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

ANNUAL REPORT
2015 CROP YEAR

Sixty-seventh annual report

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CLIMATOLOGY

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

2014-2015 Weather Trend in Relation with the 26-year (1989-2015) Climate Data

This year's crop season was slightly warmer (1.5 ^{o}F higher) than in 2013-14 (Fig. 1). Higher temperature deviation from historical averages were recorded February through August. The June deviation was the greatest at 6.7 ^{o}F higher than normal. The sunlight received during the winter months followed the historical expected sunlight. However, sunlight recorded from April to June was consistently higher than average before falling below historical averages from July to September (Fig. 2). The potential evapotranspiration demand was just slightly below the 11-yr average from fall to winter months. From April to June, potential evapotranspiration was higher than the 11-yr average and peaked in June with 1.2 inches higher than the 11-yr average (Fig. 3).

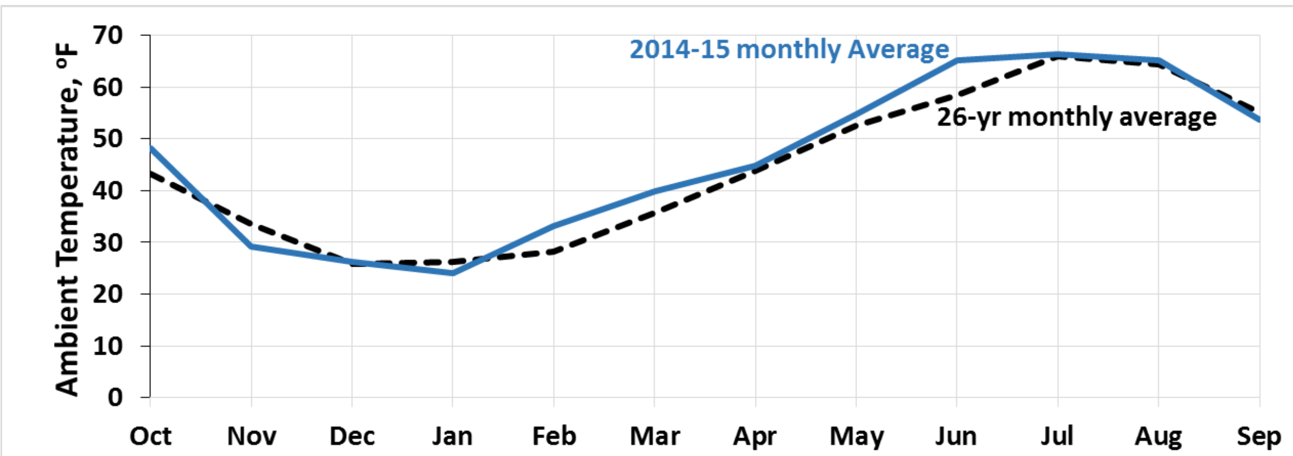

Figure 1. 2014-15 monthly mean temperature relative to the mean historical ambient temperature.

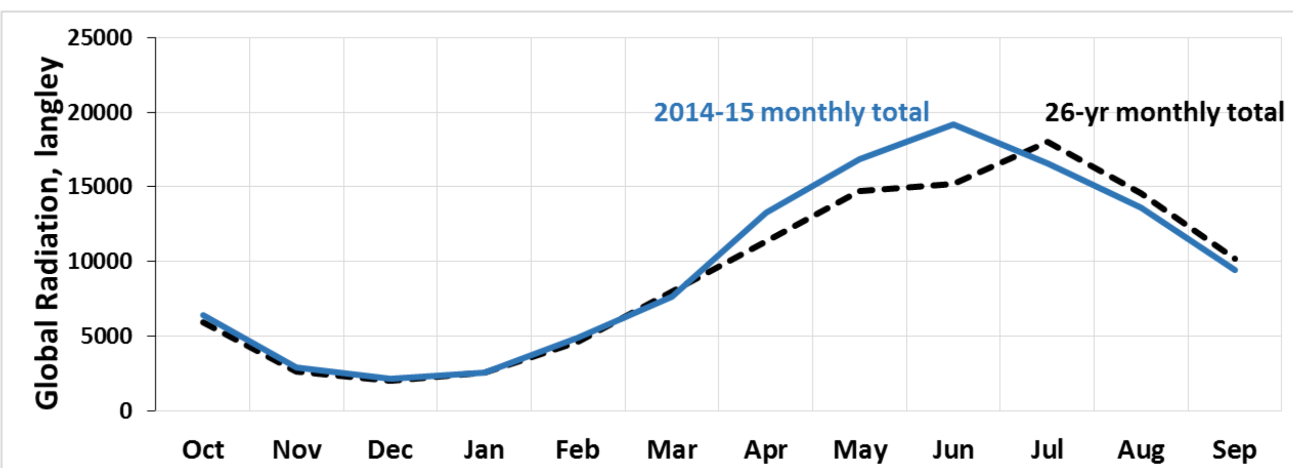

Figure 2. 2014-2015 monthly total solar global radiation relative to the historical monthly total.

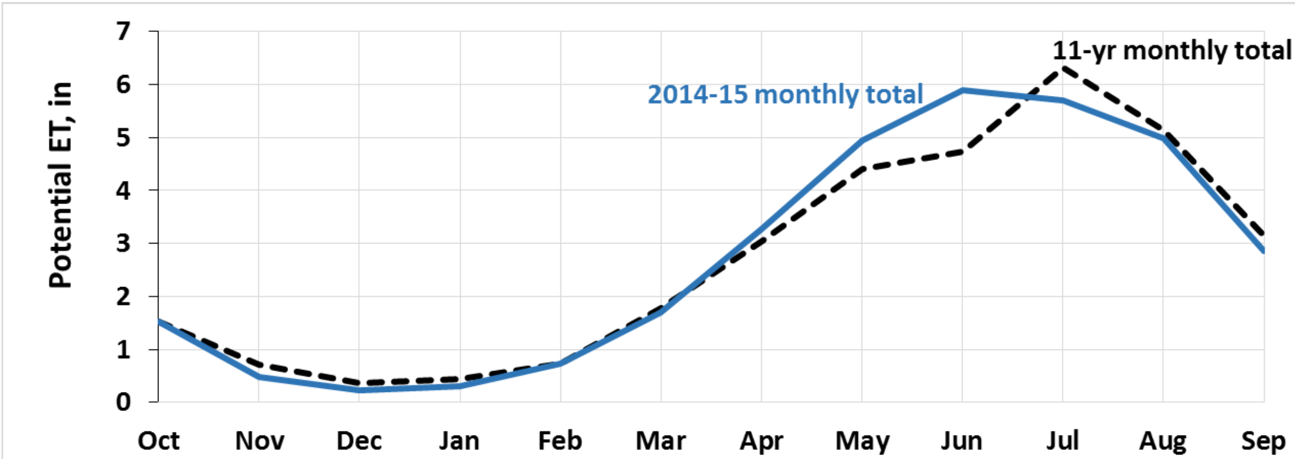

Figure 3. 2014-2015 monthly total potential evapotranspiration (grass as reference) relative to the 11-yr ETo monthly total (2004-2015).

This year, rainfall received from October to March was consistently above historical expected rainfall (Fig. 4). Beginning April until September, rainfall was well-below the historical expected rainfall – 73% below the average rainfall for that period. April to September received only 2.7 inches of rain compared with the 10.0 inches expected rain for the period. Although a full soil profile was expected at spring planting, the shortage of rain (Fig 4) in combination with high temperature (Fig 1), high sunlight (Fig 2,) and high evapotranspiration demand (Fig 3) is a formula for drought. It is expected that for soil without underground water recharge, yields are unusually low compared with years where rainfall follows the average historical rainfall pattern.

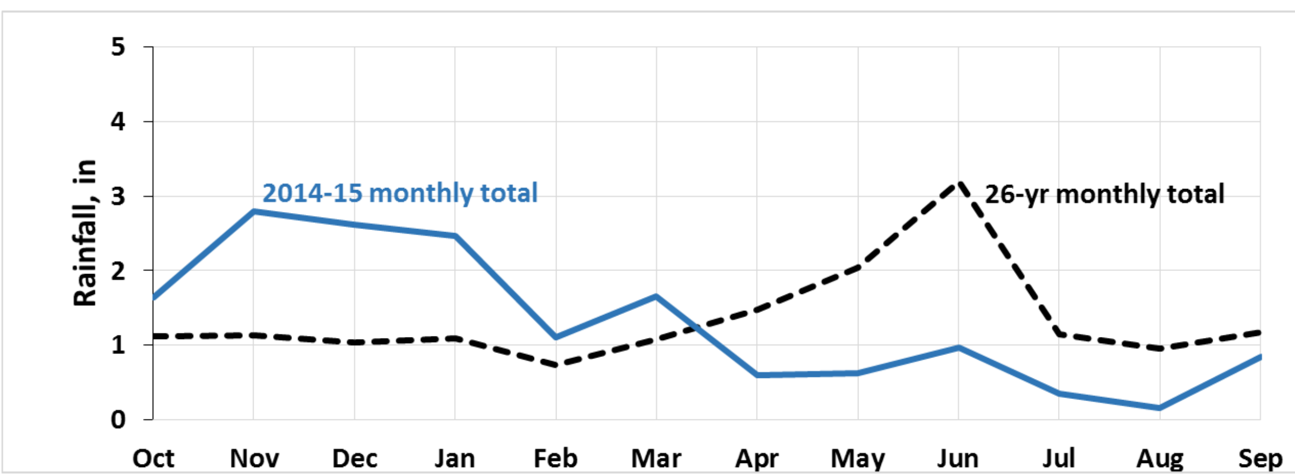

Figure 4. 2014-15 monthly total rainfall and cumulative rainfall received relative to the historically expected rain.

Summary of Climatic Data by Months for the 2015 Crop Year: September 1, 2014 - August 31, 2015
and Averages for the Years 1980-2015 at the
Northwestern Agricultural Research Center, Kalispell, Montana

	Sept 2014	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	May 2015	June 2015	July 2015	Aug 2015	
Precipitation (inches)													Total
Current Year	0.75	2.13	2.84	2.66	2.52	1.04	1.43	0.30	0.43	1.02	0.63	0.19	15.94
1981-2015	1.62	1.34	1.62	1.53	1.40	1.17	1.30	1.76	2.37	3.38	1.56	1.10	20.08
Average Temperature (F°)													Average
Current Year	54.2	48.0	28.8	25.0	22.6	32.4	38.6	43.6	52.7	63.7	65.7	64.0	44.9
1980-2015	53.9	42.3	32.4	24.2	24.6	27.1	35.0	43.0	51.3	57.6	64.5	63.6	43.3

Last killing frost[1] in spring

Spring 2015	May 18	32°
Median for 1980-2015	May 20	

First killing frost[1] in fall

Fall 2015	September 17	29°
Median for 1980-2015	September 16	

Frost Free Period

Average 1980-2015	123 days

Growing Degree Days April - August 2015

	April	May	June	July	Aug	Total
Base 50	104	261	447	470	499	1780
Base 40	242	448	699	728	716	2832
Base 32	382	653	939	948	943	3864

Maximum summer temperature	95	June 29 & Aug 2, 2015
Minimum winter temperature	-24	Dec 30, 2014

[1] In this summary 32 degrees or below is considered a killing frost.

Climatological Data**:** Northwestern Agricultural Research Center, Kalispell, Montana

Summary of the 2014-2015 crop year

September 2014: With September came the start of the new crop year as well as the first frost. On September 11th a low of 27°F was recorded. September temperatures ranged from a low of 25°F on the 12th, to a high of 85°F on the 25th, with a low average of 40°F and a high average of 69° Fahrenheit. The total precipitation for September was 0.75", which is 0.86" below the 35-year average precipitation for September of 1.61 inches.

October 2014: October temperatures ranged from a low of 25°F on the 3rd to a high of 75°F on the 8th, with a low average of 36°F and a high average of 60° Fahrenheit. The total precipitation for October was 2.13", which is 0.79"above the 35-year average precipitation for October of 1.34 inches. The precipitation accumulation for the crop year so far was 2.88 inches, which is 0.07" below the 35 year average precipitation accumulation of 2.95 inches.

November 2014: November temperatures ranged from a low of -4°F on the 30th, to a high of 60°F on the7th, with a low average of 21°F and a high average of 37° Fahrenheit. The total precipitation for November was 2.84", which is 1.22" above the 35 year average precipitation for November of 1.62 inches. The precipitation accumulation for the crop year so far was 5.72", which is 1.15" above the 35 year average precipitation accumulation in November of 4.57 inches.

December 2014: December temperatures ranged from a low of -24°F on the 30th, the coldest day of the year, to a high of 47°F on five separate days, with a low average of 18°F and a high average of 32° Fahrenheit. The total precipitation for December was 2.66", which is 1.13" above the 35 year average precipitation for December of 1.53 inches. The precipitation accumulation for the crop year so far was 8.38", which is 2.28" above the 35 year average precipitation accumulation in December of 6.10 inches.

January 2015: January temperatures ranged from a low of -11°F on the 9th to a high of 53°F on the 26th and 27th, with a low average of 15°F and a high average of 31°F. The total precipitation for the month of January was 2.52", which is 1.12" above the 35 year average precipitation for January of 1.40 inches. The precipitation accumulation for the crop year so far was 10.90", which is 3.40" above the 35 year average precipitation accumulation in January of 7.50 inches.

February 2015: February temperatures ranged from a low of 10°F on the 28th to a high of 56°F on the 14th, with a low average of 23°F and a high average of 41° Fahrenheit. The total precipitation for the month of February was 1.04", which is 0.13" below the 35 year average precipitation for February of 1.17 inches. The precipitation accumulation for the crop year so far was 11.94", which is 3.27" above the 35 year average precipitation accumulation in February of 8.67 inches.

March 2015: March temperatures ranged from a low of 6°F on the 4th and 5th to a high of 66°F on the 28st, with a low average of 27°F and a high average of 50° Fahrenheit. The total precipitation for the month of March was 1.43”, which is 0.13” above the 35 year average precipitation for March of 1.30 inches. The precipitation accumulation for the crop year so far was 13.37”, which is 3.40” above the 35 year average precipitation accumulation in March of 9.97 inches.

April 2015: April temperatures ranged from a low of 23°F on the 5th to a high of 73°F on the 29th, with a low average of 31°F and a high average of 56° Fahrenheit. The total precipitation for the month of April was 0.30”, which is 1.46” below the 35 year average precipitation for April of 1.76 inches. The precipitation accumulation for the crop year so far was 13.67”, which is 1.94” above the 35 year average precipitation accumulation in April of 11.73 inches.

May 2015: May temperatures ranged from a low of 27°F on the 9th to a high of 77°F on the 31st, with a low average of 39°F and a high average of 67° Fahrenheit. The total precipitation for the month of May was 0.43”, which is 1.94” below the 35 year average precipitation for May of 2.37 inches. The precipitation accumulation for the crop year so far was 14.10”, which is equal to the 35 year average precipitation accumulation in May of 14.10 inches.

June 2015: June temperatures ranged from a low of 40°F on the 13th and 14th to a high of 95°F on the 29th, with a low average of 49°F and a high average of 79° Fahrenheit. The total precipitation for the month of June was 1.02” which is 2.36” below the 35 year average precipitation for June of 3.38 inches. The precipitation accumulation for the crop year so far was 15.12”, which is 2.36” below the 35 year average precipitation accumulation in June of 17.48 inches.

July 2015: July temperatures ranged from a low of 40°F on the 6th to a high of 93°F on the 5th and 6th, with a low average of 51°F and a high average of 80° Fahrenheit. The total precipitation for the month of July was 0.63” which is 0.93” below the 35 year average precipitation for July of 1.56 inches. The precipitation accumulation for the crop year so far was 15.75”, which is 3.29” below the 35 year average precipitation accumulation in July of 19.04 inches.

August 2015: August temperatures ranged from a low of 33°F on the 20th to a high of 95°F on the 2nd. This tied the high temperature for the year with June 29th, with a low average of 46°F and a high average of 82° Fahrenheit. Total precipitation for the month of August was 0.19” which is 0.91” below the 35 year average precipitation for August of 1.10 inches. The total precipitation accumulation for the crop year was 15.94 inches. This is 4.20” below the 35 year average precipitation accumulation of 20.14 inches.

Summary of Temperature Data at the Northwestern Agricultural Research Center
On a Crop Year Basis September 1, 1980 - August 31, 2015
AVERAGE TEMPERATURE BY YEAR AND MONTH
In degrees Fahrenheit

YEAR	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	MEAN
1980-81	54.1	45.3	35.8	32.2	30.1	31.3	38.5	44.5	52.5	53.8	62.8	66.4	45.6
1981-82	55.3	43.2	36.0	27.0	21.6	24.5	37.5	39.4	49.8	59.8	61.1	63.0	43.2
1982-83	53.4	41.0	29.1	25.9	30.3	33.8	37.9	42.4	51.9	57.6	59.6	65.4	44.0
1983-84	50.4	42.9	36.6	11.1	27.6	32.4	38.3	42.2	48.7	56.4	65.3	64.6	43.0
1984-85	49.5	40.0	32.6	20.6	19.2	19.0	30.8	44.8	53.7	57.6	68.3	60.2	41.4
1985-86	47.8	40.8	18.6	18.3	25.4	25.6	40.6	43.8	53.7	63.9	59.9	66.1	42.0
1986-87	50.2	43.0	30.3	24.9	22.2	27.9	35.0	47.8	55.6	61.6	62.9	59.8	43.4
1987-88	56.1	43.3	35.3	25.4	20.5	30.3	37.8	45.7	51.4	60.9	63.7	63.9	44.5
1988-89	53.4	43.4	36.3	23.3	27.5	12.4	28.8	44.2	49.6	59.8	65.4	61.9	42.2
1989-90	52.7	42.7	35.8	25.3	30.5	24.5	34.8	45.2	49.8	57.2	65.2	64.8	44.0
1990-91	59.1	41.9	36.1	16.5	18.3	34.6	32.8	42.4	50.3	55.1	64.0	65.2	43.0
1991-92	54.4	40.6	32.1	29.3	28.7	34.5	39.7	45.1	53.5	55.5	61.2	61.8	44.7
1992-93	51.1	44.7	33.1	19.4	14.7	18.4	33.7	43.6	56.0	56.5	56.6	59.7	40.6
1993-94	51.4	44.4	25.0	27.4	32.9	20.6	37.5	45.4	54.0	57.3	66.4	63.0	43.8
1994-95	56.3	42.8	29.7	27.1	23.6	33.7	33.1	42.6	51.6	56.3	63.1	59.5	43.3
1995-96	54.9	41.1	34.9	26.7	17.4	24.0	29.0	43.2	46.6	58.5	65.4	62.5	42.0
1996-97	52.3	42.1	27.3	19.8	19.8	28.0	32.3	38.3	52.3	57.8	62.8	63.8	41.4
1997-98	55.6	43.7	33.0	27.9	25.1	33.0	34.9	44.5	54.1	56.0	68.4	65.6	45.2
1998-99	59.7	42.3	37.0	27.4	30.4	32.2	37.5	41.6	48.8	55.8	60.9	65.5	44.9
1999-00	51.3	42.9	38.1	31.0	25.8	26.3	36.9	43.4	50.4	56.2	63.9	63.4	44.1
2000-01	52.0	33.5	27.5	18.4	24.0	20.6	33.6	40.5	53.4	54.8	63.1	64.6	40.5
2001-02	57.3	42.0	36.6	27.0	27.2	25.7	25.0	41.6	47.5	57.7	67.2	60.4	42.9
2002-03	54.4	37.5	32.6	30.6	28.8	28.1	33.4	44.5	50.5	60.1	69.1	66.9	44.7
2003-04	55.5	46.3	27.3	24.2	21.1	27.6	39.5	45.1	51.0	57.3	66.0	64.0	43.7
2004-05	52.3	43.4	33.8	29.4	20.6	30.6	36.1	43.9	51.8	55.3	62.6	62.8	43.6
2005-06	51.0	43.6	32.6	18.1	33.2	24.2	35.5	43.9	52.6	60.7	69.1	63.8	44.0
2006-07	53.5	44.0	32.5	24.1	22.1	28.3	37.7	42.7	52.6	59.0	72.0	62.3	44.2
2007-08	53.6	40.3	32.6	26.2	19.7	30.2	32.9	37.8	47.0	55.6	65.1	63.6	42.1
2008-09	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
2009-10	60.1	38.9	35.3	18.0	26.4	31.4	37.9	41.2	47.1	56.0	61.9	61.4	43.0
2010-11	51.9	43.9	29.0	23.8	24.3	19.5	34.7	38.7	48.7	53.5	61.9	64.4	41.2
2011-12	56.2	43.3	31.6	28.0	26.4	28.2	36.7	45.2	48.8	54.9	65.2	63.1	44.0
2012-13	55.4	41.9	35.8	28.5	23.9	32.6	35.3	40.4	52.4	58.5	67.2	66.0	44.8
2013-14	57.2	39.6	31.4	21.9	26.6	17.1	33.2	42.3	51.8	55.9	66.6	65.1	42.4
2014-15	54.2	48.0	28.8	25.0	22.6	32.4	38.6	43.6	52.7	63.7	65.7	64.0	44.9
MEAN	53.9	42.3	32.4	24.2	24.6	27.1	35.0	43.0	51.3	57.6	64.5	63.6	43.3

Mean temperature for all years = 43.3

Precipitation by Day for Crop Year September 2014- August 2015
Northwest Agriculture Research Center, Kalispell Montana

DAY	SEPT 2014	OCT 2014	NOV 2014	DEC 2014	JAN 2015	FEB 2015	MAR 2015	APR 2015	MAY 2015	JUNE 2015	JULY 2015	AUG 2015
1	0.03	0.47	0.02	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
2	0.00	0.00	0.56	0.01	0.00	0.14	0.00	0.00	0.00	0.41	0.00	0.00
3	0.03	0.00	0.36	0.00	0.11	0.00	0.00	0.00	0.00	0.58	0.00	0.00
4	0.44	0.00	0.05	0.04	0.20	0.00	0.00	T	0.00	0.03	0.00	0.00
5	0.00	0.00	0.03	0.45	0.95	0.00	0.00	0.00	T	0.00	0.04	0.01
6	0.00	0.00	0.00	0.00	0.46	0.04	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.06	0.00	0.05	0.00	0.09	0.00	0.00	0.00	0.00
8	0.00	0.00	0.01	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.15	0.00
9	0.00	0.00	0.13	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00
10	0.06	0.00	0.83	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00
11	0.09	0.00	0.00	0.00	0.25	0.03	0.00	T	0.00	0.00	0.20	0.02
12	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
13	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.18	0.18	0.00	0.03	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.18	T	0.00	0.00	0.01	0.05
16	0.00	0.04	0.00	0.00	0.04	0.00	0.22	0.00	0.00	0.00	0.04	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	T	0.44	0.00	0.50	0.00	0.00	0.00	0.00	0.00
19	0.01	0.01	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.06
20	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.06	0.00	0.28	0.00	0.07	0.00	0.00	0.00	0.00	0.01	0.00
22	0.00	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
23	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.36	0.06	0.27	0.03	0.00	0.05	0.00	0.00	0.00	0.00	0.00
25	0.00	0.02	0.10	0.20	0.04	0.00	0.15	0.00	0.00	0.00	0.00	0.00
26	0.03	0.22	0.20	0.03	0.00	0.00	0.14	0.00	0.00	0.00	0.05	0.00
27	T	0.01	0.20	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.03	0.00	0.45	0.00	0.00	0.08	0.00	0.00	0.00	0.04	0.00
29	0.00	0.45	0.11	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
30	0.02	0.00	0.00	0.00	0.00		0.00	0.00	0.08	0.00	0.00	0.04
31		0.00		0.00	0.00		0.00		0.17		0.00	0.01
TOTAL	0.75	2.13	2.84	2.66	2.52	1.04	1.43	0.30	0.43	1.02	0.63	0.19

Year to date 15.94

T = trace

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	0.56	21.84
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
2009-10	0.04	1.72	0.37	2.66	1.42	0.66	0.72	3.47	2.45	5.03	1.25	1.35	21.14
2010-11	1.71	0.74	2.77	1.69	2.43	1.61	0.87	2.25	3.20	4.48	0.99	0.24	22.98
2011-12	0.91	2.46	0.46	0.40	1.08	1.15	1.16	1.35	2.11	7.11	1.41	0.56	20.16
2012-13	0.75	2.46	1.66	1.84	0.67	0.20	0.66	2.12	3.29	2.76	0.03	0.93	17.37
2013-14	2.65	0.36	2.00	0.99	1.36	1.66	2.32	0.76	1.17	6.39	0.51	1.73	21.90
2014-15	0.75	2.13	2.84	2.66	2.52	1.04	1.43	0.30	0.43	1.02	0.63	0.19	15.94
MEAN	1.62	1.34	1.62	1.53	1.40	1.17	1.30	1.76	2.37	3.38	1.56	1.10	20.08

Mean monthly precipitation for all crop years = 1.68

YEAR 2015 - GROWING DEGREE DAYS JANUARY THROUGH OCTOBER
CALCULATED AT BASE 50, BASE 40, AND BASE 32
Page 1: January - May

January

	Temperatures		Growing Degree Days		
Day	MAX	MIN	Base 50	Base 40	Base 32
1	13	-2	0.0	0.0	0.0
2	14	-1	0.0	0.0	0.0
3	18	14	0.0	0.0	0.0
4	17	10	0.0	0.0	0.0
5	15	9	0.0	0.0	0.0
6	27	15	0.0	0.0	0.0
7	34	18	0.0	0.0	1.0
8	27	4	0.0	0.0	0.0
9	27	-11	0.0	0.0	0.0
10	15	-10	0.0	0.0	0.0
11	20	15	0.0	0.0	0.0
12	27	21	0.0	0.0	0.0
13	28	22	0.0	0.0	0.0
14	31	23	0.0	0.0	0.0
15	28	22	0.0	0.0	0.0
16	27	24	0.0	0.0	0.0
17	39	19	0.0	0.0	3.5
18	36	17	0.0	0.0	2.0
19	45	30	0.0	2.5	6.5
20	39	27	0.0	0.0	3.5
21	35	8	0.0	0.0	1.5
22	27	9	0.0	0.0	0.0
23	31	14	0.0	0.0	0.0
24	42	28	0.0	1.0	5.0
25	47	28	0.0	3.5	7.5
26	53	24	1.5	6.5	10.5
27	53	18	1.5	6.5	10.5
28	36	16	0.0	0.0	2.0
29	43	15	0.0	1.5	5.5
30	33	11	0.0	0.0	0.5
31	26	13	0.0	0.0	0.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
30.7	14.5	3.0	21.5	59.5

February

	Temperatures		Growing Degree Days		
Day	MAX	MIN	Base 50	Base 40	Base 32
1	27	15	0.0	0.0	0.0
2	29	15	0.0	0.0	0.0
3	37	22	0.0	0.0	2.5
4	41	24	0.0	0.5	4.5
5	38	26	0.0	0.0	3.0
6	46	31	0.0	3.0	7.0
7	52	31	1.0	6.0	10.0
8	45	39	0.0	2.5	10.0
9	50	29	0.0	5.0	9.0
10	41	33	0.0	0.5	5.0
11	43	34	0.0	1.5	6.5
12	45	31	0.0	2.5	6.5
13	45	33	0.0	2.5	7.0
14	56	28	3.0	8.0	12.0
15	50	28	0.0	5.0	9.0
16	46	22	0.0	3.0	7.0
17	45	18	0.0	2.5	6.5
18	41	20	0.0	0.5	4.5
19	43	21	0.0	1.5	5.5
20	45	23	0.0	2.5	6.5
21	38	28	0.0	0.0	3.0
22	38	12	0.0	0.0	3.0
23	31	12	0.0	0.0	0.0
24	33	17	0.0	0.0	0.5
25	38	19	0.0	0.0	3.0
26	44	19	0.0	2.0	6.0
27	38	12	0.0	0.0	3.0
28	34	10	0.0	0.0	1.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
41.4	23.3	4.0	49.0	141.5

March

	Temperatures		Growing Degree Days		
Day	MAX	MIN	Base 50	Base 40	Base 32
1	36	11	0.0	0.0	2.0
2	36	8	0.0	0.0	2.0
3	28	9	0.0	0.0	0.0
4	28	6	0.0	0.0	0.0
5	36	6	0.0	0.0	2.0
6	44	19	0.0	2.0	6.0
7	55	23	2.5	7.5	11.5
8	56	23	3.0	8.0	12.0
9	54	23	2.0	7.0	11.0
10	59	25	4.5	9.5	13.5
11	62	26	6.0	11.0	15.0
12	52	31	1.0	6.0	10.0
13	59	28	4.5	9.5	13.5
14	60	29	5.0	10.0	14.0
15	54	34	2.0	7.0	12.0
16	49	42	0.0	5.5	13.5
17	48	29	0.0	4.0	8.0
18	38	32	0.0	0.0	3.0
19	44	34	0.0	2.0	7.0
20	54	32	2.0	7.0	11.0
21	58	36	4.0	9.0	15.0
22	55	33	2.5	7.5	12.0
23	57	33	3.5	8.5	13.0
24	46	36	0.0	3.0	9.0
25	48	35	0.0	4.0	9.5
26	48	35	0.0	4.0	9.5
27	49	30	0.0	4.5	8.5
28	66	30	8.0	13.0	17.0
29	52	37	1.0	6.0	12.5
30	56	32	3.0	8.0	12.0
31	65	34	7.5	12.5	17.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
50.1	27.1	62.0	176.0	302.5

April

	Temperatures		Growing Degree Days		
Day	MAX	MIN	Base 50	Base 40	Base 32
1	52	35	1.0	6.0	11.5
2	49	30	0.0	4.5	8.5
3	43	28	0.0	1.5	5.5
4	49	28	0.0	4.5	8.5
5	44	23	0.0	2.0	6.0
6	51	25	0.5	5.5	9.5
7	47	33	0.0	3.5	8.0
8	52	25	1.0	6.0	10.0
9	58	25	4.0	9.0	13.0
10	58	27	4.0	9.0	13.0
11	61	40	5.5	10.5	18.5
12	52	29	1.0	6.0	10.0
13	48	27	0.0	4.0	8.0
14	62	30	6.0	11.0	15.0
15	46	34	0.0	3.0	8.0
16	51	27	0.5	5.5	9.5
17	59	29	4.5	9.5	13.5
18	67	36	8.5	13.5	19.5
19	61	33	5.5	10.5	15.0
20	60	30	5.0	10.0	14.0
21	66	36	8.0	13.0	19.0
22	70	35	10.0	15.0	20.5
23	58	32	4.0	9.0	13.0
24	56	35	3.0	8.0	13.5
25	55	29	2.5	7.5	11.5
26	55	34	2.5	7.5	12.5
27	55	31	2.5	7.5	11.5
28	62	32	6.0	11.0	15.0
29	73	38	11.5	16.5	23.5
30	64	35	7.0	12.0	17.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
56.1	31.0	104.0	242.0	382.0

May

	Temperatures		Growing Degree Days		
Day	MAX	MIN	Base 50	Base 40	Base 32
1	63	36	6.5	11.5	17.5
2	71	43	10.5	17.0	25.0
3	66	28	8.0	13.0	17.0
4	65	29	7.5	12.5	16.5
5	72	36	11.0	16.0	22.0
6	63	28	6.5	11.5	15.5
7	60	34	5.0	10.0	15.0
8	62	36	6.0	11.0	17.0
9	55	27	2.5	7.5	11.5
10	64	30	7.0	12.0	16.0
11	68	38	9.0	14.0	21.0
12	63	44	6.5	13.5	21.5
13	63	44	6.5	13.5	21.5
14	58	37	4.0	9.0	15.5
15	66	37	8.0	13.0	19.5
16	67	42	8.5	14.5	22.5
17	62	45	6.0	13.5	21.5
18	61	32	5.5	10.5	14.5
19	64	34	7.0	12.0	17.0
20	66	36	8.0	13.0	19.0
21	74	38	12.0	17.0	24.0
22	76	42	13.0	19.0	27.0
23	75	39	12.5	17.5	25.0
24	73	44	11.5	18.5	26.5
25	67	41	8.5	14.0	22.0
26	70	43	10.0	16.5	24.5
27	65	46	7.5	15.5	23.5
28	73	45	11.5	19.0	27.0
29	73	48	11.5	20.5	28.5
30	67	48	8.5	17.5	25.5
31	77	52	14.5	24.5	32.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
66.7	38.8	260.5	448.0	652.5

YEAR 2015 - GROWING DEGREE DAYS JANUARY THROUGH OCTOBER
CALCULATED AT BASE 50, BASE 40, AND BASE 32

Page 2: June - October

JUNE

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Growing Degree Days Base 40	Growing Degree Days Base 32
1	77	52	14.5	24.5	32.5
2	77	52	14.5	24.5	32.5
3	58	46	4.0	12.0	20.0
4	64	41	7.0	12.5	20.5
5	69	42	9.5	15.5	23.5
6	75	44	12.5	19.5	27.5
7	77	50	13.5	23.5	31.5
8	81	54	17.5	27.5	35.5
9	88	52	19.0	29.0	37.0
10	90	50	18.0	28.0	36.0
11	82	53	17.5	27.5	35.5
12	84	59	21.5	31.5	39.5
13	74	40	12.0	17.0	25.0
14	67	40	8.5	13.5	21.5
15	72	43	11.0	17.5	25.5
16	74	42	12.0	18.0	26.0
17	76	50	13.0	23.0	31.0
18	78	49	14.0	23.5	31.5
19	80	47	15.0	23.5	31.5
20	73	41	11.5	17.0	25.0
21	75	43	12.5	19.0	27.0
22	76	43	13.0	19.5	27.5
23	79	44	14.5	21.5	29.5
24	79	53	16.0	26.0	34.0
25	83	49	16.5	26.0	34.0
26	87	54	20.0	30.0	38.0
27	88	58	22.0	32.0	40.0
28	92	58	22.0	32.0	40.0
29	95	62	24.0	34.0	42.0
30	84	57	20.5	30.5	38.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
78.5	48.9	447.0	699.0	939.0

JULY

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Growing Degree Days Base 40	Growing Degree Days Base 32
1	88	56	21.0	31.0	39.0
2	87	58	22.0	32.0	40.0
3	87	54	20.0	30.0	38.0
4	90	56	21.0	31.0	39.0
5	93	56	21.0	31.0	39.0
6	93	40	18.0	23.0	31.0
7	76	48	13.0	22.0	30.0
8	73	46	11.5	19.5	27.5
9	83	49	16.5	26.0	34.0
10	86	52	19.0	29.0	37.0
11	88	58	22.0	32.0	40.0
12	69	61	15.0	25.0	33.0
13	79	54	16.5	26.5	34.5
14	75	54	14.5	24.5	32.5
15	73	45	11.5	19.0	27.0
16	75	50	12.5	22.5	30.5
17	72	M	11.0	16.0	20.0
18	64	42	7.0	13.0	21.0
19	77	49	13.5	23.0	31.0
20	84	53	18.5	28.5	36.5
21	86	53	19.5	29.5	37.5
22	86	M	18.0	23.0	27.0
23	82	48	16.0	25.0	33.0
24	82	51	16.5	26.5	34.5
25	83	53	18.0	28.0	36.0
26	79	49	14.5	24.0	32.0
27	72	M	11.0	16.0	20.0
28	59	49	4.5	14.0	22.0
29	73	M	11.5	16.5	20.5
30	81	M	15.5	20.5	24.5
31	87	47	18.0	26.5	34.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
80.1	51.2	470.0	727.5	947.5

AUGUST

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Growing Degree Days Base 40	Growing Degree Days Base 32
1	92	47	21.0	26.5	34.5
2	95	47	22.5	26.5	34.5
3	89	49	19.5	27.5	35.5
4	92	52	22.0	29.0	37.0
5	84	56	20.0	30.0	38.0
6	80	57	18.5	28.5	36.5
7	71	44	10.5	17.5	25.5
8	77	43	13.5	20.0	28.0
9	83	45	16.5	24.0	32.0
10	83	50	16.5	26.5	34.5
11	89	52	20.5	29.0	37.0
12	89	53	21.0	29.5	37.5
13	92	54	23.0	30.0	38.0
14	94	53	23.5	29.5	37.5
15	82	55	18.5	28.5	36.5
16	71	44	10.5	17.5	25.5
17	74	43	12.0	18.5	26.5
18	77	43	13.5	20.0	28.0
19	83	44	16.5	23.5	31.5
20	67	33	8.5	13.5	18.0
21	83	34	16.5	21.5	26.5
22	75	34	12.5	17.5	22.5
23	68	34	9.0	14.0	19.0
24	75	35	12.5	17.5	23.0
25	81	45	15.5	23.0	31.0
26	86	47	18.0	26.5	34.5
27	89	47	19.5	26.5	34.5
28	84	50	17.0	27.0	35.0
29	81	47	15.5	24.0	32.0
30	79	50	14.5	24.5	32.5
31	69	46	9.5	17.5	25.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
81.7	46.2	498.5	717.5	942.5

SEPTEMBER

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Growing Degree Days Base 40	Growing Degree Days Base 32
1	69	45	9.5	17.0	25.0
2	77	52	14.5	24.5	32.5
3	69	35	9.5	14.5	20.0
4	63	45	6.5	14.0	22.0
5	49	44	0.0	6.5	14.5
6	60	44	5.0	12.0	20.0
7	59	43	4.5	11.0	19.0
8	60	41	5.0	10.5	18.5
9	62	40	6.0	11.0	19.0
10	73	40	11.5	16.5	24.5
11	74	39	12.0	17.0	24.5
12	77	42	13.5	19.5	27.5
13	83	42	16.5	22.5	30.5
14	79	44	14.5	21.5	29.5
15	65	41	7.5	13.0	21.0
16	61	35	5.5	10.5	16.0
17	55	29	2.5	7.5	11.5
18	61	46	5.5	13.5	21.5
19	62	35	6.0	11.0	16.5
20	67	41	8.5	14.0	22.0
21	75	42	12.5	18.5	26.5
22	71	33	10.5	15.5	20.0
23	67	32	8.5	13.5	17.5
24	73	32	11.5	16.5	20.5
25	73	35	11.5	16.5	22.0
26	78	39	14.0	19.0	26.5
27	71	31	10.5	15.5	19.5
28	64	28	7.0	12.0	16.0
29	66	28	8.0	13.0	17.0
30	68	28	9.0	14.0	18.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
67.7	38.4	267.0	441.5	639.0

OCTOBER

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Growing Degree Days Base 40	Growing Degree Days Base 32
1	72	30	11.0	16.0	20.0
2	65	44	7.5	14.5	22.5
3	71	48	10.5	19.5	27.5
4	59	32	4.5	9.5	13.5
5	60	26	5.0	10.0	14.0
6	63	28	6.5	11.5	15.5
7	66	31	8.0	13.0	17.0
8	60	48	5.0	14.0	22.0
9	63	43	6.5	13.0	21.0
10	67	45	8.5	16.0	24.0
11	76	34	13.0	18.0	23.0
12	62	30	6.0	11.0	15.0
13	68	32	9.0	14.0	18.0
14	68	32	9.0	14.0	18.0
15	65	29	7.5	12.5	16.5
16	63	28	6.5	11.5	15.5
17	63	27	6.5	11.5	15.5
18	64	27	7.0	12.0	16.0
19	53	35	1.5	6.5	12.0
20	54	45	2.0	9.5	17.5
21	59	32	4.5	9.5	13.5
22	57	33	3.5	8.5	13.0
23	58	25	4.0	9.0	13.0
24	54	20	2.0	7.0	11.0
25	51	25	0.5	5.5	9.5
26	53	29	1.5	6.5	10.5
27	46	37	0.0	3.0	9.5
28	50	31	0.0	5.0	9.0
29	49	32	0.0	4.5	8.5
30	47	35	0.0	3.5	9.0
31	47	42	0.0	4.5	12.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
59.8	33.4	157.0	319.5	470.5

Julian Date Calendar for Year 2015

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	32	60	91	121	152	182	213	244	274	305	335
2	2	33	61	92	122	153	183	214	245	275	306	336
3	3	34	62	93	123	154	184	215	246	276	307	337
4	4	35	63	94	124	155	185	216	247	277	308	338
5	5	36	64	95	125	156	186	217	248	278	309	339
6	6	37	65	96	126	157	187	218	249	279	310	340
7	7	38	66	97	127	158	188	219	250	280	311	341
8	8	39	67	98	128	159	189	220	251	281	312	342
9	9	40	68	99	129	160	190	221	252	282	313	343
10	10	41	69	100	130	161	191	222	253	283	314	344
11	11	42	70	101	131	162	192	223	254	284	315	345
12	12	43	71	102	132	163	193	224	255	285	316	346
13	13	44	72	103	133	164	194	225	256	286	317	347
14	14	45	73	104	134	165	195	226	257	287	318	348
15	15	46	74	105	135	166	196	227	258	288	319	349
16	16	47	75	106	136	167	197	228	259	289	320	350
17	17	48	76	107	137	168	198	229	260	290	321	351
18	18	49	77	108	138	169	199	230	261	291	322	352
19	19	50	78	109	139	170	200	231	262	292	323	353
20	20	51	79	110	140	171	201	232	263	293	324	354
21	21	52	80	111	141	172	202	233	264	294	325	355
22	22	53	81	112	142	173	203	234	265	295	326	356
23	23	54	82	113	143	174	204	235	266	296	327	357
24	24	55	83	114	144	175	205	236	267	297	328	358
25	25	56	84	115	145	176	206	237	268	298	329	359
26	26	57	85	116	146	177	207	238	269	299	330	360
27	27	58	86	117	147	178	208	239	270	300	331	361
28	28	59	87	118	148	179	209	240	271	301	332	362
29	29		88	119	149	180	210	241	272	302	333	363
30	30		89	120	150	181	211	242	273	303	334	364
31	31		90		151		212	243		304		365

CEREALS

Title: Barley Off Station – 2015

Objective: To evaluate the agronomic performance of barley varieties grown in environments representative of northwestern Montana.

Results:

Yields averaged 127.1 bu/A and ranged from 87.2 bu/A for Haybet to 151.1 bu/A for Champion. Heading dates averaged 172 Julian days (June 21) and ranged from 168 to 177 Julian days. Protein averaged 13.4 % with a range from 11.8% for MT100120 to 15.3% for Haybet. Percent plump averaged 93.9% and ranged from 70.6% for Haybet to 98.2% for Merit. Lodging was not experienced in the entire nursery.

Summary:

The 2015 growing season afforded an average barley yield of 127.1 bu/A which is comparable to the average yield in 2014 of 128.3 bu/A.

Table 1. Materials and Methods - Barley Off Station - 2015

Seeding Date:	4/23/2015	Harvest Date:	8/6/2015
Julian Date:	113	Julian Date:	218
Seeding Rate:	80 lb/A	Soil Test:	144-12-222
Previous Crop:	Canola	Soil Type:	Creston Sil
Tillage:	Conventional	Fertilizer:	250-40-90
Irrigation:	None	Herbicide:	Huskie plus 11 floz/A & Axial 16.4 floz/A

Table 2. Barley Off Station, Kalispell, MT- 2015

Culitivar	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PLMP %
Champion	171	33.0	151.1	13.4	51.8	97.2
MT100120	174	35.3	150.9	11.8	53.7	97.9
Craft	169	34.7	143.2	13.5	51.8	96.5
MT100126	173	34.3	141.8	11.9	53.0	97.2
MT124027	174	34.0	134.7	12.4	50.0	94.9
Merit	174	33.7	131.7	13.6	50.9	98.2
MT124728	171	33.0	131.2	13.4	50.8	96.3
Haxby	170	32.0	127.9	13.1	51.8	93.4
Conrad	176	31.3	127.0	13.9	50.7	96.0
Hockett	169	32.0	126.8	13.3	50.3	95.4
Harrington	173	33.7	122.3	13.8	48.4	91.7
AC Metcalfe	173	33.7	119.9	13.8	48.7	91.4
Stockford	172	33.0	112.7	13.8	48.4	97.4
Moravian 115	177	29.0	112.6	12.8	47.0	95.4
Lavina	168	32.0	112.3	14.1	45.5	82.3
Haybet	171	34.7	87.2	15.3	45.3	70.6
Mean	172	33.1	127.1	13.4	49.9	93.3
CV	0.8	4.4	6.3	2.6	1.4	2.0
LSD	2.3	2.5	13.3	0.6	1.2	3.1
Pr>F	0.0001	0.002	0.0001	0.0001	0.0001	0.0001

HD: heading, HT: height, YLD: yield, PRO: protein, TWT: test weight, PLMP: percent plump

[1] adjusted to 13% moisture

[2] reported on a dry matter bases

Title: Hull-less Barley Evaluation – 2015

Objective: To evaluate the agronomic performance of hull-less barley varieties grown in environments representative of northwestern Montana.

Results:

Significant differences were observed for heading, height, yield, protein, test weight, and percent plump. Heading date averaged 172 Julian days (June 21), and ranged from 168 to 177 Julian days. The average height was 32.8 inches, ranging from 27.7 to 36.7 inches. Yields averaged 110.3 bu/A and ranged from 90.6 bu/A for PI596299 to 147.1 bu/A for X05013-T1. Protein averaged 15.1% and ranged from 13.3% for 09WA-265.12 to 16.8% for PI596299. Test weight averaged 58.4 lb/bu and ranged from 47.0 lb/bu for PI596299 to 60.1 lb/bu for both 09WA-265.12 and Goose 1. Percent plump averaged 73.9% and ranged from 39.8% for Goose 5 to 94.3% for X05013-T1.

Summary:

The highest yielding cultivars were X05013-T1 and 09WA-265.12.

Table 1. Materials and Methods - Hull-less Barley - 2015

Seeding Date:	4/23/2015	Harvest Date:	8/5/2015
Julian Date:	113	Julian Date:	217
Seeding Rate:	80 lb/A	Soil Test:	144-12-222
Previous Crop:	Canola	Soil Type:	Creston Sil
Tillage:	Conventional	Fertilizer:	250-40-90
Irrigation:	None	Herbicide:	Huskie plus 11 floz/A & Axial 16.4 floz/A

Table 2. Hull-less Barley, Kalispell, MT - 2015

Culitvar	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PLMP %
X05013-T1	173	33.7	147.1	14.2	59.2	94.3
09WA-265.12	175	33.7	140.6	13.3	60.6	90.3
MT110065	177	33.7	123.9	14.6	57.4	69.6
X07G30-T131	174	34.3	120.4	15.6	58.8	94.0
MT110066	174	32.7	116.7	15.1	57.9	66.2
X0626-T229	168	27.7	115.5	15.5	56.9	91.2
MT110016	173	32.7	113.0	14.8	58.6	86.3
MT110061	175	33.0	112.3	14.6	58.1	67.5
MT110008	175	33.7	108.7	14.4	59.1	90.0
MT110009	176	36.7	106.5	16.3	59.2	92.2
Goose 2	168	34.3	97.1	15.3	60.3	59.2
Goose 4	168	30.7	95.4	15.2	60.1	58.3
Goose 6	168	34.0	93.7	15.1	60.2	55.1
Goose 1	168	32.3	92.7	15.9	60.6	52.9
Goose 5	168	30.7	91.3	15.2	60.2	39.8
PI596299	169	31.7	90.6	16.8	47.0	74.8
Mean	172	32.8	110.3	15.1	58.4	73.9
CV	0.5	4.1	6.6	2.2	1.2	8.1
LSD	1.6	2.3	12.2	0.6	1.2	10.0
Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

HD: heading, HT: height, YLD: yield, PRO: protein, TWT: test weight, PLMP: percent plumps

[1] adjusted to 13% moisture

[2] reported on a dry matter bases

Title: Intrastate Barley Evaluation – 2015

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

Results:

Significant differences were observed for heading, height, and yield (Table 2). Values for protein, test weight, and percent plump were obtained from a single representative sample of each cultivar. Heading date averaged 171 Julian days (June 20) and ranged from 167 to 178 Julian days. Heights averaged 22.7 inches and ranged from 15.0 to 25.3 inches. Yield averaged 59.2 bu/A and ranged from 49.5 bu/A for MT124148 to 70.1 bu/A for Hockett. Protein averaged 14.5% with a range from 12.1% for MT124113 to 16.2% for Conrad and AC Metcalfe. Average test weight was 45.0 lb/bu and ranged from 39.6 lb/bu for Haybet to 47.5 lb/bu for Craft and MT124127. Percent plump averaged 83.3% ranging from 37.5% for Haybet to 94.9% for ME3.

Summary:

The highest yielding commercially available cultivars were Hocket, Conrad, Merit, Champion, and Craft.

Table 1. Materials and Methods - Intrastate Barley Evaluation - 2015

Seeding Date:	4/23/2015	Harvest Date:	8/4/2015
Julian Date:	113	Julian Date:	216
Seeding Rate:	80 lb/A	Soil Type:	Kalispell VFSL
Previous Crop:	Canola	Soil Test:	90-10-147
Tillage:	Conventional-till	Fertilizer:	244-10-70
Irrigation:	None	Herbicide:	Huskie plus 11 floz/A & Axial 16.4 floz/A

Table 2. Intrastate Barley Evaluation, Kalispell, MT - 2015.

Cultivar	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PLMP %
Hockett	169	22.7	70.1	14.1	46.4	93.9
MT124663	167	23.0	69.4	13.4	46.2	90.8
MT124113	167	24.0	69.3	12.1	46.5	92.0
MT124128	167	23.3	67.6	12.5	46.8	92.7
MT124134	167	22.7	66.7	12.2	46.8	94.3
ME5	173	23.0	66.3	14.4	44.8	92.7
MT124601	172	24.0	65.9	14.2	46.7	84.6
MT124457	171	23.7	65.4	14.5	47.0	91.8
Conrad	175	21.3	64.6	16.2	43.8	71.0
Merit	171	22.7	64.5	15.1	43.2	82.8
Champion	171	25.3	63.2	14.3	47.3	87.3
MT124073	173	23.3	62.7	15.0	45.6	87.0
MT124118	169	23.7	62.1	14.5	46.7	85.7
Craft	170	24.7	61.8	15.3	47.5	90.3
MT124555	171	23.0	61.7	14.3	46.7	92.2
MT124127	171	23.0	61.6	14.3	47.5	90.2
MT124677	168	15.0	61.5	13.7	45.7	83.6
MT124112	168	22.0	61.4	13.7	46.0	86.6
MT124728	172	21.3	60.7	14.5	44.1	77.0
MT124673	168	23.0	60.0	13.5	47.0	87.4
MT124016	176	22.7	59.9	13.8	43.3	84.7
MT124008	171	22.7	59.9	14.9	43.9	75.2
Lavina	169	23.0	59.9	15.4	41.4	56.5
MT124025	175	24.3	58.5	14.6	44.8	85.5
MT124645	170	22.3	58.3	15.0	44.8	86.8
Haxby	169	21.3	57.9	14.7	46.6	70.9
ME4	171	22.0	57.8	15.6	44.9	88.4
MT124069	172	22.3	57.7	15.1	45.0	85.3
ME3	169	23.7	57.7	14.2	45.8	94.9
MT124015	175	22.7	57.7	15.1	45.6	84.2
MT124454	170	23.7	57.2	15.0	46.1	81.5
ME2	169	22.3	57.2	15.0	46.0	84.9
MT124071	171	23.0	56.3	13.6	45.1	83.7
MT124370	178	22.0	55.8	14.3	44.6	81.7
MT124026	174	23.0	55.3	15.1	44.4	79.4

HD: heading, HT: height, YLD: yield, PRO: protein, TWT: test weight, PLMP: percent plump

[1] adjusted to 13% moisture

[2] reported on a dry matter bases

Table 2. continued

Cultivar	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PLMP %
Harrington	171	22.7	55.1	15.0	44.9	92.2
MT124716	174	22.0	54.9	15.3	43.4	73.3
AC Metcalfe	174	24.0	54.8	16.2	44.4	80.4
MT124361	171	22.7	54.8	14.4	45.5	78.8
MT124018	171	23.7	54.7	14.7	44.7	90.0
ME1	171	24.0	54.3	15.6	44.7	87.5
MT124027	176	21.7	54.1	14.5	43.4	82.3
MT124007	173	23.0	54.0	14.5	45.9	82.7
MT124001	171	23.7	53.8	15.1	43.2	72.4
MT124380	174	21.0	53.7	13.6	45.4	85.2
Moravian 115	173	21.0	51.9	15.7	40.4	88.4
Stockford	170	21.7	51.7	14.5	43.5	91.8
Haybet	168	22.7	51.0	15.3	39.6	37.5
MT124148	176	21.0	49.5	14.9	43.6	59.5
Mean	171	22.7	59.2	14.5	45.0	83.3
LSD	2.9	3.0	8.84	na	na	na

HD: heading, HT: height, YLD: yield, PRO: protein, TWT: test weight, PLMP: percent plump, na: nonreplicated data

[1] adjusted to 13% moisture

[2] reported on a dry matter bases

Title: Wild Oat Herbicide Screening Trial - 2015

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

Materials and Methods:

Twelve herbicides were applied to evaluate the consistency of wild oat control in spring wheat. The experimental design was a randomized complete block with three replications. Buckpronto hard red spring wheat was planted on a seven inch row spacing to a depth of two inches on April 15, at a rate of 120 lb/A. Wild oat was seeded in the center of each plot at a density of 30 seeds per square foot on April 17. Herbicide treatments were applied using a CO_2 backpack sprayer with Teejet XR11002 nozzles in 20 GPA of water. Spring wheat and wild oat plants were at the 2-tiller and 3-leaf stage, respectively, at the time of application. Crop injury and wild oat control were both evaluated at one, three, and five weeks after application. Spring wheat yield and test weight were determined on July 31.

Results:

The greatest crop injury was initially observed with the tank mix of Varro, Widematch, and Affinity TankMix. Nevertheless, all injury symptoms diminished within five weeks of application, regardless of the treatment applied. Most treatments afforded excellent control of wild oat. The most complete control was observed with the tank mix of Varro, Olympus, and Carnivor. However, Wolverine Advanced and Goldsky plus MCPA failed to provide statistically equivalent control. Grain yields were low due to the drought conditions experienced during the growing season. As a result, yield differences were not observed among treatments, despite the wide range in wild oat control.

Summary:

Overall, Varro provided excellent control of wild oat, regardless of the tank mix partner. Wolverine Advanced and Goldsky do not appear to be well suited for wild oat control in this region of Montana.

Table 1. Materials and Methods - Spring Wheat Wild Oats - 2015

Seeding Date:	4/17/2015	Harvest Date:	7/31/2015
Julian Date:	107	Julian Date:	212
Previous Crop:	Canola	Soil Type:	Creston Sil
Tillage:	Conventional	Soil Test:	116-16-278
Irrigation:	None	Fertilizer:	244-70-10, 6-30-20

Table1. Herbicide efficacy for wild oat control in spring wheat, Kalispell, MT.

Treatment		Percent Crop Injury 5/28	6/9	6/25	Percent Control Wild Oats 5/28	6/9	6/25	Yield[1] bu/A	PRO[2] %	TWT[1] %
check		0.0	0.0	0.0	0.0	0.0	0.0	39.2	14.7	59.1
Varro	6.9 oz/A	10.0	13.3	0.0	61.7	90.0	96.0	46.4	14.6	59.0
Bromac	1.0 pt/A									
Ammonium Sulfate	0.5 lb/A									
Varro	6.9 oz/A	26.7	20.0	0.0	68.3	93.3	98.3	41.4	14.9	59.3
Weld Herbicide	1.3 pt/A									
Ammonium Sulfate	0.5 lb/A									
Varro	6.9 oz/A	16.7	11.7	0.0	73.3	85.0	96.3	48.3	14.7	59.1
Carnivor Herbicide	1.0 pt/A									
Ammonium Sulfate	0.5 lb/A									
Varro	6.9 oz/A	11.7	15.0	0.0	70.0	91.7	89.3	41.9	14.9	59.2
Widematch	1.0 pt/A									
2, 4-D Ester	0.5 pt/A									
Ammonium Sulfate	0.5 lb/A									
Varro	6.9 oz/A	20.0	20.0	0.0	68.3	83.3	96.7	41.4	14.9	59.7
Widematch	1.0 pt/A									
MCPA Ester	0.5 pt/A									
Ammonium Sulfate	0.5 lb/A									
Varro	6.9 oz/A	30.0	18.3	0.0	55.0	93.3	98.0	37.1	15.2	58.8
Widematch	1.0 pt/A									
Affinity Tank mix	0.6 oz/A									
Ammonium Sulfate	0.5 lb/A									
Varro	6.9 oz/A	23.3	15.0	0.0	66.7	81.7	99.0	45.1	15.0	59.3
Olympus	0.2 oz/A									
Carnivor Herbicide	1.0 pt/A									
Ammonium Sulfate	0.5 lb/A									
Huskie Complete	13.7 oz/A	21.7	18.3	0.0	60.0	93.3	96.0	42.8	14.8	59.0
Ammonium Sulfate	0.5 lb/A									
Wolverine Advanced	27.4 oz/A	3.3	16.7	0.0	46.7	78.3	79.7	41.7	14.6	59.0
Everest 2.0	0.8 oz/A	6.7	15.0	0.0	60.0	90.0	95.0	41.7	14.7	59.3
Supremacy	4.5 oz/A									
NIS	0.3 % v/v									
Goldsky	1.0 pt/A	13.3	16.7	0.0	63.3	86.7	80.0	44.5	14.4	59.4
MCPA Ester	0.5 pt/A									
Axial XL	16.4 oz/A	6.7	10.0	0.0	56.7	81.7	97.3	44.9	14.4	59.2
Huskie	13.5 oz/A									
Mean		14.6	14.6	0.0	57.7	80.6	86.3	42.8	14.7	59.2
CV		42.3	40.0	0.0	25.3	12.2	8.1	9.5	1.2	0.6
LSD		10.4	9.9	ns	24.6	16.6	11.8	ns	0.3	ns
Pr>F		0.0001	0.0277	1.0000	0.0004	0.0001	0.0001	0.1400	0.0002	0.3579

PRO: protein, TWT: test weight

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Title: Evaluation of Abscisic Acid in Sprout Susceptible Spring Wheat - 2015

Objective: To evaluate foliar applications of abscisic acid (ABA), at three different growth stages and four use rates on two susceptible spring wheat varieties, for prevention of pre-harvest sprout.

Materials and Methods:

A commercial formulation of ABA was applied at three growth stages (boot, anthesis and soft dough), at four use rates (0.0, 0.5, 1.0, and 4.0 times the labeled rate) to two sprout-susceptible spring wheat varieties: Treasure soft white spring wheat and Vida hard red spring wheat. The experimental design was a split plot with four replications. Treasure and Vida were the whole plot treatments, while ABA rate and timing combinations were the sub-plot effects. The study was irrigated when the plants reached physiological maturity to enhance preharvest sprout. Approximately 0.30 inches of water was applied by hand-lines on August 7, 10, 11, and 13.

Results:

Significant difference were observed for the two spring wheat varieties (Table 4). Treasure was later to mature and was shorter than Vida. Treasure also produced the highest grain yield, but had lower protein, test weight, thousand kernel weight, and falling number values.

ABA had minimal effect on plant growth, yield or grain quality. Heading occurred later as application timing was delayed (Table 2). In addition, protein increased as ABA rate increased (Table 3). However, ABA did not impact falling number.

Summary:

Applications of ABA had minimal impact on wheat growth and development and failed to have any effect on falling number.

Table 1. Materials and Methods - Evaluation of Abscisic Acid in Sprout Susceptible Spring Wheat - 2015

Seeding Date:	4/21/2015	Harvest Date:	8/14/2015
Julian Date:	111	Julian Date:	226
Previous Crop:	Canola	Fertilizer:	250-40-90
Tillage:	Conventional	Herbicide:	Huskie Complete 13.7oz/A
Soil Type:	Creston SiL	Insecticide:	Warrior II 1.92 floz/A
Soil Test:	144-12-222	Fungicide:	Quadris 6 floz/A

Table 2. Main effect of application timing on the agronomic performance of spring wheat - 2015

Timing	HD	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN
	Julian	in	%	bu/A	%	lb/bu	g	sec
Flag Leaf	170.6	34.0	0.0	123.8	12.0	61.1	39.8	324.6
Anthesis	171.0	33.7	0.3	122.9	12.0	61.3	39.6	325.0
Soft Dough	171.7	33.4	0.8	121.8	12.0	61.2	39.3	329.1
LSD	0.8	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.0484	0.4970	0.4219	0.9088	0.9111	0.8503	0.8687	0.7609

Table 3. Main effect of application rate on the agronomic performance of spring wheat - 2015

Rate of ConTego	HD	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN
lb ai/A	Julian	in	%	bu/A	%	lb/bu	g	sec
Check	171.3	33.9	1.3	122.3	11.9	61.3	39.5	325.9
0.078	171.1	33.5	0.0	122.2	11.9	61.2	39.3	324.5
0.156	171.1	33.9	0.2	125.4	12.0	61.2	39.7	324.6
0.624	170.9	33.5	0.0	121.5	12.1	61.2	39.9	330.0
LSD	ns	ns	ns	ns	0.2	ns	ns	ns
Pr>F	0.4812	0.5206	0.2350	0.3450	0.0431	0.5965	0.3448	0.3809

Table 4. Main effect of variety on the agronomic performance of spring wheat -2015

Variety	HD	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN
	Julian	in	%	bu/A	%	lb/bu	g	sec
Vida	169.3	34.5	0.1	118.9	13.5	61.4	39.8	341.7
Treasure	172.9	32.9	0.6	126.8	10.5	61.0	39.4	310.8
LSD	0.4	0.5	ns	1.5	0.1	0.1	0.4	6.1
Pr>F	0.0001	0.0001	0.2825	0.0001	0.0001	0.0001	0.0266	0.0001

HD: heading date, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Table 5. Effect of application timing and rate on the agronomic performance of spring wheat -2015

Timing	HD Julian	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec
				Check				
Flag Leaf	171.1	34.0	0.0	123.4	12.0	61.1	39.4	324.4
Anthesis	171.1	34.3	1.3	124.4	11.7	61.4	39.6	330.3
Soft Dough	171.8	33.4	2.5	119.3	11.9	61.3	39.5	322.8
				0.078 lbai/A				
Flag Leaf	170.5	34.3	0.0	126.9	11.9	61.1	39.7	325.3
Anthesis	170.9	33.1	0.0	120.4	11.9	61.3	39.3	321.6
Soft Dough	172.0	33.1	0.0	119.2	11.8	61.3	39.0	326.6
				0.156 lbai/A				
Flag Leaf	170.6	34.0	0.0	126.3	12.0	61.1	39.8	322.0
Anthesis	170.9	33.8	0.0	125.8	12.2	61.2	40.0	321.7
Soft Dough	171.8	33.9	0.6	124.1	11.9	61.2	39.3	330.0
				0.624 lbai/A				
Flag Leaf	170.3	33.9	0.0	118.8	12.1	61.3	40.4	326.7
Anthesis	171.0	33.6	0.0	120.9	12.2	61.2	39.6	326.3
Soft Dough	171.4	33.1	0.0	124.8	12.1	61.0	39.5	337.1
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.8455	0.6349	0.8008	0.2762	0.5693	0.4385	0.7145	0.4526

Table 6. Effect of variety and application timing on the agronomic performance of spring wheat -2015

Timing	HD Julian	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec
				Vida				
Flag Leaf	168.8	34.9	0.0	119.3	13.5	61.4	40.2	339.3
Anthesis	169.3	34.5	0.0	117.8	13.5	61.5	39.5	342.0
Soft Dough	169.9	34.1	0.3	119.7	13.4	61.5	39.8	343.7
				Treasure				
Flag Leaf	172.5	33.1	0.0	128.4	10.5	60.9	39.5	309.9
Anthesis	172.6	32.9	0.6	127.9	10.5	61.1	39.7	307.9
Soft Dough	173.6	32.6	1.3	124.0	10.5	60.9	38.9	314.5
LSD	ns	ns	ns	2.6	ns	ns	ns	ns
Pr>F	0.6482	0.8530	0.7187	0.0057	0.6432	0.2928	0.0791	0.7592

HD: heading date, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Table 7. Effect of variety and application rate on the agronomic performance of spring wheat -2015

Rate of ConTego lb ai/A	HD Julian	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec
				Vida				
Check	169.6	35.0	0.0	118.6	13.4	61.5	39.7	340.3
0.078	169.1	34.3	0.0	117.3	13.3	61.4	39.3	337.6
0.156	169.3	34.5	0.4	121.4	13.5	61.4	40.1	340.0
0.624	169.3	34.3	0.0	118.4	13.6	61.4	40.2	348.9
				Treasure				
Check	173.1	32.8	2.5	126.1	10.4	61.0	39.3	311.4
0.078	173.2	32.8	0.0	127.1	10.4	61.0	39.3	311.4
0.156	172.8	33.3	0.0	129.4	10.6	60.9	39.3	309.2
0.624	172.5	32.8	0.0	124.6	10.6	61.0	39.5	311.1
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.5382	0.4594	0.1386	0.4064	0.9948	0.8455	0.4985	0.5713

HD: heading date, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Table 8. Effect of variety, timing, and application rate on the agronomic performance of spring wheat -2015

Rate of ConTego lb ai/A	HD Julian	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec
Vida & Flag leaf								
Check	169.3	35.3	0.0	120.6	13.5	61.3	39.5	338.1
0.078	168.3	35.3	0.0	121.2	13.4	61.3	39.7	340.0
0.156	169.0	34.3	0.0	120.6	13.6	61.4	40.3	334.2
0.624	168.5	35.0	0.0	114.8	13.6	61.5	41.2	345.1
Vida & Anthesis								
Check	169.5	35.5	0.0	117.6	13.2	61.6	39.7	346.7
0.078	169.0	33.8	0.0	115.1	13.3	61.4	38.9	336.6
0.156	169.5	34.5	0.0	120.1	13.6	61.4	40.0	337.0
0.624	169.3	34.3	0.0	118.5	13.7	61.4	39.6	347.9
Vida & Soft Dough								
Check	170.0	34.3	0.0	117.5	13.4	61.7	39.9	336.3
0.078	170.0	33.8	0.0	115.8	13.3	61.5	39.3	336.2
0.156	169.5	34.8	1.3	123.4	13.4	61.4	39.9	348.6
0.624	170.0	33.8	0.0	122.0	13.5	61.3	40.0	353.9
Treasure & Flag leaf								
Check	173.0	32.8	0.0	126.1	10.5	60.9	39.3	310.8
0.078	172.8	33.3	0.0	132.7	10.4	60.9	39.6	310.7
0.156	172.3	33.8	0.0	131.9	10.5	60.8	39.2	309.8
0.624	172.0	32.8	0.0	122.9	10.6	61.1	39.7	308.3
Treasure & Anthesis								
Check	172.8	33.0	2.5	131.1	10.3	61.3	39.6	314.0
0.078	172.8	32.5	0.0	125.8	10.5	61.1	39.7	306.7
0.156	172.3	33.0	0.0	131.5	10.8	61.0	40.0	306.3
0.624	172.8	33.0	0.0	123.3	10.6	61.1	39.7	304.7
Treasure & Soft Dough								
Check	173.5	32.5	5.0	121.1	10.4	60.9	39.2	309.4
0.078	174.0	32.5	0.0	122.7	10.3	61.0	38.7	316.9
0.156	174.0	33.0	0.0	124.7	10.5	61.0	38.8	311.4
0.624	172.8	32.5	0.0	127.6	10.7	60.8	39.1	320.3
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.6953	0.7567	0.6404	0.1486	0.9565	0.9192	0.9437	0.9582

HD: heading date, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Title: Fungicide evaluation in spring wheat – 2015

Objective: To evaluate the effects of fungicides and application timing on stripe rust control in spring wheat.

Results:

The efficacy of three fungicides were evaluated for the control of stripe rust in spring wheat. Fungicides were applied at the three tiller (3T) stage on June 5th, and at early boot (EB) on June 17th, or sequentially at 3T and EB (Table 2). The experimental design was a randomized complete block with three replications.

Stripe rust infection level was low, with the non-treated check experiencing 30% infection. As a result, no significant differences in stripe rust control were detected among the treatments. Nevertheless, significant differences were observed for yield. Prosaro applied at 6.5 fl oz/A at EB afforded the greatest yield at 77.8 bu/A, which was significantly greater than the non-treated check at 56.2 bu/A. All other treatments produced yields equivalent to the non-treated check.

Summary:

Dry weather conditions kept stripe rust infection levels low and prevented an accurate determination of fungicide efficacy.

Table 1. Materials and Methods - Efficacy of Fungicide on Spring Wheat, Kalispell - 2015

Seeding Date:	5/6/2015	Harvest Date:	8/11/2015
Julian Date:	126	Julian Date:	223
Seeding Rate:	110 lbs/A	Soil Type:	Creston SiL
Previous Crop:	Spring Wheat	Soil Test:	431-40-258
Tillage:	Conventional	Fertilizer:	0-30-0
Irrigation:	None	Herbicide:	Huskie Complete 13.7 oz/A

Table 2. Efficacy of fungicide application rate and timing in the control of stripe rust in spring wheat.

Treatment	Rate	Timing	SR %	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] %
Check			30.0	0.0	56.2	12.7	60.8
Stratego	4 fl oz/A	3T	19.3	0.0	65.5	12.5	61.2
induce 90 SL	0.13 % v/v						
Prosaro 421 SC	5 fl oz/A	EB	2.7	0.0	64.2	12.9	61.3
induce 90 SL	0.13 % v/v						
Prosaro 421 SC	6.5 fl oz/A	EB	2.7	0.0	77.8	13.5	62.1
induce 90 SL	0.13 % v/v						
Stratego	4 fl oz/A	3T	2.3	0.0	60.9	12.8	61.4
induce 90 SL	0.13 % v/v						
Prosaro 421 SC	6.5 fl oz/A	EB					
induce 90 SL	0.13 % v/v						
Headline	6 fl oz/A	EB	3.7	0.0	69.8	13.2	61.7
Mean			10.1	0.0	65.7	12.9	61.4
CV			193.4	0.0	9.2	5.3	1.4
LSD			ns	ns	11.0	ns	ns
Pr>F			0.4235	1.0000	0.0201	0.5648	0.5757

SR: stripe rust, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight

ns: nonsignificant

[1] adjusted to 13%, [2] adjusted to 12%

3T = 3 tiller on June 5, EB = early boot on June 17

Project Title:	Nitrogen use response of irrigated and dryland spring wheat
Project Leader:	Jessica Torrion (PI), Bob Stougaard (Co-PI)
Project Personnel:	John Garner, Brooke Bohannon
Objective:	To evaluate variety-specific nitrogen use response of irrigated spring wheat for agronomic performance.

Eight spring wheat cultivars were grown under four different nitrogen levels as a split plot, randomized complete block design, with four replications, where nitrogen levels represent the whole plot factor and the spring wheat varieties were the sub plot factor. The four nitrogen treatments included no added fertilizer and 150, 281, and 412 pounds/A, respectively, based on soil test N levels plus supplemental N fertilization. For the irrigated study, irrigation was applied when necessary to keep soil moisture from falling below 50% of the plant available water. Other agronomic management procedures are detailed in Table 1.

Table 1. Agronomic management for irrigated and dryland experiments

Seeding Date:	4/22/15	Herbicide:	5/20/15
Julian Date:	112		13.7 fl oz/A Huskie complete + 0.5 lb/A AMS
Seeding Rate:	20 plnts/sqft	Pesticide:	6/19/15
Previous Crop:	Canola		12 fl oz/A Quadris + 1.92 fl oz/A Warrior II
Tillage:	Conventional	Harvest Date:	8/5/2015 (Dryland)
Soil Type:	Fine sandy loam	Julian Date:	217
Soil Test:	19-6-111	Harvest Date:	8/12/2015 (Irrigated)
Fertilizer:	___-48-115	Julian Date:	224

Irrigated

Nitrogen treatment had significant effect on physiological maturity, moisture content, yield, protein, and test weight (Table 2). Volt had the highest yield at 106.3 bu/A with 281 lbs N, while Cabernet had the least yield at 57.8 bu/A with 412 lbs N. The 150 lbs/A total N consistently showed yield response across varieties. Except for Volt and McNeal, the 281 lbs N/A reduced yield. The highest N at 412 lbs/A significantly reduced yields (Figure 2).

The known inverse relationship between yield and protein is evident (Figure 1 and 2). Increased N supply consistently increased protein across varieties with irrigation. For irrigated spring wheat, test weights has inverse relation with N supply. The lower the N supply the higher the test weight, as N supply increased, test weight decreased (Figure 3). Increased N beyond 150 lbs/A is not economically justifiable with this year's protein premium/discount. Plant height, seed size, thousand kernel weight and falling number were not influenced by the N treatment, but appeared strongly related to variety.

Table 2. Effect of N levels to agronomic performance of irrigated spring wheat — 2015

Variety	HT in	PM* days	SS seeds/lb	MC %	YLD bu/A	PRO %	TWT lb/bu	TKW g	FN sec
19 lbs N (no added fertilizer)									
Brennan	22.5	83	12484	4.4	64.8	14.4	63.4	36.4	424
Buck Pronto	26.5	82	10483	5.1	75.8	13.0	63.2	43.4	370
Cabernet	22.5	83	11525	5.3	79.5	12.2	63.6	39.5	317
Expresso	25.8	84	11270	5.1	75.2	13.8	63.2	40.3	303
McNeal	27.5	83	10863	5.3	78.5	11.8	62.6	41.9	508
Solano	22.5	84	10537	5.5	81.8	13.2	63.7	43.2	360
Volt	28.3	85	12015	5.9	87.6	12.0	64.4	37.9	390
WB Rockland	23.3	84	10468	4.6	68.3	14.6	62.8	43.4	307
150 lbs N (soil + fertilizer)									
Brennan	22.3	86	12059	5.3	78.5	15.0	63.4	37.6	398
Buck Pronto	26.5	85	10352	6.2	91.9	13.8	62.7	43.9	375
Cabernet	22.0	84	11521	6.0	88.5	12.6	63.6	39.5	316
Expresso	27.5	86	10879	7.0	104.4	13.9	62.5	41.9	306
McNeal	29.5	86	10796	6.8	101.8	13.2	62.5	42.2	457
Solano	25.3	86	10679	6.7	99.1	13.9	63.0	42.5	350
Volt	28.0	86	12150	6.8	101.2	12.7	64.0	37.5	369
WB Rockland	24.5	86	10357	6.3	93.4	15.0	62.3	43.8	341
281 lbs N (soil + fertilizer)									
Brennan	23.0	85	12025	4.9	72.2	16.0	62.2	37.8	383
Buck Pronto	26.8	85	9828	5.9	87.3	15.1	60.9	46.2	360
Cabernet	21.8	85	11415	5.7	85.2	13.9	62.5	39.8	319
Expresso	26.3	87	10931	6.9	102.3	15.0	60.7	41.5	301
McNeal	32.0	87	10387	6.9	102.8	14.2	60.5	43.8	461
Solano	25.5	87	10573	6.6	98.3	14.8	61.1	42.9	358
Volt	28.3	87	11780	7.2	106.3	13.8	62.4	38.6	366
WB Rockland	24.0	87	10213	6.2	92.2	16.1	60.1	44.5	328
412 lbs N (soil + fertilizer)									
Brennan	23.8	86	12113	4.2	62.4	16.3	61.4	37.5	409
Buck Pronto	26.0	84	10113	5.4	80.3	14.9	60.3	44.9	367
Cabernet	23.0	86	11384	3.9	57.8	14.2	61.8	40.0	331
Expresso	24.8	86	11081	5.7	84.4	15.3	59.9	41.0	295
McNeal	27.8	87	10246	6.4	94.2	14.6	60.1	44.3	461
Solano	24.8	86	10706	5.8	86.7	15.2	61.1	42.4	342
Volt	26.0	86	11926	6.4	95.3	14.1	62.8	38.1	361
WB Rockland	24.8	87	10149	5.3	79.1	16.7	59.8	44.7	315
C.V	12.3	2.2	8.0	16.1	17.0	9.6	2.7	7.8	15.5
LSD	ns	1.8	ns	0.8	11.8	0.8	2.0	ns	ns
$Pr>F_{(0.05)-N}$	0.107	0.003	0.088	0.002	0.002	<.0001	0.009	0.105	0.291
$Pr>F_{(0.05)-Var}$	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
$Pr>F_{(0.05)-N \times Var}$	0.168	0.936	0.801	0.121	0.127	0.134	0.843	0.607	0.002

HT: height, PM: physiological maturity *(duration from emergence), SS: seed size, MC: moisture content, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, ns: nonsignificant

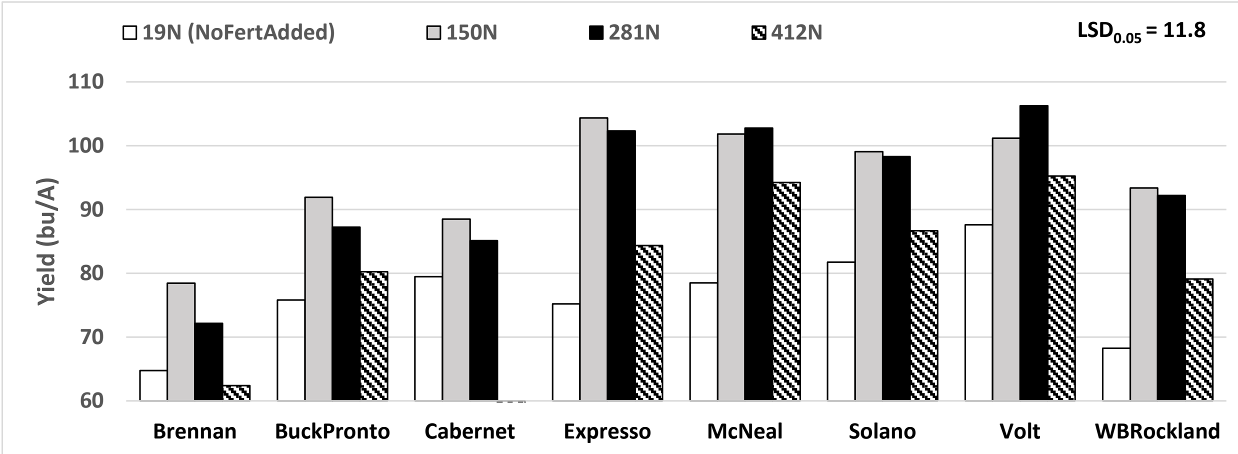

Figure 1. Yield response to N levels of an irrigated spring wheat on fine sandy loam soil, Creston, MT.

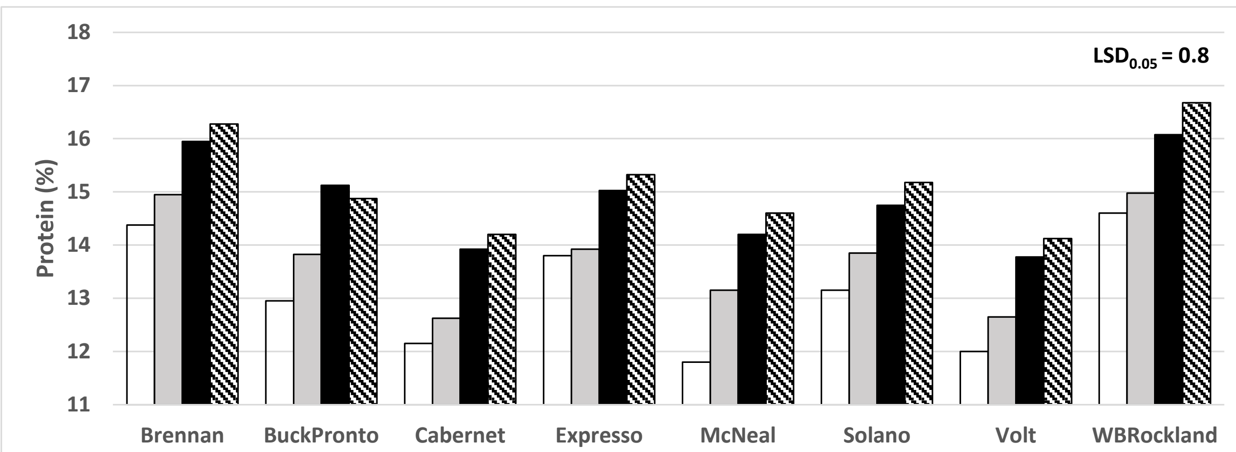

Figure 2. Protein response to N levels of an irrigated spring wheat, fine sandy loam soil, Creston, MT

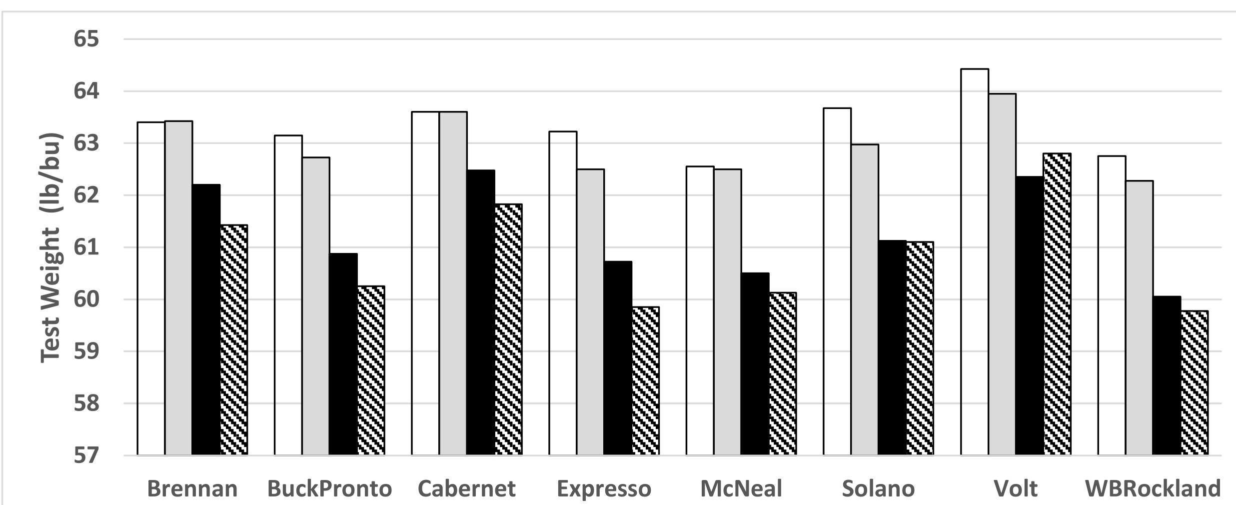

Figure 3. Test weight response to N levels of an irrigated spring wheat, fine sandy loam soil, Creston, MT

Dryland

No yield response for N application was observed due to extreme drought year. Volt had the highest yield and Brennan had the least. Nitrogen treatment had significant effect on increased protein up to 150 lbs N/A (Table 3). Despite protein advantage at 150 lbs N/A, application of N during such dry season on fine sandy loam soil with only 4.7 inches plant available water (PAW) cannot be justified (root zone 50% PAW at planting + rainfall, see Figure 5).

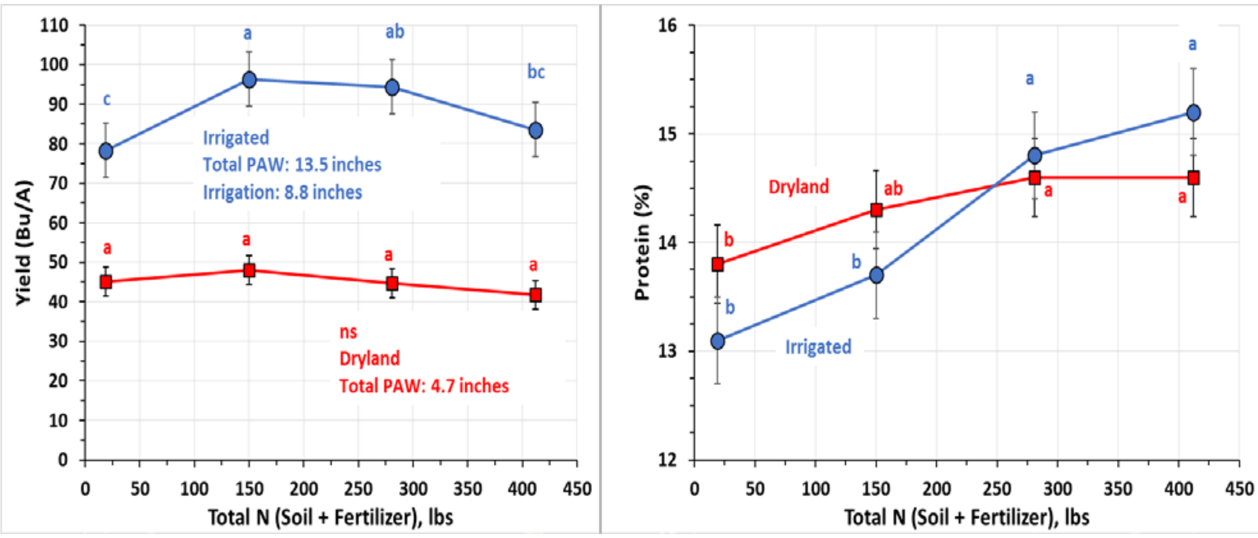

Figure 4. Spring wheat yield response to total N supply per water regime (left) and their corresponding protein quality (right). *Same letter assignment indicates that they are not significantly different*.

Adjusted Gross Return for Irrigated and Dryland N Study

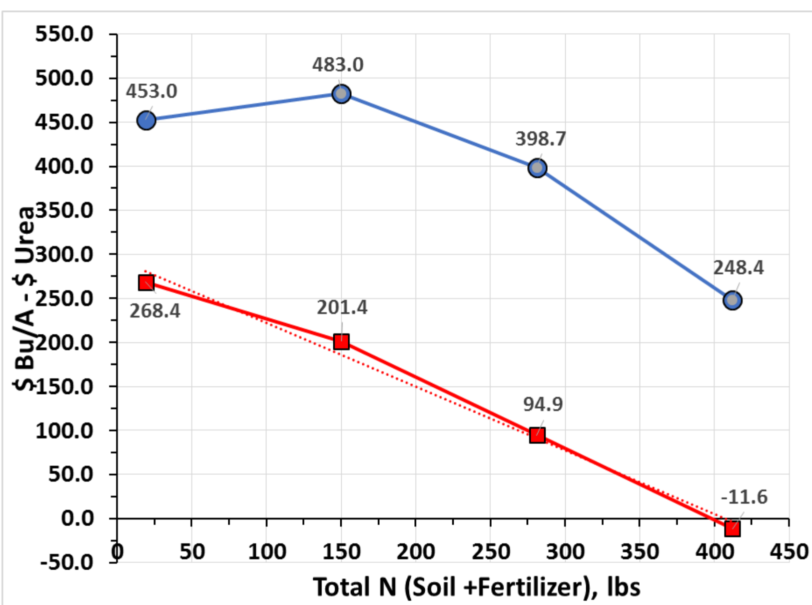

Figure 5. Adjusted gross return of N application for two water regimes.

For irrigated spring wheat in 2015, adjusted gross returns diminished with N application resulting to more than 150 lbs total N. For dryland spring, N application did not provide any economic advantage (Figure 5) despite the increased protein with N supply (Figure 4, right). Thus, for extreme drought like this year, reduction of N input should be considered.

Table 3. Effect of N levels to agronomic performance of dryland spring wheat — 2015

Variety	HT in	PM* days	SS seeds/lb	MC %	YLD bu/A	PRO %	TWT lb/bu	TKW g	FN sec
19 lbs N (no added fertilizer)									
Brennan	19.9	76	14800	9.5	40.7	14.1	62.5	30.9	459
Buck Pronto	22.2	77	13103	9.6	44.6	13.7	61.5	34.8	420
Cabernet	17.6	76	14134	10.0	43.9	13.3	62.2	32.4	343
Expresso	22.0	78	13250	11.0	47.5	14.3	61.6	34.3	307
McNeal	23.8	77	14031	10.3	45.2	13.0	60.8	32.4	537
Solano	21.8	77	12524	10.3	49.4	13.9	62.2	36.3	390
Volt	23.0	78	14717	11.5	49.9	12.7	62.8	30.9	418
WB Rockland	19.6	79	12311	10.6	39.8	15.0	61.5	36.9	315
150 lbs N (soil + fertilizer)									
Brennan	19.9	76	15644	9.4	41.9	14.5	62.3	29.0	455
Buck Pronto	22.1	76	13458	9.5	46.1	14.2	61.1	33.8	407
Cabernet	17.3	76	14841	9.5	42.6	13.8	61.6	30.6	348
Expresso	22.4	79	13283	10.2	52.8	15.1	62.0	34.2	322
McNeal	23.3	78	13821	9.9	49.4	13.7	60.7	32.8	507
Solano	21.2	77	12375	10.0	51.4	14.7	61.8	36.6	388
Volt	23.5	78	14128	9.9	53.9	13.0	63.6	32.6	433
WB Rockland	20.9	78	12481	9.8	45.7	15.5	61.7	36.4	341
281 lbs N (soil + fertilizer)									
Brennan	19.9	76	15313	10.1	37.7	15.0	61.9	29.7	424
Buck Pronto	21.9	76	12776	10.0	42.8	14.6	60.9	35.6	411
Cabernet	17.5	77	13493	10.6	40.2	14.1	61.6	33.9	338
Expresso	21.9	78	12864	11.4	48.0	15.1	61.2	35.4	301
McNeal	24.6	77	13728	11.8	46.4	14.1	59.9	33.1	507
Solano	20.8	79	12272	11.4	43.3	14.8	61.5	37.1	360
Volt	23.1	79	14320	12.0	55.9	13.3	62.5	31.7	388
WB Rockland	21.0	79	12042	11.1	43.5	15.8	61.2	37.8	314
412 lbs N (soil + fertilizer)									
Brennan	20.3	77	15098	9.8	35.8	15.1	62.0	30.1	415
Buck Pronto	23.0	76	12781	9.9	40.7	14.7	61.0	35.5	397
Cabernet	17.8	76	14032	10.1	37.5	14.0	61.8	32.4	326
Expresso	23.0	79	13032	12.1	44.0	15.4	60.5	34.8	276
McNeal	23.9	78	13280	11.7	45.5	14.3	60.5	34.2	523
Solano	21.0	78	12533	11.1	45.3	14.9	61.5	36.2	352
Volt	23.6	79	14635	10.8	47.4	13.3	63.0	31.0	404
WB Rockland	20.8	78	11963	12.4	37.3	15.1	60.7	38.0	301
C.V	10.5	1.8	8.9	12.6	15.5	6.4	1.6	8.9	18.3
LSD	ns	ns	ns	ns	ns	0.6	ns	ns	ns
$Pr>F_{(0.05)-N}$	0.699	0.450	0.259	0.275	0.357	0.007	0.247	0.262	0.123
$Pr>F_{(0.05)-Var}$	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
$Pr>F_{(0.05)-N \times Var}$	0.921	0.469	0.651	0.087	0.288	0.822	0.082	0.670	0.012

HT: height, PM: physiological maturity *(duration from emergence), SS: seed size, MC: moisture content, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, ns: nonsignificant

Title: Effect of Actigard on Wheat Resistance to Orange Wheat Blossom Midge – 2015.

Objective: To evaluate the efficacy of Actigard for the control of OWBM in susceptible and resistant spring wheat cultivars.

Materials and Methods:

Spring wheat varieties containing the Sm1 gene for resistance to the wheat midge are available to aid in their control. However, some damage is incurred prior to the synthesis of the active compound. This study was designed to determine if treatment with Actigard prior to larval feeding could upregulate the Sm1 gene and shorten the lag phase. This study was established as a split plot design with three replications. Egan, a cultivar with resistance to the OWBM, and McNeal, a non-resistant cultivar were the whole plot treatments. Actigard was applied to both varieties at three rates and at three wheat growth stages. Actigard was applied at 0.0, 0.25, and 0.50 oz/A when wheat was at the late boot stage, 50% headed, and 50% flowering growth stages. Lorsban was applied at 50% heading to serve as a control.

Results:

The study site experienced severe drought and low midge pressure. As a result, any treatment affects that might have been present were largely masked by these environmental conditions. However, a few treatment effects were detected, and were largely associated with differences between the two spring wheat varieties. Spring wheat yields averaged 20.4 bu/A, with McNeal producing slightly higher yields that Egan (21.0 and 19.9 bu/A, respectively). Egan had greater protein and higher falling number values, but McNeal had higher test weight and greater thousand kernel weight. Most importantly, midge larvae were not detect in the heads of Egan, while McNeal averaged 0.037 larvae per head. There was a trend in the data (Pr=0.0536) which indicated a slight yield increase for the Actigard and Lorsban treatments, compared to the non-treated check. However, the timing of Actigard treatments had no impact on any of the variables measured.

Summary:

Record breaking drought and low midge populations prevented an accurate assessment of Actigard for improving crop resistance against the orange wheat blossom midge.

Table 1. Materials and Methods - Sm1 Actigard - 2015

Seeding Date:	5/6/2015	Harvest Date:	8/12/2015
Julian Date:	125	Julian Date:	224
Seeding Rate:	80 lb/A	Soil Type:	Somers Silty Clay Loam
Previous Crop:	Spring Wheat	Fertilizer (PP):	23-55-30-22
Tillage:	Conventional	Fertilizer (TD):	1.4Zn-200N
Irrigation:	None	Pesticide:	None

PP: pre-plant, TD: top dress

Table 2. Main effect of application timing

Timing	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec	OWBM no/ spk
Late Boot	20.0	0.0	21.2	17.4	54.0	24.8	525.0	0.0
50% Heading	19.8	0.0	20.0	17.4	54.3	24.8	533.7	0.0
50% Flowering	19.7	0.0	20.1	17.4	54.1	24.8	533.9	0.0
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.4718	1.0000	0.3878	0.9582	0.4585	0.9048	0.3941	0.2999

Table 3. Main effect of insecticide application

Insecticide	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec	OWBM no/ spk
check	19.8	0.0	18.4	17.3	54.3	24.9	522.3	0.0
Actigard 0.25	19.6	0.0	20.3	17.6	54.1	24.6	534.0	0.0
Actigard 0.50	20.1	0.0	21.0	17.3	54.3	25.2	527.4	0.0
Lorsban 1.0	19.8	0.0	22.1	17.4	53.9	24.6	539.7	0.0
LSD	ns	ns	2.6	ns	ns	ns	ns	ns
Pr>F	0.6174	1.0000	0.0536	0.7255	0.3437	0.4648	0.1628	0.5609

Table 4. Main effect of variety

Variety	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec	OWBM no/ spk
Egan	19.6	0.0	19.9	18.2	53.3	23.5	540.7	0.0
McNeal	20.0	0.0	21.0	16.6	55.0	26.1	521.1	0.0
LSD	ns	ns	0.9	0.2	0.2	0.4	9.2	0.0
Pr>F	0.1869	1.0000	0.0189	0.0001	0.0001	0.0001	0.0002	0.0429

HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, OWBM: orange wheat blossom midge, ns: nonsignificant
[1]adjusted to 13% moisture, [2]adjusted to 12%

Table 5. Effect of application timing and insecticide application

	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN	OWBM
	in	%	bu/A	%	lb/bu	g	sec	no/ spk
				check				
Late Boot	19.7	0.0	18.2	17.3	54.6	25.6	521.6	0.0
50% Heading	19.8	0.0	18.4	17.6	54.0	24.3	525.3	0.0
50% Flowering	19.8	0.0	18.6	17.1	54.4	24.6	520.1	0.1
				Actigard .25				
Late Boot	19.3	0.0	20.1	17.6	53.9	24.4	526.2	0.0
50% Heading	19.5	0.0	20.7	17.4	54.2	24.7	534.7	0.0
50% Flowering	19.8	0.0	20.1	17.8	54.1	24.6	541.2	0.1
				Actigard .50				
Late Boot	20.7	0.0	23.2	17.4	53.8	24.5	519.2	0.1
50% Heading	19.7	0.0	18.7	17.6	54.7	25.8	537.6	0.0
50% Flowering	19.8	0.0	21.1	16.9	54.3	25.4	525.5	0.0
				Lorsban 1.0				
Late Boot	20.2	0.0	23.3	17.4	53.9	24.8	532.9	0.0
50% Heading	20.0	0.0	22.2	17.0	54.1	24.5	537.4	0.0
50% Flowering	19.3	0.0	20.8	17.7	53.8	24.4	548.8	0.0
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.5984	1.0000	0.6615	0.3604	0.3743	0.4391	0.8555	0.7137

Table 6. Effect of application timing and variety

	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN	OWBM
	in	%	bu/A	%	lb/bu	g	sec	no/ spk
				Egan				
Late Boot	19.7	0.0	20.4	18.2	53.2	23.7	536.0	0.0
50% Heading	19.8	0.0	19.5	18.2	53.4	23.7	544.0	0.0
50% Flowering	19.5	0.0	19.8	18.2	53.2	23.1	542.1	0.0
				McNeal				
Late Boot	20.3	0.0	21.9	16.7	54.9	26.0	514.0	0.0
50% Heading	19.8	0.0	20.5	16.7	55.1	26.0	523.5	0.0
50% Flowering	19.9	0.0	20.5	16.6	55.1	26.4	525.7	0.1
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.6127	1.0000	0.7120	0.9511	0.3743	0.0660	0.8684	0.2764

HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, OWBM: orange wheat blossom midge, ns: nonsignificant
[1]adjusted to 13% moisture, [2]adjusted to 12%

Table 7. Effect of insecticide application and Variety

	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN	OWBM
	in	%	bu/A	%	lb/bu	g	sec	no/ spk
				Check				
Egan	19.6	0.0	17.7	18.1	53.4	23.6	528.6	0.0
McNeal	20.0	0.0	19.1	16.5	55.2	26.2	516.0	0.0
				Actigard 0.25				
Egan	19.3	0.0	20.4	18.3	53.3	23.5	552.1	0.0
McNeal	19.8	0.0	20.2	16.9	54.8	25.6	515.9	0.1
				Actigard 0.50				
Egan	20.1	0.0	20.3	18.1	53.5	23.9	527.9	0.0
McNeal	20.0	0.0	21.7	16.5	55.1	26.5	526.9	0.1
				Lorsban 1.0				
Egan	19.6	0.0	21.2	18.2	52.9	23.0	554.1	0.0
McNeal	20.1	0.0	22.9	16.6	54.9	26.1	525.3	0.0
LSD	ns	ns	ns	ns	ns	ns	18.5	ns
Pr>F	0.7710	1.0000	0.3595	0.7192	0.3401	0.3453	0.0436	0.6393

HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, OWBM: orange wheat blossom midge, ns: nonsignificant

[1]adjusted to 13% moisture, [2]adjusted to 12%

Table 8. Effect of application timing, insecticide and variety

	Height inches		Lodging %		Yield[1] bu/A		Protien[2] %		TWT[1] lb/bu		TKW[1] g		FN sec		OWBM no/spk	
	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal
								Check								
Late Boot	19.3	20.0	0.0	0.0	17.5	18.9	18.1	16.5	53.9	55.2	24.7	26.6	525.6	517.6	0.0	0.0
50% Heading	19.7	20.0	0.0	0.0	17.9	18.8	18.4	16.9	53.0	54.9	23.4	25.3	531.0	519.6	0.0	0.0
50% Flowering	19.7	20.0	0.0	0.0	17.5	19.6	18.0	16.2	53.3	55.5	22.6	26.6	529.3	510.8	0.0	0.1
								Actigard .25								
Late Boot	19.0	19.7	0.0	0.0	19.5	20.8	18.1	17.0	53.2	54.5	23.8	25.1	537.7	514.7	0.0	0.1
50% Heading	19.3	19.7	0.0	0.0	20.7	20.6	18.2	16.7	53.6	54.9	23.9	25.5	554.1	515.2	0.0	0.0
50% Flowering	19.7	20.0	0.0	0.0	21.1	19.1	18.5	17.0	53.0	55.2	22.9	26.2	564.5	517.9	0.0	0.1
								Actigard .50								
Late Boot	20.7	20.7	0.0	0.0	22.6	23.7	18.2	16.6	53.1	54.6	23.2	25.7	533.1	505.4	0.0	0.1
50% Heading	20.0	19.3	0.0	0.0	18.1	19.4	18.3	17.0	54.0	55.4	24.6	27.0	536.3	538.8	0.0	0.0
50% Flowering	19.7	20.0	0.0	0.0	20.2	22.0	18.0	15.9	53.3	55.3	23.9	26.9	514.3	536.6	0.0	0.1
								Lorsban 1.0								
Late Boot	19.7	20.7	0.0	0.0	22.1	24.4	18.4	16.5	52.5	55.2	23.0	26.6	547.6	518.3	0.0	0.0
50% Heading	20.0	20.0	0.0	0.0	21.2	23.2	17.9	16.1	53.2	55.1	23.0	26.0	554.6	520.3	0.0	0.0
50% Flowering	19.0	19.7	0.0	0.0	20.4	21.2	18.3	17.2	53.0	54.5	23.1	25.8	560.2	537.5	0.0	0.0
LSD	ns		ns		ns		ns		ns		ns		ns		ns	
Pr>F	0.9948		1.0000		0.8167		0.1744		0.0866		0.3259		0.3794		0.8020	

TWT: test weight, TKW: thousand kernal weight, FN: falling number, OWBM: orange wheat blossom midge, ns: nonsignificant

[1]adjusted to 13% moisture, [2]adjusted to 12%

Title: Effect of Salicylate on Wheat Resistance to Orange Wheat Blossom Midge – 2015.

Objective: To evaluate the efficacy of Salicylate for the control of OWBM in susceptible and resistant spring wheat cultivars.

Materials and Methods:

Spring wheat varieties containing the Sm1 gene for resistance to the orange wheat blossom midge are available to aid in their control. However, some damage is incurred prior to the synthesis of the active compound. This study was designed to determine if treatment with salicylate prior to larval feeding could upregulate the Sm1 gene and shorten the lag phase. This study was established as a split plot design with three replications. Egan, a cultivar with resistance to the OWBM, and McNeal, a non-resistant cultivar were the whole plot treatments. Salicylate was applied to both varieties at three rates and at three wheat growth stages. Salicylate was applied at 0, 21, and 42 g ai/A when wheat was at the late boot stage, 50% headed, and 50% flowering growth stages.

Results:

The study site experienced severe drought and low midge pressure. As a result, any treatment effects that might have been present were largely masked by these environmental conditions. However, a few treatment effects were detected, and were largely associated with the differences between the two spring wheat varieties. Spring wheat yields averaged 23.6 bu/A, with McNeal producing slightly higher yields then Egan (24.0 and 23.2 bu/A, respectively). Egan had greater protein and higher falling numbers, but McNeal had higher test weight and greater thousand kernel weight. There were trends in the data which indicated a slight reduction in height, yield and test weight as rates of salicylate increased (Pr>F 0.4162, 0.1139, and 0.0519, respectively), while protein tended to increase (Pr>F=0.1148). However, the timing of salicylate treatments had no impact on any of the variables measured.

Summary:

Record breaking drought and low midge populations prevented an accurate assessment of salicylate for improving crop resistance against the wheat midge.

Table 1. Materials and Methods - Sm1 Salicylate - 2015

Seeding Date:	5/6/2015	Harvest Date:	8/12/2015
Julian Date:	125	Julian Date:	224
Seeding Rate:	80 lb/A	Soil Type:	Somers Silty Clay Loam
Previous Crop:	Spring Wheat	Fertilizer (PP):	23-55-30-22
Tillage:	Conventional	Fertilizer (TD):	1.4Zn-200N
Irrigation:	None	Pesticide:	None

PP: pre-plant, TD: top dress

Table 2. Main effect of application timing

	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN	OWBM
	in	%	bu/A	%	lb/bu	g	sec	no/ spk
Late Boot	21.1	0.0	23.5	17.4	53.5	24.4	521.2	0.0
50% Heading	31.9	0.0	23.5	17.6	53.6	24.8	526.7	0.0
50% Flowering	20.8	0.0	23.9	17.3	53.9	25.1	526.5	0.0
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.4284	1.0000	0.9314	0.7382	0.5950	0.4983	0.6398	0.7849

Table 3. Main effect of treatment rate

	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN	OWBM
	in	%	bu/A	%	lb/bu	g	sec	no/ spk
Untreated Check	31.5	0.0	24.5	17.1	54.0	25.0	524.9	0.0
Salicylic acid 21 g ai/A	21.3	0.0	23.6	17.5	53.6	24.5	526.1	0.0
Salicylic acid 42 g ai/A	21.0	0.0	22.7	17.7	53.5	24.8	523.4	0.0
LSD	ns	ns	ns	ns	0.4	ns	ns	ns
Pr>F	0.4162	1.0000	0.1139	0.1148	0.0519	0.4177	0.9195	0.6380

Table 4. Main effect of variety

	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN	OWBM
	in	%	bu/A	%	lb/bu	g	sec	no/ spk
Egan	20.7	0.0	23.2	18.0	53.0	23.7	533.1	0.0
McNeal	28.6	0.0	24.0	16.8	54.4	25.8	516.6	0.0
LSD	ns	ns	0.7	0.4	0.3	0.6	10.8	ns
Pr>F	0.2797	1.0000	0.0205	0.0001	0.0001	0.0001	0.0048	0.1510

HT; height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, OWBM: orange wheat blossom midge, ns: nonsignificant

[1]adjusted to 13% moisture, [2]adjusted to 12%

Table 5. Effect of application timing and rate of treatment

	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN	OWBM
	in	%	bu/A	%	lb/bu	g	sec	no/ spk
				Check				
Late Boot	21.2	0.0	25.3	17.0	53.8	24.8	523.2	0.0
50% Heading	52.8	0.0	24.6	17.1	54.1	25.3	523.1	0.0
50% Flowering	20.5	0.0	23.8	17.1	54.0	25.0	528.3	0.0
				Salicylic acid 21 g ai/A				
Late Boot	21.3	0.0	23.3	17.3	53.6	24.3	517.9	0.0
50% Heading	21.5	0.0	24.0	17.6	53.4	24.3	530.6	0.1
50% Flowering	21.2	0.0	23.7	17.5	53.8	24.8	529.8	0.1
				Salicylic acid 42 g ai/A				
Late Boot	20.8	0.0	22.0	17.9	53.1	23.9	522.3	0.0
50% Heading	21.3	0.0	21.9	17.9	53.4	24.8	526.5	0.0
50% Flowering	20.8	0.0	24.1	17.2	54.0	25.6	521.5	0.1
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.4536	1.0000	0.4226	0.6385	0.4195	0.5898	0.8834	0.3361

Table 6. Effect of application timing and variety

	HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN	OWBM
	in	%	bu/A	%	lb/bu	g	sec	no/ spk
				Egan				
Late Boot	20.4	0.0	23.3	17.8	53.0	23.5	526.4	0.0
50% Heading	21.1	0.0	22.8	18.1	52.8	23.4	535.6	0.0
50% Flowering	20.4	0.0	23.5	18.0	53.1	24.0	537.1	0.0
				McNeal				
Late Boot	21.8	0.0	23.7	17.0	54.0	25.2	515.9	0.0
50% Heading	42.7	0.0	24.1	17.0	54.4	26.1	517.9	0.1
50% Flowering	21.2	0.0	24.2	16.5	54.7	26.2	515.9	0.1
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.4118	1.0000	0.5437	0.3703	0.1814	0.4151	0.6917	0.2130

HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, OWBM: orange wheat blossom midge, ns: nonsignificant

[1]adjusted to 13% moisture, [2]adjusted to 12%

Table 7. Effect of treatment rate and variety

	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec	OWBM no/ spk
				Egan				
Untreated Check	20.7	0.0	24.5	17.5	53.5	24.1	531.4	0.0
Salicylic acid 21 g ai/A	21.0	0.0	23.2	18.1	52.9	23.3	536.4	0.0
Salicylic acid 42 g ai/A	20.3	0.0	21.9	18.3	52.7	23.6	531.4	0.0
				McNeal				
Untreated Check	42.3	0.0	24.6	16.7	54.5	26.0	518.3	0.0
Salicylic acid 21 g ai/A	21.7	0.0	24.1	16.8	54.4	25.6	515.9	0.1
Salicylic acid 42 g ai/A	21.7	0.0	23.4	17.0	54.3	25.9	515.5	0.1
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.4060	1.0000	0.2903	0.4796	0.2222	0.8449	0.8413	0.5795

HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, OWBM: orange wheat blossom midge, ns: nonsignificant

[1]adjusted to 13% moisture, [2]adjusted to 12%

Table 8. Effect of application timing, treatment rate and variety

	Height inches		Lodging %		Yield[1] bu/A		Protien[2] %		TWT[1] lb/bu		TKW[1] g		FN sec		OWBM no/spk	
	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal	Egan	McNeal
								check								
Late Boot	20.7	21.7	0.0	0.0	25.7	24.9	16.9	17.1	53.7	53.8	24.3	25.4	524.1	522.3	0.1	0.0
50% Heading	21.0	84.7	0.0	0.0	23.8	25.3	17.8	16.5	53.3	54.8	23.9	26.7	534.6	511.6	0.0	0.1
50% Flowering	20.3	20.7	0.0	0.0	23.9	23.7	17.7	16.5	53.3	54.8	24.0	26.0	535.5	521.0	0.0	0.0
								Salicylic acid 21 g ai/A								
Late Boot	20.7	22.0	0.0	0.0	23.3	23.3	17.8	16.7	53.0	54.2	23.4	25.2	536.6	499.2	0.0	0.0
50% Heading	21.3	21.7	0.0	0.0	23.5	24.5	18.1	17.1	52.6	54.2	22.7	25.8	531.5	529.8	0.1	0.1
50% Flowering	21.0	21.3	0.0	0.0	22.9	24.4	18.4	16.6	52.9	54.7	23.7	25.8	541.0	518.7	0.0	0.1
								Salicylic acid 42 g ai/A								
Late Boot	20.0	21.7	0.0	0.0	20.9	23.1	18.6	17.2	52.2	54.0	22.9	25.0	518.5	526.2	0.0	0.0
50% Heading	21.0	21.7	0.0	0.0	21.2	22.5	18.5	17.3	52.6	54.1	23.7	25.9	540.7	512.3	0.0	0.0
50% Flowering	20.0	21.7	0.0	0.0	23.8	24.4	17.9	16.5	53.2	54.7	24.4	26.8	534.9	508.1	0.0	0.2
LSD	ns		ns		ns		ns		ns		ns		ns		ns	
Pr>F	0.4324		1.0000		0.3365		0.5002		0.3449		0.8856		0.2147		0.6929	

TWT: test weight, TKW: thousand kernel weight, FN: falling number, OWBM: orange wheat blossom midge, ns: nonsignificant

[1]adjusted to 13% moisture, [2]adjusted to 12%

Project Title:	Evaluation of water use efficiency of spring wheat on fine sandy loam
Project Leaders:	Jessica Torrion (PI), Bob Stougaard (Co-PI)
Project Personnel:	John Garner, Brooke Bohannon
Objective:	To evaluate water use response of spring wheat varieties on yield and quality

Methods:

Eight spring wheat cultivars were grown under six irrigation levels as a split plot, randomized complete block design with four replications, where irrigation levels represent the whole plot and the eight spring wheat varieties were the sub plot factor. The irrigation levels were full irrigation (100ET, FullIrr), deficit irrigation (66ET, 2/3FullIrr), various levels of early irrigation termination events (FullIrr-1, FullIrr-2 FullIrr-3) and a rainfed check. The daily potential evapotranspiration was monitored (Creston Weather Station) and daily crop water use was determined using a crop coefficient approach. To trigger irrigation, daily soil water balance was calculated and plant water availability was maintained above 50% in treatment 100ET and irrigated 1.25 inches each irrigation event. The deficit irrigation followed the same schedule with 100ET, except 0.85 inch was applied for each irrigation event. The FullIrr-3, FullIrr-2, and FullIrr-1 were terminated on June 23, July 6, and July 13, respectively. Details of agronomic management is shown in Table 1. The cumulative amount of water in the dryland and irrigated treatments is shown in Figure 1.

Table 1: Material and Methods – Water use efficiency in spring wheat — 2015

Seeding Date:	4/22/15	Herbicide:	5/20/15
Julian Date:	112		13.7 fl oz/A Huskie complete + 0.5 lb/A AMS
Seeding Rate:	20 plnts/sqft	Pesticide:	6/19/15
Previous Crop:	Canola		12 fl oz/A Quadris + 1.92 fl oz/A Warrior II
Tillage:	Conventional		
Irrigation:	Yes		
Soil Type:	Fine sandy loam	Harvest Date:	8/13/15
Soil Test:	19-6-111	Julian Date:	225
Fertilizer:	281-48-115		

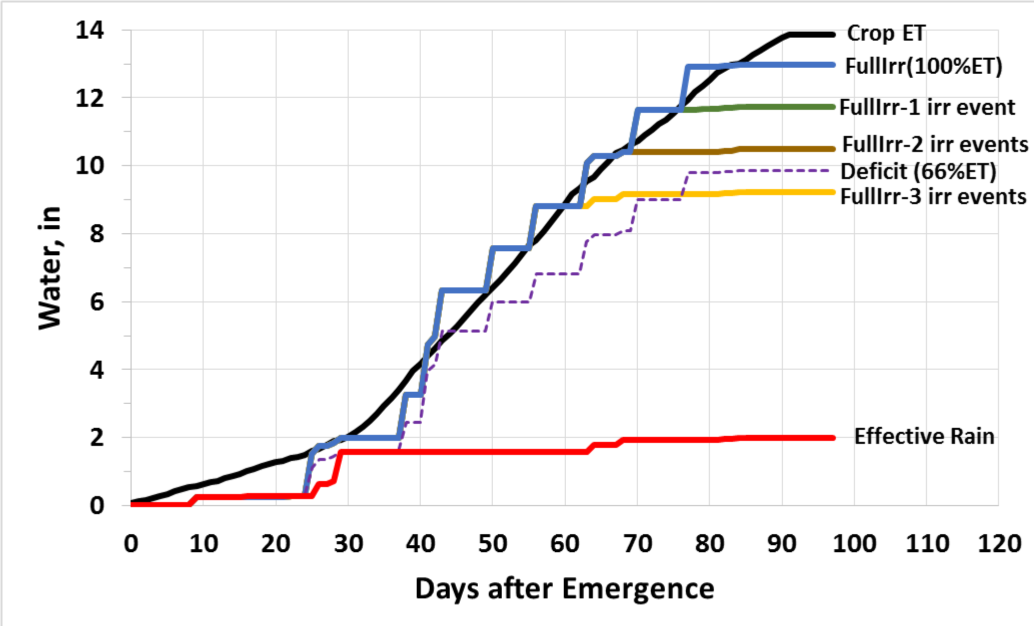

Figure 1. Cumulative rain and irrigation treatments relative to crop water use (Crop ET).

Summary:

The irrigation main effect was significant among all agronomic traits except protein, still the expected relationship between yield and protein was observed. Volt had the highest yield response while Brennan yielded the least consistently across all water regimes (Figure 2). The maximum yield response was when total plant available water was at 11 inches (Figure 3).

Among varieties, Volt had the highest yield but with the lowest protein due to dilution effect of these two factors. Test weight increased with irrigation, but late season irrigation events that occurred during milk and early dough (FullIrr-1 and FullIrr, respectively) on average decreased test weights, Expresso was the exception.

Heights ranged from 19.8 inches for Cabernet under dryland treatment to 29.4 inches for McNeal under FullIrrig-2 treatment. An interaction between irrigation and varieties was observed for falling number. All varieties had falling number greater than 250 seconds. McNeal had highest falling number for all treatments. Late season rainfall that would have triggered preharvest sprout was lacking. No visible plant lodging was observed.

A significant interaction between irrigation and variety for protein was observed. Late season irrigation appears to increase protein selectively with varieties. An expected relationship between seed size and yield was observed (compare TKW or SS with yield in Table 2). As yield increased with irrigation, seed size decreased due to increased number of seeds per unit area, whereas seed size increased when number of seeds per unit area decreased for low yield.

Table 2. Spring wheat water use effects on agronomic performance — 2015

Cultivar	HT in	PM* days	SS seeds/lb	MC %	YLD bu/A	PRO %	TWT lb/bu	TKW g	FN sec
Full Irrigation (FullIrrig)									
Brennan	21.3	84	12517	11.1	58.5	15.8	62.5	36.3	411
Buck Pronto	26.2	84	11295	10.6	68.5	14.4	62.0	40.8	366
Cabernet	20.7	84	12446	11.4	64.6	13.8	62.7	36.6	311
Expresso	26.5	86	11354	11.1	85.0	14.9	62.8	40.0	305
McNeal	28.2	87	11003	11.3	81.4	14.3	61.7	41.6	470
Solano	22.1	86	10975	11.9	77.2	14.3	62.4	41.4	334
Volt	26.8	86	12503	13.0	87.8	13.5	62.4	36.3	349
WB Rockland	23.1	88	10735	13.6	71.5	15.7	60.3	42.3	300
Deficit Irrigation (2/3FullIrrig)									
Brennan	21.2	83	12755	10.6	52.4	16.1	62.7	35.6	402
Buck Pronto	25.8	83	10778	10.5	73.4	14.8	61.8	42.1	382
Cabernet	20.2	82	12951	10.4	61.0	13.6	63.0	35.1	316
Expresso	24.7	83	12027	11.2	78.1	14.2	62.6	37.8	301
McNeal	28.4	85	11286	10.6	79.1	14.1	61.9	40.4	504
Solano	22.8	85	11316	10.6	77.3	14.2	62.8	40.2	356
Volt	25.9	85	12622	11.4	80.7	13.0	63.5	36.0	385
WB Rockland	23.0	85	10882	12.4	66.5	15.8	60.9	41.8	292
One Irrigation Event terminated Early (FullIrrig-1)									
Brennan	21.3	84	12322	10.6	58.8	15.9	62.9	36.9	421
Buck Pronto	25.6	84	10959	10.6	70.5	14.6	62.1	41.5	367
Cabernet	21.3	83	12539	10.6	70.2	13.7	63.3	36.4	320
Expresso	25.0	85	11854	11.5	78.6	14.6	62.3	38.4	277
McNeal	28.4	87	11390	11.2	84.0	13.9	61.7	40.1	517
Solano	23.0	85	11356	12.7	76.1	14.6	61.3	40.1	323
Volt	27.2	86	12550	12.2	90.4	13.4	62.9	36.2	371
WBRockla	22.8	87	10977	11.0	67.9	15.2	61.5	41.4	290
Two Irrigation Events Terminated Early (FullIrrig-2)									
Brennan	21.1	83	12553	10.5	57.4	15.7	62.7	36.2	425
Buck Pronto	25.6	83	11519	10.3	68.4	14.0	62.1	39.6	376
Cabernet	21.3	82	12337	10.5	70.3	13.7	62.8	36.9	321
Expresso	25.4	86	12049	11.5	76.5	14.6	61.9	37.7	349
McNeal	29.4	87	11271	11.0	86.7	13.7	61.8	40.3	521
Solano	23.3	86	11556	10.6	79.8	14.2	62.9	39.3	355
Volt	26.9	87	13754	11.2	80.9	13.0	63.5	33.1	393
WB Rockland	22.9	87	11966	12.3	70.8	16.0	61.0	38.2	313
Three Irrigation Events Terminated Early (FullIrrig-3)									
Brennan	21.2	79	12597	10.7	49.7	15.3	62.6	36.2	413
Buck Pronto	25.3	81	11510	10.3	63.4	14.9	61.3	39.5	384
Cabernet	20.6	81	12609	10.6	63.4	13.5	62.6	36.1	359
Expresso	23.8	83	12428	10.7	69.6	14.6	62.0	36.7	310
McNeal	26.2	81	12270	11.5	70.0	13.9	60.7	37.4	471
Solano	23.3	83	12419	10.7	68.3	14.2	62.3	36.7	354
Volt	25.2	82	13204	10.8	78.8	13.1	63.4	34.6	400
WB Rockland	21.1	83	11556	11.7	65.7	15.3	61.4	39.4	324
Dryland									
Brennan	20.5	76	14993	10.3	25.5	15.4	61.8	30.3	449
Buck Pronto	22.7	78	12645	10.0	36.2	14.8	61.2	36.0	399
Cabernet	16.7	76	14765	10.3	25.6	14.3	61.2	30.7	361
Expresso	20.8	79	12451	10.1	33.0	15.5	61.3	36.6	298
McNeal	25.1	80	13343	10.2	34.4	14.5	60.7	34.2	535
Solano	20.1	77	12455	10.0	34.6	15.4	61.6	36.5	381
Volt	22.0	79	14479	10.1	40.7	13.3	63.1	31.4	416
WB Rockland	19.8	79	11860	9.8	29.2	16.1	61.3	38.3	323
C.V	13.4	4.3	10.0	11.1	28.3	6.7	1.8	9.7	18.9
LSD	1.4	2.8	715.8	0.8	6.3	ns	0.6	2.4	27.0
$Pr>F_{(0.05)-Irr}$	<.0001	<.0001	<.0001	0.0002	<.0001	0.3347	0.0056	<.0001	0.0026
$Pr>F_{(0.05)-Var}$	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
$Pr>F_{(0.05)-Irr\ x\ Var}$	0.8163	0.7680	0.0115	0.2475	0.3060	0.0035	0.2655	0.0972	0.6269

HT: height, PM: physiological maturity *(duration from emergence), SS: seed size, MC: moisture content, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, ns: nonsignificant

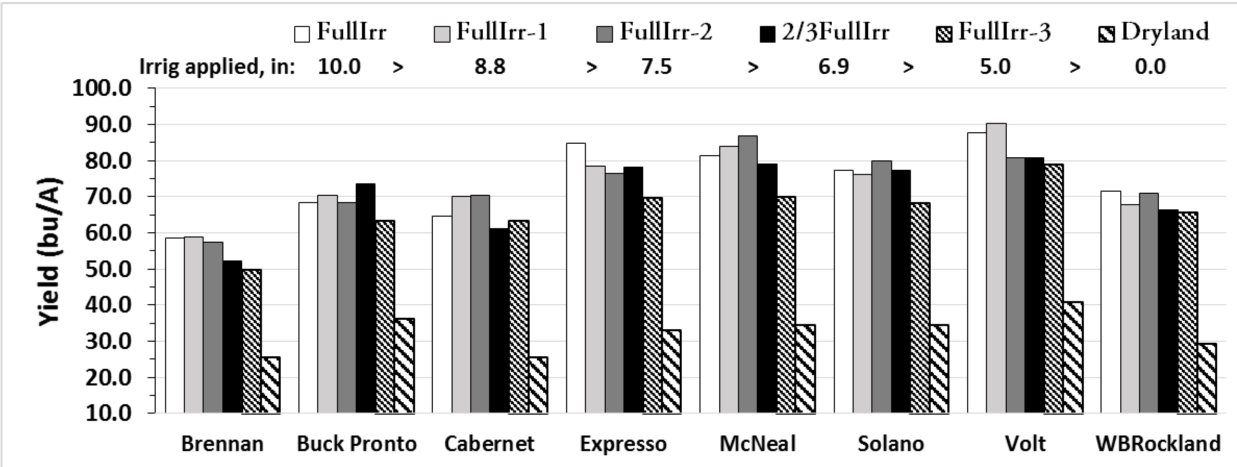

Figure 2. Yield response to water use efficiency of spring wheat on fine sandy loam soil, Creston, MT.

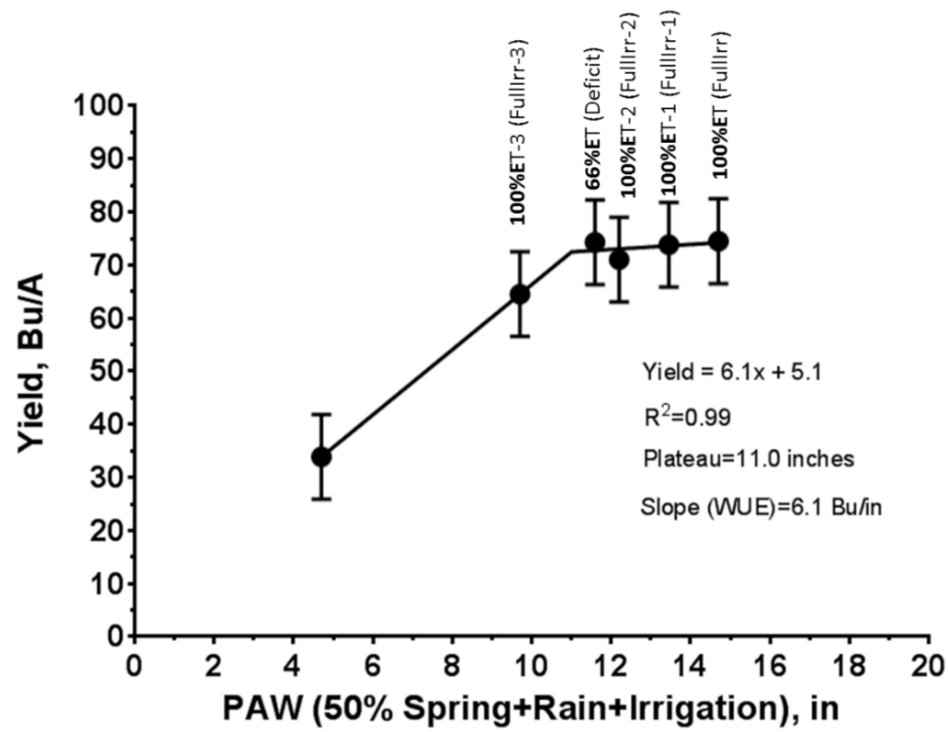

Figure 3. Yield response of spring wheat to water regimes on fine sandy loam soil, Creston, MT.

Title: Evaluation of Advanced Spring Wheat Experimental Lines – 2015

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

Results:

Significant differences were observed in heading date, percent stripe rust infection, height, lodging and yield. Protein and test weight values were reported from a representative sample of each variety. Heading date averaged 170 days (June 19) and spanned a six day period ranging from 168 to 174 days. Stripe rust pressure was generally low this year. Average percent infection was 16.9% and ranged from 4.6% for WB 9668 to 47.5% for LNR-0757. The mean height was 35.2 inches and ranged from 29.0 for WB 9668 to 45.4 inches for Thatcher. Lodging averaged 5.7% with a range from 0.0% to 56.7 percent. Grain yield averaged 111.2 bu/A and ranged from 89.2 bu/A for MT 1429 to 131.5 bu/a for MT 1451. Protein averaged 15.5 % and ranged from 13.4% for WPSP2-VIDA1 to 17.0% for Egan. Test weight averaged 61.9 lb/bu and ranged from 59.5 for WB 9507 to 63.6 for MT 1415 and LCS Breakaway.

Summary:

Despite the season's drought, the spring wheat nursery afforded yields greater than those from 2014. Vida and Duclair were the highest yielding commercially available varieties at 123.5 and 122.0 bu/A, respectively. Egan, a variety with resistance to the orange wheat blossom midge, yielded 115.9 bu/A and provided the highest percent protein at 17.0 percent.

Table 1. Materials and Methods - Evaluation of Advanced Spring Wheat Experimental Lines - 2015

Seeding Date:	4/22/2015	Harvest Date:	8/19/2015
Julian Date:	112	Julian Date:	231
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Winter Wheat	Soil Test:	63-16-242
Tillage:	Conventional	Fertilizer:	250-40-90
Irrigation:	None	Herbicide:	Huskie Complete 13.7oz/A
Instecticide:	Warrior II 1.92 floz/A	Fungicide:	Quadris 6 floz/A

Table 2. Agronomic data from the evaluation of advanced spring wheat lines 2015.

Cultivar	HD Julian	SR %	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu
MT 1451	171	9.2	36.6	3.3	131.5	16.0	62.1
LIMAGR143	170	14.6	40.0	15.0	125.3	15.7	62.5
MT 1453	169	15.2	34.4	6.7	124.6	14.7	62.2
MT 1414	173	12.1	35.5	0.0	123.9	15.0	60.8
VIDA	172	21.3	36.6	19.0	123.5	15.6	61.6
DUCLAIR	169	9.2	34.8	0.7	122.0	15.8	60.7
WPSP2-VIDA2	173	10.0	35.3	0.0	121.6	14.2	62.7
WB 9668	168	4.6	29.0	0.0	121.6	16.9	62.0
MT 1422	172	13.2	42.2	56.7	120.7	15.0	62.7
MT 1406	168	10.9	37.4	0.0	120.6	16.1	61.6
MT 1331	169	30.8	33.5	0.0	120.2	14.7	60.2
SY ROWYN	169	12.9	33.8	14.0	120.2	14.1	62.4
SY INGMAR	171	12.4	33.2	0.0	119.2	15.8	63.2
SY VALDA	171	19.5	32.8	0.0	118.8	14.2	63.2
MT 1418	173	9.9	35.5	0.0	118.3	15.3	60.9
MT 1338	169	36.0	36.3	0.0	117.8	16.1	62.9
MT 1412	173	12.3	35.4	0.0	117.5	15.4	62.2
MT 1348	169	27.6	35.3	20.0	117.4	16.0	61.8
LCS BREAKAWAY	169	11.7	34.8	0.0	117.1	16.5	63.6
WPSP2-VIDA1	173	16.0	36.4	0.0	116.1	13.4	62.9
EGAN	173	5.8	35.0	0.0	115.9	17.0	61.4
MT 1401	168	8.5	36.2	35.0	114.9	16.8	62.0
CORBIN	169	19.1	35.5	5.0	114.8	14.8	62.6
REEDER	171	15.4	37.1	0.0	114.2	14.8	62.8
MT 1426	168	13.8	36.8	1.7	114.1	16.1	60.6
LNR-0311	171	24.1	37.2	11.7	114.0	13.9	63.3
WPSP2-CHOTEAU1	169	16.9	35.8	3.3	113.9	15.8	62.1
MT 1219	169	20.5	33.5	30.0	113.5	15.1	61.7
WB9879CLP	169	14.4	34.8	0.0	113.2	15.8	61.7
WB 9377	172	9.4	30.4	0.0	112.9	14.9	62.5
MT 1425	169	12.6	36.4	0.7	112.8	16.0	61.8
MT 1442	172	18.4	35.4	3.3	112.8	16.0	62.5

HD: heading date, SR: stripe rust, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight

[1] adjusted to 13% moisture, [2] adjusted to 12%

Table 2. continued.

Cultivar	HD Julian	SR %	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu
WB GUNNISON	171	19.3	33.8	0.0	112.4	15.2	63.5
SY SOREN	171	28.4	31.4	0.0	112.3	16.1	63.1
MT 1427	168	18.4	35.1	1.3	112.2	15.4	60.9
MT 1404	172	9.8	35.0	29.0	112.0	15.2	62.0
CHOTEAU	171	12.4	34.6	0.0	111.7	15.5	61.8
MT 1454	169	12.4	35.1	0.0	110.7	15.0	61.3
MT 1320	168	11.3	35.8	1.7	110.4	16.5	62.6
MT 1337	168	12.6	36.8	0.0	110.1	15.8	61.9
MT 1319	168	11.2	35.3	0.0	109.8	16.0	61.5
MT 1316	168	10.1	33.6	0.0	108.7	16.7	61.4
MT 1455	170	12.6	33.1	0.0	107.7	15.9	61.5
MT 1432	170	9.4	32.9	3.3	107.3	16.0	60.9
MT 1415	173	9.5	33.9	0.0	107.2	15.8	63.6
MT 1349	171	12.9	34.8	0.0	107.0	16.0	59.6
MT 1413	172	17.8	35.7	0.0	106.9	14.7	61.5
SY TYRA	171	41.8	30.6	0.0	106.4	14.3	63.1
MT 1439	170	12.1	35.4	0.0	106.0	15.4	61.9
MT 1417	173	16.2	35.2	1.7	105.5	16.0	62.3
MT 1424	173	19.3	33.3	0.0	104.6	15.3	62.2
MT 1436	170	14.4	36.6	0.7	103.8	15.0	61.3
MT 1447	169	9.8	34.6	3.3	103.7	16.2	61.0
MT 1421	171	16.3	36.3	0.0	102.9	16.2	60.9
BRENNAN	169	18.8	30.8	0.0	102.4	15.9	62.6
MT 1448	170	8.7	34.8	26.7	100.8	15.1	61.5
MCNEAL	173	19.6	31.5	0.0	99.7	15.1	61.7
MT 1434	168	30.5	34.1	0.0	95.6	15.2	61.1
FORTUNA	171	11.1	41.7	30.0	95.4	15.9	61.6
THATCHER	174	14.9	45.4	28.3	93.9	16.1	61.2
WB 9507	172	41.1	35.9	8.3	92.9	14.1	59.5
MT 1408	173	36.5	33.9	0.0	91.1	14.5	61.5
LNR-0757	173	47.5	35.8	0.0	90.7	13.5	59.8
MT 1429	169	26.7	34.7	1.7	89.2	15.9	61.2
Mean	170	16.9	35.2	5.7	111.2	15.5	61.9
LSD at 0.05	1.5	13.6	2.4	24.1	10.3	NA	NA

HD: heading date, SR: stripe rust, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight

[1] adjusted to 13% moisture, [2] adjusted to 12%

Title: Evaluation of Sm1 Experimental Spring Wheat Lines for Resistance to the Orange Wheat Blossom Midge (OWBM).

Objective: To evaluate insect resistance and agronomic performance of experimental spring wheat lines northwestern Montana.

Results:

Despite record low rain fall, significant differences were observed for height, test weight, thousand kernel weight, and number of OWBM per spike. The average number of OWBM per spike was 0.03 and ranged from 0.0 to 0.5 OWBM per spike. Plant height averaged 20.0 inches and ranged from 19.3 inches to 21.3 inches. Test weight averaged 55.9 lb/bu and ranged from 54.3 lb/bu for 12401227 to 57.6 lb/bu for 12401424 and 12400038. Thousand kernel weights averaged 25.5 grams, ranging from 21.5 grams for 12400817 to 31.9 grams for Hank.

Summary:

Midge pressure was low at this location. Never the less, Hank, a non-resistant variety, had the greatest number of OWBM larvae per spike in comparison to the cultivars with the Sm1 resistant gene.

Table 1. Materials and Methods - Sm1 Advanced Lines - 2015

Seeding Date:	5/6/2015	Harvest Date:	8/12/2015
Julian Date:	125	Julian Date:	224
Seeding Rate:	80 lb/A	Soil Type:	Somers Silty Clay Loam
Previous Crop:	Spring Wheat	Fertilizer (PP):	23-55-30-22
Tillage:	Conventional	Fertilizer (TD):	1.4Zn-200N
Irrigation:	None	Pesticide:	None

PP: pre-plant, TD: top dress

Table 2. Agronomic data from the evaluation of Sm1 Advanced Spring Wheat Lines, Kalispell, MT - 2015.

Cultivar	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec	OWBM #/spk
12401424	20.3	0.0	28.3	15.6	57.6	26.0	305	0.0
12400725	20.7	0.0	28.2	15.9	54.4	26.3	486	0.0
12401218	20.3	0.0	28.1	14.7	57.1	24.5	439	0.0
12401117	19.7	0.0	27.7	14.4	56.9	26.5	445	0.0
EGAN	21.0	0.0	27.1	15.6	54.4	25.8	506	0.0
12401161	19.7	0.0	26.8	15.2	55.0	24.3	503	0.0
12401322	20.0	0.0	26.7	16.4	56.9	31.4	456	0.0
12400976	19.3	0.0	26.4	15.9	55.3	24.7	479	0.0
12401236	19.7	0.0	26.4	15.2	56.8	28.8	483	0.1
12401182	20.7	0.0	25.8	15.4	56.6	23.7	473	0.0
12400038	19.3	0.0	25.3	14.8	57.6	25.2	429	0.0
12401502	20.3	0.0	24.8	16.1	55.0	24.9	474	0.0
HANK	20.3	0.0	24.5	15.4	55.2	31.9	428	0.5
12401277	20.0	0.0	24.4	16.8	56.9	25.6	466	0.0
12401227	21.3	0.0	24.2	15.1	54.3	23.2	448	0.0
12401935	19.7	0.0	23.9	15.7	55.2	22.4	455	0.0
12400877	19.3	0.0	23.5	16.2	55.3	22.5	453	0.1
12400592	20.7	0.0	22.4	15.7	55.4	24.4	492	0.0
12400986	19.3	0.0	22.2	16.1	55.5	22.5	479	0.0
12400817	19.7	0.0	21.9	17.0	55.9	21.5	466	0.1
12401161	19.3	0.0	20.4	16.7	56.6	28.7	485	0.0
Mean	20.0	0.0	25.2	15.7	55.9	25.5	459.5	0.03
CV	3.7	0.0	15.4	6.5	2.1	8.1	17.5	424.8
LSD	1.2	ns	ns	ns	1.9	3.4	ns	0.2
Pr>F	0.0318	1.0000	0.4728	0.1724	0.0056	0.0001	0.6918	0.0343

HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, OWBM: orange wheat blossom midge, ns: nonsignificant

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Title: Western Regional Soft White Spring Wheat Evaluation - 2015

Objective: To evaluate soft white spring wheat varieties for agronomic performance in environments representative of northwestern Montana.

Results:

Significant differences were observed in heading date, percent stripe rust infection, plant height, lodging, yield, protein, test weight, and falling number. Heading dates averaged 172 Julian days (June 21) and spanned a 7 day period that ranged from 169 to 176 days. Stripe rust was observed on all cultivars and averaged 7.4%, ranging from 3.3% for M12001 to 15.7% for ALPOWA. Plant heights averaged 34.1 inches, ranging from 30.7 inches for WB6121 to 36.3 inches for ARS-Loualp68. Lodging was minimal with the exception of LOUISE and ARS-Loualp68 at 41.7% and 53.3%, respectively. Yield averaged 125.5 bu/A and ranged from 110.2 bu/A for ALPOWA to 142.5 bu/A for WA8224. Protein averaged 10.6%, ranging from 10.0% for M12003 and ARS-Alplou37 to 12.2% for WB6121. Test weight averaged 61.6 lb/bu and ranged from 60.4 lb/bu for Treasure to 62.5 lb/bu for ARS-Loualp61. Falling number averaged 308.5 seconds, and ranged from a low of 256.5 seconds for M12001 to a high of 345.1 for ALPOWA.

Summary:

WA8224 was the highest yielding variety and statistically equivalent to the greatest test weight and falling number values. Preliminary findings demonstrate that WA8224 is a suitable soft white wheat for this region. However, cultivar differences were prevalent and continual screening of soft white wheats is necessary to identify those which perform best in northwestern Montana.

Table 1. Materials and Methods - Western Regional Soft White Spring Wheat - 2015

Seeding Date:	4/22/2015	Harvest Date:	8/13/2015
Julian Date:	112	Julian Date:	225
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Winter Wheat	Soil Test:	63-16-242
Tillage:	Conventional-Till	Fertilizer:	250-40-90
Irrigation:	None	Herbicide:	Huskie Complete 13.7 oz/A
Fungicide:	Quadris 6 floz/A	Insecticide:	Warrior II 1.92 floz/A

Table 2. Agronomic data from the evaluation of Western Regional Soft White Spring Wheat lines 2015.

Cultivar	HD Julian	SR %	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	FN sec
WA8224	172	4.0	35.0	0.0	142.5	10.1	62.2	324.3
WA8239	173	4.0	32.7	0.0	136.9	10.7	62.0	310.7
WA8214	169	7.7	32.7	0.0	135.1	10.9	61.0	328.3
M12003	174	4.3	33.7	0.0	133.9	10.0	61.0	264.7
SY3024-2	170	6.0	36.0	8.3	130.2	10.4	61.7	314.9
UI Stone	172	8.7	35.3	0.0	128.8	10.3	62.2	293.0
M12001	173	3.3	32.0	0.0	127.0	10.4	61.2	256.5
IDO1401	169	5.7	33.7	3.3	125.0	10.5	61.4	299.9
ARS-Loualp61	173	13.7	35.7	0.0	124.2	10.4	62.5	304.3
ARS-Loualp68	175	8.0	36.3	53.3	122.9	11.1	62.1	343.7
IDO1403	173	5.0	31.7	3.3	121.8	11.2	61.8	308.6
WB6121	169	4.0	30.7	0.0	120.4	12.2	61.2	291.3
ARS-Alplou37	174	13.0	36.0	5.0	118.2	10.0	61.4	333.5
LOUISE	173	7.3	36.0	41.7	117.3	10.5	61.3	323.3
Treasure	176	8.3	34.0	8.3	113.7	10.9	60.4	294.7
ALPOWA	174	15.7	33.7	0.0	110.2	10.1	61.8	345.1
Mean	172	7.4	34.1	7.7	125.5	10.6	61.6	308.5
CV	0.5	48.8	4.6	213.7	5.9	2.3	0.5	4.8
LSD	1.3	6.0	2.6	27.5	12.3	0.4	0.5	24.7
Pr>F	0.0001	0.0029	0.0007	0.0077	0.0004	0.0001	0.0001	0.0001

HD: heading date, SR: stripe rust, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, FN: falling number

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Title: Western Regional Hard Red Spring Wheat Evaluation – 2015

Objective: To evaluate hard red spring wheat varieties for agronomic performance in environments representative of northwestern Montana.

Results:

Significant differences were observed in heading date, percent stripe rust infection, head smut, yield, protein, test weight, and falling number. Heading dates averaged 171 Julian days (June 20) and spanned a 7 day period that ranged from 168 to 175 Julian days. Stripe rust averaged 5.4% and was observed on all cultivars. Glee was the most susceptible cultivar to stripe rust at 13.3% infection, and WB9518 was the least susceptible at 1.3% infection. Plant heights averaged 34.4 inches. Head Smut was detected in the nursery, with the highest infection levels being observed with Jefferson and UI Platinum. That being said, symptoms were noted on less than 3 heads per plot. Lodging was minimal with an average of 1.0%, ranging from 0.0% to 10.0% for Glee. Yields averaged 135.3 bu/A, ranging from 126.2 bu/A for UI Winchester to 143.7 bu/A for SY10136. Protein content averaged 13.0% and ranged from 12.1% for UC1741 to 14.8% for Egan. Test weight averaged 61.9 lb/bu and ranged from 60.7 lb/bu for Patwin 515 to 63.4 lb/bu for SY3051-9. Falling number averaged 375.3 seconds, ranging from 295.8 seconds for UC1744 to 491.6 seconds for Egan.

Summary:

Nine varieties were statistically equivalent to SY10136, the highest yielding variety. However, only one variety, SY3059-1, was statistically equivalent to Egan with respect to falling numbers. Varietal differences exist and therefore continual screening is important to identify those which perform best in northwestern Montana.

Table 1. Materials and Methods - Western Regional Hard Red Spring Wheat - 2015

Seeding Date:	4/22/2015	Harvest Date:	8/18/2015
Julian Date:	112	Julian Date:	230
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Winter Wheat	Soil Test:	63-16-242
Tillage:	Conventional-Till	Fertilizer:	250-40-90
Irrigation:	None	Herbicide:	Huskie Complete 13.7 oz/A
Fungicide:	Quadris 6 floz/A	Insecticide:	Warrior II 1.92 floz/A

Table 2. Agronomic data from the evaluation of Western Regional Hard Red Spring Wheat lines 2015.

Cultivar		HD Julian	SR %	HT in	Head[1] Smut	LOD %	YLD[2] bu/A	PRO[3] %	TWT[2] lb/bu	FN sec
SY10136	HW	169	5.3	33.3	1.0	0.0	143.7	12.3	60.8	360.1
SY3001-2	HR	172	5.7	34.7	1.0	6.7	141.5	13.1	61.6	391.8
UC1745	HR	175	5.7	34.3	1.0	0.0	140.5	12.2	62.8	325.1
WA8217	HR	171	4.3	35.7	1.0	0.0	140.0	13.1	62.5	382.8
UC1741	HW	173	3.0	33.7	1.0	0.0	139.4	12.1	60.9	332.5
UC1768	HR	173	2.7	34.3	1.0	0.0	139.4	12.6	62.0	387.6
SY3051-9	HR	171	9.0	35.3	1.0	0.0	136.4	13.7	63.4	473.2
WB9518	HR	171	1.3	34.3	1.0	0.0	136.3	13.9	62.2	372.8
SY40292R	HR	173	3.7	36.0	1.0	0.0	136.2	13.5	61.2	391.9
Patwin 515	HW	173	2.3	30.0	1.0	0.0	135.3	12.8	60.7	359.4
Jefferson	HR	170	5.0	34.3	1.7	0.0	132.2	12.5	62.2	390.2
UC1744	HW	171	4.0	34.3	1.0	0.0	132.0	13.3	61.1	295.8
Glee	HR	170	13.3	36.3	1.0	10.0	130.4	12.4	62.8	338.1
Egan	HR	173	4.7	36.3	1.0	0.0	128.3	14.8	61.2	491.6
UI Platinum	HW	168	5.7	34.0	1.7	0.0	127.5	12.2	62.7	358.8
UI Winchester	HR	170	10.7	33.7	1.3	0.0	126.2	13.2	62.3	353.6
Mean		171.5	5.4	34.4	1.1	1.0	135.3	13.0	61.9	375.3
CV		0.6	59.4	6.6	21.6	443.6	4.7	2.7	0.6	3.5
LSD		1.6	5.3	ns	0.4	ns	10.5	0.6	0.6	22.0
Pr>F		0.0001	0.0061	0.2475	0.0063	0.3305	0.0345	0.0001	0.0001	0.0001

HW: hard white, HR: hard red, HD: heading date, SR: stripe rust, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, FN: falling number, ns: nonsignificant

[1] 1 means none detected, 2 means at least 1 to 3 heads infected per plot ($60ft^2$)

[2] adjusted to 13% moisture

[3] adjusted to 12% moisture

Title: Effects of plant growth regulators (PGRs) on winter wheat yield and quality – 2015

Objective: To evaluate winter wheat height response to the application of different commercial plant growth regulators.

Materials and Methods:

Lodging is a recurring problem in winter wheat production, and is largely a function of plant height. This study was designed to determine the effect of plant growth regulators on reducing crop height, and in turn, percent lodging.

Results:

The study was established as a randomized complete block with three replications. Yellowstone winter wheat was planted at 80 lb/A in 7 inch rows on September 29, 2014. Treatments were applied the following spring. Palisade and Cerone were applied at the two node and flag leaf stage of growth, respectively, either alone or as sequential applications. Palisade was applied at 10.5 oz/A and 14.4 oz/A, while Cerone was applied at 0.5 pt/A and 1.0 pt/A.

The application of plant growth regulators had a significant effect on lodging yet had no significant effect on height. Lodging averaged 12.2% and ranged from 0.0% to 58.0 percent. All treatments afforded a significant reduction in lodging compared to the control. However, there were no significant differences among PGR treatments.

Summary:

Plant growth regulators were effective at reducing lodging. However, the degree of lodging did not impact winter wheat yields.

Table 1. Materials and Methods - Effect of PGRs on Winter Wheat, Kalispell - 2015

Seeding Date:	9/29/2014	Harvest Date:	7/30/2015
Julian Date:	272	Julian Date:	211
Seeding Rate:	80 lbs/A	Soil Type:	Creston SiL
Previous Crop:	Canola	Soil Test:	29-10-158
Tillage:	Conventional	Fertilizer:	9-40-10, 0-0-62,130-0-0 TD
Irrigation:	None	Herbicide:	Huskie Complete 13.7 oz/A

Table 2. Agronomic data from the effects of PGRs on winter wheat yield and quality, Kalispell, MT - 2015.

Treatment	Rate	HD Julian	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec
Check		153	40.7	58.0	143.5	11.5	60.3	39.3	409.4
Cerone	0.5 pt/A	153	39.7	0.0	156.6	11.3	61.1	38.6	428.5
Cerone	1.0 pt/A	152	38.7	0.0	142.4	11.2	61.3	39.1	432.2
Palisade	10.5 fl oz/A	153	40.3	20.7	143.7	11.1	60.7	39.9	421.9
Palisade	14.4 floz/A	153	41.0	0.0	152.8	11.2	61.4	38.8	425.0
Palisade	10.5 fl oz/A	152	40.3	6.7	152.2	11.7	60.9	37.6	431.3
+ Cerone	0.5 pt/A								
Palisade	14.4 fl oz/A	152	39.3	0.0	143.9	11.3	61.0	38.9	430.7
+ Cerone	1 pt/A								
Mean		153	40.0	12.2	147.9	11.3	61.0	38.9	425.6
CV		0.4	3.2	167.9	4.9	5.8	1.0	3.2	4.8
LSD		ns	ns	36.4	ns	ns	ns	ns	ns
Pr>F		0.6596	0.3697	0.0359	0.1606	0.9449	0.3849	0.4958	0.8246

HD: heading date, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, ns: nonsignificant

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Title: Fungicide Evaluation in Winter Wheat – 2015

Objective: To evaluate application timings and rates of Headline for the control of stripe rust in winter wheat.

Results:

Headline was applied to Decade winter wheat at two rates (6 and 9 fl oz/A) and two growth stages (two tiller and flag leaf), either as single or sequential applications on May 1 and May 20, respectively (Table 2). The application of Headline resulted in significant differences for percent stripe rust infection, yield, and test weight. Stripe rust infection averaged 25.2%, and ranged from 7.7% to 61.7 percent. Most treatments afforded commercially acceptable control. However, the 6 oz/A rate applied at the two tiller stage of growth produced infection levels comparable to the non-treated check. In turn, yields were statistically equivalent between these two treatments.

An analysis was performed to evaluate the economic feasibility of sequential fungicide applications. The highest adjusted gross return ($497.20) was obtained with 9 oz/A applied as a single application at flag leaf (Table 3). Conversely, the least profitable fungicide treatment ($413.50) was 9 oz/A applied sequentially. This occurred despite having the highest level of stripe rust control. In short, there was not a direct relationship between stripe rust control and profitability.

Further, there was not a direct relationship between yield and profitability. Although the sequential application at 6 fl oz/A afforded the highest yield at 109.9 bu/A, the adjusted gross return was $495.60 per acre. The benefit of making two applications at the 6 fl oz/A rate compared to a single application at flag leaf was $4.70. In comparison the financial loss of sequential applications at the 9 fl oz/A compared to the single application at flag leaf was $83.70/A.

Summary:

Headline was effective at controlling stripe rust and the most economical application timing was at flag leaf at 9 fl oz/A.

Table 1. Materials and Methods - Effect of Fungicide on Winter Wheat, Kalispell - 2015

Seeding Date:	9/29/2014	Harvest Date:	7/28/2015
Julian Date:	272	Julian Date:	209
Seeding Rate:	80 lbs/A	Soil Type:	Creston SiL
Previous Crop:	Canola	Soil Test:	29-10-158
Tillage:	Conventional	Fertilizer:	9-40-70, 130-0-0 TD
Irrigation:	None	Herbicide:	Huskie 11 oz/A

Table 2. Effect of Headline on agronomic performance of winter wheat, Kalispell, MT - 2015

Application Timing	Rate fl oz/A	HD Julian	SR %	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu
Two Tillers + Flag Leaf	9	153.0	7.7	0.0	97.9	10.2	61.6
Two Tillers + Flag Leaf	6	153.3	10.7	0.0	109.9	9.8	62.1
Flag Leaf	9	153.7	10.7	0.0	107.0	10.1	61.3
Flag Leaf	6	153.0	15.0	0.0	103.6	10.1	61.7
Two Tillers	9	153.0	24.3	0.0	96.5	9.7	60.5
Two Tillers	6	153.3	46.7	0.0	88.2	9.5	60.9
Check		152.7	61.7	2.7	78.8	9.8	59.7
Mean		153.1	25.2	0.4	97.4	9.9	61.1
CV		0.5	63.4	375.6	10.2	3.5	1.3
LSD		ns	28.5	ns	17.7	ns	1.4
Pr>F		0.7783	0.0079	0.2622	0.0269	0.2849	0.0380

HD: heading date, SR: stripe rust, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, ns: nonsignificant

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Table 3. Economic analysis for the application of Headline fungicide to winter wheat for stripe rust control.

Application timing	Rate fl oz/A	YLD bu/A	Gross Return $5.00/bu	Headline Cost per Acre $3.67/oz	Application Cost per Acre $5.00	Adjusted Gross Return $/Acre
Flag leaf	9	107.0	535.20	33.00	5.00	497.20
Two tillers + Flag leaf	6	109.9	549.60	44.00	10.00	495.60
Flag leaf	6	103.6	517.90	22.00	5.00	490.90
Two tillers	9	96.5	482.30	33.00	5.00	444.30
Two tillers	6	88.2	441.00	22.00	5.00	414.00
Two tillers + Flag leaf	9	97.9	489.60	66.10	10.00	413.50
Check		78.8	393.90	0.00	0.00	393.90
Mean		97.4	487.07	.	.	449.90
CV		10.2	10.2	.	.	11.1
LSD		17.7	88.4	.	.	88.4
Pr>F		0.0269	0.0269	.	.	0.0942

YLD: yield

Title: Evaluation of Winter Wheat Lines for Stripe Rust Resistance and Agronomic Performance.

Objective: To evaluate experimental winter wheat lines for stripe rust resistance and agronomic performance.

Results:

Significant differences were observed in all response variables. Initial stripe rust rating averaged 15.6% on June 12, ranging from 0.0% for MT1564 to 78.7% for CDC Falcon. By June 26 stripe rust infection increased to an average of 27.7% ranging from 7.3 % for MT1564 to 81.3% for Decade. Heading date averaged 152 days (June 1), and spanned a 6 day period from 148 days for MT1564 to 154 days for MT1563. Plant height averaged 34.9 inches and ranged from 23.7 inches for MT 1599 to 39.7 inches for MT1561. Yield averaged 99.4 bu/A, ranging from 69.1 bu/A for Decade to 129.1 bu/A for MT1563. Protein averaged 10.8% and ranged from 9.6% for MT1561 to 12.1% for MT1566. Test weight averaged 62.7 lb/bu, ranging from 59.9 lb/bu for Decade to 64.9 lb/bu for Promontory.

Summary:

MT1561 and MT1563 were the two highest yielding experimental varieties. Yellowstone was the highest yielding commercial variety. MT1564 and MT1569 showed the greatest resistance to stripe rust. However, nine other varieties produced statistically similar results. In conclusion winter wheat breeding efforts are producing varieties that have high levels of stripe rust resistance, are high yielding and suitable for growing in the northwest region of Montana.

Table 1. Materials and Methods - Winter Wheat Stripe Rust Screening - 2015

Seeding Date:	9/29/2014	Harvest Date:	7/28/2015
Julian Date:	272	Julian Date:	209
Seeding Rate:	100 lb/A	Soil Type:	Creston SiL
Previous Crop:	Canola	Soil Test:	29-10-158
Tillage:	Conventional	Fertilizer:	9-40-70, 130-0-0 TD
Irrigation:	None	Herbicide:	Huskie 11 oz/A

Table 2. Agronomic data from the winter wheat stripe rust nursery, Kalispell 2015

Cultivar	HD Julian	6/12 SR %	6/26 SR %	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu
MT1563	154	9.3	27.7	38.3	129.1	10.1	63.1
MT1561	153	7.7	15.7	39.7	120.2	9.6	62.4
Yellowstone	152	3.3	36.0	38.3	105.3	10.4	62.6
MT1564	148	0.0	7.3	36.0	104.7	11.4	63.7
MT1565	151	6.3	11.7	34.3	103.0	11.1	62.2
Promontory	152	3.0	14.0	36.0	101.4	10.6	64.9
MT1568	152	3.0	32.7	35.7	100.9	11.0	62.9
MT1567	151	5.0	31.0	34.0	98.4	11.2	62.6
MT1569	152	3.0	9.3	35.3	97.3	11.7	63.1
MT1562	151	7.3	20.0	34.7	96.9	11.0	63.0
MT1566	151	5.0	25.0	35.0	95.0	12.1	63.3
MT1599	152	10.0	20.3	23.7	91.7	10.2	61.3
CDC Falcon	153	78.7	73.0	32.7	78.6	10.3	62.2
Decade	152	77.3	81.3	35.3	69.1	10.2	59.9
Mean	152	15.6	28.9	34.9	99.4	10.8	62.7
CV	0.6	38.4	51.4	4.8	8.1	4.0	0.5
LSD	1.6	10.1	25.0	2.8	13.5	0.7	0.6
Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

HD: heading, SR: stripe rust, HT: height, YLD: yield, PRO: protein, TWT: test weight

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Title: Foliar application of abscisic acid in winter wheat – 2015

Objective: To evaluate winter wheat height response to foliar applied abscisic acid.

Results:

Plant height is directly related to lodging, which reduces grain quality and yield. This study was designed to determine the effect of abscisic acid (ABA) on reducing plant height.

The study was established as a randomized complete block with three replications. Yellowstone winter wheat was planted at 80 lb/A in 7 inch rows on September 29, 2014. The factorial treatment arrangement consisted of abscisic acid applied at three different rates and at two different growth stages. The treatment was applied at 0.078 lb ai/A, 0.156 lb ai/A, and 0.624 lb ai/A on May 7^{th} and May 20^{th}, 2015 when the wheat crop was at the two node or flag leaf stage of growth, respectively.

No significant effect was observed for plant height or lodging. However, the application of abscisic acid did have an effect on heading date and test weight (Table 2). Abscisic acid treatments had no effect on heading date when applied at the two node stage of growth. However, when abscisic acid was applied at the flag leaf stage, heading occurred earlier as the application rate increased. As a result, the earliest heading date was observed when the highest rate was applied at flag leaf. At the same time, the highest test weight was associated with this same treatment.

Summary:

It may be possible that the early heading allowed the plant to initiate grain filling before drought conditions became severe, which in turn improved test weight. However, abscisic acid is known to impact plant water use under stressful conditions by regulating stomatal apertures. In either case, these results indicate that foliar applications of ABA may provide benefits with respect to grain quality.

Table 1. Materials and Methods - Winter Wheat Abscisic Acid - 2015

Seeding Date:	9/29/2014	Harvest Date:	7/30/2015
Julian Date:	272	Julian Date:	211
Seeding Rate:	80 lbs/A	Soil Type:	Creston SiL
Previous Crop:	Spring Wheat	Soil Test:	29-10-158
Tillage:	Conventional	Fertilizer:	9-40-10, 0-0-62,130-0-0 TD
Irrigation:	None	Herbicide:	Huskie Complete 13.7 oz/A

Table 2. Agronomic effect of foliar applied abscisic acid on winter wheat

Rate of ConTego lb ai/A	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec
Non-treated check	152.7	43.0	149.1	11.4	61.2	39.6	417.8
				Two nodes			
0.078	152.7	41.7	151.5	11.1	61.6	41.0	413.2
0.156	152.7	42.0	149.1	11.4	61.5	40.0	426.2
0.624	152.0	41.3	147.2	11.6	60.6	39.7	435.4
				Flagleaf			
0.078	153.0	42.0	150.2	11.3	61.4	40.7	417.1
0.156	152.3	41.0	134.3	11.6	60.5	38.5	432.2
0.624	151.7	41.7	148.3	11.3	61.9	41.1	421.5
Mean	152.4	41.8	149.2	11.4	51.4	40.1	423.3
CV	0.3	1.8	5.2	5.2	0.5	3.8	4.8
LSD P=.05	0.8	ns	ns	ns	0.4	ns	ns
Pr>F	0.0314	0.1360	0.9872	0.9230	0.0203	0.4205	0.7957

HD: heading, HT: height, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, ns: nonsignificant

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Table 3. Main effect of application timing

Timing	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec
two node	153	42.0	149.2	11.4	61.2	40.1	423.2
flag leaf	152	41.9	145.5	11.4	61.2	40.0	422.2
LSD	ns	ns	ns	ns	ns	ns	ns
Pr>0.05	0.4226	0.8075	0.3067	0.9715	0.9415	0.7759	0.9068

Table 4. Main effect of treatment rate

Rate of ConTego lb ai/A	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec
Non-treated check	153	43.0	149.1	11.4	61.2	39.6	417.8
0.078	153	41.8	150.9	11.2	61.5	40.9	415.2
0.156	153	41.5	141.7	11.5	61.0	39.2	429.2
0.624	152	41.5	147.7	11.4	61.2	40.4	428.5
LSD	ns	ns	ns	ns	ns	ns	ns
Pr>0.05	0.0848	0.1063	0.5344	0.7843	0.2392	0.4618	0.4335

HD: heading date, HT: height, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, ns: nonsignificant

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Table 5. Effect of application timing and treatment rate

Timing	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	TKW[1] g	FN sec
			Non-treated check				
two node	153	43.0	149.1	11.4	61.2	39.6	417.8
flag leaf	153	43.0	149.1	11.4	61.2	39.6	417.8
			0.078 lb ai/A				
two node	153	41.7	151.5	11.1	61.6	41.0	413.2
flag leaf	153	42.0	150.2	11.3	61.4	40.7	417.1
			0.156 lb ai/A				
two node	153	42.0	149.1	11.4	61.5	40.0	426.2
flag leaf	152	41.0	134.3	11.6	60.5	38.5	432.2
			0.624 lb ai/A				
two node	152	41.3	147.2	11.6	60.6	39.7	435.4
flag leaf	152	41.7	148.3	11.3	61.9	41.1	421.5
LSD	ns	0.6	ns	ns	1.1	ns	ns
Pr>0.05	0.4547	0.0293	0.4486	0.8263	0.0452	0.4392	0.8542

HD: heading date, HT: height, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number, ns: nonsignificant

[1] adjusted to 13% moisture, [2] adjusted to 12% moisture

Title: Evaluation of Winter Wheat Experimental Lines - 2015

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

Results:

Winter wheat yields averaged 115.0 bu/A, and ranged from to 59.5 bu/A for Jerry to 154.6 bu/A for MT1354 (Table 2). Stripe rust was prevalent in the nursery, with an average infection level of 40.7% and ranged from 3.7% for MT0978 to 96.7% for WB4059CLP. Days to fifty percent heading averaged 153 days (June 2) and ranged from 147 days (May 27) for Freeman and T158 to 157 days (June 6) for WB3768. Height averaged 38.2 inches and ranged from 28.8 inches for WB4059CLP to 50.6 inches for MTF1232. No lodging was observed in the entire nursery. Percent protein averaged 9.9% and ranged from 9.0% for MT 1332 and MT1286 to 11.4% for Brawl CL Plus.

Summary:

Despite unseasonably low levels of precipitation, significant stripe rust pressure was prevalent. In conclusion an inverse relationship exists between percent yield loss as a function of percent stripe rust infection (Graph 1).

Table 1. Materials and Methods - Winter Wheat Intrastate, Kalispell - 2015

Seeding Date:	9/29/2014	Harvest Date:	7/29/2015
Julian Date:	272	Julian Date:	210
Seeding Rate:	100 lb/A	Soil Type:	Creston SiL
Previous Crop:	Canola	Soil Test:	29-10-158
Tillage:	Conventional	Fertilizer:	9-40-70, 130-0-0 TD
Irrigation:	None	Herbicide:	Huskie 11 oz/A

Graph 1. Yield loss as a function of stripe rust infection

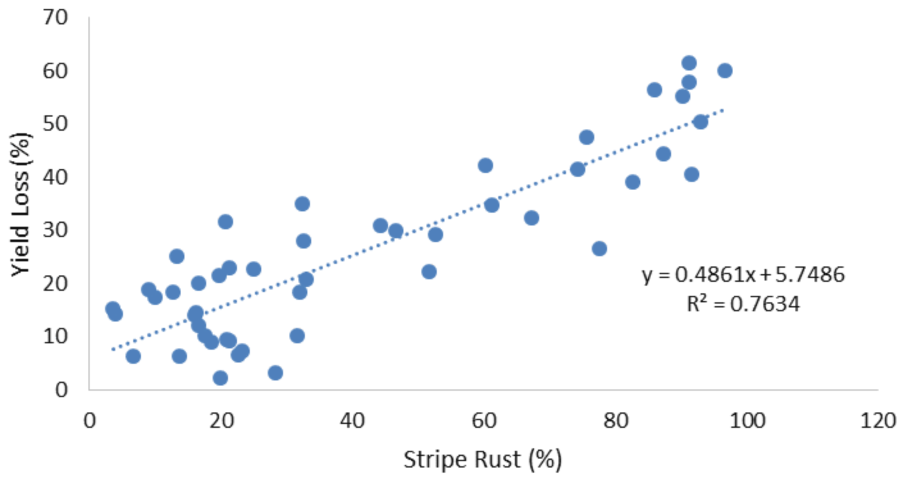

Table 2. Agronomic data from the Intrastate Winter Wheat nursery, Kalispell 2015

Cultivar	HD Julian	SR %	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu
MT1354	154	14.3	40.1	154.6	10.0	63.0
Colter	155	20.0	41.6	151.2	9.9	62.3
CDC Chase	155	28.3	41.2	149.7	10.1	62.3
MT1332	154	13.7	39.4	144.8	9.0	62.0
MTS1224	154	6.7	36.9	144.7	9.7	62.4
MT1257	153	22.7	39.9	144.3	10.1	61.9
MT1138	154	23.3	40.6	143.5	9.5	62.3
MTCL1131	155	18.7	42.1	140.6	10.2	62.9
Yellowstone	153	21.3	40.7	140.5	9.7	62.3
MT1265	155	21.0	41.4	139.9	9.3	61.3
MT1078	153	31.7	37.7	139.0	9.2	61.3
MT1117	154	17.7	40.3	138.8	9.8	62.7
WB3768	157	16.7	43.5	135.8	9.6	62.7
MT1348	152	16.0	36.1	132.9	9.7	63.4
Warhorse	154	4.0	38.7	132.4	11.0	62.3
SY Clearstone 2CL	154	16.3	40.2	132.0	10.4	62.3
MT0978	154	3.7	38.9	130.8	10.5	62.1
WB-Quake	153	10.0	37.7	127.5	9.6	62.8
MTCL1329	152	32.0	36.3	126.3	10.0	63.0
MTS0826-63	155	12.7	41.5	126.1	10.1	63.4
Judee	153	9.0	37.8	125.4	9.9	63.0

HD: heading, SR: stripe rust ,HT: height, YLD: yield, PRO: protein, TWT: test weight

[1]adjusted to 13% moisture, [2]adjusted to 12%

Table 2. con't

Cultivar	HD Julian	SR %	HT in	YLD bu/A	PRO %	TWT lb/bu
MT1361	155	16.7	34.5	123.7	9.8	62.1
Keldin	153	33.0	35.6	122.3	9.8	63.1
SY Monument	151	19.7	37.0	121.5	9.2	61.6
Freeman	147	51.7	38.4	120.3	9.4	61.2
LCS Mint	150	25.0	38.2	119.4	9.7	63.9
T158	147	21.3	35.2	119.0	10.1	63.2
WB4623CLP	153	13.3	35.4	115.9	10.9	63.2
MT1286	155	77.7	39.2	113.5	9.0	62.0
06BC796#68	150	32.7	31.8	111.3	9.9	63.6
MTF1232	156	52.7	50.6	109.4	10.1	63.1
MTCS1204	155	46.7	38.6	108.2	10.4	62.4
WB4614	153	44.3	33.2	106.9	9.8	62.4
SY Wolf	151	20.7	32.7	105.7	9.6	62.6
Ledger	153	67.3	36.0	104.6	9.9	63.4
Rampart	153	61.3	41.8	101.0	9.5	62.6
MTS1305	152	32.3	34.0	100.7	9.5	62.6
Denali	152	82.7	38.9	94.2	10.1	60.8
Cowboy	152	91.7	35.2	91.7	10.1	59.5
Brawl CL Plus	148	74.3	35.6	90.5	11.4	60.9
CDC Falcon	153	60.3	32.1	89.2	9.9	61.3
Byrd	150	87.3	36.6	86.0	9.1	59.8
Bearpaw	153	75.7	37.4	81.2	10.4	58.7
LCH 10-13	151	93.0	39.9	76.7	10.5	61.7
Decade	152	90.3	36.1	69.3	9.5	58.7
Broadview	154	86.0	36.4	67.3	11.2	56.5
Genou	154	91.3	43.1	65.0	10.1	60.9
WB4059CLP	148	96.7	28.8	61.6	10.9	60.4
Jerry	154	91.3	44.8	59.5	9.5	57.4
Mean	153	40.7	38.2	115.0	9.9	61.9
LSD	1.5	17.0	3.2	12.4	.	.

HD: heading, SR: stripe rust ,HT: height, YLD: yield, PRO: protein, TWT: test weight

[1]adjusted to 13% moisture, [2]adjusted to 12%

OILSEEDS

Project Title: Canola Planting Date and Population Study – 2015.

Objective: To identify the optimum canola planting date and density for northwestern Montana.

Materials and Methods:

The factorial treatment arrangement consisted of two canola varieties, three seeding dates and three plant densities. The two varieties selected were DKL 30-03 and DKL 70-07, representing early and late maturity groups, respectively. The three seeding dates were April 21, May 8, and May 22. The first seeding date was the earliest date we could get into the field. Subsequent planting dates were targeted at increments of 300 growing degree days at base 32F (GDD32), which represents the number of GDD necessary for the first true leaves to emerge. 300 GDD separated the first and second seeding date and 272 GDD had accumulated between the second and third date. Targeted plant densities were 4, 8, and 16 plants per square foot. Seeding rates were calculated using the following formula: lb/A = (9.6 x desired plant density per sqft x thousand kernel weights) / percent survival (Table 1). The experimental design was a split plot randomized complete block with three replications, where the main plot factor was seeding date, and the sub plot factor consisted of plant density and variety combinations.

Soil test results showed 61-8-180-62 pounds of available nutrients and a fertilizer blend of 125-35-35-20 was broadcast and incorporated one day prior to each seeding date. Each seeding date was treated with glyphosate, Warrior II, and Quadris for the control of weeds, insects, and diseases, respectively.

An economic analysis was performed for each treatment by calculating adjusted gross returns (AGR). Adjusted gross returns were determined using a market price of $7.75/bu, multiplied by yield, minus the seed cost at $5.00/ lb.

Table 1. Seeding rates and cost to achieve target plant densities.

Variety	TKW	Plants/sqft	Rate (lb/A)	Seed cost @ $5/lb
DKL 30-03	4.8	4.0	2.5	12.50
DKL 30-03	4.8	8.0	4.9	24.50
DKL 30-03	4.8	16.0	9.8	49.00
DKL 70-07	5.1	4.0	2.6	13.00
DKL 70-07	5.1	8.0	5.2	26.00
DKL 70-07	5.1	16.0	10.4	52.00

Estimated survival rate: 75%

lb/A = (9.6 x TKW x Desired Plant Density)/75

Variety	TKW	Plant/sqft	Rate (lb/ac)
DKL 30-03	4.8	4	2.5
DKL 30-03	4.8	8	4.9
DKL 30-03	4.8	16	9.8
DKL 70-07	5.1	4	2.6
DKL 70-07	5.1	8	5.2
DKL 70-07	5.1	16	10.4

Variety	TKW	Plant/sqft	Rate (lb/ac)
DKL 30-03	4.8	4	2.5
DKL 30-03	4.8	8	4.9
DKL 30-03	4.8	16	9.8
DKL 70-07	5.1	4	2.6
DKL 70-07	5.1	8	5.2
DKL 70-07	5.1	16	10.4

Results:

Varietal differences were significant for flowering, physiological maturity, lodging, height, yield, oil content, test weight, and adjusted gross returns (Table 2). DKL 30-03 was the earliest maturing variety, reaching flowering and physiological maturity about two days earlier than DKL 70-07. Although DKL 30-03 was the shortest variety, it had the greatest lodging. Biomass was similar between the two varieties, but DKL 70-07 out-yielded DKL 30-03 by 7.8 bu/A. At the same time, DKL 70-07 was the most profitable, generating an additional $59.00 per acre as compared to DKL 30-03.

The plant density counts were taken prior to bolt (STAND 1) and at pod fill (STAND 2). The populations obtained in the field were, on average, very close to the targeted populations of 4, 8, and 16 plants/sqft (Table 3). The main effect of plant density had significant effects on several variables. As density increased, flowering was delayed, plant height decreased, and lodging tended to increase. However, due to the plastic nature of canola, plant density provided no detectable differences in yield or biomass. The most profitable seeding rate was 8 plants/sqft, but this was not statistically significant.

Of the three main effects, seeding date had the greatest influence on canola emergence rate. As seeding date was delayed, emergence rate increased from a low of 20 days after planting (dap) at the first planting to a high of 6.8 dap at the third planting (Table 4). It is likely that soil temperature during germination influenced emergence rate. The average 2 inch soil temperature from time of seeding to 50% emergence for the three seeding dates were 48.9°F, 54.2°F, and 60.8° Fahrenheit.

Seeding date also had an effect of plant stand. The second seeding on May 8 provided the greatest average plant density at 13.7 plants/sqft, which is approximately 4 plants/sqft greater than either of the other two seeding dates.

The main effect of seeding date also influenced flowering, physiological maturity, stand, height, yield, biomass, test weight, and adjusted gross return (Table 4). As seeding date became later, plants matured and developed more quickly. However, plant height, biomass, yield, test weight and adjusted gross returns all decreased.

Summary:

In summary, the highest seed quality, greatest yield and adjusted gross return was afforded with the earliest seeding date despite the overall delay in crop development (Table 4). When faced with the decision of having to plant late or re-plant a field, one needs to know what the expected yield is for a particular field and estimate a yield reduction of approximately 30% for a late May seeding date.

Table 2. Main effect of variety on agronomic performance of canola - 2015

	EMERG dap	FLWR dap	PM dap	STAND 1 sqft	STAND 2 sqft	LOD %	HT in	YLD[1] bu/A	BIO g/sqft	OIL[1] %	TWT[1] lb/bu	TKW[1] g	AGR $/A
DKL 30-03	11.8	47.9	91.5	10.8	10.9	5.4	45.9	55.9	94.0	47.2	50.3	3.8	404.70
DKL 70-07	11.7	49.1	93.6	11.1	10.9	3.4	47.2	63.7	95.1	47.9	51.0	3.8	463.50
LSD	ns	0.4	0.3	ns	ns	1.4	1.4	3.3	ns	0.5	0.3	ns	25.50
Pr>0.05	0.8176	0.0001	0.0001	0.7214	0.9202	0.0080	0.0636	0.0013	0.8708	0.0089	0.0003	0.4024	0.0016

Table 3. Main effect of plant density on agronomic performance of canola - 2015

	EMERG dap	FLWR dap	PM dap	STAND 1 sqft	STAND 2 sqft	LOD %	HT in	YLD[1] bu/A	BIO g/sqft	OIL[1] %	TWT[1] lb/bu	TKW[1] g	AGR $/A
4 plants/ sqft	12.2	48.3	92.4	4.7	4.7	1.3	47.8	57.1	93.6	47.8	50.6	3.9	429.80
8 plants/sqft	11.7	48.6	92.4	10.1	10.6	1.7	46.7	63.2	96.0	47.4	50.5	3.7	464.40
16 plants/sqft	11.4	48.6	92.8	18.1	17.4	10.3	45.2	59.2	94.1	47.5	50.9	3.8	408.10
LSD	ns	0.2	ns	2.6	2.3	ns	1.9	ns	ns	ns	ns	ns	39.40
Pr>0.05	0.0617	0.0028	0.5875	0.0001	0.0001	0.0512	0.0350	0.1336	0.9357	0.5270	0.4419	0.0519	0.0738

Table 4. Main effect of seeding date on agronomic performance of canola - 2015

	EMERG dap	FLWR dap	PM dap	STAND 1 sqft	STAND 2 sqft	LOD %	HT in	YLD[1] bu/A	BIO g/sqft	OIL[1] %	TWT[1] lb/bu	TKW[1] g	AGR $/A
4/11	20.1	53.8	105.4	9.4	9.8	8.6	52.3	71.6	103.4	47.8	52.9	3.6	525.10
5/8	8.4	48.2	88.1	13.7	13.3	2.4	46.2	.	102.2	47.3	49.2	3.8	.
5/22	6.8	43.4	84.2	9.8	9.6	2.2	41.3	48.1	78.1	47.6	49.9	4.0	343.10
LSD	1.6	1.4	1.8	2.2	2.4	ns	3.6	13.9	13.8	ns	1.0	ns	107.60
Pr>0.05	0.0001	0.0001	0.0001	0.0103	0.0214	0.2890	0.0028	0.0184	0.0116	0.7623	0.0012	0.0599	0.0184

Emerg: emergence, dap: days after planting, FLWR: 50% flowering, PM: physiological maturity, STAND 1: plant density prior to bolt, STAND 2: plant density at pod fill, LOD: lodigng, HT: height, YLD: yield, BIO: biomass, TWT: test weight, AGR: adjusted gross return, ns: nonsignificant

[1] adjusted to 8% moisture content, . missing values

Table 5. Effect of variety and plant density on agronomic performance of canola - 2015

	EMERG dap	FLWR dap	PM dap	STAND 1 sqft	STAND 2 sqft	LOD %	HT in	YLD[1] bu/A	BIO g/sqft	OIL[1] %	TWT[1] lb/bu	TKW[1] g	AGR $/A
							DKL 30-03						
4 plants/ sqft	12	48	91	4.3	4.3	1.7	46.9	50.1	92.0	47.5	50.2	3.9	375.80
8 plants/sqft	12	48	91	9.9	10.1	2.1	46.7	57.8	95.3	47.2	50.2	3.7	423.50
16 plants/sqft	11	48	92	18.3	18.1	12.6	44.1	59.9	94.7	47.0	50.4	3.7	414.90
							DKL 70-07						
4 plants/ sqft	12	49	94	5.0	5.0	0.9	48.7	64.1	95.2	48.1	51.0	3.9	483.80
8 plants/sqft	12	49	94	10.3	11.0	1.2	46.8	68.6	96.7	47.6	50.8	3.8	505.40
16 plants/sqft	12	49	94	17.8	16.8	8.1	46.2	58.5	93.5	47.9	51.3	3.8	401.40
LSD	ns	ns	ns	ns	ns	ns	ns	5.7	ns	ns	ns	ns	44.10
Pr>0.05	0.8053	0.7445	0.4132	0.7148	0.4097	0.0692	0.4166	0.0135	0.9660	0.5222	0.6726	0.8840	0.0120

Table 6. Effect of varity and seeding date on agronomic perormance of canola - 2015

	EMERG dap	FLWR dap	PM dap	STAND 1 sqft	STAND 2 sqft	LOD %	HT in	YLD[1] bu/A	BIO g/sqft	OIL[1] %	TWT[1] lb/bu	TKW[1] g	AGR $/A
							DKL 30-03						
4/11	20.1	52.7	104.1	9.3	10.2	9.7	51.0	68.3	110.4	47.3	52.1	3.6	500.80
5/8	8.4	48.0	86.8	13.1	12.8	2.7	46.6	.	99.3	47.0	49.2	3.8	.
5/22	6.9	42.9	83.6	10.1	9.6	4.0	40.2	43.5	72.4	47.4	49.6	3.9	308.70
							DKL 70-07						
4/11	20.0	55.0	106.8	9.6	9.4	7.6	53.5	74.8	96.5	48.3	53.6	3.6	549.50
5/8	8.4	48.3	89.3	14.2	13.8	2.2	45.7	.	105.0	47.5	49.2	3.9	.
5/22	6.8	43.9	84.8	9.4	9.6	0.4	42.4	52.6	83.9	47.8	50.2	4.0	377.60
LSD	ns	0.7	0.5	ns	ns	ns	ns	ns	ns	ns	0.6	ns	ns
Pr>0.05	0.9864	0.0026	0.0007	0.4968	0.6162	0.2051	0.0940	0.4900	0.3108	0.4619	0.0054	0.9359	0.4900

Emerg: emergence, dap: days after planting, FLWR: 50% flowering, PM: physiological maturity, STAND 1: plant density prior to bolt, STAND 2: plant density at pod fill, LOD: lodigng, HT: height, YLD: yield, BIO: biomass, TWT: test weight, AGR: adjusted gross return, ns: nonsignificant

[1] adjusted to 8% moisture content, . missing values

Table 7. Effect of plant density and seeding date on agronomic performance of canola - 2015

	EMERG	FLWR	PM	STAND 1	STAND 2	LOD	HT	YLD[1]	BIO	OIL[1]	TWT[1]	TKW[1]	AGR
	dap	dap	dap	sqft	sqft	%	in	bu/A	g/sqft	%	lb/bu	g	$/A
						4 plants/ sqft							
4/11	20.5	53.8	105.0	4.1	3.8	0.8	54.1	68.5	102.5	47.4	52.8	3.8	518.00
5/8	8.8	48.2	88.0	5.3	5.3	1.3	46.5	.	103.3	47.6	49.0	3.9	.
5/22	7.3	42.8	84.3	4.8	4.8	1.7	42.8	45.7	75.1	48.5	50.0	4.0	341.60
						8 plants/ sqft							
4/11	19.8	53.8	104.8	9.0	9.7	1.3	53.2	75.7	105.1	47.4	52.6	3.5	561.70
5/8	8.2	48.2	88.3	12.6	13.3	1.5	45.3	.	103.1	47.3	49.3	3.8	.
5/22	7.0	43.7	84.0	8.8	8.7	2.2	41.7	50.6	79.9	47.5	49.7	3.9	367.20
						16 plants/ sqft							
4/11	19.8	53.8	106.5	15.3	16.0	23.7	49.4	70.5	102.7	48.5	53.3	3.5	495.60
5/8	8.3	48.2	87.8	23.1	21.2	4.5	46.7	.	100.0	47.0	49.3	3.8	.
5/22	6.2	43.7	84.2	15.8	15.2	2.8	39.4	47.9	79.5	46.8	50.0	4.0	320.70
LSD	ns	0.3	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Pr>0.05	0.7058	0.0008	0.3605	0.1889	0.3334	0.1161	0.1577	0.8751	0.9942	0.1267	0.8114	0.6595	0.8751

Emerg: emergence, dap: days after planting, FLWR: 50% flowering, PM: physiological maturity, STAND 1: plant density prior to bolt, STAND 2: plant density at pod fill, LOD: lodigng, HT: height, YLD: yield, BIO: biomass, TWT: test weight, AGR: adjusted gross return, ns: nonsignificant

[1] adjusted to 8% moisture content, . missing values

Table 8. Effect of variety, seeding date and plant density on agronomic performance of canola -2015

	EMERG dap	FLWR dap	PM dap	STAND 1 sqft	STAND 2 sqft	LOD %	HT in	YLD[1] bu/A	BIO g/sqft	OIL[1] %	TWT[1] lb/bu	TKW[1] g	AGR $/A
4/21 - 4 plants/ sqft													
DKL 30-03	20	53	103	4.6	4.3	0.7	52.1	60.5	118.4	46.8	52.0	3.7	456.60
DKL 70-07	21	55	107	3.5	3.3	1.0	47.1	76.4	86.6	48.1	49.1	3.8	579.50
4/21 - 8 plants/ sqft													
DKL 30-03	20	53	103	8.4	9.0	1.0	41.3	69.7	103.7	47.3	49.6	3.5	515.80
DKL 70-07	20	55	106	9.5	10.3	1.7	52.4	81.8	106.5	47.5	52.0	3.5	607.70
4/21 - 16 plants/ sqft													
DKL 30-03	20	53	106	14.8	17.3	27.3	46.3	74.7	109.1	47.7	49.2	3.5	530.00
DKL 70-07	20	55	107	15.7	14.7	20.0	41.5	66.2	96.3	49.4	49.5	3.5	461.20
5/8 - 4 plants/sqft													
DKL 30-03	9	48	87	3.5	3.7	1.7	48.4	.	84.2	47.5	52.4	3.9	.
DKL 70-07	8	48	89	7.0	7.0	1.0	46.3	.	122.4	47.7	49.1	3.9	.
5/8 - 8 plants/sqft													
DKL 30-03	8	48	87	12.3	13.0	1.0	37.7	.	110.5	46.9	49.7	3.8	.
DKL 70-07	8	48	90	12.9	13.7	2.0	56.2	.	95.8	47.6	53.6	3.7	.
5/8 - 16 plants/sqft													
DKL 30-03	8	48	86	23.5	21.7	5.3	45.8	.	103.1	46.7	48.9	3.6	.
DKL 70-07	9	48	89	22.7	20.7	3.7	44.2	.	97.0	47.4	50.4	4.0	.
5/22 - 4 plants/sqft													
DKL 30-03	7	43	84	4.9	5.0	2.7	54.1	39.7	73.4	48.2	53.2	4.0	295.00
DKL 70-07	7	43	85	4.6	4.7	0.7	44.2	51.8	76.7	48.7	49.3	4.0	388.20
5/22 - 8 plants/sqft													
DKL 30-03	7	43	83	9.0	8.3	4.3	42.0	45.9	71.8	47.5	49.8	3.7	331.30
DKL 70-07	7	44	85	8.5	9.0	0.0	50.4	55.4	88.0	47.6	54.2	4.0	403.00
5/22 - 16 plants/sqft													
DKL 30-03	6	43	84	16.5	15.3	5.0	47.1	45.0	71.8	46.5	49.5	4.0	299.80
DKL 70-07	6	44	85	15.1	15.0	0.7	41.1	50.8	87.1	47.1	50.3	3.9	341.60
LSD	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Pr>0.05	0.7029	0.8741	0.0677	0.5014	0.7460	0.3012	0.8653	0.1230	0.2970	0.7940	0.8366	0.5802	0.1230

Emerg: emergence, dap: days after planting, FLWR: 50% flowering, PM: physiological maturity, STAND 1: plant density prior to bolt, STAND 2: plant density at pod fill, LOD: lodigng, HT: height, YLD: yield, BIO: biomass, TWT: test weight, AGR: adjusted gross return, ns: nonsignificant

[1] adjusted to 8% moisture content, . missing values

Title: Evaluation of Green & Grow Seed Treatment Rates on Canola – 2015

Objective: To evaluate different rates of Green & Grow Agriplier seed treatment on canola development and yield.

"Agriplier is derived from naturally occurring soil bacteria that produce exudates with beneficial plant growth and enhancement properties such as increased yields, early vigor, and more uniform stands".

Results:

Agriplier treatments provided significant differences in plant population (table 2). The average number of plants per square foot was 12.7 and ranged from 9.3 for the AGR300 treatment to 17.0 plants per ft^2 for the AGR200 treatment. Despite the differences in plant population, Agriplier had no significant effect on yield. In addition, no differences were observed between treatments in flowering date, plant height, percent lodging, percent pod shatter, oil content, or test weight.

Table 1. Materials and Methods - Green & Grow - 2015

Seeding Date:	4/21/2015	Harvest Date:	8/10/2015
Julian Date:	111	Julian Date:	222
Seeding Rate:	10 plants/ft^2 6" rows	Soil Type:	Creston SiL
Previous Crop:	Spring Wheat	Soil Test:	61-8-180-62
Tillage:	Conventional-Till	Fertilizer:	125-35-35-20
Irrigation:	None	Insecticide:	Warrior II 1.92 oz/A
Herbicide:	Stinger 8 oz/A	Fungicide:	Quadris 6 oz/A

Table 2. Agronomic data from the statewide Green and Grow seed Treatment Trial, Kalispell, MT - 2015

Treatment	PLNT sqft	FLWR Julian	HT in	LOD %	SHTTR %	YLD[1] bu/A	OIL[1] %	TWT[1] lb/bu	MC %
CTRL	12.3	165	43.3	5.5	0.0	65.7	48.0	52.6	7.6
AGR100	12.0	165	45.0	1.8	0.0	76.1	48.6	52.3	7.0
AGR200	17.0	165	44.3	0.8	0.0	72.8	48.2	52.3	7.3
AGR300	9.3	165	44.3	2.5	0.0	70.3	48.2	52.3	7.2
Mean	12.7	165	44.2	2.6	0.0	71.2	48.3	52.4	7.3
CV	25.2	0.2	4.5	183.7	0.0	14.5	1.8	0.4	7.9
LSD	5.1	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.0437	0.4363	0.6732	0.5646	1.0000	0.5662	0.8204	0.2243	0.4947

PLNT: plant, FLWR: 50% flowering, HT: height, LOD: lodging, SHTTR: shatter, MC: moisture content

[1] adjusted to 8% moisture.

Title: Statewide Canola Variety Evaluation, Kalispell – 2015

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

Results:

Significant differences were observed in plant density, flowering date, plant height, yield, percent oil, and test weight. Plants density averaged 15.5 plants/ft^2 and ranged from 9.8 plants/ft^2 for Cara to 20.4 plants/ft^2 for InVigor L130. Flowering date averaged 169 days (June 18) and spanned a 5 day period that ranged from 166 to 171 days. Plant height averaged 47.7 inches and ranged from 41.8 inches for Arriba to 53.3 inches for InVigor 5440. Lodging averaged 11.6% however, no significant difference was observed among entries. Shatter was 0.0% for all varieties. Yields averaged 61.3 bu/A and ranged from 43.2 bu/A for Cara to 72.9 bu/A for InVigor 5440. Oil content averaged 50.4%, ranging from 46.8% for InVigor L130 to 54.8% for 6074RR and C1516. Test weights averaged 51.0 lb/bu and ranged from 48.5 lb/bu for HyClass 955 to 57.4 lb/bu for C1516.

Summary:

InVigor 5440 was the highest yielding variety and had an oil content of 49.5%. Based on the LSD value for yield at 12.4, 11 varieties were statistically equivalent to InVigor 5440.

Table 1. Materials and Methods - Canola Variety Trial, Kalispell, MT - 2015

Seeding Date:	4/21/2015	Harvest Date:	8/10/2015
Julian Date:	111	Julian Date:	222
Seeding Rate:	10 plants/ft^2 6" rows	Soil Type:	Creston SiL
Previous Crop:	Spring Wheat	Soil Test:	61-8-180-62
Tillage:	Conventional	Fertilizer:	125-35-35-20
Irrigation:	None	Insecticide:	Warrior II 1.92 oz/A
Herbicide:	Stinger 8 oz/A	Fungicide:	Quadris 6 oz/A

Table 2. Agronomic data from the statewide canola variety trial, Kalispell, MT - 2015

Variety	PLNT sqft	FLWR Julian	HT in	LOD %	SHTTR %	YLD[1] bu/A	OIL[1] %	TWT[1] lb/bu	MC %
InVigor 5440	16.9	169	53.3	14.3	0.0	72.9	49.5	51.0	12.5
HyClass 930	14.3	166	46.8	7.3	0.0	71.3	49.3	48.7	7.8
DKL 70-07	16.3	168	48.5	9.3	0.0	68.6	49.4	48.9	8.3
HyClass 955	16.8	167	46.3	8.3	0.0	68.4	49.3	48.5	7.3
InVigor L252	15.2	169	48.8	9.5	0.0	68.3	54.7	51.8	15.0
G49720	17.0	169	45.8	16.3	0.0	66.0	49.9	49.7	10.4
DKL 70-10	16.7	169	49.8	6.3	0.0	65.1	47.1	49.5	9.1
DKL 38-48	13.5	167	44.5	10.0	0.0	64.8	49.1	49.8	9.2
6044RR	16.6	170	47.3	13.8	0.0	64.6	52.4	52.7	16.0
InVigor L140P	19.0	169	48.3	13.0	0.0	64.1	47.7	49.4	9.7
HyClass 970	12.7	169	47.0	14.3	0.0	64.0	52.9	51.5	15.5
G28101	16.0	169	47.0	15.3	0.0	61.6	49.1	49.2	7.3
InVigor L130	20.4	169	50.3	7.0	0.0	59.7	46.8	49.1	7.8
Arriba	17.5	168	41.8	8.8	0.0	55.0	47.7	49.5	7.8
DKL 70-50CR	16.3	168	44.8	15.0	0.0	54.6	52.3	50.3	12.3
C1511	14.0	169	50.0	13.0	0.0	53.9	50.0	54.4	20.5
6074RR	12.2	171	49.5	10.0	0.0	50.4	54.8	56.6	24.8
C1516	12.7	171	51.5	15.0	0.0	47.3	54.8	57.4	25.0
Cara	9.8	169	45.8	14.3	0.0	43.2	50.4	51.0	12.8
Mean	15.5	169	47.7	11.6	0.0	61.3	50.4	51.0	12.6
CV	19.7	0.5	7.0	60.5	0.0	14.3	3.6	1.7	15.6
LSD	4.3	1.2	4.7	ns	ns	12.4	2.6	1.2	2.8
Pr>F	0.0016	0.0001	0.0029	0.6236	1	0.0001	0.0001	0.0001	0.0001

PLNT: plant, FLWR: 50% flowering, HT: height, LOD: lodging, SHTTR: shatter, YLD: yield, TWT: test weight, MC: moisture content, ns: nonsignificant

[1] adjusted to 8% moisture.

PULSES

Project Title: Statewide Lentil Variety Trial - 2015

Objective: To evaluate Lentil cultivars for yield and agronomic performance in Northwestern Montana.

Results:

No significant difference was observed for lentil yield. Yields averaged 15.2 bu/A (Table 2) that ranged from 12.9 bu/A for PSO7ND055E to 17.6 bu/A for CDC Impala CL. Statistical difference was observed for flowering, with an average occurrence at 173 Julian days (June 22): the earliest was PSO7ND055E at 169 days (June 16); the latest was CDC Redcoats at 177 days (June 26). Significant difference in height at flowering was observed and averaged 11.6 inches, ranging from 10.0 inches for PSO7ND055E to 12.5 inches for Viceroy. No significant differences were observed for heights at pod fill or physiological maturity. No statistical difference was observed for test weight, which averaged 59.9 lb/bu. Thousand kernel weight was significant and averaged 45.2 grams, and ranged from 32.6 grams for Viceroy to 62.3 grams for NDL08187L.

Summary:

Lentil yields on average were down from last year by more than 8 bu/A. The nursery was planted under rainfed condition and there was an extreme moisture stress (drought year) that influenced low yields.

Table 1.Material and Methods — Lentil Variety Trial — 2015

Seeding Date:	4/29/2015	Harvest Date:	8/17/2015
Julian Date:	119	Julian Date:	229
Seeding Rate:	12 plants/sqft	Soil Test:	NA
Previous Crop:	Barley	Fertilizer:	6-30-20
Tillage:	Conventional	Herbicide:	Prowl H20 2 pt/A + Pursuit 3 oz/A (pre-plant)
Irrigation:	None		Assure II 10-12 floz/A + NIS 1 qt/100 gal + AMS 2-4 lb/A
Soil Type:	Creston Silt Loam		

Table 3. Lentil agronomic data — 2015

Cultivar	FLWR Julian	HT FLWR in	HT PF in	HT PM in	YLD lb/A	YLD bu/A	TWT lb/bu	TKW g
CDC Impala CL	174	11.0	11.5	11.0	1056.6	17.6	66.2	32.8
Viceroy	173	12.5	13.8	13.3	985.7	16.5	64.1	32.6
CDC Richlea	173	12.3	13.3	12.5	971.7	16.2	59.5	53.3
Avondale	172	11.5	13.3	13.3	931.4	15.5	43.9	50.7
CDC Redcoats	177	12.3	12.3	12.5	849.4	14.2	61.5	42.8
NDL08187L	175	12.0	12.7	12.4	810.0	13.5	60.2	62.3
PSO7ND055E	169	10.0	13.7	11.4	776.1	12.9	63.5	41.6
Mean	173	11.6	12.9	12.3	911.5	15.2	59.9	45.2
CV	0.87	5.7	10.2	11.1	17.7	17.6	20.1	2.5
LSD	2.25	1.0	ns	ns	ns	ns	ns	1.7
Pr>F	0.0001	0.0007	0.2261	0.2148	0.2051	0.2004	0.2375	0.0001

FLWR: 50% flower, HT FLWR: height at flowering, HT PF: height at pod fill, HT PM: height at physiological maturity, YLD: yield, TWT: test weight, TKW: thousand kernel weight, ns: nonsignificant.

Project Title: Statewide Pea Variety Trial - 2015

Objective: To evaluate pea cultivars for yield and agronomic performance in Northwestern Montana.

Results:

No significant difference was observed for yellow pea yield. Mean yield was 19.2 bu/A and ranged from 13.8 bu/A for Mystique to 24.5 bu/A for Nette 2010 (Table 2). Statistical difference was observed for flowering, with an average occurrence at 171 Julian days (June 20); the earliest was Universal Yellow at 167 days (June 16); the latest was CDC Amarillo at 174 days (June 23). Significant difference in height at 50% flowering averaged 15.1 inches, and ranged from 11.6 inches for Delta to 17.6 inches for Jetset. Delta remained the shortest variety at pod fill and at physiological maturity while Jetset remained the tallest. No statistical difference was observed for test weight, which averaged 64.6 lb/bu. Thousand kernel weight was significant with an average of 188.2 grams and ranged from 160.3 grams for CDC Meadow to 215.0 grams for Mystique.

No significant difference was observed for green pea yield, which averaged 19.3 bu/A (Table 3). Days to flowering was significant among cultivars with an average occurrence at 171 Julian days (June 20). Height at flowering ranged from 11.4 inches for Arcadia to 16.9 inches for Viper. Viper was the tallest variety until physiological maturity. Test weight averaged 63.8 lb/bu with no significant difference observed amongst cultivars. Significant difference was observed for thousand kernel weight and ranged from 155.5 grams for Aragorn to 205.9 grams for Majoret.

Summary:

Pea yields on average were down from last year by more than 50 bu/A. The nursery was planted under rainfed condition and there was an extreme moisture stress (drought year) that affected low yields.

Table 1. Materials and Methods — Pea Variety Trial — 2015

Seeding Date:	4/29/2015	Harvest Date:	7/24/2015
Julian Date:	119	Julian Date:	205
Seeding Rate:	8 plants/sqft	Soil Test:	NA
Previous Crop:	Barley	Fertilizer:	6-30-20
Tillage:	Conventional	Herbicide:	Prowl H20 2 pt/A + Pursuit 3 oz/A (pre-plant)
Irrigation:	None		Assure II 10-12 floz/A + NIS 1 qt/100 gal + AMS 2-4 lb/A
Soil Type:	Creston Silt Loam		Basagran 1-2 pt/A + MSO 0.5-1 pt/A + 28% UAN 2-4 pt/A

Table 2. Yellow pea agronomic data — 2015

Cultivar	FLWR Julian	HT FLWR in	HT PF in	HT PM in	YLD lb/A	YLD bu/A	TWT lb/bu	TKW g
Nette 2010	168	14.0	17.7	15.5	1470.5	24.5	66.4	182.8
CDC Saffron	173	14.1	17.2	15.8	1396.0	23.3	60.8	190.4
Jetset	171	17.6	22.1	18.7	1358.7	22.7	65.4	184.6
Univeral Yellow	167	15.0	19.1	15.9	1301.9	21.7	65.1	172.1
Early star	171	17.0	20.8	18.5	1258.3	21.0	65.5	178.5
CDC Treasure	170	16.3	21.4	17.6	1255.4	20.9	65.3	175.5
Agassiz	172	15.4	21.5	18.1	1207.7	20.2	64.3	194.1
DS Admiral	171	15.8	20.2	16.4	1197.6	20.0	64.8	187.8
Hyline	170	15.8	19.1	15.8	1168.6	19.5	65.6	193.4
Navarro	168	13.5	16.6	15.7	1166.3	19.4	64.5	200.8
CDC Meadow	170	14.7	17.3	16.9	1163.0	19.4	65.2	160.3
AAC Carver	173	16.2	19.5	18.0	1032.3	17.2	65.0	189.0
Abarth	173	14.9	18.2	17.6	1031.6	17.2	63.7	208.3
CDC Amarillo	174	14.9	18.3	17.0	971.1	16.2	64.6	185.0
Korando	171	13.9	17.3	15.0	895.9	14.9	65.1	208.4
Delta	169	11.6	15.4	13.2	891.6	14.9	64.8	173.7
Mystique	171	15.4	19.9	16.0	829.6	13.8	62.6	215.0
Mean	171	15.1	18.9	16.6	1152.7	19.2	64.6	188.2
CV	1.0	10.8	10.4	10.9	25.7	25.7	3.5	4.3
LSD	2.4	2.3	2.8	2.6	ns	ns	ns	11.6
Pr>F	0.0001	0.0014	0.0002	0.0074	0.1118	0.1086	0.2315	0.0001

Table 3. Green pea agronomic data — 2015

Cultivar	FLWR Julian	HT FLWR in	HT PF in	HT PM in	YLD lb/A	YLD bu/A	TWT lb/bu	TKW g
Majoret	170	14.5	18.1	16.0	1246.2	20.8	64.0	205.9
Aragorn	167	13.7	17.9	16.6	1243.7	20.7	63.1	155.5
Arcadia	171	11.4	16.5	14.8	1201.6	20.1	63.9	171.1
Hampton	172	14.0	17.1	14.2	1201.6	20.1	63.2	202.6
CDC Striker	173	14.1	18.0	16.0	1140.6	19.0	64.6	192.8
Viper	170	16.9	19.8	18.1	1121.1	18.7	64.2	184.0
LN1123	174	13.4	16.1	14.4	1075.7	17.9	62.6	172.6
Daytona	172	15.7	19.4	17.8	1043.5	17.4	64.8	197.8
Mean	171	14.2	17.9	16.0	1159.3	19.3	63.8	185.3
CV	0.8	11.9	8.5	12.3	21.9	21.9	3.1	5.0
LSD	1.9	2.5	2.2	ns	ns	ns	ns	13.5
Pr>F	0.0001	0.0088	0.0300	0.0738	0.9167	0.9156	0.7042	0.0001

FLWR: 50% flower, HT FLWR: height at flowering, HT PF: height at pod fill, HT PM: height at physiological maturity, YLD: yield, TWT: test weight, TKW: thousand kernel weight, ns: nonsignificant.

FORAGES

Project Title:	Effects of Boron Fertilizer on Alfalfa Yield and Quality — 2015
Project Leader:	Jessica Torrion (PI), Bob Stougaard (Co-PI)
Project Personnel:	John Garner, Brooke Bohannon, Emily Glunk
Objective:	To evaluate the effects of boron fertilizer rate and timing on alfalfa yield and quality.

Summary:

Boron treatments were applied to evaluate the impact on alfalfa yield and quality, which included 5 rates of 0, 0.25, 0.5, 1, and 2 lbs/A at begin season (April 16) and 4 rates of 0, 0.25, 0.5, and 1 lbs/A at midseason (June 23). The experimental design was a randomized complete block with five treatments and four replications. Treatments were applied when the crop averaged 2-3 inches in height. There was a full soil profile beginning of green up in spring as rainfall received in the fall and early spring was above average. From the first green up to the last cutting (April to September, 2015) only 3.5 inches of rain was received and supplemental irrigation was needed. Height measurements were taken prior to cutting when plants averaged 10% flowering. Three cuttings were made.

No significant differences were observed for height or yield (Table 2). Average total yields were 6.1 T/A. First harvest had the highest yield at 3 T/A while third had the lowest at 1.4 T/A. The initial soil test for Boron in spring was low, but the average Boron tissue test (Table 3) were near or at sufficiency level for low Boron application, thus, no consistent hay quality trend can be observed. Alfalfa Boron trial was conducted on the second year of alfalfa establishment. Future studies will consider irrigation as an additional factor to Boron uptake and hay quality.

Table 1. Materials and methods.

Seeding Date:	5/15/14	1st Application Date:	4/16/15
Julian Date:	135	Julian Date:	106
Seeding Rate:	12 lbs/A	2nd Application Date:	6/23/15
Previous Crop:	Barley	Julian Date:	174
Tillage:	Conventional	1st Harvest Date:	6/10/15
Irrigation:	Yes	Julian Date:	161
Soil Type:	Fine sandy loam	2nd Harvest Date:	7/14/15
Soil Test:	30-21-201	Julian Date:	195
Fertilizer:	Liquid Boron 10% -Agrisolutions	3rd Harvest Date:	10/2/15
Rates:	0.0, 0.25, 0.5, 1.0, 2.0 lbs/A	Julian Date:	275

Table 2. Effects of boron fertilizer on alfalfa yield — 2015

	1st Harvest - Jun 10		2nd Harvest -Jul 14		3rd Harvest - Oct 2		Harvest Total
	HT	YLD	HT	YLD	HT	YLD	YLD
Treatment	in	T/A	in	T/A	in	T/A	T/A
0 lbs B	27	3.0	22	1.9	21	1.6	6.5
0.25 lb B begin + mid season	28	3.1	22	1.7	21	1.5	6.2
0.5 lb B begin + mid season	27	2.9	21	1.7	23	1.4	6.0
1 lb B begin + mid season	29	3.0	21	1.6	21	1.4	6.0
2 lbs B begin season	28	3.0	20	1.6	20	1.3	5.9
Mean	28	3.0	21	1.7	21	1.4	6.1
CV	8	11	10	9	17	13	8
LSD	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.5978	0.9730	0.5875	0.0855	0.8307	0.3720	0.4408

HT: height, YLD: yield, ns: nonsignificant, B: boron (amount applied begin season same as mid season)

Table 3. Boron uptake and hay quality — 2015

	CP	ADF	NDF	TDN	RFV	B
Treatment	%	%	%	%	%	ppm
	1st Harvest - Jun 10					
0 lbs B	25.6	30.0	44.1	66.3	138	25
0.25 lb B begin + mid season	25.7	27.7	38.8	68.8	161	34
0.5 lb B begin + mid season	27.7	28.6	36.0	67.8	172	30
1 lb B begin + mid season	22.9	33.0	38.5	63.1	153	30
2 lbs B begin season	28.9	30.4	34.7	65.9	175	38
	2nd Harvest - Jul 14					
0 lbs B	22.7	35.0	40.3	60.9	142	25
0.25 lb B begin + mid season	22.4	36.3	42.5	59.5	133	33
0.5 lb B begin + mid season	22.8	37.8	45.7	57.9	121	34
1 lb B begin + mid season	28.3	28.2	31.9	68.2	195	30
2 lbs B begin season	25.6	34.5	40.2	61.5	144	38
	3rd Harvest - Oct 2					
0 lbs B	25.6	22.1	29.1	74.8	229	32
0.25 lb B begin + mid season	27.4	24.3	29.0	72.5	224	41
0.5 lb B begin + mid season	25.0	25.7	31.0	71.0	207	32
1 lb B begin + mid season	24.7	22.9	30.4	74.0	217	43
2 lbs B begin season	25.1	25.8	29.7	70.8	215	40

CP: crude protein, ADF: acid detergent fiber, NDF: neutral detergent fiber, TDN: total digestible nutrients, RFV: relative feed value, B: boron (amount applied begin season same as mid season)