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

ANNUAL REPORT
2009 CROP YEAR

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NORTHWESTERN AGRICULTURAL RESEARCH CENTER
STAFF 2009

Full Time Staff Members **Years in Service**

Robert N. Stougaard, Interim Superintendent – Professor, Weed Science 18
Began November 1991

Heather E. Mason, Assistant Professor of Cropping Systems 1
Began September 2008

Louise M. Strang – Research Associate 26
Began May 1983

Gary R. Haaven – Ag Research Specialist 27
Began April 1982

Barbara F. Honeycutt – Administrative Associate 9
Began December 1999

Sarah Gunderson – Research Assistant I 15
Began March 1994

Janice Haaven – Research Assistant I 13
Began March 1996

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

Seasonal Employees

Paul Koch
James Thompson

MSU Student Seasonal Employees

Jane Johnson
Danielle Josephsen
Jacob Josephsen
Janie Tikka
Rosemary Till

CLIMATOLOGY

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

CLIMATOLOGICAL OVERVIEW 2009
NORTHWESTERN AGRICULTURAL RESEARCH CENTER
Kalispell, Montana

The precipitation for the 2008-2009 crop year at 19.01 inches was approximately 1.12 inches less than the long-term average in this area. April, May, and June were particularly dry. Average temperatures were below the average for September 2008 through April 2009. May through August experienced average temperatures above normal.

Summary of Climatic Data by Months for the 2009 Crop Year - September 2008 - August 2009 and Averages for the Years 1980-2009 at the Northwestern Agricultural Research Center, Kalispell, Montana

	Sept. 2008	Oct. 2008	Nov. 2008	Dec. 2008	Jan. 2009	Feb. 2009	Mar. 2009	Apr. 2009	May 2009	June 2009	July 2009	Aug. 2009	Total or Average
Precipitation (inches)													
Current Year	1.57	0.61	1.71	2.37	1.72	1.59	1.43	0.98	1.62	1.98	2.44	0.99	19.01
1980-2009	1.67	1.27	1.60	1.49	1.37	1.19	1.32	1.77	2.42	3.16	1.71	1.16	20.13
Average Temperature (F°)													
Current Year	52.4	41.7	33.3	18.0	21.5	24.5	26.2	41.8	53.3	59.2	67.1	66.1	42.1
1980-2009	53.5	42.2	32.5	24.2	24.5	27.1	34.7	43.2	51.5	57.7	64.4	63.5	43.3

Last killing frost[1] in spring		
Spring 2009	May 2	28°F
Median for 1980-2009	May 20	
First killing frost[1] in fall		
Fall 2009	October 6	26°F
Median for 1980-2009	September 17	
Frost Free Period		
2009	156	
Avg. 1980-2009	119	
Growing Degree Days April - August 2009		
Base 50	1719	
Base 40	2843	
Base 32	3922	
Maximum summer temperature	96°F July 24, 2009	
Minimum winter temperature	-21°F December 21, 2008	

1. In this summary 32 degrees is considered a killing frost.

MAXIMUM / MINIMUM TEMPERATURES BY MONTH & DAY
JANUARY 2006- DECEMBER 2009

2009

YR	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
06	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	35	10	36	19	29	6	36	31	53	31	76	54	83	43	82	55	83	53	51	37	53	32	50	22
2	29	14	32	23	33	22	41	28	57	28	64	43	83	44	92	55	88	56	51	37	48	22	34	10
3	27	3	36	19	44	22	38	28	66	34	68	41	86	49	90	57	91	49	59	39	41	22	29	7
4	12	2	35	19	45	25	45	22	56	42	78	41	87	55	90	54	87	42	59	39	46	22	21	9
5	22	6	24	9	43	27	47	22	60	45	83	50	88	49	93	53	80	44	53	35	48	23	21	9
6	32	19	30	9	37	6	51	24	57	43	81	44	83	56	87	59	81	49	54	26	50	23	25	10
7	38	31	35	29	25	8	59	26	55	43	54	33	73	51	81	63	68	45	60	26	46	35	11	-8
8	41	31	41	14	32	21	64	30	52	38	62	42	74	42	66	48	61	40	45	22	47	35	10	-16
9	43	34	34	14	21	2	60	32	54	34	55	35	71	43	74	52	70	37	45	24	41	32	10	-16
10	41	31	30	22	17	1	57	29	62	33	62	36	72	43	77	49	75	38	34	9	49	31	12	2
11	36	32	33	16	11	-14	59	29	63	39	70	40	79	45	87	52	76	39	34	9	47	30	16	2
12	40	19	28	18	19	-14	58	30	54	33	77	43	85	54	87	58	80	42	32	8	42	22	19	7
13	40	18	31	19	25	-8	56	43	53	36	82	46	88	61	70	55	83	40	36	8	39	22	22	5
14	43	27	33	4	31	-8	51	30	54	39	83	52	69	53	65	52	84	42	46	24	39	21	8	3
15	37	28	27	4	41	9	50	31	61	35	83	53	70	48	60	49	83	44	42	34	36	25	11	6
16	39	18	28	19	44	31	47	27	68	41	75	53	80	50	60	50	84	49	53	33	38	28	35	11
17	27	16	36	11	37	26	54	26	82	41	73	50	84	51	67	44	88	52	51	32	53	29	39	34
18	26	21	31	11	39	17	59	30	82	46	75	51	87	49	73	50	80	42	56	32	57	35	M	M
19	M	M	38	25	41	17	59	36	69	51	73	50	91	57	82	52	80	42	59	31	44	27	35	30
20	26	18	40	20	44	27	65	34	58	41	65	50	83	49	85	53	82	43	51	31	42	25	34	31
21	21	18	39	10	52	27	73	35	57	33	71	52	83	49	89	55	63	33	53	33	42	25	39	32
22	21	18	39	9	51	31	76	41	64	38	70	48	87	51	90	61	66	35	47	34	41	28	40	32
23	M	M	37	10	49	31	69	41	73	38	58	48	90	51	84	44	73	37	55	35	36	27	38	27
24	20	9	41	32	42	31	42	27	80	50	70	45	96	59	79	46	80	41	48	38	38	32	38	12
25	16	1	41	12	38	31	45	28	76	50	82	53	87	59	79	43	82	42	51	27	38	32	22	15
26	15	-11	25	12	39	17	48	30	74	43	75	45	96	62	87	48	81	44	47	28	47	26	22	14
27	12	-14	25	24	34	17	50	30	77	48	71	44	84	59	87	46	80	37	54	40	40	27	17	12
28	15	2	29	6	38	26	43	31	75	43	77	46	84	61	84	42	69	34	40	34	40	19	17	12
29	34	15			41	31	42	35	81	45	82	45	81	49	90	47	73	38	39	34	35	25	19	14
30	34	25			39	21	44	33	84	49	81	45	79	46	78	51	67	41	40	34	40	35	22	18
31	44	26			35	23			86	53			83	53	88	53			52	37			31	20
AVG	27.9	15.1	33.4	15.7	36.0	16.4	52.9	30.6	65.9	40.7	72.5	45.9	82.8	51.3	80.7	51.5	77.9	42.3	48.3	29.4	43.4	27.2	24.1	11.8

MAXIMUM TEMPERATURE | MINIMUM TEMPERATURE -21°F

"M": missing data

Summary of Precipitation at the Northwestern Agricultural Research Center On a Crop Year Basis

Total Precipitation in Inches by Year and Month

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	TOTAL
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
2004-05	1.89	1.62	0.84	1.49	1.38	0.01	1.41	2.21	1.73	8.44	0.26	0.99	22.27
2005-06	2.28	2.20	1.45	1.42	3.04	1.14	0.55	2.12	2.89	5.50	0.51	0.24	23.34
2006-07	1.95	1.10	2.28	0.95	0.39	2.26	0.54	1.62	3.29	1.35	0.75	0.23	16.71
2007-08	1.28	1.11	1.02	1.13	1.31	0.76	0.61	0.90	2.33	3.65	3.80	1.15	19.05
2008-09	1.57	0.61	1.71	2.37	1.72	1.59	1.43	0.98	1.62	1.98	2.44	0.99	19.01
MEAN	1.67	1.27	1.60	1.49	1.37	1.19	1.32	1.77	2.42	3.16	1.71	1.16	20.17
	SEPT	OCT	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	TOTAL

Mean precipitation for all crop years = 20.14

Precipitation by Day for Crop Year September 2008- August 2009
Northwest Agriculture Research Center, Kalispell Montana

DAY	SEPT. 2008	OCT. 2008	NOV. 2008	DEC. 2008	JAN. 2009	FEB. 2009	MAR. 2009	APR. 2009	MAY 2009	JUNE 2009	JULY 2009	AUG. 2009	Year Total
1			0.03	0.01	0.09			0.2	0.01				
2	0.28		0.06	0.19	0.63	0.11		0.06	0.06				
3		0.06	0.23	0.01	0.18		0.17	0.22	0.01				
4		0.02					0.07						
5		0.26	0.30		0.04				0.19				
6		0.05		0.16	0.03	0.11	0.06		0.24	0.23		0.02	
7		0.02	0.12	0.03	0.48	0.29			0.17		0.17	T	
8		0.02	0.27	0.02	0.03		0.05		0.10	0.16			
9			0.05				0.23			0.03			
10	0.05		M	0.08			0.23			0.03			
11			M		0.05	0.01	0.02		0.02				
12			0.25			0.12			0.07				
13			0.29	0.16				0.03	0.07		T	0.20	
14		0.03	0.05						0.04		1.51	0.20	
15						0.02			0.35			0.47	
16						0.06	0.04			0.01		0.10	
17				0.02			T					T	
18		0.01		0.53			T			0.07			
19		0.07		0.25					0.02		0.07		
20				M					0.04	0.22			
21	0.15	0.07	0.03	M					0.20	T	0.05		
22	0.81			0.20			0.13			1.20			
23	0.28				0.01	0.04	0.06			0.02			
24					0.01		0.05		0.03				
25				0.07		0.03	0.22			0.01			
26			0.03	0.20		0.54		0.07					
27						0.26		0.38			0.48		
28				0.16	0.17			0.02					
29				0.20			0.06						
30			T	0.07									
31				0.01			0.04				0.16		
TOTAL	1.57	0.61	1.71	2.37	1.72	1.59	1.43	0.98	1.62	1.98	2.44	0.99	19.01

YEAR 2009 - GROWING DEGREE DAYS JANUARY THROUGH OCTOBER 2009
CALCULATED AT BASE 50, BASE 40, AND BASE 32
Page 1: January - May

JANUARY

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	35	10	0.0	0.0	1.5
2	29	14	0.0	0.0	0.0
3	27	3	0.0	0.0	0.0
4	12	2	0.0	0.0	0.0
5	22	6	0.0	0.0	0.0
6	32	19	0.0	0.0	0.0
7	38	31	0.0	0.0	3.0
8	41	31	0.0	0.5	4.5
9	43	34	0.0	1.5	6.5
10	41	31	0.0	0.5	4.5
11	36	32	0.0	0.0	2.0
12	40	19	0.0	0.0	4.0
13	40	18	0.0	0.0	4.0
14	43	27	0.0	1.5	5.5
15	37	28	0.0	0.0	2.5
16	39	18	0.0	0.0	3.5
17	27	16	0.0	0.0	0.0
18	26	21	0.0	0.0	0.0
19	M	M	0.0	0.0	0.0
20	26	18	0.0	0.0	0.0
21	21	18	0.0	0.0	0.0
22	21	18	0.0	0.0	0.0
23	M	M	0.0	0.0	0.0
24	20	9	0.0	0.0	0.0
25	16	1	0.0	0.0	0.0
26	15	-11	0.0	0.0	0.0
27	12	-14	0.0	0.0	0.0
28	15	2	0.0	0.0	0.0
29	34	15	0.0	0.0	1.0
30	34	25	0.0	0.0	1.0
31	44	26	0.0	2.0	6.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
27.4	15.6	0.0	6.0	49.5

February

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	36	19	0.0	0.0	2.0
2	32	23	0.0	0.0	0.0
3	36	19	0.0	0.0	2.0
4	35	19	0.0	0.0	1.5
5	24	9	0.0	0.0	0.0
6	30	9	0.0	0.0	0.0
7	35	29	0.0	0.0	1.5
8	41	14	0.0	0.5	4.5
9	34	14	0.0	0.0	1.0
10	30	22	0.0	0.0	0.0
11	33	16	0.0	0.0	0.5
12	28	18	0.0	0.0	0.0
13	31	19	0.0	0.0	0.0
14	33	4	0.0	0.0	0.5
15	27	4	0.0	0.0	0.0
16	28	19	0.0	0.0	0.0
17	36	11	0.0	0.0	2.0
18	31	11	0.0	0.0	0.0
19	38	25	0.0	0.0	3.0
20	40	20	0.0	0.0	4.0
21	39	10	0.0	0.0	3.5
22	39	9	0.0	0.0	3.5
23	37	10	0.0	0.0	2.5
24	41	32	0.0	0.5	4.5
25	41	12	0.0	0.5	4.5
26	25	12	0.0	0.0	0.0
27	25	24	0.0	0.0	0.0
28	29	6	0.0	0.0	0.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
31.1	14.6	0.0	1.5	41.0

March

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	29	6	0.0	0.0	0.0
2	33	22	0.0	0.0	0.5
3	44	22	0.0	2.0	6.0
4	45	25	0.0	2.5	6.5
5	43	27	0.0	1.5	5.5
6	37	6	0.0	0.0	2.5
7	25	8	0.0	0.0	0.0
8	32	21	0.0	0.0	0.0
9	21	2	0.0	0.0	0.0
10	17	1	0.0	0.0	0.0
11	11	-14	0.0	0.0	0.0
12	19	-14	0.0	0.0	0.0
13	25	-8	0.0	0.0	0.0
14	31	-8	0.0	0.0	0.0
15	41	9	0.0	0.5	4.5
16	44	31	0.0	2.0	6.0
17	37	26	0.0	0.0	2.5
18	39	17	0.0	0.0	3.5
19	41	17	0.0	0.5	4.5
20	44	27	0.0	2.0	6.0
21	52	27	1.0	6.0	10.0
22	51	31	0.5	5.5	9.5
23	49	31	0.0	4.5	8.5
24	42	31	0.0	1.0	5.0
25	38	31	0.0	0.0	3.0
26	39	17	0.0	0.0	3.5
27	34	17	0.0	0.0	1.0
28	38	26	0.0	0.0	3.0
29	41	31	0.0	0.5	4.5
30	39	21	0.0	0.0	3.5
31	35	23	0.0	0.0	1.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
36.0	16.4	1.5	28.5	101.0

April

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	36	31	0.0	0.0	2.0
2	41	28	0.0	0.5	4.5
3	38	28	0.0	0.0	3.0
4	45	22	0.0	2.5	6.5
5	47	22	0.0	3.5	7.5
6	51	24	0.5	5.5	9.5
7	59	26	4.5	9.5	13.5
8	64	30	7.0	12.0	16.0
9	60	32	5.0	10.0	14.0
10	57	29	3.5	8.5	12.5
11	59	29	4.5	9.5	13.5
12	58	30	4.0	9.0	13.0
13	56	43	3.0	9.5	17.5
14	51	30	0.5	5.5	9.5
15	50	31	0.0	5.0	9.0
16	47	27	0.0	3.5	7.5
17	54	26	2.0	7.0	11.0
18	59	30	4.5	9.5	13.5
19	59	36	4.5	9.5	15.5
20	65	34	7.5	12.5	17.5
21	73	35	11.5	16.5	22.0
22	76	41	13.0	18.5	26.5
23	69	41	9.5	15.0	23.0
24	42	27	0.0	1.0	5.0
25	45	28	0.0	2.5	6.5
26	48	30	0.0	4.0	8.0
27	50	30	0.0	5.0	9.0
28	43	31	0.0	1.5	5.5
29	42	35	0.0	1.0	6.5
30	44	33	0.0	2.0	6.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
52.9	30.6	85.0	199.5	335.0

May

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	53	31	1.5	6.5	10.5
2	57	28	3.5	8.5	12.5
3	66	34	8.0	13.0	18.0
4	56	42	3.0	9.0	17.0
5	60	45	5.0	12.5	20.5
6	57	43	3.5	10.0	18.0
7	55	43	2.5	9.0	17.0
8	52	38	1.0	6.0	13.0
9	54	34	2.0	7.0	12.0
10	62	33	6.0	11.0	15.5
11	63	39	6.5	11.5	19.0
12	54	33	2.0	7.0	11.5
13	53	36	1.5	6.5	12.5
14	54	39	2.0	7.0	14.5
15	61	35	5.5	10.5	16.0
16	68	41	9.0	14.5	22.5
17	82	41	16.0	21.5	29.5
18	82	46	16.0	24.0	32.0
19	69	51	10.0	20.0	28.0
20	58	41	4.0	9.5	17.5
21	57	33	3.5	8.5	13.0
22	64	38	7.0	12.0	19.0
23	73	38	11.5	16.5	23.5
24	80	50	15.0	25.0	33.0
25	76	50	13.0	23.0	31.0
26	74	43	12.0	18.5	26.5
27	77	48	13.5	22.5	30.5
28	75	43	12.5	19.0	27.0
29	81	45	15.5	23.0	31.0
30	84	49	17.0	26.5	34.5
31	86	53	19.5	29.5	37.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
65.9	40.7	248.5	448.5	663.5

YEAR 2009 - GROWING DEGREE DAYS JANUARY THROUGH OCTOBER 2009
CALCULATED AT BASE 50, BASE 40, AND BASE 32
Page 2: June - October

JUNE

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	76	54	15.0	25.0	33.0
2	64	43	7.0	13.5	21.5
3	68	41	9.0	14.5	22.5
4	78	41	14.0	19.5	27.5
5	83	50	16.5	26.5	34.5
6	81	44	15.5	22.5	30.5
7	54	33	2.0	7.0	11.5
8	62	42	6.0	12.0	20.0
9	55	35	2.5	7.5	13.0
10	62	36	6.0	11.0	17.0
11	70	40	10.0	15.0	23.0
12	77	43	13.5	20.0	28.0
13	82	46	16.0	24.0	32.0
14	83	52	17.5	27.5	35.5
15	83	53	18.0	28.0	36.0
16	75	53	14.0	24.0	32.0
17	73	50	11.5	21.5	29.5
18	75	51	13.0	23.0	31.0
19	73	50	11.5	21.5	29.5
20	65	50	7.5	17.5	25.5
21	71	52	11.5	21.5	29.5
22	70	48	10.0	19.0	27.0
23	58	48	4.0	13.0	21.0
24	70	45	10.0	17.5	25.5
25	82	53	17.5	27.5	35.5
26	75	45	12.5	20.0	28.0
27	71	44	10.5	17.5	25.5
28	77	46	13.5	21.5	29.5
29	82	45	16.0	23.5	31.5
30	81	45	15.5	23.0	31.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
72.5	45.9	347.0	585.0	817.0

JULY

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	83	43	16.5	23.0	31.0
2	83	44	16.5	23.5	31.5
3	86	49	18.0	27.5	35.5
4	87	55	20.5	30.5	38.5
5	88	49	18.0	27.5	35.5
6	83	56	19.5	29.5	37.5
7	73	51	12.0	22.0	30.0
8	74	42	12.0	18.0	26.0
9	71	43	10.5	17.0	25.0
10	72	43	11.0	17.5	25.5
11	79	45	14.5	22.0	30.0
12	85	54	19.5	29.5	37.5
13	88	61	23.5	33.5	41.5
14	69	53	11.0	21.0	29.0
15	70	48	10.0	19.0	27.0
16	80	50	15.0	25.0	33.0
17	84	51	17.5	27.5	35.5
18	87	49	18.0	27.5	35.5
19	91	57	21.5	31.5	39.5
20	83	49	16.5	26.0	34.0
21	83	49	16.5	26.0	34.0
22	87	51	18.5	28.5	36.5
23	90	51	18.5	28.5	36.5
24	96	59	22.5	32.5	40.5
25	87	59	22.5	32.5	40.5
26	96	62	24.0	34.0	42.0
27	84	59	21.5	31.5	39.5
28	84	61	22.5	32.5	40.5
29	81	49	15.5	25.0	33.0
30	79	46	14.5	22.5	30.5
31	83	53	18.0	28.0	36.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
82.8	51.3	536.0	820.0	1068.0

AUGUST

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	82	55	18.5	28.5	36.5
2	92	55	20.5	30.5	38.5
3	90	57	21.5	31.5	39.5
4	90	54	20.0	30.0	38.0
5	93	53	19.5	29.5	37.5
6	87	59	22.5	32.5	40.5
7	81	63	22.0	32.0	40.0
8	66	48	8.0	17.0	25.0
9	74	52	13.0	23.0	31.0
10	77	49	13.5	23.0	31.0
11	87	52	19.0	29.0	37.0
12	87	58	22.0	32.0	40.0
13	70	55	12.5	22.5	30.5
14	65	52	8.5	18.5	26.5
15	60	49	5.0	14.5	22.5
16	60	50	5.0	15.0	23.0
17	67	44	8.5	15.5	23.5
18	73	50	11.5	21.5	29.5
19	82	52	17.0	27.0	35.0
20	85	53	19.0	29.0	37.0
21	89	55	20.5	30.5	38.5
22	90	61	23.5	33.5	41.5
23	84	44	17.0	24.0	32.0
24	79	46	14.5	22.5	30.5
25	79	43	14.5	21.0	29.0
26	87	48	18.0	27.0	35.0
27	87	46	18.0	26.0	34.0
28	84	42	17.0	23.0	31.0
29	90	47	18.0	26.5	34.5
30	78	51	14.5	24.5	32.5
31	88	53	19.5	29.5	37.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
80.7	51.5	502.0	790.0	1038.0

SEPTEMBER

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	83	53	18.0	28.0	36.0
2	88	56	21.0	31.0	39.0
3	91	49	18.0	27.5	35.5
4	87	42	18.0	24.0	32.0
5	80	44	15.0	22.0	30.0
6	81	49	15.5	25.0	33.0
7	68	45	9.0	16.5	24.5
8	61	40	5.5	10.5	18.5
9	70	37	10.0	15.0	21.5
10	75	38	12.5	17.5	24.5
11	76	39	13.0	18.0	25.5
12	80	42	15.0	21.0	29.0
13	83	40	16.5	21.5	29.5
14	84	42	17.0	23.0	31.0
15	83	44	16.5	23.5	31.5
16	84	49	17.0	26.5	34.5
17	88	52	19.0	29.0	37.0
18	80	42	15.0	21.0	29.0
19	80	42	15.0	21.0	29.0
20	82	43	16.0	22.5	30.5
21	63	33	6.5	11.5	16.0
22	66	35	8.0	13.0	18.5
23	73	37	11.5	16.5	23.0
24	80	41	15.0	20.5	28.5
25	82	42	16.0	22.0	30.0
26	81	44	15.5	22.5	30.5
27	80	37	15.0	20.0	26.5
28	69	34	9.5	14.5	19.5
29	73	38	11.5	16.5	23.5
30	67	41	8.5	14.0	22.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
77.9	42.3	419.5	615.0	839.0

OCTOBER

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	51	37	0.5	5.5	12.0
2	51	37	0.5	5.5	12.0
3	59	39	4.5	9.5	17.0
4	59	39	4.5	9.5	17.0
5	53	35	1.5	6.5	12.0
6	54	26	2.0	7.0	11.0
7	60	26	5.0	10.0	14.0
8	45	22	0.0	2.5	6.5
9	45	24	0.0	2.5	6.5
10	34	9	0.0	0.0	1.0
11	34	9	0.0	0.0	1.0
12	32	8	0.0	0.0	0.0
13	36	8	0.0	0.0	2.0
14	46	24	0.0	3.0	7.0
15	42	34	0.0	1.0	6.0
16	53	33	1.5	6.5	11.0
17	51	32	0.5	5.5	9.5
18	56	32	3.0	8.0	12.0
19	59	31	4.5	9.5	13.5
20	51	31	0.5	5.5	9.5
21	53	33	1.5	6.5	11.0
22	47	34	0.0	3.5	8.5
23	55	35	2.5	7.5	13.0
24	48	38	0.0	4.0	11.0
25	51	27	0.5	5.5	9.5
26	47	28	0.0	3.5	7.5
27	54	40	2.0	7.0	15.0
28	40	34	0.0	0.0	5.0
29	39	34	0.0	0.0	4.5
30	40	34	0.0	0.0	5.0
31	52	37	1.0	6.0	12.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
48.3	29.4	36.0	141.0	283.0

SMALL GRAIN VARIETY EVALUATIONS

754

Small grain variety evaluations include research pertaining to experimental and commercially available cereal cultivars for pest resistance, agronomic performance, and end-use quality.

Project Title: Intrastate Barley Evaluation

Project Leader: Bob Stougaard

Project personnel: Tom Blake, and Stan Bates

Objectives: To evaluate barley varieties and experimental lines for agronomic performance in environments and cropping systems representative of northwestern Montana.

Results:

The average Julian heading date for the nursery was 186 (July 5), which is comparable to last year's date of 189. Yields averaged 140 bu/A which is slightly better than the previous year's average of 134 bu/A. Yields ranged from a high of 179 bu/A for Goldeneye to a low of 119 bu/A for MT02155. Overall protein concentrations were less in 2009 compared to 2008, with mean protein percentages of 12.5 and 13.7, respectively. Proteins ranged from a low of 9.9 for MT061045 to a high of 13.8 for MT061201, Metcalf, and MT061035. Test weights were good, averaging 53 lb/bu and ranging from a low of 47.8 for MT070192 to a high of 54.9 for MT050048. Plant height was less than normal and averaged 29 inches, with Tradition being the tallest entry at 33 inches. Percent plumps were good and averaged 96.9 %. MT070192 had the lowest plump value at 88.5 percent.

Summary:

A late planting and below normal rainfall in May and June reduced plant height. However yields were slightly greater than the previous year. Goldeneye continues to be the highest yielding entry in this nursery.

Future Plans:

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

Table 1. Agronomic data from the intrastate barley trial. Kalispell, MT, 2009.

Planted: May 13, 2009		Harvested:August 26, 2009					
Cultivar	Entry	Yield bu/A	Test weight lb/bu	Protein %	Plump %	Heading date Julian	Plant height inches
Goldeneye	1	179.6	51.2	12.9	91.0	182.9	28.5
MT070193	62	167.8	49.1	13.2	92.5	183.7	26.5
MT061035	34	156.6	53.3	13.8	97.0	188.1	27.7
MT030079	21	154.8	54.6	13.2	98.5	185.1	28.7
Craft	8	154.6	54.5	12.5	97.0	184.2	30.6
MT050030	25	153.3	53.0	11.2	97.5	188.8	30.0
MT070156	54	152.2	52.9	10.3	96.5	186.0	26.8
MT050201	29	151.2	54.1	12.9	95.0	185.4	32.8
MT070125	51	150.8	52.2	13.2	98.0	188.6	29.1
MT050062	28	150.1	54.4	11.7	98.0	185.7	32.4
MT070148	53	148.8	53.4	13.2	97.5	184.9	28.7
MT061032	33	147.6	54.1	12.0	98.0	188.7	28.5
MT070192	61	146.7	47.8	12.2	88.5	182.9	28.0
MT070158	56	145.5	54.3	13.3	98.0	186.0	26.5
MT070175	60	145.5	53.5	13.5	98.5	186.6	30.4
MT061048	38	145.3	53.4	12.5	97.0	188.3	29.2
MT050049	27	144.6	54.2	13.3	98.5	185.0	29.5
MT070063	47	144.6	54.2	11.9	98.0	184.6	30.6
MT070087	49	144.4	54.2	12.8	95.0	186.6	27.1
MT061169	41	143.8	54.4	12.6	97.5	187.6	28.6
MT030063	20	143.1	54.3	12.5	99.5	188.0	32.2
MT070159	57	142.0	52.7	12.8	96.5	186.6	26.1
Champion	10	141.8	54.6	13.1	97.5	185.2	29.8
MT070086	48	141.6	53.9	12.8	97.0	188.8	22.5
MT070174	59	141.0	53.3	12.6	98.5	183.6	28.5
MT020162	15	140.9	53.7	11.5	99.0	187.1	31.6
MT070062	46	140.8	54.3	10.7	98.5	186.0	29.0
MT040073	22	140.4	53.7	12.9	97.5	184.5	28.3
MT030042	19	140.2	53.0	12.6	96.5	187.2	26.9
MT070219	63	139.8	51.3	13.2	93.0	181.1	30.4
MT040226	24	139.2	54.7	13.6	98.5	186.3	32.2
MT061045	36	138.2	53.6	9.9	97.5	189.4	29.4
MT010158	12	138.1	52.5	12.0	98.5	186.3	30.3
MT040209	23	138.0	53.3	12.8	93.5	188.5	29.4
MT070157	55	137.5	54.0	12.2	98.0	187.2	25.6
Geraldine	6	137.1	53.2	12.9	95.5	191.8	29.5

Table 1. Continued.

Planted: May 13, 2009		Harvested: August 26, 2009					
Cultivar	Entry	Yield bu/A	Test weight lb/bu	Protein %	Plump %	Heading date Julian	Plant height inches
MT050048	26	137.0	54.9	10.4	99.0	186.1	29.5
MT061036	35	136.3	52.8	13.3	96.0	190.0	28.5
MT061104	39	136.3	53.1	13.2	97.5	187.7	30.3
MT061207	43	136.3	53.4	11.8	99.0	185.4	29.2
Haxby	4	136.2	52.8	11.5	98.0	183.9	28.5
MT061047	37	136.2	54.0	12.4	98.5	187.6	28.8
MT020205	18	136.0	52.2	12.6	98.0	185.4	29.5
Conrad	7	135.9	53.5	10.3	98.5	187.3	28.9
Tradition	11	135.9	51.2	12.9	98.0	182.5	33.1
Bentley	64	135.9	53.0	13.0	99.0	186.7	31.8
MT061026	32	135.9	49.2	12.4	90.5	180.7	25.2
MT061025	31	135.3	49.9	11.0	93.5	182.4	26.5
MT061011	30	135.0	48.5	13.1	91.0	182.0	25.8
MT061248	45	134.5	54.4	12.6	99.0	185.3	28.1
MT010160	13	134.4	53.5	13.0	96.0	186.9	30.7
Harrington	2	134.0	52.8	13.3	98.5	187.7	31.3
Metcalfe	3	133.3	52.9	13.8	97.5	187.1	31.0
MT070111	50	133.1	53.9	13.3	97.5	187.3	28.8
Hockett	5	133.0	52.6	13.2	93.5	185.2	28.7
MT061225	44	132.7	54.5	10.3	98.0	184.5	29.0
Baronesse	9	132.7	54.4	12.6	98.5	189.2	27.5
MT070161	58	132.6	52.4	13.3	97.0	186.8	25.8
MT070136	52	129.5	52.3	12.0	98.5	188.9	29.4
MT061134	40	128.3	52.2	13.1	97.5	185.8	30.3
MT020167	16	126.5	53.8	12.4	98.0	187.7	28.5
MT020204	17	126.3	53.2	13.3	97.5	185.3	30.7
MT061201	42	122.6	54.3	13.8	99.5	184.5	30.0
MT020155	14	119.1	51.9	13.6	95.5	183.4	28.1
							22.5
MEAN		140.43	53.07	12.53	96.89	186.10	28.89
MAX		179.58	54.90	13.80	99.50	191.81	33.13
MIN		119.08	47.80	9.90	88.50	180.70	22.46
LSD 0.05		18.20	NA	NA	NA	1.72	2.16

Project Title: Off Station Barley Evaluation

Project Leader: Bob Stougaard

Cooperators: Tom Blake, Stan Bates

Objectives: To evaluate barley varieties for agronomic performance in environments and cropping systems representative of northwestern Montana.

Results:

The 2009 planting season was delayed due to a cold-wet spring. This was followed by below normal rainfall during May and June. Heading was slightly delayed and averaged 184 (July 30), with Goldeneye having the earliest heading date (178) and Geraldine being the latest (197). The dry conditions reduced tillering, and reduced yields in the process. Yields averaged 65 bu/A as compared to 83 bu/A during the previous year. Yields ranged from a high of 79 bu/A for Champion to a low of 56 bu/A for Harrington. Test weights were higher than normal. Test weights averaged nearly 54 lb/bu, with Champion and Hockett meeting or exceeding 55 lb/bu, while Goldeneye had the low test weight of 50.33 lb/bu. Percent plumps also were on the low side, averaging 89 percent. Plant heights were less than previous years and averaged 19 inches.

Summary:

Below normal rainfall reduced tillering, plant height and yields. Metcalfe and Harrington yield poorly and do not seem well adapted to this region.

Table 1. Agronomic data from the barley off-station nursery. Kalispell, MT.

Planted: May 6, 2009					Harvested: August 11, 2009	
Cultivar	Yield Bu/A	Test weight lb/Bu	Grain moisture %	Plump %	Heading date Julian	Plant height inches
Champion	79.43	55.00	12.80	91.33	181.33	20.73
Goldeneye	76.60	50.33	11.20	67.00	178.67	19.95
Pinnacle	71.27	52.80	15.90	97.67	181.00	19.03
MT920041/Harrington	68.83	54.57	12.17	82.17	185.00	18.37
Baronesse	68.00	53.93	12.23	91.17	190.67	17.85
MT970229/LK232	65.83	53.27	12.13	93.83	180.33	20.73
Calgary	65.50	53.47	11.37	81.33	187.67	17.06
Hockett	65.27	55.30	13.10	96.17	182.67	19.95
Craft	64.50	55.27	12.87	95.67	179.33	22.05
Gallatin	63.90	54.03	13.30	90.33	180.67	20.21
Conrad	63.00	52.90	13.07	91.33	196.00	18.37
Geraldine	62.13	54.30	12.53	88.33	197.00	18.64
Haxby	61.73	54.80	11.90	88.50	180.33	20.73
MT960225/H1851195	60.37	52.27	12.33	87.33	179.33	20.21
Metcalfe	58.23	54.47	13.50	94.17	185.33	20.34
Harrington	56.07	54.07	12.30	91.00	187.67	18.24
Mean	65.67	53.80	12.67	89.21	184.56	19.53
Max	79.43	55.30	15.90	97.67	197.00	22.05
Min	56.07	50.33	11.20	67.00	178.67	17.06
C.V. (%)	8.79	0.90	2.20	3.05	1.21	5.70
PR>F (trt)	0.0020	0.0001	0.0001	0.0001	0.0001	0.0003
LSD (0.05)	9.63	0.81	0.46	4.54	3.73	1.85

Project Title: CHS Spring Wheat Nursery

Project leader: Bob Stougaard

Objective: To evaluate private spring wheat varieties

Results:

Variety selection is one of the most important annual decisions made by cereal producers. The decision should ideally be based on reliable data that's been generated locally or in environments very similar to the Flathead valley. To do otherwise can be disastrous. One only needs to think back to the winter wheat variety "Tomahawk" to appreciate how important variety selection can be. This nursery was designed with input from area producers in order to evaluate spring wheat varieties that aren't normally included in standard variety evaluations conducted by MSU.

Treatments consisted of 14 private, and 6 public spring wheat varieties (Table 1). Individual plots consisted of seven rows, 15 feet in length with each entry replicated three times in a randomized complete block design. The study was conducted using conventional tillage practices, in a field that had been in alfalfa the previous four years. A blend of 11-52-80 was applied on April 20. The nursery was planted on May 6 at a seeding rate of 80 lb/A in six inch rows, to a depth of 1.5 inches. Heading was recorded when 50 percent of the plants in a plot had half of the head exposed. Height measurements were recorded near maturity. The study was harvested on August 21. Grain yield, test weight, moisture, thousand kernel weight (TKW), and grain protein were then determined.

A cool spring and late planting date contributed to reduce tillering and yields. Yields averaged 45 bu/A and ranged from a high of 53 bu/A for Vida, to a low of 39 bu/A for Kelby. While Kelby had the lowest yield, it had the highest protein (16.5 %), and while Vida had the highest yield, the associated protein content was one of the lowest (13.5 %). Test weights were about average and ranged from a high of 62.2 lb/bu for Jedd to a low of 58.2 for Traverse. Thousand kernel weights ranged from a low of 31.5 g for Albany to a high of 52 g for Hollis. Hollis also was the tallest variety in the study (27.3 inches). Plant height averaged 23.3 inches, with the shortest variety being Cabernet (20.5 inches). Heading occurred over a period of eight days with the average heading date being 178 (June 27).

Summary:

Yields among the 20 varieties differed by only 14 bu/A, with the highest yielding entries being Vida, Bullseye, Knudson, Albany, and Reeder. Proteins were good, but test weights were average.

Future Plans:

Continue to evaluate private spring wheat varieties in environments typical of northwest MT, with the purpose of identifying those materials that are best suited to this area.

Table 1. Agronomic data from the CHS spring wheat nursery. Kalispell, MT, 2009.

Planted: May 6, 2009 Harvested: August 21, 2009

Cultivar	Yield bu/A	Test weight lb/bu	Grain moisture %	Protein %	TKW g	Heading date Julian	Plant height inches
Vida	52.9	60.9	12.1	13.5	37.3	177.7	23.7
Bullseye	49.7	61.9	12.2	13.6	38.9	178.3	21.8
Knudson	48.9	61.4	12.1	14.8	39.5	179.0	24.9
Albany	48.3	59.5	12.2	14.1	31.5	182.0	23.1
Reeder	48.3	61.9	11.7	14.4	35.7	178.0	22.8
MT0414	47.0	61.4	11.7	14.9	36.3	177.7	24.5
Kuntz	46.7	61.6	12.2	13.5	34.3	179.3	24.1
Faller	45.9	59.7	11.8	14.1	39.7	180.0	23.2
Hank	45.7	61.1	11.8	13.9	48.2	176.0	23.1
Traverse	45.6	58.2	11.5	14.3	38.4	176.7	25.2
McNeal	45.4	60.6	11.7	14.4	37.7	181.3	23.9
Hollis	45.2	62.1	12.4	14.6	52.0	176.3	27.3
Choteau	45.1	59.4	11.6	15.5	36.3	177.7	22.8
Cabernet	43.7	59.3	11.2	13.7	38.2	178.0	20.5
Jerome	42.2	60.8	12.0	13.8	44.5	174.0	23.2
RB07	41.7	59.8	11.6	16.0	34.4	177.3	23.5
Solano	40.7	60.3	11.3	15.1	39.7	179.3	21.5
Expresso	39.7	60.3	11.4	15.6	38.4	179.3	21.9
Jedd	39.2	62.2	11.9	14.3	39.5	181.0	20.8
Kelby	39.0	60.8	11.7	16.3	35.3	177.0	23.0
MIN	39.0	58.2	11.2	13.5	31.5	174.0	20.5
MAX	52.9	62.2	12.4	16.3	52.0	182.0	27.3
MEAN	45.0	60.7	11.8	14.5	38.8	178.3	23.3
Pr>F (trt)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0045	0.0001
C.V	6.4	0.4	1.4	1.9	2.1	1.1	3.9
LSD (0.05)	4.7	0.4	0.2	0.5	1.3	3.3	1.5

Project Title: Evaluation of Soft White Spring Wheat Varieties

Project Leader: Bob Stougaard

Cooperators: Luther Talbert, and Susan Lanning

Objectives: To evaluate soft white spring wheat varieties and experimental lines for agronomic performance in environments and cropping systems representative of northwestern Montana.

Results:

A cold-wet spring delayed planting. This was followed by a period of below normal rainfall, where total precipitation for May and June was two inches below the long-term average. The combined effect reduced tillering. The combined stress also caused the crop to head early, shortened crop height and reduced yields.

The average Julian heading date was 177 (June 26), which was four days earlier than the previous year. Pettit and Cataldo were the earliest heading varieties (174.3), while Wakanz headed last (182). Plant height also was less than the previous year. The average plant height for the nursery was 21.8 inches and ranged from a low of 18.8 inches for Calorwa to a high of 25.1 inches for Louise.

Not surprisingly, yields were less than the previous year. Yields averaged 61.8 bu/A in 2009 as compared to 106 bu/A during 2008. Yields ranged from a high of 70 bu/A for Alturas to a low of 47.7 bu/A for Cataldo. Test weights were good, averaging 60.3 for the nursery. The highest test weights were observed for Jubilee (62.2) while Calorwa had the lowest (57.8). Grain protein averaged 12.1 for the nursery. Interestingly, Calorwa and Cataldo had the lowest (10.9) and highest (15.1) protein levels, while they also were the two lowest yielding varieties in the nursery.

Summary:

Yields were low during 2009. Although the relative yield ranking of the varieties fluctuated between 2008 and 2009, Wakanz, Choteau, and Eden consistently yield poorly.

Table 1. Agronomic data from the soft white spring wheat nursery. Kalispell, MT.

Planted:May 6, 2009					Harvested:August 21, 2009	
	Yield	Test weight	Grain moisture	Protein	Heading date	Plant height
Cultivar	Bu/A	lb/Bu	%	%	Julian	inches
ALTURAS	70.0	60.1	11.5	13.2	178.3	21.8
BZ604002	69.5	61.4	11.5	11.9	176.7	23.4
VIDA	67.3	60.9	11.4	11.7	177.7	23.8
ALPOWA	66.4	60.4	11.5	11.4	179.3	23.0
LOUISE	65.3	59.8	11.5	11.7	178.7	25.1
WA008008	65.3	60.1	11.3	11.5	176.3	21.5
WHITEBIR	64.8	62.1	11.9	12.1	179.7	23.2
WA008039	64.3	60.2	11.5	11.9	178.3	23.0
ZAK	63.4	60.3	11.6	13.0	178.3	22.4
CENTENNI	62.7	61.0	11.5	11.6	176.7	22.6
JUBILEE	62.6	62.2	11.8	11.8	178.3	22.3
PETTIT	61.7	60.7	11.6	12.3	174.3	19.6
TREASURE	61.6	59.3	11.5	11.8	179.7	20.7
NICK	61.2	60.7	11.2	11.4	176.3	21.0
BZ604026	58.7	61.0	11.5	11.5	176.7	21.8
EDEN	58.6	60.1	11.4	11.5	178.7	19.7
WAKANZ	58.3	58.7	11.0	13.0	182.0	20.7
CHOTEAU	53.8	59.6	11.2	11.7	176.7	21.5
CALORWA	52.5	57.8	10.9	10.9	176.0	18.8
CATALDO	47.7	59.8	11.3	15.1	174.3	20.3
MIN	47.7	57.8	10.9	10.9	174.3	18.8
MAX	70.0	62.2	11.9	15.1	182.0	25.1
MEANS	61.8	60.3	11.4	12.1	177.7	21.8
Pr>F (trt)	0.0003	0.0001	0.0001	NA	0.0001	0.0001
C.V. (%)	8.2	0.7	1.1	NA	0.3	4.3
LSD (0.05)	8.4	0.7	0.2	NA	0.8	1.5

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

Project Leader: Bob Stougaard

Project personnel: Luther Talbert, and Susan Lanning

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

Results:

The average Julian heading date was 183 (July 2), which was four days earlier than the previous year. Heading dates ranged from 179 (June 28) for MTHW0771 to 190 (July 9) for BZ9M7106 (Table 1). Plant height was less than the previous year, averaging 31.5 inches in 2009 as compared to 33.3 inches in 2008. Thatcher was the tallest variety (43.4) and Jedd was the shortest (25.9).

Yields averaged 86 bu/A, with Agripr12, MTHW0771, Reeder, AP604 CL, and MT0414 producing 99 bu/A or more. It's worth noting that Reeder, AP604 CL, and MT 0415 have consistently ranked among the highest yielding cultivars for the past three years. BZ9M7106 was the lowest yielding entry, producing only 37 bu/A. BZ9M7106 also had the most midge larvae. Midge densities were low this year, averaging only 10 larvae per spike as compared to 66 larvae per spike during 2008. The low midge densities had minimal impact on grain yield, but test weight were reduced ($R^2 = 0.42$). BZ9M7106 had lowest test weight (54.6 lb/bu), while MT 0815 had the highest test weight (64.5 lb/bu). Protein levels were good and averaged 14.8% for the nursery. Protein ranged from a high of 18.9 for Jenna, to a low of 13.1 for MT 0813. Lodging was not observed.

Summary:

A late planting date plus dry conditions in May and June combined to reduce tillering, shorten plant height, accelerate plant development, and reduce yields. Midge damage hurt test weights, but only had a marginal impact on yield.

Future Plans:

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

Table 1. Agronomic data from the spring wheat advanced yield trial. Kalispell, MT, 2009.

Planted: May 13, 2009							Harvested: September 2, 2009		
Cultivar	Entry	Yield bu/A	Test weight lb/bu	Grain mositure %	Protein %	Heading date Julian	Plant height inches	OWBM dockage[1] No/pan	OWBM No/head
AGRIPR12	59	105.7	63.5	12.7	14.0	183.0	27.2	5.0	12.3
MTHW0771	54	104.2	64.4	11.3	14.1	178.7	27.3	3.0	0.0
REEDER	4	100.7	62.5	13.0	14.8	185.0	33.7	4.0	0.3
AP604 CL	17	100.5	64.1	11.5	14.5	181.7	31.5	1.0	2.0
MT 0414	25	99.2	63.4	11.2	15.3	185.0	32.6	3.0	0.7
JEDD	13	98.4	63.8	11.7	14.9	181.0	25.9	5.0	0.7
MT 0869	52	97.6	62.7	11.1	15.6	183.7	31.4	9.0	0.3
CHOTEAU	6	96.6	62.7	10.7	14.7	182.7	30.6	17.0	10.0
BRENNAN	57	95.9	64.1	10.8	15.6	182.7	27.8	0.0	2.0
VIDA	7	95.7	61.4	12.1	14.1	183.3	32.0	4.0	1.3
ONEAL	12	95.6	61.5	14.5	14.2	185.0	32.0	7.0	37.7
MT 0815	35	94.7	64.5	11.5	15.2	181.7	34.3	4.0	18.7
MT 0807	31	94.6	64.0	10.7	14.5	180.3	33.2	3.0	0.3
MT 0814	34	94.3	62.9	11.0	15.9	181.3	29.9	4.0	15.0
AGRIPR11	58	94.1	62.9	11.9	15.3	183.3	31.1	8.0	10.0
MT 0873	53	93.8	63.2	11.9	14.5	184.7	30.2	3.0	1.0
MT 0855	47	93.1	61.6	10.9	15.2	181.7	30.7	1.0	6.0
MT 0827	39	92.7	62.9	10.9	14.7	182.3	31.8	4.0	0.0
MT 0813	33	92.6	64.1	11.0	13.1	178.7	29.9	5.0	0.0
HANK	8	92.2	62.2	11.8	14.0	181.0	30.0	2.0	3.7
MT 0862	50	92.1	62.4	10.2	14.4	182.0	29.0	8.0	11.7
MT 0847	43	91.4	63.2	11.1	15.3	184.3	31.2	6.0	7.0
CORBIN	10	91.2	63.4	12.2	15.0	182.7	31.8	4.0	1.0
MT 0735	20	91.2	62.7	10.9	15.2	181.3	32.0	2.0	0.7
MT 0801	29	90.4	61.7	10.9	13.7	183.3	33.1	2.0	0.0
MT 0824	37	90.1	61.7	11.6	14.2	183.3	30.4	2.0	10.3
MT 0856	48	90.0	60.8	10.5	15.2	181.0	30.2	2.0	4.3
MT 0832	42	89.8	62.0	11.0	14.2	182.3	30.3	4.0	6.3
MTHW0867	55	89.7	61.1	10.8	14.3	184.0	32.4	9.0	3.7
MT 0746	23	89.2	60.9	11.4	13.5	184.3	34.6	5.0	6.7
MT 0808	32	89.0	63.1	11.6	14.5	180.0	32.0	2.0	1.3
MT 0664	18	88.7	62.8	11.0	14.1	184.7	32.7	12.0	16.7
MT 0750	26	88.3	61.7	11.9	13.5	184.3	34.5	5.0	0.3
MT 0755	28	88.2	62.2	11.4	15.4	182.7	30.7	3.0	1.7
MT 0747	24	88.0	62.3	10.7	14.3	184.0	33.1	1.0	0.3
MT 0861	49	87.9	61.0	11.0	15.6	184.7	28.3	12.0	29.7

Table 1. Continued

Planted: May 13, 2009		Harvested: September 2, 2009							
Cultivar	Entry	Yield bu/A	Test weight lb/bu	Grain mositure %	Protein %	Heading date Julian	Plant height inches	OWBM dockage[1] No/pan	OWBM No/head
KUNTZ	16	86.7	63.4	11.3	14.0	184.7	28.9	9.0	9.7
MT 0830	41	86.5	63.0	11.3	15.5	183.3	29.9	4.0	8.7
MT 0816	36	86.3	62.1	11.0	16.9	179.7	28.7	5.0	2.0
JENNA	56	86.1	61.2	10.4	18.9	186.7	31.8	7.0	21.7
MT 0718	19	85.4	62.7	11.1	15.1	184.3	29.0	10.0	4.7
MT 0852	45	85.3	62.4	11.2	15.0	184.3	32.0	20.0	3.3
KELBY	15	85.2	64.0	10.5	14.3	182.0	28.7	0.0	0.3
FREYR	14	85.1	62.7	11.7	14.6	183.7	33.1	4.0	17.0
MT 0853	46	85.0	61.9	10.8	16.3	182.0	30.8	4.0	0.0
MT 0826	38	83.6	62.5	10.8	14.4	183.0	30.2	3.0	4.0
MT 0868	51	82.8	62.9	11.6	15.0	183.7	30.3	3.0	1.3
MCNEAL	3	82.5	61.9	10.5	14.2	185.0	31.2	5.0	33.0
MT 0751	27	82.1	60.8	11.2	14.9	183.3	32.7	2.0	14.0
MT 0802	30	80.3	59.0	14.6	14.8	185.7	32.7	18.0	70.7
MT 0849	44	79.4	61.1	11.3	15.3	183.3	30.0	7.0	4.3
MT 0829	40	77.7	61.7	10.7	14.9	182.0	30.2	12.0	8.7
VOLT	11	76.2	63.1	11.0	14.2	189.7	31.5	15.0	4.3
FORTUNA	2	75.9	63.4	11.3	13.8	183.7	39.8	4.0	1.0
MT 0744	21	75.4	61.2	12.4	14.6	185.7	34.8	7.0	33.0
MT 0745	22	74.8	61.6	12.4	15.0	184.3	30.3	10.0	4.7
OUTLOOK	5	74.4	59.5	10.1	14.5	185.3	32.6	5.0	16.7
BZ92413W	60	74.4	61.9	11.9	15.3	183.0	30.3	12.0	9.3
BZ92413R	61	73.2	61.5	12.6	13.4	184.0	30.0	12.0	23.7
MOTT	63	73.1	62.2	10.7	15.1	186.0	34.1	15.0	23.7
LILLIAN	64	69.2	59.6	10.6	15.2	187.0	39.8	30.0	16.0
CONAN	9	62.2	61.3	11.4	15.2	183.7	30.7	6.0	10.3
THATCHER	1	57.1	61.1	10.7	14.4	188.3	43.4	45.0	10.7
BZ9M7106	62	37.3	54.6	14.7	15.0	190.0	32.2	100.0	62.3
MIN		37.3	54.6	10.1	13.1	178.7	25.9	0.0	0.0
MAX		105.7	64.5	14.7	18.9	190.0	43.4	100.0	70.7
MEAN		86.41	62.18	11.41	14.8	183.48	31.5	8.52	10.04
PR>F (trt)		0.0001	NA	NA	NA	0.0001	0.0001	NA	NA
C.V.		8.89	NA	NA	NA	0.40	3.9	NA	NA
LSD 0.05		12.42	NA	NA	NA	1.21	1.98	NA	NA

[1]Number of larvae found after processing grain samples with the dockage tester.

Project Title:	Evaluation of spring wheat varieties for resistance to the Orange Wheat Blossom Midge (OWBM).
Project Leader:	Bob Stougaard
Cooperators:	Luther Talbert, Susan Lanning, and David Weaver
Objectives:	To evaluate spring wheat varieties for agronomic performance and resistance to the OWBM.

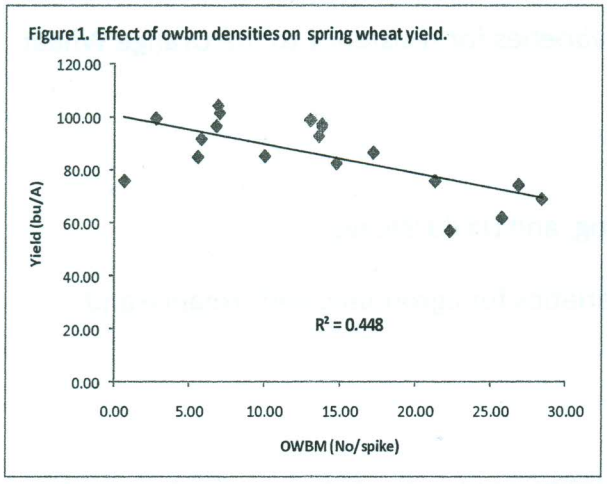
Results:

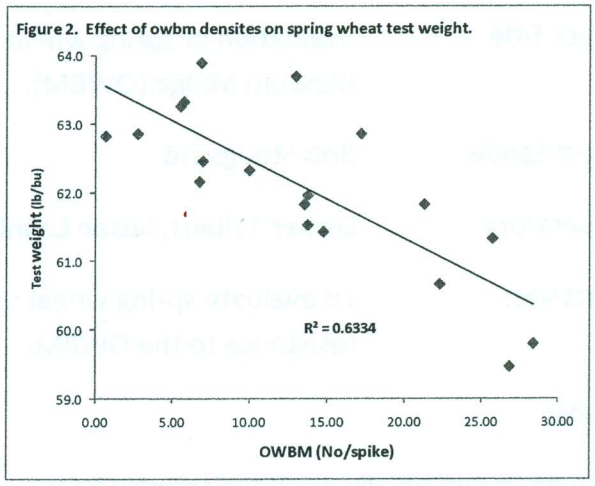
Nineteen commercially available spring wheat varieties were evaluated as a subset within the Advanced Yield Trial to assess resistance to the OWBM. The previous crop was alfalfa and the field was fertilized with 11-52-80 lb/A of N-P-K, respectively. The soil type was a Creston silt loam (25-50-25) with an organic matter content of 4%, a pH of 7.5, and a CEC of 20 meq/100g. The experimental design was a randomized complete block with three replications. The spring wheat varieties were planted on May 13, 2009 at a rate of 80 lb/A to a depth of 1.5 inches. Each plot was 15 foot long and consisted of 7 rows, spaced 6 inches apart.

Heading was recorded when 50 percent of the plants in a plot had half of the head exposed. Height measurements were recorded on August 7. Three randomly selected spikes were collected on August 5. Each spike was dissected and the number of larvae, damaged kernels and healthy kernels were determined. Plots were harvested on September 2. Grain yield, test weight, protein, and moisture were determined in each plot, while falling numbers were determined from a composite sample of all three replications.

The average Julian heading date was 188, four days earlier than the previous year. Heading date varied by 11 days, with MTHW0771 (June 27) and Volt (July 8) being the first and last entries to head, respectively (Table 1). While plant developmental rates varied among varieties, there was not a strong relationship between plant phenology and OWBM infestation ($R^2 = 0.28$).

Midge densities were very low during 2009. The average density was only 13 larvae per spike, and ranged as high as 28 larvae per spike for Lillian. In comparison, owbm densities during 2008 averaged 85 larvae per spike, with the highest density being 194 larvae per spike for MTHW0471. Nevertheless, spring wheat yields were negatively affected by the owbm, despite the low infestation (Figure 1.)





Spring wheat yields averaged 86 bu/A, ranging from a low of 57 for Thatcher to a high of 104 for MTHW0771 (Table 1). The difference in yields among the entries was partly due to owbm infestation ($R^2 = 0.44$), demonstrating that oviposition preference can be observed even under low selection pressures. There was a moderate relationship between larvae per spike and the number collected as dockage ($R^2 = 0.33$).

Although midge damage decreased grain yields, the insect had a more direct effect on test weights (Figure 2). Overall, test weights decreased as midge densities increased, and the relationship was quite strong ($R^2 = 0.63$). Test weights averaged 62.1 lb/bu, and ranged from a high of 63.9 for MTHW0771 to a low of 59.5 for Outllook.

Protein ranged from a low of 13.9 for Corbin and Kuntz, to a high of 16.6 for Lillian. Lillian also had the highest midge density, illustrating that protein tended to increase as midge densities increased. However the relationship was not strong ($R^2 = 0.14$). Falling numbers varied from a low of 131.7 for Lillian to a high of 294.3 for Corbin. However, there was no relationship between midge densities and falling numbers. Moreover, all entries were well below the minimum standard of 330.

Summary:

Yields and test weights were negatively affected by midge damage despite the low densities. Reeder and Jedd continue to demonstrate reduced oviposition preference, while Outlook and Conan appear to attract females.

Table 1. Agronomic data from the spring wheat AYT off-station subset. Kalispell, MT, 2009

Planted: May 13, 2009 Harvested: September 2, 2009

Cultivar	Yield bu/A	Test weight lb/bu	Grain moisture %	Protein %	Falling numbers sec.	Heading date Julian	Plant height inches	OWBM dockage[1] No/pan	OWBM No/spike	Damaged kernels %
MTHW0771	104.2	63.9	11.3	14.5	223.7	178.7	27.3	3.0	6.9	10.1
REEDER	101.5	62.5	12.2	14.9	234.7	185.0	33.7	2.3	7.0	15.3
MT0414	99.4	62.9	11.0	15.1	237.7	185.0	32.5	1.3	2.8	4.7
JEDD	98.9	63.7	11.2	14.1	241.0	181.0	25.9	2.7	13.0	17.3
ONEAL	97.2	62.0	13.0	14.7	269.3	185.0	32.0	7.3	13.8	19.0
CHOTEAU	96.6	62.2	10.7	14.9	217.0	182.7	30.6	10.3	6.8	13.7
VIDA	96.4	61.5	11.5	14.9	166.0	183.3	32.0	3.7	13.8	20.6
HANK	92.8	61.8	11.1	14.3	175.0	181.0	30.1	1.0	13.6	14.4
CORBIN	91.7	63.3	11.6	13.9	294.3	182.7	31.8	4.3	5.8	13.4
KUNTZ	86.6	62.9	11.4	13.9	260.3	184.7	28.9	7.3	17.2	24.0
FREYR	85.3	62.3	11.6	15.1	180.0	183.7	33.1	8.0	10.0	17.6
KELBY	85.0	63.3	10.8	15.3	156.3	182.0	28.7	1.7	5.6	9.3
MCNEAL	82.5	61.4	10.5	15.3	256.7	185.0	31.2	7.0	14.8	23.1
FORTUNA	75.9	62.8	11.3	14.9	201.3	183.7	39.8	3.0	0.7	1.4
VOLT	75.9	61.8	11.3	14.1	173.0	189.7	31.5	18.7	21.3	23.6
OUTLOOK	74.3	59.5	10.3	15.6	181.7	185.3	32.5	6.3	26.9	42.1
LILLIAN	69.1	59.8	10.8	16.6	131.7	187.0	39.8	19.0	28.4	43.0
CONAN	62.0	61.3	11.7	15.1	220.3	183.7	30.7	4.7	25.8	24.2
THATCHER	57.0	60.7	10.7	15.4	236.0	188.3	43.4	29.3	22.3	26.3
MEAN	85.9	62.1	11.3	14.9	213.5	184.1	32.4	7.4	13.5	19.1
Pr>F (trt)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C.V.	8.1	0.8	4.0	2.6	14.4	3.3	3.7	81.4	57.8	51.1
LSD (0.05)	11.6	0.8	0.7	0.6	50.9	0.9	2.0	10.0	12.9	16.2

[1]Number of orange wheat blossom midge larvae found after processing grain samples with the Carter Day dockage tester.

Project Title: Evaluation of Winter Wheat Cultivars for Agronomic Performance.

Project Leader: Bob Stougaard

Project personnel: Phil Bruckner, and Jim Berg

Objectives: To evaluate winter wheat varieties and experimental lines for agronomic performance and disease resistance in environments and cropping systems representative of northwestern Montana.

Results:

The average Julian heading date for the nursery was 156 (June 15). Hawken and Neeley had the earliest and latest heading dates, respectively. Yields averaged 86 bu/A as compared to 127 bu/A during the previous year. Yields ranged from a high of 101 bu/A for UT9325-55 to a low of 71 bu/A for Bynum. Test weights were normal, averaging 62.2 lb/bu and ranging from a high of 63.7 for MT0861 to a low of 59.8 for Wahoo. Plant heights were shorter than normal, and averaged 29.8 inches. Lodging was not detected. Protein content was normal and averaged 12.7 percent for the nursery. Protein levels were highest for MT0754 (14.3) while NI04421 had the lowest concentration (10.0).

Summary:

The 2008-2009 growing season was characterized as cold and dry. The environmental stress reduced tillering, plant height, and resulted in low yields. Yellowstone and Jagalene continue to be top performers.

Future Plans:

Continue to evaluate winter wheat for the purpose of identifying varieties that are best suited for District 1.

Table 1. Agronomic data from the intrastate winter wheat nursery grown at Kalispell, MT.

Planted: September 19, 2008 Field D1 Harvested: August 5, 2009

Entry	Cultivar/Line	Yield	Test weight	Heading date	Plant height	Grain moisture	Protein
		bu/ac	lb/bu	Julian	in	%	%
39	UT9325-55	101.1	63.0	156.7	31.6	11.2	12.0
3	Yellowstone	99.5	62.6	158.3	29.8	11.3	12.7
6	Jagalene	96.6	63.3	154.7	29.1	11.1	12.3
8	Neeley	93.9	61.8	160.0	33.9	11.4	11.5
26	Darrell	93.2	62.5	154.3	29.6	11.6	12.2
20	MT0495	93.1	62.0	156.7	29.0	11.0	12.0
29	Peregrine	92.1	63.6	159.3	34.8	11.4	11.5
30	Accipiter	91.1	61.5	159.3	29.9	11.0	11.4
9	Pryor	91.1	62.7	157.3	27.5	11.1	11.2
2	CDC Falcon	91.0	60.7	156.0	27.0	10.9	12.5
27	Hawken	89.9	62.4	153.7	26.8	11.0	12.1
32	MT06103	89.8	62.2	154.3	31.8	11.0	14.1
49	MT0861	89.8	63.7	157.0	30.6	11.4	13.2
25	Alice (HWW)	89.5	61.1	154.0	26.4	11.2	12.4
11	Rocky	89.3	63.6	156.4	32.2	11.9	12.0
14	NuSky (HWW)	89.0	62.9	157.7	31.8	11.1	13.2
45	MT0766	88.9	63.4	155.7	30.1	11.3	13.8
41	MT0738	88.6	62.1	158.3	30.8	10.9	13.5
42	MT0742	88.2	63.0	156.3	32.1	11.2	11.9
5	Ledger	88.1	61.5	154.3	28.8	11.2	11.9
23	MT0552	87.9	60.6	156.0	29.0	10.9	13.4
38	NI04421	87.5	62.3	154.0	29.9	11.8	10.0
13	Norris (CL)	87.4	63.3	154.7	31.5	10.9	12.4
15	Wahoo	87.0	59.8	154.0	27.9	11.6	12.3
44	MTW0759	86.8	63.2	156.7	30.6	11.0	14.3
37	Settler CL	86.7	61.8	155.7	28.0	11.1	12.6
24	Ripper	86.5	62.0	154.0	27.6	11.0	11.7
18	Hyalite (CL, HWW)	86.4	63.2	155.7	31.0	11.3	12.6
36	Overland	86.3	62.0	154.7	29.7	11.4	12.3
10	Jerry	85.6	61.9	156.0	32.8	11.6	11.6
22	MTS0532 (HWW)	84.6	61.6	156.3	27.8	11.1	12.5
34	MTS0713	84.1	63.1	156.3	27.4	11.1	13.2
7	Tiber	84.1	61.7	159.7	36.6	10.9	14.2
28	BZ9W02-2051	83.9	61.9	157.0	28.4	11.0	12.9
33	MTS0705	83.3	62.3	159.0	32.9	11.2	14.1
17	Carter	83.0	60.7	155.7	25.3	11.3	12.7
47	MTW0782	82.4	62.5	156.0	29.8	11.3	13.3
12	Promontory	82.2	63.5	156.7	28.8	11.3	11.4
31	AP 503 CL2	80.8	62.5	156.0	27.4	11.0	12.8
1	Genou	79.6	61.8	156.0	31.7	11.4	13.1
48	MTW0785	79.5	62.7	157.0	28.9	11.7	12.5
35	Radiant	79.4	61.5	158.3	29.6	10.5	13.4
19	Wendy (HWW)	79.2	62.0	154.0	26.2	11.0	13.4
43	MT0754	79.2	62.3	157.7	28.3	10.9	14.3

Table 1. Continued.

Planted: September 19, 2008		Field D1		Harvested: August 5, 2009			
Entry	Cultivar/Line	Yield bu/ac	Test weight lb/bu	Heading date Julian	Plant height in	Grain moisture %	Protein %
21	MTS0531 (HWW)	78.5	61.9	156.3	27.2	11.3	12.2
4	Rampart	77.3	61.6	156.0	32.6	10.9	13.6
40	MTS0721	77.2	62.0	155.0	27.5	11.1	13.8
46	MT0771	75.7	62.8	156.0	30.4	11.6	14.2
16	Bynum (CL)	71.0	61.4	154.3	31.6	11.3	13.4
	Average	**86.3**	**62.2**	**156.2**	**29.8**	**11.2**	**12.7**
	LSD (0.05)	**9.0**		**1.3**	**2.6**		
	C. V. (%)	**5.9**		**0.5**	**5.0**		
	P-value (Varieties)	**<.0001**		**<.0001**	**<.0001**		

WEED MANAGEMENT INVESTIGATIONS

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Weed management investigations includes research pertaining to chemical, cultural, and biological control methods.

Project Title: Camelina tolerance to soil applied herbicides

Project leader: Bob Stougaard

Objective: To evaluate the response of camelina to preemergence applications of several major herbicide families.

Results:

The study was conducted under dry-land conditions, using conventional tillage, with the previous crop being alfalfa. The soil type was a Kalispell very fine sandy loam with a sand, silt and clay content of 60, 25, and 15 percent, respectively. The soil had a CEC of 15, an organic matter content of 3 percent, a pH of 7.0. 'Ligena' camelina was seeded 0.25 inches deep, at a rate of 5 lb/A in six inch wide rows on May 4. Herbicide treatments were applied preemergence on May 6, with a CO_2 backpack sprayer in 20 GPA of water using 11002 flat fan nozzles. The experiment was established as a randomized complete block with three replications, with each plot measuring 10 by 15 feet.

Treatments included a non-treated control along with the herbicides Outlook (dimethenamid), Prowl (pendimethalin), Facet (quinclorac), Cinch (metolachlor), and KIH-485 (pyroxasulfone). Each herbicide was applied at three rates (Table 1). Treatments were visually rated for percent crop injury and stunting on June 17, using a scale of 0 (no injury/no stunting) to 100 (complete injury/stunting). Plant density and biomass were determined in each plot by collecting the above ground plant material from two, 1.5 ft^2quadrates on August 4. Plant height and days to flowering also were evaluated in order to further assess crop injury potential. Plots were harvested on August 18. Plots were hand weeded to prevent weed competition from confounding yield results.

Crop injury ranged from 0 to 78 percent, depending on the herbicide and rate applied. Crop injury was mostly expressed in the form of plant density reductions, but stunting also contributed to the overall response (Figures 1 and 2). KIH-485 caused the greatest injury, which was largely manifested in the form of stand loss (Table 1). In contrast, Facet caused the least amount of injury.

Figure 1. Relationship betewen stunting and crop injury.

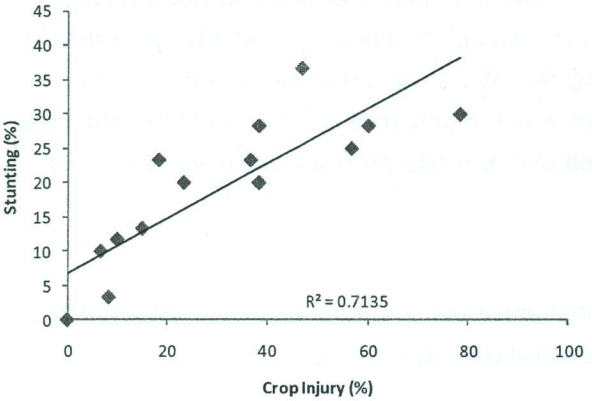


Figure 2. Relationship between plant density and crop injury.

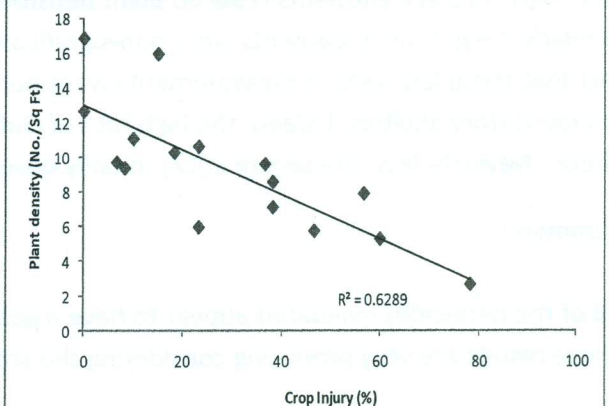


Table 1. Camelina tolerance to soil applied herbicides.

Herbicide	Rate Lb ai/A	Crop injury %	Stunting %	Height cm	Density No/Ft	Biomass g/ft	Flowering Julian	Test weight lb/bu	Yield lb/A
Check	0.000	0	0	81	13	66	175	52	1929
Outlook	0.560	10	12	84	11	85	175	51	2203
Outlook	0.840	37	23	88	10	80	177	50	2002
Outlook	1.125	60	28	84	5	90	178	50	1578
Prowl	0.950	23	20	82	11	88	176	51	1929
Prowl	1.900	23	20	83	6	55	177	50	1884
Prowl	3.800	47	37	81	6	66	178	50	1861
Facet	0.250	0	0	80	17	69	174	52	1921
Facet	0.500	7	10	86	10	89	176	52	2220
Facet	0.750	8	3	86	9	58	174	52	1951
Cinch	0.950	15	13	86	16	72	176	51	2079
Cinch	1.910	18	23	82	10	68	176	50	1942
Cinch	2.860	38	28	82	7	73	177	50	1937
KIH-485	0.056	38	20	81	9	75	178	51	1999
KIH-485	0.111	57	25	82	8	77	177	50	1875
KIH-485	0.223	78	30	81	3	62	178	49	1816
MAX		78	37	88	17	90	178	52	2220
MIN		0	0	80	3	55	174	49	1578
MEAN		29	18	83	9	73	177	51	1945
Pr>F (trt)		0.0001	0.0318	0.4929	0.0117	0.8966	0.0281	0.0002	0.0109
CV		58.13	69.9	4.83	43.08	35.05	0.81	1.34	8.03
LSD (0.05)		27.87	21.36	NS	6.69	NS	2.37	1.13	261.68

Although several treatments reduced plant densities by more than half, biomass was not affected. Similarly, height measurements were non-significant, even though stunting was initially observed. The fact that these late season measurements were non-significant indicates that camelina has robust compensatory abilities. Indeed, the high rate of Outlook was the only treatment to yield less than the check. Nevertheless, the severe injury initially observed with KIH-485 precludes its use in camelina.

Summary:

All of the herbicides evaluated appear to have a potential fit for use in camelina except for KIH-485. These results are very promising considering the soil textural class at this site.

Future Plans: Continue to evaluate soil applied herbicides for use in camelina.

Project Title: Camelina tolerance to postemergence herbicides.

Project leader: Bob Stougaard

Objective: To evaluate the response of camelina to postemergence applications of several major herbicide families.

Results:

The experiment was established as a randomized complete block with three replications, with each plot measuring 10 by 15 feet. The study was conducted under rain-fed conditions, using conventional tillage, with the previous crop being alfalfa. 'Ligena' camelina was seeded 0.25 inches deep, at a rate of 5 lb/A in six inch wide rows on May 4.

Herbicide treatments were applied just prior to the bolting stage on June 11 when camelina was approximately 3.5 inch tall. Treatments were applied with a CO_2 backpack sprayer in 20 GPA of water using 11002 flat fan nozzles. Herbicide treatments consisted of pyridine (Stinger, Starane, Grandstand, and Milestone), quinoline (Facet), phenoxy (Thistrol), aryloxyphenoxypropionate (Assure II), cyclohexanedione (Select Max), and N-phenylphthalimide (Resource) chemistries. Each herbicide was applied at two rates (Table 1).

Treatments were visually rated for percent crop injury on June 17, using a scale of 0 (no injury) to 100 (complete injury). Treatments also were visually evaluated for percent green leaf area (GLA) on August 10, using a scale of 0 (completely senesced) to 100 (completely green). Plant height and days to flowering also were evaluated in order to further assess crop injury potential. Plots were harvested on September 10. Plots were hand-weeded throughout the growing season to prevent weed competition from confounding yield results.

Table 1. Herbicides evaluated.

	Rate (lb ai/A)		Surfactant	
Herbicide	Low	High	Type	Rate
Stinger	0.094	0.187	NIS	0.25%
Starane	0.105	0.245	NIS	0.25%
Grandstand	0.094	0.187	NIS	0.25%
Milestone	0.009	0.018	NIS	0.25%
Facet	0.500	0.750	COC	2 pt
Resource	0.027	0.054	COC	1%
Thistrol	0.500	1.000	NA	NA
Select Max	0.090	0.182	NIS	0.25%
Assure II	0.068	0.137	NIS	0.25%

Table 2. Camelina tolerance to postemergence herbicides.

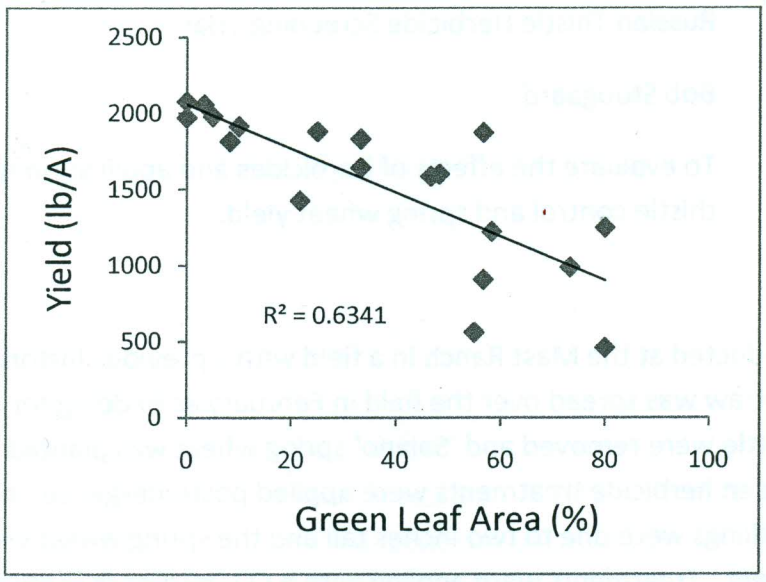
	Yield (lb/A)		Crop Injury (%)		Flowering (Julian)		Height (inches)		GLA (%)[1]	
Herbicide	Low[2]	High[2]	Low	High	Low	High	Low	High	Low	High
Stinger	907	561	10	13	174	174	35	31	57	55
Starane	1832	1643	65	77	181	183	26	24	33	33
Grandstand	1881	1586	33	53	179	183	29	24	25	47
Milestone	988	460	32	32	185	190	28	25	73	80
Facet	1600	1222	3	7	175	174	33	34	48	58
Resource	1873	1247	96	99	185	187	28	28	57	80
Thistrol	1816	1425	30	50	178	180	27	25	8	22
Select Max	1972	1979	10	7	175	175	31	33	0	5
Assure II	2058	1914	7	7	175	175	32	31	3	10
Check	2077		0		174		33		0	
MIN	460		0		174		24		0	
MAX	2077		99		190		35		80	
MEAN	1528		33		179		29		37	
Pr>F (trt)	0.0010		0.0001		0.0001		0.0001		0.0001	
CV	14.6		18.6		0.5		7.6		24.4	
LSD (0.05)	373.0		10.2		1.6		3.7		14.8	

[1]Green leaf area: Percent of leaf tissue that is green.

[2]Low and High refers to the relative rate of the herbicide.

Crop injury ranged from 0 to 99 percent, depending on the herbicide and rate applied. However, crop injury ratings did not correlated well with yield ($R^2 = 0.0005$). For example, the low rate of Resource resulted in 96% injury, but yields were comparable to the non-treated check. In contrast the high rate of Stinger caused only 13% injury, but reduced yields by nearly 73%. Similarly, flowering and height measurements failed to correlate well with yield. However, there was good agreement between percent green leaf area (GLA) and yield (Figure 1).

In short, yield reductions were most severe with those herbicides that delayed plant maturity. Yields were most reduced with applications of Stinger and Milestone. Both herbicides not only delayed plant maturity, but also appeared to have had a negative effect on flower development and pollination. Although yields were reduced with Stinger and Milestone, low rates of the other pyridines afforded yields comparable to the non-treated check. Other herbicides demonstrating potential for use in camelina include Assure II and Select Max. Thistrol and Facet also showed potential. Although camelina recovered from the initial damage caused by Resource, the degree of injury precludes its use in the crop.



Summary:

Herbicides that delayed crop maturity had the greatest negative effect on yield. Postemergence herbicides that show potential for use in camelina include Select Max, Assure II, and the low rates of Starane, Grandstand, and Thistrol.

Future Plans:

Continue to evaluate postemergence herbicides for use in camelina.

Project Title: Russian Thistle Herbicide Screening Trial

Project leader: Bob Stougaard

Objective: To evaluate the effects of herbicides and application rates on Russian thistle control and spring wheat yield.

Results:

This study was conducted at the Mast Ranch in a field with a previous history of high Russian thistle densities. Straw was spread over the field in February as bedding for spring calving operations. The cattle were removed and 'Salano' spring wheat was planted with an air drill on May 2, 2009. Sixteen herbicide treatments were applied postemergence on May 28 when Russian thistle seedlings were one to two inches tall and the spring wheat was in the 4-leaf stage of development. Treatments were applied with a CO_2 backpack sprayer in 20 GPA of water using 1102 flat fan nozzles. Individual plots were 10 by 15 feet and each treatment was replicated three times. The area was sprayed with Axial on June 11 for the control of green foxtail. Crop injury and Russian thistle control were evaluated at 1, 3, and 7 weeks after application. Spring wheat test weight and yield were determined on August 31.

Excessive straw at this site altered the C:N ratio and impacted N availability sporadically throughout the study area. As a result, it was not possible to accurately assess herbicide injury (data not presented). However, Russian thistle densities were high, which allow for an assessment of herbicide efficacy. Huskie was the most effective herbicide evaluated. Injury symptoms were immediate and control was greater than 90 percent, regardless of the rate or surfactant system utilized (Table 1). Wolverine, 2,4-D and Curtail also afforded a similar level of control. All other herbicides evaluated failed to provide acceptable control of Russian thistle.

Late planting, excessive straw, and below normal rainfall all contributed to lower than normal yields. As a result, weed control had no impact on yield (figure 1). However, there was a strong relationship between weed control and test weight. Test weights ranged from 53 to 58 lb/bu and increased as the level of Russian thistle control improved (Figure 2).

Summary: Huskie provided the most complete control of Russian thistle. Curtail, 2,4-D and Wolverine also provide good control of Russian thistle.

Figure 1. Relationship between yield and Russian thistle control.

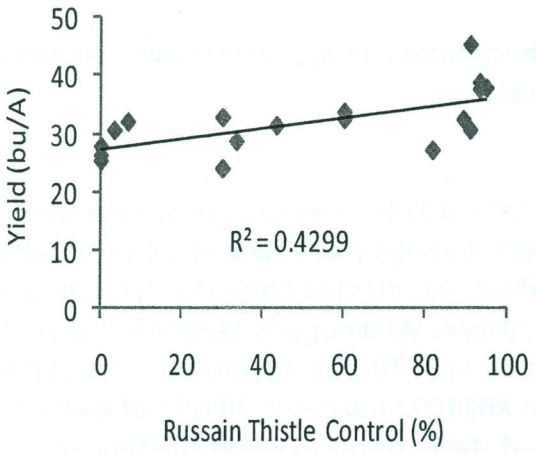


Figure 2. Relationship between test weight and Russian thistle control.

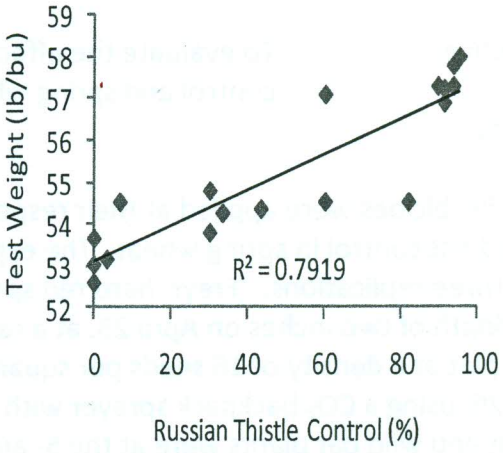


Table 1. Effect of herbicides on Russian thistle control.

			Percent Control			Test weight	Yield
trt	Herbicide	Rate/A	4-Jun	19-Jun	17-Jul	lb/bu	bu/A
5	Huskie + AMS + NIS	13.5 oz	90	95	95	58	38
4	Huskie + AMS	15 oz	88	95	93	58	38
3	Huskie + AMS	13.5 oz	83	93	93	57	39
2	Huskie + AMS	11 oz	83	93	91	57	45
15	Curtail + NIS	2 pt	62	78	91	57	30
17	2,4-D + NIS	1 pt	68	73	89	57	32
9	Wolverine	27.4 oz	57	87	82	55	27
14	Bronate Advanced	12.8 oz	47	73	60	55	32
6	Widematch + MCPA	1 pt + 0.5 pt	40	63	60	57	34
10	Widematch + MCPA ester	0.75 pt + 0.5 pt	38	58	43	54	31
12	Goldsky + NIS	1 pt	37	22	33	54	29
18	MCPA + NIS	1 pt	37	33	30	54	24
13	Aim + NIS	0.2 oz	27	23	30	55	33
7	Affinity TM + Starane + NIS	0.6 oz + 0.33 pt	13	15	7	55	32
11	Orion	17 oz	22	13	3	53	30
16	Harmony GT XP + NIS	0.6 oz	23	17	0	53	25
1	nontreated		0	0	0	54	26
8	nontreated		0	0	0	53	28
	MEAN		45	52	50	55	32
	PR>F (trt)		0.0001	0.0001	0.0001	0.0002	0.1989
	CV		27	24	23	2.8	24
	LSD (0.05)		21	21	19	2.5	13

Project Title: Wild Oat Herbicide Screening Trial

Project Leader: Bob Stougaard

Objective: To evaluate the effects of herbicides and application rates on wild oat control and spring wheat yield.

Results:

Eight herbicides were applied at their respective 1X and 1/3X rates to evaluate the consistency of wild oat control in spring wheat. The experimental design was a randomized complete block with three replications. 'Freyr' hard red spring wheat was planted on seven inch row spacings, to a depth of two inches on April 23, at a rate of 70 lb/A. Wild oat was seeded in the center of each plot at a density of 16 seeds per square foot on April 30. The herbicides were applied on May 29, using a CO_2 backpack sprayer with Teejet XR11002 nozzles in 20 GPA of water. Spring wheat and wild oat plants were at the 5- and 4-leaf stage, respectively, at the time of application. Broadleaf weeds were controlled with 0.6 oz/A of Harmony Extra applied post emergence on June 4. Crop injury and wild oat control were evaluated one and six weeks after application, respectively. Spring wheat yield and test weight were determined on August 20.

Crop injury was most noticeable with Silverado, Puma, and Everest applied at the 1X rate. However, injury was marginal with all herbicides when applied at the 1/3Xrate (Table 1). All herbicides evaluated provided 89% wild oat control or greater when applied at their respective 1X rates. Averaged over rates, control declined by about 50% when herbicides were applied at the 1/3X rate. However, Axial, Everest, and Silverado maintained 89% control or more even when applied at the lower rate. Wild oat competition was minimal this year, and the level of control had little effect on spring wheat yield. Nevertheless, the highest yields were associated with Axial.

Summary:

Overall, herbicide performance during 2009 was excellent with all herbicides when applied at labeled rates. However, Axial produced the highest yields.

Table 1. Effects of wild oat herbicides and use rates on crop injury, wild oat control, and yield.

Treatment	Rate (1X)	Crop Injury (%)		TRT	Percent control		TRT	Yield (bu/A)		TRT
(TRT)	(lb ai/ac)	1X	1/3X	mean	1X	1/3X	mean	1X	1/3X	mean
Achieve	0.1800	0	0	0	95	47	71	56	55	55
Axial	0.0530	5	0	2	100	89	94	62	62	62
Discover	0.0500	5	0	2	89	20	54	58	54	56
Everest	0.0262	18	8	13	100	99	99	57	60	58
Goldsky	0.1050	3	3	3	99	33	66	58	52	55
Hoelon	0.7500	13	3	8	90	33	61	55	52	53
Puma	0.0830	18	5	11	90	10	50	59	50	54
Silverado	0.0028	25	10	17	97	94	95	61	57	59
Rate mean		11	4	7	95	53	74	58	55	56
Untreated		0	0	0	0	0	0	51	52	51
LSD (0.05)			10.3			18			5	
C.V.			94			17			5	

OILSEED AND PULSE CROP INVESTIGATIONS

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Oilseed and Pulse Crop Investigations includes information about statewide variety evaluations and agronomic research related to fertility requirements, crop rotation, and cultural management of oilseed and pulse crops.

Project title: Nitrogen and Sulfur Fertility for Camelina and Canola in Northwestern Montana

Project leader: Heather Mason

Project personnel: Louise Strang

Objective: To evaluate the response of canola and camelina varieties to varying levels of nitrogen (N) and sulfur (S) fertilizer.

Results:

Two camelina varieties ('Blaine Creek' and 'Suneson') and two canola varieties ('Hyola 357 Magnum' and 'InVigor 5550') and were grown under 7 N and S fertilizer combinations (4 N levels x 2 S levels, minus the 0N,20S combination). Fertilizer levels were determined following spring soil testing and were set at 0, 40, 80 and 120 lb N/a and 0 and 20 lb S/a. Canola and camelina seed yield, time to flowering and maturity, test weight and oil content were recorded.

Canola and camelina crops established evenly and grew well in 2009. Average seed yield of canola (2,219 lb/a) and camelina (2,170 lb/a) were similar (Table 1). In both crops, N fertilizer affected only a few of the measured traits, which could be due to relatively high initial soil N levels (30 lb N/a) and high organic matter (5.3%) in soils at the study site.

Camelina seed and oil yield did not respond to N fertilizer, but oil concentration in the seed decreased with increasing N (Table 1). In terms of test weight, there was an indication that camelina varieties respond differently to N fertilizer, as N fertilizer did not affect Suneson's test weight, but the test weight of Blaine Creek increased from 51.6 to 52.6 lb/bu as N fertilizer increased from 0 to 120 lb N/a.

In camelina, applications of S fertilizer did not affect seed or oil yield, but did reduce days to maturity in the variety Suneson from 88 to 86 dap. In canola, seed yield was affected by S fertilizer, where yields increased by 250 lb/a with applications of 20 lb S/a. Our results suggest that canola is more responsive to S fertilizer than camelina, but further testing is required to substantiate these findings.

Varieties differed in their performance regardless of their fertilizer treatments. Blaine Creek out-yielded Suneson camelina by 176 lb/a, and Hyola 357 Magnum yield was 275 lb/a higher than InVigor 5550.

Summary:

Camelina and canola have the potential to be high yielding crops in this region of Montana, but more research is required to solidify fertilizer recommendations, especially in camelina. This year's data confirm the importance of S fertilizer in a canola fertility program, as a 20 lb/a application of S increased canola yield by 250 lb/a.

Future Plans:

The study will be conducted again in 2010, on a site that is lower in organic matter and background soil N. Since prior research indicates that canola is responsive to N fertilizer, we hypothesize that we will see larger responses in both of these crops when they are grown at more suitable sites. In addition to the Kalispell site, the study was and will be continue to be conducted at two other research centers (Northern and Central Agricultural Research Centers). With multiple study locations and years, we hope to develop N and S fertilizer guidelines for these crops.

Table 1. Camelina and canola seed yield, oil content and oil yield at varying N and S fertilizer levels, Northwestern Agricultural Research Center, Kalispell, MT, 2009.
ns denotes non-significant treatment effects ($P>0.05$)

	Camelina				Canola		
	Seed yield (lb/a)	**Oil content (%)**	**Oil yield (lb/a)**		**Seed yield (lb/a)**	**Oil content (%)**	**Oil yield (lb/a)**
N (lb/a)				**N (lb/a)**			
0	2081	39.0	808	0	2201	40.9	899
40	2236	36.7	821	40	2301	40.5	929
80	2201	36.5	805	80	2092	40.0	837
120	2162	36.0	780	120	2280	40.1	913
LSD (0.05)	*ns*	1.21	*ns*	*LSD (0.05)*	*ns*	*ns*	*ns*
S (lb/a)				**S (lb/a)**			
0	2178	36.8	801	0	2092	40.2	839
20	2162	37.3	805	20	2345	40.5	949
LSD (0.05)	*ns*	*ns*	*ns*	*LSD (0.05)*	232.4	*ns*	*ns*
Variety				**Variety**			
Blaine Creek	2258	36.6	826	Hyola 357	2356	38.8	915
Suneson	2082	37.5	780	Magnum InVigor 5550	2081	41.9	874
LSD (0.05)	150.3	0.49	*ns*	*LSD (0.05)*	179.7	0.45	*ns*
Overall mean	2170	37.1	803	**Overall mean**	2219	40.4	895

Project title: Yield and Yield Component Responses to Camelina Seeding Rate and Genotype

Project leader: Heather Mason

Project personnel: Louise Strang, James Thompson

Objective: To investigate the yield and yield component response of different camelina breeding lines to three seeding rates in Montana.

Results:

This study was conducted to investigate how different camelina genotypes responded to seeding rate. In addition to seed yield, special attention was paid to how the yield components (e.g., racemes/plant, pods/raceme) of camelina, a plant known to have a strong compensatory ability, would respond to changes in seeding rate. Twelve genotypes (9 high-yielding and 3 low-yielding) were planted at three seeding rates (2, 4 and 6 lb/a) on May 16, 2009 and were combined harvested on August 25, 2009. The trial was also conducted near Amsterdam, MT.

Camelina stands were well established and the desired seeding rates were achieved (Table 1). Averaged across the camelina genotypes, camelina flowered 44 days after planting (June 29) and reached physiological maturity on August 11 (87 days after planting). Camelina plants stood about 37 in tall. Seed yield averaged 2,281 lb/a and average test weight was 52.1 lb/bu. Oil content was close to 39% which brought average oil yield to 900 lb/a (Table 1).

Although there was a slight trend toward reduced yield with increased seeding density, the differences among densities were not statistically significant (Table 1). Very few of the other agronomic traits (e.g., flowering time, oil yield) were affected by seeding rate; however several yield components were influenced by seeding density. At lower seeding rates, camelina plants displayed an increase in the number of reproductive branches (racemes), and more pods per raceme (Table 2). This translated into greater yield *per plant* at lower densities, and demonstrates the ability of camelina to compensate in reduced stands. Seeding rate did not affect the number of seeds per pod or the seed weight (Table 2).

Summary:

Camelina responded to increased seeding rates mainly by producing fewer racemes and less pods per raceme. Increasing the seeding density in camelina didn't affect seed or oil yield in a statistically significant way, but there was a trend towards reduced yield with increasing seeding rates. Despite that trend, increased seeding rates could help reduce weed problems in this crop.

Future Plans:
This study will be conducted again in 2010 at both locations, and may lead to future studies that could help to determine the role of increased seeding rates in camelina weed management.

Table 1. Seed yield and agronomic response of camelina genotypes to plant density

Seeding density *lb/a*	Plant density *plants/ft2*	Bolting *dap*	Flowering *dap*	Maturity *dap*	Plant height *in*	Seed yield *lb/a*	Test weight *lb/bu*	Oil content *%*	Oil yield *lb/a*
2	17	28	44	87	38	2501	52.2	40.2	1005
4	30	28	44	87	37	2224	52.2	39.2	876
6	41	28	44	87	36	2119	52.0	38.5	821
LSD (α=0.05)	0.5	ns	ns	ns	ns	ns	ns	ns	ns
Overall mean	29	28	44	87	37	2281	52.1	39.3	901

dap= days after planting

Table 2. Yield component response of camelina genotypes to plant density

Plant density *lb/a*	Racemes per plant *#/plant*	Pods per raceme *#/raceme*	Seeds per pod *#/pod*	Seed weight *g/1000*	Seed yield *g/plant*	Main raceme length *mm*	Pods on main raceme *#*
2	12	20	11	1.19	2.97	28.2	40.1
4	9	18	11	1.18	2.06	25.4	36.0
6	8	16	10	1.19	1.71	23.0	32.8
LSD (α=0.05)	2.0	1.8	ns	ns	0.604	ns	4.28
Overall mean	9	18	11	1.19	2.25	25.5	36.3

Project Title: Statewide Canola Variety Evaluation

Project Leader: Heather Mason

Project personnel: Louise Strang, James Thompson

Project Objective: To evaluate seed yield and agronomic performance of 15 canola varieties in northwestern Montana

Results:

Fifteen varieties of canola (Table 1) were seeded at a rate of 5 lb/a and a depth of 0.5 in on May 1, 2009 under conventional tillage and dryland conditions. The plots were combine harvested on August 21, 2009.

The average time to flowering for canola varieties was 50 days after planting (June 20), with the crop reaching average harvest maturity approximately 50 days later (August 9), a total of 100 days after planting. Average plant height was 39.9 in, but varied widely from 33.8 in (Hyola 357 Magnum) to 43.5 in (InVigor 5550). Little to no lodging or pod shatter was observed, which is atypical for this shatter-prone crop.

Differences in seed yield and test weight were significant among varieties included in this year's evaluation. On average, canola yielded 2,489 lb/a, and test weights were 49.9 lb/bu. The three highest yielding varieties were Hyola 357 Magnum (52.9 lb/bu), HyClass 940-RR (52.8 lb/bu) and DKL52-41 (52.6 lb/bu). Average oil content of canola seed was 40.1%, ranging from 36.9 to 42.2%. Differences in oil yield among varieties were also significant. Oil yields ranged from 760 lb/a (UISC3117) to 1,095 lb/a (DKL72-55), with an average of 999 lb/a.

Summary:

Canola yields were relatively high, with over half the varieties reaching over 50 bu/a seed yield. In this crop year, flea beetles were the only pest observed and no disease problems were noted.

Future Plans:

With continued variety development and release, further canola evaluations will be conducted in order to identify varieties best suited to our growing region.

Table 1. 2009 Statewide Canola Variety Evaluation results, Northwestern Agricultural Research Center, Kalispell, MT

Variety	Seed Yield	Seed Yield	Oil Yield	Test Weight	Protein Content	Oil Content	Moisture	Shatter	Days to Flower *days after planting*	Harvest Maturity *days after planting*	Plant Height	Lodging
	bu/a	*lb/a*	*lb/a*	*lb/bu*	*%*	*%*	*%*	*%*			*in*	*0 to 9*
Hyola 357 Magnum	**52.9****	2571	981	48.6	21.7	38.1	6.1	1.3	47	101	33.8	3
HyClass 940-RR	**52.8***	2640	1079	50.0	20.0	40.8	5.5	2.5	50	100	39.0	1
DKL52-41	**52.6***	2603	1047	49.5	21.6	40.2	5.5	5.0	50	100	41.3	1
DKL30-42	**52.5***	2651	1089	50.5	20.2	41.1	5.1	2.5	49	100	37.8	1
DKL72-55	**51.8***	2590	1095	50.0	18.7	42.2	5.1	2.5	50	100	37.5	1
InVigor 5550	**50.8***	2578	1012	50.7	21.4	39.3	5.8	3.8	52	100	43.8	1
InVigor 5440	**50.8***	2567	998	50.6	21.5	38.8	6.0	1.3	53	101	43.5	0
InVigor 8440	**50.7***	2495	999	49.2	20.1	40.1	5.8	5.0	51	100	40.8	1
IS 3057 RR	**50.2***	2500	1052	49.8	19.2	42.1	5.3	5.0	47	99	36.3	1
HyClass 924-RR	46.9	2371	927	50.6	22.5	39.1	5.3	2.5	49	100	40.3	1
IS 7145 RR	46.9	2367	956	50.5	21.0	40.4	5.5	6.3	53	101	40.0	0
InVigor 5630	46.3	2275	930	49.2	19.6	40.9	5.8	5.0	53	101	43.5	1
UISC0135	43.3	2149	820	49.7	22.5	38.1	5.7	3.8	49	99	41.3	1
Oscar	41.1	2071	764	50.4	22.1	36.9	7.3	3.8	51	102	41.5	1
UISC3117	37.8	1875	760	49.6	19.2	40.5	5.8	5.0	50	100	40.8	3
Average	48.5	2489	999	49.9	20.8	40.1	5.6	3.6	50	100	39.9	1
LSD (α =0.05)	5.40	261.6	113.8	0.41	1.10	0.80	0.40	5.80	1.1	0.8	2.80	0.9

Seed and oil yields are adjusted to 8% grain moisture content.

**Indicates highest yielding variety.

*Indicates varieties yielding equal to the highest yielding variety based on Fisher's protected LSD at the 0.05 probability level.

Project Title: Statewide Camelina Variety Evaluation

Project Leader: Heather Mason

Project Personnel: Louise Strang, James Thompson

Projective Objective: To evaluate seed yield and agronomic performance of 15 camelina varieties in northwestern Montana.

Results:

Fifteen varieties of camelina were included in the trial; four commercially available varieties, six varieties supplied by Sustainable Oils (SO) and five varieties supplied by Great Plains-The Camelina Company (GP) (Table 1). Camelina was seeded at a rate of 5 lb/a and a depth of 0.5" on May 1, 2009 under conventional tillage and dryland conditions. The plots were combine harvested on August 7, 2009.

Good camelina stand establishment was obtained. The average time to flowering for camelina varieties was 50 days after planting (June 20), with the crop reaching average harvest maturity approximately 41 days later (August 1), a total of 91 days after planting. Plant height averaged 29.1 in, with a range of 25.0 to 30.8 in. Little to no lodging or pod shatter was observed in these variety evaluations.

Differences in seed yield and test weight were significant among varieties included in this year's evaluation. On average, camelina yielded 2,106 lb/a, and test weights were 52.1 lb/bu. The three highest yielding varieties were Calena (46.1 bu/a), SO-5 (43.4 bu/a) and Suneson (43.4 bu/a). Average oil content of camelina seed was 38.8%, ranging from 38.2 to 39.3%. Differences in oil yield among varieties were also significant. Average oil yield among all varieties was 825 lb/a. The 3 highest oil yielding varieties were Calena (950 lb/a), SO-5 (909 lb/a) and Suneson (896 lb/a).

Summary:

Camelina yields were much higher than in 2008, and comparable to that of canola crops grown in 2009. No pest or disease problems were observed. Calena and SO-5 emerged as the highest seed and oil yielding variety in the evaluation, which is consistent with results from 2008.

Future Plans:

With continued variety development and release, evaluations will be conducted in order to identify varieties best suited to this growing region.

Table 1. 2009 Statewide Camelina Variety Evaluation results, Northwestern Agricultural Research Center, Kalispell, MT

Variety	Seed Yield	Seed Yield	Oil Yield	Test Weight	Protein	Oil	Moisture	Shatter	Days to Flower	Harvest Maturity	Plant Height	Lodging
	bu/a	*lb/a*	*lb/a*	*lb/bu*	*%*	*%*	*%*	*%*	*days after planting*	*days after planting*	*in*	*0-9*
Calena	**46.1****	2423	950	52.60	24.54	38.9	8.6	0.8	50	93	29.8	1.5
SO-5	**43.4***	2262	909	52.13	23.72	39.3	10.0	0.8	50	93	28.0	2.3
Suneson	**43.4***	2298	896	52.93	52.93	38.8	8.3	1.5	49	91	29.3	1.3
Blaine Creek	**43.0***	2237	875	52.03	24.70	38.7	8.9	1.5	50	92	29.8	1.3
GP-42	**41.6***	2190	856	52.70	24.52	39.0	8.3	1.5	50	93	30.8	1.5
SO-3	**40.7***	2090	830	51.30	23.90	39.3	9.0	1.5	50	93	29.0	1.0
GP-10	**40.4***	2128	831	52.70	24.96	39.0	8.1	0.5	50	93	27.8	2.0
Ligena	**40.2***	2070	809	51.50	25.03	38.3	9.9	1.5	50	95	30.8	1.3
SO-6	39.6	2040	795	51.45	51.45	38.6	8.8	3.0	51	91	29.0	1.3
GP-68	38.3	1972	767	51.45	25.05	38.5	8.7	1.8	49	88	30.0	1.5
SO-2	37.7	1972	780	52.28	23.89	39.1	9.2	4.0	50	92	29.3	1.3
SO-4	36.1	1856	718	51.43	24.89	38.6	8.3	0.5	48	87	26.3	2.3
GP-11	34.9	1842	706	52.75	25.28	38.2	8.4	1.5	50	88	28.3	2.0
SO-1	33.1	1714	677	51.78	24.45	39.2	8.6	1.5	51	88	28.3	1.3
GP-07	24.8	1270	484	51.15	26.60	38.2	7.7	1.8	48	87	25.0	1.3
Average	38.9	2106	825	52.09	28.83	38.8	8.8	1.6	50	91	29.1	1.6
LSD (α=0.05)	6.10	314.8	127.1	0.521	0.820	0.61	1.12	3.09	1.1	3.2	2.0	1.11

Seed and oil yields are adjusted to 8% grain moisture content.

**Indicates highest yielding variety

*Indicates varieties yielding equal to the highest yielding variety based on Fisher's protected LSD at the 0.05 probability level.

Project Title: Seeding date and potassium fertilizer effects on winter canola survival

Project Leader: Heather Mason

Project personnel: Louise Strang, James Thompson

Project Objective: To evaluate the effects of seeding date and potassium (K) fertilizer on the overwintering ability and seed yield of winter canola in northwestern Montana.

Results:

Field trials were initiated in the fall of 2009. Two winter canola varieties were differing in winter hardiness rating (HyClass 107W and HyClass 110W) were sown at a target rate of 5 lb/a into soil measured to be deficient in K (55 ppm soil test K). Plots were seeded on 4 seeding dates: August 19, August 28, September 8 and September 22, 2009. Five levels (0, 20, 40, 80, 120 lb K/a) of K fertilizer (0-0-60) were broadcast and incorporated into the subplots prior to planting at each seeding date.

After seedling emergence, stands continued to grow until the first killing frost (October 6, 2009). At that time, winter canola plants at the first three seeding dates were well established, while plants in the final seeding date had barely emerged. Plant stand, leaf stage and dry weight decreasingly corresponded with delayed seeding dates.

In the spring of 2010, plants resumed growth, although survival looked patchy. Several hard spring frosts damaged the growing crops and they were terminated in mid-May 2010.

Future Plans:

The trial will be seeded again in the fall of 2010 and again in 2011 if overwintering in 2010 is successful.

Project Title: National winter canola variety evaluation

Project Leader: Heather Mason

Project personnel: Louise Strang, James Thompson

Project Objective: To evaluate the winter survival, seed yield and agronomic traits of winter canola varieties in northwestern Montana.

Results:

Eighteen winter canola varieties were planted on August 28, 2009. Stands established nicely and made it to the 4-6 leaf stage prior to the date of first frost, October 6, 2009. In spring, plots seemed to be emerging early on, but survival was variable across plots. A hard spring frost appeared to kill many of the young plants, thus the trial was deemed to be a crop failure and was terminated in mid-May 2010.

Future Plans:

The National Winter Canola Variety Evaluations will be continued, but fewer entries will be included until we start to see some success with winter survival in this crop.

Project title: Quantifying the Nitrogen Benefit of Legumes in a Crop Rotation

Project leader: Heather Mason

Project personnel: Louise Strang

Objective: To quantify the amount of nitrogen supplied by legumes to subsequent spring wheat and canola crops

Results:

The trial was established this year, and will be conducted for a total of three years at this site. In the first year of this study, plots measuring 4' x 15' were planted to pea, chickpea, lentil and wheat on May 17, 2009. In order to make comparisons with a fallow system, some plots were also left fallow (not planted to any crop). In the second year of this study, spring wheat and canola will be planted into the harvested legume, wheat and fallow plots. Four levels of N fertilizer will also be applied as treatments in these wheat and canola plots. Together, these treatments will allow us to quantify the amount of N that the various legume crops were able to supply to a subsequent crop, and to determine if spring wheat and canola perform differently based on which crop they follow in a given cropping sequence.

In 2009, observations were recorded on days to flowering and maturity, stand density, height and grain/biomass yield (Table 1). Due to differences in time to maturity, varieties were harvested at different times. Peas were harvested August 19, while wheat was harvested Sept.9. Lentil and Chickpeas did not mature to harvestability and therefore were not harvested for grain; instead they were harvested for forage yield, expressed as dry biomass yield, on dates ranging from Sept 17-21.

Table 1. Grain/biomass yield and other agronomic characteristics of initial crop varieties grown in 2009.

Crop species	Variety	Days to flowering (dap)[1]	Days to maturity (dap)	Stand density (plants/ft^2)	Plant height (in)	Grain yield (lb/a)	Dry biomass yield (lb/a)
Field pea	Aragorn	49	90	11	n/a	3475	n/a
Field pea	Universal	48	89	9	n/a	4053	n/a
Chickpea	Sierra	52	114	4	28	n/a	8966
Chickpea	Dylan	47	112	7	25	n/a	8710
Lentil	Brewer	55	114	17	23	n/a	8731
Lentil	Richlea	47	113	18	21	n/a	6671
Spring wheat	Jedd	49	99	25	27	4380	n/a

[1] dap= days after planting

Future plans:

The second year of the study will continue in 2010, with spring wheat and canola planted into plots where pea, lentil, chickpea and fallow treatments stood in 2009. Nitrogen fertilizer treatments will be applied at 0, 40, 80 and 120 lb N/ac, and data on yield, and soil and plant N status will be collected. The study will also be initiated at another site in 2010, starting with the planting of pea, lentil and wheat plots. Chickpeas have been removed due to their requirement for a longer growing season that what is typically experienced in this area.

Project Title: Statewide Pea Variety Evaluation

Project Leader: Heather Mason

Project personnel: Louise Strang, James Thompson

Project Objective: To evaluate seed yield and agronomic performance of 13 pea varieties in northwestern Montana

Results:

Thirteen pea varieties (Table 1) were seeded into Creston sandy loam soil on May 1, 2009. The field was prepared for planting using conventional tillage. No pesticides were applied and the trial was not irrigated. Seeds, treated with fungicide and inoculated with *Rhizobium* sp., were sown at a rate of 8 seeds/ft^2 at a depth of 1.5 in. Plots were combine harvested at physiological maturity on August 11, 2009, 102 days after planting.

Peas were seeded two weeks later than the previous year, which delayed flowering and maturity by approximately one week. The average time to flower was 58 days after planting (June 28) and plants reached grain maturity (10% moisture) an average of 92 days after planting (August 1). Canopy height ranged from 17 to 27 inches and lodging scores ranged from 1 (no lodging) to 2 (Table 1).

Pea grain yield across varieties averaged 43.1 bu/a (3,323 lb/a), ranging from 34.0 bu/a (Stirling) to 46.8 bu/a (CDC Mozart), however yield differences among varieties were not significant. Test weights averaged 75 lb/bu. SW Midas had the largest seeds (2,700 /lb) while PS0010836 had the smallest seeds (1,730/lb).

Summary:

Grain yields were not significantly different among the commercially available varieties, and average yields were comparable to those obtained in 2008. No major disease or insect pests were observed.

Future Plans:

Pea variety evaluations will continue to be conducted each year in order to identify varieties suitable to our growing region.

TABLE 1. 2009 Statewide Pea Variety Evaluation Results
Northwestern Ag Research Center, Kalispell, MT

Variety	Grain Yield	Grain Yield	Seed Weight	Test Weight	Days to Flower	Grain Maturity	Canopy Height	Lodging Index
	bu/a	*lb/a*	*#/lb*	*lb/bu*	*days after planting*	*days after planting*	*in*	*0-9*
CDC Mozart	46.8	3538	1888.00	75.78	59	92	19	2
Cruiser	46.7	3484	2260.00	74.58	56	88	27	1
Medora	46.5	3437	2190.33	73.96	62	94	24	0
PS9910140	45.5	3353	1895.33	73.70	58	92	21	2
Delta	45.4	3446	1844.67	76.08	56	87	20	1
Majoret	44.2	3285	1960.00	74.45	60	94	21	1
SW Midas	44.1	3313	2700.67	74.98	59	91	26	1
CDC Golden	43.9	3284	2504.00	75.08	59	91	23	1
PS0010836	42.7	3168	1730.25	74.10	58	96	19	2
CDC Striker	41.3	3154	1804.00	76.45	63	90	24	0
PS01102958	40.2	2996	1885.50	74.75	61	95	20	1
DS Admiral	39.9	3016	2272.00	75.53	58	91	24	1
Stirling	34.0	2550	2283.25	75.18	50	96	17	1
Average	43.1	3232	2093.69	74.97	58	92	22	1.00
LSD (α=0.05)	ns	ns	ns	ns	ns	ns	ns	ns

Grain yield is adjusted to 10% grain moisture content.
ns indicates that differences among varieties are not significant at α=0.05.

Project title: Statewide Lentil Variety Evaluation

Project leader: Heather Mason

Project personnel: Louise Strang, James Thompson

Objectives: To evaluate seed yield and agronomic performance of 13 lentil varieties in northwestern Montana.

Results:

Thirteen lentil varieties (Table 1) were seeded into Creston sandy loam soil on May 1, 2009. The field was previously seeded to alfalfa, and was prepared for planting using conventional tillage. No pesticides were applied and the trial was not irrigated. Seeds, treated with fungicide and inoculated with *Rhizobium* sp., were sown at a rate of 10-12 seeds/ft^2 at a depth of 1.5 in. Plots were combine harvested at physiological maturity on August 20, 2009.

Although plots were seeded two weeks later than the previous year, average flowering and maturity dates were delayed by only a few days. The average time to flowering was 56 days after planting (June 26) and plants reached grain maturity (10% moisture) an average of 99 days after planting (August 8) (Table 1). Canopy height ranged from 12 to 17 in and lodging scores ranged from 1 (no lodging) to 9 (severe lodging).

Test weights were high, averaging almost 70 lb/bu. Grain yields were similar to those achieved in 2008, ranging from 27.9 bu/a (2,013 lb/a) for Crimson to 40.8 bu/a (2,916 lb/a) for LC01602300R. Overall lentil yield across varieties was 34.9 bu/a, and Richlea and Merrit were the highest yielding commercially available varieties (Table 1). Merrit lentil had the largest seeds (6,490/lb) while Crimson, had the smallest seeds (13,245/lb).

Summary:

Later planting dates did not seem to affect the ability of lentil to mature in sandy loam soil. Grain yields were similar to those achieved in 2008, with LC01602300RR, Meritt and Richlea achieving the highest grain yields overall.

Future Plans:

Trials will continue to be conducted each year in order to identify varieties suitable to the region.

Table 1. 2009 Statewide Lentil Variety Evaluation results, Northwestern Agricultural Research Center, Kalispell, MT

Variety	Grain Yield	Grain Yield	Test Weight	Seed Weight	Days to Flower	Days to Maturity	Canopy Height	Lodging Index
	bu/a	*lb/a*	*lb/bu*	*#/lb*	*days after planting*	*days after planting*	*in*	*0-9*
LC01602300R	**40.8****	2916	71.4	8305	56	101	16	1
Merrit	**39.9***	2735	68.5	6490	50	103	15	5
Richlea	**39.4***	2737	69.4	8350	60	102	15	4
Riveland	**36.7***	2396	65.3	5693	53	102	17	6
Pennell	**35.1***	2404	68.5	6511	52	103	15	5
Brewer	34.5	2378	68.9	7154	50	93	15	7
Meteor	34.2	2368	69.2	9144	61	97	17	9
LC01602245P	33.8	2488	73.7	10226	53	93	12	8
Vantage	33.5	2317	69.1	8726	58	97	16	7
LC01602062T	33.2	2383	71.8	9461	53	94	14	6
LC01602307E	32.8	2315	70.5	9795	60	103	16	6
Redberry	31.9	2249	70.6	10139	61	103	16	2
Crimson	27.9	2013	72.3	13245	61	94	13	8
Average	34.9	2438	69.9	8711	56	99	15	6
LSD (α=0.05)	6.19	431.0	0.83	368.2	1.2	2.2	1.2	1.4

Grain yield is adjusted to 10% grain moisture content.

**Indicates highest yielding cultivar

*Indicates cultivars yielding equal to the highest yielding cultivar based on Fisher's Protected LSD at the 0.05 probability level.

FORAGE CROP INVESTIGATIONS

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Forage Crop Investigations includes information about forage variety evaluations and research related to the management of forage cropping systems.

Project Title: 2009 Intrastate Alfalfa Variety Evaluation – Dryland

Project Leader: Heather Mason

Project Personnel: Louise Strang

Objectives: To evaluate the yield performance of alfalfa varieties in a northwestern Montana dryland environment

Results:

Nine alfalfa cultivars were planted at a rate of 5 lb/a on May 9, 2008 in a randomized complete block design with four replications. In the spring of 2009, stands were well established following a cool, wet winter. All harvests were taken at the full bloom stage of the alfalfa crop. Yields at first harvest (June 26, 2009) were above average at 3.05 t/a. The growing season was warmer and drier than normal, but a wet July resulted in another good harvest (1.82 t/a) from the second cutting on August 4, 2009. Drier weather in the last summer and early fall resulted in reduced yields (0.93 t/a) from the third haying on October 16, 2009. Hay yields of the nine varieties did not differ in the 2009 or 2008 season.

Table 1. Stand and yield data from the Intrastate Alfalfa Variety Evaluation, 2009.

Cultivar	MT-ID#	Stand	Harv-1	Harv-2	Harv-3	2009 Total	2008 Total	Total 08-09
		% plot	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*
Rebound 5.0	MT-398	81	2.99	1.93	1.06	5.98	0.90	6.88
DKA43-13	MT-413	95	2.91	1.90	1.18	5.98	1.24	7.22
54V09	MT-414	68	2.91	1.82	0.90	5.62	0.98	6.60
FSG 229CR	MT-415	94	3.29	1.94	0.97	6.20	1.31	7.51
FSG 429SN	MT-416	81	3.05	1.76	0.90	5.71	0.99	6.70
FSG 408DP	MT-417	74	3.02	1.94	0.96	5.92	1.03	6.95
Ladak-65	MT-2	84	2.84	1.59	0.74	5.17	0.92	6.09
Melton	MT-338	85	3.34	1.93	0.91	6.18	1.04	7.22
Shaw	MT-328	69	3.15	1.59	0.80	5.54	1.13	6.67
Mean		81	3.05	1.82	0.93	5.81	1.06	6.87
P>F		ns	ns	ns	ns	ns	ns	ns
LSD (0.05)		29.99	0.83	0.44	0.31	1.42	0.40	1.58

Project Title: 2009 Intrastate Alfalfa Variety Evaluation – Irrigated

Project Leader: Heather Mason

Project Personnel: Louise Strang

Objectives: To evaluate the yield performance of alfalfa varieties in a northwestern Montana irrigated environment

Results:

Nine alfalfa cultivars were planted at a rate of 5 lb/a on May 9, 2008 in a randomized complete block design with four replications, and were grown under irrigated conditions. All harvests were taken at the full bloom stage of the alfalfa crop. Overall hay yield for the 2009 growing season was 5.54 t/a. Differences were observed among varieties at the first cutting (June 17, 2009) but no differences among varieties were observed for the second (August 5, 2009) or third haying (October 16, 2009) or for overall yield in 2008, 2009 or total yield. At the time of first cutting, Shaw had the highest hay yield and Ladak-65 had the lowest hay yield. This trend continued throughout the season, although the differences between varieties were not statistically significant.

Table 1. Stand and yield data from the irrigated Intrastate Alfalfa Variety Evaluation, 2009.

Variety	MT-ID#	Stand	Harv-1	Harv-2	Harv-3	2009 Total	2008 Total	Total 08-09
		% plot	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*	*t/a*
Rebound 5.0	MT-398	98	2.48	1.81	1.11	5.39	2.58	7.97
DKA43-13	MT-413	91	2.38	1.92	1.10	5.40	2.26	7.66
54V09	MT-414	95	2.74	2.01	1.20	5.95	2.76	8.71
FSG 229CR	MT-415	98	2.54	1.89	1.08	5.51	2.98	8.49
FSG 429SN	MT-416	94	2.50	1.94	1.12	5.55	2.72	8.27
FSG 408DP	MT-417	98	2.50	1.74	1.11	5.35	2.89	8.24
Ladak-65	MT-2	88	2.31	1.81	0.87	5.00	2.50	7.50
Melton	MT-338	94	2.64	2	1.15	5.68	2.7	8.38
Shaw	MT-328	96	2.83	2.07	1.13	6.02	2.99	9.01
mean		94	2.55	1.90	1.10	5.54	2.71	8.25
P<F		ns	0.05	ns	ns	ns	ns	ns
LSD(0.05)		7.0	0.314	0.293	0.351	0.710	0.568	1.028