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

ANNUAL REPORT
2004 CROP YEAR

Prepared by

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STAFF 2004

Full Time Staff Members — **Years in Service**

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Began January 2001

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Began November 1991

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Began July 2002

Gary R. Haaven – Ag Research Specialist 22
Began April 1982

Barbara F. Honeycutt – Administrative Support 4
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Paul P. Koch – Ag Research Technician 8
Began May 1995

Janice Haaven – Research Aide 2
Began March 2003

Vern R. Stewart – Professor Emeritus
Leon E. Welty – Superintendent Retired

Part Time Employees

Cleo Gorton (May-June)
Sarah Gunderson (June-August)
Melvin Moe (May-December)
Amy Smith (June-September)

Student Interns

Frankie Crutcher (May-August)

Student Employees

Michelle Passmore (June-August)

CLIMATOLOGY

Weather information as recorded at the
Northwestern Agricultural Research Center, Kalispell, Montana.

CLIMATOLOGICAL OVERVIEW 2004
NORTHWEST AGRICULTURAL RESEARCH CENTER
Kalispell, MT

The 2003/2004 crop year began with a wetter than normal September. September precipitation was 2.56 inches contrasting with a 20-year average of 1.55 inches. However, rainfall for October through December was below average. At the beginning of January 2004, we were just –0.51 short of average precipitation. Rainfall for the 2004 crop growing season fell short of average. At the end of June, we were 2.56 inches short of the 20-year average; by the end of July, the shortfall was –2.88 inches. August brought unusually heavy precipitation, 3.6 inches, more than double the average of 1.51 inches. The crop year ended August 31 with a precipitation deficit of just -.79. However, in many ways, precipitation came too late in the year to benefit most crops, and was damaging to small grain and forage harvests.

In terms of temperature, we were slightly above average at 43.7° F compared to the long-term average of 43.2°F. The last recorded frost was May 14, with the first frost of the fall recorded on October 2 fall. This gave the 2004 growing season 140 frost-free days versus the long-term average of 115 days.

Summary of Climatic Data by Months for the 2004 Crop Year: September 2003 - August 2004 and Averages for the Period 1949-2004 at the Northwestern Agricultural Research Center - Kalispell, Montana

ITEM	Sept. 2003	Oct. 2003	Nov. 2003	Dec. 2003	Jan. 2004	Feb. 2004	Mar. 2004	Apr. 2004	May 2004	June 2004	July 2004	Aug. 2004	Total or Average
Precipitation (inches)													
Current Year	2.56	1.29	0.59	1.04	2.02	0.42	0.57	2.23	1.97	1.31	1.24	3.6	18.84
Avg. 1949 to Crop Year 04	1.55	1.35	1.52	1.58	1.47	1.16	1.20	1.55	2.30	2.89	1.56	1.51	19.65
Average Temperature (F)													
Current Year	55.5	46.3	27.3	24.2	21.1	27.6	39.5	45.1	51.0	57.3	66.0	64.0	43.7
Mean 1949 to 2003-2004	53.7	42.9	32.5	25.5	22.7	27.6	33.8	43.2	51.6	58.1	64.1	63.1	43.2

Last killing frost in spring

Spring 2004	May 14	26°F
Avg. 1949-2004	May 22	

First killing frost in fall

Fall 2004	Oct 2	32°F
Avg. 1949-2004	September 13	

Frost Free Period

2003-2004	140
Avg. 1949-2004	115

Growing Degree Days (base 50):	1875 days	April - October 2004
	1884 days	1949-2004 Average
Growing Degree Days (base 32):	4763 days	April 2004 - October 2004
	4830	2001-2004

Maximum summer temperature	94°F on August 15, 2004
Minimum winter temperature	-30°F on January 5 & 6, 2004

In this summary 32° Farenheit is considered a killing frost.

MAXIMUM / MINIMUM TEMPERATURES IN DEGREES FARENHEIT BY MONTH & DAY
JANUARY- DECEMBER 2004

2004

YR	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
04	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	25	1	34	16	44	26	51	32	66	35	61	42	78	57	86	49	84	47	61	32	39	20	30	24
2	26	10	32	16	40	26	45	23	72	40	65	36	72	51	91	48	77	49	59	31	43	21	33	27
3	15	9	27	7	34	14	58	29	74	40	73	40	81	50	88	55	59	46	64	32	49	36	35	32
4	9	-8	28	6	31	15	62	42	73	40	78	48	73	52	78	49	57	48	66	31	45	22	40	34
5	-3	-30	32	21	35	30	64	29	69	46	82	47	67	51	83	48	64	47	67	31	40	22	39	28
6	-8	-30	31	12	36	27	69	31	61	33	76	48	70	52	85	47	67	36	66	31	49	29	36	27
7	2	-20	31	12	37	24	66	30	68	40	57	46	76	55	79	49	69	36	61	41	51	39	36	26
8	14	2	35	26	46	36	64	33	74	39	57	42	67	43	60	47	69	38	63	31	48	24	36	27
9	22	13	35	28	57	24	45	31	57	43	62	39	67	41	76	47	74	39	67	32	51	22	39	32
10	30	16	36	28	52	23	57	32	60	34	68	47	81	47	80	48	69	36	55	40	45	22	39	32
11	31	26	35	12	49	23	59	29	61	39	61	51	82	53	82	47	71	38	55	32	54	26	50	32
12	38	23	35	5	50	25	64	31	61	33	53	46	71	41	85	46	64	50	57	34	39	27	51	19
13	28	24	34	6	54	28	69	33	46	26	61	47	80	44	88	46	57	47	63	33	35	31	35	15
14	28	22	25	11	48	28	73	37	52	26	62	47	86	51	89	49	57	47	61	34	35	31	28	16
15	31	26	27	19	47	26	50	31	56	36	60	36	92	60	94	51	53	43	69	34	36	28	39	28
16	30	27	30	22	49	31	46	32	64	39	62	36	93	56	93	52	50	44	57	42	40	29	42	29
17	35	27	37	21	47	38	50	29	62	36	70	44	92	52	89	59	58	46	52	34	47	35	42	29
18	30	26	39	32	52	42	50	30	70	34	65	36	93	58	89	60	59	46	36	32	47	24	43	28
19	29	26	41	31	65	32	48	34	71	42	66	48	85	60	74	48	51	38	48	35	41	28	35	30
20	32	25	39	31	65	22	53	32	71	38	66	36	81	60	75	51	55	37	55	35	42	23	49	32
21	33	25	38	29	50	26	53	31	67	42	63	45	77	47	79	53	50	33	45	35	38	23	37	23
22	33	28	42	14	55	28	55	29	68	43	76	47	79	47	83	60	51	35	47	36	35	24	31	21
23	36	28	38	13	64	31	61	37	54	41	79	46	82	50	71	54	57	35	44	38	33	25	30	3
24	36	32	40	14	55	36	67	36	57	37	83	49	83	48	56	51	60	40	48	30	37	27	11	20
25	34	13	43	23	54	35	56	28	59	33	81	55	88	50	56	51	67	39	43	31	45	34	27	20
26	17	12	44	32	54	36	61	33	65	46	77	49	90	54	57	50	71	38	43	22	44	32	32	26
27	34	15	44	30	55	33	71	39	62	47	71	47	86	53	59	50	74	39	47	22	39	26	35	10
28	35	16	47	23	51	30	73	35	64	49	78	51	80	49	62	53	73	37	47	23	31	17	28	10
29	44	30	38	26	55	26	50	27	55	43	83	52	81	48	68	55	73	37	44	26	27	19	27	21
30	42	35			65	26	62	31	59	44	81	56	88	52	67	47	69	38	43	35	31	25	28	18
31	42	27			74	35			54	44			86	52	81	45			48	33			27	12
AVG	26.8	15.4	35.8	19.5	50.6	28.5	58.4	31.9	63.0	39.0	69.2	45.3	80.9	51.1	77.5	50.5	63.6	41.0	54.2	32.5	41.2	26.4	35.2	23.6

MAXIMUM TEMPERATURE	94	MINIMUM TEMPERATURE	-30

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
2002-03	1.18	0.25	0.87	1.67	1.63	1.01	2.32	2.23	1.78	1.57	0.05	0.35	14.91
2003-04	2.56	1.29	0.59	1.04	2.02	0.42	0.57	2.23	1.97	1.31	1.24	3.60	18.84
MEAN	1.55	1.35	1.52	1.58	1.47	1.16	1.20	1.55	2.30	2.89	1.56	1.51	19.65
	SEPT	OCT	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	TOTAL

Mean precipitation for all crop years = 19.65

CROP YEAR 2004 - GROWING DEGREE DAYS APRIL THROUGH OCTOBER 2004

Calculated at Both Base 50 and Base 32

pl	MAX	MIN	Base 50	Base 32
1	51	32	0.5	9.5
2	45	23	0.0	6.5
3	58	29	4.0	13.0
4	62	42	6.0	20.0
5	64	29	7.0	16.0
6	69	31	9.5	18.5
7	66	30	8.0	17.0
8	64	33	7.0	16.5
9	45	31	0.0	6.5
#	57	32	3.5	12.5
#	59	29	4.5	13.5
#	64	31	7.0	16.0
#	69	33	9.5	19.0
#	73	37	11.5	23.0
#	50	31	0.0	9.0
#	46	32	0.0	7.0
#	50	29	0.0	9.0
#	50	30	0.0	9.0
#	48	34	0.0	9.0
#	53	32	1.5	10.5
#	53	31	1.5	10.5
#	55	29	2.5	11.5
#	61	37	5.5	17.0
#	67	36	8.5	19.5
#	56	28	3.0	12.0
#	61	33	5.5	15.0
#	71	39	10.5	23.0
#	73	35	11.5	22.0
#	50	27	0.0	9.0
#	62	31	6.0	15.0

AV MAX	AV MIN	Total Base 50	Total Base 32
58.4	31.9	134.0	415.5

May	MAX	MIN	Base 50	Base 32
1	66	35	8.0	18.5
2	72	40	11.0	24.0
3	74	40	12.0	25.0
4	73	40	11.5	24.5
5	69	46	9.5	25.5
6	61	33	5.5	15.0
7	68	40	9.0	22.0
8	74	39	12.0	24.5
9	57	43	3.5	18.0
10	60	34	5.0	15.0
11	61	39	5.5	18.0
12	61	33	5.5	15.0
13	46	26	0.0	7.0
14	52	26	1.0	10.0
15	56	36	3.0	14.0
16	64	39	7.0	19.5
17	62	36	6.0	17.0
18	70	34	10.0	20.0
19	71	42	10.5	24.5
20	71	38	10.5	22.5
21	67	42	8.5	22.5
22	68	43	9.0	23.5
23	54	41	2.0	15.5
24	57	37	3.5	15.0
25	59	33	4.5	14.0
26	65	46	7.5	23.5
27	62	47	6.0	22.5
28	64	49	7.0	24.5
29	55	43	2.5	17.0
30	59	44	4.5	19.5
31	54	44	2.0	17.0

AV MAX	AV MIN	Total Base 50	Total Base 32
63.3	39.0	203.0	594.0

June	MAX	MIN	Base 50	Base 32
1	61	42	5.5	19.5
2	65	36	7.5	18.5
3	73	40	11.5	24.5
4	78	48	14.0	31.0
5	82	47	16.0	32.5
6	76	48	13.0	30.0
7	57	46	3.5	19.5
8	57	42	3.5	17.5
9	62	39	6.0	18.5
10	68	47	9.0	25.5
11	61	51	6.0	24.0
12	53	46	1.5	17.5
13	61	47	5.5	22.0
14	62	47	6.0	22.5
15	60	36	5.0	16.0
16	62	36	6.0	17.0
17	70	44	10.0	25.0
18	65	36	7.5	18.5
19	66	48	8.0	25.0
20	66	36	8.0	19.0
21	63	45	6.5	22.0
22	76	47	13.0	29.5
23	79	46	14.5	30.5
24	83	49	16.5	34.0
25	81	55	18.0	36.0
26	77	49	13.5	31.0
27	71	47	10.5	27.0
28	78	51	14.5	32.5
29	83	52	17.5	35.5
30	81	56	18.5	36.5

AV MAX	AV MIN	Total Base 50	Total Base 32
69.2	45.3	296.0	758.0

ul	MAX	MIN	Base 50	Base 32
1	78	57	17.5	35.5
2	72	51	11.5	29.5
3	81	50	15.5	33.5
4	73	52	12.5	30.5
5	67	51	9.0	27.0
6	70	52	11.0	29.0
7	76	55	15.5	33.5
8	67	43	8.5	23.0
9	67	41	8.5	22.0
#	81	47	15.5	32.0
#	82	53	17.5	35.5
#	71	41	10.5	24.0
#	80	44	15.0	30.0
#	86	51	18.5	36.5
#	92	60	23.0	41.0
#	93	56	21.0	39.0
#	92	52	19.0	37.0
#	93	58	22.0	40.0
#	85	60	22.5	40.5
#	81	60	20.5	38.5
#	77	47	13.5	30.0
#	79	47	14.5	31.0
#	82	50	16.0	34.0
#	83	48	16.5	33.5
#	88	50	18.0	36.0
#	90	54	20.0	38.0
#	86	53	19.5	37.5
#	80	49	15.0	32.5
#	81	48	15.5	32.5
#	88	52	19.0	37.0
#	86	52	19.0	37.0

AV MAX	AV MIN	Total Base 50	Total Base 32
80.9	51.1	501.0	1036.5

Aug	MAX	MIN	Base 50	Base 32
1	86	49	18.0	35.5
2	91	48	18.0	35.0
3	88	55	20.5	38.5
4	78	49	14.0	31.5
5	83	48	16.5	33.5
6	85	47	17.5	34.0
7	79	49	14.5	32.0
8	60	47	5.0	21.5
9	76	47	13.0	29.5
10	80	48	15.0	32.0
11	82	47	16.0	32.5
12	85	46	17.5	33.5
13	88	46	18.0	34.0
14	89	49	18.0	35.5
15	94	51	18.5	36.5
16	93	52	19.0	37.0
17	89	59	22.5	40.5
18	89	60	23.0	41.0
19	74	48	12.0	29.0
20	75	51	13.0	31.0
21	79	53	16.0	34.0
22	83	60	21.5	39.5
23	71	54	12.5	30.5
24	56	51	3.5	21.5
25	56	51	3.5	21.5
26	57	50	3.5	21.5
27	59	50	4.5	22.5
28	62	53	7.5	25.5
29	68	55	11.5	29.5
30	67	47	8.5	25.0
31	81	45	15.5	31.0

AV MAX	AV MIN	Total GDD Base 50	Total GDD Base 32
77.5	50.5	437.5	975.5

Sept	MAX	MIN	Base 50	Base 32
1	84	47	17.0	33.5
2	77	49	13.5	31.0
3	59	46	4.5	20.5
4	57	48	3.5	20.5
5	64	47	7.0	23.5
6	67	36	8.5	19.5
7	69	36	9.5	20.5
8	69	38	9.5	21.5
9	74	39	12.0	24.5
10	69	36	9.5	20.5
11	71	38	10.5	22.5
12	64	50	7.0	25.0
13	57	47	3.5	20.0
14	57	47	3.5	20.0
15	53	43	1.5	16.0
16	50	44	0.0	15.0
17	58	46	4.0	20.0
18	59	46	4.5	20.5
19	51	38	0.5	12.5
20	55	37	2.5	14.0
21	50	33	0.0	9.5
22	51	35	0.5	11.0
23	57	35	3.5	14.0
24	60	40	5.0	18.0
25	67	39	8.5	21.0
26	71	38	10.5	22.5
27	74	39	12.0	24.5
28	73	37	11.5	23.0
29	73	37	11.5	23.0
30	69	38	9.5	21.5

AV MAX	AV MIN	Total Base 50	Total Base 32
63.6	41.0	204.5	609.0

Oct	MAX	MIN	Base 50	Base 32
1	61	32	5.5	14.5
2	59	31	4.5	13.5
3	64	32	7.0	16.0
4	66	31	8.0	17.0
5	67	31	8.5	17.5
6	66	31	8.0	17.0
7	61	41	5.5	19.0
8	63	31	6.5	15.5
9	67	32	8.5	17.5
10	55	40	2.5	15.5
11	55	32	2.5	11.5
12	57	34	3.5	13.5
13	63	33	6.5	16.0
14	61	34	5.5	15.5
15	69	34	9.5	19.5
16	57	42	3.5	17.5
17	52	34	1.0	11.0
18	36	32	0.0	2.0
19	48	35	0.0	9.5
20	55	35	2.5	13.0
21	45	35	0.0	8.0
22	47	36	0.0	9.5
23	44	38	0.0	9.0
24	48	30	0.0	8.0
25	43	31	0.0	5.5
26	43	22	0.0	5.5
27	47	22	0.0	7.5
28	47	23	0.0	7.5
29	44	26	0.0	6.0
30	43	35	0.0	7.0
31	48	33	0.0	8.5

AV MAX	AV MIN	Total Base 50	Total Base 32
54.2	32.5	99.0	374.0

WEED AND SMALL GRAIN MANAGEMENT FOR WESTERN MONTANA

754

The Weed and Small Grain Management Project (754) includes research related to all types of weeds and small grains from seeding to data collection to publications.

Project Title: Effect of Apogee (Prohexadione Calcium) on Spring Barley Yield and Yield Components

Project Leader: Bob Stougaard

Project Personnel: Qingwu Xue and Fernando Guillen

Objective:

To investigate interaction of Apogee application rate and timing on barley yield and yield components.

Results:

"Morex" six-row malt barley was planted on April 4, 2004 with a seeding rate of 65 lb/A. The factorial treatment design consisted of Apogee applied at two rates (0.069 and 0.137 lb ai/A) and four barley growth stages (tillering, jointing, booting and heading). Apogee was applied with a CO_2 backpack sprayer in 20 GPA of water using XR11002 nozzles.

Lodging was not observed though there was adequate soil moisture during the 2004 growing-season. Apogee reduced plant height. Both application rate and timing affected plant height, but rate had the most significant effect. Plant height was reduced more with the high rate than at low rate and this response was observed with all timings except when applied at tillering. Heading date was affected by both application rate and timing. In general, the high rate and early application (before booting) delayed heading more than the low rate and late application.

The effect of Apogee on grain yield was also related to application rate and timing. When compared to the nontreated, the low rate did not negatively affect yields regardless of application timing. In contrast, the high rate reduced yields when applied at jointing or booting. However, yields tended to increase with both rates when applications were made during heading.

In general, test weight increased as application was delayed, regardless of the rate applied. The highest test weights were obtained when Apogee was applied at heading. There was a direct relationship between application timing and grain plumpness (PP), with PP increasing as applications were delayed. The PP values were greatest when Apogee was applied at the highest rate. The effect of Apogee on thousand kernel weights (TKW) and protein was similar to PP.

Summary:

Effect of Apogee on barley yield and yield components was related to both application rate and timing. Application at high rate from tillering to booting tended to reduce yield. Early application also reduced grain test weight, plumpness and protein content.

Table 1. Effect of Apogee PGR on plant height, heading date, grain yield, biomass, spikes per square foot and seed per spike in spring barley in 2004 season at Kalispell, MT.

TRT	Plant height (in)		Heading date (Julian)		Grain yield (Bu/A)		Biomass (Lb/A)		Spikes ft^{-2}		Seeds $spike^{-1}$	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Tillering	36.2	34.1	168	169	106.4	108.0	8775.9	9293.3	42.2	44.5	48.1	47.4
Jointing	37.0	33.2	168	169	107.8	90.2	9433.2	8109.5	42.6	37.5	46.4	43.1
Booting	34.0	30.4	168	169	106.4	94.6	9705.0	8331.2	43.3	37.6	43.2	43.7
Heading	34.1	32.0	167	167	113.9	119.0	9525.5	10025.7	43.6	41.3	48.1	47.9
Untreated	34.1		167		103.9		9705.0		40.7		44.1	
ANOVA												
Overall	**		**		*		NS		NS		NS	
Rate	**		*		NS		NS		NS		NS	
Timing	0.09		**		*		NS		NS		NS	
Rate x timing	NS		NS		NS		NS		NS		NS	
Mean tests												
LSD (overall)	3.66		1.3		16.9		NS		NS		NS	
LSD (rate)	1.93		0.6		NS		NS		NS		NS	
LSD (timing)	2.72		0.9		11.4		NS		NS		NS	
Dunnett's	5.12		1.8		23.3		NS		NS		NS	

Table 2. Effect of Apogee PGR on grain test weight, plumpness, 1000 kernel weight (TKW) and protein content in spring barley in 2004 season at Kalispell, MT.

TRT	Test weight (Lb/Bu)		Plumpness (%)		TKW (g)		Protein (%)	
	Low	High	Low	High	Low	High	Low	High
Tillering	45.2	44.9	36.8	35.4	32.8	32.3	16.0	16.0
Jointing	45.2	45.3	45.4	53.5	34.4	34.9	15.6	15.8
Booting	45.6	45.1	50.1	55.3	36.1	36.0	16.5	16.2
Heading	46.0	46.4	59.9	67.1	34.8	38.0	16.4	16.3
Untreated	45.1		66.2		36.3		15.7	
ANOVA								
Overall	*		***		***		0.11	
Rate	NS		0.12		NS		NS	
Timing	0.07		***		***		*	
Rate x timing	NS		NS		NS		NS	
Mean tests								
LSD (overall)	1.3		12.0		2.4		0.7	
LSD (rate)	NS		6.2		NS		NS	
LSD (timing)	0.9		8.7		1.7		0.5	
Dunnett's	1.7		16.9		3.3		1.0	

Project Title: Agronomic Performance Evaluation of Intrastate Spring Barley Cultivars.

Project Leader: Bob Stougaard

Project Personnel: Tom Blake, Pat Hensleigh, Qingwu Xue, and Fernando Guillen

Objectives:

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

Results:

In 2004 spring barley growing season, temperature was near normal except a warmer April. The precipitation during grain filling was higher than previous season. Barley yields were higher than previous season. Averaged over all 64 entries, yields were 130 Bu/A compared to the 2003 average of 116 Bu/A. Yield ranged from 112 Bu/A in Haybet to 158 Bu/A in MT020262. More than half of the entries yield more than Galltin (127 Bu/A). Test weights were excellent and averaged 51.5 Lb/Bu. Grain plumpness was very high and averaged 92%. Grain plumpness was linearly related to 1000 kernel weight (TKW). TKW ranged from 34.8 g in Lagecy to 51.8 g in MT000138, and only 3 entries had a TKW lower than 40 g. Heading was earlier than previous season with an average of Julian 169 (June 20). The average plant height was 36 in. Grain protein was lower than previous season and averaged 14.3%. Disease and lodging were minimal in this season for barley entries.

Summary:

The 2004 was an ideal season for barley growth and resulted in high yield, excellent test weight and grain plumpness. MT020162, MT020166, MT020167, MT020116 and WPB Xena were top yielding entries (>140 Bu/A).

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 6, 2004 Harvested: August 11, 2004

Entry	Cultivar	Yield	Test weight	Grain moisture	Heading date	Plant height	Lodging index	Plump	TKW	Protein
		Bu/A	Lb/Bu	%	Julian	in	%	%	g	%
58	MT020162	157.9	51.9	13.2	169.0	41.6	0	94.5	48.3	14.4
60	MT020167	143.8	51.7	12.4	169.0	36.0	0	88.9	43.6	14.4
59	MT020166	142.6	51.3	12.2	169.3	33.1	0	92.0	45.9	13.2
23	MT970116	142.5	53.2	12.6	167.7	38.6	0	93.6	49.0	14.2
6	WPB Xena	140.4	51.6	12.8	169.7	34.9	0	91.7	47.8	13.4
54	MT020090	140.1	50.6	11.6	173.7	32.1	0	95.0	49.7	13.9
20	APB B99AL-616	139.9	49.7	12.8	169.7	34.6	0	84.3	41.4	14.6
3	Eslick	139.5	52.4	12.4	170.3	36.3	0	96.8	46.0	13.3
5	Calgary	138.6	50.6	11.4	170.0	31.3	0	85.1	40.1	13.4
29	MT000040	138.0	53.2	12.6	169.0	36.9	0	94.7	45.0	14.3
46	MT010212	138.0	51.9	13.0	168.3	38.6	0	94.0	47.8	14.0
32	MT000092	137.0	51.6	12.6	168.3	36.1	0	91.1	43.3	13.9
9	Hays	137.0	47.9	12.6	169.7	34.2	0	80.1	44.0	14.5
17	Lacey	136.5	48.7	11.4	165.3	40.4	0	81.3	38.0	14.1
33	MT000125	135.9	52.5	13.2	168.7	36.9	0	96.0	49.0	14.1
31	MT000047	135.8	51.7	13.0	168.3	38.1	0	87.8	44.5	14.7
50	MT020072	135.6	53.1	12.8	173.0	35.9	0	98.7	50.4	14.1
57	MT020155	135.4	50.7	12.2	161.7	35.7	0	87.3	44.0	13.7
51	MT020075	135.1	50.6	12.0	173.0	33.5	0	92.2	48.0	14.3
61	MT020204	134.7	52.0	12.0	166.3	36.7	0	91.5	44.2	13.8
15	Tradition	134.4	49.1	10.8	166.7	40.1	0	89.2	38.1	13.7
53	MT020085	134.1	49.5	11.5	173.0	31.1	0	89.3	45.2	13.8
26	MT981006	133.8	52.1	12.4	170.7	33.3	0	92.7	44.8	14.7
63	WPB BZ596-117	133.8	53.1	12.6	168.7	37.8	0	94.4	46.9	14.3
22	MT910189	133.5	52.5	12.8	165.7	35.5	0	96.5	50.6	13.9
27	MT981210	133.2	52.4	12.2	168.7	36.1	0	97.0	47.8	14.8
37	MT010081	133.0	53.3	12.8	170.0	37.1	0	95.5	48.2	15.5
44	MT010191	132.7	52.3	12.2	172.7	33.2	0	96.3	45.5	14.4
10	Harrington	132.5	49.8	12.2	171.0	36.7	0	84.7	42.4	14.7
36	MT010080	132.4	52.9	12.6	167.3	37.2	0	97.0	49.6	15.0
4	Baronesse	132.2	52.1	12.4	171.7	33.6	0	92.2	43.6	14.2
47	MT010213	131.9	52.8	12.6	169.0	32.9	0	95.4	43.2	15.1
21	Auriga	130.8	52.0	12.0	169.7	27.9	0	91.4	43.8	13.1
18	Metcalfe	130.5	52.2	12.4	172.3	35.4	0	94.0	44.5	14.1
39	MT010156	130.2	52.4	11.8	166.7	37.9	0	96.5	48.3	15.3
42	MT010162	129.3	52.3	12.8	170.0	33.8	0	95.1	46.0	13.8
40	MT010158	128.7	52.8	12.2	167.0	35.7	0	96.8	49.4	14.2
62	MT020205	128.0	52.6	12.4	166.3	36.3	0	95.6	46.8	14.3
12	Merit	127.8	50.6	12.0	172.0	35.1	0	94.9	46.4	15.0
34	MT000138	127.4	54.1	12.0	166.7	38.0	0	98.8	51.8	15.1

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

Planted: April 6, 2004 — Harvested: August 11, 2004

Entry		Yield	Test weight	Grain moisture	Heading date	Plant height	Lodging index	Plump	TKW	Protein
		Bu/A	Lb/Bu	%	Julian	in	%	%	g	%
1	Gallatin	127.2	52.4	12.8	168.3	36.7	0	90.0	43.2	14.5
24	MT970229	126.5	53.8	13.0	171.0	34.9	0	97.7	50.1	13.9
30	MT000045	126.5	51.7	12.8	170.7	35.3	0	97.6	48.2	14.0
48	MT020037	126.2	52.6	13.0	167.7	35.3	0	93.3	47.4	14.7
2	Haxby	125.6	52.8	13.0	168.3	35.0	0	92.2	46.7	14.0
64	MT020246	125.5	51.1	12.2	175.0	30.9	0	92.0	46.7	12.7
52	MT020080	125.1	49.9	11.6	172.7	30.6	0	95.3	47.8	13.4
14	Legacy	125.1	46.1	11.2	169.3	39.5	0	73.4	34.8	13.3
25	MT981004	124.9	49.9	12.2	169.7	33.8	0	80.1	40.7	15.3
38	MT010155	124.6	52.4	12.2	166.3	37.5	0	98.5	48.0	15.2
43	MT010177	124.3	51.8	13.0	166.7	32.7	0	94.5	48.7	14.8
7	Valier	124.2	51.4	12.4	171.0	35.8	0	87.3	42.5	15.6
19	Copeland	124.1	49.6	12.4	174.3	35.1	0	87.8	43.0	13.6
28	MT981238	122.3	53.1	12.6	166.0	37.6	0	95.4	50.4	15.2
35	MT000153	122.1	52.6	11.8	168.0	32.8	0	95.6	50.2	14.9
49	MT020064	121.4	53.2	12.4	168.0	34.3	0	97.8	48.3	14.7
55	MT020120	120.9	50.8	12.0	172.0	33.6	0	93.8	42.4	14.4
13	2B965057	120.7	50.4	12.0	170.3	30.9	0	93.3	43.4	15.6
11	Conlon	120.6	52.2	12.8	160.0	35.3	0	96.5	49.2	14.1
45	MT010205	120.2	50.6	12.8	172.7	33.8	0	96.0	45.0	15.0
41	MT010160	119.8	52.4	12.2	169.0	33.2	0	95.9	45.5	14.5
16	Morex	115.3	49.1	10.8	165.3	43.1	0	82.9	37.9	14.4
56	MT020139	115.0	52.0	12.8	169.0	36.0	0	95.8	46.8	16.2
8	Haybet	111.7	48.6	12.4	168.3	40.7	0	82.9	40.9	14.4
Mean		**130.5**	**51.5**	**12.3**	**169.1**	**35.5**	**0**	**92.3**	**45.6**	**14.3**
C.V. (%)		**9.25**			**0.60**	**6.62**				
LSD (0.05)		**14.50**			**1.57**	**3.23**				

Project Title:	Evaluation of Durum Wheat Variety Performance in Off-Stations Trials
Project Leader:	Bob Stougaard
Project Personnel:	Luther Talbert, Susan Lanning, Qingwu Xue, and Fernando Guillen

Objectives:

To evaluate the performance of durum wheat varieties in different environments across Montana

Results:

In 2004 spring wheat growing season, temperature was near normal except a warmer April. The precipitation during grain filling was higher than previous season. Average yield (61 Bu/A) in this season was higher than previous season (41 Bu/A). Yields in durum entries were still lower than common spring wheat McNeal. Most entries yielded more than check entry (Mountrail, 59 Bu/A). Grain test weight was normal and averaged 60 Lb/Bu. The average heading date was Julian 170 (June 19) and range was within one week. Plant height (35 in) in this season was higher than previous season (27 in). No disease and lodging were observed in this season.

Summary:

The 2004 was the second season to evaluate durum wheat performance in Northwestern Montana. The yield of durum entries was higher than previous season and test weight was normal (60 lb/Bu). Most of the entries yielded more than check entry (Mountrail).

Future Plans:

Durum wheat off-station trial will be continued in Northwestern Montana.

Table 1. Agronomic data from the Durum Spring Wheat Nursery Grown at the Northwestern Agricultural Research Center, Kalispell, MT.

Planted: April 7, 2004 Harvested: August 12, 2004

ENTRY	ID	Cultivar	Yield	Test weight	Grain moisture	Heading date	Plant height	Protein
			Bu/A	Lb/Bu	%	Julian	in	%
13	PI574642	MCNEAL	69.8	60.2	9.7	169.7	32.4	
4	NDMUNICH	Munich	64.0	59.1	9.6	168.7	34.3	
2	PI478289	MONROE	62.0	59.7	10.3	166.0	37.7	
12	DILSE	DILSE	62.0	59.7	9.5	172.7	33.9	
7	D89135	MAIER	61.8	60.2	10.2	170.0	33.1	
1	CI 17789	VIC	61.4	59.9	10.2	170.7	38.3	
3	CANKYLE	KYLE	61.0	59.9	11.0	174.0	39.5	
10	ACAVONLE	AC AVONLEA	59.8	59.9	9.8	168.0	36.9	
5	D87130	BEN	59.7	60.2	10.4	169.7	37.3	
6	D901313	MOUNTRAIL	59.3	58.5	9.9	171.0	33.1	
11	PIERCE	PIERCE	56.5	60.5	9.2	170.7	34.5	
9	D901442	LEBSOCK	55.4	59.1	10.2	168.0	33.6	
8	D91080	PLAZA	55.1	59.0	9.3	172.0	28.5	
Mean			**60.6**	**59.7**	**9.9**	**170.1**	**34.8**	
C.V. (%)			**9.39**			**0.50**	**4.84**	
LSD (0.05)			**9.59**			**1.45**	**2.84**	

Project Title: Evaluation of Clearfield Winter Wheat Lines for Herbicide Tolerance.

Project Leader: Bob Stougaard

Project Personnel: Phil Bruckner, Jim Berg, Qingwu Xue, and Fernando Guillen

Objectives: Evaluate crop tolerance, yield potential and agronomic attributes of experimental herbicide resistant winter wheat lines.

Results:

In 2003-04 season, 10 herbicide resistant (Clearfield) winter wheat lines and 2 susceptible cultivars were evaluated for their agronomic performance after herbicide (Beyond) was applied at 2 rates (label rate: 1X and double label rate: 2X). The herbicide was sprayed on April 16, 2004 using a tractor sprayer when seedlings were 5" tall.

Despite lower temperature than normal during the winter months (Nov.-Jan.), winterkill was minimal and was not recorded. The adequate moisture in spring and early summer resulted in high yield this season. In overall, herbicide application did not affect grain yield, test weight, heading and protein content. Yield averaged 111 Bu/A. Several entries yielded more than check cultivar (Above, a commercially available herbicide resistant cultivar). Test weight was excellent for all entries with a mean of 63 Lb/Bu. Heading date ranged from Julian 148 to 151. Although plant height (42 in) was taller than normal, the lodging was minimal. Protein content ranged from 12.3% to 15.2%.

Herbicide application slightly reduced plant height. When herbicide was applied at label rate (1X), no crop injury was observed in Clearfield lines. However, herbicide application at higher rate (2X) resulted in some crop injury in some entries. The symptoms of disease infestation were moderate in some entries. MTCL0303, MTCL0306, MTCL0316 and 'Above' had stripe rust ranged from 10% to 62%. Several lines also had TCK infestation.

Summary:

Despite some crop injury at higher herbicide rate, Clearfield entries performed very well in yield and test weight. The 2003-04 was an ideal season for evaluating disease pressures. More than half of the Clearfield entries showed excellent resistance to stripe rust and TCK.

Future Plans:

Continue to evaluate herbicide resistant winter wheat materials for herbicide tolerance and agronomic attributes.

Table 1. Agronomic data from the Clearfield winter wheat lines grown at the Northwestern Agricultural Research Center, Kalispell, MT in 2003-2004 season.

Planted: September 18, 2003 Harvested: July 29, 2004

Entry	ID	Yield (Bu/A)			Grain moisture (%)			Test weight (Lb/Bu)			Heading date (Julian)			Plant height (in)			Protein (%)		
		0X	1X	2X	0X	1X	2X	0X	1X	2X	0X	1X	2X	0X	1X	2X	0X	1X	2X
1	MTCL0303	114.1	115.4	95.4	12.9	12.0	11.2	63.0	62.5	61.4	150.7	150.7	151.0	45.7	44.2	42.7	12.6	13.0	13.0
2	MTCL0306	119.2	113.8	122.5	12.6	11.9	12.7	62.9	62.9	63.0	151.0	149.3	150.0	44.5	45.4	43.2	13.1	13.7	13.1
3	MTCL0313	119.7	122.3	122.8	11.7	11.8	10.8	63.7	63.6	62.5	152.0	150.7	151.7	47.6	45.4	45.8	12.3	13.0	12.6
4	MTCL0316	123.6	120.5	116.9	12.5	11.9	11.2	63.5	63.6	63.4	150.7	150.3	150.0	44.2	44.9	44.1	12.5	12.7	12.7
5	MTCL0318	109.4	114.8	115.9	12.4	10.5	11.8	63.5	63.3	63.6	150.7	150.0	150.3	42.5	42.0	40.9	14.0	14.1	14.1
6	MTCL0319	107.6	100.4	106.4	11.3	11.0	11.4	62.9	63.2	63.1	149.3	148.7	148.3	41.5	41.1	38.2	14.4	14.8	15.2
7	MTCL0322	105.4	102.4	104.6	11.6	11.6	11.8	63.5	63.4	63.7	150.0	148.3	149.0	40.4	40.0	38.8	13.9	14.5	14.0
8	MTCL0325	111.2	110.6	113.5	14.0	13.0	14.6	62.7	62.9	62.7	151.0	150.3	150.3	45.4	43.4	42.7	13.7	14.2	14.0
9	MTI01159	101.1	100.2	104.8	11.8	11.3	10.8	61.3	61.0	60.3	151.7	151.7	151.7	39.1	38.6	37.0	12.6	13.1	13.0
10	Above	109.1	100.3	105.8	11.4	11.0	11.4	62.8	63.1	63.1	148.0	148.0	148.0	39.8	39.8	37.3	12.7	12.9	13.0
	Mean	**112.0**	**110.1**	**110.9**	**12.2**	**11.6**	**11.8**	**63.0**	**63.0**	**62.7**	**150.5**	**149.8**	**150.0**	**43.1**	**42.5**	**41.1**	**13.2**	**13.6**	**13.5**
11	Rampart	115.2	0.0	0.0	12.0	0.0	0.0	63.0	0.0	0.0	152.7	0.0	0.0	43.8	0.0	0.0	14.1	0.0	0.0
12	Neeley	122.2	0.0	0.0	11.9	0.0	0.0	62.2	0.0	0.0	155.7	0.0	0.0	43.8	0.0	0.0	12.5	0.0	0.0
	LSD (0.05)																		
	Entry		**10.37**									**0.75**			**1.51**				
	Rate		**NS**									**0.34**			**0.70**				

NS: Not significant at level of 0.05.

Table 2. Crop injury, lodging and disease infection in Clearfield winter wheat lines grown at the Northwestern Agricultural Research Center, Kalispell, MT in 2003-2004 season.

Planted: September 18, 2003 Harvested: July 29, 2004

Entry	ID	Crop injury (%) (5/3/04)			Crop injury (%) (5/10/04)			Lodging index (%)			Stripe rust (%)			TCK (0-1)		
		0X	1X	2X	0X	1X	2X	0X	1X	2X	0X	1X	2X	0X	1X	2X
1	MTCL0303	0.0	0.0	11.7	0.0	0.0	6.7	0.0	1.7	1.7	33.3	40.0	61.7	0.3	0.0	0.3
2	MTCL0306	0.0	0.0	8.3	3.3	0.0	6.7	0.0	0.0	0.0	13.3	36.7	11.7	0.0	0.0	0.3
3	MTCL0313	0.0	0.0	5.0	1.7	0.0	8.3	0.0	1.7	3.3	1.7	0.0	13.3	0.0	0.7	0.7
4	MTCL0316	0.0	0.0	1.7	0.0	0.0	5.0	0.0	0.0	0.0	10.0	10.0	20.0	0.0	0.3	0.0
5	MTCL0318	0.0	0.0	5.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.3	0.3
6	MTCL0319	0.0	0.0	3.3	1.7	0.0	1.7	0.0	0.0	0.0	0.0	8.3	11.7	0.0	0.0	0.0
7	MTCL0322	0.0	0.0	13.3	3.3	0.0	8.3	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0
8	MTCL0325	0.0	0.0	13.3	0.0	3.3	10.0	0.0	0.0	0.0	1.7	1.7	0.0	0.0	0.0	0.0
9	MTI01159	0.0	0.0	6.7	0.0	0.0	6.7	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0
10	Above	0.0	0.0	11.7	3.3	0.0	1.7	0.0	0.0	0.0	18.3	28.3	16.7	0.0	0.0	0.0
	Mean	**0.0**	**0.0**	**8.0**	**1.3**	**0.3**	**6.0**	**0.0**	**0.3**	**0.5**	**7.8**	**13.2**	**13.7**	**0.0**	**0.1**	**0.1**
11	Rampart	0.0	81.7	85.0	1.7	98.0	98.0	1.7			0.0			0.0		
12	Neeley	0.0	81.7	85.0	3.3	98.0	98.0	0.0			10.0			0.0		
	LSD (0.05)															
	Entry		**2.41**			**2.45**			**1.24**			**13.67**			**0.31**	
	Rate		**1.20**			**1.23**			**NS**			**NS**			**NS**	

NS: Not significant at level of 0.05.

Project Title: Agronomic Performance Evaluation of Intrastate Winter Wheat Cultivars

Project Leader: Bob Stougaard

Project Personnel: Phil Bruckner, Jim Berg, Qingwu Xue, and Fernando Guillen

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:

Although temperature was lower than long-term average during the winter months (Nov.-Jan.), winterkill was minimal and was not recorded. During early spring, symptoms of snow mold (yellow leaves and slow growth) were observed in some plots; however, the symptoms were disappeared at later growing season and seemed not affect yield. The disease infection was moderate in this season. Stripe rust was minimal (<4%) in 60% of the entries. However, there were 15 entries had stripe rust ranged from 11% (Norstar) to 46% (BigSky). TCK infection was also occurred in 29 entries. Yield ranged from 81 to 138 Bu/A, with an average of 110 Bu/A. Eight cultivars yielded over 120 Bu/A. Grain test weight ranged from 57 (Paul and WA7939) to 64 Lb/Bu (Promontory) and averaged 61 Lb/Bu. Heading date was earlier than normal and ranged from Julian 149 to 161. Plant height was taller than normal and average 43 inches. As a result, lodging occurred in some entries and was as high as 59% in Paul. Grain protein ranged from 11% to 14% and averaged 13%.

Summary:

The 2003-04 was an ideal season to evaluate disease resistance in winter wheat entries. The entries with top yield had excellent disease resistance. However, the yield range among entries was greater than normal as a result of disease infection and lodging.

Future Plans:

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

Table 1. Agronomic data from the Intrastate Winter Wheat Nursery Grown at the Northwestern Agricultural Research Center, Kalispell MT in 2003-04 season.

Planted: September 18, 2003 Harvested: August 11, 2004

Entry #	Cultivar/Line	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Lodge index %	Stripe rust %	TCK 0-1	Moisture %	Protein %
30	MT00159	137.8**	61.3	155.7	42.9	-1.4	2.0	0.0	10.6	12.3
45	MT9982-53	132.4*	61.8	155.7	44.2	4.1	1.2	0.0	11.2	13.0
17	NuHorizon (HWW)	127.3*	63.0	150.0	36.7	-7.1	0.3	0.0	10.6	12.2
46	MT9982-65	126.0*	61.2	155.7	41.1	-2.4	-0.1	0.3	10.6	12.5
7	Bighorn	124.1*	61.8	154.6	39.7	22.6	0.0	0.0	10.8	12.4
11	Promontory	123.4*	64.1	154.1	41.9	5.4	-1.1	0.0	12.2	12.0
21	BZ9W96-788	122.5*	61.4	151.1	39.8	-0.9	2.0	0.7	10.8	12.5
16	NuFrontier (HWW)	121.1*	62.4	151.0	40.3	4.8	0.9	0.3	10.6	11.8
29	MT0097	120.4	59.6	156.2	43.9	56.8	-0.2	0.7	10.4	12.9
25	Expedition	119.9	62.0	149.7	40.9	-4.0	3.9	0.7	10.8	13.5
8	Quantum 542	119.5	61.8	152.4	46.6	12.0	-0.3	1.0	10.8	12.9
36	WA7936 (HWW)	119.3	59.1	161.0	40.1	20.2	-0.4	0.0	10.6	12.9
20	Pryor	119.3	60.8	155.0	38.3	-0.4	19.9	0.7	10.2	11.9
40	MT0245	118.1	61.8	153.6	41.5	21.2	0.3	0.3	10.8	13.5
14	CDC Falcon	117.9	60.6	155.4	39.0	-2.5	7.6	0.7	10.4	12.3
35	WA7939	117.6	57.2	160.2	41.4	6.5	-0.2	0.0	9.6	12.7
4	Rocky	116.7	62.2	153.3	46.4	1.8	-0.4	0.7	11.8	12.7
48	Judith	115.5	61.4	153.4	44.4	4.8	2.4	0.3	10.8	12.5
18	Golden Spike (HWW)	113.6	61.6	157.5	44.1	35.4	-0.3	0.0	9.8	11.2
22	Jagalene	113.6	63.1	148.9	39.4	5.9	-0.7	0.0	10.4	13.8
23	Wahoo	113.0	60.6	149.5	40.5	6.5	1.1	0.7	11.8	12.6
27	Millenium	112.8	61.4	152.4	42.7	1.4	0.5	0.7	11.0	13.0
41	MT0277	112.7	61.3	151.3	41.1	17.4	0.2	0.0	10.8	13.0
2	Neeley	112.1	62.1	155.8	43.1	1.7	27.6	1.0	10.6	12.2
44	MTW02115 (HWW)	110.4	61.9	154.4	44.5	26.9	7.7	0.7	11.0	12.9
33	MT01148	109.9	61.7	156.6	43.8	58.1	-0.5	0.0	10.6	12.9
32	MTW01143	109.6	60.3	156.7	43.6	41.8	-1.0	0.0	10.6	12.4
28	Genou (MTS0031)	109.2	61.1	155.0	42.2	5.4	11.4	0.0	12.2	13.0
3	Tiber	108.5	62.2	156.1	46.7	-0.1	6.4	0.0	10.6	12.6
38	MT02113	108.5	60.4	154.5	40.7	-3.1	30.3	0.0	10.8	13.5
47	MTS0023-58	108.1	59.0	159.5	44.7	19.0	0.3	0.3	9.8	13.6
42	MTS0222	107.8	60.7	152.6	40.0	3.1	1.0	0.0	10.4	14.3
39	MT02136	107.5	58.9	151.5	41.2	34.6	26.7	0.3	10.2	12.1
26	Above (IMI)	107.2	62.1	148.8	39.9	-2.2	14.3	0.3	10.8	12.6
24	Jerry	107.1	59.9	154.3	48.1	29.3	-0.2	0.3	11.5	13.0

Table 1 (continued). Agronomic data from the Intrastate Winter Wheat Nursery Grown at the Northwestern Agricultural Research Center, Kalispell MT in 2003-04 season.

Planted: September 18, 2003 Harvested: August 11, 2004

Entry #	Cultivar/Line	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Lodge index %	Stripe rust %	TCK 0-1	Moisture %	Protein %
5	**Vanguard**	105.3	61.2	154.0	43.7	2.6	3.8	1.0	11.0	13.7
19	**GM10004 (HWW)**	104.7	61.3	153.2	44.7	2.9	41.6	0.0	10.6	11.7
6	**Morgan**	103.3	60.2	156.1	43.3	24.7	0.9	0.7	10.2	12.6
1	**Rampart**	103.3	60.6	154.8	43.3	1.2	-0.5	1.0	10.6	13.9
12	**BigSky**	102.4	62.4	155.1	48.4	5.4	45.9	0.3	11.0	12.7
31	**MTW01133**	102.0	58.7	150.0	35.5	0.1	30.8	1.0	10.0	12.6
34	**MT0177**	100.4	61.4	154.7	44.1	14.2	35.4	0.7	11.2	12.5
43	**MTW02111 (HWW)**	95.0	59.7	159.4	42.4	4.3	35.0	0.0	11.0	11.6
49	**Elkhorn**	92.2	60.9	156.8	48.0	19.4	6.0	0.7	10.6	13.0
10	**Norstar**	89.9	61.8	161.3	52.1	40.9	13.6	0.7	11.4	13.4
13	**NuSky (HWW)**	89.6	59.8	156.2	42.0	27.1	29.4	0.3	10.4	12.5
37	**MTCL01159 (IMI)**	87.4	59.3	154.1	38.0	8.5	1.0	0.0	10.2	12.7
15	**Paul**	86.9	57.3	155.0	40.7	58.8	23.5	0.3	9.8	13.3
9	**NuWest (HWW)**	81.1	60.3	155.3	42.9	7.6	33.0	1.0	10.2	12.4
	Average	**110.5**	**61.0**	**154.5**	**42.5**	**13.1**	**9.4**	**0.4**	**10.7**	**12.7**
	LSD (0.05)	**17.3**		**1.8**	**2.4**	**30.3**	**28.5**	**0.7**		
	C.V. (%)	**9.2**		**0.7**	**3.3**	**134.6**	**184.4**	**108.8**		
	P-value (Varieties)	**<.0001**		**<.0001**	**<.0001**	**0.0021**	**0.0103**	**0.0002**		

** = indicates highest value within a column

* = indicates varieties with values equal to highest variety within a column based on Fisher's protected LSD (p=0.05)

Project Title: Bedstraw Control by Starane in Peppermint

Project Leader: Bob Stougaard

Project Personnel: Qingwu Xue and Fernando Guillen

Objective: Evaluate the bedstraw control in peppermint using herbicide Starane.

Results:

The study was conducted in an established field of Black Mitchum peppermint, planted in the fall of 2000. The Starane herbicide was applied at two crop growth stages (dormancy and 8 inches tall) and at two rates (0.67 and 1.33 pt/A) with and without surfactant MSO. The herbicide was applied using a CO_2 backpack sprayer in 20 GPA of water with teejet XR11002 nozzle. The bedstraw was about 1 inch tall at mint dormancy (4/30/2004) and about 4 inches tall at the late application (5/17/2004).

Application of Starane resulted in excellent control of bedstraw at both rates, regardless of application timing or whether or not using MSO surfactant. Due to a late emergence, bedstraw interference did not reduce mint biomass and oil yields. Crop injury was not observed when Starane was applied at the lower rate when mint was dormant. However, injury increased as the application rate increased and timing was delayed. The injured plants had a purple discoloration and were slightly stunted. The degree of crop injury decreased over time after application. However, crop injury was still observed with high rate at late application.

Summary:

Application of Starane provided excellent control of bedstraw. Higher rate and late application resulted in some crop injury. However, the degree of crop injury decreased over time after application.

Table 1. Effect of Starane ap0plication on bedstraw control, mint injury and yield in 2004 season.

Trt no.	Treatment Name	Product rate	Rate Unit	Appl Code	Mint injury (%) stunt 6/1/04	Mint injury (%) discolor 6/1/04	Mint injury (%) stunt 6/25/04	Weed biomass ton/A	Mint yield ton/A	Mint oil lb/A
1	Starane	0.67	pt/A	A	0.0	0.0	0.0	0.0	3.8	43.2
2	Starane	0.67	pt/A	A	0.0	0.0	0.0	0.0	4.1	34.4
	MSO	0.625	% V/V	A						
3	Starane	1.33	pt/A	A	16.7	3.3	8.3	0.0	4.1	43.7
4	Starane	1.33	pt/A	A	20.0	5.0	5.0	0.0	3.1	45.7
	MSO	0.625	% V/V	A						
5	Starane	0.67	pt/A	B	6.7	18.3	3.3	0.0	3.2	43.1
6	Starane	0.67	pt/A	B	0.0	16.7	0.0	0.0	2.9	37.4
	MSO	0.625	% V/V	B						
7	Starane	1.33	pt/A	B	6.7	25.0	13.3	0.0	3.2	37.2
8	Starane	1.33	pt/A	B	6.7	25.0	13.3	0.0	3.2	42.2
	MSO	0.625	% V/V	B						
9	Untreated				0.0	0.0	0.0	0.5	4.1	55.4
LSD (P=0.05)					6.97	6.42	5.46	0.21	1.15	14.97
CV					63.93	35.79	65.53	202.11	18.81	8.60
Treatment F					10.51	25.38	9.51	6.61	1.55	1.51
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0007	0.216	0.2324

Crop growth stage at application: A=dormant; B= 8 inches tall.
0.67 pt/A = 0.125 LB A/A; 1.33 pt/A = 0.25 LB A/A.

Project Title: Effect of Auxinic Herbicides on Peppermint Tolerance

Project Leader: Bob Stougaard

Project Personnel: Qingwu Xue and Fernando Guillen

Objective: To evaluate the mint tolerance to different auxinic herbicides at different application rates.

Results:

The field study was conducted in an established field of Black Mitchum peppermint, planted in the fall of 2000. The field was sprayed by Goal 2XL on March 31, 2004 as a dormant treatment. The treatments included 3 rates of Banvel, Tordon, Garlon, Stinger and Starane applications, and an untreated check. These 5 herbicides were applied at 0.125, 0.25, and 0.5 lb ai/A on May 6, 2004 when mint was 3 inches tall. The treatments were applied using a CO_2 backpack sprayer in 20 GPA of water using XR11002 nozzles.

Stunting occurred with all treatments and increased as a function of the rate applied. Also, stunting was the greatest with the initial rating, but decreased as the season progressed. Treatments of Tordon, Garlon, Banvel, and Starane at 0.5 lb ai/A resulted in the most pronounced stunting. Discoloration was also evident with all treatments and consisted of various shades of red and purple. In contrast to the stunting symptoms, discoloration tended to get more severe with time for Banvel and Tordon treatments.

Herbicide rate effect on mint biomass and oil yields was less consistent. For example, biomass yield decreased as Banvel rate increased. In contrast, biomass and oil yields increased as Garlon rate increased. There was no clear relationship among the herbicides with respect to the rate applied and biomass and oil yields.

Summary:

Although visual injury symptoms were evident with all of the herbicides evaluated, the mint crop survived surprisingly well! The fact that neither Banvel nor Tordon obliterated the crop is noteworthy. Although these results represent a single growing season, it seems that peppermint mint has ability to tolerate a wide range of auxinic herbicides.

Table 1. Effects of Banvel, Tordon, Garlon, Stinger and Starane on mint injury, yield and oil content in 2004.

Trt no.	Treatment name	Product rate	Unit	Mint injury (%)				Mint yield	Mint oil
				stunt 6/1/04	discolor 6/1/04	stunt 6/25/04	discolor 6/25/04	ton/A	lb/A
1	Banvel SGF	8	fl oz/A	18.3	10.0	1.7	18.3	4.6	32.4
2	Banvel SGF	16	fl oz/A	18.3	13.3	6.7	28.3	3.7	38.1
3	Banvel SGF	32	fl oz/A	21.7	20.0	15.0	50.0	3.1	21.5
4	Tordon 22K	0.5	pt/A	18.3	11.7	1.7	15.0	3.7	29.3
5	Tordon 22K	1	pt/A	30.0	16.7	5.0	25.0	3.9	34.0
6	Tordon 22K	2	pt/A	51.7	26.7	21.7	50.0	2.8	26.7
7	Garlon	0.125	qt/A	28.3	13.3	1.7	1.7	3.3	26.0
8	Garlon	0.25	qt/A	33.3	13.3	5.0	0.0	3.4	34.5
9	Garlon	0.5	qt/A	63.3	15.0	23.3	0.0	5.4	53.7
10	Stinger	0.333	pt/A	8.3	0.0	0.0	5.0	3.2	36.5
11	Stinger	0.67	pt/A	5.0	0.0	0.0	5.0	3.4	35.5
12	Stinger	1.33	pt/A	11.7	0.0	0.0	10.0	4.3	30.8
13	Starane	0.67	pt/A	16.7	0.0	0.0	1.7	3.6	37.8
14	Starane	1.33	pt/A	30.0	13.3	1.7	3.3	4.6	42.9
15	Starane	2.67	pt/A	55.0	16.7	11.7	0.0	3.0	35.4
16	Untreated			0.0	0.0	0.0	0.0	4.6	52.0
LSD (P=0.05)				11.79	5.64	6.34	5.55	1.01	12.71
CV				27.58	31.81	64.01	24.96	15.96	21.50
Treatment F				19.61	18.08	12.69	77.84	4.47	3.81
Treatment Prob(F)				0.0001	0.0001	0.0001	0.0001	0.0002	0.0009

The low, medium, and high rates for all treatments correspond to 0.125, 0.25, and 0.5 lb ai/A, respectively.

Project Title: Montana Statewide Spring Oat Variety Performance.

Project Leader: Bob Stougaard

Project Personnel: Tom Blake, Pat Hensleigh, Qingwu Xue, and Fernando Guillen

Objectives:

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

Results:

The temperature and soil moisture were ideal for oat growth and development in 2004 season. Oat yields were averaged 193 Bu/A compared to the 2003 average of 102 Bu/A. Yields ranged from a low of 163 Bu/A for Ajay to 216 Bu/A for ABSP19-9. Test weights were excellent and averaged 37.5 Lb/Bu. Heading date averaged on Julian 173 (June 22) and the range was within a week. Plant height was higher than normal and averaged 40 in. Grain protein ranged form 12.6% to 15.2%. No disease and lodging were observed in this season.

Summary:

High yield and excellent test weight were obtained in oat entries in 2004 season. ABSP19-9, Monico and ABSP14-6 were top yielding entries this season.

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 7, 2004 Harvested: August 12, 2004

Entry	ID	Pedigree	Yield	Test weight	Grain moisture	Heading date	Plant height	Protein
			Bu/A	Lb/Bu	%	Julian	in	%
10	ABSP19-9	83Ab3083/Monida	215.8	37.3	10.2	175.7	42.8	14.7
9	ABSP 9-2	Monico	203.9	39.1	10.1	171.7	39.4	13.9
13	ABSP14-6	83Ab3119/Monida	202.7	37.6	9.8	172.3	41.5	14.4
3	81Ab5792	Rio Grande	198.9	35.4	9.5	170.3	38.2	13.7
6	ND930122	Killdeer	198.6	37.8	9.5	171.0	41.2	13.7
2	CI483126	Monida	195.6	35.3	10.7	175.3	45.3	12.6
14	98AB6646	IAH61-3-3/90Ab1322	194.4	37.5	10.2	173.3	36.5	15.0
15	98AB6491	90Ab1322/Ogle	193.3	38.0	10.5	173.3	36.7	14.2
16	96AB8597	Otana/87Ab4983	193.3	37.5	10.5	175.0	37.9	13.5
12	87AB5632	Monida/75Ab861	192.8	36.7	10.3	173.7	40.3	14.6
7	OT351	CDC Pacer	192.6	39.5	10.5	173.0	45.9	12.6
8	90Ab1322	Maverick	186.9	38.1	10.6	173.0	34.3	13.2
5	PI583735	Celsia	186.1	37.2	10.3	175.3	43.8	15.1
11	OT373	CDC Dancer	185.3	38.3	10.0	173.0	45.0	13.9
1	CI 9252	Otana	181.2	37.9	10.7	173.7	46.1	14.8
4	PI537436	Ajay	163.3	36.3	9.8	173.3	27.3	15.2
Mean			**192.8**	**37.5**	**10.2**	**173.3**	**40.1**	**14.1**
C.V. (%)			**8.50**			**0.39**	**5.42**	
LSD (0.05)			**27.34**			**1.14**	**3.63**	

Project Title: Agronomic Performance Evaluation of Soft White Winter Wheat Cultivars.

Project Leader: Bob Stougaard

Project Personnel: Phil Bruckner, Jim Berg, Qingwu Xue, and Fernando Guillen

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

Results:

Despite lower temperature than normal during the winter months (Nov.-Jan.), winterkill was minimal and was not recorded. Disease symptoms (stripe rust and TCK) in soft white entries were minimal though hard red entries had moderate infestations in diseases. Yield ranged from 106 Bu/A (NuSky) to 143 Bu/A (Hubbard), with an average of 130 Bu/A. Except NuSky, all soft white entries yielded more than check hard red entry (Neeley). Grain test weight was close to normal and averaged 60 Lb/Bu. Warmer early spring (Mar.-Apr.) resulted in early heading. The mean heading date was Julian 156 and varied within one week. Plant height was taller than normal with an average of 39 inches. As a result, 3 entries (Eltan, Neeley and NuSky) were lodging. Grain protein was normal and averaged 11.6%.

Summary:

High yield and good test weight were obtained in soft white winter wheat cultivars in 2003-04 season. The 2003-04 was also an ideal season for evaluation of disease resistance. All entries showed excellent resistance to stripe rust.

Future Plans:

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

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

Planted: September 18, 2003 Harvested: August 11, 2004

Entry	Cultivar	Yield	Test weight	Grain moisture	Heading date	Plant height	Protein	Lodging	Stripe rust	TCK
		Bu/A	Lb/Bu	%	Julian	in	%	%	%	0-1
13	Hubbard	142.6	60.4	11.0	156.3	44.2	11.5	3.3	0.0	0.0
12	Finch	139.9	61.7	10.6	159.3	39.6	10.8	0.0	0.0	0.0
3	ROD	139.6	56.7	10.2	158.7	37.0	11.5	0.0	0.0	0.3
6	MACVICAR	138.4	59.8	10.2	154.0	36.4	10.6	0.0	0.0	0.3
14	Simon	137.1	59.5	10.2	153.3	38.6	11.7	0.0	0.0	0.0
2	ELTAN	134.9	57.8	10.2	159.3	39.1	12.0	13.3	0.0	0.0
10	LAMBERT	133.7	60.1	10.0	152.7	38.8	11.4	0.0	0.0	0.0
4	MAC-1	130.7	61.2	10.8	153.0	39.2	11.5	1.7	0.0	0.0
8	LEWJAIN	130.1	58.2	9.4	156.3	34.6	11.6	1.7	0.0	0.0
5	KMOR	127.2	56.1	10.4	156.3	36.4	11.4	1.7	0.0	0.0
9	HILL 81	126.6	60.8	11.4	157.7	40.3	12.1	0.0	0.0	0.0
15	Kolding Exp. line	122.9	62.2	11.0	153.7	37.5	11.2	0.0	0.0	0.0
1	NEELEY	116.3	61.1	11.2	155.3	42.8	12.0	25.0	1.7	0.0
11	NuSky	106.0	59.8	11.2	155.0	43.3	12.5	13.3	3.3	0.7
7	STEPHENS*									
Mean		**130.4**	**59.7**	**10.6**	**155.8**	**39.1**	**11.6**	**4.3**	**0.4**	**0.1**
C.V. (%)		**7.37**			**0.70**	**2.86**		**204**	**300**	**277**
LSD (0.05)		**16.14**			**1.84**	**1.88**		**14.65**	**1.80**	**0.44**

*: The cultivar Stephens was not emerged after panting.

Project Title:	Effects of N, Seed Size and Herbicide (Beyond) on Yield in Clearfield Spring Wheat
Project Leader:	Bob Stougaard
Project Personnel:	Qingwu Xue and Fernando Guillen
Objective:	Investigate the effects of N, seed size, and Beyond application on spring wheat yield

Results:

Clearfield spring wheat was planted on April 12, 2004 at the rate of 16 plants per square foot. The treatments included two levels of N application and two seed size classes with and without herbicide (Beyond) application. The two levels of N were established before planting by applying fertilizers at the rates of 0-35-119 (low N) and 100-35-119 (high N) Lb/A, respectively. The herbicide, Beyond was applied at rate of 0.0937 Lb ai/A with 0.25% nonionic surfactant and 28% UAN when wheat plants were about 9" tall with 5 main stem leaves and 2-4 tillers (May 18, 2004). The herbicide was applied with a CO_2 backpack sprayer in 20 GPA of water using XR11002 nozzles.

All three factors (N, seed size and herbicide) affected Clearfield spring wheat yield. In general, increased N and using large seeds increased yield by about 4-5%. In addition to yield, using large seeds also increased 1000-kernel weight (TKW) and grain protein. However, the N application did not affect TKW and protein. Application of Beyond reduced yield and protein by about 6%, and TKW by about 4%. Seed size, and N and Beyond applications had little effect on grain test weight.

Summary:

This study demonstrated that increased N and using large seeds provided some yield benefits though in a small scale (about 5%) in Clearfield spring wheat. Using large seeds also slightly increased kernel weight and grain protein content.

Table 1. Effect of N application, seed size and Beyond application on yield, test weight, 1000-kernle weight and grain protein in Clearfield spring wheat.

Planted: April 12, 2004 Harvested: August 20, 2004

Nitrogen	Seed size	Yield (Bu/A)			Test weight (Lb/Bu)			Thousand-kernel weight (g)			Protein (%)		
		Untreated	Treated	Treated as % of untreated	Untreated	Treated	Treated as % of untreated	Untreated	Treated	Treated as % of untreated	Untreated	Treated	Treated as % of untreated
High	Large	68.8	63.5	92.3	60.2	60.2	99.9	36.7	35.4	96.5	17.0	15.9	93.5
High	Small	63.1	63.9	101.3	59.7	59.2	99.2	35.5	34.2	96.3	16.6	15.4	92.8
Low	Large	67.2	60.7	90.4	60.8	60.2	99.1	36.8	35.5	96.3	17.0	16.0	94.1
Low	Small	62.8	58.0	92.3	59.8	60.8	101.7	36.1	35.0	97.0	16.6	15.7	94.6
CV (%)		4.64			0.51			1.86					
LSD(0.05)		2.62			0.27			0.59					

Project Title: Agronomic Performance Evaluation of Advanced Spring Wheat Experimental Lines.

Project Leader: Bob Stougaard

Project Personnel: Luther Talbert, Susan Lanning, Qingwu Xue, and Fernando Guillen

Objectives:

To evaluate advanced spring wheat experimental lines for agronomic performance and disease resistance in environments and cropping systems representative of northwestern Montana.

Results:

In 2004 spring wheat growing season, temperature was near normal except a warmer April. The precipitation during grain filling was higher than previous season. As a result, the average yield (93 Bu/A) was higher than previous year (78 Bu/A). Yield ranged from 69 Bu/A (MT 0346) to 111 Bu/A (MTHW0357). Among the 64 entries, 12 entries yield more than 100 Bu/A and 50 entries yielded more than McNeal (87 Bu/A). Grain test weight was excellent with an average of 61 Lb/Bu. Several entries had a test weight over 62 Lb/Bu. Heading date was a few days earlier than previous year and averaged on Julian 168 (June 17), ranging from Julian 160 (June 9) to 174 (June 23). Plant height was normal and averaged 37 in. Although the soil moisture was high during grain filling, disease pressure and lodging were minimal in this season.

Summary:

The 2004 season was ideal for spring wheat and high yield was obtained in most of the tested entries. MTHW0357, MT0249, MTHW0202, BZ999592 and Newana were top yielding entries with a yield over 104 Bu/A.

Future Plans:

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

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

Planted: April 6, 2004 Harvested: August 19, 2004

Entry	ID	Cultivar	Yield	Test weight	Grain moisture	Heading date	Plant height	Protein
			Bu/A	Lb/Bu	%	Julian	in	%
60	MTHW0357	MTHW9420/BZ991408	110.7	62.8	14.7	166.6	34.5	12.8
21	MT 0249	ND695/MT9433	106.3	60.6	14.5	166.6	35.4	15.1
58	MTHW0202	ID377S/MTHW9701	105.0	62.6	14.7	160.3	34.9	14.4
48	BZ999592	MCNEAL/906R	104.6	63.1	14.6	167.9	36.1	14.7
3	CI 17430	NEWANA	103.5	60.9	14.4	172.2	35.0	13.8
12	BZ992322	HANK	103.2	59.1	14.0	166.5	34.1	14.9
25	MT 0266	ND695/MT9755	102.7	59.4	14.0	165.5	37.0	15.5
51	AGRIPRO3	FREYR	101.9	61.1	14.2	167.1	36.6	14.8
19	MT 0245	MT9433/ND695	101.7	60.6	15.6	169.5	37.8	14.7
22	MT 0255	MT9755/WA7802	101.5	61.0	15.0	166.3	38.6	15.0
31	MT 0315	MT9609/SCHOLAR	101.4	61.6	15.1	168.2	39.8	14.6
23	MT 0260	MT9653/ND695	101.0	61.5	15.4	171.2	37.5	14.3
2	CI 13596	FORTUNA	100.7	62.1	14.6	168.0	45.3	15.1
10	WB 926	WESTBRED 926	100.1	60.5	14.1	165.1	32.4	14.6
6	PI527682	AMIDON	99.4	60.7	14.6	168.6	42.0	14.2
8	PI607557	SCHOLAR	99.3	61.7	14.4	170.2	39.2	15.2
11	BZ992588	Conan	99.0	60.9	14.0	166.5	34.9	14.8
57	MTHW0002	MTHW9520/MTHW9427	98.9	59.8	15.3	166.7	34.8	12.8
30	MT 0313	MT9609/SCHOLAR	98.9	61.5	14.0	169.0	38.2	15.0
15	MT 0205	MCNEAL/MT8808	98.2	60.2	14.5	168.3	33.5	14.0
61	MTHW0361	BZ991408/MTHW9420	97.2	61.5	14.4	164.9	33.2	14.4
40	MT 0342	MT9719/MT9715	96.7	62.2	15.0	167.9	37.4	13.5
52	AGRIPRO4	01II 27-2-2 CL	96.5	62.5	14.7	166.5	38.6	15.0
43	MT 0351	MT9806/SD3345	96.1	60.5	15.0	166.9	36.5	14.3
13	PI632252	OUTLOOK	94.7	58.5	13.6	171.4	36.6	14.3
49	AGRIPRO1	NORPRO	94.4	61.3	15.7	167.7	34.8	14.1
33	MT 0318	MT9609/SCHOLAR	94.2	61.4	14.8	166.3	36.1	15.0
34	MT 0319	MT9609/SCHOLAR	94.2	62.2	15.0	167.2	37.1	14.6
53	AGRIPRO5	01II 27-20-1 CL	94.0	62.1	15.0	166.4	37.7	15.3
35	MT 0325	MT9609/SCHOLAR	94.0	61.7	15.1	168.1	37.4	15.7
63	MTHW0366	BZ991408/ID508	93.9	62.5	14.8	165.7	35.6	14.3
50	AGRIPRO2	KNUDSON	93.3	60.9	13.4	168.7	35.3	14.0
17	MT 0228	MCNEAL/WA7802	93.2	61.4	14.7	168.4	37.8	14.1
59	MTHW0204	MTHW9427/MT9410	93.2	60.1	15.1	168.0	34.3	12.4
9	ND 695	Reeder	92.4	61.7	14.2	167.6	37.7	16.1
20	MT 0247	MT9433/ND695	92.4	62.3	15.0	167.4	36.2	15.5
24	MT 0261	ND695/MT9653	92.2	61.2	14.8	169.3	39.4	15.0
37	MT 0336	MT9609/MT9806	91.9	60.6	14.6	167.4	37.7	14.0
29	MT 0311	SCHOLAR/MT9754	91.6	61.2	15.6	167.2	36.9	15.3
36	MT 0326	MT9609/SCHOLAR	90.8	61.9	15.8	166.1	39.9	14.3

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

Planted: April 6, 2004 Harvested: August 19, 2004

56	PI619086	EXPLORER	90.7	60.4	14.5	163.7	33.3	15.2
46	ALSEN	ALSEN	90.5	61.8	14.8	166.6	36.9	16.2
4	PI549275	HI-LINE	90.2	60.4	14.3	166.5	33.9	15.2
47	BZ996434	BORDER/CONAN	89.6	63.2	14.8	166.4	38.6	15.4
7	PI592761	ERNEST	89.3	60.7	15.2	170.7	40.0	15.1
54	AGRIPRO6	01II 27-24-1 CL	89.1	61.8	14.1	166.4	36.7	15.8
16	MT 0220	MCNEAL/ND695	88.8	61.0	14.4	166.7	34.3	16.4
14	MT 9929	CHOTEAU	88.6	60.0	15.1	167.7	35.2	15.2
64	BZ996472	BZ992-634/GOLDEN86	88.6	63.5	14.9	162.6	34.0	14.6
62	MTHW0362	BZ991408/MTHW9711	87.5	61.9	15.5	165.8	33.9	13.0
44	MT 0352	MT9806/SD3345	87.2	60.3	15.5	169.4	36.7	13.4
5	PI574642	MCNEAL	86.8	60.8	13.8	168.7	36.9	13.8
55	PI612605	MTHW9420	86.7	58.3	13.8	166.6	35.7	12.9
41	MT 0345	MT9754/SCHOLAR	85.4	59.7	15.0	168.6	34.9	15.1
18	MT 0234	ERNEST/ND695	85.1	62.2	14.8	166.2	36.2	15.4
32	MT 0317	MT9609/SCHOLAR	84.7	61.2	14.5	171.0	39.0	15.2
39	MT 0339	MT9715/SCHOLAR	84.4	58.0	15.5	166.8	36.6	13.9
28	MT 0307	MCNEAL/MT9719	82.9	61.5	13.8	168.5	35.6	14.2
26	MT 0305	MCNEAL/MT9719	82.9	60.9	13.7	171.8	34.6	14.9
38	MT 0338	MT9609/MT9808	81.6	57.9	14.5	172.1	36.7	15.4
45	MT 0354	MT9806/SD3345	81.5	58.6	13.8	168.7	32.8	13.2
1	CI 10003	THATCHER	81.4	59.4	14.6	173.9	48.0	14.9
27	MT 0306	MCNEAL/MT9719	76.4	62.9	14.8	166.5	37.5	14.6
42	MT 0346	MT9754/SCHOLAR	69.0	56.3	13.6	172.0	35.8	15.3
Mean			**92.9**	**60.9**	**14.6**	**167.7**	**36.7**	**14.7**
C.V. (%)			**8.43**			**0.56**	**3.25**	
LSD (0.05)			**10.30**			**1.46**	**1.84**	

Project Title: Evaluation of Spring Wheat Variety Performance in Off-Stations Trials

Project Leader: Bob Stougaard

Project Personnel: Luther Talbert, Susan Lanning, Qingwu Xue, and Fernando Guillen

Objectives:

To evaluate the performance of spring wheat varieties in different environments across Montana

Results:

In 2004 spring wheat growing season, temperature was near normal except a warmer April. The precipitation during grain filling was higher than previous season. Yield ranged from 67 Bu/A in Choteau to 90 Bu/A in MT0266 with an average of 76 Bu/A. The average yield in this season was higher than previous year (52 Bu/A). Grain test weight was normal with an average of 60 Lb/Bu. Heading date was similar to previous year and averaged on Julian 168 (June 17). Average plant height was 33 in, which was higher than previous year (27 in). Due to high soil moisture during grain filling, 1000 kernel weight (TKW) was higher and averaged 36.7 g. WB926, WB936, Hank, Fortuna and MTHW0202 still had a TKW over 40 g. Grain protein was very high in this season and ranged from 15.2% to 17.6%. Disease and lodging were not observed in this season.

Summary:

The 2004 season was ideal for spring wheat and high yield was obtained in most of the tested entries. Grain protein was very high in this season.

Future Plans:

Spring wheat off-station trial will be continued in Northwestern Montana.

Table 1. Agronomic data from the Off-station Spring Wheat Nursery Grown at the Northwestern Agricultural Research Center, Kalispell, MT.

Planted: April 7, 2004 Harvested: August 12, 2004

Entry	ID	Cultivar	Yield	Test weight	Grain moisture	Heading date	Plant height	TKW	Protein
			Bu/A	Lb/Bu	%	Julian	in	g	%
19	MT 0266	ND695/MT9755	90.1	58.8	10.1	166.0	34.3	40.5	16.4
17	MT 0245	MT9433/ND695	81.7	60.3	10.7	168.7	32.5	36.0	17.2
10	ND 695	Reeder	81.4	62.3	10.6	166.7	35.0	37.0	16.7
22	WB 936	WESTBRED 936	81.1	59.2	10.0	165.7	29.8	44.1	17.0
20	PI615543	ALSEN	81.1	61.3	10.3	166.3	33.3	35.0	16.6
18	MT 0249	ND695/MT9433	79.8	60.6	10.4	166.3	33.1	33.8	17.1
11	PI632252	OUTLOOK	78.6	59.3	10.2	172.7	34.4	32.3	15.6
13	BZ992322	HANK	78.0	58.8	10.2	166.3	30.3	43.1	16.7
8	BZ992588	Conan	77.7	61.6	10.4	167.3	31.4	38.5	16.0
9	PI607557	SCHOLAR	77.5	61.7	10.6	171.3	36.1	37.2	17.0
4	PI527682	AMIDON	77.3	61.2	10.8	169.0	38.7	34.3	16.6
7	WB 926	WESTBRED 926	75.0	60.1	10.4	165.3	30.4	41.3	16.3
5	C982-324	RAMBO	74.9	60.5	10.5	168.3	31.1	35.0	16.3
16	MTHW0202	ID377S/MTHW9701	74.4	61.0	10.7	164.0	30.4	40.2	15.5
14	MTHW9420	MT8182/MT8289	74.1	59.1	10.0	166.7	30.4	35.6	15.2
15	PI619086	EXPLORER	73.0	59.4	10.0	164.7	30.2	30.9	16.7
3	PI574642	MCNEAL	73.0	59.6	10.5	171.3	33.6	35.8	16.9
21	CI 17430	NEWANA	72.7	60.3	10.3	172.0	29.5	33.8	15.7
1	CI 13596	FORTUNA	71.7	60.8	11.2	168.7	38.3	41.2	16.6
2	PI549275	HI-LINE	71.3	59.2	10.6	167.3	30.8	33.5	16.0
6	PI592761	ERNEST	67.7	61.2	10.6	170.3	35.7	35.0	17.1
12	MT 9929	CHOTEAU	67.4	59.6	10.2	168.0	29.8	33.0	17.6
Mean			**76.3**	**60.3**	**10.4**	**167.9**	**32.7**	**36.7**	**16.5**
C.V. (%)			**7.18**	**1.29**	**3.37**	**0.54**	**4.19**	**3.18**	
LSD (0.05)			**9.16**	**1.3**	**0.59**	**1.51**	**2.26**	**1.95**	

TKW = 1000 kernel weight.

Project Title: Fall Application of Herbicides for White Cockle Control in Peppermint

Project Leader: Bob Stougaard

Project Personnel: Qingwu Xue and Fernando Guillen

Objective: Evaluate the white cockle control in peppermint by different herbicides applied at fall dormancy

Results:

The field trial was conducted in a farmer's peppermint field near Whitefish, MT. White cockle is the dormant perennial weed in the mint field. Treatments included seven herbicides and an untreated check. The herbicides were applied on October 17, 2003 at the mint dormancy, using a CO_2 backpack sprayer in 20 GPA of water with teejet XR11002 nozzle.

Among the seven herbicides applied, MCPB, Raptor, and Bromoxynil plus MCPA did not provide any white cockle control. The 2, 4-DB herbicide provided some white cockle control initially, but its effect diminished eventually. Banvel and Garlon provided excellent white cockle control. Starane also performed well for white cockle control though it is not as effective as Banvel and Garlon.

Summary:

When applied at fall dormancy, Banvel and Garlon provided good white cockle control in peppermint.

Table 1. Effect of different herbicides on white cockle control applied as fall dormant treatments.

Trt no.	Treatment Name	Rate LB A/A	Product rate	Unit	White cockle control (%)			
					perennial	perennial	seedling	total
					4/9/04	6/18/04	6/18/04	7/20/04
1	2,4-DB	0.5	2	pt/A	23.3	13.3	0.0	0.0
2	MCPB	0.5	2	pt/A	0.0	0.0	0.0	0.0
3	Banvel SGF	0.25	1	pt/A	98.3	91.7	55.0	63.3
4	Garlon	1	2	pt/A	98.3	86.7	73.3	56.7
5	Starane	0.25	1.33	pt/A	76.7	33.3	23.3	23.3
6	Raptor	0.047	6	oz/A	0.0	0.0	0.0	0.0
7	Bromoxynil+MCPA	1	1.6	pt/A	0.0	0.0	0.0	0.0
8	Untreated				0.0	0.0	0.0	0.0
LSD ((P=0.05)					8.22	26.68	27.07	32.90
CV					12.66	54.16	81.52	104.86
Treatment F					287.22	20.09	10.90	6.31
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0018

All treatments were applied with a nonionic surfactant (0.25% v/v) plus 28%UAN (1 q5/A).

Project Title: Spring Application of Herbicides for White Cockle Control in Peppermint

Project Leader: Bob Stougaard

Project Personnel: Qingwu Xue and Fernando Guillen

Objective: Evaluate the white cockle control in peppermint by different herbicides applied at fall dormancy

Results:

The field trial was conducted in a farmer's peppermint field near Whitefish, MT. White cockle is the dormant perennial weed in the mint field. Treatments included seven herbicides (Karmex, Sinbar, Devrinol, Treflan, Spartan, Goal, and Banvel) and an untreated check. The herbicides were applied on April 2, 2004 at the mint dormancy, using a CO_2 backpack sprayer in 20 GPA of water with teejet XR11002 nozzle. All herbicide treatments included Gramoxone at 1.6 pt/A.

When combining with Gramoxone, all herbicides except Treflan provided over 80% white cockle control initially. Although the white cockle control reduced as growing season progressed, these herbicides still managed to suppress the weed 60-70% at later growing season.

Summary:

When combining with Gramoxone, Karmex, Sinbar, Devrinol, Spartan, Goal, and Banvel performed well for controlling white cockle. However, Treflan only provided moderate white cockle control.

Table 1. Effect of different herbicides on white cockle control applied as spring dormant treatments.

Trt no.	Treatment name	Rate LB A/A	Product rate	Unit	White cockle control (%)				
					seedling	seedling	perennial	seedling	total
					4/30/04	5/25/04	6/18/04	6/18/04	7/20/04
1	Karmex	1	1.25	lb/A	96.0	85.0	53.3	86.7	76.7
2	Sinbar	0.75	0.94	lb/A	91.7	83.3	0.0	83.3	71.7
3	Devrinol	4	8	lb/A	86.7	83.3	60.0	76.7	78.3
4	Treflan	0.75	1.5	pt/A	59.3	58.3	0.0	35.0	23.3
5	Spartan	0.314	6.7	oz/A	85.0	78.3	26.7	65.0	63.3
6	Goal 2XL	1	4	pt/A	81.0	73.3	50.0	70.0	60.0
7	Banvel SGF	0.25	1	pt/A	93.3	75.0	48.3	70.0	56.7
8	Untreated				0.0	0.0	0.0	0.0	0.0
LSD (P=0.05)					24.32	21.23	48.22	26.73	36.05
CV					18.73	18.07	92.41	25.09	38.29
Treatment F					15.98	16.50	2.77	11.00	5.47
Treatment Prob(F)					0.0001	0.0001	0.0499	0.0001	0.0034

All treatments included Gramoxone Extra at 1.6 pt/A

Project Title: Evaluation of Wild Oat Herbicides in Spring Wheat

Project Leader: Bob Stougaard

Project Personnel: Qingwu Xue and Fernando Guillen

Objective: Assess new and established wild oat herbicides for efficacy and crop tolerance.

Results:

An herbicide resistant (Clearfield) spring wheat cultivar was planted on April 12, 2004 at 65 lb/A using a double disk press drill set to a planting depth of 1.5 inches. Wild oat seeds were then planted in the center of each plot to assure a uniform weed density throughout the study site. The treatments included an experimental prepackaged combination of Beyond and MCPA (BAS 777), four existing wild oat herbicides (Discover, Everest, Achieve and Puma), 2,4-D Ester, Prowl H2O, and their combinations as well as an untreated check (Table 1). Herbicides were applied in 20 GPA on May 17, 2004 using a backpack sprayer with teejet XR11002 nozzles. At the time of herbicides application, spring wheat was about 4 inches tall with 4-5 main stem leaves and 2-3 tillers. The wild oat was 3-4 inches tall with 3-5 main stem leaves and 0-3 tillers.

Crop injury was not observed with the application of any herbicide alone or combinations. Discover, Everest and Achieve provided excellent wild oat control (>94%) when combining with Prowl H2O. Either applied alone or combined with Prowl H2O, BAS 777 also provided excellent wild oat control (99%). However, the treatments including Puma only provided 75-80% wild oat control. Yield reduced significantly in untreated check plots (50 Bu/A) and application of herbicide increased yield. However, there was no yield difference among the herbicide treatments and yield was averaged 63 Bu/A.

Summary:

Except the treatments including Puma, all herbicides provided excellent wild oat control. Also, crop injury was not observed with the application of Beyond and MCPA (BAS 777) for the Clearfield cultivar.

Future Plans:

Continue to evaluate wild oat herbicides in order to determine the consistancy of control and crop injury potential over years.

Table 1. Evaluation of wild oat (WO) herbicides in Spring Wheat.

Trt No.	Treatment	Rate	Crop injury (%)		WO Control (%)		Yield
		lb ai/A	6/1/2004	6/25/2004	6/25/2004	7/27/2004	Bu/A
1	Check		0	0	0.0	0.0	50.2
2	BAS 777	0.28	0	0	85.7	99.0	66.0
3	BAS 777 Prowl H20	0.28 0.75	0	0	95.3	98.7	65.9
4	BAS 777 Prowl H20	0.28 1.25	0	0	97.7	99.7	66.3
5	Puma 2,4-D Ester	0.08 0.25	0	0	88.7	83.3	61.2
6	Puma 2,4-D Ester Prowl H20	0.08 0.25 0.75	0	0	93.3	80.0	61.6
7	Puma 2,4-D Ester Prowl H20	0.08 0.25 1.25	0	0	96.0	75.0	62.0
8	Discover Prowl H20	0.0625 0.75	0	0	97.7	95.0	63.2
9	Everest Prowl H20	0.0268 0.75	0	0	96.7	99.3	61.3
10	Achieve Prowl H20	0.178 0.75	0	0	92.7	94.0	62.1
LSD (P=0.05)					13.3	8.8	5.7
CV					9.2	6.2	5.4
Treatment Prob(F)					0.0001	0.0001	0.0008

FORAGE INVESTIGATION

759

Forage investigation is part of Project 759 and includes research related to all types of forage from seeding to data collection to publications

PROJECT TITLE: **2002 DRYLAND INTRASTATE ALFALFA YIELD TRIAL**

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

OBJECTIVE: Compare yield potential of new releases and experimental lines with older, established cultivars.

METHODS: The experiment was established on 5/8/02. Fourteen cultivars were seeded in 5-ft by 15-ft plots consisting of 7 rows spaced 6-inches apart. Seeding rate was 5 lbs/acre pure live seed, and seeding depth was 0.5 in. Mono-ammonium phosphate fertilizer (11-52-0) was applied preplant at a rate of 400 lbs/acre and at 120 lbs/acre each spring following. The experimental design was a randomized complete block with 14 cultivars and four replications.

Crop year precipitation was 18.84 inches. Average monthly temperatures were 43.2, 51.6, 58.1, 64.1, and 63.1 degrees F from April to August, respectively.

Forage yield harvest dates were 6/14/03, 7/29, and 9/27/04. Plots were harvested with a sickle-bar research plot swather. Harvest area was 100 ft^2. After recording the fresh harvest weight, a subsample of approximately 500 g was taken, weighed, dried at 60°C in a forced air oven for 48 to 72 h, and reweighed to determine DM content.

Analysis of variance was calculated by the ANOVA procedure of XLSTAT Ver.7.5 (2004). Critical value for a significant F-test was tested at P=0.05. Treatment effects were compared by protected LSD when the F test for treatment was significant.

RESULTS: The total yields for 2004 were statistically similar except for 'Ameristand 403T' which produced the least forage. Over the 2 years of the study, 'HybriForce 400' was most productive (8.87 t/a), and Ameristand 403T was least productive (5.77 t/a).

2004 Summary table is presented on the next page.

2004 Summary of the 2002 DRYLAND INTRASTATE ALFALFA YIELD TRIAL

Kalispell, 2004

Cultivar	Harvest-1	Harvest-2	Harvest-3	2004 Total	2003 Total	2003-04 Total	%Mean
	t/a	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*	
HybriForce 400	2.78	**1.76**	**0.81**	**5.34**	**3.52**	**8.87**	117.6
6420	2.69	**1.66**	**0.72**	**5.07**	**3.00**	**8.07**	107.0
Wrangler	2.67	**1.51**	**0.61**	**4.79**	**3.25**	**8.04**	106.7
HybriForce-420/Wet	2.56	**1.67**	**0.69**	**4.91**	**3.07**	**7.99**	105.9
Ladak DL	2.60	**1.65**	**0.63**	**4.89**	**3.08**	**7.97**	105.7
WL 319HQ	2.65	**1.59**	**0.59**	**4.84**	**3.12**	**7.95**	105.5
Plumas	2.54	**1.48**	**0.59**	**4.61**	**3.14**	**7.74**	102.7
Rugged	2.48	**1.43**	**0.61**	**4.52**	**3.07**	**7.59**	100.6
Shaw	2.43	**1.27**	**0.54**	**4.25**	**3.03**	**7.28**	96.5
Rebel	2.40	**1.32**	**0.55**	**4.28**	**2.93**	**7.21**	95.6
Cooper	2.40	**1.32**	0.51	**4.23**	**2.94**	**7.17**	95.1
XTRA-3	2.36	**1.43**	0.50	**4.29**	2.85	**7.14**	94.7
Ladak 65	2.47	**1.24**	0.46	**4.18**	2.65	6.82	90.5
Ameristand 403T	2.08	1.00	0.31	3.39	2.38	5.77	76.5
mean	2.51	1.45	0.58	4.54	3.00	7.54	
LSD(0.05)	ns	0.57	0.28	1.38	0.63	1.86	
Pr>F	0.37	0.00	<0.00	0.00	0.00	<0.00	

PROJECT TITLE: **2004 DRYLAND INTRASTATE ALFALFA YIELD TRIAL**

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

OBJECTIVE: Compare yield potential of new releases and experimental lines with older, established cultivars under non-irrigated conditions.

METHODS: The trial was seeded on 4/22/04. Thirteen cultivars were seeded in 5-ft by 20-ft plots consisting of 7 rows spaced 6-inches apart. Seeding rate was 9 lbs/acre pure live seed, and seeding depth was 0.5 in. Mono-ammonium phosphate fertilizer (11-52-0) was applied preplant at a rate of 120 lbs/acre. Pursuit (3 oz./a) and Prowl (1.8 pt/a) were preplant incorporated for weed control. The experimental design was a randomized complete block with 13 cultivars and four replications.

Crop year precipitation was 18.84 inches. Average monthly temperatures were 45.1, 51.0, 57.3, 66.0, and 64.0 degrees F from April to August, respectively.

Forage yield harvest dates were 7/30 and 9/28/04. Plots were harvested with a sickle-bar research plot swather. Harvest area was 100 ft^2. After recording the fresh harvest weight, a subsample of approximately 500 g was taken, weighed, dried at 60°C in a forced air oven for 48 to 72 h, and reweighed to determine DM content.

Analysis of variance was calculated by the ANOVA procedure of XLSTAT Ver.7.5 (2004). Critical value for a significant F-test was tested at P=0.05. Treatment effects were compared by protected LSD when the F test for treatment was significant.

RESULTS: The total yields for 2004 were statistically similar except for 'FGI 4S42' and 'Rebound 5.0' which produced the least forage.

A table summarizing the 2004 trials is presented on the next page.

2004 Summary of the 2004 DRYLAND INTRASTATE ALFALFA YIELD TRIAL
Kalispell, 2004

Cultivar	Harvest-1	Harvest-2	2004 Total	%Mean
	t/a	*t/a*	*t/a*	
Ladak 65	**1.13**	0.67	**1.80**	108.6
Cooper	**1.12**	0.67	**1.79**	107.9
Shaw	**1.09**	0.66	**1.75**	105.4
Boulder	**1.12**	0.62	**1.74**	104.6
54Q25	**1.07**	0.65	**1.72**	103.8
MT-9321	0.99	0.69	**1.68**	101.2
DKA 33-16	**1.06**	0.59	**1.65**	99.5
VL02	**1.02**	0.63	**1.64**	98.8
MT-2003-1	**1.05**	0.59	**1.63**	98.3
DKA 50-18	0.99	0.59	**1.59**	95.5
6400HT	0.99	0.56	**1.55**	93.3
FGI 4S42	0.98	0.56	1.53	92.4
Rebound 5.0	0.97	0.51	1.48	88.9
mean	1.04	0.61	1.66	
LSD(0.05)	0.13	NS	0.26	

PROJECT TITLE: **2001 IRRIGATED INTRASTATE ALFALFA YIELD TRIAL**

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

OBJECTIVE: Compare yield potential of new releases and experimental lines with older, established cultivars in an irrigated/high rainfall environment.

METHODS: The experiment was established on 5/3/01. Nineteen cultivars were seeded in 5-ft by 15-ft plots consisting of 7 rows spaced 6-inches apart. Seeding rate was 8 lbs/acre pure live seed, and seeding depth was 0.5 in. Monoammonium phosphate fertilizer (11-52-0) was applied preplant at a rate of 400 lbs/acre and at 120 lbs/acre each spring following. The experimental design was a randomized complete block with 19 cultivars and four replications.

Crop year precipitation was 18.84 inches. Average monthly temperatures were 45.1, 51.0, 57.3, 66.0, and 64.0 degrees F from April to August, respectively.

Forage yield harvest dates were 6/22/03, 7/29/03, and 9/30/04. Plots were harvested with a sickle-bar research plot swather. Harvest area was 75 ft^2. After recording the fresh harvest weight, a subsample of approximately 500 g was taken, weighed, dried at 60°C in a forced air oven for 48 to 72 h, and reweighed to determine DM content.

Analysis of variance was calculated by the ANOVA procedure of XLSTAT Ver.7.5 (2004). Critical value for a significant F-test was tested at P=0.05. Treatment effects were compared using protected LSD when the F test for treatment was significant.

RESULTS: The highest yielding cultivars in 2004 were 'Riley', 'Cooper', 'WBRR', 'Goliath', 'Mariner II', 'DAK 9901', 'Ascend 552', 'Alliant', and 'A 30-06'. Over the 3 years of the study, Alliant was the most productive (23.89 t/a), and 'Wrangler' was least productive (20.62 t/a).

A summary of the 2004 data is presented on the next page.

2004 Summary of the 2001 Irrigated Intrastate Alfalfa Yield Trial
Kalispell-2004

Cultivar	MTNO	*Harv-1* Yield	*Harv-2* Yield	*Harv-3* Yield	2004 Total Yield	2003 Total Yield	2002 Total Yield	2002-04 Total Yield	%Mean
		tons DM/acre							
Alliant	380	2.95	**2.67**	**1.29**	**6.90**	7.69	**9.30**	**23.89**	107.0
DK A42-15	381	2.94	2.25	1.06	6.25	6.85	**10.27**	**23.38**	104.7
Cooper	335	3.21	2.26	**1.25**	**6.72**	7.27	**9.33**	**23.33**	104.5
WBRR	384	3.08	2.33	**1.40**	**6.80**	7.16	**9.13**	**23.10**	103.4
Mariner II	374	2.92	2.30	**1.23**	**6.45**	7.02	**9.46**	**22.93**	102.7
Goliath	373	3.00	2.33	**1.32**	**6.66**	7.23	**9.03**	**22.91**	102.6
Riley	122	3.47	2.33	**1.39**	**7.20**	**7.47**	**7.92**	**22.59**	101.1
DAK 9901	377	3.15	2.34	**1.22**	**6.71**	7.09	**8.68**	**22.49**	100.7
Ascend 552	378	2.86	**2.40**	**1.24**	**6.51**	7.34	**8.63**	**22.48**	100.7
Shaw	328	3.16	2.21	1.05	6.42	**6.30**	**9.61**	**22.34**	100.0
Monument II	376	2.79	2.23	**1.23**	6.25	**7.22**	**8.82**	**22.29**	99.8
Reliance	375	2.71	2.34	1.05	6.09	6.94	**9.11**	**22.14**	99.1
WL 327	383	2.75	2.15	1.01	5.92	6.88	9.28	**22.08**	98.9
Plumas	336	2.97	2.16	1.01	6.13	6.70	**9.00**	21.83	97.8
A 30-06	382	2.99	2.27	**1.21**	**6.47**	6.68	8.63	21.79	97.6
Amerstand 403T	372	2.64	2.24	**1.26**	6.14	6.65	**8.97**	21.76	97.5
Abound	379	2.52	2.34	1.16	6.02	6.85	**8.75**	21.62	96.8
Ladak 65	2	3.10	2.11	1.07	6.28	6.13	8.39	20.81	93.2
Wrangler	146	2.76	2.13	**1.22**	6.11	6.40	8.11	20.62	92.3
mean		2.95	2.28	1.19	6.42	6.94	8.97	22.33	
LSD(0.05)		NS	0.30	0.24	0.83	0.72	0.90	1.55	

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

PROJECT TITLE: **2002 IRRIGATED INTRASTATE ALFALFA YIELD TRIAL**

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

OBJECTIVE: Compare yield potential of new releases and experimental lines with older, established cultivars in an irrigated/high rainfall environment.

METHODS: The experiment was established on 5/8/02. Fourteen cultivars were seeded in 5-ft by 15-ft plots consisting of 7 rows spaced 6-inches apart. Seeding rate was 8 lbs/acre pure live seed, and seeding depth was 0.5 in. Monoammonium phosphate fertilizer (11-52-0) was applied preplant at a rate of 400 lbs/acre and at 120 lbs/acre each spring following. The experimental design was a randomized complete block with 14 cultivars and four replications.

Crop year precipitation was 18.84 inches. Average monthly temperatures were 45.1, 51.0, 57.3, 66.0, and 64.0 degrees F from April to August, respectively.

Forage yield harvest dates were 6/23, 7/30, and 9/30/04. Plots were harvested with a sickle-bar research plot swather. Harvest area was 100 ft^2. After recording the fresh harvest weight, a subsample of approximately 500 g was taken, weighed, dried at 60°C in a forced air oven for 48 to 72 h, and reweighed to determine DM content.

Analysis of variance was calculated by the ANOVA procedure of XLSTAT Ver.7.5 (2004). Critical value for a significant F-test was tested at P=0.05. Treatment effects were compared by protected LSD when the F test for treatment was significant.

RESULTS: Yield data was so variable that significant differences among varieties were not determined. Over the 2 years of the study, 'Cooper', 'Plumas', and 'HybriForce 420/Wet' were the most productive (>12.5 t/a), and 'Ladak DL' was least productive (11.25 t/a).

See the summary table on the next page.

2004 Summary of the 2002 IRRIGATED INTRASTATE ALFALFA YIELD TRIAL
Kalispell, 2004

Cultivar	*H-1* Yield	*H-2* Yield	*H-3*	2004 Total Yield	2003 Total Yield	2003-04 Total Yield	%Mean
				tons DM/acre			
Cooper	3.61	2.04	1.10	6.75	5.82	12.57	104.5
Plumas	3.48	2.05	1.03	6.55	5.99	12.55	104.3
HybriForce-420/Wet	3.58	2.00	0.99	6.57	5.96	12.53	104.1
WL 319HQ	**3.63**	2.08	0.93	6.64	5.69	12.33	102.5
Shaw	3.47	2.00	1.02	6.50	5.82	12.32	102.4
6420	3.58	1.90	0.89	6.37	5.91	12.28	102.1
XTRA-3	3.31	2.13	0.99	6.43	5.79	12.22	101.6
Rebel	3.40	1.95	0.95	6.31	5.73	12.04	100.0
Rugged	3.54	1.87	0.95	6.37	5.58	11.94	99.3
Ameristand 403T	3.41	1.92	0.98	6.31	5.61	11.92	99.1
HybriForce 400	3.44	1.76	0.91	6.11	5.59	11.70	97.2
Ladak 65	3.41	1.82	0.89	6.13	5.32	11.44	95.1
Wrangler	3.38	1.86	0.86	6.09	5.28	11.37	94.5
Ladak DL	3.23	1.78	0.84	5.86	5.39	11.25	93.5
mean	3.46	1.94	0.95	6.36	5.68	12.03	
LSD(0.05)	0.02	NS	NS	NS	NS	NS	

PROJECT TITLE: **2004 IRRIGATED INTRASTATE ALFALFA YIELD TRIAL**

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

OBJECTIVE: Compare yield potential of new releases and experimental lines with older, established cultivars under non-irrigated conditions.

METHODS: The trial was seeded on 4/23/04. Thirteen cultivars were seeded in 5-ft by 20-ft plots consisting of 7 rows spaced 6-inches apart. Seeding rate was 9 lbs/acre pure live seed, and seeding depth was 0.5 in. Mono-ammonium phosphate fertilizer (11-52-0) was applied preplant at a rate of 120 lbs/acre. Pursuit (3 oz./a) and Prowl (1.8 pt/a) were preplant incorporated for weed control. The experimental design was a randomized complete block with 13 cultivars and four replications.

Crop year precipitation was 18.84 inches. Average monthly temperatures were 45.1, 51.0, 57.3, 66.0, and 64.0 degrees F from April to August, respectively.

Forage yield harvest dates were 7/30 and 9/28/04. Plots were harvested with a sickle-bar research plot swather. Harvest area was 100 ft^2. After recording the fresh harvest weight, a subsample of approximately 500 g was taken, weighed, dried at 60°C in a forced air oven for 48 to 72 h, and reweighed to determine DM content.

Analysis of variance was calculated by the ANOVA procedure of XLSTAT Ver.7.5 (2004). Critical value for a significant F-test was tested at P=0.05. Treatment effects were compared by protected LSD when the F test for treatment was significant.

RESULTS: The total yields for 2004 showed no significant differences among cultivars. A table is presented on the next page.

INTRASTATE ALFALFA YIELD TRIAL - Irrigated
Kalispell, 2004

		Total Dry Matter Yield		
		Harv-1	Harv-2	Total
Variety	MT#	t/a	t/a	t/a
Cooper	MT-335	2.11	**1.08**	3.19
FGI 4S42	MT-394	2.18	**0.98**	3.16
MT-9321	MT-333	2.19	0.91	3.11
Shaw	MT-328	2.04	**1.04**	3.08
54Q25	MT-393	2.18	0.87	3.06
Ladak 65	MT-2	2.22	0.76	2.98
Rebound 5.0	MT-398	2.17	0.79	2.95
MT-2003-1	MT-400	2.04	0.89	2.93
Boulder	MT-397	1.93	**0.96**	2.89
VL02	MT-392	1.83	**0.99**	2.83
DKA 50-18	MT-396	1.97	0.79	2.76
6400HT	MT-399	1.91	0.85	2.76
DKA 33-16	MT-395	1.96	0.72	2.68
	mean	2.06	0.89	2.95
	LSD(0.05)	0.35	0.17	0.46
	Pr>F	0.40	0.00	0.44

PROJECT TITLE: *Medicago falcata* Trial

PROJECT LEADER: Duane Johnson, NWARC
Res.Asst. - Louise Strang, NWARC

OBJECTIVE: Determine the performance of *M. falcata* in a forage legume/grass mixture.

METHODS: A *Medicago falcata* germplasm accession was seeded alone and in mixture with orchard grass (*Dactylis glomerata* L.) or meadow brome grass (*Bromus biebersteinii*) in a dry land nursery on 4/23/04. *M. sativa* cv. 'Shea' was included alone and in the same mixtures for comparison. The mixtures contained either 20% or 40% legume seed. The 2 alfalfas, 2 grasses, and 8 combinations were planted in 5' x 20' plots in a randomized complete block design with 4 replicates. Stand composition was visually estimated on 6/4/04. The trial was harvested 8/2 and 9/29/04. Subsamples from each species and mixture were weighed fresh and dry to determine dry matter content. Species separations were postponed until the following year.

RESULTS: The *M. falcata* established poorly both alone and in the grass mixtures. The best total forage yields came from the *M. sativa* pure stand, followed by the *M.sativa* / meadow brome mixtures.

***M. falcata* Trial**
Kalispell, 2004

Species	Stand	Harv-1	Harv-2	TotalYld
	%grass/alfalfa	*t/a*	*t/a*	*t/a*
M. sativa	0/90	**0.91**	**0.48**	**1.39**
80-MB:20-Ms	74/44	**0.73**	0.32	1.05
60-MB:40-Ms	71/65	**0.72**	0.32	1.04
60-OG:40-Ms	90/89	0.58	0.28	0.85
80-OG:20-Ms	66/40	0.46	0.31	0.76
Orchard grass	90/0	0.36	0.15	0.51
M. falcata	0/24	0.41	0.04	0.45
80-OG:20-Mf	68/6	0.32	0.12	0.45
60-OG:40-Mf	80/12	0.31	0.12	0.43
Meadow brome	70/0	0.37	0.04	0.42
60-MB:40-Mf	54/11	0.31	0.10	0.41
80-MB:20-Mf	80/6	0.34	0.05	0.39
mean		0.49	0.19	0.68
LSD(0.05)		0.22	0.16	0.33
Pr>F		< 0.0001	< 0.0001	< 0.0001

PROJECT TITLE: **SPRING CEREAL FORAGE**

PROJECT COOPERATORS: Dave Wichman, MSU - CARC
Duane Johnson, MSU – NWARC
Louise Strang, MSU - NWARC

OBJECTIVE: To compare the yield and feeding quality of different species and cultivars of spring cereal crops as to their suitability as annual forage crops.

METHODS: Fertilizer was applied preplant at the following rates: 100 lbs/acre N, 28 lbs/a P_2O_5, 60 lbs/a K_2O, 48 lbs/a SO_2. Pursuit and Prowl were preplant incorporated for weed control. Eighteen small grain selections were seeded 4/22/04 in a randomized complete block design with 3 replicates. Seeding rate was 21 seeds/ft^2. Plots were 5' wide x 15' long with 6" row spacing.

Crop year precipitation was 18.84 inches. Average monthly temperatures were 45.1, 51.0, 57.3, 66.0, and 64.0 degrees F from April to August, respectively. No irrigation was applied.

The forage was harvested when the heads had reached anthesis, 75 to 82 days after seeding, depending on species. Data collected included dry matter production, % nitrate, protein, ADF, and NDF.

Analysis of variance was calculated by the ANOVA procedure of XLSTAT Ver.7.5 (2004). Critical value for a significant F-test was tested at P=0.05. Treatment effects were compared by protected LSD when the F test for treatment was significant.

RESULTS: There were no significant yield differences among species and varieties in 2004. 'Red 1' triticale produced the most forage, followed by 'SK3P' spelt and 'Lucile' emmer. The wheat x spelt hybrid yielded the least. 'Monico' was the most productive barley variety, and 'Maverick' was the most productive oat. Although quality data is not yet available, past studies have shown barley to have the most stable nitrate concentrations, an important safety factor for livestock forage.

Please refer to the table on the next page.

2004 SPRING CEREAL FORAGE TRIAL

Kalispell

Cultivar	Species	Heading *day*	Anthesis *day*	Height *inches*	Yield *t/a*
Red 1	triticale	66	76	33	2.34
SK3P	spelt	69	75	36	2.32
Lucile	emmer	74	77	32	2.26
Monico	barley	69	82	32	2.23
Maverick	oats	72	82	39	2.13
Westford	barley	70	82	33	2.11
Moravian 37	barley	71	82	33	2.09
Harrington	barley	70	82	30	2.08
Otana	oats	70	82	41	2.08
Hays	barley	70	82	38	2.07
Bz 598-257	barley	67	81	33	2.06
Paul	oats	72	82	40	2.00
Valier	barley	71	80	35	1.95
Haybet	barley	66	81	36	1.88
Bestford	barley	68	80	31	1.82
Logan	barley	65	82	36	1.81
91002005	triticale	66	75	29	1.81
93ST59	wht X splt	69	76	30	1.73
mean		69	80	34	2.04
LSD(0.05)		3	3	ns	ns
Pr>F		< 0.0001	< 0.0001	0.24	0.80

PROJECT TITLE: Sulfur Recommendations for Irrigated Alfalfa

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

OBJECTIVE: Test variable rates of S fertilization on irrigated alfalfa to: 1) determine optimum plant S tissue levels for optimum economic yield and safe feeding, 2) determine specific plant tissues (leaves vs. whole plants) for monitoring purposes, and 3) begin to develop S fertilizer rate recommendations.

METHODS: 'Shaw' alfalfa was planted in 4 replicates of 9- 5'x20' plots on 5/2/02 Soil samples taken on 4/19/02 showed pH=7.6, N=9 ppm, P=15 ppm, K=94 ppm, S=7 ppm, salt= .56. 13 lbs N/a and 62 lbs P_2O_5/a were applied and incorporated before seeding. In early spring 2003, ammonium sulfate and ammonium nitrate were applied in a randomized complete block design to equal 4 S rates of 10, 20, 30, and 40 lbs/a and 4 N rates of 8.8, 17.5, 26.3, and 35 lbs/a. The trial was harvested on 6/24 and 8/3/04 and whole plant and middle section leaves were sampled and analyzed for S concentrations.

RESULTS: In 2004 there were no significant differences in forage yield among the 8 fertilizer treatments and the control. Results of the 2004 tissue analyses are pending. For 2003 the 20-40 lb/a S treatments contained more total S in the whole plant tissue than the control (0-S, 0-N) treatment. Yields, however, were not affected by S or N fertilizer levels.

Table 1.
Kalispell, 2004

N lb/a	S lb/a	Harv-1: *t/a*	Harv-2: *t/a*	Total *t/a*
0	0	3.62	2.43	6.05
8.8	10	3.67	2.37	6.04
17.5	20	3.81	2.07	5.88
26.3	30	3.62	2.42	6.04
35.0	40	3.80	2.31	6.11
8.8	0	3.90	2.33	6.22
17.5	0	3.57	2.37	5.94
26.3	0	3.37	2.22	5.59
35.0	0	3.48	2.24	5.71
	mean	3.65	2.31	5.95
	LSD(0.05)	ns	ns	ns
	Pr>F	0.947	0.685	0.950

For further information on this topic:
http://www.animalrangeextension.montana.edu/Articles/Forage/General/Fertilizer-guidelines.htm

PROJECT TITLE: Fertility Management for Barley Forage

PROJECT COOPERATORS: Mal Westcott, WARC; Duane Johnson, NWARC; Louise Strang, NWARC

OBJECTIVE: Investigate the interaction between nitrogen (N) and sulfur (S) fertilizer on the yield and forage quality of 'Haybet' barley.

METHODS: A dryland area was divided into 4 replicates of 6 plots/replicate. Each plot was 5' x 20' in size. Five fertilizer treatments consisting of 3 N rates and 2 S rates plus an unfertilized control were applied in a randomized complete block design on 4/29/04. Haybet barley was seeded at 75 lbs/a on 4/30/04. All plots were harvested at the early milk stage of grain development (7/12/04) and tissue samples analyzed for total N, P, K, and S and for nitrate and crude protein concentration.

RESULTS: Neither nitrogen nor sulfur fertilization affected forage yield significantly in 2004 or in the 2 previous years of the study. The addition of 20 lbs S/a did not significantly affect nitrate levels. The N and S fertilizer treatments had no significant effect on forage quality factors measured at Kalispell in 2004. The addition of S fertilizer did, however, reduce the N:S ratio of the forage by 15% in 2004, from 13.1 to 11.1. This represents an improvement in forage quality for ruminant animals, for which a 10:1 ratio is preferred.

Please see the table on the next page summarizing this data.

BARLEY FORAGE FERTILITY TRIAL
Kalispell, 2004

Yield (t/a)

	S-rate		
N-rate	0	20	mean
0	3.70	3.31	3.51
60	3.49	3.56	3.52
120	3.54	3.75	3.64
mean	3.58	3.54	NS

NO_3 %

	S-rate		
N-rate	0	20	mean
0	5669	5756	5712
60	6942	5666	6304
120	4995	7198	6096
mean	5869	6207	NS

P %

	S-rate		
N-rate	0	20	mean
0	0.242	0.219	0.231
60	0.222	0.217	0.220
120	0.207	0.205	0.206
mean	0.224	0.214	NS

K %

	S-rate		
N-rate	0	20	mean
0	1.290	1.229	1.260
60	1.143	1.227	**1.185**
120	0.996	1.158	**1.077**
mean	1.143	1.205	NS

Total N %

	S-rate		
N-rate	0	20	mean
0	2.219	2.069	2.144
60	2.304	2.134	2.219
120	2.139	2.170	2.155
mean	2.221	2.124	NS

Total S %

	S-rate		
N-rate	0	20	mean
0	0.194	0.191	0.193
60	0.214	0.193	0.204
120	0.195	0.191	0.193
mean	0.201	0.192	NS

CP %

	S-rate		
N-rate	0	20	mean
0	13.9	12.9	13.4
60	14.4	13.3	13.9
120	13.4	13.6	**13.5**
mean	13.9	13.3	NS

SPECIALTY CROP EVALUATION

759

Specialty crop evaluation is part of Project 759 and includes research related to a wide variety of unique crops from seeding to data collection to publications.

PROJECT TITLE: **Western Regional Winter Lentil Yield Trial**

PROJECT LEADER: Fred Muehlbauer, WSU
Cooperator: Duane Johnson, NWARC
Louise Strang, NWARC

OBJECTIVE: Compare winter survival and yield potential of experimental lentil breeding lines in a northwest Montana environment.

METHODS: Eight lentil accessions from Washington State University were seeded into 60 ft^2 plots at 12 seeds/ft^2 on 9/24/03. Stand counts were taken 4/27/04. Weed control was done by hand. Dates were recorded when 50% of each plot had bloomed and when 50% had reached maturity (yellow leaves, hard seed). The plants were uprooted when they reached maturity, and the seeds thrashed out when the plants were dry. The lentils from each plot were weighed to determine yield and 100-seed samples weighed to determine seed weight (no. of seed/lb).

RESULTS: All the entries survived the winter very well. First blooms appeared between 5/26 and 6/1. The plants had matured by 7/21. Lentil yields ranged from 353 lbs/acre ('WA8649041') to 1527 lbs/acre ('LC9979062'). 'WA8649041' had the smallest seeds and 'LC9976079' were the largest.

WESTERN REGIONAL WINTER LENTIL YIELD TRIAL
Kalispell, 2003-2004

Cultivar	Spring Stand %	Flower date	Maturity date	Yield lbs/a	Seed Size #/lb
LC9979062	76	5/26	7/20	**1527**	**13993**
LC9979010	89	5/31	7/19	1139	**14024**
LC9979065	79	6/1	7/20	1107	14578
LC9979120	88	5/31	7/20	1004	16998
LC9978057	90	5/26	7/18	805	**12833**
LC9976079	88	5/26	7/18	781	**12671**
LC9978094	90	5/31	7/21	656	**14055**
WA8649041	88	6/1	7/21	353	18132
mean	86			922	14661
LSD(0.05)	ns			333	1493
Pr>F	0.79			<0.00	<0.00

PROJECT TITLE: **Western Regional Winter Pea Yield Trial**

PROJECT LEADER: Fred Muehlbauer, WSU
Cooperator: Duane Johnson, NWARC
Louise Strang, NWARC

OBJECTIVE: Compare winter survival and yield potential of experimental pea breeding lines in a northwest Montana environment.

METHODS: Eight dry pea accessions from Washington State University were seeded into 60 ft^2 plots at 12 seeds/ft^2 on 9/24/03. Entries were arranged in a randomized complete block design with 4 replicates. Stand counts were taken 4/27/04. Weeds were controlled by hand. Number of nodes between cotyledons and first reproductive node were counted. Dates were recorded when 50% of each plot had bloomed and when 50% had reached maturity (yellow leaves, hard seed). The plants were uprooted when they reached maturity, and the seeds thrashed out when the plants were dry. The peas from each plot were weighed to determine yield and 100-seed samples weighed to determine seed weight (no. of seed/lb).

RESULTS: Ice sheeting destroyed all plots in the first and half the plots of the second replicate. The remaining plots survived the winter fairy well. First blooms appeared between 6/1 and 6/10. The plants had matured by 7/19. The plants were uprooted and left to dry in the plots. When dry the peas were fed into a plot combine to be thrashed. Peas from each plot were weighed to determine yield and 100-pea subsamples were weighed to determine seed size (number/pound). Pea yields ranged from 1256 lbs/acre ('PS9430706') to 2722 lbs/acre ('PS9830S358'). 'PS9830S431' had the smallest seeds and PS9830S358 had the largest.

WESTERN REGIONAL WINTER PEA YIELD TRIAL
Kalispell, 2003-2004

	Stand	First Flower	Nodes	Maturity	Yield	SeedWt
Cultivar	%	*date*	*to 1st fl*	*date*	*lbs/a*	*#/lb*
PS9830S358	54	6/3	**16**	7/19	**2722**	**3165**
PS9830S431	65	6/1	15	7/19	**2503**	3913
PS9830F011	54	6/4	13	7/19	**2070**	**3178**
PS7530726	51	6/6	15	7/19	**1811**	**3373**
PS9830F009	56	6/10	**16**	7/19	1618	**3347**
PS9630448	45	6/7	**17**	7/19	1328	3713
PS9830F010	43	6/6	15	7/19	1296	**3554**
PS9430706	69	6/7	**16**	7/19	1256	3614
mean	55		15		1825	3482
LSD(0.05)	ns		2		1079	399
Pr>F	0.99		0.16		0.24	0.02

PROJECT TITLE: **Western Regional Spring Lentil Yield Trial**

PROJECT LEADER: Fred Muehlbauer, WSU
Cooperator: Duane Johnson, NWARC
Louise Strang, NWARC

OBJECTIVE: Compare yield potential of experimental lentil breeding lines with released varieties in a northwest Montana environment.

METHODS: Nine lentil accessions from Washington State University and 3 named cultivars were seeded into 75 ft^2 plots at 8.3 seeds/ft^2 on 4/13/04. The soil was fertilized with 13 lbs. N/a and 62 lbs. P_2O_5/a. Pursuit (at 3-oz./acre) and Prowl (at 1.8 pt./acre) had been applied and pre-plant incorporated for early weed control. Stand counts were taken 4/27/04. Dates were recorded when 50% of each plot had bloomed. When the plants reached maturity (yellow leaves, hard seed) The were uprooted and left to dry in the plots. The lentils were thrashed out with a plot combine when the plants were dry. The lentils from each plot were weighed to determine yield and 100-seed samples weighed to determine seed weight (no. seeds/lb).

RESULTS: All the entries developed good stands. First blooms appeared between 6/16 and 6/21. The seeds were thrashed out on 8/12. Lentil yields ranged from 496 lbs/acre ('LC99602075L') to 860 lbs/acre ('LC01601640P'). 'LC01602341E' had the smallest seeds and 'LC860616L' were the largest.

WESTERN REGIONAL LENTIL YIELD TRIAL
Kalispell, 2004

Cultivar	Cotyledon Color	Type	1st Flower *date*	1st Flower *day*	Yield *lbs/a*	SeedWt *#/lb*
LC01601640P	Yellow	Pardina	6/19	67	**859.5**	12052
LC01600405T	Red	Turkish Red	6/17	**65**	**853.7**	11025
LC01602341E	Yellow	Eston	6/19	67	**839.9**	13374
LC01602307E	Yellow	Eston	6/20	68	**777.0**	11210
LC01602062T	Red	Turkish Red	6/18	66	**760.8**	10905
LC860359L	Yellow	Laird	6/21	69	**753.7**	**7417**
Merrit	Yellow	Brewer	6/17	**65**	**720.4**	**8627**
LC01602245P	Yellow	Pardina	6/17	**65**	**700.6**	11707
Castillion	Yellow	Castilion	6/17	**65**	617.4	**7415**
LC860616L	Yellow	Laird	6/18	66	587.2	**6783**
Pennell	Yellow	Laird	6/21	69	565.7	**7216**
LC99602075L	Yellow	Laird	6/16	**64**	496.4	**6980**
		mean		66	711.0	9559
		LSD(0.05)		2	206.1	1390
		Pr>F		<0.00	0.02	<0.00

PROJECT TITLE: **Western Regional Dry Pea Yield Trial**

PROJECT LEADER: Fred Muehlbauer, WSU
Cooperator: Duane Johnson, NWARC
Louise Strang, NWARC

OBJECTIVE: Compare yield potential of experimental spring pea breeding lines in a northwest Montana environment.

METHODS: Seven dry pea accessions from Washington State University and 3 named varieties were seeded into 75 ft^2 plots at 8.3 seeds/ft^2 on 4/13/04. The soil was fertilized with 13 lbs. N/a and 62 lbs. P_2O_5/a. Pursuit (at 3-oz./acre) and Prowl (at 1.8 pt./acre) had been applied and pre-plant incorporated for early weed control. Entries were arranged in a randomized complete block design with 4 replicates. Stand counts were made on 6/25. Dates were recorded when 50% of each plot had bloomed and when 50% had reached maturity (yellow leaves, hard seed). The plants were uprooted when they reached maturity, and the seeds thrashed out when the plants were dry. The peas from each plot were weighed to determine yield and 100-seed samples weighed to determine seed weight (no. of seed/lb).

RESULTS: First blooms appeared between 6/10 and 6/17. The plants had matured by 7/23. The plants were uprooted and left to dry in the plots. When dry the peas were fed into a plot combine to be thrashed. Peas from each plot were weighed to determine yield and 100-pea sub samples were weighed to determine seed size (number/pound). Pea yields ranged from 1845 lbs/acre ('PS810162') to 3131 lbs/acre ('PS0010792'). 'Lifter' had the smallest seeds and PS0010792 had the largest.

WESTERN REGIONAL DRY PEA YIELD TRIAL
Kalispell, 2004

Cultivar	Cotyledon Color	Vine Type	Leaf Type	First Flower	Maturity	Yield	SeedWt
				day	*day*	*lbs/a*	*#/lb*
PS0010792	Green	Short	Normal Leaf	63	101	**3131**	**1939**
Stirling	Green	Short	Semi-leafless	61	100	**3079**	2158
PS0010804	Yellow	Short	Semi-leafless	64	99	**2828**	2072
PS0010836	Yellow	Short	Semi-leafless	65	100	**2786**	**1948**
Delta	Yellow	Short	Semi-leafless	63	**98**	**2767**	**2029**
PS9910140	Yellow	Short	Semi-leafless	64	100	2374	2246
PS0010806	Yellow	Short	Semi-leafless	64	100	2313	2035
PS9910592	Green	Short	Semi-leafless	64	100	2286	2122
Lifter	Green	Short	Normal	64	101	1897	2576
PS810162	Green	Short	Semi-leafless	**58**	100	1845	**2003**
			mean	63	100	2531	2113
			LSD(0.05)	1	1	612	95
			Pr>F	<0.00	0.00	0.00	<0.00

PROJECT TITLE: Oil Seed Trial

PROJECT LEADER: Duane Johnson, NWARC
Louise Strang, Research Asst.

OBJECTIVE: Assess the suitability of various oilseed crops for production in northwest Montana.

METHODS: The following oilseed cultivars were seeded at NWARC in 2004:
'Gold of Pleasure' camelina (seeded 3/30/04);
'Oscar', 'Minot', 'Cheetah', 'CHS905', 'CHS2061', and 'Crosby' canola (4/21);
'Sterling', 'Garnet', and 'Gem' rapeseed (4/21);
'Meyer' crambe and 'Amulet' mustard (4/21);
'Pembina' and 'Omega' flax (4/21);
'MT2004' and 'Nutrasaf' safflower (4/21);
'CL340' and '8242 NS' sunflower (4/30);
'Surge' soybean and 'Resina' calendula (4/30).

Each entry was seeded in 7-18' rows spaced 6" apart. The experimental design was a split block with one species per block and cultivars randomized within each species block. The plot area had been fertilized with 13 lbs N and 62 lbs P_2O_5/a on 3/25/04. Stand establishment was visually estimated on 6/1/04. The camelina was harvested with a Hege plot combine on 8/17, and the canola, mustard, crambe and rape were harvested 8/31/04. The safflower and calendula were hand harvested 10/28. The flax and safflower were ruined by the late August rains and no seed was obtained. Birds harvested the sunflower seeds from the standing heads, and the soybeans fell to deer predation.

RESULTS: Harvest was difficult this year due to the 3.6 inches of rain that fell in August. The safflower and soybeans never fully matured, and the flax did not dry sufficiently to allow combining. The calendula continued to flower through October, so very little mature seed was obtained. The canolas 'CHS905', 'CHS2061', and 'Crosby' produced the most harvestable seed. Birds feasted on the sunflowers before the seed could be harvested. This problem must be addressed before further work can be done on this crop. See table.

OILSEEDS - 2004

Species	Cultivar	Stand	Bloom	Height	Yield
		%	*day*	*in*	*lbs/a*
Camelina	G of P	58	69		(958.5)*
Canola	Oscar	**84**	66	44	1445.6
Canola	Minot	**93**	65	43	1490.8
Canola	Cheetah	**80**	70	45	890.5
Canola	CHS905	**94**	70	53	**1741.8**
Canola	CHS2061	**98**	66	48	**1625.3**
Canola	Crosby	**91**	66	48	**1544.0**
Rapeseed	Sterling	74	65	46	1375.9
Rapeseed	Garnet	**93**	64	48	1421.4
Rapeseed	Gem	**84**	64	46	1520.6
Crambe	Meyer	**83**	64	46	1503.2
Mustard	Amulet	**83**	65	49	1444.1
Flax	Pembina	**91**	70	31	
Flax	Omega	**95**	71	31	
Safflower	MT2004	**99**	**101**	39	
Safflower	Nutrasaf	**100**	**103**	42	
Sunflower	CL340	45	88	60	
Sunflower	8242 NS	50	84	**64**	
Soybean	Jim	**78**		25	
Soybean	Surge	**86**		23	
Calendula	Resina	**84**	66	29	25.4
	mean	84	73	43	1335.7
	LSD(0.05)	24	2	4	217.0
	Pr>F	0.000	< 0.0001	< 0.0001	< 0.0001

Camelina yield determined from border areas.

PROJECT TITLE Pacific Northwest Canola Variety Trial

PROJECT LEADER: Jack Brown, Univ. of Idaho
Cooperators: Duane Johnson, NWARC
Louise Strang, NWARC

OBJECTIVE: To compare seed yield potential of experimental canola breeding lines in comparison with available varieties in a northwest Montana environment.

METHODS: Thirty cultivars/experimental lines of canola were seeded 4/26/04. Each plot consisted of 7-20' rows with 6" row spacing and 2' between plots. Seeding rate was 6 lbs/acre. The varieties were arranged in a split block configuration with 4 replicates. Stand establishment was evaluated by counting plants in square foot quadrats in each plot. The date on which 50% of the plants bloomed was recorded for each plot.

All plots were sprayed with Paraquat on 8/11/04 to facilitate drying prior to harvest. The trial was harvested with a Hege plot combine on 9/8/04. The seed was dried and weighed for yield determination, and 1-pint samples from each were weighed to determine test weight.

RESULTS: Stand establishment was good, with 'HyClass 2061 RR', 'Profit', 'UISC00.3.1.7', and 'UISH03.2' having over 30 plants/ft^2. 'Goldrush' was the earliest to bloom. Plant height varied from 48 to 58 inches. .Because of late August rains, harvesting was difficult, and some seed had sprouted. Many plots lodged severely. Seed yield ranged from 1027 lbs/acre (Goldrush) to 2488 lbs/acre ('KAB.36'). Test weight ranged from 48.8 lbs/bu ('Sterling') to 53.6 lbs/bu ('IMC 210RR').

A table summarizing this data is presented on the next page

PACIFIC NORTHWEST CANOLA VARIETY TRIAL
Kalispell, 2004

Variety	Stand *#/sqft*	1st Blm. *day**	Height *in*	Maturity *day**	Yield *lbs/a*	Test Weight *lbs/bu*
UISH00.3.13.25	25.5	60	50	**104**	ms	ms
KAB.36	22.5	64	52	107	**2488**	49.8
HyClass 2061 RR	**32.3**	61	**54**	107	**2319**	50.6
SW Marksman RR	26.3	62	53	108	**2304**	51.6
UISH00.3.19.23	**29.3**	61	51	106	**2237**	49.9
UISC00.3.1.17	19.8	60	**55**	107	**2125**	50.3
DLK 225 RR	14.8	59	53	106	**2096**	50.6
Hylite 225	24.5	60	49	106	**2096**	51.1
Sterling	24.5	60	50	105	**2055**	48.8
UISC00.3.8.DE	20.3	60	49	105	**1913**	49.6
CNH 1503RR	19.5	62	**58**	106	**1871**	50.8
IMC 209RR	23.5	65	**56**	108	**1831**	**52.1**
CNH 1501RR	13.0	61	**56**	108	**1827**	51.6
Hyola 357 Magn	23.3	60	50	107	**1827**	50.4
Premier	21.0	60	52	106	**1811**	**53.2**
Sunrise	20.0	62	52	107	**1804**	51.5
Gem CF	24.5	60	50	107	**1803**	50.1
Hyola 401	22.8	60	48	108	**1772**	50.9
UISC02.4.18	21.8	60	50	105	**1760**	51.3
Profit	**33.3**	60	**55**	108	**1740**	50.3
UISC00.1.3.5	24.5	60	52	**104**	**1629**	50.9
UISC00.3.1.7	**31.5**	60	48	105	**1600**	49.8
Clearwater CF	23.5	64	**54**	105	**1582**	51.6
CNR 603	26.0	65	51	108	1558	**52.1**
IMC 210RR	27.8	65	53	108	1492	**53.6**
Hero	14.0	60	52	105	1371	50.4
UISH03.2	**38.5**	62	52	**104**	1353	51.0
Westar	14.3	63	52	105	1343	51.0
CNH 1604RR	23.3	63	**57**	108	1343	49.0
Goldrush	19.0	**48**	53	**103**	1027	**53.0**
mean	23.5	61	52	106	1792	50.9
LSD(0.05)	10.5	2	5	2	927	1.6
Pr>F	0.000	< 0.0001	0.006	< 0.0001	0.035	0.016

PROJECT TITLE Pacific Northwest Mustard Variety Trial

PROJECT LEADER: Jack Brown, Univ. of Idaho
Cooperators: Duane Johnson, NWARC
Louise Strang, NWARC

OBJECTIVE: To compare seed yield potential of experimental mustard breeding lines in comparison with available varieties in a northwest Montana environment.

METHODS: Twenty-six cultivars/experimental lines of mustard were seeded 4/26/04. Each plot consisted of 7-20' rows with 6" row spacing and 2' between plots. Seeding rate was 5 lbs/acre. The varieties were arranged in a randomized split block configuration with 4 replicates. Stand establishment was evaluated by counting plants in square foot quadrats in each plot. The date on which 50% of the plants bloomed was recorded as first bloom day for each plot.

All plots were sprayed with Paraquat on 8/11/04 to facilitate drying prior to harvest. The trial was harvested with a Hege plot combine on 9/8/04. The seed was dried and weighed for yield determination, and 1-pint samples from each were weighed to determine test weight.

RESULTS: Stand establishment was good, with 'Big Bear' and "2XH83.8.7' having over 30 plants/ft^2. 'AC.Pennent" was the earliest to bloom. Plant height varied from 50 to 62 inches. Because of late August rains, harvesting was difficult, and some plots were left uncut. Many plots lodged severely. Seed yield ranged from 990 lbs/acre ('Arid') to 2327 lbs/acre ('2BH63.64.3.13'). Test weight ranged from 50.0 lbs/bu (Arid) to 56.4 lbs/bu ('UI.529.28').

PACIFIC NORTHWEST MUSTARD VARIETY TRIAL
Kalispell, 2004

Variety	Stand *pl/sqft*	First Blm *day*	Height *in*	Maturity *day*	Yield *lbs/a*	TestWt. *lbs/bu*
2BH63.64.3.13	19	54	**62**	102	**2327**	55.5
2XH83.8.15	**24**	55	**62**	102	**2005**	**56.0**
UI.529.28	15	55	**60**	104	1921	**56.4**
99.BJ.89.1	12	61	56	105	1847	53.5
2XH83.8.1	20	57	**59**	104	1807	55.4
Viscount	20	54	**61**	103	1805	**56.2**
88.BJ.81.4	22	60	54	106	1800	52.8
2XH83.8.7	**31**	55	**59**	103	1770	55.6
UI.529.15	15	56	**59**	105	1752	55.8
2BH63.64.3.14	22	55	**59**	103	1722	55.7
UI.529.32	16	56	**61**	104	1703	55.5
UI.529.27	14	54	**57**	103	1666	55.7
Kodiak	**28**	60	55	103	1661	54.6
2BH63.64.3.15	13	57	**61**	106	1648	**56.0**
99.BJ.94.1	**25**	60	55	102	1596	54.5
Tilney	12	54	**60**	101	1586	55.1
AC.Pennent	**24**	**51**	56	101	1579	**56.1**
Idagold	16	**52**	**57**	103	1570	55.8
J00D.09439	**29**	59	50	106	1563	51.7
99.BJ.99.7	**27**	63	**57**	104	1545	52.6
99.BJ.92.1	19	60	**59**	104	1526	53.5
P.Gold	23	60	**59**	104	1409	53.1
Big Bear	**30**	64	**57**	104	1305	54.9
Cutlass	5	61	53	105	1099	54.2
Arid	22	60	51	107	990	50.0
mean	20	57	57	104	1620	54.6
LSD(0.05)	8	3	6	4 (ns)	354	0.6
Pr>F	< 0.0001	< 0.0001	0.008	0.353	0.023	< 0.0001

99.BJ.99.4 - missing plot