.69	0.69	0.33	1.63	
CV(s/mean)%	10.9	5.4	8.0	6.7	6.7	8.7	5.9	

Table 4. 2002 Summary of the 2001 Irrigated Intrastate Alfalfa Yield Trial
Kalispell-2002

Cultivar	*7/1/02* Yield	*8/1/02* Yield	*10/7/02* Yield	2002 Total Yield	2001 Total Yield	2001-02 Total Yield	%Mean
	tons DM/acre						
DK A42-15	6.15	**2.44**	**1.68**	**10.27**	2.87	**13.14**	110.8
Shaw	5.71	2.20	**1.71**	**9.61**	**3.16**	**12.77**	107.7
Cooper	5.66	2.10	**1.58**	9.33	**3.15**	**12.48**	105.3
Mariner II	5.54	2.28	**1.63**	**9.46**	**2.99**	**12.44**	104.9
WL 327	5.52	2.24	1.53	9.28	**2.92**	**12.21**	103.0
Alliant	5.52	2.26	1.52	9.30	2.83	**12.13**	102.3
Plumas	5.13	2.24	**1.63**	9.00	**3.08**	12.09	102.0
Goliath	5.34	2.17	1.52	9.03	**3.06**	12.09	102.0
Reliance	5.39	2.19	1.53	9.11	**2.93**	12.04	101.5
WBRR	5.46	2.15	1.53	9.13	2.76	11.90	100.4
Amerstand 403T	5.39	2.13	1.46	8.97	2.81	11.79	99.4
DAK 9901	4.72	**2.30**	**1.67**	8.68	**3.04**	11.73	98.9
Abound	5.10	2.16	1.50	8.75	**2.92**	11.67	98.4
A 30-06	4.97	2.16	1.50	8.63	**2.89**	11.52	97.2
Monument II	5.25	2.11	1.47	8.82	2.67	11.49	96.9
Ascend 552	4.83	2.17	**1.64**	8.63	2.67	11.29	95.2
Ladak 65	5.42	1.79	1.18	8.39	2.63	11.02	92.9
Wrangler	4.85	1.87	1.39	8.11	2.84	10.95	92.4
Riley	4.71	1.82	1.40	7.92	2.62	10.53	88.8
mean	5.30	2.14	1.53	8.97	2.89	11.86	
LSD(0.05)	NS	0.16	0.16	0.90	0.28	1.02	
CV(s/mean)	11.3	5.4	7.2	7.1	6.8	6.1	

Table 5. 2002 Summary of the 2002 Irrigated Intrastate Alfalfa Yield Trial
Kalispell, 2002

Cultivar	*8/2/02* Yield	*10/7/02* Yield	2002 Total Yield	%Mean
	----------tons DM/acre----------			
HybriForce 400	**1.72**	**1.25**	**2.97**	108
DS9809 HYB exp.	**1.76**	**1.21**	**2.96**	108
Cooper	**1.70**	**1.25**	**2.94**	107
Plumas	**1.68**	**1.21**	**2.88**	105
6420	1.61	**1.26**	**2.86**	104
FG 3R134 exp.	**1.64**	**1.19**	**2.83**	103
Shaw	1.60	**1.18**	**2.77**	101
Ameristand 403T	1.62	1.12	2.74	100
Rebel	1.58	**1.15**	2.72	99
WL 319HQ	**1.67**	1.03	2.71	99
Rugged	**1.66**	1.00	2.66	97
ZD 0130 exp.	1.54	1.04	2.59	94
Wrangler	1.52	0.93	2.45	89
Ladak 65	1.54	0.81	2.35	86
mean	1.63	1.11	2.75	
LSD(0.05)	0.14	0.12	0.22	
CV(s/mean) %	6.2	7.5	5.6	

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2002 IRRIGATED INTRASTATE ALFALFA YIELD TRIAL

Cultivar	*8/2/2002* Yield	*10/7/2002* Yield	2002 Total Yield	%Mean
		tons DM/acre		
HybriForce 400	**1.72**	**1.25**	**2.97**	108
DS9809 HYB exp.	**1.76**	**1.21**	**2.96**	108
Cooper	**1.70**	**1.25**	**2.94**	107
Plumas	**1.68**	**1.21**	**2.88**	105
6420	1.61	**1.26**	**2.86**	104
FG 3R134 exp.	**1.64**	**1.19**	**2.83**	103
Shaw	1.60	**1.18**	**2.77**	101
Ameristand 403T	1.62	1.12	2.74	100
Rebel	1.58	**1.15**	2.72	99
WL 319HQ	**1.67**	1.03	2.71	99
Rugged	**1.66**	1.00	2.66	97
ZD 0130 exp.	1.54	1.04	2.59	94
Wrangler	1.52	0.93	2.45	89
Ladak 65	1.54	0.81	2.35	86
mean	1.63	1.11	2.75	
LSD(0.05)	0.14	0.12	0.22	
CV(s/mean) %	6.2	7.5	5.6	

Yield values in **bold** are not significantly different (P=0.05) from the highest yield in the same column.

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2002 Spring Cereal Forage Trial

VARIETY	SPECIES	PLANT HEIGHT	HEADING	YIELD	
		inches	*days from seeding*	*t/a*	
Pronghorn	Triticale	36	62	1.99	
Lewis	Barley	25	73	2.07	
Logan	Barley	25	70	2.69	
MT981060	Barley	20	72	2.15	
Bestford	Barley	23	71	2.17	
BZ 598-227	Barley	28	69	1.89	
Washford	Barley	24	74	2.65	
Westford	Barley	24	71	2.23	
Haybet	Barley	27	70	2.16	
93ST59	SW/SP	32	71	1.51	
Otana	Oat	37	71	2.09	
Rio Grande	Oat	29	62	1.85	
TripleCrown	Oat	31	72	2.64	
Paul	Oat	37	72	2.21	
SK3P	Spelt	37	68	2.50	
Lucile	Emmer	38	67	2.04	
Mean		29	70	2.18	
LSD(0.05)		6	3	0.70	(P=0.33)
CV(s/mean)		12.5	2.8	22.9	

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TIMOTHY TRIAL

CULTIVAR	SPECIES	*6/28/2002* 1st Harvest DM Yld *t/a*	*10/2/2002* 2nd Harvest DM Yld *t/a*	Total 2002 DM Yld *t/a*	2001 DM Yld *t/a*	2000 DM Yld *t/a*	1999 DM Yld *t/a*	1999-2002 TOTAL *t/a*
Colt	Timothy	2.56	0.58	3.14	4.68	5.02	2.61	15.44
TM8903	Timothy	2.75	0.66	3.41	5.31	5.19	2.58	16.49
TM9710-02	Timothy	2.50	0.58	3.07	4.43	5.61	3.69	16.80
Benchmark	Orchardgrass	2.37	0.72	3.09	3.38	6.80	4.06	17.32
Haymate	Orchardgrass	2.42	0.60	3.02	3.75	6.03	3.79	16.58
OG9202	Orchardgrass	2.89	0.71	3.60	4.00	6.91	3.96	18.47
OG9503	Orchardgrass	2.58	0.60	3.19	3.38	6.90	3.70	17.17
mean		2.58	0.63	3.22	4.13	6.06	3.48	16.90
LSD(0.05)		NS	NS	NS	0.67	0.77	0.72	1.59
CV(s/mean)%		17.8	20.6	16.3	10.9	8.5	13.9	7.8

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1999 Montana Perennial Forage Legume Species/Variety Evaluation

Entry	*6/27/2002* 1st Harvest	*8/1/2002* 2nd Harvest	*10/2/2002* 3rd Harvest	2002 Total	1999-2002 Total	%Mean
	tons DM/acre					
RDWY Sainfoin	**5.00**	2.00	0.50	**7.49**	**25.81**	139.2
97-1 Sainfoin	**4.78**	1.82	0.41	**7.01**	**23.30**	125.7
Remont Sainfoin	**5.06**	1.92	0.44	**7.42**	**23.24**	125.4
Alf+Snfn 3+16	**4.31**	**2.33**	**0.74**	**7.37**	22.98	123.9
WYPX 2-94 Sainfoin	**4.93**	1.57	0.20	**6.69**	22.56	121.7
AC Grazeland alfalfa	4.11	1.95	**0.84**	**6.90**	20.74	111.9
Alf+Snfn 3+8	3.64	**2.12**	0.65	**6.41**	20.19	108.9
Ladak 65	4.04	1.63	0.72	**6.39**	20.11	108.5
Windsor Cicer Milkvetch	**5.34**	1.11	0.33	**6.78**	16.93	91.3
Monarch Cicer Milkvetch	**4.87**	1.07	0.18	6.12	15.76	85.0
Lutana Cicer Milkvetch	**4.96**	1.02	0.22	6.19	15.72	84.8
L-2 Synthetic B.Trefoil	2.51	1.19	0.09	3.78	12.11	65.3
Eski Sainfoin	2.69	1.00	0.10	3.79	10.99	59.3
Tretana B.Trefoil	1.88	0.79	0.09	2.75	9.05	48.8
mean	4.15	1.54	0.39	6.08	18.54	
LSD(0.05)	1.04	0.24	0.12	1.15	2.65	
CV(s/mean)x100	17.6	10.8	20.5	13.2	10.0	

Yield values in **bold** are not significantly different (P=0.05) from the highest yield in the same column.

PROJECT TITLE: Sulfur Recommendations for Irrigated Alfalfa

PROJECT COOPERATORS: Duane Johnson and Louise Strang, NWARC
Dennis Cash, MSU Bozeman

OBJECTIVE: Test variable rates of S fertilization on irrigated alfalfa to:
Determine optimum plant S tissue levels for optimum economic yield and safe feeding,
Determine specific plant tissues (leaves vs. whole plants) for monitoring purposes, and
Begin to develop S fertilizer rate recommendations.

METHODS: On 5/2/02 'Shaw' alfalfa was planted at 23 lbs/a in nine 5' x 20' plots with 4 replicates. The plots were harvested 7/31 and 10/3/02. Dried forage samples were analyzed for CP, ADF, NDF, S, Cu, and Zn, and soil was sampled from 3 depths to determine background levels. Fertilizer treatment levels for 2003 were estimated from these data.

PROJECT TITLE: Hulless Oats Cultivar Trial

PROJECT COOPERATORS: Duane Johnson and Louise Strang, NWARC

OBJECTIVE: Evaluate hulless oat cultivars and breeding lines for yield potential in a Northwestern Montana environment.

RESULTS: Twenty-one experimental selections of hulless oat were compared to 6 currently available oat cultivars (both hulled and hulless). The trial was seeded on April 29, 2002 at 60 lbs/a seeding rate.

Experimental design was a randomized complete block with 4 replicates. Plots were fertilized with 13 lbs N/a and 62 lbs P_2O_5/a on 4/12/02. Good stands were obtained. Yields in 2002 ranged from 1759 lbs/a for one of the experimental lines to 3740 lbs/a for 'Monida' (Table 1).

Table 1. Grain Yield of hulless oat lines at Kalispell in 2002.

Cultivar	Yield *lbs/a*	%Mean
Monida	**3740**	176
99Ab12635	2561	121
99Ab12621	2305	109
99Ab12423	2273	107
Provena	2271	107
99Ab12443	2261	107
98Ab7055	2238	105
Lamont	2235	105
99Ab12356	2231	105
96Ab8858	2207	104
98Ab7351	2105	99
99Ab12631	2104	99
98Ab7523	2051	97
99Ab12428	2030	96
97Ab8390	2029	96
99Ab12379	2027	96
94Ab6965	1994	94
94Ab6860	1979	93
95Ab11633	1940	91
Pennuda	1908	90
95Ab13061	1883	89
MF9714-136	1879	89
Paul	1863	88
96Ab8905	1822	86
96Ab8902	1800	85
95Ab12970	1797	85
98Ab6384	1759	83

MEAN	2122
LSD(0.05)	359
CV(s/mean)	12.0

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2002

Hulless Oats

Kalispell, 2002

Cultivar	Yield *lbs/a*	%Mean
Monida	**3740**	176
99Ab12635	**2561**	121
99Ab12621	**2305**	109
99Ab12423	**2273**	107
Provena	**2271**	107
99Ab12443	**2261**	107
98Ab7055	**2238**	105
Lamont	**2235**	105
99Ab12356	**2231**	105
96Ab8858	**2207**	104
98Ab7351	2105	99
99Ab12631	2104	99
98Ab7523	2051	97
99Ab12428	2030	96
97Ab8390	2029	96
99Ab12379	2027	96
94Ab6965	1994	94
94Ab6860	1979	93
95Ab11633	1940	91
Pennuda	1908	90
95Ab13061	1883	89
MF9714-136	1879	89
Paul	1863	88
96Ab8905	1822	86
96Ab8902	1800	85
95Ab12970	1797	85
98Ab6384	1759	83
MEAN	2122	
LSD(0.05)	359	
CV(s/mean)	12.0	

PROJECT TITLE: Western Regional Lentil Yield Trial

PROJECT COOPERATORS: Duane Johnson and Louise Strang, NWARC
Fred Muehlbauer and Rick Short, USDA-ARS, Pullman, WA

OBJECTIVE: Evaluate lentil cultivars for yield potential in a Northwestern Montana environment.

RESULTS: Fifteen lentil varieties were seeded on April 29, 2002. Experimental design was a randomized complete block with 4 replicates. Plots were fertilized with 120 lbs N/a, 50 lbs P_2O_5/a, 60 lbs K_2O/a, and 20 lbs S/a on 4/19/02. Pursuit (2 oz./a) was applied post-emergence for weed control. Poor stands were obtained because of dry conditions, very light, sandy soil and sloping ground. Lentil yields in 2002 were about 75% lower than the average 2001 yields. The highest yielding variety produced only 539 lbs/acre (Table 1).

Table 1. WESTERN REGIONAL LENTIL YIELD TRIAL
Kalispell, 2002

Cultivar	Maturity	Yield	Seed Size	Seed coat	Cotyledon	Source	Size
	days	*lbs/a*	*#/lb*				
LC99602972T	115.7	**539.1**	**16460**	brown	red	WSU	small
LC8601847E	115.7	**400.1**	**14040**	green	yellow	WSU	small
Pardina	114.4	386.2	13290	brown	yellow	Spokane Seed	small
LC99602427P	115.3	356.4	12280	brown	yellow	WSU	small
Crimson	114.2	308.3	**14860**	brown	red	public	small
Eston	115.0	299.4	**16490**	green	yellow	Spokane Seed	small
LC8602303T	114.5	294.0	**15300**	brown	red	WSU	small
LC99602477E	114.7	290.1	11790	green	yellow	WSU	small
LC8601787P	114.4	250.3	13050	brown	yellow	WSU	small
LC760209C	116.4	222.6	9906	red	yellow	WSU	large
LC760139L	115.4	218.0	9708	brown	yellow	WSU	large
Merrit	115.4	214.0	7358	red	yellow	public	large
LC860359L	**119.7**	145.9	9029	brown	yellow	WSU	large
LC860616L	**119.3**	114.6	6972	brown	yellow	WSU	large
Pennell	113.3	103.9	8617	red	yellow	public	large
mean	115.6	276.2	11943				
LSD(0.05)	2.5	145.3	3025				
CV(s/mean)	1.5	36.3	17.7				

PROJECT TITLE: Statewide Lentil Yield Trial

PROJECT COOPERATORS: Duane Johnson and Louise Strang, NWARC
Dave Wichman and Karnes Neill, CARC, Moccasin, MT

OBJECTIVE: Evaluate lentil cultivars for yield potential in a Northwestern Montana environment.

RESULTS: Ten lentil varieties were seeded on April 29, 2002. Experimental design was a randomized complete block with 4 replicates. Plots were fertilized with 120 lbs N/a, 50 lbs P_2O_5/a, 60 lbs K_2O/a, and 20 lbs S/a on 4/19/02. Pursuit (2 oz./a) was applied post-emergence for weed control. Poor stands were obtained because of dry conditions, very light, sandy soil and sloping ground. Lentil yields in 2002 were about 75% lower than the average 2001 yields. The highest yielding variety produced only 459 lbs/acre (Table 1).

Table 1. STATEWIDE LENTIL YIELD TRIAL

Kalispell, 2002

Cultivar	Yield *lbs/a*	Seed Size *#/lb*	Seed coat	Cotyledon	Source	Maturity
Pardina	**459**	**13600**	brown	yellow	Spokane Seed	medium
Red Chief	**435**	9654	red	red	Public	early
Eston	**314**	**19950**	green	yellow	Spokane Seed	medium
Brewer	**304**	9489	green	yellow	USDA-ARS	early
CDC Milestone	283	**17560**	green	yellow	CDC-U of Sask.	medium
CDC Richlea	276	10100	green	yellow	Public	medium
CDC Vantage	218	9126	green	yellow	CDC-U of Sask.	medium
Laird	194	10400	green	yellow	Columbia Grain	late
Crimson	187	**21214**	brown	red	Public	medium
CDC Glamis	143	7845	green	yellow	CDC-U of Sask.	medium
mean	281	12894				
LSD(0.05)	164	105840 (P=0.12)				
CV(s/mean)	39	54.2				

PROJECT TITLE: Western Regional Dry Pea Yield Trial

PROJECT COOPERATORS: Duane Johnson and Louise Strang, NWARC
Fred Muehlbauer and Rick Short, USDA-ARS, Pullman, WA

OBJECTIVE: Evaluate dry pea cultivars for yield potential in a northwestern Montana environment.

RESULTS: Five dry pea varieties were seeded on April 29, 2002. Experimental design was a randomized complete block with 4 replicates. Plots were fertilized with 120 lbs N/a, 50 lbs P_2O_5/a, 60 lbs K_2O/a, and 20 lbs S/a on 4/19/02. Pursuit (2 oz./a) was applied post-emergence for weed control. Poor stands were obtained because of dry conditions, very light, sandy soil and sloping ground. Dry weather and low temperature stress from May through June, as well as soil erosion hindered stand establishment and seed production resulting in poor yields. Average pea yields were 85% lower than the average of all entries in 2001. 'Midas' was the highest yielding cultivar (Table 1).

Table 1. WESTERN REGIONAL DRY PEA YIELD TRIAL
Kalispell, 2002

Cultivar	Nodes	1st Bloom	Maturity	Yield	Color	Leaf Type	Source
	to 1st flw	*days*	*days*	*lbs/a*			
Midas	14	67	**88**	**372.3**	yellow	afila	Svalof Weibull
Lifter	14	65	**88**	253.0	green	normal	Spokane Seed
PS610152	11	68	**86**	246.1	green	afila	WSU
Eiffel	13	67	**87**	229.2	yellow	afila	Danisco
Universal	14	68	85	212.1	yellow	afila	Svalof Weibull
mean	67	87	262.5				
LSD(0.05)	NS	2.3	96.3				
CV(s/mean)%	2.5	1.4	20.2				

SW Lentils - 2002

	Marurity	Yield	Seed Size
	day after pl	*lbs/a*	*#/lb*
Brewer	68	196	5513
CDC Glamis	43	157	7845
CDC Milestone	86	283	12323
CDC Richlea	65	214	10097
CDC Vantage	67	293	9126
Crimson	87	187	21214
Eston	64	168	6810
Laird	65	96	2522
Red Chief	85	322	7561
Pardina	87	340	7567
mean	71	226	9058
sd	33	161	8264

PROJECT TITLE: Agronomic Performance Evaluation of Intrastate Spring Barley Cultivars.

PROJECT LEADER: Bob Stougaard, Weed Scientist, NWARC, Kalispell

PROJECT PERSONNEL: Qingwu Xue, Research Associate, NWARC, Kalispell.
Suzanne Mickelson, Barley Breeder, Bozeman.
Pat Hensleigh, Research Associate, Bozeman.

OBJECTIVES:

To evaluate spring barley cultivars and experimental lines for agronomic performance in environments and cropping systems representative of northwestern Montana.

RESULTS:

Cool and moist conditions during the early growing season (May and June) promoted tillering, but delayed heading in during 2002. High temperature and limited precipitation in July shortened the grain filling period. Yield ranged from 110.3 (Haybet) to 163.8 bu/a (BZ594-20), with an average of 143.3 bu/a. Among the 64 tested entries, 62% of them yielded over the check variety, Gallatin (140 bu/a). Grain test weight ranged from 43.4 (Haybet) to 52.8 lb/bu (MT970229), with an average of 49.8 lb/bu. However, only 7 entries had a lower test weight than 48 lb/bu. Heading date ranged from Julian 175 (Colon) to 188 days (Justina, MT970155 and MT000063), with an average of Julian 183 days. Plant height at harvest averaged 31 in (27-35 in). Only 4 entries had lodging rated over 30%. The average kernel plumpness was 86% (36-99%), however, only Haybet had extremely low plumpness (36%) and more than 50% of entries had a plumpness greater than 90%. Due to a hot and dry grain filling period, grain protein was much higher than previous years, and protein content ranged from 14.7% (BZ594-20) to 17.8% (Haybet). No disease evaluations were recorded in the 2002 nursery because of dry grain filling period.

SUMMARY:

Although cool temperatures during the early developmental stage delayed heading and high temperature and limited precipitation shortened the grain filling period, good yield, test weight and kernel plumpness were still obtained in 2002 barley growing season. However, the yield, test weight and plumpness were lower than previous years due to the short grain filling period in 2002.

FUTURE PLANS:

Continue barley evaluations for the purpose of identifying cultivars best suited for District 1.

Table 1. Agronomic data from the Intrastate Spring Barley Nursery grown at the Northwestern Agricultural Research Center Kalispell, MT.

Planted: April 25, 2002 Harvested: August 29, 2002

Cultivar	Yield	Test weight	Grain moist	Heading date	Height	Plump	Lodging index	Protein
	Bu/A	Lb/Bu	%	Julian	in	%	%	%
BZ594-20	163.8	50.9	10.5	176	30.5	94.6	16.7	14.7
6B952482	161.3	48.0	9.4	179	35.0	91.0	12.7	15.7
MT981212	159.5	51.4	11.1	180	33.7	91.7	1.4	16.3
MT000153	159.3	50.5	11.6	177	31.6	90.9	7.8	16.2
MT960099	159.1	49.8	10.5	185	27.2	76.9	5.3	15.8
MT000180	156.0	51.3	11.7	184	34.0	93.1	6.0	15.7
MT970110	155.3	51.3	10.9	185	33.6	94.4	6.5	16.0
MT970229	154.4	52.8	10.8	184	31.1	98.4	2.2	15.8
B99AL-621	153.3	50.2	10.4	186	28.4	87.9	17.7	15.8
MT981006	152.9	48.7	10.5	182	30.5	84.9	9.9	16.7
MT981004	152.2	48.1	10.0	182	32.1	78.8	9.7	17.3
MT981210	151.6	51.0	10.6	183	32.8	91.8	6.9	16.1
BZ596117	151.4	52.3	11.0	184	29.8	95.6	2.9	16.0
MT950186	151.3	51.3	10.7	184	32.7	88.0	2.0	16.3
MT960100	151.3	50.6	10.6	186	28.1	87.9	3.1	16.2
MT960226	151.1	50.7	10.0	180	30.6	93.5	2.8	15.1
MT000159	151.0	48.8	11.0	185	32.4	78.5	23.0	16.8
MT960222	150.7	48.6	10.8	184	29.9	83.3	44.7	16.2
MT000047	149.2	50.3	10.3	183	31.1	84.5	12.3	15.8
MT000130	148.7	51.9	10.6	178	34.5	96.6	11.8	15.1
MT960101	148.4	48.2	10.2	186	29.0	72.0	7.7	17.0
MT970026	147.3	50.9	10.5	179	30.6	88.9	5.5	16.3
Calgary	147.2	47.7	9.8	185	28.4	76.3	5.8	16.3
MT981238	147.0	51.5	10.7	179	31.7	91.7	4.0	16.5
MT970148	146.9	49.7	10.5	178	29.2	89.0	0.0	14.9
MT981030	146.8	51.6	11.1	187	32.6	92.7	3.6	15.4
Valier	146.4	50.2	10.8	184	30.3	80.9	11.1	17.3
MT970116	145.5	51.6	10.7	177	31.7	90.8	7.7	15.2
MT000092	145.2	50.6	11.1	180	32.0	90.7	22.7	15.8
MT000125	145.0	50.7	10.5	183	30.9	91.6	4.8	15.4
MT000178	144.6	50.1	9.8	185	32.2	94.8	7.1	16.2
Baronesse	144.2	50.2	10.2	187	29.1	91.8	17.1	16.0

Table 1 (Continued). Agronomic data from the Intrastate Spring Barley Nursery grown at the Northwestern Agricultural Research Center Kalispell, MT.

Cultivar	Yield	Test weight	Grain moist	Heading date	Height	Plump	Lodging index	Protein
	Bu/A	Lb/Bu	%	Julian	in	%	%	%
Conlon	142.6	52.6	10.5	175	31.8	98.7	1.9	15.4
MT000177	142.3	51.2	10.7	181	31.7	97.7	8.7	15.7
MT981177	142.2	51.3	10.5	180	30.1	94.6	2.7	15.8
MT981042	142.0	51.6	10.2	186	30.1	92.8	5.7	16.4
MTLB 13	141.8	50.0	10.1	178	29.9	90.5	7.6	16.4
Garnet	141.8	49.6	10.3	185	31.9	93.4	10.1	16.1
MT000157	141.5	48.1	10.6	187	30.9	63.6	31.2	17.0
MT000040	141.3	49.5	10.3	183	29.5	77.6	12.9	17.3
Legacy	140.9	44.0	9.2	183	33.9	58.8	50.4	16.3
Gallatin	139.9	50.2	10.5	179	31.5	81.4	6.6	16.2
MT960228	139.2	50.8	10.2	185	31.3	90.4	20.6	15.9
MT990172	138.1	50.6	10.9	180	28.9	92.6	15.4	16.0
NORD 1963	137.9	49.1	10.5	186	28.5	93.3	13.4	15.7
MT990106	137.3	49.5	10.3	185	28.2	91.7	8.9	16.5
MT000237	137.1	49.1	10.4	186	31.6	88.9	14.2	16.5
MT000239	136.7	47.2	10.4	187	30.1	83.6	7.4	16.4
H3860224	136.4	49.1	11.2	186	29.4	84.2	15.9	17.1
MT910189	136.4	49.8	10.9	178	29.9	91.5	8.4	16.0
MT000156	136.1	51.0	10.1	177	31.6	93.7	1.3	17.1
MT000045	136.0	50.3	10.3	180	30.5	91.0	6.7	16.3
MT000063	136.0	50.7	10.7	188	29.6	82.8	9.6	16.5
MT000138	135.9	52.1	10.8	178	32.7	97.6	3.2	16.7
Nord 1958	133.5	50.6	10.9	185	29.1	95.8	5.5	15.2
MT970155	133.4	49.2	10.0	188	29.7	89.9	8.5	16.8
MT990244	132.7	50.1	10.5	176	28.8	87.8	12.9	16.9
MT981060	131.1	44.7	9.6	181	33.6	59.5	19.8	16.2
MT981091	130.3	48.8	10.1	180	29.5	79.8	9.7	16.6
Harrington	129.6	45.2	9.9	183	29.0	65.6	21.3	16.4
MT000066	128.2	49.8	11.1	185	30.8	84.9	8.1	16.6
Justina	124.3	46.5	10.1	188	30.8	64.8	20.0	16.0
Merit	120.0	49.1	9.8	185	29.6	92.4	4.5	16.0
Haybet	110.3	43.4	9.4	182	32.9	35.7	29.9	17.8
Mean	143.3	49.8	10.5	182	30.9	86.3	11.0	16.2
LSD (0.05)	17.81		0.91	3.0	2.24		15.79	

PROJECT TITLE: Evaluation of Clearfield Winter Wheat Lines for Herbicide Tolerance.

PROJECT LEADERS: Bob Stougaard, Weed Scientist, NWARC, Kalispell.

PROJECT COOPERATORS: Qingwu Xue, Research Associate, NWARC, Kalispell.
Phil Bruckner, Winter Wheat Breeder, Bozeman.
Jim Berg, Research Associate, Bozeman

OBJECTIVES:

To evaluate early generation soft white winter wheat lines for herbicide tolerance and agronomic performance.

RESULTS:

Twenty-five experimental lines and five check soft winter wheat varieties were planted on October 1, 2001 with 2 replications. The plots in first replication were sprayed with Imazamox (Brand name: Beyond) on May 1, 2002. The herbicide was applied at a rate of 0.046 lb ai/a with 1% v/v of SUN-IT II plus 2.5% v/v of 28% UAN under clear sky with adequate soil moisture. The wheat plants had 7 main stem leaves with 0-4 tillers when the herbicide was applied. The wheat plots were harvested on August 14, 2002.

The mild winter resulted in high winter survival in all tested entries (>95%). Disease symptoms were very minimal and no disease evaluations were recorded. Averaged across tested entries, yield in herbicide treated plots (118.2 bu/a) was close to that in untreated plots (120.7 bu/a). Some treated entries (J473, J476, J484, J523 and J524) showed 10-14% yield reduction as compared to the untreated checks. In contrast, treated entries (J439, J461, J483 and J527) showed a 9-13% yield increase. The herbicide reduced plant height; the average height was 32.8 inches in treated plots and 34.5 inches in untreated plots. The largest reduction in height (16%) occurred in J455. The herbicide also slightly reduced grain protein content. Herbicide treatments resulted in minor crop injury in most of the tested entries (5-25%). Only three entries (J502, J520 and J527) had no injury. However, the herbicide had little effect on grain test weight (59 lb/bu) and heading date (Julian 167 days).

SUMMARY:

Many herbicide tolerance lines showed good yield, test weight and protein content during the 2001-02 growing season. The results of this project will further the selection process toward the release of Clearfield winter wheat cultivars.

FUTURE PLANS:

Continue to evaluate experimental winter wheat lines for herbicide tolerance.

Table 1. Agronomic data from the Clearfield Winter Wheat Lines for Herbicide Tolerance Northwestern Agricultural Research Center Kalispell, MT.

Entry	ID	PEDIGREE	Yield (Bu/A)			Test Weight (Lb/Bu)			Winter Survival	
			Treated	Untreated	Treated as % of Untreated	Treated	Untreated	Treated as % of Untreated	Treated %	Untreated %
1	J439	Daws*2/Fidel	128.8	117.9	109.2	59.6	58.5	101.9	100	100
2	J443	Daws*2/Fidel	118.3	111.1	106.5	60.1	59.9	100.2	100	100
3	J445	Daws*2/Fidel	118.9	122.6	97.0	59.4	61.3	97.0	100	100
4	J449	Daws*2/Fidel	121.8	118.7	102.7	57.4	58.2	98.7	100	100
5	J455	Daws*2/Fidel	115.2	120.8	95.3	58.2	58.3	99.8	100	100
6	J459	Daws*2/Fidel	130.6	134.8	96.9	62.4	61.7	101.1	100	100
7	J461	Daws*2/Fidel	124.3	112.3	110.7	60.6	60.4	100.4	100	100
8	J462	Daws*2/Fidel	122.4	124.5	98.3	59.4	59.1	100.5	100	100
9	J467	Daws*2/Fidel	110.2	113.7	96.9	58.9	59.3	99.3	100	100
10	J472	Eltan//Daws/Fidel	117.1	120.5	97.2	56.0	57.3	97.7	99	99
11	J473	Eltan//Daws/Fidel	104.9	120.5	87.1	60.4	61.0	99.0	100	95
12	J476	Eltan//Daws/Fidel	103.0	119.4	86.3	59.4	56.5	105.1	100	99
13	J480	Eltan//Daws/Fidel	109.5	108.9	100.5	58.5	54.9	106.6	100	100
14	J483	Eltan//Daws/Fidel	127.3	112.0	113.7	55.9	54.3	103.0	100	100
15	J484	Eltan//Daws/Fidel	115.7	129.0	89.7	58.0	61.0	95.1	100	100
16	J486	Eltan//Daws/Fidel	117.8	114.0	103.3	55.7	55.2	100.9	100	100
17	J488	Eltan//Daws/Fidel	122.1	124.1	98.4	58.0	58.2	99.6	100	100
18	J489	Malcolm*2/Fidel	114.3	111.2	102.7	60.7	61.9	98.1	100	100
19	J502	Malcolm*2/Fidel	127.3	118.8	107.1	56.9	56.1	101.5	100	100
20	J512	Malcolm/Fidel//Eltan	118.5	125.1	94.7	56.8	57.2	99.2	100	100
21	J517	Malcolm/Fidel//Eltan	116.0	114.1	101.7	57.7	59.3	97.4	100	100
22	J520	Malcolm/Fidel//Eltan	121.9	113.9	107.0	59.6	58.8	101.2	100	100
23	J523	Malcolm/Fidel//Eltan	117.3	130.4	89.9	60.7	60.0	101.2	100	100
24	J524	Malcolm/Fidel//Eltan	104.1	113.3	91.9	57.9	59.9	96.6	100	100
25	J527	Malcolm/Fidel//Eltan	124.3	113.8	109.2	59.9	59.9	99.9	100	99
26	Daws	check	-	133.5	-	-	61.8	-	100	100
27	Eltan	check	-	142.1	-	-	59.4	-	100	100
28	Malcolm	check	-	136.3	-	-	58.6	-	100	100
29	MTI01158	check (IMI)	115.4	122.8	94.0	63.9	64.7	98.8	100	100
30	Fidel	check (IMI)	125.0	119.6	104.5	61.9	59.9	103.3	99	100
	Average		118.2	120.7	98.0	59.0	59.1	99.9	99.9	99.7

Table 1 (Continued). Agronomic data from the Clearfield Winter Wheat Lines for Herbicide Tolerance Northwestern Agricultural Research Center Kalispell, MT.

Entry	ID	PEDIGREE	Heading Date (Julian)			Height (in)			Injury (%)		Protein (%)		
			Treated	Untreated	Treated as % of Untreated	Treated	Untreated	Treated as % of Untreated	Treated	Untreated	Treated	Untreated	Treated as % of Untreated
1	J439	Daws*2/Fidel	166	167	99.4	31.1	31.1	100.0	25	0	11.1	11.7	94.7
2	J443	Daws*2/Fidel	167	167	100.0	33.1	32.7	101.2	5	10	11.9	11.2	105.8
3	J445	Daws*2/Fidel	167	167	100.0	30.3	32.3	93.9	15	0	11.7	11.2	104.2
4	J449	Daws*2/Fidel	167	166	100.6	30.3	30.7	98.7	10	5	11.6	11.9	97.6
5	J455	Daws*2/Fidel	172	169	101.8	29.5	35.0	84.3	25	0	12.1	12.1	100.0
6	J459	Daws*2/Fidel	169	163	103.7	33.9	33.9	100.0	5	0	11.1	11.6	95.8
7	J461	Daws*2/Fidel	165	165	100.0	31.9	34.3	93.1	5	5	10.5	11.5	91.5
8	J462	Daws*2/Fidel	169	167	101.2	34.3	37.0	92.6	25	0	12.1	12.7	95.3
9	J467	Daws*2/Fidel	166	167	99.4	33.5	33.1	101.2	5	0	11.6	12.0	96.2
10	J472	Eltan//Daws/Fidel	170	169	100.6	28.7	33.9	84.9	20	0	12.0	11.4	104.9
11	J473	Eltan//Daws/Fidel	168	167	100.6	29.9	32.7	91.6	20	5	11.5	12.3	93.3
12	J476	Eltan//Daws/Fidel	167	168	99.4	31.5	32.7	96.4	10	0	11.3	12.1	92.8
13	J480	Eltan//Daws/Fidel	168	169	99.4	29.5	33.5	88.2	20	0	12.1	13.1	92.6
14	J483	Eltan//Daws/Fidel	169	169	100.0	32.3	32.7	98.8	20	0	11.7	12.2	95.3
15	J484	Eltan//Daws/Fidel	168	166	101.2	30.7	34.6	88.6	25	10	12.3	11.3	109.0
16	J486	Eltan//Daws/Fidel	168	169	99.4	31.5	32.7	96.4	20	0	12.4	12.7	97.7
17	J488	Eltan//Daws/Fidel	168	168	100.0	33.5	35.4	94.4	5	0	11.8	11.7	100.8
18	J489	Malcolm*2/Fidel	165	165	100.0	36.6	36.6	100.0	15	10	11.8	12.1	97.3
19	J502	Malcolm*2/Fidel	165	166	99.4	26.4	29.9	88.2	0	0	12.5	12.8	97.6
20	J512	Malcolm/Fidel//Eltan	170	169	100.6	31.9	32.7	97.6	5	0	12.9	12.1	106.6
21	J517	Malcolm/Fidel//Eltan	169	168	100.6	36.6	40.9	89.4	10	0	11.7	12.2	96.5
22	J520	Malcolm/Fidel//Eltan	169	169	100.0	41.7	46.1	90.6	0	0	12.3	13.1	94.3
23	J523	Malcolm/Fidel//Eltan	169	163	103.7	33.1	31.1	106.3	10	0	10.4	11.6	89.2
24	J524	Malcolm/Fidel//Eltan	168	167	100.6	38.2	39.8	96.0	15	0	12.3	11.9	103.8
25	J527	Malcolm/Fidel//Eltan	167	167	100.0	41.3	41.7	99.1	0	0	12.2	12.7	95.9
26	Daws	check	-	165	-	-	31.9	-	(100)	0	-	11.2	-
27	Eltan	check	-	-	-	-	35.4	-	(100)	5	-	11.7	-
28	Malcolm	check	-	167	-	-	35.0	-	(100)	0	-	11.4	-
29	MTI01158	check (IMI)	164	163	100.6	31.1	32.7	95.2	20	0	12.7	13.0	97.8
30	Fidel	check (IMI)	164	164	100.0	31.9	33.1	96.4	5	0	11.3	12.3	91.4
	Average		167.6	166.8	100.5	32.8	34.5	94.9	12.6	1.7	11.8	12.0	98.1

TANK MIX OPTIONS FOR WILD OAT HERBICIDES

Herbicide	Aim	Banvel	Bronate	Buctril	Curtail (M)	2,4-D	MCPA	Starane	Stinger	SU's	Sequential
Achieve			X	X	M	Ester			X		5 days
Assert			X		M	Ester	Ester	X			4 days
Avenge			X	X	X	X	X			X	
Cheyenne*				X				X	X		5 days
Discover**		X	X	X	X	Amine	X	X	X	X	4 days
Everest***	X		X	X	X	X	X	X	X	with 2,4-D	
Fargo											
Hoelon****				X						X	5 days
Puma****			X	X	M		Ester	X		X	5 days
Tiller**, *****				X				X	X	Peak	5 days

* already contains MCPA and Harmony Extra
** Tankmix options vary depending on the grass weed being targeted.
*** MUST be applied in tankmix combination with NIS.
**** Tankmix options vary depending on the crop.
***** already contains 2,4-D and MCPA

PROJECT TITLE: Agronomic Performance Evaluation of Intrastate Winter Wheat Cultivars

PROJECT LEADER: Bob Stougaard, Weed Scientist, NWARC, Kalispell.

PROJECT PERSONNEL: Qingwu Xue, Research Associate, NWARC, Kalispell.
Phil Bruckner, Winter Wheat Breeder, Bozeman.
Jim Berg, Research Associate, Bozeman.

OBJECTIVES:

To evaluate new and existing winter wheat cultivars for agronomic performance and disease resistance in environments and cropping systems representative of northwestern Montana.

RESULTS:

The mild winter resulted in 100% winter survival in the 47 tested entries and only 2 entries had a winter survival between 98-99% during 2001-02 winter wheat growing season. Disease symptoms were very minimal and no disease evaluations were recorded. Yield and test weight were excellent for all tested entries. Yield ranged from 104 bu/a (Vanguard, BZ9W97-761, BigSky,and Norstar) to 136 bu/a (Gary), with an average of 119 bu/a. The highest test weight was recorded in Prowers 99 (65.1 lb/bu) and the lowest was in MTS9719 (60.5 lb/bu), with the average test weight being 62.5 lb/bu. The heading dates were about one week delayed as compared to previous years because of the cool and moist conditions of May and early June. The average heading date was 166, and ranged from 161 (Above) to 169 (Golden Spike, Norstar, MTS0023, and MTS9719). Plant height was shorter than normal, with an average of 38 inches and ranged from 32 (NuHorizon) to 50 inches (Norstar). There were no lodging problems for any of the tested entries due to a dry grain filling period. The grain protein content averaged 12.6%, and ranged from 10.8% (Golden Spike) to 14.4% (Vanguard and McGuire).

SUMMARY:

High winter survival, lack of disease and a moist early spring resulted in excellent grain yield, test weight and other agronomic performance characteristics in the winter wheat entries. Gary, DW Red, MT00117 and MT9951 were superior entries with high yields (>130 bu/a) during 2001-02 growing season.

FUTURE PLANS:

Continue winter wheat evaluations for the purpose of identifying those cultivars best suited for production in District 1.

Table 1. Agronomic data from the Intrastate Winter Wheat Nursery grown at the Northwestern Agricultural Research Center Kalispell, MT.

Planted: October 1, 2001 Harvested: August 14, 2002

Cultivar	Yield	Test weight	Grain moist	Heading date	Plant height	Lodge score	Winter survival	Protein
	Bu/A	Lb/Bu	%	Julian	in	0-9	%	%
Gary	135.8	61.6	10.6	166	40.7	0.0	100	11.2
MT00117	133.1	61.2	10.9	167	37.8	0.0	100	11.7
DW Red	130.5	63.4	11.0	167	35.0	0.0	100	12.5
MT9951	129.7	62.0	10.8	167	42.1	0.0	100	12.6
Judith	129.1	61.7	10.8	165	38.6	0.0	100	12.3
MT9904	129.0	62.1	10.7	166	40.8	0.0	100	12.3
Promontory	128.1	63.9	10.9	164	35.7	0.0	100	12.1
BZ9W96-895	127.9	63.2	11.3	165	36.6	0.0	100	11.9
Wahoo	127.6	62.1	10.6	163	34.4	0.0	100	12.2
MTR9997	127.5	63.5	11.2	165	38.6	0.0	100	12.6
MT0088	127.4	61.4	10.4	165	37.4	0.0	100	11.3
Pryor	126.9	61.6	10.3	167	33.9	0.0	100	11.6
MT9426	126.6	60.6	10.5	167	34.6	0.0	100	12.4
Rocky	125.5	64.2	11.2	165	40.3	0.0	100	12.1
MT9982	124.7	61.6	11.6	167	37.1	0.0	100	12.3
MT0097	124.5	62.7	11.4	166	36.6	0.0	100	12.6
MT00159	124.5	62.3	11.0	166	35.2	0.0	100	12.1
MTW0049	123.3	63.9	11.6	167	36.6	0.0	100	12.6
Quantum 542	122.8	62.2	10.9	164	39.5	0.0	100	13.4
Morgan	121.6	61.7	10.6	168	38.5	0.0	100	12.4
Neeley	121.0	62.9	10.6	167	39.1	0.0	100	12.5
MT00154	120.7	63.5	11.1	167	41.5	0.0	100	13.4
MT00118	120.6	62.7	10.8	165	38.7	0.0	100	12.5
MTS0023	120.1	61.3	10.6	169	40.9	0.0	100	14.2
MT0099	119.6	61.9	10.4	165	38.1	0.0	100	13.0
NuWest	118.6	62.2	11.0	167	37.0	0.0	100	12.6
NuFrontier	118.6	63.7	10.9	164	34.9	0.0	100	11.4
Golden Spike	118.4	62.0	10.6	169	39.4	0.0	100	10.8
Jerry	118.1	62.9	10.6	167	39.4	0.0	100	12.6
Ransom	117.3	61.2	10.4	165	39.8	0.0	100	12.5
MT9989	117.3	60.7	10.4	165	39.5	0.0	100	12.7
CDC Falcon	117.1	61.6	10.6	165	32.4	0.0	100	12.0
Prowers 99	115.9	65.1	11.2	163	39.8	0.0	100	13.4
Nuplains	115.5	63.7	11.3	164	32.7	0.0	100	13.0
NuHorizon	115.4	64.0	11.1	162	32.0	0.0	100	12.2

(Continued on next page)

Table 1 (continued). Agronomic data from the Intrastate Winter Wheat Nursery grown at the Northwestern Agricultural Research Center Kalispell, MT.

Cultivar	Yield	Test weight	Grain moist	Heading date	Plant height	Lodge score	Winter survival	Protein
	Bu/A	Lb/Bu	%	Julian	in	0-9	%	%
SD97457	115.0	63.6	10.9	162	35.0	0.0	100	13.6
Tiber	114.4	63.5	10.9	168	41.7	0.0	98	12.8
Erhardt	113.5	63.5	11.4	167	37.3	0.0	100	13.0
Bighorn	113.3	61.5	11.1	166	35.3	0.0	100	13.5
Above	112.8	63.2	10.4	161	35.3	0.0	100	13.2
NuSky	112.8	62.1	11.2	167	38.3	0.0	99	12.1
MTS0031	110.8	62.9	10.5	166	37.7	0.0	100	13.4
McGuire	109.2	62.3	10.6	162	35.6	0.0	100	14.4
Elkhorn	107.5	62.3	10.6	168	45.7	0.0	100	13.1
MTS9719	105.7	60.5	10.1	169	37.3	0.0	100	12.1
Vanguard	104.1	62.9	10.6	166	39.9	0.0	100	14.4
BZ9W97-761	104.0	61.5	10.6	165	38.5	0.0	100	12.3
BigSky	104.0	62.8	10.6	167	39.4	0.0	100	13.4
Norstar	103.9	63.1	10.8	169	49.9	0.0	100	12.2
Mean	**119.4**	**62.5**	**10.8**	**166**	**38.0**	**0.0**	**99.9**	**12.6**
LSD (0.05)	**8.51**		**0.55**	**1.37**	**2.03**			
C.V. (%)	**4.39**		**3.14**	**0.51**	**3.30**			

PROJECT TITLE: Montana Statewide Spring Oat Variety Performance.

PROJECT LEADER: Bob Stougaard, Weed Scientist, NWARC, Kalispell.

PROJECT PERSONNEL: Qingwu Xue, Research Associate, NWARC, Kalispell.
Suzanne Mickelson, Barley Breeder, Bozeman.
Pat Hensleigh, Research Associate, Bozeman.

OBJECTIVES:

To evaluate the agronomic performance of oat varieties and experimental lines in environments and cropping systems representative of northwestern Montana.

RESULTS:

Cool and moist conditions in May and June resulted in the slow development of oat entries. Although the precipitation was lower than long-term average during grain filling period, the grain yield and test weight were not affected by low soil moisture. Yield in oat entries ranged from 196.1 bu/a (Whitestone) to 249.6 bu/a (ABSP 9-2), with an average of 222.2 bu/a. Only Whitestone yielded lower than 200 bu/a. Three entries, ABSP 9-2, CDC Pacer and 90Ab1322 yielded more than 240 bu/a. Grain test weight ranged from 32.1 lb/bu in Ajay to 38.3 lb/bu in CDC Dancer. The test weight in 5 entries (ABSP 9-2, CDC Pacer, CDC Dancer, Killdeer, and Otana) was greater than 36 lbs/bu. The plant height ranged from 28.1 to 43.3 inches, with an average of 37.7 inches. Three entries (87AB5632, Monida, and Otana) had moderate lodging (>20%). The grain protein content ranged from 13.7 (CDC Pacer and 87AB5632) to 15.9% (Celsia), with an average of 14.8%. No disease evaluations were recorded in the 2002 nursery because of dry grain filling period.

SUMMARY:

Despite lower precipitation during grain filling, the soil storage moisture combining with more tillers resulted in excellent yield, test weight and protein content in oat nursery in 2002.

FUTURE PLANS:

Cultivars will continue to be evaluated at Kalispell in an attempt to identify those cultivars best adapted to District 1.

Table 1. Agronomic data from the State Oat Nursery grown at the Northwestern Agricultural Research Center Kalispell, MT.

Planted: April 25, 2002 Harvested: August 30, 2002

Cultivar	Yield	Test weight	Grain moist	Height	Lodging index	Protein
	Bu/A	Lb/Bu	%	in	%	%
ABSP 9-2	249.6	36.2	14.8	38.3	0.0	14.4
CDC Pacer	246.7	37.2	13.8	40.3	11.7	13.7
90Ab1322	241.5	34.5	14.4	33.6	0.0	14.9
95A10854	232.9	35.5	14.0	37.4	0.0	15.0
ABSP19-9	229.1	34.9	14.2	38.8	0.0	14.9
ABSP14-6	228.4	35.3	14.3	36.7	1.7	14.4
CDC Dancer	225.4	38.3	14.3	41.6	3.3	14.4
87AB5632	225.1	35.0	14.3	37.5	20.0	13.7
Killdeer	221.1	37.0	13.5	34.9	8.3	15.0
Celsia	215.5	35.0	14.0	40.4	0.0	15.9
94AB5543	214.5	35.8	14.1	39.1	8.3	15.3
Rio Grande	212.3	33.7	14.2	34.6	6.7	14.5
Ajay	211.5	32.1	13.6	28.1	0.0	15.7
Otana	205.6	36.7	15.0	43.3	30.0	15.4
Monida	200.3	33.4	14.3	40.7	28.3	14.7
Whitestone	196.1	35.5	14.1	38.2	10.0	15.6
Mean	222.2	35.4	14.2	37.7	8.0	14.8
LSD (0.05)	30.4			2.1	19.1	

PROJECT TITLE:	Wild Oat Control in Spring Wheat with Reduced Rates of Achieve.
PROJECT LEADER:	Bob Stougaard, Weed Scientist, NWARC, Kalispell.
PROJECT COOPERATORS:	Qingwu Xue, Research Associate, NWARC, Kalispell.
OBJECTIVES:	To determine the consistency of wild oat control with reduced herbicide rates.

RESULTS:

McNeal spring wheat was planted on April 23, 2002 at a rate of 60 lbs/acre on 6-inch rows to a depth of 1.75 inches. Plots were 10 X 15 ft with four replicates arranged in a randomized complete block design. The field was fertilized with fertilizer blend of 195-52-62-20 lb/a. Wild oat was planted in all plots to improve the consistency of weed pressure. Achieve herbicide was applied at four rates on May 27, 2002, including normal labeled rate (1X), one-half (1/2X), one-fourth (1/4X) and one-eighth (1/8X) of normal rate. Nontreated and handweeded controls were included for comparison. Treatments were applied with a CO_2 backpack sprayer in 20 gallons water per acre at 30 psi. Teejet XR11002 nozzles spaced 20 inches apart were used for applications. The spring wheat had 4-5 main stem leaves with 1-2 tillers and wild oat had 3 main stem leaves with 0-1 tillers. To control broadleaf weeds, the 0.01546 lb ai/a Express plus 0.375 lb ai/a MCPA with 1 pt/a NIS was applied on June 14, 2002. Wild oat variables were measured prior to spring wheat maturity and wild oat seed shatter. Spring wheat was harvested on August 19, 2002.

The wild oat density, biomass, seeds production and dockage significantly decreased as herbicide rate increased. However, reduced rates were effective for wild oat control in spring wheat in 2002 season. For example, a 1/4X rate resulted in 80% reduction in wild oat biomass and seeds production, and less than 1% of dockage. Spring wheat yield and test weight increased as herbicide rate increased initially, then reached to plateau after the herbicide rate increased over 1/4X. However, grain protein content increased at untreated and 1/8X rate (Table 1). The increase in grain protein in these plots could be due to more soil water stress during grain filling.

SUMMARY:

Environmental conditions at the time of application favored Achieve efficacy for wild oat control in the 2002 spring wheat growing season. Both 1/4X and 1/2X rates resulted in an effective wild oat control, high crop yield and test weight as compared to label rate.

FUTURE PLANS:

Continue to evaluate integrated approaches for the control of wild oat.

Table 1. Effect of Achieve herbicide rate on wild oat control, and spring wheat yield, test weight and grain protein at Northwestern Agricultural Research Center, Kalispell, MT in 2002.

	Wild oat				Spring wheat		
Achieve rate	Density	Biomass	Seeds production	Docakge	Yield	Test weight	Protein content
lb ai/a	m^2	g/m^2	$seeds/m^2$	%	bu/a	lb/bu	%
0	137	436.5	7871	5.58	48.1	57.9	15.1
0.023 (1/8X)	118	180.1	3738	2.08	74.2	57.7	14.7
0.046 (1/4X)	72	75.4	1655	0.93	92.6	58.9	14.1
0.089 (1/2X)	40	31.9	968	0.78	92.2	58.7	14.2
0.178 (1X)	24	14.0	494	0.77	94.2	58.9	14.1
Handweeded	0	0.0	0	0.67	99.7	58.8	14.1
LSD(0.05)	30	56.4	1015	0.7	8.2	0.6	0.3

PROJECT TITLE: Indian Ricegrass and Downy Brome Tolerance to Herbicides

PROJECT LEADER: Bob Stougaard, Weed Scientist

PROJECT PERSONNEL: Qingwu Xue, Postdoctoral Research Scientist

OBJECTIVES:

There is an increased interest in the production of Indian Ricegrass as an alternative grain crop. However, the lack of herbicide options severely restricts the production of this crop and the ultimate growth as a major commodity in the state. This is especially important for weed species that contain gluten in the seed. This study was initiated to screen various herbicide classes for tolerance toward Indian Ricegrass and for control of downy brome.

MATERIALS and METHODS:

The study was conducted at the John Sheldon farm, near Creston, MT, in an established field of Indian ricegrass. Applications were made on June 20, when the ricegrass was 12 to 15 inches in height and the downy brome was 3 to 4 inches tall. Downy brome was uniformly present throughout the study area. Plots were 10 x 15 ft with 3 replicates arranged in a randomized complete block design. All herbicide applications were made with a CO2 backpack sprayer pressurized to 30 psi delivering an output of 20 gpa. Teejet XR11002 nozzles spaced 20 inches apart were used for application.

RESULTS:

Of the five herbicides evaluated, Prowl and Dimension were the only herbicides to not injure the crop. Select caused the greatest amount of crop injury, but Plateau and Lexone caused severe damage as well. Lexone was the only herbicide that controlled downy brome. The lack of control observed with the other materials may be due to the fact that the weed was already emerged and well established at the time that applications were made.

There appears to be some herbicides classes available that have tolerance to Indian ricegrass. However, the effect of application timing on crop tolerance and weed control needs to be further investigated. The use of fall and/or spring dormant applications may provide the greatest benefits.

Dill Herbicide Tolerance Study

Treatment	Rate	Rate Unit	Percent Crop Injury 6/28/02	Percent Crop Injury 7/17/02	Dill Yield lb/A
Check			0	0	2296
Sonolan	0.75	LB A/A	0	0	3089
Prowl	0.743	LB A/A	0	0	2804
Assure	0.048	LB A/A	0	0	2604
UAN	2	QT/A			
MSO	1	QT/A			
Discover	0.05	LB A/A	0	0	3092
DSV-Score	0.4	% V/V			
Caparol	0.5	LB A/A	33	28	1871
Caparol	0.75	LB A/A	53	55	1936
Lorox	0.5	LB A/A	45	42	1830
Lorox	0.75	LB A/A	67	60	1125
Pursuit	0.047	LB A/A	83	82	1803
NIS	0.25	% V/V			
Pursuit	0.063	LB A/A	97	96	763
NIS	0.25	% V/V			
Raptor	0.031	LB A/A	90	82	1868
NIS	0.25	% V/V			
Raptor	0.039	LB A/A	93	92	1491
NIS	0.25	% V/V			
Harmony Extra	0.014	LB A/A	100	100	481
NIS	0.25	% V/V			
Harmony Extra	0.019	LB A/A	100	100	347
NIS	0.25	% V/V			
Express	0.009	LB A/A	100	97	1218
NIS	0.25	% V/V			
Express	0.014	LB A/A	97	100	668
NIS	0.25	% V/V			
2,4-D Amine	0.475	LB A/A	40	96	496
2,4-D Amine	0.713	LB A/A	47	100	600
MCPA Amine	0.25	LB A/A	37	32	2038
MCPA Amine	0.5	LB A/A	37	60	1618
LSD			22.4	18.8	842.1
CV			25.52	19.6	31.49
REP (F)			0.046	0.0494	0.1547
TMT (F)			0.0001	0.0001	0.0001

PROJECT TITLE: Herbicide Tolerance of Dill

PROJECT LEADER: Bob Stougaard, Weed Scientist

PROJECT PERSONNEL: Qingwu Xue, Postdoctoral Research Scientist

OBJECTIVES:

There is increased interest in the production of dill as an essential oil crop. However, the lack of herbicide options severely restricts the production of this crop and the ultimate growth as a major commodity in this region of the state. This study was initiated to screen various herbicide classes for tolerance toward dill.

MATERIALS and METHODS:

The area for the study was previously cropped to spring wheat. Tillage consisted of plowing in the fall, and two passes with field cultivator and a packing operation prior to seeding in the spring. Dill seed (*Anethum graveolens*), cultivar 'Mammoth' was planted on April 17 with a double disk drill at 3.8 lbs/acre pls at 0.5-inch depth in a seedbed with excellent soil moisture. The soil was a Swims silty clay loam. Plots were 10 x 15 ft with 3 replicates arranged in a randomized complete block design.

Sonalan and Prowl herbicides were applied prior to seeding on April 17. The Sonalan and Prowl herbicides were incorporated with two passes of a spring-tooth cultivator set to a depth of two inches. All other herbicides were applied on June 12. All herbicide applications were made with a CO2 backpack sprayer pressurized to 30 psi delivering an output of 20 gpa. Teejet XR11002 nozzles spaced 20 inches apart were used for application.

RESULTS:

Treatments that demonstrated the greatest crop tolerance included Sonalan, Prowl, Assure II, Discover, Caparol, and the low rate of Lorox and MCPA. Individually, these compounds provide control of several grass and broadleaf weeds and provide insights as to which herbicide mode of actions to pursue. Further research is warranted to evaluate additional herbicide families, a wider range of rates of several herbicides and also combinations of herbicides that would provide full spectrum control of monocots and dicots. Most importantly would be the identification of additional preemergence herbicides.

Bedstraw Control in Peppermint

Treatment	Rate	Crop Injury	Bed Straw % Composition	Bed Straw lb/A	Mint T/A
Nontreated Check	0	2	8.2	436	3.06
Starane	0.06	2	1.22	49	3.23
Starane	0.125	0	0	0	3.63
Starane	0.25	5	0	0	2.84
Tough NIS	0.46 0.25%	5	0.19	4	2.54
Tough NIS	0.58 0.25%	3	0.59	32	3.33
Tough NIS	0.93 0.25%	5	0.06	3	2.85
Stinger	0.12	3	6.92	326	3.1
Stinger	0.14	3	13.49	822	3.22
Stinger	0.18	17	10.98	414	2.42
Spartan	0.09	5	17.19	736	2.57
Spartan	0.14	2	11.67	591	2.71
Spartan	0.18	7	5.27	197	3.04
Handweeded Check	0	8	0	0	3.64
LSD		8.1	14.497	718.2	1.063
CV		100.78	159.52	165.94	21.01
REP (F)		0.3443	0.2609	0.2498	0.5372
TMT (F)		0.0456	0.2027	0.2053	0.4103

PROJECT TITLE: Bedstraw Control in Peppermint

PROJECT LEADER: Bob Stougaard, Weed Scientist

PROJECT PERSONNEL: Qingwu Xue, Postdoctoral Research Scientist

OBJECTIVES:

Bedstraw has historically been one of the most difficult to control of all weeds that infest peppermint. Therefore, research was undertaken to evaluate new and established herbicides for the control of bedstraw. This study evaluated Spartan, Starane, Stinger, and Tough applied at three rates, for the control of bedstraw.

MATERIALS and METHODS:

The study was located in an established stand of peppermint at the Northwestern Agricultural Research Center. The soil consisted of a Creston Silt Loam and the crop received supplemental irrigation throughout the growing season. Plots were 10 x 15 feet with three replicates in a randomized complete block design. Catchweed bedstraw, *Galium aparine* L., was planted in very wet soil 0.75 inches deep in 6 in rows down the center of the plots on April 19 into dormant peppermint at a rate of 12 pls ft^{-2} to establish an equal plant density among the plots. Spartan 75 DF (sulfentrazone), was applied on April 17 to dormant peppermint. Applications of Starane 1.5 EC (fluroxypyr), Tough 3.75 EC (pyridate) + nonionic surfactant at 0.25 % v/v, and Stinger 3 SL (clopyralid) were made to 2-inch tall bedstraw, on June 7. All herbicide applications were applied with a CO_2 backpack sprayer in 20 gallons water per acre. Teejet XR11002 nozzles spaced 20 inches apart and an operating pressure of 30 psi were used for all herbicide applications.

RESULTS:

Crop injury was minimal with most treatments, but was consistently observed with Spartan. Bedstraw populations were low compared to previous years. Stinger failed to suppress bedstraw at any of the rates evaluated. Starane and Tough provided excellent control of bedstraw at all rates evaluated and may be due to the small weed size at application. Bedstraw control with Spartan increased as rates increased, but was less consistent than either Starane or Tough.

STARANE TOLERANCE IN PEPPERMINT- 2002

Trtmt No.	Treatment Name	Rate	Rate Unit	Grow Stg	Injury MENPI	fwt T/A	dwt T/A
1	Check				8.33	16.8	2.99
2	Starane	0.06	LB A/A	2 in	0	15.17	2.7
3	Starane	0.125	LB A/A	2 in	0	17.41	3.09
4	Starane	0.25	LB A/A	2 in	3.33	15.54	2.76
5	Starane	0.375	LB A/A	2 in	3.33	17.64	3.13
6	Starane	0.06	LB A/A	4 in	8.33	13.4	2.38
7	Starane	0.125	LB A/A	4 in	8.33	14.78	2.63
8	Starane	0.25	LB A/A	4 in	10	15.17	2.7
9	Starane	0.375	LB A/A	4 in	18.33	14.96	2.66
10	Starane	0.06	LB A/A	6 in	8.33	16.3	2.9
11	Starane	0.125	LB A/A	6 in	13.33	14.91	2.65
12	Starane	0.25	LB A/A	6 in	26.67	15.17	2.7
13	Starane	0.375	LB A/A	6 in	31.67	14.44	2.57
LSD (P=.05)					10.305	3.222	0.573
CV					56.78	12.32	12.33
Replicate F					2.931	1.134	1.137
Replicate Prob(F)					0.0726	0.3384	0.3376
Treatment F					7.489	1.203	1.202
Treatment Prob(F)					0.0001	0.3358	0.3363

PROJECT TITLE: Peppermint Tolerance to Starane, 2001

PROJECT LEADER: Bob Stougaard, Weed Scientist

PROJECT COOPERATORS: Qingwu Xue, Postdoctoral Research Scientist

OBJECTIVES:

Previous research has demonstrated adequate crop tolerance for applications of Starane to spearmint. This study was initiated to determine if similar levels of tolerances would exist for peppermint.

MATERIAL and METHODS:

The study was conducted on an established peppermint field located at the Northwestern Agricultural Research Center. The soil consisted of a Creston Silt Loam and the crop received supplemental irrigation throughout the growing season. Plots were 10 x 15 feet with three replicates in a randomized complete block design. Starane 1.5 EC (fluroxypyr) was applied to peppermint at the two, eight, and twelve-inch height growth stages on May 20, June 7, and June 24, respectively. All herbicide applications were applied with a CO_2 backpack sprayer in 20 gallons water per acre. Teejet XR11002 nozzles spaced 20 inches apart and an operating pressure of 30 psi were used for all herbicide applications. An application of 1/2 lb of Sinbar 80WP (terbacil) and 1/2 pint of Stinger 3 SL (clopyralid) was applied to dormant peppermint on April 15 to reduce competition from weeds not controlled by Starane. All remaining weeds were controlled by hand removal.

RESULTS:

Crop injury increased with rate and as application was delayed, but was less compared to previous years. Injury symptoms included a gray-blue cast to the foliage, cupping of the upper-most leaves, and stunted growth. Injury symptoms were transitory. Mint fresh and dry weights were unaffected by Starane applications. The absence of significant visual injury as well as the lack of hay yield reductions might be due to timely irrigation shortly after application. The impact of irrigation timing on mint tolerance to Starane should be investigated further.

Table 1. Effect of herbicide rate on wild oat control and crop yield grown at Northwestern Agricultural Research Center, Kalispell, MT in 2002.

			Wild Oat				Wheat
		Rate	Control	Density	Dry weight	dockage	yield
Treatment	Rate	Unit	%	m^2	g/m^2	%	Bu/A
Achieve	0.178	LB A/A	96	18.3	18.3	0.40	78
Super charge	0.5	% V/V					
AMS	15	LB/100 GAL					
Achieve	0.089	LB A/A	85	93.3	43.4	1.57	71
Super charge	0.5	% V/V					
AMS	15	LB/100 GAL					
Discover	0.05	LB A/A	98	1.8	0.2	0.37	87
DSV	0.4	% V/V					
Discover	0.025	LB A/A	91	12.2	8.7	0.60	80
DSV	0.4	% V/V					
Assert	0.46	LB A/A	94	54.9	10.2	0.66	77
NIS	0.25	% V/V					
Assert	0.23	LB A/A	82	115.2	41.5	1.80	63
NIS	0.25	% V/V					
Everest	0.0275	LB A/A	100	81.7	5.6	0.47	71
NIS	0.25	% V/V					
Everest	0.0135	LB A/A	98	106.1	13.2	0.49	75
NIS	0.25	% V/V					
Hoelon	1	LB A/A	95	16.5	4.4	0.53	79
COC	1	PT/A					
Hoelon	0.5	LB A/A	83	37.8	36.7	0.83	74
COC	1	PT/A					
Puma	0.0825	LB A/A	97	6.1	10.1	0.45	77
Puma	0.0412	LB A/A	85	16.5	3.7	0.68	77
Check			0	161.0	424.0	7.02	36
	LSD		9.1	60.412	28.004	0.888	25.9
	CV		6.33	62.58	33.75	41.81	20.49
	REP (F)		0.0978	0.1627	0.2235	0.2798	0.0311
	TMT (F)		0.0001	0.0005	0.0001	0.0001	0.0913

PROJECT TITLE: Wild Oat Herbicide Screening Trial in Spring Wheat.

PROJECT LEADER: Bob Stougaard, Weed Scientist, NWARC, Kalispell.

PROJECT PERSONNEL: Qingwu Xue, Research Associate, NWARC, Kalispell.

OBJECTIVES: To evaluate new and existing wild oat herbicides for efficacy and crop injury.

RESULTS:

Spring wheat cultivar, WPB 926, was planted on April 25, 2002 at a rate of 75 lb/a on 7-inch rows to a depth of 1.75 inches. A fertilizer blend of 119-52-62-20 lb/a was applied prior to seedbed preparation. Plots were 10x15 ft with three replicates arranged in a randomized complete block design. Wild oat was planted in the center of all plots to improve the consistency of weed pressure. Treatments were applied on May 26 with a CO_2 backpack sprayer in 20 gallons water per acre at 30 psi. Teejet XR11002 nozzles spaced 20 inches apart were used for applications. The environmental conditions at application time were 57 F temperature, 83% relative humidity, 0 wind speed, 58 F soil temperature and excellent soil moisture. The spring wheat was in the 3-4 leaf stage and 3.5 inches tall at the time of application. Wild oat was in the 2-3 leaf stage and 1.5 to 2 inches tall. Each herbicide was applied at 2 rates (label rate: 1X and one half of label rate: 1/2X). The broadleaf weeds were controlled by application of 0.1546 lb ai/a Express and 0.375 lb ai/a MCPA Ester with 1 pt/a NIS on June 14.

At the label rate (1X), all the six herbicides had excellent wild oat control, with more than a 94% control rating, minimal wild oat biomass and dockage. However, wild oat control at the1/2X rate varied among herbicides. The1/2X rate of Everest provided excellent wild oat control (98%), but other herbicides at the1/2X rate only resulted in 82-91% control and a slight reduction in crop yield as compared to 1X rate. Herbicide application at both rates significantly increased spring wheat yield and reduced the dockage as compared to untreated check (Table 1).

SUMMARY:

At label rates, all six herbicides provided excellent wild oat control. Therefore, the environmental conditions during herbicide application favored for both ACC-ase class (Achieve, Discover, Hoelon and Puma) and ALS class (Assert and Everest) herbicides. However, only Everest herbicide provided excellent control at 1/2X rate, and the efficacy of other herbicides was reduced at 1/2X rate as compared to 1X rate.

FUTURE PLANS:

Continue to evaluate wild oat herbicides for performance and crop tolerance.

Table 1 (Continued). Agronomic data from the TCK Winter Wheat Screening Nursery grown at the Northwestern Agricultural Research Center Kalispell, MT.

Plot #	Experimental lines	Yield	Test weight	Grain moist	Heading date	Plant height	TCK injury	Winter survival	Lodge score
		Bu/A	Lb/Bu	%	Julian	in	0-3		0-9
33	96X90cC4-10	122.6	64.2	12.4	165	34.3	2	100	0
46	95X185cE38	122.4	63.0	10.4	165	34.3	0.5	100	0
62	95X189cE69	121.5	63.4	10.7	165	36.6	2	100	0
58	95X189cE49	120.8	60.8	10.2	167	37.8	0	100	0
40	Yuma	120.1	64.4	10.6	161	33.1	0	100	0
54	95X189cE18	119.7	62.1	10.5	165	39.4	1.5	100	0
51	95X185cE91	118.5	64.3	10.8	165	41.7	0	100	0
55	95X189cE20	118.4	62.4	10.5	165	37.0	0	100	0
60	95X189cE59	118.1	62.0	10.3	165	35.8	0	100	0
42	95X185cE4	117.7	61.9	10.6	168	34.3	0	100	0
32	96X90cC4-2	114.3	64.1	11.2	164	33.5	0	100	0
59	95X189cE57	114.2	62.5	10.4	167	38.2	1	100	0
49	95X185cE63	113.4	63.2	11.0	165	35.0	0	100	0
34	96X90cC6-2	112.3	63.9	14.3	167	34.3	0.5	100	0
7	94X126E64-6	112.1	65.4	11.3	164	33.5	1.5	100	0
1	Yuma	112.1	64.9	10.9	161	33.5	2	100	0
28	96X90cC1-5	110.2	63.5	16.7	169	33.9	0	100	0
8	94X126E66-2	109.9	63.1	10.6	168	32.7	0	100	0
61	95X189cE65	108.8	62.7	10.2	165	35.8	1	100	0
45	95X185cE34	108.7	64.3	11.4	164	38.6	1	100	0
31	96X90cC2-8	108.0	65.1	11.5	165	33.5	0	100	0
50	95X185cE72	104.9	63.6	11.5	165	33.1	1	100	0
57	95X189cE43	104.4	63.0	10.5	165	37.4	0.5	100	0
44	95X185cE23	104.2	63.9	11.9	167	32.3	0	100	0
29	96X90cC1-9	103.7	64.1	15.9	167	31.9	0	100	0
30	96X90cC2-2	102.9	65.0	11.3	164	33.5	0	100	0
5	94X126E40-1	95.9	64.2	10.6	166	36.6	0	100	0
43	95X185cE10	92.8	63.5	11.9	169	38.6	0	100	0
47	95X185cE44	86.4	64.6	11.5	163	34.3	0	100	0
4	94X126E20-3	86.1	64.3	11.1	164	33.9	1	100	0
	Mean	122.0	63.4	11.1	166.0	36.1	0.5	100.0	0.0

Table 1. Agronomic data from the TCK Winter Wheat Screening Nursery grown at the Northwestern Agricultural Research Center Kalispell, MT.

Planted: October 1, 2001 Harvested: August 14, 2002

Plot #	Experimental lines	Yield	Test weight	Grain moist	Heading date	Plant height	TCK injury	Winter survival	Lodge score
		Bu/A	Lb/Bu	%	Julian	in	0-3		0-9
24	94X129E67-2	152.4	61.9	10.6	167	38.2	0	100	0
27	94X129E111-5	142.0	63.8	12.4	165	37.4	1	100	0
22	94X129E57-5	141.6	62.5	10.6	167	35.8	1	100	0
20	94X129E26-2	138.9	62.5	10.5	167	37.0	2	100	0
16	94X126E192-5	137.7	63.8	10.9	169	35.0	0	100	0
6	94X126E64-2	137.4	65.3	11.7	165	34.6	1	100	0
19	94X129E17-5	137.3	61.2	10.6	169	36.6	1	100	0
21	94X129E26-5	137.1	62.6	11.3	167	38.2	2.5	100	0
53	95X185cE99	136.8	62.3	10.2	165	39.0	0	100	0
66	Promontory	136.7	65.2	11.0	164	36.2	0	100	0
23	94X129E67-1	135.5	62.6	11.6	167	37.4	0	100	0
14	94X126E184-1	134.9	65.4	11.4	165	35.8	0	100	0
17	94X126E203-6	134.8	64.1	10.6	167	40.6	0	100	0
25	94X129E68-5	133.2	63.6	11.7	167	37.0	1.5	100	0
35	96X95cC2-8	133.0	60.2	10.1	169	37.4	0	100	0
38	96X95cC8-1	132.0	62.0	10.9	169	37.4	0	100	0
15	94X126E186-6	131.8	64.5	10.9	167	39.8	0	100	0
41	Promontory	130.2	65.8	11.1	163	34.3	0	100	0
26	94X129E92-4	129.8	62.4	10.6	167	37.8	1	100	0
11	94X126E119-4	129.8	63.7	10.5	166	39.4	0	100	0
10	94X126E108-6	129.7	64.2	10.9	166	38.2	1	100	0
36	96X95cC4-8	129.0	61.7	10.5	168	34.3	1	100	0
12	94X126E126-1	128.6	63.0	10.4	167	33.1	1	100	0
13	94X126E158-1	128.5	63.8	10.7	166	37.0	1	100	0
18	94X129E9-4	127.9	64.1	12.9	166	37.0	0	100	0
56	95X189cE41	127.8	63.0	10.3	167	40.9	0	100	0
52	95X185cE93	127.8	62.7	11.1	167	42.1	2	100	0
63	95X189cE78	127.7	62.9	10.5	167	40.6	0	100	0
64	95X189cE91	126.6	62.7	10.6	167	40.6	1	100	0
39	96X95cC8-9	126.6	61.1	10.6	169	34.3	0	100	0
48	95X185cE57	125.6	63.4	11.2	168	32.3	0	100	0
3	94X126E13-4	124.2	64.6	11.3	165	33.9	0	100	0
65	Yuma	123.7	63.4	10.4	160	34.3	1.5	100	0
9	94X126E66-5	123.7	63.4	10.7	168	33.5	0	100	0
2	Promontory	123.5	66.1	11.5	163	33.1	0	100	0
37	96X95cC6-2	123.1	62.2	10.2	169	38.2	0	100	0

Continued on next page.

PROJECT TITLE: Early Generation Winter Wheat Screening for TCK (Dwarf Bunt) Fungus (*Tilletia controversa* Kuhn).

PROJECT LEADERS: Bob Stougaard, Weed Scientist, NWARC, Kalispell.

PROJECT COOPERATORS: Qingwu Xue, Research Associate, NWARC, Kalispell.
Phil Bruckner, Winter Wheat Breeder, Bozeman.
Jim Berg, Research Associate, Bozeman

OBJECTIVES:

To evaluate early generation winter wheat lines for agronomic performance and resistance to both introduced and natural TCK inoculums.

RESULTS:

The mild winter resulted in 100% winter survival in all tested entries during 2001-02 winter wheat growing season. The TCK fungus was minimal due to the mild winter and lack of snow cover. 94X129E26-5, 95X185cE93, 94X129E26-2, 95X189cE69, 96X90cC4-10 and Yuma had moderate TCK infection (>2). Yield and test weight were excellent for the tested entries. Yield ranged from 86 bu/a (94X126E20-3 and 95X185cE44) to 152 bu/a (94X129E67-2), and only 4 entries (94X126E40-1, 95X185cE10, 94X126E20-3 and 95X185cE44) had a yield lower than 100 bu/a. Test weight in all entries were over 60 lb/bu, and ranged from 60 (96X95cC2-8) to 66 lb/bu (Promontory). Heading date ranged from Julian 160 to 169 days, with an average of 166 days. The mean plant height was 36 inches and ranged from 32 to 42 inches. No lodging was observed in any of the entries.

SUMMARY:

The 2001-02 growing conditions permitted minimal opportunity for screening of experimental lines for TCK fungus tolerance. However, these observations will further the selection process toward the release of cultivars suitable for planting in TCK prone areas.

FUTURE PLANS:

Continue to evaluate experimental winter wheat lines for resistance to TCK fungus.

Table 1. Agronomic data from the Soft White Winter Wheat Nursery grown at the Northwestern Agricultural Research Center Kalispell, MT.

Planted: October 1, 2001 Harvested: August 14, 2002

Cultivar	Yield	Test weight	Grain moist	Heading date	Plant height	Lodging index	Winter survival	Protein
	Bu/A	Lb/Bu	%	Julian	in	%	%	%
STEPHENS	134.0	61.5	10.5	169	34.8	0	100	10.1
ELTAN	132.5	58.0	10.5	173	37.1	0	100	11.9
MAC-1	127.9	61.4	10.5	167	36.0	0	100	12.3
NEELEY	127.3	62.7	10.9	167	38.8	0	100	12.0
LEWJAIN	126.4	60.8	10.2	173	32.3	0	100	10.1
BRUEHL	125.5	59.4	10.0	173	33.5	0	100	10.6
HILL 81	125.1	59.2	10.3	169	36.4	0	100	12.9
LAMBERT	125.1	57.8	10.0	165	35.8	0	100	12.8
KMOR	124.7	59.5	9.8	170	32.9	0	100	10.2
ROD	121.7	55.7	9.7	170	32.5	0	100	12.2
MACVICAR	119.2	59.8	9.8	168	33.2	0	100	10.3
KW960195	118.1	60.9	10.1	165	31.2	0	100	11.5
MADSEN	116.5	58.5	9.9	169	31.4	0	100	12.2
DAWS	116.3	58.7	10.0	167	32.9	0	100	11.9
MALCOLM	114.3	53.9	9.6	168	32.5	0	100	13.5
CASHUP	112.8	59.8	9.8	167	30.2	0	100	10.5
Mean	**123.0**	**59.2**	**10.1**	**169**	**33.9**	**0.0**	**100**	**11.6**
LSD (0.05)	**7.55**		**0.51**	**0.99**	**2.03**			
C.V. (%)	**3.68**		**3.04**	**0.35**	**3.59**			

PROJECT TITLE: Agronomic Performance Evaluation of Soft White Winter Wheat Cultivars.

PROJECT LEADER: Bob Stougaard, Weed Scientist, NWARC, Kalispell.

PROJECT PERSONNEL: Qingwu Xue, Research Associate, NWARC, Kalispell.
Phil Bruckner, Winter Wheat Breeder, Bozeman.
Jim Berg, Research Associate, Bozeman.

OBJECTIVES:

To evaluate the agronomic performance of soft white winter wheat cultivars in environments and cropping systems representative of northwestern Montana.

RESULTS:

The mild winter resulted in 100% winter survival in all tested entries during 2001-02 winter wheat growing season. Disease symptoms were very minimal and no disease evaluations were recorded. Yield ranged from 112.8 bu/a (Cashup) to 134.0 bu/a (Stephens), with an average of 123.0 bu/a. Test weight ranged from 53.9 lb/bu (Malcolm) to 62.7 lb/bu (Neeley), with an average of 59.2 lb/bu. Three entries had a low test weight (Lambert, Rod and Malcolm) (<58 lb/bu). Heading dates were delayed by the cool and moist spring season and ranged between Julian 165 (KW960195 and Lambert) and 173 (Eltan, Lewjain and Bruehl). All the soft white cultivars had a short to medium height and ranged from 30 to 37 inches. No lodging was observed in any of the entries. The average grain protein content was 11.6%, and the ranged from 10.1% (Stephens and Lewjain) to 13.5% (Malcolm).

SUMMARY:

Despite limited precipitation during grain filling, the stored soil moisture permitted good yields and test weights. High winter survival and lack of disease also favored the soft white winter wheat in 2001-02 season. Several cultivars exhibited superior yield performance and agronomic traits that may make them an excellent choice for planting in northwestern Montana.

FUTURE PLANS:

Continue to evaluate soft white winter wheat cultivars for adaptation in District 1.

Indian Ricegrass and Downy Brome Tolerance to Herbicides

Treatment	Rate	Ricegrass Injury 6/7/02	Ricegrass Injury 7/17/02	Downy brome control 7/17/02	Ricegrass DWT (g) 7/25/02	% composition Ricegrass	% composition Downy brome
Nontreated		0	0	0	274	98	2
Plateau MSO	0.0625 0.187	40	48	7	215	98	2
Plateau MSO	0.094 0.187	50	70	20	197	98	2
Dimension	0.25	0	3	0	277	96	4
Dimension	0.5	0	7	0	254	93	7
Select COC	0.094 1	77	98	0	1	1	99
Prowl	1	0	3	0	252	95	5
Lexone	0.75	47	83	99	76	100	0
LSD		9.6	10.2	21.6	54.9	6	6
CV		20.66	14.84	78.17	16.22	4.06	22.87
REP (F)		0.204	0.3475	0.2009	0.0073	0.4508	0.4508
TMT (F)		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001