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

ANNUAL REPORT
2016 CROP YEAR

Sixty-eighth annual report

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NORTHWESTERN AGRICULTURAL RESEARCH CENTER
STAFF 2016

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Erik Echegaray, Post-Doctoral Research Associate

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Jordan Penney, Farm Manager

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Jessica Torrion, Assistant Professor of Crop Physiology

Sherry Turner, Research Associate

Part Time Staff Members

Mary Ann Davis, Research Assistant II

Olin Erickson, Research Assistant II

Seasonal Employees

Brad Carlin

Dave Davis

Don Edsall

Dennara Gaub

Dennis Graham

Ashley Hubbard

Whitney Kirkland

Nathan Moon

Justin Vetch

Stephanie Wilson

Intern

Myndi Holbrook

Cole McCann

Graduate Students

Breno Almeida

Anish Sapkota

CLIMATOLOGY

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

AgriMet
Cooperative Agricultural Weather Network

2015-2016 Weather Trend in Relation with the 28-year (1989-2016) Climate Data

Temperatures and rainfall from December 2015 through April 2016 were slightly higher compared with the 28-year average. Thereafter, the monthly mean temperatures and rainfall closely followed the historical average (Fig. 1and 2). The potential evapotranspiration demand followed the historical average except for July through September 2016 (Fig. 3).

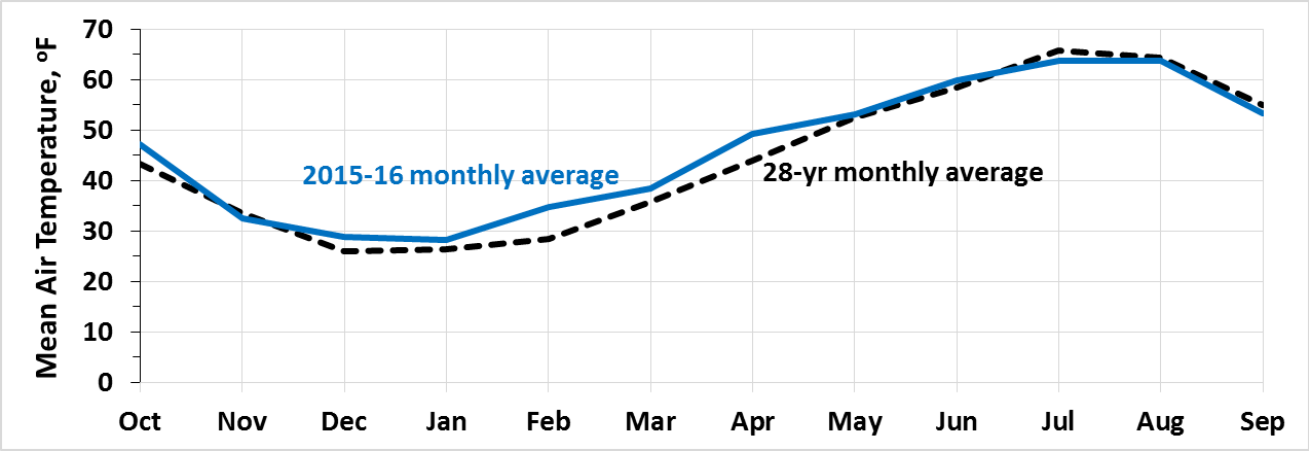


Figure 1. 2015-16 monthly mean temperature relative to the mean historical ambient temperature.

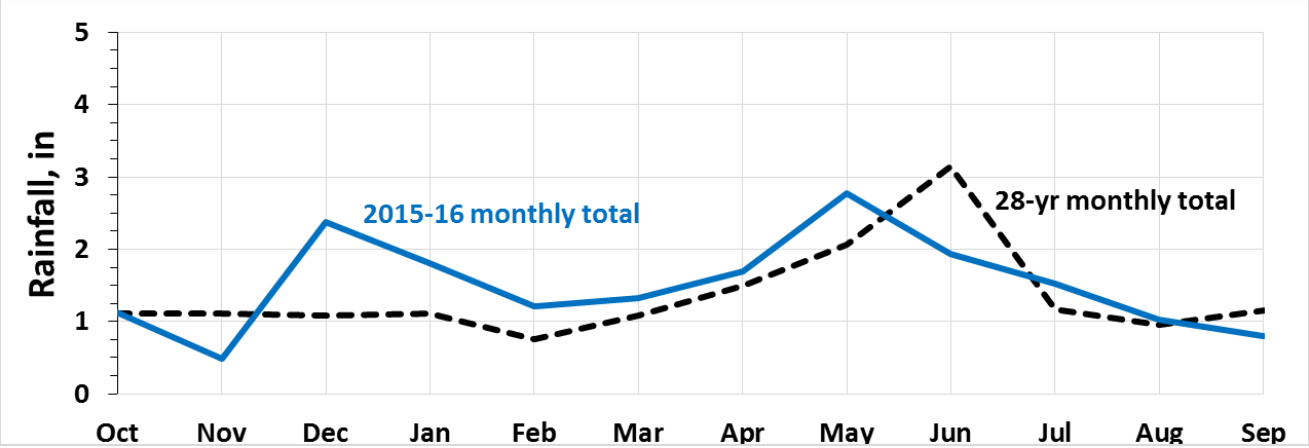


Figure 2. 2015-16 monthly total rainfall received relative to the historically expected rain.

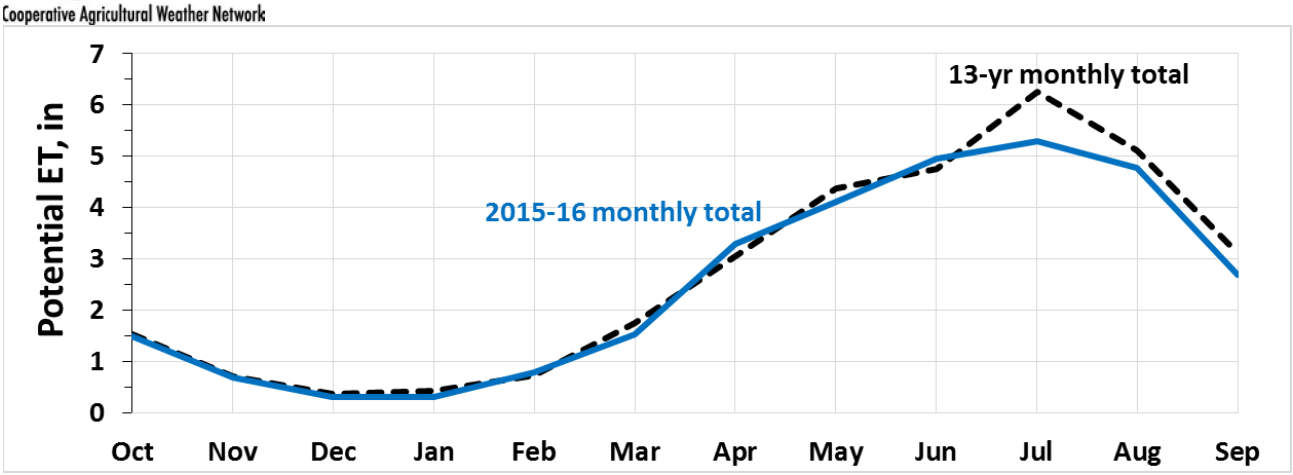


Figure 3. 2015-2016 monthly total potential evapotranspiration (ETo, grass as reference) relative to the 13-year ETo monthly total (2004-2016).

Summary of Climatic Data by Months for the 2016 Crop Year: September 1, 2015 - August 31, 2016 and Averages for the Years 1981-2016 at the Northwestern Agricultural Research Center, Kalispell, Montana

	Sept. 2015	Oct. 2015	Nov. 2015	Dec. 2015	Jan. 2016	Feb. 2016	Mar. 2016	Apr. 2016	May 2016	June 2016	July 2016	Aug. 2016	
Precipitation (inches)													Total
Current Year	0.96	0.79	1.00	2.16	1.42	1.01	0.97	1.50	2.78	2.07	1.55	1.11	17.32
1981-2016	1.60	1.43	1.60	1.50	1.40	1.16	1.29	1.75	2.38	3.35	1.56	1.11	20.13
Average Temperature (F°)													Average
Current Year	52.8	46.6	31.2	27.4	27.0	33.2	37.2	47.8	51.4	58.4	62.6	62.7	44.9
1980-2016	53.9	42.4	32.3	24.3	24.6	27.3	35.0	43.1	51.3	57.6	64.4	63.5	43.3

Last killing frost[1] in spring

Spring 2016	May 30	32°
Median for 1980-2016	May 20	31°

First killing frost[1] in fall

Fall 2016	Sep 4	32°
Median for 1980-2016	Sep 17	29°

Frost Free Period

Avg. 1980-2016 122 days

Growing Degree Days April - August 2016

	April	May	June	July	Aug	Total
Base 50	170	214	350	411	442	1587
Base 40	325	392	560	666	672	2615
Base 32	490	601	793	906	908	3698

Maximum summer temperature	Aug 31	91°
Minimum winter temperature	Jan 2	-2°

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

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

Summary of the 2015-2016 crop year

September 2015: With September came the start of the new crop year as well as the first frost. On September 17th a low of 29°F was recorded. September temperatures ranged from a low of 28°F on the last three days of September, to a high of 83°F on the 13th, with a low average of 38°F and a high average of 68° Fahrenheit. The total precipitation for September was 0.96", which is 0.64" below the 35-year average precipitation for September of 1.61 inches.

October 2015: October temperatures ranged from a low of 20°F on the 24th to a high of 76°F on the 11th, with a low average of 33°F and a high average of 60° Fahrenheit. The total precipitation for October was 0.79", which is 0.53" below the 35-year average precipitation for October of 1.32 inches. The precipitation accumulation for the crop year so far was 1.75", which is 1.18" below the 35 year average precipitation accumulation in October of 2.93 inches.

November 2015: November temperatures ranged from a low of 2°F on the 26th, to a high of 56°F on the 2nd and 16th, with a low average of 23°F and a high average of 39° Fahrenheit. The total precipitation for November was 1.00", which is 0.62" below the 35 year average precipitation for November of 1.62 inches. The precipitation accumulation for the crop year so far was 2.75", which is 1.80" below the 35 year average precipitation accumulation in November of 4.55 inches.

December 2015: December temperatures ranged from a low of 8°F on the 17th and 18th, to a high of 51°F on the 10th, with a low average of 22°F and a high average of 33° Fahrenheit. The total precipitation for December was 2.16", which is 0.66" above the 35 year average precipitation for December of 1.50 inches. The precipitation accumulation for the crop year so far was 4.91", which is 1.14" below the 35 year average precipitation accumulation in December of 6.05 inches.

January 2016: January temperatures ranged from a low of -1°F, the coldest day of the year, on the 2nd to a high of 42°F on the 29th, with a low average of 22°F and a high average of 32°F. The total precipitation for the month of January was 1.42", which is 0.02" above the 35 year average precipitation for January of 1.40 inches. The precipitation accumulation for the crop year so far was 6.33", which is 1.12" below the 35 year average precipitation accumulation in January of 7.45 inches.

February 2016: February temperatures ranged from a low of 4°F on the 3rd to a high of 51°F on the 17th, with a low average of 25°F and a high average of 42° Fahrenheit. The total precipitation for the month of February was 1.01", which is 0.15" below the 35 year average precipitation for February of 1.16 inches. The precipitation accumulation for the crop year so far was 7.34", which is 1.27" below the 35 year average precipitation accumulation in February of 8.61 inches.

March 2016: March temperatures ranged from a low of 19°F on the 19th and 20th to a high of 55°F on the 21st and 22nd, with a low average of 28°F and a high average of 46° Fahrenheit. The total precipitation for the month of March was 0.97", which is 0.32" below the 35 year average precipitation for March of 1.29 inches. The precipitation accumulation for the crop year so far was 9.60", which is 1.59" below the 35 year average precipitation accumulation in March of 9.90 inches.

April 2016: April temperatures ranged from a low of 24°F on the 2nd to a high of 78°F on the 21st, with a low average of 34°F and a high average of 61° Fahrenheit. The total precipitation for the month of April was 1.50", which is 0.25" below the 35 year average precipitation for April of 1.75 inches. The precipitation accumulation for the crop year so far was 9.81", which is 1.84" below the 35 year average precipitation accumulation in April of 11.65 inches.

May 2016: May temperatures ranged from a low of 28°F on the 14th to a high of 77°F on the 4th and the 9th, with a low average of 39°F and a high average of 64° Fahrenheit. The total precipitation for the month of May was 2.78", which is 0.40" above the 35 year average precipitation for May of 2.38 inches. The precipitation accumulation for the crop year so far was 12.59", which is 1.44" below the 35 year average precipitation accumulation in May of 14.03 inches.

June 2016: June temperatures ranged from a low of 35°F on the 15th to a high of 86°F on the 6th 7th, and 8th, with a low average of 45°F and a high average of 72° Fahrenheit. The total precipitation for the month of June was 2.07" which is 1.28" below the 35 year average precipitation for June of 3.35 inches. The precipitation accumulation for the crop year so far was 14.66", which is 2.72" below the 35 year average precipitation accumulation in June of 17.38 inches.

July 2016: July temperatures ranged from a low of 40°F on the 17th to a high of 91°F, the hottest day of the year on the 31st, with a low average of 48°F and a high average of 77° Fahrenheit. The total precipitation for the month of July was 1.55" which is 0.01" below the 35 year average precipitation for July of 1.56 inches. The precipitation accumulation for the crop year so far was 16.21", which is 2.73" below the 35 year average precipitation accumulation in July of 18.94 inches.

August 2016: August temperatures ranged from a low of 37°F on the 25th to a high of 89°F on the 16th, 22nd and 30th, with a low average of 46°F and a high average of 79° Fahrenheit. Total precipitation for the month of August was 1.11" which is equal to the 35 year average precipitation for August of 1.11 inches. The total precipitation accumulation for the crop year was 17.32 inches. This is 2.73" below the 35 year average precipitation accumulation of 20.05 inches.

Summary of Temperature Data at the Northwestern Agricultural Research Center
On a Crop Year Basis
Average Temperature by Year and Month
In degrees Farenheit

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	64.3	45.0
2015-16	52.8	46.6	31.2	27.4	27.0	33.2	37.2	47.8	51.4	58.4	62.6	62.7	44.9
MEAN	53.9	42.4	32.3	24.3	24.6	27.3	35.0	43.1	51.3	57.6	64.4	63.5	43.3

Mean temperature for all years = 43.3

Summary of Precipitation Data at the Northwestern Agricultural Research Center
On a Day Basis September - August
Precipitation by Day
In Inches

DAY	SEPT. 2015	OCT. 2015	NOV. 2015	DEC. 2015	JAN. 2016	FEB. 2016	MAR. 2016	APR. 2016	MAY 2016	JUNE 2016	JULY 2016	AUG. 2016
1	0.00	0.00	0.40	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.03	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00
3	0.20	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.07	0.00	0.00	0.04	T	0.00	0.00	0.00	0.00	0.00	0.00	0.01
5	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.04	0.00	0.00	0.05	0.04	0.00	0.00	0.00	0.03	0.00
7	0.01	0.00	0.00	0.12	0.00	0.00	0.07	0.00	0.00	0.00	0.15	0.00
8	0.00	0.13	0.00	0.52	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.02
9	0.00	0.00	0.05	0.01	0.03	0.00	0.00	0.00	0.09	0.05	0.09	0.00
10	0.00	0.00	0.15	0.00	0.00	0.00	0.05	0.00	0.01	0.01	0.17	0.54
11	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.08	0.72	0.50
12	0.00	0.00	0.01	0.00	0.02	0.06	0.04	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.06	0.21	0.05	0.04	0.01	0.07	T	0.00	0.00
14	0.00	0.00	0.00	0.00	0.21	0.07	0.19	0.03	0.00	0.02	0.03	0.00
15	0.21	0.00	0.00	0.00	0.00	0.06	0.00	0.51	0.00	0.56	0.00	0.00
16	0.00	0.00	0.00	0.13	0.12	0.15	0.00	0.00	0.00	0.24	0.00	0.00
17	0.00	0.00	0.00	0.01	0.11	0.00	0.15	0.00	0.00	0.14	0.05	0.00
18	0.00	0.00	0.02	0.23	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.01	0.00	0.16	0.00	0.00	0.36	0.04	0.00	0.01
20	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.08	0.00	0.28	0.00
21	0.02	0.00	0.00	0.01	0.26	0.00	0.09	0.00	0.04	0.00	0.00	0.00
22	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.68	0.20	0.00	0.00
23	0.00	0.00	0.00	0.09	0.00	0.00	0.08	0.13	0.55	0.00	0.00	0.00
24	0.00	0.00	0.30	0.13	0.16	0.00	0.04	0.80	0.76	0.00	0.00	0.00
25	0.00	0.02	0.00	0.08	0.00	0.00	0.01	0.02	0.00	0.70	0.00	0.00
26	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	T	0.00	0.00
27	0.00	0.27	0.00	0.00	0.00	0.00	0.06	0.00	0.07	0.00	0.00	0.00
28	0.00	0.02	0.00	T	0.00	0.00	0.06	0.00	0.02	0.03	0.02	0.00
29	0.00	0.00	0.00	0.08	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.00
30	0.00	0.11	0.00	0.04	0.16		0.00	0.00	0.05	0.00	0.00	0.03
31		0.20		0.00	0.12		0.01		0.00		0.00	0.00
TOTAL	0.96	0.79	1.00	2.16	1.42	1.01	0.97	1.50	2.78	2.07	1.55	1.11

Year to date = 17.32

Summary of Precipitation at the Northwestern Agricultural Research Center
On a Crop Year Basis
Total Precipitation by Year and Month
In Inches

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
2015-16	0.96	0.79	1.00	2.16	1.42	1.01	0.97	1.50	2.78	2.07	1.55	1.11	17.32
MEAN	1.60	1.32	1.60	1.55	1.40	1.16	1.29	1.75	2.38	3.35	1.56	1.10	20.08

Mean monthly precipitation for all crop years = 1.67

YEAR 2016 - GROWING DEGREE DAYS JANUARY THROUGH OCTOBER
CALCULATED AT BASE 50, BASE 40, AND BASE 32
Page 1: January - May

January

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	20	12	0.0	0.0	0.0
2	16	-1	0.0	0.0	0.0
3	16	3	0.0	0.0	0.0
4	21	11	0.0	0.0	0.0
5	21	10	0.0	0.0	0.0
6	27	11	0.0	0.0	0.0
7	26	15	0.0	0.0	0.0
8	29	22	0.0	0.0	0.0
9	25	22	0.0	0.0	0.0
10	27	21	0.0	0.0	0.0
11	27	19	0.0	0.0	0.0
12	32	25	0.0	0.0	0.0
13	40	31	0.0	0.0	4.0
14	32	27	0.0	0.0	0.0
15	32	21	0.0	0.0	0.0
16	31	23	0.0	0.0	0.0
17	34	27	0.0	0.0	1.0
18	38	31	0.0	0.0	3.0
19	39	23	0.0	0.0	3.5
20	38	30	0.0	0.0	3.0
21	35	25	0.0	0.0	1.5
22	35	20	0.0	0.0	1.5
23	41	27	0.0	0.5	4.5
24	41	20	0.0	0.5	4.5
25	36	27	0.0	0.0	2.0
26	37	26	0.0	0.0	2.5
27	40	28	0.0	0.0	4.0
28	41	31	0.0	0.5	4.5
29	42	32	0.0	1.0	5.0
30	39	30	0.0	0.0	3.5
31	38	26	0.0	0.0	3.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
32.1	21.8	0.0	2.5	51.0

February

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	32	23	0.0	0.0	0.0
2	31	20	0.0	0.0	0.0
3	30	4	0.0	0.0	0.0
4	34	6	0.0	0.0	1.0
5	36	28	0.0	0.0	2.0
6	41	32	0.0	0.5	4.5
7	40	15	0.0	0.0	4.0
8	38	16	0.0	0.0	3.0
9	41	20	0.0	0.5	4.5
10	42	19	0.0	1.0	5.0
11	41	18	0.0	0.5	4.5
12	50	32	0.0	5.0	9.0
13	38	32	0.0	0.0	3.0
14	42	32	0.0	1.0	5.0
15	46	33	0.0	3.0	7.5
16	50	36	0.0	5.0	11.0
17	51	36	0.5	5.5	11.5
18	45	34	0.0	2.5	7.5
19	46	31	0.0	3.0	7.0
20	39	24	0.0	0.0	3.5
21	40	25	0.0	0.0	4.0
22	41	31	0.0	0.5	4.5
23	41	24	0.0	0.5	4.5
24	42	18	0.0	1.0	5.0
25	41	20	0.0	0.5	4.5
26	47	20	0.0	3.5	7.5
27	51	23	0.5	5.5	9.5
28	50	29	0.0	5.0	9.0
29	47	29	0.0	3.5	7.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
41.8	24.5	1.0	47.5	149.5

March

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	43	26	0.0	1.5	5.5
2	35	26	0.0	0.0	1.5
3	43	31	0.0	1.5	5.5
4	47	32	0.0	3.5	7.5
5	54	27	2.0	7.0	11.0
6	52	32	1.0	6.0	10.0
7	44	27	0.0	2.0	6.0
8	48	31	0.0	4.0	8.0
9	47	23	0.0	3.5	7.5
10	46	28	0.0	3.0	7.0
11	49	32	0.0	4.5	8.5
12	54	34	2.0	7.0	12.0
13	52	32	1.0	6.0	10.0
14	48	33	0.0	4.0	8.5
15	43	32	0.0	1.5	5.5
16	40	31	0.0	0.0	4.0
17	42	27	0.0	1.0	5.0
18	41	20	0.0	0.5	4.5
19	41	19	0.0	0.5	4.5
20	47	19	0.0	3.5	7.5
21	55	23	2.5	7.5	11.5
22	55	29	2.5	7.5	11.5
23	40	32	0.0	0.0	4.0
24	49	34	0.0	4.5	9.5
25	45	33	0.0	2.5	7.0
26	45	25	0.0	2.5	6.5
27	46	27	0.0	3.0	7.0
28	43	29	0.0	1.5	5.5
29	42	29	0.0	1.0	5.0
30	52	24	1.0	6.0	10.0
31	48	25	0.0	4.0	8.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
46.3	28.1	12.0	100.5	225.0

April

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	56	27	3.0	8.0	12.0
2	63	24	6.5	11.5	15.5
3	69	33	9.5	14.5	19.0
4	67	25	8.5	13.5	17.5
5	49	34	0.0	4.5	9.5
6	52	36	1.0	6.0	12.0
7	63	30	6.5	11.5	15.5
8	65	27	7.5	12.5	16.5
9	71	32	10.5	15.5	19.5
10	74	38	12.0	17.0	24.0
11	61	31	5.5	10.5	14.5
12	67	34	8.5	13.5	18.5
13	51	37	0.5	5.5	12.0
14	50	29	0.0	5.0	9.0
15	46	32	0.0	3.0	7.0
16	52	34	1.0	6.0	11.0
17	58	30	4.0	9.0	13.0
18	63	31	6.5	11.5	15.5
19	69	31	9.5	14.5	18.5
20	67	33	8.5	13.5	18.0
21	78	39	14.0	19.0	26.5
22	77	43	13.5	20.0	28.0
23	75	44	12.5	19.5	27.5
24	60	45	5.0	12.5	20.5
25	54	40	2.0	7.0	15.0
26	55	42	2.5	8.5	16.5
27	59	36	4.5	9.5	15.5
28	60	40	5.0	10.0	18.0
29	52	39	1.0	6.0	13.5
30	52	34	1.0	6.0	11.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
61.2	34.3	170.0	324.5	490.0

May

Day	Temperatures MAX	Temperatures MIN	Growing Degree Days Base 50	Base 40	Base 32
1	62	33	6.0	11.0	15.5
2	67	34	8.5	13.5	18.5
3	71	34	10.5	15.5	20.5
4	77	34	13.5	18.5	23.5
5	76	49	13.0	22.5	30.5
6	76	50	13.0	23.0	31.0
7	67	37	8.5	13.5	20.0
8	72	42	11.0	17.0	25.0
9	77	37	13.5	18.5	25.0
10	49	33	0.0	4.5	9.0
11	57	39	3.5	8.5	16.0
12	60	38	5.0	10.0	17.0
13	66	38	8.0	13.0	20.0
14	55	28	2.5	7.5	11.5
15	64	37	7.0	12.0	18.5
16	64	36	7.0	12.0	18.0
17	64	37	7.0	12.0	18.5
18	71	45	10.5	18.0	26.0
19	75	48	12.5	21.5	29.5
20	54	42	2.0	8.0	16.0
21	59	42	4.5	10.5	18.5
22	60	42	5.0	11.0	19.0
23	47	40	0.0	3.5	11.5
24	47	40	0.0	3.5	11.5
25	57	41	3.5	9.0	17.0
26	65	45	7.5	15.0	23.0
27	65	47	7.5	16.0	24.0
28	58	37	4.0	9.0	15.5
29	60	37	5.0	10.0	16.5
30	65	32	7.5	12.5	16.5
31	64	37	7.0	12.0	18.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
63.6	39.1	214.0	392.0	601.0

YEAR 2016 - GROWING DEGREE DAYS JANUARY THROUGH OCTOBER
CALCULATED AT BASE 50, BASE 40, AND BASE 32
Page 2: June - October

JUNE

Day	Temperatures		Growing Degree Days		
	MAX	MIN	Base 50	Base 40	Base 32
1	69	40	9.5	14.5	22.5
2	74	56	15.0	25.0	33.0
3	66	53	9.5	19.5	27.5
4	74	43	12.0	18.5	26.5
5	79	38	14.5	19.5	26.5
6	86	48	18.0	27.0	35.0
7	86	53	19.5	29.5	37.5
8	86	56	21.0	31.0	39.0
9	84	51	17.5	27.5	35.5
10	73	39	11.5	16.5	24.0
11	73	40	11.5	16.5	24.5
12	64	37	7.0	12.0	18.5
13	69	38	9.5	14.5	21.5
14	73	46	11.5	19.5	27.5
15	51	35	0.5	5.5	11.0
16	63	42	6.5	12.5	20.5
17	63	40	6.5	11.5	19.5
18	64	40	7.0	12.0	20.0
19	66	44	8.0	15.0	23.0
20	66	39	8.0	13.0	20.5
21	78	47	14.0	22.5	30.5
22	65	42	7.5	13.5	21.5
23	75	42	12.5	18.5	26.5
24	75	42	12.5	18.5	26.5
25	58	40	4.0	9.0	17.0
26	65	41	7.5	13.0	21.0
27	73	44	11.5	18.5	26.5
28	82	53	17.5	27.5	35.5
29	85	52	18.5	28.5	36.5
30	85	55	20.0	30.0	38.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
72.3	44.5	349.5	560.0	793.0

JULY

Day	Temperatures		Growing Degree Days		
	MAX	MIN	Base 50	Base 40	Base 32
1	86	51	18.5	28.5	36.5
2	85	47	17.5	26.0	34.0
3	76	52	14.0	24.0	32.0
4	81	52	16.5	26.5	34.5
5	72	43	11.0	17.5	25.5
6	71	45	10.5	18.0	26.0
7	60	52	6.0	16.0	24.0
8	72	51	11.5	21.5	29.5
9	64	42	7.0	13.0	21.0
10	69	42	9.5	15.5	23.5
11	71	46	10.5	18.5	26.5
12	66	51	8.5	18.5	26.5
13	70	54	12.0	22.0	30.0
14	69	45	9.5	17.0	25.0
15	74	43	12.0	18.5	26.5
16	80	46	15.0	23.0	31.0
17	66	40	8.0	13.0	21.0
18	76	46	13.0	21.0	29.0
19	83	46	16.5	24.5	32.5
20	79	49	14.5	24.0	32.0
21	79	45	14.5	22.0	30.0
22	85	49	17.5	27.0	35.0
23	80	55	17.5	27.5	35.5
24	75	41	12.5	18.0	26.0
25	78	47	14.0	22.5	30.5
26	86	52	19.0	29.0	37.0
27	84	49	17.0	26.5	34.5
28	87	51	18.5	28.5	36.5
29	85	51	18.0	28.0	36.0
30	86	55	20.5	30.5	38.5
31	91	56	21.0	31.0	39.0

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
77.0	48.2	410.5	666.0	906.0

AUGUST

Day	Temperatures		Growing Degree Days		
	MAX	MIN	Base 50	Base 40	Base 32
1	82	47	16.0	24.5	32.5
2	80	45	15.0	22.5	30.5
3	88	49	19.0	27.5	35.5
4	63	39	6.5	11.5	19.0
5	78	40	14.0	19.0	27.0
6	88	47	19.0	26.5	34.5
7	86	50	18.0	28.0	36.0
8	79	46	14.5	22.5	30.5
9	78	49	14.0	23.5	31.5
10	69	48	9.5	18.5	26.5
11	58	51	4.5	14.5	22.5
12	74	49	12.0	21.5	29.5
13	80	49	15.0	24.5	32.5
14	82	50	16.0	26.0	34.0
15	87	52	19.5	29.0	37.0
16	89	43	19.5	24.5	32.5
17	88	51	19.5	28.5	36.5
18	87	55	21.0	30.5	38.5
19	77	38	13.5	18.5	25.5
20	72	40	11.0	16.0	24.0
21	81	43	15.5	22.0	30.0
22	89	51	20.0	28.5	36.5
23	72	43	11.0	17.5	25.5
24	72	45	11.0	18.5	26.5
25	73	37	11.5	16.5	23.0
26	75	39	12.5	17.5	25.0
27	75	45	12.5	20.0	28.0
28	83	51	17.0	27.0	35.0
29	79	43	14.5	21.0	29.0
30	89	45	19.5	25.5	33.5
31	88	47	19.0	26.5	34.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
79.4	46.0	442.0	671.5	908.0

SEPTEMBER

Day	Temperatures		Growing Degree Days		
	MAX	MIN	Base 50	Base 40	Base 32
1	81	51	16.0	26.0	34.0
2	80	51	15.5	25.5	33.5
3	62	43	6.0	12.5	20.5
4	64	32	7.0	12.0	16.0
5	66	31	8.0	13.0	17.0
6	61	36	5.5	10.5	16.5
7	55	39	2.5	7.5	15.0
8	59	48	4.5	13.5	21.5
9	66	34	8.0	13.0	18.0
10	64	36	7.0	12.0	18.0
11	75	47	12.5	21.0	29.0
12	70	32	10.0	15.0	19.0
13	59	27	4.5	9.5	13.5
14	64	26	7.0	12.0	16.0
15	66	30	8.0	13.0	17.0
16	71	34	10.5	15.5	20.5
17	70	37	10.0	15.0	21.5
18	56	39	3.0	8.0	15.5
19	57	37	3.5	8.5	15.0
20	63	36	6.5	11.5	17.5
21	62	37	6.0	11.0	17.5
22	61	45	5.5	13.0	21.0
23	62	41	6.0	11.5	19.5
24	61	44	5.5	12.5	20.5
25	61	38	5.5	10.5	17.5
26	60	36	5.0	10.0	16.0
27	72	37	11.0	16.0	22.5
28	81	38	15.5	20.5	27.5
29	75	40	12.5	17.5	25.5
30	72	41	11.0	16.5	24.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
65.9	38.1	239.0	413.5	606.5

OCTOBER

Day	Temperatures		Growing Degree Days		
	MAX	MIN	Base 50	Base 40	Base 32
1	78	47	14.0	22.5	30.5
2	78	30	14.0	19.0	23.0
3	63	30	6.5	11.5	15.5
4	57	33	3.5	8.5	13.0
5	52	35	1.0	6.0	11.5
6	48	39	0.0	4.0	11.5
7	50	37	0.0	5.0	11.5
8	49	36	0.0	4.5	10.5
9	58	43	4.0	10.5	18.5
10	58	34	4.0	9.0	14.0
11	42	26	0.0	1.0	5.0
12	42	24	0.0	1.0	5.0
13	47	23	0.0	3.5	7.5
14	47	28	0.0	3.5	7.5
15	56	43	3.0	9.5	17.5
16	55	44	2.5	9.5	17.5
17	53	39	1.5	6.5	14.0
18	50	41	0.0	5.5	13.5
19	50	40	0.0	5.0	13.0
20	50	31	0.0	5.0	9.0
21	50	31	0.0	5.0	9.0
22	48	36	0.0	4.0	10.0
23	51	28	0.5	5.5	9.5
24	51	28	0.5	5.5	9.5
25	46	32	0.0	3.0	7.0
26	51	36	0.5	5.5	11.5
27	45	40	0.0	2.5	10.5
28	47	42	0.0	4.5	12.5
29	54	29	2.0	7.0	11.0
30	48	30	0.0	4.0	8.0
31	48	41	0.0	4.5	12.5

AV MAX	AV MIN	Total Base 50	Total Base 40	Total Base 32
52.3	34.7	57.5	197.0	367.5

Julian Date Calendar for Year 2016

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	32	61	92	122	153	183	214	245	275	306	336
2	2	33	62	93	123	154	184	215	246	276	307	337
3	3	34	63	94	124	155	185	216	247	277	308	338
4	4	35	64	95	125	156	186	217	248	278	309	339
5	5	36	65	96	126	157	187	218	249	279	310	340
6	6	37	66	97	127	158	188	219	250	280	311	341
7	7	38	67	98	128	159	189	220	251	281	312	342
8	8	39	68	99	129	160	190	221	252	282	313	343
9	9	40	69	100	130	161	191	222	253	283	314	344
10	10	41	70	101	131	162	192	223	254	284	315	345
11	11	42	71	102	132	163	193	224	255	285	316	346
12	12	43	72	103	133	164	194	225	256	286	317	347
13	13	44	73	104	134	165	195	226	257	287	318	348
14	14	45	74	105	135	166	196	227	258	288	319	349
15	15	46	75	106	136	167	197	228	259	289	320	350
16	16	47	76	107	137	168	198	229	260	290	321	351
17	17	48	77	108	138	169	199	230	261	291	322	352
18	18	49	78	109	139	170	200	231	262	292	323	353
19	19	50	79	110	140	171	201	232	263	293	324	354
20	20	51	80	111	141	172	202	233	264	294	325	355
21	21	52	81	112	142	173	203	234	265	295	326	356
22	22	53	82	113	143	174	204	235	266	296	327	357
23	23	54	83	114	144	175	205	236	267	297	328	358
24	24	55	84	115	145	176	206	237	268	298	329	359
25	25	56	85	116	146	177	207	238	269	299	330	360
26	26	57	86	117	147	178	208	239	270	300	331	361
27	27	58	87	118	148	179	209	240	271	301	332	362
28	28	59	88	119	149	180	210	241	272	302	333	363
29	29	60	89	120	150	181	211	242	273	303	334	364
30	30		90	121	151	182	212	243	274	304	335	365
31	31		91		152		213	244		305		366

CEREALS

Title: Barley Off-Station – 2016

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

Results:

Twenty-four barley varieties were evaluated for yield and agronomic performance using a randomized complete block design with three replications. Significant differences were observed for heading, height, test weight, and percent plump, but no significant differences were observed for yield and protein (Table 2). Heading date averaged 176 Julian days (June 24) and ranged from 169 days for Conlon to 179 days for Merit, MT100126, and Moravian115. Heights averaged 27.8 inches and ranged from 19.4 inches for Stockford to 31.2 inches for Stepford. Yields averaged 86.6 bushels per acre. Protein averaged 9.57 percent. Average test weight was 52.6 lb/bu and ranged from 47.4 lb/bu for Stepford to 54.4 lb/bu for Champion. Percent plump averaged 96.9 %, and ranged from 89.0 % for Lavina to 99.2 % for Conlon.

Summary:

The highest yielding commercially available cultivars in this study were Hockett, Merit, and Synergy; however, their differences were not statistically significant.

Table 1. Materials and Methods.

Seeding Date:	4/21/2016	Harvest Date:	8/17/2016
Julian Date:	112	Julian Date:	230
Seeding Rate:	80lb/A	Soil Type:	Creston SiL
Previous Crop:	WW	Soil Test:	96-8-200
Tillage:	Conventional	Fertilizer:	50-25-60
Herbicide: Post	Huskie 11oz/A + Axial 16.4 oz/A + NIS 1qt/100gal + UAN		
Herbicide: Late Post - Stinger 1/3 pt/A			

Table 2. Barley off station, Kalispell, MT- 2016.

Culitivar	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PLMP %
Hockett	176	30.2	111.0	9.93	54.3	98.6
MT090190	178	29.9	107.3	9.53	54.2	97.7
Merit	179	30.5	105.7	9.30	53.1	97.1
Synergy	177	29.2	102.4	9.83	51.9	98.3
Haxby	171	30.2	100.9	9.73	54.1	98.2
Stepford	172	31.2	90.3	10.43	47.4	96.4
Moravian115	179	21.6	89.9	9.33	51.8	98.6
Copeland	177	29.6	89.7	9.60	52.9	98.1
Eslick	178	25.1	89.4	8.83	52.3	97.1
MT100126	179	27.3	88.9	9.20	54.2	97.9
Craft	173	30.6	87.1	9.50	53.1	98.4
MT090182	177	30.6	87.1	8.93	52.8	97.9
MT124555	175	25.5	85.3	9.07	53.4	98.6
Hays	178	26.2	83.6	9.93	50.4	90.8
Metcalfe	176	29.4	83.5	9.80	53.4	96.6
Harrington	177	28.9	81.8	9.53	53.7	97.9
Lavina	175	28.3	80.6	10.17	51.0	89.0
MT100120	178	27.3	80.5	8.43	53.1	98.3
Pinnacle	175	27.8	79.5	9.20	53.8	98.7
Champion	176	27.6	79.2	9.67	54.4	98.1
Conrad	177	26.9	76.6	9.47	52.6	98.2
Conlon	169	26.3	72.7	10.20	51.0	99.2
Stockford	176	19.4	69.1	10.07	50.8	95.7
Haybet	175	28.6	56.0	9.90	51.7	91.1
Mean	176	27.8	86.6	9.57	52.6	96.9
CV	0.8	13.2	24.7	7.30	1.6	1.0
LSD	2.2	6.0	ns	ns	1.4	1.6
Pr>F	0.0001	0.0408	0.4436	0.1702	0.0001	0.0001

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

[1] adjusted to 13% moisture.

[2] reported on a dry matter basis.

Title: Intrastate Barley Evaluation – 2016

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

Results:

Forty-eight experimental and commercially available barley lines were evaluated for yield and agronomic performance. Significant differences were observed for heading, height, protein, and test weight (Table 2). Heading date averaged 178 Julian days (June 26) and ranged from 172 days for 08ARS116-91 to 183 days for Overture and Genie. Heights averaged 31.3 inches and ranged from 25.6 inches for Vespa and MT124673 to 36.9 inches for MT124073. Yields averaged 94.6 bu/A, and ranged from 59.4 to 115 bushels per acre. Yet, there were no significant differences among varieties for yield. Protein averaged 9.53 % and ranged from 8.58 % for MT090190 to 10.95 % for 08MT-15. Average test weight was 53.8 lb/bu and ranged from 52.0 lb/bu for Odyssey to 55.5 lb/bu for Haxby. Percent plump was taken on a representative non-replicated subsample and averaged 97.9 percent. No lodging occurred in this study.

Summary:

The highest yielding commercially available cultivars were Overture, Harrington, and Genie. However, there were no significant differences in the yield between any of the varieties.

Table 1. Materials and Methods.

Seeding Date:	4/21/2016	Harvest Date:	8/22/2016
Julian Date:	112	Julian Date:	235
Seeding Rate:	80lb/A	Soil Type:	Creston SiL
Previous Crop:	WW	Soil Test:	96-8-200
Tillage:	Conventional	Fertilizer:	50-25-60
Herbicide: Post -	Huskie 11oz/A + Axial 16.4 oz/A + NIS 1qt/100gal + UAN 28% 1qt/A		
Herbicide: Late Post - Stinger 1/3pt/A			

Table 2. Intrastate Barley Evaluation, Kalispell, MT - 2016.

Cultivar	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PLMP %
Overture	183	27.8	115.6	8.79	52.1	96.9
MT124073	179	36.9	114.1	9.88	54.8	98.5
08ARS028-20	179	33.1	110.8	9.05	54.2	97.3
MT090182	178	34.7	110.0	8.67	54.1	97.1
Harrington	179	35.7	108.7	10.25	54.9	98.1
Genie	183	26.7	108.4	8.98	53.6	98.7
Hockett	178	33.3	106.6	9.48	54.3	98.1
ME08032-156	178	28.7	106.6	9.32	53.2	99.3
MT124688	177	33.9	106.4	9.57	54.7	97.9
Haxby	174	31.1	105.9	10.30	55.5	98.9
Copeland	178	33.5	105.7	9.64	54.5	98.4
Metcalfe	178	33.5	105.5	10.29	54.0	97.3
08ARS116-91	172	30.8	104.5	9.77	53.6	96.2
MT124555	176	31.9	104.4	8.89	54.5	99.2
Vespa	181	25.6	104.0	9.14	52.5	98.2
MT124118	177	34.8	103.3	10.03	55.2	98.7
MT124016	179	30.6	100.8	9.30	53.7	99.1
MT100120	178	33.3	97.9	8.67	53.7	98.4
Balster	178	32.0	97.7	9.32	52.5	97.9
Odyssey	182	26.8	97.6	9.19	52.0	98.5
Growler	179	29.5	96.2	9.11	52.6	97.7
MT100126	180	32.3	95.8	8.65	53.7	97.2
MT124582	173	32.7	95.6	9.69	54.2	97.4
MT124069	178	33.1	95.2	9.19	53.2	96.7
10WA-117.17	178	30.1	94.8	9.39	53.9	97.4
MT124243	179	32.7	94.3	8.71	53.3	98.2
Synergy	177	32.2	93.9	9.11	52.2	98.8
MT124411	173	32.8	93.9	10.51	54.1	97.0
08ARS012-79	178	30.6	92.4	9.32	54.1	97.1
Westminster	180	26.6	91.6	9.37	53.9	98.9
MT124728	178	31.4	91.6	10.56	54.7	98.2
MT124454	174	34.4	90.5	9.44	55.0	97.9
MT090193	180	33.3	89.4	9.04	52.7	97.8
MT090190	178	31.1	89.3	8.58	53.6	97.6

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 basis.

Table 2. (continued).

Cultivar	HD Julian	HT in	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PLMP %
08MT-19	176	31.0	89.1	9.17	54.6	98.4
11WA-107.43	175	31.1	88.6	9.97	54.6	98.6
MT124112	173	30.7	87.0	9.95	52.7	98.3
Champion	178	29.1	86.7	9.80	55.1	97.5
MT124645	177	31.5	85.5	9.99	53.3	98.3
MT124663	173	30.4	85.5	9.77	52.6	98.8
ME08053-050	177	29.8	84.0	10.23	53.5	99.0
MT124716	177	32.5	83.4	10.42	55.0	98.3
10WA-117.24	178	30.7	82.5	9.86	52.4	97.7
08MT-95	178	34.3	77.9	9.64	54.1	97.7
MT124457	174	33.6	76.1	9.57	54.5	97.7
08MT-63	178	31.5	75.8	8.71	53.4	91.7
MT124673	178	25.6	60.6	10.24	52.7	97.4
08MT-15	179	25.9	59.4	10.95	54.1	98.6
Mean	178	31.3	94.6	9.53	53.8	97.9
CV	0.9	10.4	19.0	5.41	1.3	na
LSD	2.6	5.3	ns	0.84	1.1	na
Pr>F	0.0001	0.0019	0.0781	0.0001	0.0001	na

HD: heading, HT: height, YLD: yield, PRO: protein, TWT: test weight, PLMP: percent plumps, na: nonreplicated data, ns: nonsignificant.

[1] adjusted to 13% moisture.

[2] reported on a dry matter basis.

Title: Effect of Palisade on Lodging in Barley - 2016

Objective: To evaluate the effect of Palisade when applied at different rates and timings in barley.

Materials and Methods:

Palisade was applied at 7 oz/A to Goldeneye six row barley at the tillering (June 1) and flag leaf (June 10) growth stages either as single or sequential applications (Table 2). Treatments were applied using a CO_2 backpack sprayer with Teejet XR11002 nozzles in 20 GPA of water and were replicated three times using a randomized complete block design.

Results:

Differences in height were observed on July 1. A single application of Palisade at flag leaf stage resulted in the greatest reduction in plant height. The height of the remaining treatments were not different from the non-treated check. Despite the initial PGR effect, height differences were no longer detectable at the August 9th assessment. Similarly, no differences were observed for lodging, yield or grain quality.

Summary:

Palisade applied at 7 oz/A at flag leaf resulted in an initial reduction in plant height. However, this response was temporary, and treatment differences could not be detected at harvest.

Table 1. Materials and Methods.

Seeding Date:	4/29/2016	Harvest Date:	9/1/2016
Julian Date:	120	Julian Date:	245
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Canola	Soil Test:	104-24-652-154
Tillage:	Conventional	Fertilizer:	BC: 125-30-30-20, DR:3-14-0
Herbicide:	Huskie 11 oz/A + Axial 16.4 oz/A + NIS 1 qt/100 gal + UAN 28% 1 qt/A		

Table 2. Effect of Palisade rate and timing on agronomic performance in barley, Kalispell, MT, 2016

				Height (inches)		LOD	YLD[1]	PP	TWT[1]
	Rate	Timing		7/1	8/9	%	bu/A	%	lb/bu
Check				41.9	42.6	43.3	71.6	91.9	50.4
Palisade	7 fl oz/A	Tillering		40.7	42.3	14.0	96.1	94.9	51.7
Palisade	2 fl oz/A	Tillering	+						
Palisade	5 fl oz/A	Flag leaf		40.6	41.9	29.0	83.9	94.3	51.7
Palisade	5 fl oz/A	Tillering	+						
Palisade	2 fl oz/A	Flag leaf		40.7	40.4	31.7	79.1	92.1	51.0
Palisade	7 fl oz/A	Flag leaf		37.5	42.8	46.7	98.8	93.2	51.1
Mean				40.3	42.0	32.9	85.9	93.3	51.2
CV				2.9	4.2	83.1	14.5	2.5	1.7
LSD				2.2	ns	ns	ns	ns	ns
Pr>F				0.0174	0.5201	0.6293	0.1209	0.4784	0.3933

LOD: lodging, YLD: yield, PP: percent plump, TWT: test weight, ns: nonsignificant.

[1] adjusted to 13% moisture.

Title: Effect of Absolute and Prosaro Fungicides for the Control of Stripe Rust in Spring Wheat - 2016

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

Materials and Methods:

Five fungicide treatments were evaluated for the control of stripe rust in spring wheat. Hank spring wheat was planted two inches deep, on 7.5 inch row spacings on May 3. The experimental design was a randomized complete block design with three replications. Absolute and Prosaro were each applied at two rates along with the standard treatment of tebuconazole. Fungicide applications were made at flag leaf stage on June 10, 2016 and included the adjuvant Induce at 0.125% v/v. Fungicide treatments were applied using a CO_2 backpack sprayer with Teejet XR11002 nozzles in 20 GPA of water.

Results:

All treatments reduced the incidence of stripe rust and increased yields about two-fold. Likewise, fungicide treatments also improved test weight and TKW relative to the check. However, stripe rust infection, yield, test weight and TKW did not differ among fungicide treatments. Lodging, protein and falling numbers did not differ among treatments.

Summary:

All fungicides evaluated provided equivalent control of strip rust.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	8/18/2016
Julian Date:	113	Julian Date:	231
Seeding Rate:	120 lb/A	Soil Type:	Creston SiL
Previous Crop:	Spring Wheat	Soil Test:	99-32-432-40
Tillage:	Conventional	Fertilizer:	BC: 235-40-60 DR: 3-14-0
Herbicide:	Huskie 11 oz/A + Axial 16.4 oz/A + NIS 1 qt/100gal + UAN 28% 1 qt/A		

Table 2. Efficacy of fungicide application rate in the control of stripe rust in spring wheat, Kalispell, MT - 2016.

		Percent Stripe Rust			LOD	YLD[1]	PRO[2]	TWT[1]	TKW	FN
Treatment	Rate	6/24	7/15	7/26	%	bu/A	%	lb/bu	g	sec
Check		8.3	73.3	94.3	28.3	42.6	13.83	51.8	28.7	396.5
Absolute 500SC	4 fl oz/A	0.0	33.3	61.7	23.3	88.5	13.73	57.9	41.8	415.5
Absolute 500SC	5 fl oz/A	0.0	23.3	61.7	41.7	89.9	13.90	58.7	43.6	429.1
Prosaro 421 SC	5 fl oz/A	0.0	26.7	66.7	13.3	83.5	13.83	58.1	43.1	433.8
Prosaro 421 SC	6.5 fl oz/A	0.0	21.7	76.0	22.3	90.1	13.97	57.5	40.6	421.8
Tebuconozole	4 fl oz/A	0.0	20.0	61.7	41.7	90.6	14.17	57.8	42.6	420.2
Mean		1.4	33.1	70.3	28.4	80.9	13.91	57.0	40.0	419.5
CV		169.7	17.4	13.7	104.7	5.7	1.22	1.0	5.2	3.3
LSD		4.3	10.5	17.5	ns	8.3	ns	1.0	3.8	ns
Pr>F		0.0070	0.0001	0.0109	0.8151	0.0001	0.1168	0.0001	0.0001	0.0828

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.

Project Title: Response of Egan Spring Wheat to Nitrogen and Irrigation

Objective: To evaluate nitrogen and water inputs response of Egan spring wheat yield and quality

Personnel: Jessica A. Torrion, John Garner

Methods:

Egan spring wheat was grown under four nitrogen levels and four irrigation levels as a strip-split plot, randomized complete block design with four replications, where irrigation levels represent the whole plot factor, and nitrogen as a strip factor. Irrigation treatments included 50 percent evapotranspiration (ET), 75ET, 100ET, and a rainfed check. The four nitrogen treatments included an unfertilized check for N, 52, 102, and 152 lbs/A added nitrogen. The check had an initial 98 lbs/A soil N. The resulting total N for the treatments were 98 (check), 150, 200, and 250 Total lb of N per acre. For simplicity, treatments are labeled as Total N and not added N.

Table 1: Management information

Seeding Date:	4/22/16	Herbicide:	5/17/16
Julian Date:	113		Huskie 11 fl oz/A + Axial 16.4 fl oz/A
Seeding Rate:	25 plnts/sqft	Insecticide:	6/27/16
Previous Crop:	Alfalfa		1.92 fl oz/A Warrior II
Tillage:	Conventional	Harvest Date:	8/18/16
Irrigation:	Yes	Julian Date:	231
Soil Type:	Fine sandy loam		
Soil Test:	57-10-95		
Fertilizer:	(__)-63-148		

Summary:

Nitrogen treatments had no significant effect on yield, but irrigation treatments did (Fig.1). Yield of 50ET was equivalent to 75ET or 100ET which means that the supposedly deficit 50ET had not affected Egan's yield. The smaller amount of irrigation applied at each of the irrigation events must have improved the capture and storage of rainfall events occurred in between irrigation events. This strategy, however, can be adapted with care.

Protein responded with N applied until 200 lbs total N treatment. Egan has a high falling number and any effect by either irrigation or nitrogen is less of a concern. This one-year-only preliminary data suggests that for adjusted gross income, one should stay within 98-150 lbs total N/A and the conservative and risky 50ET irrigation application as long as it is done right.

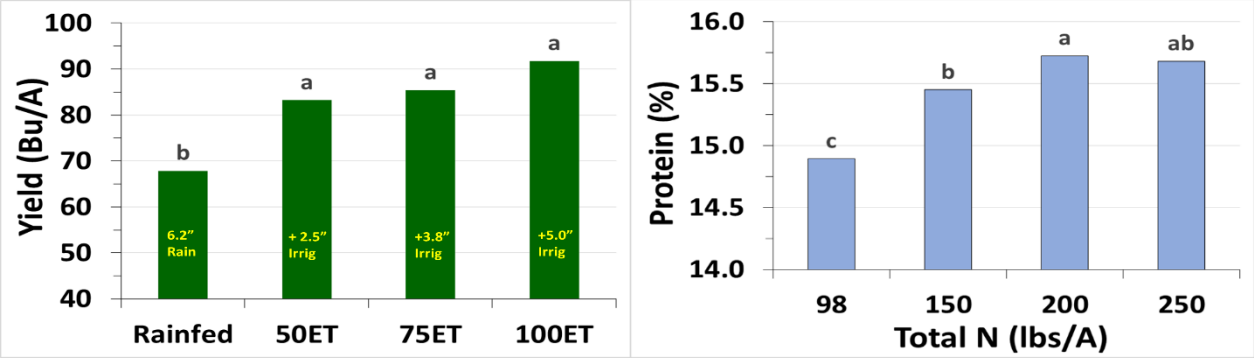


Figure 1. Yield response to water regimes (right) and protein response to total Nitrogen (left). Same letter assignment denotes nonsignificance at α = 0.05.

Table 2. Detailed data of the nitrogen and irrigation effects on Egan spring wheat agronomic performance

Total Nitrogen lbs/A	HT in	YLD bu/A	PRO %	TWT lb/bu	TKW g	FN sec
			Rainfed			
98	35.3	66.1	15.18	61.5	39.5	537.5
150	35.5	69.1	15.45	61.5	39.6	508.8
200	35.3	65.4	15.58	61.2	39.8	507.3
250	35.3	70.9	15.53	61.0	38.6	526.3
			Deficit Irrigation (50 ET)			
98	37.5	86.7	14.53	62.5	43.1	521.3
150	37.3	83.9	15.38	62.3	42.9	509.5
200	37.3	75.0	15.75	62.1	43.0	487.0
250	37.5	87.1	15.85	62.1	42.8	500.0
			Slightly Deficit Irrigation (75 ET)			
98	37.3	85.2	14.90	62.4	42.6	507.3
150	37.3	86.2	15.43	62.5	43.3	510.8
200	36.3	82.0	15.83	62.4	42.9	488.0
250	37.8	88.0	15.70	62.1	42.2	475.8
			Full Irrigation (100 ET)			
98	38.3	93.7	14.98	62.6	42.0	501.5
150	38.8	89.9	15.55	62.4	42.1	498.0
200	38.5	87.5	15.75	62.3	41.9	492.5
250	39.5	95.8	15.65	62.3	40.9	463.5
$Pr>F_{(0.05)-I}$	0.0302	0.0025	0.9621	0.0001	<.0001	0.0254
$Pr>F_{(0.05)-N}$	0.3963	0.2948	0.0001	0.0041	0.3817	0.0472
$Pr>F_{(0.05)-I\times N}$	0.6214	0.5526	0.0662	0.3801	0.9667	0.4698

HT: height, YLD: yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number.

Project Title: Evaluation of Yield and Protein in Irrigated Soft White and Hard Red Spring Wheat - 2016

Objective: To evaluate nitrogen use response of spring wheat varieties on yield and quality

Personnel: J.A. Torrion, R.N. Stougaard, L. Talbert, J. Garner, B. Bicego-Almeida

Methods:

Eight spring wheat cultivars, including four soft white and four hard red, were grown under five nitrogen (N) levels as a split plot, randomized complete block design with four replications. The N levels represent the whole plot factor and the eight spring wheat varieties were the sub plot factor. The five N treatments included an unfertilized check, 40, 80, 120, and 160 lbs/A added N. The check had an initial 98 lbs/A soil N. The resulting total N of the five treatments were 98 (check), 138, 178, 218, and 258 total lbs N per acre. Supplemental irrigation was applied to keep soil moisture from falling below 50% of the plant available water. Total irrigation applied was 5.7".

Summary:

N treatment was significant for protein and recorded a maximum protein response at 138 total N/A (Figure 1). Protein ranged from 10.45 percent for UI-Stone to 16.30 percent for Egan (Figure2, Table 2). All other agronomic traits showed no significant difference for N treatment (Table 2). Note that the check (no added N) had high initial N content. Yield and other traits were significant for the variety main effect. On average, yield of soft whites were higher than hard reds (Figure 3). Within hard red market class, Egan yield was significantly depressed from McNeal, but equivalent with Solano and Vida. Egan consistently had high protein. Refer to Table 3 for yield response - bushels produced per lb of N.

T able 1: Material and Methods

Seeding Date:	4/21/16	Herbicide:	5/17/16
Julian Date:	112		Huskie 11 fl oz/A + Axial 16.4 fl oz/A
Seeding Rate:	25 plnts/sqft	Fungicide:	6/23/16
Previous Crop:	Alfalfa		8.2 fl oz/A Prosaro
Tillage:	Conventional	Insecticide:	6/27/16
Irrigation:	Yes		1.92 fl oz/A Warrior II
Soil Type:	Fine sandy loam	Harvest Date:	8/25/16
Soil Test:	57-10-95	Julian Date:	238
Fertilizer:	(__)-63-148		

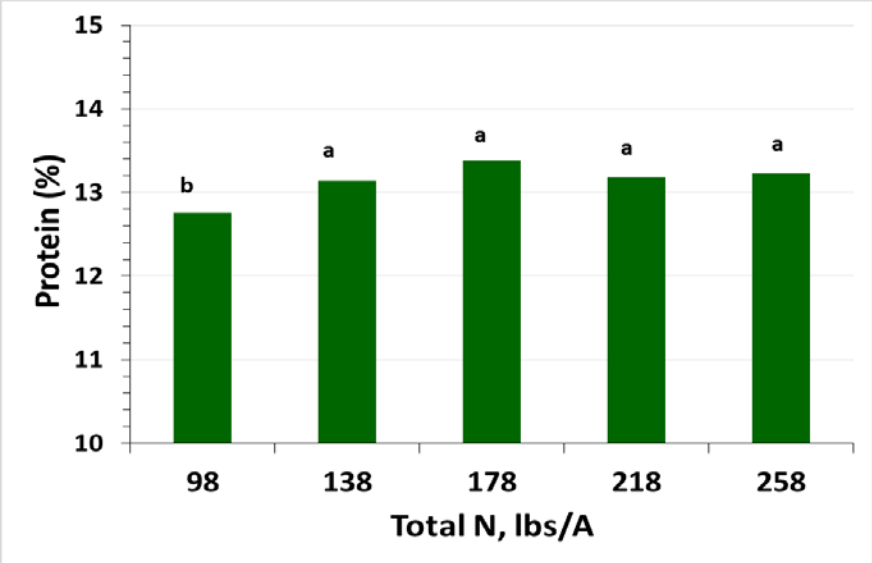


Figure 1. Mean protein response of irrigated wheat with total nitrogen (N) on an irrigated fine sandy loam soil. Same letter assignment denotes nonsignificance at α =0.05.

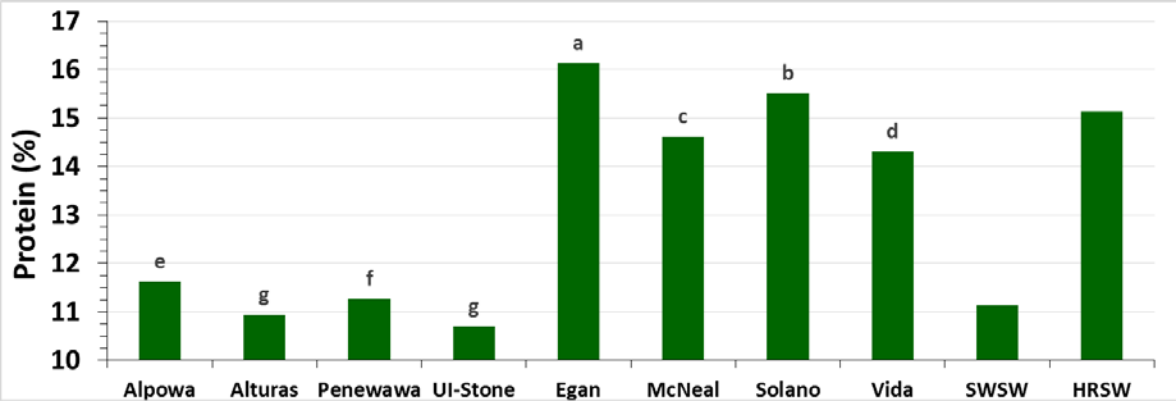


Figure 2. Mean variety protein response of soft white spring wheat (SWSW) and hard red spring wheat (HRSW). Same letter assignment denotes nonsignificance at α = 0.05.

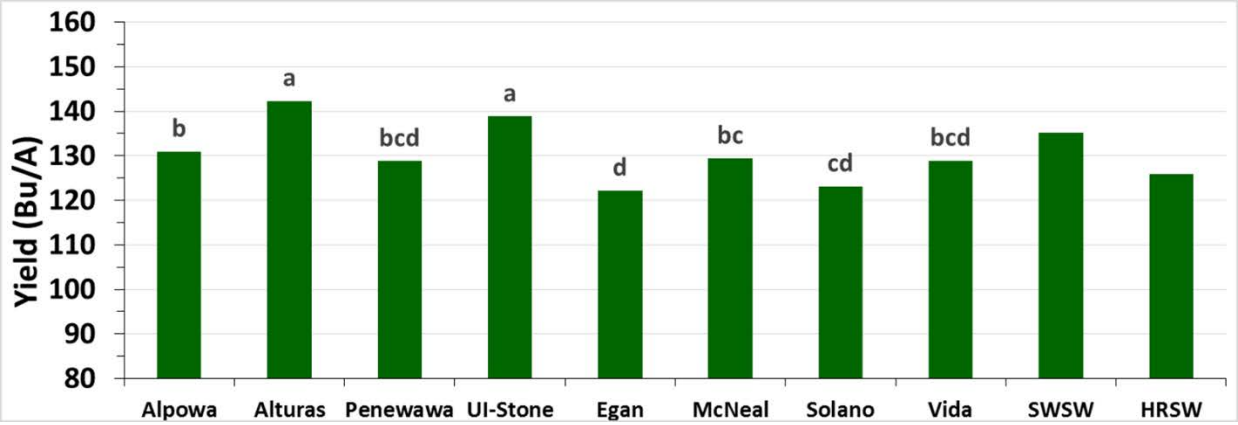


Figure 3. Mean yield response of soft white spring wheat (SWSW) and hard red spring wheat (HRSW). Same letter assignment denotes nonsignificance at α = 0.05.

Table 2. Nitrogen effects on irrigated spring wheat agronomic performance

Cultivar	HT in	LOD %	YLD bu/A	PRO %	TWT lb/bu	TKW g	FN sec	PM days	MC %
98 lbs/A Nitrogen (no added fertilizer)									
Alpowa	35.0	7.5	137.9	11.15	64.3	43.5	377	100	10.9
Alturas	36.8	5.0	155.8	10.75	63.4	42.7	295	103	10.9
Penewawa	35.5	2.5	133.1	10.95	63.6	42.1	331	99	10.8
UI-Stone	34.5	0.0	143.8	10.45	63.2	42.3	308	100	11.0
Egan	37.8	0.0	125.2	15.38	62.5	43.0	489	99	10.5
McNeal	37.3	0.0	121.8	14.08	63.3	45.7	487	102	10.7
Solano	28.3	0.0	127.6	15.15	63.8	39.3	398	102	10.9
Vida	34.0	1.3	131.1	14.13	63.1	42.2	355	103	11.1
138 lbs/A Nitrogen									
Alpowa	35.0	25.0	128.1	11.55	64.0	43.3	341	102	11.2
Alturas	38.0	0.0	139.4	10.98	63.1	41.5	289	103	11.0
Penewawa	35.0	7.5	128.6	11.30	63.2	41.2	329	100	10.9
UI-Stone	34.0	20.0	141.8	10.85	62.8	41.9	255	102	11.1
Egan	35.8	10.0	121.9	16.30	62.2	42.1	478	101	10.7
McNeal	39.0	12.5	131.6	14.48	63.4	45.7	464	102	10.9
Solano	30.0	0.0	127.9	15.35	63.6	44.9	407	103	11.4
Vida	36.0	7.5	123.8	14.33	62.8	42.3	347	104	11.9
178 lbs/A Nitrogen									
Alpowa	35.8	2.5	131.8	11.90	64.2	43.8	357	101	11.0
Alturas	37.3	5.0	139.3	11.00	63.3	41.8	277	103	11.1
Penewawa	35.0	10.0	130.8	11.40	63.5	41.5	307	102	10.9
UI-Stone	33.5	25.0	146.9	10.85	63.0	41.0	291	101	11.4
Egan	36.8	0.0	109.5	16.40	62.4	42.0	491	101	10.7
McNeal	37.0	1.3	130.1	14.83	63.3	45.0	492	102	10.8
Solano	28.5	0.0	113.7	15.85	63.6	46.0	400	103	10.9
Vida	34.5	1.3	127.0	14.83	62.9	42.3	346	102	11.5
218 lbs/A Nitrogen									
Alpowa	34.5	17.5	133.6	11.68	64.2	44.1	360	100	10.9
Alturas	37.0	12.5	140.0	10.85	63.2	42.0	282	102	11.1
Penewawa	33.5	5.0	118.0	11.20	63.2	42.7	328	101	10.8
UI-Stone	34.5	1.3	141.7	10.65	62.9	42.0	301	99	10.8
Egan	38.8	0.0	127.0	16.28	62.4	42.0	477	100	10.6
McNeal	39.3	0.0	128.1	14.73	63.3	46.1	440	102	10.9
Solano	29.3	0.0	127.0	15.50	63.6	45.5	396	102	11.4
Vida	35.0	0.0	138.3	14.53	62.8	41.6	344	104	11.9
258 lbs/A Nitrogen									
Alpowa	35.5	5.0	123.5	11.83	64.1	45.2	346	102	11.2
Alturas	37.5	10.0	137.2	11.10	63.3	42.6	274	103	11.1
Penewawa	34.5	27.5	133.5	11.50	63.0	42.8	299	101	11.0
UI-Stone	34.3	17.5	120.2	10.70	62.9	39.6	291	101	11.1
Egan	37.0	2.5	127.5	16.28	62.4	40.0	461	101	10.7
McNeal	37.8	2.5	135.5	14.95	63.3	46.4	473	103	11.2
Solano	29.8	0.0	119.7	15.73	63.3	44.7	383	105	11.6
Vida	34.3	25.0	124.5	13.70	62.4	41.5	348	105	11.9
LSD	ns	ns	ns	0.5	ns	ns	ns	ns	ns
$Pr>F_{(0.05)-N}$	0.8506	0.6023	0.6953	0.0441	0.3877	0.8374	0.3642	0.6523	0.1937
$Pr>F_{(0.05)-V}$	<.0001	0.0266	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
$Pr>F_{(0.05)-N\times V}$	0.6691	0.2489	0.1062	0.7361	0.8687	0.0041	0.2922	0.4980	0.0853

FN: falling number, HT: height, LOD: lodging, MC: moisture content, PM: physiological maturity, PRO: protein, TKW: thousand kernel weight, TWT: test weight, YLD: yield, V: variety.

Table 3. Nitrogen productivity (Bushels per lb N) of irrigated soft white spring wheat (SWSW) and hard red spring wheat (HRSW)

	98	138	178	218	258
Variety			Total N (lbs/A)		
			SWSW		
Alpowa	1.34	0.95	0.74	0.60	0.51
Alturas	1.45	1.03	0.80	0.65	0.55
Penewawa	1.31	0.93	0.72	0.59	0.50
UI-Stone	1.42	1.01	0.78	0.64	0.54
Average	**1.38**	**0.98**	**0.76**	**0.62**	**0.52**
			HRSW		
Egan	1.25	0.89	0.69	0.56	0.47
McNeal	1.32	0.94	0.73	0.59	0.50
Solano	1.26	0.89	0.69	0.57	0.48
Vida	1.32	0.93	0.72	0.59	0.50
Average	**1.29**	**0.91**	**0.71**	**0.58**	**0.49**

Project Title: Evaluation of Yield and Protein in Rainfed Soft White and Hard Red Spring Wheat - 2016

Objective: To evaluate nitrogen use response of spring wheat varieties on yield and quality

Personnel: J.A. Torrion, R.N. Stougaard, L. Talbert, J. Garner, B. Bicego-Almeida

Methods:

Eight spring wheat cultivars, including four soft white and four hard red, were grown under five nitrogen (N) levels as a split plot, randomized complete block design with four replications. The N levels represent the whole plot factor and the eight spring wheat varieties were the sub plot factor. The five N treatments included an unfertilized check, 40, 80, 120, and 160 lbs/A added N. The check had an initial 98 lbs/A N. The resulting total N of the five treatments were: 98 (check), 138, 178, 218, and 258 total lbs of N per acre.

Summary:

Highest protein response was achieved at 178 lbs/A N (Figure 1). Protein ranged from 10.28 percent for Alturas to 15.98 percent for Egan (Figure 2, Table 2). Within the hard red spring wheat market class, Egan achieved the highest N whereas Vida had the lowest (Figure 2). No significant differences were observed among the other agronomic traits with N main effect. For rainfed conditions, Vida achieved the highest yield whereas Egan, Solano, and McNeal were equivalent (Figure 3). Refer to Table 3 for yield response - bushels produced per lb of N.

Table 1: Material and Methods

Seeding Date:	4/21/16	Herbicide:	5/17/16
Julian Date:	112		Huskie 11 fl oz/A + Axial 16.4 fl oz/A
Seeding Rate:	25 plnts/sqft	Fungicide:	6/23/16
Previous Crop:	Alfalfa		8.2 fl oz/A Prosaro
Tillage:	Conventional	Insecticide:	6/27/16
Irrigation:	Yes		1.92 fl oz/A Warrior II
Soil Type:	Fine sandy loam	Harvest Date:	8/24/16
Soil Test:	57-10-95	Julian Date:	237
Fertilizer:	(__)-63-148		

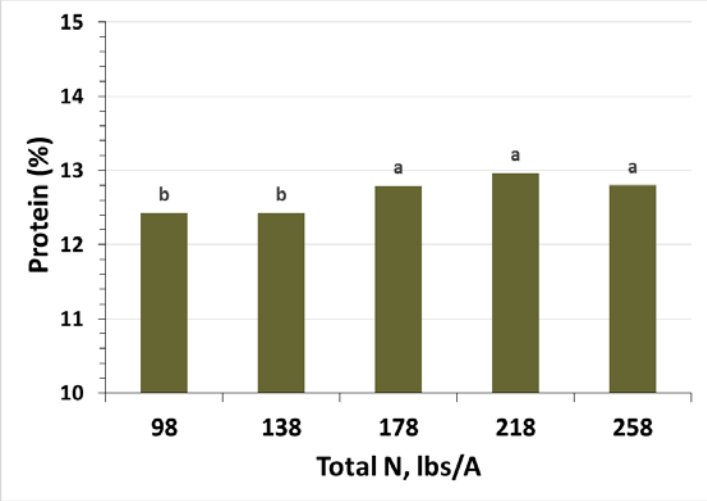


Figure 1. Mean protein response of rainfed wheat on an irrigated fine sandy loam soil – 2016. Same letter assignment denotes nonsignificance at α =0.05.

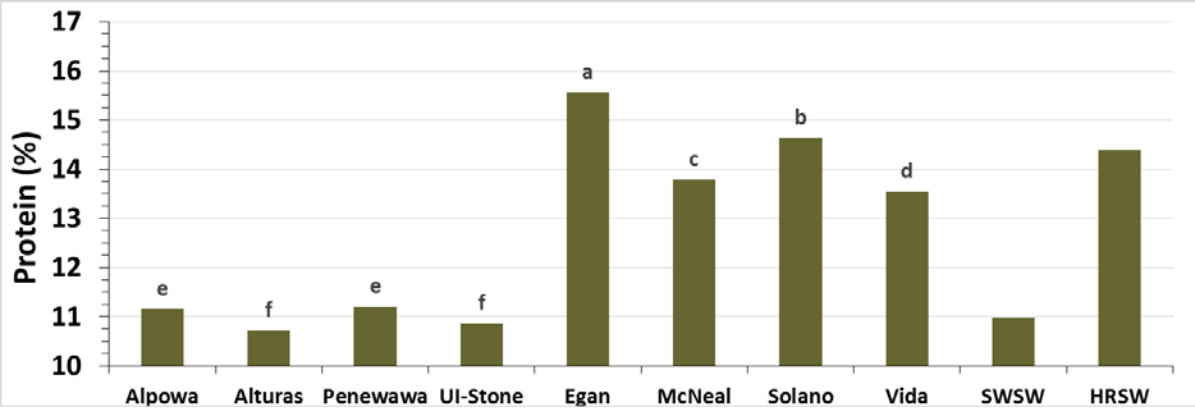


Figure 2. Mean variety protein response of soft white spring wheat (SWSW) and hard red spring wheat (HRSW). Same letter assignment denotes nonsignificance at α = 0.05.

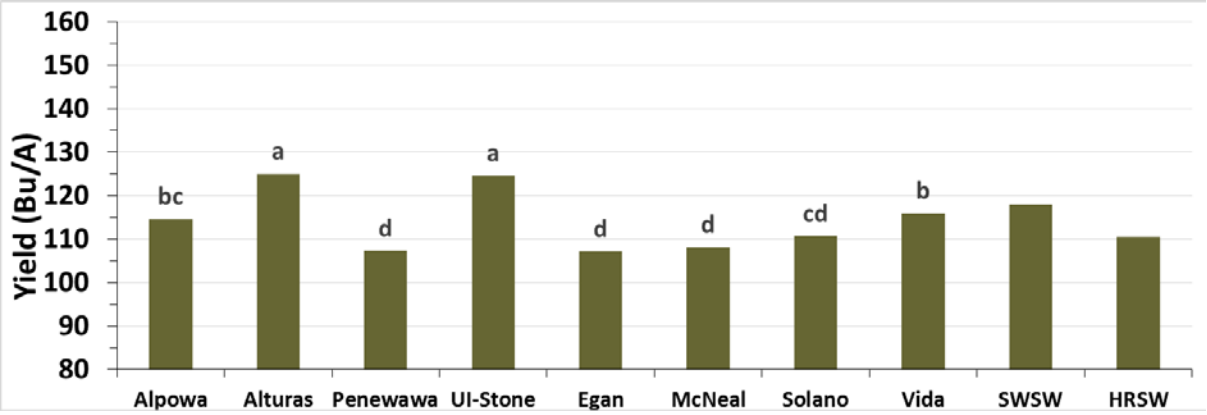


Figure 3. Mean yield response of soft white spring wheat (SWSW) and hard red spring wheat (HRSW). Same letter assignment denotes nonsignificance at α = 0.05

Table 2. Nitrogen effects on dryland spring wheat agronomic performance

Cultivar	HT in	LOD %	YLD bu/A	PRO %	TWT lb/bu	TKW g	FN sec	PM days	MC %
98 lbs/A Nitrogen (No added fertilizer)									
Alpowa	35.3	7.5	117.0	11.00	63.0	39.2	413.3	93.5	10.2
Alturas	37.8	0.0	129.0	10.40	62.0	36.9	316.5	95.3	10.2
Penewawa	34.3	0.0	111.1	11.08	62.0	38.8	352.3	92.8	10.2
UI-Stone	35.3	17.5	120.5	10.63	61.9	37.8	344.0	93.8	10.2
Egan	37.8	0.0	108.7	15.20	61.3	38.8	510.0	94.3	10.0
McNeal	37.5	0.0	111.5	13.50	62.4	40.3	537.0	95.0	10.1
Solano	29.3	0.0	107.8	14.35	63.1	41.1	451.5	96.8	10.3
Vida	35.0	0.0	116.8	13.30	62.8	39.3	409.5	96.8	10.5
138 lbs/A Nitrogen									
Alpowa	36.5	10.0	114.8	11.08	62.6	39.9	420.3	93.8	10.2
Alturas	38.0	0.0	125.5	10.28	62.1	38.9	355.0	94.8	10.3
Penewawa	35.0	0.0	108.4	10.88	61.9	38.2	345.3	93.3	10.3
UI-Stone	35.0	1.3	131.8	10.80	62.5	37.4	373.3	95.0	10.3
Egan	38.3	0.0	108.5	15.30	61.3	39.3	489.3	94.0	10.0
McNeal	39.0	0.0	103.7	13.48	62.4	41.5	515.5	95.8	10.1
Solano	30.3	0.0	112.3	14.35	63.1	40.5	411.8	98.3	10.4
Vida	35.8	5.0	115.3	13.28	62.4	38.3	413.8	97.0	10.5
178 lbs/A Nitrogen									
Alpowa	33.5	15.0	113.2	11.35	62.6	39.1	421.8	92.8	10.3
Alturas	37.5	5.0	128.8	10.85	62.2	38.0	313.3	94.8	10.1
Penewawa	34.0	0.0	109.9	11.35	61.4	37.0	362.8	93.8	10.2
UI-Stone	35.8	10.0	122.0	10.90	62.2	38.3	353.3	93.3	10.2
Egan	36.5	5.0	110.8	15.50	61.2	38.2	514.0	94.0	10.0
McNeal	36.8	0.0	107.8	14.13	62.4	42.4	523.0	94.0	10.2
Solano	29.0	0.0	112.5	14.65	62.9	42.8	453.0	97.0	10.3
Vida	34.5	5.0	115.1	13.65	62.2	38.6	413.5	95.5	10.5
218 lbs/A Nitrogen									
Alpowa	34.5	2.5	112.1	11.30	63.0	40.4	388.5	94.3	10.3
Alturas	36.5	0.0	115.8	11.03	62.4	39.0	314.0	95.0	10.2
Penewawa	32.3	0.0	100.3	11.40	62.0	39.4	338.0	94.8	10.3
UI-Stone	34.5	0.0	125.8	11.03	62.8	38.9	342.3	94.3	10.3
Egan	36.8	0.0	100.2	15.98	61.0	39.1	511.8	93.5	10.0
McNeal	36.5	0.0	107.3	14.03	62.5	41.8	515.0	95.3	10.1
Solano	28.5	0.0	108.6	15.03	62.9	41.8	459.3	98.8	10.3
Vida	34.5	0.0	114.7	13.98	62.6	40.4	405.5	97.5	10.5
258 lbs/A Nitrogen									
Alpowa	35.8	0.0	116.0	11.03	62.7	40.0	418.3	93.8	10.4
Alturas	36.0	0.0	126.1	11.03	62.4	38.7	313.0	95.8	10.3
Penewawa	33.5	0.0	106.6	11.35	61.8	38.1	345.8	93.8	10.3
UI-Stone	35.3	0.0	122.9	10.95	62.3	39.1	342.5	93.3	10.3
Egan	37.0	0.0	107.6	15.88	61.0	37.2	487.3	93.3	10.0
McNeal	38.3	0.0	110.4	13.80	62.4	40.8	538.3	95.5	10.1
Solano	30.0	0.0	112.2	14.83	62.9	40.9	442.8	98.8	10.3
Vida	34.5	2.5	117.8	13.55	62.6	39.0	404.5	98.0	10.6
LSD	ns	ns	ns	0.4	ns	ns	ns	ns	ns
$Pr>F_{(0.05)-N}$	0.0558	0.3906	0.4605	0.0055	0.4938	0.1415	0.1549	0.1111	0.2565
$Pr>F_{(0.05)-V}$	<.0001	0.0402	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
$Pr>F_{(0.05)-N\,x\,V}$	0.9579	0.8892	0.9205	0.8236	0.0791	0.8007	0.4477	0.7054	0.7692

FN: falling number, HT: height, LOD: lodging, MC: moisture content, PM: physiological maturity, PRO: protein, TKW: thousand kernel weight, TWT: test weight, YLD: yield, V: variety.

Table 3. Nitrogen yield response (Yield per lb N) of dryland soft white spring wheat (SWSW) and hard red spring wheat (HRSW)

	98	138	178	218	258
Variety			Total N (lbs/A)		
			SWSW		
Alpowa	1.17	0.83	0.64	0.53	0.44
Alturas	1.28	0.91	0.70	0.57	0.48
Penewawa	1.09	0.78	0.60	0.49	0.42
UI-Stone	1.27	0.90	0.70	0.57	0.48
Average	**1.20**	**0.85**	**0.66**	**0.54**	**0.46**
			HRSW		
Egan	1.09	0.78	0.60	0.49	0.42
McNeal	1.10	0.78	0.61	0.50	0.42
Solano	1.13	0.80	0.62	0.51	0.43
Vida	1.18	0.84	0.65	0.53	0.45
Average	**1.13**	**0.80**	**0.62**	**0.51**	**0.43**

Title: Statewide Spring Wheat Variety Evaluation – 2016

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, height, lodging, percent stripe rust infection, percent tan spot infection, yield, protein, test weight, and pre-harvest sprout. Heading date averaged 172 days (June 20) and spanned a nine day period ranging from 168 to 177 days. The mean height was 34.1 inches and ranged from 29.1 inches for WB 161 to 46.5 inches for Fortuna. Lodging averaged 0.9% with a range from 0.0% to 12.7 percent. Grain yield averaged 82.5 bu/A and ranged from 61.2 bu/A for MT 1517 to 107.5 bu/A for HRS 3504. Despite having applied a fungicide, stripe rust did occur in all varieties. Average percent infection was 33.4% and ranged from 2.0% for WB 161 to 63.3% for MT 1510. Protein averaged 14.80% and ranged from 12.53% for WB 162 to 16.27% for SY Igmar. Test weight averaged 61.0 lb/bu and ranged from 59.2 for MT 1510 and MT 1565 to 62.7% for SY Tyra. Pre-harvest sprout averaged 64.7 and ranged from 11.4 for LCS Prime to 191.8 for WB 161.

Summary:

Overall, average yields were less in 2016 (82.5 bu/A) compared to the previous year (111.2 bu/A), which is partially attributed to the combined effects of stripe rust and tan spot. HRS 3504 was the highest yielding variety, but LCS Prime, Egan, LCS Pro, SY Valda, WB Gunnison, Reeder and Vida were statistically equivalent.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	8/30/2016
Julian Date:	113	Julian Date:	243
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Winter Wheat	Soil Test:	96-8-200
Tillage:	Conventional	Fertilizer:	235-40-60
Herbicide:	Post - Huskie 11oz/A + Axial 16.4 oz/A + NIS 1qt/100gal + UAN 28% 1qt/A		
Herbicide:	Late Post -Stinger 1/3pt/A		
Insecticide:	Warrior II 1.92 floz/A	Fungicide:	Tilt 4oz/A

Table 2. Agronomic data from the evaluation of advanced spring wheat lines, Kalispell, MT - 2016.

Cultivar	HD Julian	HT in	LOD %	SR %	TS %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PHS Delta
HRS 3504	175	32.7	0.0	26.3	22.3	107.5	13.93	61.3	54.4
LCS Prime	172	34.4	0.0	31.0	27.0	101.7	13.50	63.0	11.4
Egan	173	37.3	0.0	7.0	21.7	100.8	15.83	59.4	107.1
LCS Pro	172	39.1	2.3	27.7	22.7	100.3	15.10	62.6	53.2
SY Valda	172	32.4	0.0	31.7	28.0	97.9	14.10	62.0	27.6
WB Gunnison	173	36.1	0.0	16.0	23.3	96.7	13.90	61.1	42.6
Reeder	172	36.9	0.0	29.3	30.7	96.6	15.20	61.7	28.6
Vida	174	33.9	1.7	34.0	35.0	96.2	15.07	60.9	31.2
MT 1426	168	35.4	8.3	39.3	38.3	94.9	14.60	60.8	101.9
MT 1514	172	37.4	1.0	26.7	21.7	94.1	15.43	60.7	49.9
MT 1173	176	36.5	0.0	27.7	27.7	93.5	14.57	61.0	26.6
MT 1542	170	35.0	0.0	19.7	30.7	91.9	14.77	61.3	81.7
MT 1570	170	31.0	0.0	42.7	53.3	90.8	13.13	61.8	112.6
Duclair	172	35.3	0.0	34.3	32.7	90.7	14.93	60.4	67.8
MT 1538	173	34.5	0.0	10.0	35.7	89.6	13.73	60.4	80.1
Fortuna	170	46.5	12.3	14.0	25.0	89.4	15.63	61.3	21.3
MT 1509	173	35.0	1.7	24.3	38.7	89.3	14.83	60.8	52.9
MT 1401	170	35.8	12.7	21.0	33.3	89.1	15.00	61.9	133.1
WB 163	173	31.6	0.0	37.3	39.0	87.8	13.27	62.1	84.4
MT 1543	170	34.0	0.0	23.3	25.0	87.6	14.63	60.1	66.2
MT 1320	170	37.3	1.7	17.3	37.3	87.3	14.37	61.4	78.0
HRS 3530	177	36.9	0.0	30.0	30.7	87.3	13.43	61.3	40.8
WB 161	170	29.1	0.0	2.0	20.0	86.8	16.07	60.9	191.8
McNeal	170	35.2	0.0	20.3	23.3	86.5	15.90	60.4	17.0
MT 1348	170	34.8	0.0	16.7	34.3	85.8	13.97	61.3	55.6
SY Tyra	174	31.9	0.0	25.3	31.0	85.6	14.07	62.7	28.3
MT 1572	173	32.4	0.0	39.0	37.0	84.8	14.87	61.9	74.0
MT 1442	173	34.5	1.7	19.0	36.0	84.5	15.20	60.7	45.5
MT 1574	173	32.7	0.0	45.7	45.0	84.2	14.17	60.6	101.0
MT 1451	171	34.5	0.0	34.0	36.7	83.8	14.47	60.3	152.6
MT 1512	171	35.0	1.7	47.3	70.0	82.5	14.50	61.5	43.4
MT 1427	170	33.3	1.7	61.7	67.7	82.3	14.53	59.5	129.7
MT 1511	173	34.6	0.0	39.3	42.7	81.3	14.87	59.9	43.4
Corbin	171	36.1	0.0	30.7	29.0	80.8	15.33	61.9	39.3
MT 1219	173	31.9	1.7	51.7	55.3	80.4	14.97	60.8	88.6
MT 1519	174	31.6	0.0	40.7	33.3	80.4	15.07	60.2	60.0
Alum	174	34.9	4.0	14.3	53.3	79.3	13.57	61.3	56.5
WB 162	168	32.5	0.0	60.0	50.0	79.0	12.53	61.9	92.1
MT 1316	169	32.7	0.0	28.3	51.0	78.6	15.17	60.5	113.5
MT 1518	171	34.5	0.0	48.3	38.3	78.6	15.10	60.5	75.7

HD: heading date, HT: height, LOD: lodging, SR: stripe rust, TS: Tan Spot, YLD: yield, PRO: protein, TWT: test weight, PHS: pre-harvest sprout.

[1] adjusted to 13% moisture.

[2] adjusted to 12%.

Table 2. (continued).

Cultivar	HD Julian	HT in	LOD %	SR %	TS %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PHS Delta
Choteau	173	34.8	0.0	43.3	26.0	78.0	15.07	60.6	54.7
MT 1531	174	32.4	0.0	33.3	36.0	77.4	15.27	61.3	33.4
MT 1573	171	29.9	0.0	38.3	61.7	77.0	14.30	61.0	65.0
WPSP2-MCNEAL1	172	32.0	0.0	35.0	68.3	76.8	13.87	61.0	137.2
SY Igmar	174	33.2	0.0	24.0	31.3	76.1	16.27	61.8	30.8
MT 1523	172	33.6	0.0	34.0	34.0	75.7	14.90	61.2	35.1
HRS 3361	173	32.5	0.0	29.3	31.0	75.7	15.93	60.9	45.5
Thatcher	176	43.4	1.7	31.7	26.0	75.6	14.97	60.8	11.4
SY Soren	173	31.5	0.0	34.3	29.3	75.3	15.80	61.8	35.2
MT 1415	172	33.5	0.0	48.7	41.0	75.3	15.30	62.4	50.8
WB9879CLP	173	33.2	0.0	31.7	43.3	74.4	15.33	59.7	77.5
MT 1447	170	34.5	1.7	29.3	56.7	73.9	14.97	60.5	76.6
MT 1525	173	32.3	0.0	55.7	56.7	73.8	14.50	62.1	22.7
MT 1506	173	34.9	0.0	55.0	36.0	72.3	15.57	60.6	15.5
LNR12-0283	171	31.5	0.0	32.3	39.7	72.1	15.23	61.9	17.2
MT 1549	175	32.2	0.0	22.3	33.3	70.5	15.73	60.1	30.8
AGRIPR161	177	33.5	0.0	45.0	35.0	70.5	14.17	59.5	63.8
MT 1455	173	32.5	0.0	38.3	73.0	69.7	15.00	60.7	78.8
Brennan	170	31.2	0.0	32.7	43.3	69.3	14.87	61.4	83.3
MT 1510	170	32.9	0.0	63.3	59.0	68.3	14.97	59.2	56.1
MT 1565	174	33.6	0.7	40.0	51.7	66.7	15.90	59.2	17.5
MT 1533	173	33.2	1.7	53.3	63.3	66.6	15.60	60.1	163.1
MT 1556	174	33.1	0.0	35.0	63.3	63.6	14.93	59.6	128.1
MT 1517	173	29.3	0.0	58.3	55.0	61.2	15.17	60.4	52.5
Mean	172	34.1	0.9	33.4	39.5	82.5	14.80	61.0	64.7
CV	1.0	4.6	234.2	25.8	34.5	11.8	3.50	0.8	53.2
LSD	2.7	2.5	3.4	13.9	22.0	15.8	0.84	0.7	55.6
Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

HD: heading date, HT: height, LOD: lodging, SR: stripe rust, TS: Tan Spot, YLD: yield, PRO: protein, TWT: test weight, PHS: pre-harvest sprout.

[1] adjusted to 13% moisture.

[2] adjusted to 12%.

Title: Evaluation of Sm1 Advanced Spring Wheat Lines for Resistance to the Wheat Midge – 2016

Objective: To evaluate spring wheat experimental lines for wheat midge resistance and agronomic performance in environments and cropping systems where the wheat midge is prevalent.

Results:

Four experimental spring wheat lines were evaluated for resistance to the wheat midge in comparison to the midge resistant and susceptible check varieties, Egan and Hank, respectively. This nursery was established at Kalispell and Conrad, MT. Midge populations were low to non-existent at both locations with the susceptible variety, Hank, having an average of only 0.7 and 4.6 larvae per spike at Conrad and Kalispell, respectively. As a result, it was not possible to assess the level of resistance expressed in the experimental lines. However, the agronomic performance of the entries was determined.

At Kalispell, significant differences were observed for heading, height, stripe rust, yield, protein, test weight, and number of wheat midge per spike (Table 2). Heading averaged 178 days. Plant height averaged 33.1 inches and ranged from 30.2 inches for MT 1573 to 37.0 inches for Egan. Stripe rust was present in the nursery despite having been treated with a fungicide. Stripe rust infection averaged 13.4% and ranged from 4.3% for Egan to 35.0% for Hank. Tan spot also was present, and was significant at a probability level of 0.054 percent. Tan spot infection averaged 13.8% and ranged from 0.0% for Egan, to 31.7% for MT1573. Yield averaged 91.1 bu/A, and ranged from 82.8 bu/A for Hank to 101.6 bu/A for Egan. Protein averaged 14.15%, and ranged from 13.47% for MT 1570 to 15.59% for Egan. Test weight averaged 59.9 lb/bu and ranged from 58.1 lb/bu for Hank to 61.3 lb/bu for MT 1570. The number of wheat midge per spike averaged 0.8. The susceptible variety Hank had 4.6 wm/spike while the resistant varieties afforded complete mortality.

At Conrad, no significant differences were observed for height, lodging, yield, test weight, protein or the number of larvae per spike (Table 3). Yields averaged 65.9 bu/A , but test weights were low, averaging 55.3 lb/bu. Proteins averaged 14.49 and all entries exceed 14% except for MT 1574. Egan had the highest protein at 15.08 percent.

Summary:

The four experimental lines provided 100% midge control in Kalispell. However, in Conrad there was less than 1% infestation. Additionally, the experimental lines are significantly shorter than Egan in Kalispell but no differences were observed in Conrad. However, they produced lower yields than Egan. Efforts should continue to identify short stature, high yielding, and midge resistant wheat lines.

Table 1. Materials and Methods.

Kalispell			
Seeding Date:	5/2/2016	Harvest Date:	8/26/2016
Julian Date:	123	Julian Date:	239
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Spring wheat	Soil Test:	99-32-432-40
Tillage:	Conventional	Fertilizer:	235-40-60
Herbicide:	Huskie 11oz/A + Axial 16.4 oz/A + NIS 1qt/100gal + UAN 28%		
Fungicide:	Tilt at 4oz		
Conrad			
Seeding Date:	5/4/2016	Harvest Date:	9/15/2016
Julian Date:	125	Julian Date:	259
Seeding Rate:	N/A	Soil Type:	Silty Clay
Previous Crop:	Spring wheat	Soil Test:	N/A
Tillage:	No-till		
Fertilizer:	100 lb ammonium sulfate, 381 lbs urea, 60 lbs N		
Herbicide:	Preplant: RT3 18 oz/A + Hellfire 1 qt/A.		
	Postplant: 4 oz/ac Rimfire Max, 16 oz/ac Brox M, 4 oz/ac propiconazole		

Table 2. Agronomic data from the evaluation of Sm1 advanced spring wheat lines, Kalispell, MT - 2016.

Cultivar	HD Julian	HT in.	SR %	TS %	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	WM no./spk
Egan	179	37.0	4.3	0.0	0.0	101.6	15.59	58.6	0.0
Hank	178	32.4	35.0	3.3	0.0	82.8	13.48	58.1	4.6
MT 1570	178	31.9	14.0	11.7	2.3	94.8	13.47	61.3	0.0
MT 1572	178	32.6	10.0	19.3	0.0	89.5	14.64	60.8	0.0
MT 1573	178	30.2	7.3	31.7	0.0	93.9	13.72	60.9	0.0
MT 1574	179	34.5	10.0	16.7	0.0	83.8	14.02	59.5	0.0
Mean	178	33.1	13.4	13.8	0.4	91.1	14.15	59.9	0.8
CV	0.2	2.0	38.1	80.5	424.3	3.8	1.16	0.3	80.2
LSD	0.7	1.2	9.3	20.2	ns	6.2	0.30	0.4	1.1
Pr>F	0.0042	0.0001	0.0003	0.0538	0.4651	0.0004	0.0001	0.0001	0.0001

HD: heading date, HT: height, SR: stripe rust, TS: tan spot, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, WM: wheat midge, no./spk: number/spike, ns: nonsignificant.

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

Table 3. Agronomic data from the evaluation of Sm1 spring wheat lines, Conrad, MT - 2016.

Cultivar	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	WM no./spk
Egan	32.3	3.7	73.8	15.08	56.6	0.0
Hank	31.7	0.5	56.2	14.10	53.4	0.7
MT 1570	30.3	0.5	64.4	14.61	54.2	0.3
MT 1572	32.3	0.5	69.5	14.95	55.6	0.3
MT 1573	28.3	0.5	61.4	14.43	56.6	0.0
MT 1574	31.0	6.8	70.1	13.77	55.2	0.3
Mean	31.0	2.1	65.9	14.49	55.3	0.3
CV	6.1	144.2	13.8	6.07	2.7	182.0
LSD	ns	ns	ns	ns	ns	ns
Pr>F	0.1704	0.1191	0.2673	0.4846	0.1247	0.6113

HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, WM: wheat midge, no./spk: number per spike, ns: nonsignificant.

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

Title: Western Regional Soft White Spring Wheat Evaluation – 2016

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

Results:

Significant differences were observed for all response variables. Heading dates averaged 173 Julian days (June 21) and spanned a 10 day period that ranged from 167 to 177 days (Table 2.). Physiological maturity averaged 216 days (August 3) and ranged from 215 to 217 days. Stripe rust was observed on all cultivars despite an application of Tilt. Stripe rust infection averaged 27.8%, ranging from 3.0% for WB6121 to 63.3% for Alpowa. Plant heights averaged 36.7 inches, ranging from 34.3 inches for WA8254 to 41.6 inches for DH09X503-188-0. Lodging was minimal with the exception of Louise at 63.3 percent. Yield averaged 112.5 bu/A and ranged from 77.1 bu/A for DH09X101-41-0 to 136.2 bu/A for UI Stone. Protein averaged 11.46%, ranging from 10.09% for WA8254 to 13.70 % for WB6121. Test weight averaged 61.0 lb/bu and ranged from 59.3 for Treasure at 107 lb/A to 62.3 lb/bu for DH09X503-188-0. Falling number values averaged 323.7 seconds and ranged from 276.1 seconds for WB6121 to 366.6 seconds for Alpowa. Pre-harvest sprout averaged 124.6 and ranged from 64.6 for Alpowa to 267.7 for WB6121.

Summary:

UI Stone was the highest yielding variety and three entries yielded statistically equivalent to UI Stone; 12-SWW-052, IDO1405S and DH09X503-188-0. Preliminary findings demonstrate that UI Stone 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.

Seeding Date:	4/22/2016	Harvest Date:	8/23/2016
Julian Date:	113	Julian Date:	236
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	WW	Soil Test:	96-8-200
Tillage:	Conventional	Fertilizer:	235-40-60
Herbicide:	Huskie 11 oz/A + Axial 16.4 oz/A + NIS 1 qt/100 gal + UAN 28% 1 qt/A + Stinger 1/3 pt/A		
Insecticide:	Warrior II 1.92 floz/A	Fungicide:	Tilt at 4 oz

Table 2. Agronomic data from the evaluation of Western Regional Soft White Spring Wheat lines, Kalispell, MT - 2016

Cultivar	HD Julian	SR %	HT in.	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	FN sec	PHS delta
UI Stone	170	28.3	37.4	0.0	136.2	10.37	61.8	330.8	99.3
12-SWW-052	174	15.3	37.1	8.3	128.6	11.49	59.9	308.4	158.2
IDO1405S	172	19.3	38.5	0.0	128.4	11.81	61.2	327.0	144.5
DH09X503-188-0	177	24.3	41.6	5.0	124.8	13.12	62.3	319.4	77.7
WA 8253	171	15.0	36.7	13.3	120.9	11.26	61.4	333.2	189.7
IDO1401S	168	30.0	35.7	1.7	120.8	11.28	61.5	322.8	105.3
IDO1403S	172	7.3	35.4	0.0	117.3	12.26	60.4	365.4	76.4
Treasure 40g	175	31.7	36.1	0.0	117.2	10.59	60.2	310.5	125.0
06PN3024-2	168	16.7	37.3	3.3	115.1	11.31	61.3	345.9	119.7
Treasure 60 g	175	38.3	35.6	0.0	111.7	10.80	59.7	313.3	117.6
WB6121	167	3.0	34.8	0.0	107.2	13.70	61.3	276.1	267.7
Treasure 80g	175	44.0	35.6	1.7	106.4	10.82	59.3	316.3	120.5
ALPOWA	176	63.3	34.8	1.7	100.5	11.68	62.0	366.6	64.6
LOUISE	173	21.0	39.3	63.3	95.9	11.57	60.7	307.6	130.5
WA 8254	171	33.3	34.3	16.7	91.6	10.09	60.9	306.5	117.2
DH09X101-41-0	175	54.0	37.0	0.0	77.1	11.12	61.4	329.1	79.1
Mean	173	27.8	36.7	7.2	112.5	11.46	61.0	323.7	96.5
CV	0.7	20.3	4.6	90.6	7.4	1.70	1.0	6.8	46.46
LSD	2.0	9.4	2.8	10.9	13.8	0.33	1.0	36.5	124.6
Pr>F	0.0001	0.0001	0.001	0.0001	0.0001	0.0001	0.0001	0.0033	0.0288

HD: heading date, SR: stripe rust, HT: height, PM: physiological maturity, 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 – 2016

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

Results:

Significant differences were observed for all response variables. Heading date averaged 173 Julian days (June 21) and spanned a 9 day period that ranged from 170 to 179 Julian days. On average, physiological maturity occurred on 216 Julian days (August 3) and ranged from 215 to 217 days. Stripe rust was observed on all cultivars despite an application of Tilt. Stripe rust averaged 13.6% and ranged from 1.0% infection for Yurok to 39.3% for MT 1574. Plant height averaged 33 inches. The tallest cultivar was WA 8258 at 37.3 inches while Patwin 515 was the shortest at 26.3 inches. Lodging was minimal, with the greatest lodging being 5.0 % for UI Winchester. Yields averaged 105.7 bu/A, ranging from 76.7 bu/A for UI Winchester to 125.2 bu/A for 06PN3015-08 and IDO1602S. Protein content averaged 14.70% and ranged from 13.29% for Yurok to 16.79% for Egan. Test weight averaged 60.9 lb/bu and ranged from 58.8 lb/bu for Patwin 515 to 62.8 lb/bu for IDO1602S. Falling numbers averaged 345.1 seconds and ranged from a low of 213.3 for Patwin 515 to a high of 532.5 for 04PN3051-9. Preharvest sprout, as measured in the change (delta) in the leaf area of sprouted spikes, averaged 95.4 and ranged from a low of 12.5 for Volt to a high of 223.4 for 06PN3015-08.

Summary:

Two varieties (WA 8258 and Yurok) were statistically equivalent to 06PN3015-08 and IDO1602S, the highest yielding varieties. Stripe rust infection was generally associated with the lowest yielding varieties.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	8/26/2016
Julian Date:	113	Julian Date:	239
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Winter Wheat	Soil Test:	96-8-200
Tillage:	Conventional	Fertilizer:	235-40-60
Herbicide	Huskie 11oz/A + Axial 16.4 oz/A + NIS 1qt/100gal + UAN 28% 1qt/A		
Herbicide	Stinger 1/3pt/A		
Insecticide:	Warrior II 1.92 floz/A	Fungicide:	Tilt 4oz

Table 2. Agronomic data from the evaluation of Western Regional Hard Red Spring Wheats, Kalispell, MT - 2016

Cultivar	HD Julian	SR %	HT in	PM Julian	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	PHS delta
06PN3015-08	173	4.7	32.4	216.0	0.0	125.2	14.32	61.3	223.4
IDO1602S [3]	170	7.7	33.1	216.7	0.0	125.2	14.30	62.8	172.0
WA 8258	170	7.3	37.3	216.0	3.3	119.4	14.37	61.2	38.6
Volt	179	3.3	33.4	216.7	0.0	115.7	14.02	62.0	12.5
Yurok	179	1.0	35.7	216.7	0.0	114.8	13.29	60.0	26.4
Jefferson	172	26.0	34.9	216.3	0.0	108.6	13.70	61.3	76.4
WB9518	174	1.7	30.4	216.0	0.0	108.5	16.20	59.5	47.7
Patwin 515 [3]	174	1.3	26.3	216.3	0.0	106.5	15.50	58.8	139.3
04PN3051-9	174	15.0	34.9	214.7	0.0	106.0	16.30	62.3	51.5
Glee	171	15.3	36.7	216.0	1.7	105.0	14.18	61.8	103.4
UI Platinum [3]	170	26.0	32.7	215.7	0.0	101.4	13.83	61.5	140.7
Solano	176	4.0	28.0	216.7	0.0	101.0	15.74	60.0	55.5
Egan	174	5.3	36.1	215.0	0.0	97.9	16.79	58.9	74.4
MT 1572	172	24.0	30.7	215.7	0.0	92.7	14.33	61.5	71.1
MT 1574	175	39.3	33.0	216.0	0.0	87.1	14.63	60.8	210.7
UI Winchester	171	35.0	32.7	215.3	5.0	76.7	13.90	60.8	82.2
Mean	173	13.6	33.0	216.0	0.6	105.7	14.70	60.9	95.4
CV	0.77	30.8	3.7	0.2	168.7	8.2	2.49	0.8	39.7
LSD	2.2	7.0	2.0	0.8	1.8	14.4	0.61	0.9	63.1
Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

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% moisture.

[3] hard white spring wheat.

Title: Spring Wheat Off Station Variety Trial – 2016

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

Results:

This nursery was established to evaluate spring wheat varieties for yield and agronomic performance in the absence of fungicide or insecticide inputs. Significant differences were observed for heading, height, stripe rust, tan spot, lodging, yield, protein, test weight, wheat midge, and falling numbers. Heading averaged 179 days with a low of 177 days for MT 1401 and a high of 181 days for MT 1173. Height averaged 34.8 inches, with a low of 30.4 inches for SY Tyra and a high of 44.4 inches for Fortuna. Stripe rust was prevalent in this nursery. The average level of infection increased from 7.7% on June 24 to 48.3% on July 15. Egan demonstrated the highest level of resistance with an infection level peaking at 20 percent. Tan spot averaged 42.5%, with a low of 0.0% for MT1173 and a high of 83.3% for SY Soren. Lodging averaged 3.6 percent. Fortuna had the most lodging at 25 percent. Yield averaged 61.8 bu/A, with a low of 34.5 bu/A for Oneal to a high of 98.4 bu/A for Egan. Protein averaged 14.04%, with a low of 13.00% for Gunnison to a high of 15.37% for Egan. Test weight averaged 56.5 lb/bu, with a low of 49.7 lb/bu for SY Tyra, to 60.8 lb/bu for Fortuna. Wheat midge averaged 3.8 per spike with a low of 0.0 for Egan to a high of 7.9 to Alum. Falling numbers averaged 373.7 seconds, with a low of 302.0 for MT 1173, to a high of 483.0 for McNeal.

Summary:

Egan was the highest yielding commercially available variety. It also had the highest protein, and resistance to the wheat midge.

Table 1. Material and Methods.

Seeding Date:	5/2/2016	Harvest Date:	8/19/2016
Julian Date:	123	Julian Date:	232
Seeding Rate:	80 lb/A	Soil Type:	Creston Sil
Previous Crop:	Spring Wheat	Soil Test:	99-32-432-40
Tillage:	Conventional	Fertilizer:	235-40-60
Fungicide:	None	Insecticide:	None
Herbicide: Huskie 11 oz/A + Axial 16.4 oz/A + NIS 1qt/100gal + UAN 28% 1qt/A			

Table 2. Agronomic data from the evaluation of spring wheat varieties and experimental lines, Kalispell, MT - 2016

	HD	HT	Percent Stripe Rust		TS	LOD	YLD[1]	PRO[2]	TWT[1]	WM	FN
Cultivar	Julian	in.	6/24	7/15	%	%	bu/A	%	lb/bu	no./spike	sec
Egan	179	36.7	0.0	20.0	27.7	0.0	98.4	15.37	58.4	0.0	470.0
Reeder	179	37.3	3.0	25.0	31.7	0.0	84.5	14.03	59.7	0.1	374.5
Fortuna	180	44.4	1.0	38.3	58.3	25.0	79.8	14.20	60.8	7.5	365.8
Alum	180	36.2	2.0	36.7	45.3	21.7	77.4	14.13	59.3	7.9	352.6
MT 1316	179	35.4	4.7	28.3	35.0	3.3	72.8	13.43	57.6	3.5	389.1
Gunnison	178	32.6	3.3	23.3	38.3	0.0	72.0	13.00	58.8	4.8	403.9
MT 1348	178	34.4	1.7	41.7	53.3	6.7	71.5	13.93	57.1	1.2	349.9
Duclair	178	33.3	0.7	38.3	65.0	3.3	68.0	14.57	54.6	2.6	335.2
Brennan	178	32.7	8.7	61.7	43.3	0.0	63.1	13.93	59.4	2.9	392.4
Vida	179	34.4	7.7	46.7	36.7	0.0	62.1	14.13	56.9	7.4	331.1
MT 1401	177	33.6	5.0	45.0	47.7	11.7	60.9	13.80	56.7	2.1	343.4
McNeal	179	36.5	6.0	53.3	16.7	0.0	57.6	13.33	55.6	6.2	483.0
SY Soren	179	32.6	18.3	61.7	83.3	0.0	55.4	13.83	56.9	3.7	411.3
Choteau	178	32.4	5.3	50.0	40.0	0.0	52.6	14.23	54.5	2.0	371.8
WB9879CLP	179	33.5	8.0	46.7	43.3	0.0	51.6	15.03	54.3	3.7	360.2
Mott	179	36.6	20.0	83.3	18.3	0.0	48.6	13.23	58.9	2.7	323.4
Corbin	178	34.5	5.7	60.0	38.3	0.0	48.4	14.07	55.9	6.8	365.6
SY Tyra	179	30.4	11.0	71.7	80.0	0.0	39.6	14.17	49.7	1.2	338.4
MT 1173	181	35.3	22.3	63.3	0.0	0.0	36.6	13.67	52.1	4.2	302.0
Oneal	179	33.1	20.3	70.0	47.7	0.0	34.5	14.70	51.9	4.8	410.2
Mean	179	34.8	7.7	48.3	42.5	3.6	61.8	14.04	56.5	3.8	373.7
LSD	0.8	1.9	12.6	16.4	37.4	13.1	6.4	0.40	1.1	2.5	30.9
CV	0.3	3.4	98.7	20.6	53.2	220.5	6.3	1.73	1.2	40.0	5.0
Pr>F	0.0001	0.0001	0.0068	0.0001	0.0131	0.0055	0.0001	0.0001	0.0001	0.0001	0.0001

HD: heading date, HT: height, TS: tan spot, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, WM: wheat midge, no./spike: number/spike, FN: falling numbers.

[1]adjusted to 13% moisture.

[2]adjusted to 12% moisture.

Title: Spring Wheat Commercial Variety Evaluation - 2016

Objective: To evaluate experimental and commercially available spring wheat varieties for agronomic performance in environments representative of northwestern Montana.

Results:

Significant differences were observed in heading date, percent stripe rust infection, height, lodging, yield, protein, test weight and falling number. Heading date averaged 174 days (June 22) and spanned an eight day period ranging from 170 to 177 days. Despite the application a fungicide, significant stripe rust infection was observed. The average percent infection on July 15 was 17.6% and ranged from 5.0% for Solano to 31.7% for HRS 3361. The mean height was 33.2 inches and ranged from 28.6 for Cabernet to 37.8 inches for HRS 3530. Lodging was minimal and ranged from 0.0 to 3.7 percent. Grain yield averaged 85.0 bu/A and ranged from 58.7 bu/A for HRS 3361 to 107.2 bu/A for HRS 3504. Protein averaged 15.74% and ranged from 14.71% for HRS 3504 to 16.84% for SY3051-9. Test weight averaged 60.0 lb/bu and ranged from 56.9 lb/bu for SY Coho to 62.4 lb/bu for SY3051-9. Falling number averaged 317.6 seconds, ranging from 178.7 seconds for SY Teton to 489.8 for SY3051-9.

Summary:

HRS 3504 and SY 3015-8 were the highest yielding varieties. However, HRS 3504 had the lowest protein while SY 3015-8 produced falling numbers that would result in dockage penalties. This nursery demonstrates that there is tremendous genetic variation for yield and grain quality parameters in experimental private varieties and continual screening is important to identify those wheats that perform best in northwestern Montana.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	8/30/2016
Julian Date:	113	Julian Date:	243
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Winter Wheat	Soil Test:	96-8-200
Tillage:	Conventional	Fertilizer:	235-40-60
Herbicide:	Post - Huskie 11 oz/A + Axial 16.4 oz/A + NIS 1 qt/100gal + UAN 28% 1 qt/A		
Herbicide:	Late Post - Stinger 1/3 pt/A		
Insecticide:	Warrior II 1.92 floz/A	Fungicide:	Tilt 4 oz

Table 2. Agronomic data from the evaluation of Industry Spring Wheat lines - 2016

	HD	SR	HT	LOD	YLD[1]	PRO[2]	TWT[1]	FN
	Julian	%	in	%	bu/A	%	lb/bu	sec
HRS 3504	176	20.0	33.1	0.0	107.2	14.71	61.4	337.8
SY3015-8	174	21.7	33.2	0.0	99.3	15.62	60.8	256.3
SY Coho	176	8.3	32.6	0.0	91.3	16.02	56.9	216.9
Egan	175	13.3	37.0	0.0	91.2	16.68	58.9	473.4
SY Teton	170	11.7	31.1	0.0	87.3	14.85	58.7	178.7
SY Selway	172	18.3	36.5	0.0	86.7	15.41	58.9	298.0
SY3051-9	175	10.0	34.0	0.0	86.7	16.84	62.4	489.8
HRS 3530	177	23.3	37.8	3.7	85.2	15.00	60.4	280.0
Solano	176	5.0	28.7	0.0	84.9	15.93	59.2	310.7
Cabernet	174	10.0	28.6	0.0	79.5	15.92	59.9	317.0
HRS 3100	173	26.7	32.7	0.0	78.1	15.20	60.8	334.7
HRS 3616	174	28.3	34.3	0.0	68.7	16.51	60.3	329.5
HRS 3361	174	31.7	32.7	0.0	58.7	15.88	61.0	305.4
Mean	174	17.6	33.2	0.3	85.0	15.7	60.0	317.6
CV	0.4	23.5	4.5	113.6	7.3	1.9	0.7	6.2
LSD	1.3	7.0	2.5	0.5	10.5	0.5	0.7	33.3
Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	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: Effect of Varro Tank Mixes on Weed Control in Spring Wheat - 2016

Objective: To evaluate the efficacy and crop safety of Varro tank mixes in spring wheat.

Materials and Methods:

Varro was applied in combination with standard broadleaf herbicides to evaluate weed control and crop safety in spring wheat relative to that obtained with Huskie Complete and Wolverine Advanced. The experimental design was a randomized complete block with three replications. Egan spring wheat was planted on April 22, on 7.5 inch row spacings, to a depth of two inches. Common lambsquarters, canola, wild oats and wild buckwheat were planted in the center of each plot on April 28. Herbicide treatments were applied using a CO_2 backpack sprayer with Teejet XR11002 nozzles in 20 GPA of water. Treatments were applied on May 18 when the wheat was at the four-leaf stage and the weeds were at the two to three leaf stage.

Results:

Initial crop injury ranged from 13.3 to 23.3% for Huskie Complete and for treatments containing Varro, while Wolverine Advanced had only 3.3% injury. As the season progressed crop injury declined for all treatments and ranged 0 to 8.3 percent. Wild oats and canola were the primary weeds present, with lower densities of wild buckwheat and common lambsquarters. By July 1, weed control was 100% for all of the treatments except for Wolverine Advanced, which had 90% control for wild oats. Herbicide use improved yields by about 68% compared to the check, but there were no yield differences among the herbicides tested.

Summary:

The Varro tank mixes produced more crop injury than Wolverine Advanced. However, this early injury did not appear to impact yield. Wild oat control was excellent regardless of the tank mix partner.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	9/1/2016
Julian Date:	113	Julian Date:	245
Seeding Rate:	120 lb/A	Soil Type:	Creston SiL
Previous Crop:	No-till winter wheat	Soil Test:	104-24-652-154
Tillage:	Conventional	Fertilizer:	BC: 235-40-60 DR:3-14-0

Table 2. Effect of herbicides on agronomic performance of spring wheat, Kalispell, MT - 2016.

				Percent control													
		Crop Injury		Wild Oat			Canola			Wild Buckwheat		Lambsquarters				YLD[1]	TWT[1]
Name	Rate	5/28	6/3	5/28	6/3	7/1	5/28	6/3	7/1	5/28	6/3	5/28	6/3	7/1		lb/A	lb/bu
Check		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		60.5	60.7
VARRO +	6.85 fl oz/A																
BROMAC +	1 pt/A	20.0	3.3	25.0	82.0	100.0	85.0	93.3	100.0	85.0	93.3	88.3	93.3	100.0		95.8	61.0
AMMONIUM SULFATE	0.5 lb/A																
VARRO +	6.85 fl oz/A																
WELD HERBICIDE +	18 fl oz/A	23.3	5.0	25.0	87.7	100.0	69.3	90.0	100.0	66.7	90.0	68.3	90.0	100.0		93.7	61.6
AMMONIUM SULFATE	0.5 lb/A																
VARRO +	6.85 fl oz/A																
CARNIVORE HERBICIDE +	1 pt/A	23.3	5.0	21.7	76.7	100.0	83.3	95.0	100.0	85.0	95.0	83.3	95.0	100.0		94.9	60.7
AMMONIUM SULFATE	0.5 lb/A																
VARRO +	6.85 fl oz/A																
WIDEMATCH +	1 pt/A	23.3	8.3	25.0	87.0	100.0	71.7	83.3	100.0	73.3	86.7	73.3	86.7	100.0		93.3	60.9
2,4-D ESTER +	0.5 pt/A																
AMMONIUM SULFATE	0.5 lb/A																
VARRO +	6.85 fl oz/A																
WIDEMATCH +	1 pt/A	13.3	0.0	20.0	78.3	100.0	69.3	82.7	100.0	66.7	83.3	66.7	83.3	100.0		95.5	61.1
MCPA ESTER +	0.5 pt/A																
AMMONIUM SULFATE	0.5 lb/A																
VARRO +	6.85 fl oz/A																
WIDEMATCH +	1 pt/A	18.3	0.0	23.3	87.3	100.0	74.3	91.7	100.0	71.7	91.7	78.3	93.3	100.0		98.7	60.7
AFFINITY TANK MIX +	0.6 oz/A																
AMMONIUM SULFATE	0.5 lb/A																
VARRO +	6.85 fl oz/A																
OLYMPUS +	0.2 oz wt/A	21.7	1.7	23.3	68.3	100.0	88.3	95.0	100.0	88.3	95.0	86.7	95.0	100.0		95.1	61.4
CARNIVORE HERBICIDE +	1 pt/A																
AMMONIUM SULFATE	0.5 lb/A																
VARRO +	6.85 fl oz/A																
SENTRALLAS +	11 fl oz/A	18.3	0.0	21.7	72.3	100.0	71.7	82.7	100.0	71.7	83.3	71.7	83.3	100.0		97.6	60.8
AMMONIUM SULFATE	0.5 lb/A																
HUSKIE COMPLETE +	13.7 fl oz/A	20.0	3.3	25.0	70.0	100.0	88.3	93.3	100.0	90.0	93.3	88.3	93.3	100.0		97.2	60.5
AMMONIUM SULFATE	0.5 lb/A																
WOLVERINE ADVANCED	27.4 fl oz/A	3.3	0.0	33.3	91.0	90.0	90.0	95.0	100.0	90.0	93.3	88.3	95.0	100.0		101.8	60.9
Mean		16.8	2.4	22.1	72.8	90.0	71.9	82.0	90.9	71.7	82.3	72.1	82.6	90.9		93.1	61.0
CV		20.9	176.3	20.0	14.5	5.8	4.3	4.1	0.0	4.3	4.0	7.0	3.9	0.0		6.7	0.9
LSD		6.0	ns	7.5	18.0	8.9	5.3	5.7	ns	5.2	5.6	8.6	5.6	ns		10.6	ns
Pr>F		0.0001	0.2897	0.0001	0.0001	0.0001	0.0001	0.0001	1.0000	0.0001	0.0001	0.0001	0.0001	1.0000		0.0001	0.3564

YLD: yield, TWT: test weight, ns: nonsignificant.

[1]adjusted to 13% moisture.

Title: Evaluation of Talinor for Crop Safety and Weed Control in Spring Wheat - 2016

Objective: To evaluate the crop safety and efficacy of Talinor and standard herbicide products in spring wheat.

Materials and Methods:

Eight treatments were evaluated for weed control efficacy and crop tolerance in spring wheat. The experimental design was a randomized complete block with three replications. Egan was planted on a 7.5 inch row spacing to a depth of two inches on April 22, 2016. Common lambsquarters, canola, wild oats and wild buckwheat seed were planted in the center of each plot on April 28. Herbicide treatments were applied using a CO_2 backpack sprayer with Teejet XR11002 nozzles in 20 GPA of water. The treatments were applied on May 18 when the wheat was at the two-leaf stage.

Results:

Crop injury was minor and was primarily associated with waterlogged soil condition, the symptoms of which worsened throughout the growing season. The predominant weed species present was volunteer canola. All treatments, except Widematch, provided excellent season-long control of canola. Nevertheless, there were no significant differences in yield or test weight.

Summary:

Excellent weed control was achieved with all herbicide treatments except Widematch. The rate of Talinor and Coact did not affect weed control or yield.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	9/1/2016
Julian Date:	113	Julian Date:	245
Seeding Rate:	120 lb/A	Soil Type:	Creston SiL
Previous Crop:	NT WW	Soil Test:	104-24-652-154
Tillage:	Conventional	Fertilizer:	BC: 235-40-60 DR:3-14-0

Table 2. Effect of varying rates of herbicides on agromonic performance of spring wheat, Kalispell, MT 2016.

		Crop injury				Percent control							
		Percent				BRARA	CHEAL	POLCO	BRARA	CHEAL	POLCO	YLD[1]	TWT[1]
Treatment	Rate	5/28	6/3	6/9	7/1	6/9			8/4			bu/A	lb/bu
Check		0.0	6.7	8.3	16.7	0.0	0.0	0.0	0.0	0.0	0.0	55.0	61.1
Talinor +	2.74 fl oz/a												
Coact +	13.70 fl oz/a	0.0	5.0	6.7	16.7	95.0	95.0	93.3	99.0	99.0	92.0	70.9	61.7
COC	1.00 % v/v												
Talinor +	3.20 fl oz/a												
Coact +	16.00 fl oz/a	6.7	3.3	8.3	16.7	95.0	95.0	93.3	99.0	99.0	98.3	74.2	61.6
COC	1.00 % v/v												
Talinor +	3.60 fl oz/a												
Coact +	18.20 fl oz/a	0.0	3.3	8.3	10.0	95.0	95.0	95.0	99.0	99.0	90.0	70.7	61.4
COC	1.00 % v/v												
Huskie 2.07 EC +	11.00 fl oz/a	0.0	0.0	6.7	10.0	95.0	95.0	95.0	99.0	99.0	89.7	75.5	61.2
NIS	0.25 % v/v												
Widematch 1.5EC	1.00 pt/a	0.0	8.3	8.3	26.7	66.7	86.7	90.0	61.7	79.7	87.7	56.5	61.6
Affinity Tankmix 50 SG +	0.60 oz wt/a	0.0	3.3	8.3	18.3	95.0	95.0	93.3	99.0	99.0	81.7	70.2	61.2
MCPA Ester 3.7 EC	0.75 pt/a												
Orion	17.00 fl oz/a	0.0	3.3	10.0	15.0	95.0	95.0	95.0	99.0	99.0	90.7	72.5	61.2
Mean		0.8	4.2	8.1	16.3	79.6	82.1	81.9	82.0	84.2	78.8	68.2	61.4
CV		489.9	114.1	83.7	89.9	9.3	2.5	1.8	13.0	11.0	13.1	20.4	0.5
LSD		ns	ns	ns	ns	12.9	3.6	2.6	18.7	16.1	18.1	ns	ns
Pr>F		0.4706	0.5713	0.9990	0.8945	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.4936	0.1466

BRARA: canola, CHEAL: common lambsquarters, POLCO: wild buckwheat, YLD: yield, TWT: test weight, ns: nonsignificant.

[1] adjusted to 13% moisture.

Title: Effect of Palisade on Lodging in Spring Wheat - 2016

Objective: To evaluate the effect of Palisade on lodging when applied at different rates and timings in spring wheat.

Materials and Methods:

Palisade was applied at 7 oz/A to Egan spring wheat at the tillering (June 1) and flag leaf (June 10) growth stages either as single or sequential applications (Table 2). Treatments were applied using a CO_2 backpack sprayer with Teejet XR11002 nozzles in 20 GPA of water and were replicated three times in a randomized complete block design.

Results:

No significant differences were observed for height, lodging, test weight, yield or grain quality.

Summary:

Palisade as single or sequential applications at tillering and/or flag leaf stage had no effect on plant height, test weight, lodging or yield.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	8/31/2016
Julian Date:	113	Julian Date:	244
Seeding Rate:	120 lb/A	Soil Type:	Creston SiL
Previous Crop:	winter wheat	Soil Test:	104-24-652-154
Tillage:	Conventional	Fertilizer:	BC: 235-40-60 DR:3-14-0
Herbicide:	Huskie 11 oz/A + Axial 16.4 oz/A + NIS 1 qt/100 gal + UAN 28% 1 qt/A		

Table 2. Effect of rate and timing of Palisade on agonomic performance of spring wheat, Kalispell, MT - 2016.

			Height (inches)		LOD	YLD[1]	PRO[2]	TWT[1]	FN
	Rate	Timing	7/1	8/9	%	bu/A	%	lb/bu	sec
Check			40.9	40.9	7.7	103.3	14.9	60.6	436
Palisade 2EC	7 fl oz/a	Tillering	40.2	40.8	0.7	104.4	14.6	60.7	450
Palisade 2EC	2 fl oz/a	Tillering +							
Palisade 2EC	5 fl oz/a	Flag leaf	40.3	41.3	1.0	101.2	14.7	60.7	434
Palisade 2EC	5 fl oz/a	Tillering +							
Palisade 2EC	2 fl oz/A	Flag leaf	39.4	41.2	4.0	103.1	14.9	60.7	436
Palisade 2EC	7 fl oz/a	Flag leaf	40.3	40.8	8.3	104.2	14.9	60.6	444
Mean			40.2	41.0	4.3	103.3	14.81	60.7	440
CV			3.4	1.6	157.1	5.2	3.22	0.3	4.7
LSD			ns	ns	ns	ns	ns	ns	ns
Pr>F			0.7273	0.8082	0.5379	0.9478	0.9096	0.7925	0.8547

LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, FN: falling number, ns: nonsignificant.

[1]adjusted to 13% moisture.

[2]adjusted to 12% moisture.

Title: The Effect of Fungicide Application Timing on Stripe Rust Control in Winter Wheat - 2016

Objective: To evaluate the impact of application timing on the efficacy of new and standard fungicide products.

Materials and Methods:

Five fungicide products were applied to coincide with spring herbicide timing or at flag leaf stage to evaluate the effect of application timing on the control of stripe rust. The experimental design was a randomized complete block with three replications. Decade winter wheat was planted on a 7.5 inch row spacing to a depth of two inches on October 1, 2015. Fungicide treatments were applied the following spring using a CO_2 backpack sprayer with Teejet XR11002 nozzles in 20 GPA of water. The herbicide timing treatments were applied on April 15 when the wheat was at the two-tiller stage and seven inches tall. The flag leaf treatments were applied on May 13 when the crop was 22 inches in height.

Results:

Stripe rust infection was observed early in the spring, with symptoms becoming more severe as the season progressed. Initially at the May 18 rating stripe rust infection was less where fungicide treatments had been applied at herbicide timing. However, the flag leaf treatments proved to be more beneficial in suppressing stripe rust as the season progressed. On average, herbicide timing treatments had an infection level of 69% and yielded 57 bu/A compared to an infection level of 40% and 84 bu/A for the flag leaf treatments.

Summary:

Of the early application treatments, Quilt Xcel was the only product to produce yields significantly greater than the check. Nevertheless, the greatest efficacy and highest yields were associated with the flag leaf application timing. Trivapro afforded the greatest control of stripe rust. However, tebuconazole produced yields equivalent to the newer fungicides.

Table 1. Materials and Methods.

Julian Date:	275	Julian Date:	228
Seeding Rate:	100 lb/A	Soil Type:	Creston SiL
Previous Crop:	Spring wheat	Soil Test:	209-32-244-34
Tillage:	Conventional	Fertilizer:	BC: 9-40-40, TD: 75-0-40
Herbicide:	Huskie 11 oz/A + Axial 16.4 oz/A + NIS 1 qt/100gal + UAN 28% 1 qt/A		

Table 2. Effect of fungicide application timing on agronomic performance of winter wheat, Kalispell, MT - 2016.

		Percent Stripe Rust					HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN
Treatment	Rate	5/2	5/18	5/28	6/3	7/1	in	%	bu/A	%	lb/bu	g	sec
Check		2.0	21.7	50.0	78.3	60	45.5	0	45.2	12.20	48.6	23.4	417.0
						Herbicide timing							
Alto	4 fl oz/A	0.3	7.7	10.7	34.3	62.7	47.1	33.3	59.3	12.87	50.1	27.7	410.0
Quilt Xcel	7 fl oz/A	0.3	4.3	11.0	48.3	71.7	48.3	15.0	65.6	12.71	49.9	27.4	417.8
Trivapro	9.4 fl oz/A	0.3	5.0	11.3	56.0	62.7	47.5	2.7	50.5	12.80	48.3	24.8	417.8
Priaxor	2 fl oz/A	0.0	6.3	28.3	62.3	67.3	47.9	10.0	56.0	12.51	47.7	24.2	420.0
Tebuconazole	2 fl oz/A	0.0	5.0	15.7	55.7	78.7	48.8	18.0	54.2	12.37	48.6	25.2	416.2
Mean		**0.2**	**5.7**	**15.4**	**51.3**	**68.6**	**47.9**	**15.8**	**57.1**	**12.65**	**48.9**	**25.9**	**416.4**
						Flagleaf							
Alto	4 fl oz/A	1.3	14.3	8.7	7.0	46.3	49.2	28.3	81.1	12.20	53.6	33.0	404.0
Quilt Xcel	10.5 fl oz/A	1.0	28.7	13.3	10.0	42.7	50.3	32.7	84.9	12.93	54.1	35.0	408.3
Trivapro	13.7 fl oz/A	2.0	26.3	20.0	9.3	23.7	50.0	40.0	89.7	11.71	55.0	36.5	393.6
Priaxor	4 fl oz/A	1.0	38.3	27.0	18.7	39.3	48.9	22.0	77.4	12.53	53.0	32.4	399.6
Tebuconazole	4 fl oz/A	1.0	36.7	33.3	17.3	48.7	47.0	6.0	86.1	12.56	55.5	35.6	398.0
Mean		**1.3**	**28.9**	**20.5**	**12.5**	**40.1**	**49.1**	**25.8**	**83.8**	**12.39**	**54.2**	**34.5**	**400.7**
Grand Mean		0.9	17.7	20.9	36.1	54.9	48.2	18.9	68.2	12.49	51.3	29.6	409.3
CV		126.8	70.0	49.7	38.1	24.1	3.3	139.2	14.7	6.53	3.4	8.6	4.4
LSD		ns	21.1	17.6	23.4	22.6	2.7	ns	17.0	ns	3.0	4.3	ns
Pr>F		0.2736	0.0094	0.0020	0.0001	0.0021	0.0467	0.6394	0.0001	0.8111	0.0001	0.0001	0.6277

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: Effect of Absolute and Prosaro Fungicide on the Control of Stripe Rust on Winter Wheat - 2016

Objective: To evaluate the effects of fungicides on stripe rust control in winter wheat.

Materials and Methods:

Five fungicide treatments were applied to evaluate the effectiveness of stripe rust control in winter wheat. Decade winter wheat was planted two inches deep, on 7.5 inch row spacings, on October 2, 2015. Treatments were then imposed the following spring, using a randomized complete block with three replications. Absolute and Prosaro were each applied at two rates along with the standard treatment of tebuconazole. Fungicide applications were made at flag leaf stage on May 13 and included the adjuvant Induce 90 SL at 0.125% v/v. Treatments were applied using a CO_2 backpack sprayer with Teejet XR11002 nozzles in 20 GPA of water.

Results:

All fungicide treatments reduce stripe rust infection relative to the untreated check, but control was similar among the fungicide treatments. No significant differences were observed between fungicide treatments for height, yield, test weight or thousand kernel weight. However fungicide treatments resulted in higher values compared to the untreated check. Falling number, protein and lodging for all treatments were not significantly different from the check. The one exception was Prosaro applied at the high rate, which decreased percent protein compared to the check.

Summary:

Good control of stripe rust occurred from all of the fungicide treatments. Fungicide treatment had no effect on grain protein, lodging or falling numbers. Height, yield, test weight and thousand kernel weight increased relative to the check, but were not significantly different between treatments.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	8/18/2016
Julian Date:	113	Julian Date:	231
Seeding Rate:	120 lb/A	Soil Type:	Creston SiL
Previous Crop:	Spring Wheat	Soil Test:	99-32-432-40
Tillage:	Conventional	Fertilizer:	BC: 235-40-60 DR: 3-14-0
Herbicide:	Huskie 11 oz/A + Axial 16.4 oz/A + NIS 1 qt/100gal + UAN 28% 1 qt/A		

Table 2. Effect of fungicides on stripe control in winter wheat, Kalispell, MT - 2016.

Trt		Percent Stripe Rust			HT	LOD	YLD[1]	PRO[2]	TWT[1]	TKW[1]	FN
Treatment	Rate	5/28	7/1	7/13	in.	%	bu/a	%	lb/bu	g	sec
Check		53.3	57.7	73.0	43.3	10.0	64.1	13.24	52.8	31.7	363.8
Absolute 500SC	4 fl oz/a	13.3	19.3	27.3	46.9	30.0	102.2	13.25	57.9	40.2	354.9
Absolute 500SC	5 fl oz/a	15.0	18.3	30.0	47.0	45.0	96.1	13.22	57.7	39.3	365.4
Prosaro 421 SC	5 fl oz/a	23.3	22.0	30.0	46.1	20.0	93.3	12.85	58.8	40.6	357.4
Prosaro 421 SC	6.5 fl oz/a	28.3	21.0	23.3	46.7	24.0	95.1	12.73	58.1	40.7	364.6
Tebuconozole	4 fl oz/a	21.7	21.7	23.3	45.9	41.7	90.3	13.07	58.4	38.2	361.3
Mean		25.8	26.7	34.5	46.0	28.4	90.2	13.06	57.3	38.4	361.2
CV		26.2	34.7	31.5	2.2	100.3	10.9	1.63	2.6	7.0	2.9
LSD		12.3	16.8	19.8	1.8	ns	17.9	0.39	2.7	4.9	ns
Pr>F		0.0003	0.0027	0.0016	0.0092	0.6681	0.0105	0.0515	0.0060	0.0162	0.7715

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: Statewide Winter Wheat Variety Trial - 2016

Objective: To evaluate experimental winter wheat cultivars for resistance to stripe rust and agronomic performance in environments and cropping systems representative of northwestern Montana.

Results:

Stripe rust symptoms developed early in the season, with the initial ratings being recorded on May 24. The average infection level was 4.8%, and no significant differences in infection were detected among wheat lines. Stripe rust infection increased during the growing season, and by June 30 stripe rust infection averaged 35.2% and ranged from 11.5% for MT1694 to 95.0% for Decade. Yellowstone had previously shown excellent resistance to stripe rust. Initially, infection levels were low, but by seasons end Yellowstone had a rating of 91.5%, indicating that a new race of stripe rust may be present.

Winter wheat yields averaged 134.3 bu/A, and ranged from 19.3 bu/A for Decade to 168.1 bu/A for MT16101 (Table 2). Yellowstone yielded 132.7 bu/A, but seven experimental lines produced significantly higher yields. Days to fifty percent heading averaged 149 days (May 28) and ranged from 144 days (May 23) for MT1695 to 152 days (May31) for MT1694. Height averaged 42.1 inches and ranged from 37.4 inches for MT1697 to 46.5 inches for MT1693. No significant differences were observed in percent lodging. Protein averaged 12.33% and ranged from 11.24% for MT1694 to 15.18% for Decade. Test weight averaged 58.3 lb/bu and ranged from 49.8 lb/bu for Decade to 61.6 lb/bu for MT1695.

Summary:

Several of the MSU entries have excellent resistance to stripe rust and are higher yielding than local standard winter wheat varieties.

Table 1. Materials and Methods.

Seeding Date:	10/1/2015	Harvest Date:	8/15/2016
Julian Date:	274	Julian Date:	228
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Spring Wheat	Soil Test:	209-32-244-34
Tillage:	Conventional	Fertilizer:	9-40-40, TD: 75-0-40
Herbicide:	Huskie 11oz/A + Axial 16.4 oz/A + NIS 1qt/100gal + UAN 28% 1qt/A		

Table 2. Evaluation of Montana State University experimental lines, Kalispell, MT - 2016.

	HD	Percent Stripe Rust			HT	LOD	YLD[1]	PRO[2]	TWT[1]
Entry	Julian	5/24	6/9	6/30	in.	%	bu/A	%	lb/bu
MT16101	148	2.5	6.0	14.5	43.1	30.0	168.1	12.52	60.6
MT1694	152	25.0	6.5	11.5	44.7	0.0	167.6	11.24	60.3
MT1696	151	4.5	9.5	14.0	45.9	5.0	165.6	11.36	60.4
MT1695	144	0.0	16.0	55.0	42.5	2.5	164.7	11.45	61.6
MT16106	151	1.5	16.0	19.5	43.1	5.0	163.0	11.81	59.1
MT1693	151	1.5	7.0	16.5	46.5	0.0	160.5	11.42	60.3
MT16105	149	0.0	10.0	37.5	42.5	5.0	158.5	11.54	60.3
MT16102	148	15.0	23.5	28.5	43.1	2.5	152.8	11.55	60.2
MT1687	147	11.5	19.5	25.0	43.7	16.0	152.1	13.19	60.7
MT16104	150	0.0	29.5	45.0	43.3	2.5	148.0	11.85	59.7
MT1688	148	2.5	9.0	20.0	43.1	9.0	147.8	13.07	60.3
MT16103	147	2.5	27.5	30.0	40.2	7.5	145.7	12.10	60.2
MT1699	147	1.0	17.5	40.0	38.0	0.0	143.8	12.57	59.4
MT1690	143	2.5	14.0	25.0	43.1	33.0	142.8	14.05	59.3
MT16100	150	3.5	22.0	44.0	39.6	0.0	142.3	12.22	57.0
MT1697	148	25.0	18.0	35.0	37.4	0.0	139.1	12.22	59.3
MT1698	149	1.5	20.0	24.0	38.2	0.0	137.0	12.49	57.3
Judee	151	2.0	32.0	16.5	42.7	29.0	134.3	11.87	60.4
Yellowstone	151	7.0	47.5	91.5	44.1	15.5	132.7	11.74	55.7
MT1691	150	4.0	17.5	15.0	41.1	9.0	131.4	12.22	57.0
MT1692	150	2.0	25.0	24.0	42.5	42.5	126.1	12.80	57.3
MT1689	150	2.5	22.5	26.0	38.6	0.0	111.3	13.49	55.9
SY Wolf	147	0.0	37.5	42.5	42.3	11.5	107.3	13.09	53.4
Promontory	151	1.0	16.0	85.0	45.3	0.0	78.4	11.30	51.9
Decade	151	1.5	95.0	95.0	38.8	32.5	19.3	15.18	49.8
Mean	149	4.8	22.6	35.2	42.1	10.3	134.3	12.33	58.3
CV	0.9	200.8	26.2	21.8	2.5	127.9	8.6	2.48	2.1
LSD	2.6	ns	12.2	15.9	2.2	ns	23.9	0.63	2.5
Pr>F	0.0001	0.4462	0.0001	0.0001	0.0001	0.0613	0.0001	0.0001	0.0001

HD: heading, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, ns: nonsignificant.

[1] adjusted to 13% moisture.

[2] adjusted to 12% moisture.

Title: Statewide Winter Wheat Variety Evaluation - 2016

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 97.3 bu/A, and ranged from to 16.4 bu/A for Bearpaw to 148.9 bu/A for MT1471 (Table 2). No fungicide applications were made and stripe rust was prevalent throughout the nursery. This in turn, had a negative effect on yield (Figure 1). The average infection level was 69.5 %, and ranged from 21.7 % for MT1488 to 99.3 % for WB4059CLP. Days to fifty percent heading averaged 149 days (May 28) and ranged from 139 days (May 18) for Freeman to 153 days (June 1) for WB-Quake and BZ9W09-2212. Height averaged 41.0 inches and ranged from 32.6 inches for WB4059CLP to 46.5 inches for WB3768. Lodging averaged 8.0 % and ranged from 0.0 % to 70.0 % for MT1348. Percent protein averaged 12.33 % and ranged from 10.93 % for WB3768 to 15.44 % Bearpaw. Test weights also were affected by stripe rust (Figure 2). Test weight averaged 53.7 lb/bu and ranged from a low of 38.7 lb/bu for Byrd to a high of 59.7 lb/bu for MT1488 and Warhorse. Falling numbers were fairly high for this nursery and averaged 336 seconds. The range in falling numbers was only 93 seconds and varied from a high of 390 for WB4623CLP to low of 297 for T158. The latter was the only entry which failed to meet the 300 second discount level.

Summary:

The 2016 growing conditions provided significant disease pressure resulting in noticeable yield reductions.

Table 1. Materials and Methods.

Seeding Date:	10/1/2015	Harvest Date:	8/16/2016
Julian Date:	274	Julian Date:	229
Seeding Rate:	80 lb/A	Soil Type:	Creston SiL
Previous Crop:	Spring Wheat	Soil Test:	209-32-244-34
Tillage:	Conventional	Fertilizer:	9-40-40, TD: 75-0-40
Herbicide:	Huskie 11oz/A + Axial 16.4 oz/A + NIS 1qt/100gal + UAN 28% 1qt/A		

Table 2. Agronomic data from the Intrastate Winter Wheat nursery, Kalispell - 2016.

Cultivar	HD Julian	Percent Stripe Rust 5/24	Percent Stripe Rust 6/30	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	FN sec
MT1471	151	1.7	35.0	43.4	0.0	148.9	12.66	59.4	352
WB4623CLP	151	1.3	29.0	42.0	14.0	145.0	13.79	59.1	339
Colter	151	6.7	38.3	43.0	0.0	141.9	11.93	58.7	349
MTW1491	151	3.3	51.0	44.0	22.7	138.8	11.08	59.5	322
MT1444	151	8.7	70.3	43.6	0.0	136.1	11.18	57.6	332
MT1488	152	9.0	21.0	40.9	35.7	135.1	12.36	59.7	340
MT1465	150	2.0	37.7	39.7	0.0	135.0	11.86	58.7	375
Northern	152	11.3	51.7	42.9	15.0	133.6	11.84	56.7	341
MT1138	152	3.3	71.7	43.8	0.0	132.3	11.28	56.7	336
MT1348	149	2.7	57.3	42.9	70.0	132.2	11.60	57.7	345
MT1354	152	9.7	78.7	44.1	0.0	132.0	11.28	57.9	363
SY Sunrise	144	3.3	36.7	37.3	0.0	130.6	12.06	57.4	335
MT1265	152	6.3	66.7	44.9	13.3	130.0	11.00	57.1	340
Loma	151	22.7	34.3	40.2	43.7	128.0	11.88	57.2	319
MT1332	152	2.7	76.0	44.8	12.3	127.8	11.55	57.1	361
SY Monument	148	2.0	33.3	41.2	0.0	127.0	12.39	54.9	301
Warhorse	151	6.0	37.7	41.6	14.0	126.7	13.05	59.7	390
WB3768	151	6.3	83.3	46.5	11.7	126.7	10.93	57.5	321
MTCL1131	151	13.0	87.3	45.3	0.0	121.5	11.00	56.2	339
MT1446	148	3.3	62.7	42.8	11.0	121.1	11.28	57.0	353
MT1356	152	6.3	70.7	43.3	3.3	120.9	11.10	56.7	333
Judee	149	6.0	25.7	41.2	11.7	118.8	12.25	58.0	320
WB-Quake	153	15.0	66.7	41.1	6.0	117.4	11.47	58.9	330
SY Clearstone 2CL	150	10.3	86.3	43.7	0.0	117.2	11.44	55.3	344
T158	141	4.0	48.3	39.1	12.3	115.6	12.70	56.0	297
MT1257	150	17.7	84.7	43.3	0.0	112.3	11.60	56.4	364
MT1460	151	6.7	76.3	42.9	0.0	110.5	11.50	57.2	344
MT1443	151	27.3	82.3	40.7	0.0	106.8	11.10	56.5	357
Keldin	149	5.3	84.3	39.1	0.0	101.1	11.30	55.8	329
SY Wolf	145	13.7	50.3	41.0	0.0	98.6	12.65	52.4	307
MT1478	149	18.0	90.7	43.2	0.0	96.6	11.32	54.4	335
Yellowstone	150	7.3	86.7	42.7	0.7	94.9	11.06	56.0	337
BZ9W09-2212	153	67.3	66.7	37.7	7.3	88.9	12.34	56.6	325
MTS1407	151	19.0	69.3	36.9	0.0	88.1	12.65	52.8	308
Freeman	139	5.3	67.7	42.3	20.0	80.1	12.19	48.8	336

HD: heading, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, FN: falling number.

[1] adjusted to 13% moisture.

[2] adjusted to 12% moisture.

Table 2. (continued).

Cultivar	HD Julian	Percent Stripe Rust 5/24	Percent Stripe Rust 6/30	HT in	LOD %	YLD[1] bu/A	PRO[2] %	TWT[1] lb/bu	FN sec
PSB13NEDH-14-71	143	39.7	92.7	38.2	0.0	77.9	12.54	51.3	305
Rampart	151	23.7	81.7	45.0	32.7	70.4	12.90	52.4	349
WB4614	150	30.3	82.3	37.4	1.0	64.2	13.68	51.0	335
Brawl CLP	143	40.7	84.3	40.8	0.0	54.4	13.93	43.3	329
Cowboy	149	67.0	93.7	38.9	0.0	45.5	11.69	47.3	327
CDC Falcon	150	62.7	97.0	36.9	2.7	43.5	12.69	51.0	343
CO11D174 (Avery)	147	62.7	93.7	41.3	0.0	38.0	13.16	42.6	324
WB4059CLP	144	64.7	99.3	32.6	0.0	34.6	14.37	43.4	309
Broadview	151	35.3	88.3	35.9	7.7	27.2	14.46	49.8	327
BZ9W09-2075	151	69.7	95.7	34.9	1.7	21.8	13.93	46.1	366
Byrd	145	42.0	95.3	38.5	0.0	20.6	13.90	38.7	316
Decade	150	41.0	92.3	37.9	20.0	18.5	14.29	42.9	355
Jerry	151	61.3	96.7	42.7	3.3	18.2	14.60	44.1	313
Bearpaw	148	46.0	95.7	37.3	0.0	16.4	15.44	39.6	345
Mean	149	21.3	69.5	41.0	8.0	97.3	12.33	53.7	336.0
CV	1.0	39.5	13.9	3.3	127.5	6.5	2.81	2.2	4.6
LSD	2.3	13.6	15.7	2.2	16.6	10.2	0.56	1.9	25.3
Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

HD: heading, HT: height, LOD: lodging, YLD: yield, PRO: protein, TWT: test weight, FN: falling number.

[1] adjusted to 13% moisture.

[2] adjusted to 12% moisture.

Figure 1.

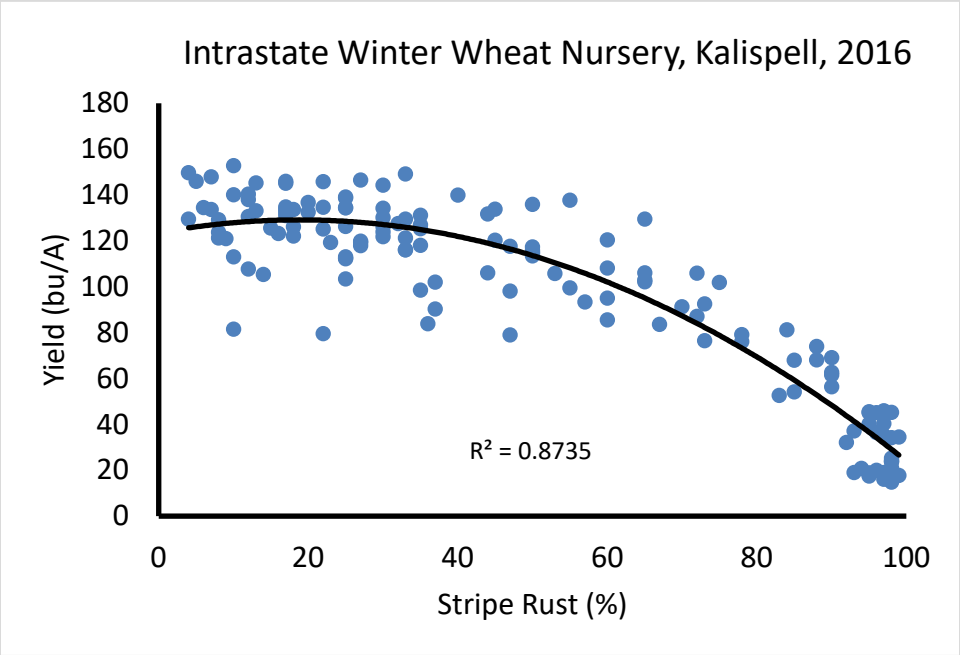
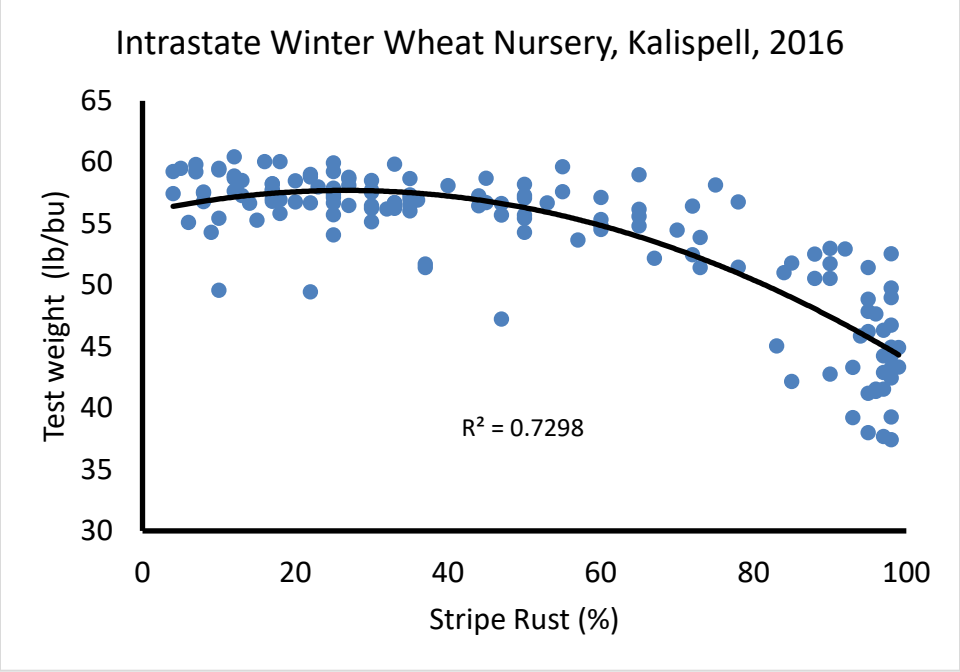


Figure 2.



OILSEEDS

Project Title: Canola Planting Date and Population Study – 2016.

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 13, May 3, and May 16. 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. 347 GDD separated the first and second seeding date and 285 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 116-22-250-46 pounds of available nutrients and a fertilizer blend of 125-30-30-20 was broadcast and incorporated one day prior to each seeding date. Each seeding date was treated with glyphosate, Warrior II, and Endura 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 $7.50/bu, multiplied by yield, minus the seed cost at $9.50/ lb.

Table 1. Seeding rates and associated costs.

Variety	TKW	Plant/sqft	Rate (lb/ac)	Seed cost per acrea @ $9.50/lb
DKL 30-03	4.997	4	2.6	24.3
DKL 30-03	4.997	8	5.1	48.6
DKL 30-03	4.997	16	10.2	97.2
DKL 70-07	4.841	4	2.5	23.5
DKL 70-07	4.841	8	5.0	47.1
DKL 70-07	4.841	16	9.9	94.2

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, lodging, height, yield, test weight, and adjusted gross returns (Table 2). DKL 30-03 was the earliest maturing variety, reaching flowering 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 produced an additional 6.4 bu/A compared to DKL 30-03. At the same time, DKL 70-07 was the most profitable, generating an additional $51.30 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, plant height decreased, and percent lodging increased. This year, but not in past years, yield increased with an increase in plant density. The most profitable seeding rate was 8 plants/sqft with an AGR of $414.90/A.

Of the three main effects, seeding date had the least influence on the response variables measured (Table 4). The number of days necessary to achieve fifty percent flowering

decreased with delayed seeding. Additionally, the number of plants per square foot decreased with delayed seeding. The first two seeding dates achieved the greatest percent survival. No significant difference was observed in yield with delayed seeding. This is in contrast to the data from 2014 and 2015 were there was a significant yield reduction with delayed seeding. It is possible that the “cool” air temperatures (72-77°F) during flowering allowed for relatively consistent yields across all three seeding dates.

Summary:

In summary, the highest seed quality, greatest yield and adjusted gross return was afforded with a targeted plant density of 8 plants per square foot (Table 3

Table 2. Main effect of variety on agronomic performance of canola - 2016.

	EMERG	FLWR	STAND 1	STAND 2	LOD	HT	YLD[1]	BIO	OIL[1]	TWT[1]	AGR
	dap	dap	sqft	sqft	%	in	bu/A	g/sqft	%	lb/bu	$/A
DKL 30-03	10	55	12.5	10.9	9.8	47.3	53.7	100.2	49.5	49.3	359.3
DKL 70-07	10	57	12.7	11.1	6.0	49.7	60.1	104.8	49.5	49.8	410.6
LSD	ns	0.4	ns	ns	2.5	0.9	4.0	ns	ns	0.2	31.05
Pr>0.05	0.7354	0.0001	0.6667	0.7101	0.0052	0.0001	0.0037	0.5145	0.6909	0.0001	0.0028

Table 3. Main effect of plant density on agronomic performance of canola - 2016.

	EMERG	FLWR	STAND 1	STAND 2	LOD	HT	YLD[1]	BIO	OIL[1]	TWT[1]	AGR
	dap	dap	sqft	sqft	%	in	bu/A	g/sqft	%	lb/bu	$/A
4 plants/ sqft	10	56	5.8	5.6	3.3	50.4	50.3	104.7	49.6	49.4	365.5
8 plants/sqft	10	56	11.5	10.4	7.4	48.7	59.7	103.4	49.6	49.5	414.9
16 plants/sqft	10	55	20.5	16.9	13.1	46.6	60.7	99.5	49.3	49.8	374.4
LSD	ns	ns	2.1	2.5	4.9	1.8	3.6	ns	ns	0.2	27.64
Pr>0.05	0.6912	0.3236	0.0001	0.0001	0.0036	0.0023	0.0001	0.8728	0.2081	0.003	0.0048

Table 4. Main effect of seeding date on agronomic performance of canola - 2016.

	EMERG	FLWR	STAND 1	STAND 2	LOD	HT	YLD[1]	BIO	OIL[1]	TWT[1]	AGR
	dap	dap	sqft	sqft	%	in	bu/A	g/sqft	%	lb/bu	$/A
4/13	12	60	13.9	11.4	8.7	46.5	53.4	94.7	49.4	49.4	358.3
5/3	7	56	14.0	12.3	11.9	47.2	57.3	123.7	49.8	49.6	388.4
5/16	10	50	9.8	8.6	3.2	51.9	59.9	89.2	49.2	49.8	408.1
LSD	0.5	0.4	2.1	ns	ns	4.0	ns	ns	ns	ns	ns
Pr>0.05	0.0001	0.0001	0.0078	0.1020	0.1584	0.0365	0.5155	0.0995	0.1889	0.2043	0.5155

FLWR: 50% flowering, dap: days after planting, 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.

Title: Evaluation of Green & Grow Seed Treatment Rates on Canola – 2016

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

Results:

"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". Agriplier treatments were applied to HyClass 930 and seeded as a randomized complete block with four replications. Seeding rate was calculated using the following equation:

(10 plants/sqft X 9.6 X thousand kernel weight)/80% survival rate.

Treatments were evaluated for plant stand, flowering date, height, lodging, shattering, yield, oil content and test weight. No significant differences were observed for any of the response variables (table 2).

Table 1. Materials and Methods.

Seeding Date:	5/3/2016	Harvest Date:	9/14/2016
Julian Date:	134	Julian Date:	258
Seeding Rate:	10 plnt/sqft 6" rows	Soil Type:	Creston SiL
Previous Crop:	Barley	Soil Test:	116-22-250-46
Tillage:	Conventional	Fertilizer:	125-30-30-20
Herbicide:	PPI: Trust 2 pt/A	Insecticide:	Warrior II 1.92floz/A
Herbicide:	Stinger 1/3pt/A	Fungicide:	Endura 6 oz/A

Table 2. Agronomic data from the statewide Green and Grow seed Treatment Trial, Kalispell, MT - 2016.

Treatment	PLNT sqft	FLWR Julian	HT in	LOD %	SHTTR %	YLD[1] bu/A	OIL[1] %	TWT[1] lb/bu
G & G 200	13.3	178	46.7	33.8	1.3	34.6	52.2	48.7
G & G 201	12.5	179	46.1	35.0	1.3	35.0	52.2	48.9
G & G 202	13.9	178	46.5	37.5	1.3	38.0	52.3	48.7
Mean	13.2	178	46.4	35.4	1.3	35.9	52.3	48.8
CV	21.1	0.5	2.8	13.5	0	8.3	0.7	0.8
LSD	ns	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.7796	0.2160	0.7974	0.5615	1.0	0.2914	0.9137	0.8104

PLNT: plant, FLWR: 50% flowering, HT: height, LOD: lodging, SHTTR: shatter, YLD: yield, TWT: test weight.

[1] adjusted to 8% moisture.

Title: Statewide Canola Variety Evaluation, Kalispell – 2016

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

Results:

Twenty-five cultivars were evaluated using a randomized complete block with four replications. Seeding rate was determined using the following equation:

(10 plants/sqft X 9.6 X thousand kernel weight)/ 80% survival.

Significant differences were observed in flowering date, plant height, percent lodging, yield, percent oil, and test weight. Flowering date averaged 180 days (June 28) and spanned a 4 day period that ranged from 177 to 181 days. Plant height averaged 52.1 inches and ranged from 45.7 inches for Arriba to 57.8 inches for InVigor 5440. Lodging averaged 25.2% ranging from 2.8% for C1516 to 55.0% for Arriba. Yields averaged 41.5 bu/A and ranged from 25.0 bu/A for Arriba to 56.6 bu/A for HyClass 972. Oil content averaged 49.3%, ranging from 46.1% for NCH13G046 to 50.9% for HyClass 970. Test weights averaged 49.4 lb/bu and ranged from 47.7 lb/bu for C5522 to 51.1 lb/bu for NCH13G046.

Summary:

HyClass 972 was the highest yielding variety and had an oil content of 49.6 percent. Based on the LSD value for yield, 3 varieties (InVigor L130, InVigor L140P, and G49720) were statistically equivalent to the highest yielding variety, HyClass 972.

Table 1. Materials and Methods.

Seeding Date:	5/3/2016	Harvest Date:	9/14/2016
Julian Date:	124	Julian Date:	258
Seeding Rate:	10 plnt/sqft 6" rows	Soil Type:	Creston SiL
Previous Crop:	Barley	Soil Test:	116-22-250-46
Tillage:	Conventional	Fertilizer:	125-30-30-20
Herbicide:	PPI: Trust 2 pt/A	Insecticide:	Warrior II 1.92floz/A
Herbicide:	Post: Stinger 1/3pt/A	Fungicide:	Endura 6 oz/A

Table 2. Agronomic data from the statewide canola variety trial, Kalispell, MT - 2016.

Cultivar	Herbicide system	PLNT sqft	FLWR Julian	HT in	LOD %	SHTTR %	YLD[1] bu/A	OIL[1] %	TWT[1] lb/bu
HyClass 972	RR	14.9	180	53.3	5.8	1.0	56.6	49.6	50.2
InVigor L130	LL	10.5	180	55.3	7.8	1.0	52.6	49.1	49.6
InVigor L140P	LL	14.1	180	50.7	25.5	1.0	51.2	49.1	48.9
G49720	RR	16.3	180	50.1	30.5	1.0	49.8	48.7	49.6
InVigor 5440	LL	17.3	180	57.8	10.0	1.0	47.1	49.1	50.0
G35153	RR	10.6	179	49.4	37.5	1.0	46.5	49.2	49.4
HyClass 970	RR	14.3	180	51.7	17.0	1.0	45.6	50.9	49.0
C1511	SU	12.7	180	51.9	14.3	1.0	45.0	48.5	49.0
C1516	SU	13.3	181	55.7	2.8	1.3	44.1	47.9	50.6
C5507	SU	16.7	180	54.2	20.0	1.0	43.9	50.0	48.0
DKL70-10	RR	15.3	180	51.6	31.3	1.0	43.6	49.9	49.0
HyClass 930	RR	15.2	179	49.3	36.3	1.0	43.5	50.5	48.9
HyClass 955	RR	16.7	179	47.4	31.3	1.0	43.3	49.8	49.3
C5522	SU	15.1	180	55.6	12.5	1.0	42.9	50.7	47.7
BY16-768	RR	13.9	180	54.6	8.8	1.0	41.7	50.1	48.1
6080 RR	RR	15.2	180	54.4	13.8	1.0	40.3	49.9	49.0
6074 RR	RR	15.7	180	54.5	12.5	1.5	38.9	50.1	49.9
G49773	RR	14.8	180	51.1	47.5	1.0	37.1	50.1	49.4
GT50	RR	19.3	180	49.7	16.8	1.0	35.7	48.0	50.3
Empire	none	15.5	179	50.2	41.3	1.0	35.5	48.1	50.1
NCH13G046	RR	13.8	180	49.9	52.5	1.0	34.6	46.1	51.1
DKL30-20	RR	15.9	177	52.0	41.3	2.3	31.3	50.7	49.4
Cara	none	13.4	180	51.5	40.0	1.0	31.0	48.1	49.5
C5513	SU	16.1	181	56.0	18.8	1.0	30.3	49.9	49.8
Arriba	none	15.7	179	45.7	55.0	1.0	25.0	48.0	49.7
Mean		14.9	180	52.1	25.2	1.1	41.5	49.3	49.4
CV		25.2	0.2	6.5	52.9	40.3	15.8	2.6	0.9
LSD		ns	0.6	4.8	16.6	ns	9.3	1.8	0.6
Pr>F		0.4287	0.0001	0.0002	0.0001	0.0923	0.0001	0.0001	0.0001

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

[1] adjusted to 8% moisture.

RR: roundup ready, LL: liberty link, SU: sulfonylurea.

PULSES

Project Title: Statewide Lentil Variety Trial - 2016

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

Results:

Significant difference was observed for lentil yield. Average yield was 48.3 bu/A (Table 2) and ranged from 36.9 bu/A for CDC Imigreen to 55.3 bu/A for Eagle. Test weights averaged 63.3 lb/bu. Thousand kernel weights were significant with an average of 38.3 grams. Statistical differences were observed for height at pod fill, with an average of 14.8 inches. No significant differences were observed for heights at flowering or at physiological maturity.

Summary:

The nursery was planted under rainfed condition with adequate moisture. This trial faced weed interference despite the use of Dimetric.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	7/29/2016
Julian Date:	113	Julian Date:	211
Seeding Rate:	12 plants/sqft	Soil Test:	116-11-125
Previous Crop:	Barley	Fertilizer:	6-30-30
Tillage:	Conventional	Herbicide:	Dimetric (metribuzin) 1/3 lb/A
Irrigation:	None	Insecticide:	Warrior II 1.92 fl oz/A
Soil Type:	Creston Silt Loam		

Table 2. Lentil agronomic data.

Cultivar	FLWR Julian	HT FLWR in	HT PF in	HT PM in	YLD lb/A	YLD bu/A	TWT lb/bu	TKW g
Eagle	193	19.0	15.3	24.3	3318.7	55.3	63.5	35.1
CDC Redcoats	193	14.8	15.5	23.5	3153.2	52.6	64.0	38.1
CDC Impala CL	193	16.0	15.3	23.0	3044.9	50.8	65.2	28.5
CDC Viceroy	193	18.0	15.5	25.3	3020.0	50.3	64.3	30.9
Avondale	193	14.0	13.5	22.0	2991.7	49.9	62.3	43.1
Imvincible	193	18.5	17.3	22.5	2740.1	45.7	64.5	31.3
CDC Richlea	193	13.5	12.8	24.3	2674.8	44.6	61.3	46.0
CDC Imigreen	193	16.8	13.5	26.0	2215.3	36.9	61.0	53.7
Mean	193	16.3	14.8	23.8	2894.8	48.3	63.3	38.3
CV	0	17.1	12.0	13.2	10.8	10.8	0.4	3.5
LSD	ns	ns	2.6	ns	459.8	7.7	0.4	2.0
Pr>F	1	0.0706	0.0369	0.6338	0.0022	0.0023	0.0001	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 - 2016

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

Results:

A significant difference was observed for yellow pea yield. Mean yield was 89.8 bu/A, and ranged from 58.1 bu/A for PSO826MT492 to 114.1 bu/A for Nette 2010 (Table 2). Statistical difference was observed for flowering, with an average occurrence at 175 Julian days (June 23). Significant differences in height averaged 24.6 inches at 50% flowering, 36.1 inches at pod fill, and 38.4 inches at physiological maturity. Statistical differences were observed for test weights with an average of 64.1 lb/bu. Thousand kernel weights were significant with an average of 241.0 grams and ranged from 215.6 grams for AC Earlystar to 275.5 grams for Navarro. Protein averaged 21.71 percent with Salamanca being highest at 23.40 percent.

No significant difference was observed for green pea yield, which averaged 78.1 bu/A (Table 3). Days to flowering was significant with an average of 175 Julian days (June 23). Average heights were 22.5 inches at flowering, 35.4 inches at pod fill, and 37.1 inches at physiological maturity. Test weights averaged 63.4 lb/bu. Thousand kernel weights averaged 222.8 grams and ranged from 201.1 grams for PSO826MT492 to 235.2 grams for Majoret. Protein averaged 21.74 percent with PSO826MT492 and Majoret having the highest at 23.20 percent.

Summary:

Pea yields on average were much higher from last year by more than 50 bu/A for green peas and more than 70 bu/A for yellow peas. The nursery was planted under rainfed condition and received adequate moisture, as opposed to last year's drought.

Table 1. Materials and Methods.

Seeding Date:	4/22/2016	Harvest Date:	7/22/2016
Julian Date:	113	Julian Date:	204
Seeding Rate:	8 plants/sqft	Soil Test:	116-11-125
Previous Crop:	Barley	Fertilizer:	6-30-30
Tillage:	Conventional	Herbicide:	Pursuit 2 oz/A + Basagran 16 oz/A
Irrigation:	None		Basagran 2 pt/A
Soil Type:	Creston Silt Loam	Insecticide:	Warrior II 1.92 fl oz/A

Table 2. Yellow pea agronomic data.

Cultivar	FLWR Julian	HT FLWR in	HT PF in	HT PM in	YLD lb/A	YLD bu/A	TWT lb/bu	TKW g	PRO %
Nette 2010	172	23.5	34.4	37.7	6844.4	114.1	65.8	249.7	20.90
Agassiz	178	25.7	40.3	44.8	6274.1	104.6	62.7	228.7	22.70
Salamanca	178	28.5	39.9	41.7	5953.4	99.2	64.1	254.1	23.40
PSO877MT632	174	21.8	34.0	39.6	5709.0	95.2	63.6	234.4	23.00
DS Admiral	176	27.8	38.5	40.2	5699.4	95.0	64.0	240.9	21.90
CDC Amarillo	179	31.1	44.6	36.8	5622.7	93.7	64.6	220.7	21.80
CDC Treasure	175	28.2	37.7	41.2	5576.1	92.9	64.8	222.8	20.30
Jet Set	177	26.5	34.8	38.6	5570.0	92.8	64.7	247.4	21.20
CDC Saffron	178	28.2	34.0	35.2	5520.2	92.0	65.1	252.4	21.30
AC Earlystar	175	27.2	40.8	42.8	5297.0	88.3	64.1	215.6	19.90
PSO826MT460	172	20.6	32.8	34.7	5285.7	88.1	63.1	250.4	22.10
Universal Yellow	172	21.3	33.9	34.9	5214.1	86.9	63.5	241.9	21.80
Spider	179	28.4	40.3	44.1	5203.7	86.7	63.7	241.0	22.90
Bridger	176	20.8	31.9	34.8	5200.8	86.7	64.7	222.3	21.90
Delta	173	19.9	31.0	34.1	5143.1	85.7	63.9	250.2	22.00
Korando	176	24.2	37.4	39.5	5053.0	84.2	64.1	262.1	22.30
Navarro	174	21.3	34.6	34.7	4363.9	72.8	64.5	275.5	22.30
PSO826MT492	172	18.3	29.9	36.0	3488.4	58.1	63.4	228.8	19.10
Mean	175	24.6	36.1	38.4	5389.9	89.8	64.1	241.0	21.71
CV	0.7	9.3	7.4	11.1	10.8	10.8	1.0	3.0	3.09
LSD	1.7	3.3	3.8	6.1	828.0	13.8	0.9	10.1	0.95
Pr>F	0.0001	0.0001	0.0001	0.0038	0.0001	0.0001	0.0001	0.0001	0.0001

Table 3. Green pea agronomic data.

Cultivar	FLWR Julian	HT FLWR in	HT PF in	HT PM in	YLD lb/A	YLD bu/A	TWT lb/bu	TKW g	PRO %
Greenwood	173	21.4	33.0	33.5	5127.9	85.5	64.5	215.0	19.20
PSO877MT499	179	21.9	31.6	33.6	5083.2	84.7	62.7	225.8	23.20
Hampton	178	26.6	35.6	36.1	5024.0	83.8	64.0	234.9	22.50
Majoret	172	22.7	36.7	43.6	4952.1	82.5	62.6	235.2	23.20
PS0877MT457	176	27.1	44.5	42.9	4763.9	79.4	63.9	218.5	21.60
Cruiser	174	21.3	35.0	35.1	4736.7	78.9	63.4	221.0	21.80
PSO826MT190	177	22.9	35.8	42.5	4540.4	75.7	62.6	201.1	22.00
Aragon	173	18.5	34.7	34.2	4403.7	73.4	63.3	224.2	21.30
PSO877MT076	172	20.1	31.2	32.2	3557.3	59.3	63.7	229.6	20.90
Mean	175	22.5	35.4	37.1	4687.7	78.1	63.4	222.8	21.74
CV	0.6	8.6	8.5	13.1	13.7	13.7	0.8	2.7	2.02
LSD	1.6	2.9	4.5	7.1	ns	ns	0.8	9.0	0.65
Pr>F	0.0001	0.0001	0.0002	0.0096	0.0595	0.0598	0.0002	0.0001	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.

Title: Herbicide Performance in Peas - 2016

Objective: To evaluate the efficacy of Dual II containing products for weed control in peas.

Materials and Methods:

Seven herbicide treatments were evaluated for weed control and crop safety in peas. The experimental design was a randomized complete block with three replications. The herbicide treatments were applied preplant and then double incorporated with a field cultivator on April 12. Hi-line peas were planted on six inch row spacings, to a depth of three inches on April 21, at a rate of 220 lb/A. Foxtail, canola, wild buckwheat and common lambsquarters were seeded in the center of each plot on April 21.

Results:

No crop injury was observed. The most complete weed control was observed with Pursuit plus Prowl. The other treatments failed to provide adequate control of volunteer canola, which was the main weed present. Yield differences were significant at the 10% level of significance.

Summary:

Overall, the products containing Dual II did not perform as well as Pursuit plus Prowl H2O.

Table 1. Materials and Methods.

Seeding Date:	4/21/2016	Harvest Date:	8/17/2016
Julian Date:	112	Julian Date:	230
Seeding Rate:	220 lb/A	Soil Type:	Creston SiL
Previous Crop:	Barley	Soil Test:	116-22-250-46
Tillage:	Conventional	Fertilizer:	BC: 6-30-30

Table 2. Effect of herbicides on weed control in peas, Kalispell, MT - 2016.

		percent weed control				YLD[1]	TWT[1]
Treatment	Rate	BRARA	AMARE	THLAR	CHEAL	bu/ac	lb/bu
Check		0.0	0.0	0.0	0.0	33.9	64.1
Broadaxe XC	19 fl oz/a	23.3	95.0	94.3	96.0	61.1	64.5
Broadaxe XC + Dual II	10 fl oz/a 8 fl oz/a	0.0	95.0	93.3	95.0	42.9	65.4
Broadaxe XC	26 fl oz/a	16.7	93.3	95.0	95.0	52.4	64.7
Broadaxe XC + Dual II	10 fl oz/a 13 fl oz/a	0.0	95.0	93.3	95.0	53.9	64.8
Dual II	16 fl oz/a	0.0	95.0	88.3	95.0	37.6	64.5
Dual II	30 fl oz/a	0.0	85.0	86.7	95.0	37.0	64.7
Pursuit + Prowl H2O	3 fl oz/a 2 pt/a	75.0	96.0	96.0	96.0	87.7	63.5
Mean		14.4	81.8	80.9	83.4	50.8	64.5
CV		107.2	6.0	4.2	1.0	37.2	0.9
LSD		27.0	8.6	6.0	1.4	33.1	1.0
Pr>F		0.0004	0.0001	0.0001	0.0001	0.0584	0.0484

BRARA: canola, AMARE: redroot pigweed, THLAR: field pennycress, CHEAL: common lambsquarters, YLD: yield, TWT: test weight.

[1] adjusted to 13% moisture.

FORAGES

Project Title: Effects of Boron Fertilizer on Alfalfa Yield and Quality — 2016

Objective: To evaluate the effects of boron fertilizer rate and timing on alfalfa yield and quality.

Personnel: J.A. Torrion, E. Glunk, R.N. Stougaard, A. Sapkota, J. Garner

Summary:

Boron treatments were applied at five rates with amounts and timing detailed in Table 1. The experimental design was a randomized complete block with four replications. There was a full soil profile beginning at green up; rainfall received in the fall and early spring was above average. From the first green up to the last cutting (April to October 24, 2016) 14.75 inches of rain was received (October received record precipitation of 5.48 inches). Supplemental irrigation was applied when needed from June to September. Height measurements were taken prior to cutting when plants achieved 10% flowering. Three cuttings were made.

No significant differences were observed for height or yield (Table 3). Average total yields were 5.4 T/A. First harvest had the highest yield at 2.4 T/A.

Significant differences were observed in boron uptake and alfalfa quality (Table 4). Crude protein was highest at second harvest. Significance in boron uptake was observed for all three harvests.

Table 1. Total B applied per treatment and application timing.

Treatment	Total B (lb/A/year)	Application
1	Untreated check	None
2	0.5	0.25 lb/A applied at 3-in regrowth in early spring + 0.25 lb/A at 3-in regrowth after first cutting
3	1.0	0.50 lb/A applied at 3-in regrowth in early spring + 0.50 lb/A at 3-in regrowth after first cutting
4	2.0	1.0 lb/A applied at 3-in regrowth in early spring + 1.0 lb/A at 3-in regrowth after first cutting
5	2.0	2.0 lb/A applied at 3-in regrowth in early spring

Table 2. Materials and methods.

Variety:	Pioneer58V09	Fertilizer:	0-0-62
Seeding Date:	5/15/14	Sulfur Fertilizer:	21-0-0-24S
Julian Date:	135	Boron Fertilizer:	10% Liquid - Agrisolutions
Seeding Rate:	12 lbs/A	1st Boron Application Date:	4/11/16
Previous Crop:	Barley	2nd Boron Application Date:	7/5/16
Tillage:	Conventional	1st Harvest Date:	6/13/16
Irrigation:	Yes	2nd Harvest Date:	8/2/16
Soil Type:	Fine sandy loam	3rd Harvest Date:	10/24/16
Soil Test:	22-18-88		

Table 3. Effects of boron fertilizer on alfalfa yield

	1st Harvest - Jun 13		2nd Harvest -Aug 2		3rd Harvest -Oct 24		Harvest Total
	HT	YLD	HT	YLD	HT	YLD	YLD
Treatment	in	T/A	in	T/A	in	T/A	T/A
0 lbs B	44	2.0	33	1.6	28	1.4	5.1
0.25 lb B begin + mid season	43	2.6	32	1.6	28	1.4	5.6
0.5 lb B begin + mid season	45	2.6	33	1.5	29	1.4	5.4
1 lb B begin + mid season	46	2.5	33	1.6	29	1.5	5.5
2 lbs B begin season	43	2.4	35	1.5	29	1.5	5.4
Mean	44	2.4	33	1.6	28	1.4	5.4
CV	7	20	4	11	4	6	7
LSD	ns	ns	ns	ns	ns	ns	ns
Pr>F	0.4898	0.4502	0.0726	0.9166	0.5289	0.2741	0.4377

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

Table 4. Boron uptake and hay quality

Treatment	CP %	ADF %	NDF %	TDN %	RFV %	B ppm
	1st Harvest - Jun 13					
0 lbs B	24.0	34.7	42.9	61.3	135.8	21.3
0.25 lb B begin + mid season	22.5	38.7	47.5	56.9	115.0	25.8
0.5 lb B begin + mid season	23.1	36.9	46.3	58.9	123.0	30.0
1 lb B begin + mid season	22.7	35.0	44.0	60.9	131.3	29.5
2 lbs B begin season	22.4	37.6	47.5	55.7	117.0	30.0
LSD	ns	ns	ns	ns	ns	3
$Pr>F_{(0.05)-B}$	0.8512	0.5509	0.3537	0.4078	0.4525	0.0003
	2nd Harvest - Aug 2					
0 lbs B	27.8	33.5	42.4	62.6	138.0	25.8
0.25 lb B begin + mid season	27.0	33.0	39.0	63.1	151.5	31.5
0.5 lb B begin + mid season	26.7	32.0	41.3	64.1	144.8	35.5
1 lb B begin + mid season	25.8	34.0	41.6	62.0	140.3	39.0
2 lbs B begin season	24.1	35.0	42.0	61.0	137.0	38.3
LSD	2	ns	ns	ns	ns	7
$Pr>F_{(0.05)-B}$	0.0540	0.1618	0.3698	0.1591	0.3369	0.0051
	3rd Harvest - Oct 24					
0 lbs B	20.5	33.5	42.6	62.6	137.8	34.3
0.25 lb B begin + mid season	20.7	33.3	41.1	62.8	143.0	44.8
0.5 lb B begin + mid season	20.3	34.6	42.2	61.4	136.8	53.5
1 lb B begin + mid season	21.1	32.9	39.5	63.1	150.3	54.5
2 lbs B begin season	20.2	34.3	40.1	61.7	144.8	55.3
LSD	ns	ns	ns	ns	ns	8
$Pr>F_{(0.05)-B}$	0.4609	0.7009	0.3062	0.7127	0.4076	0.0006

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)

Project Title: Effects of boron fertilizer and water regimes on alfalfa yield and quality — 2016

Objective: To evaluate the effects of boron fertilizer rate and irrigation application on alfalfa yield and quality.

Personnel: J.A. Torrion, R.N Stougaard, E. Glunk, E. Sapkota, J. Garner

Summary:

Boron treatments were applied at five rates detailed in Table 1. Three water use treatments were applied as the main factor, which included rainfed, half or deficit irrigation (50% ET), and sufficient or full irrigation (100% ET). The experimental design was a split plot with four replications. There was a full soil profile at the beginning of green up in spring as rainfall received in the fall and early spring was above average. Supplemental irrigation was applied when 35 percent of plant available water was used up. Rainfall events and amounts of irrigation applied per treatment are shown in Figure 1. Height measurements were taken prior to cutting when plants averaged 10% flowering. Two cuttings were made.

No significant differences were observed in height or yield data from boron fertilizer treatments (Table 3). Significant differences were observed for height and yield from water treatments (Table 4). The highest yield for total harvest was 2.16 T/A for 50 ET which was equivalent to the 100ET. This implies that the 50ET treatment did not impact yield as it allowed to store rainfall more efficiently (i.e., 60 DAE rainfall in Figure 1). Significant differences were observed for all but two nutrient analysis for hay quality from boron treatments for first harvest, but none for second harvest (Table 5). No significant differences were observed for hay quality from water treatments for first harvest, but significant differences were observed for second harvest (Table 6).

Table 1. Total B applied per treatment and application timing.

Treatment	Total B (lb/A/year)	Application
1	Untreated check	None
2	0.5	0.25 lb/A applied at 3-in regrowth in early spring + 0.25 lb/A at 3-in regrowth after first cutting
3	1.0	0.50 lb/A applied at 3-in regrowth in early spring + 0.50 lb/A at 3-in regrowth after first cutting
4	2.0	1.0 lb/A applied at 3-in regrowth in early spring + 1.0 lb/A at 3-in regrowth after first cutting
5	2.0	2.0 lb/A applied at 3-in regrowth in early spring

Table 2. Materials and methods.

Variety:	HybriForce-3400	Soil Test:	121-21-144
Seeding Date:	5/24/16	Ferilizer:	44-104-240-20S
Julian Date:	145	Boron Fertilizer:	0% Liquid - Agrisolutions
Seeding Rate:	20 lbs/A	1st Boron Application Date:	7/22/16
Previous Crop:	Spring Wheat	2nd Boron Application Date:	8/3/16
Tillage:	Conventional	1st Harvest Date:	7/27/16
Irrigation:	Yes	2nd Harvest Date:	9/17/16
Soil Type:	Fine sandy loam		

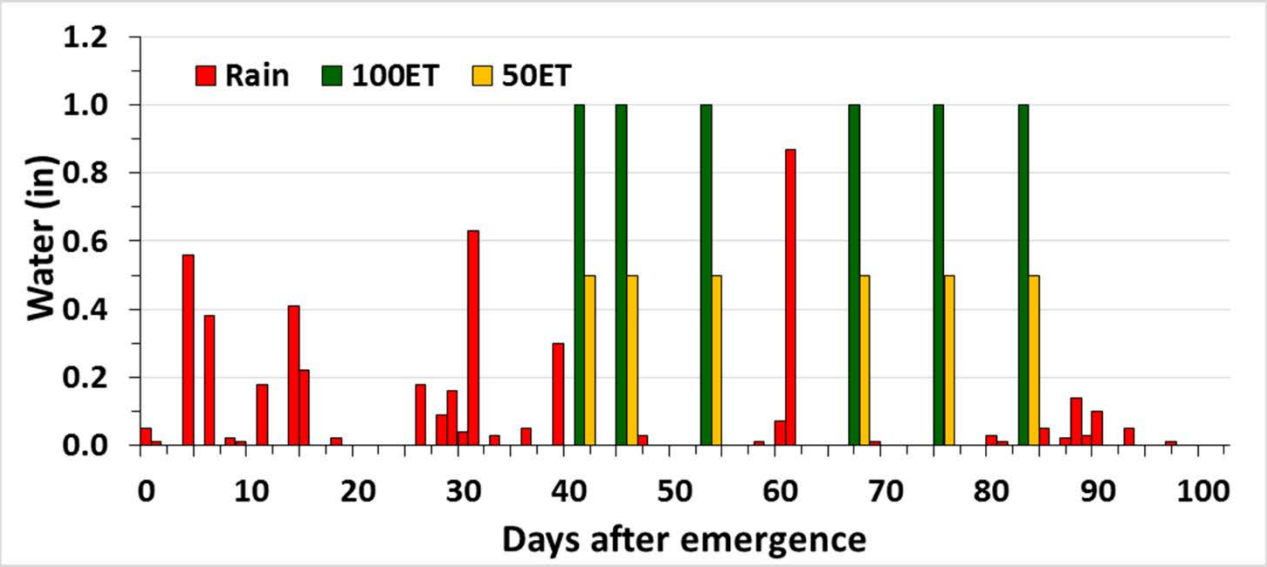


Figure 1. Rainfall events and irrigation applied per treatment.

Table 3. Effects of boron fertilizer on irrigated alfalfa yield

	1st Harvest - Jul 27		2nd Harvest -Sep 17		Harvest Total
	HT	YLD	HT	YLD	YLD
Treatment	in	T/A	in	T/A	T/A
0 lbs B	18.98	0.47	25.18	1.29	1.76
0.25 lb B begin + mid season	19.94	0.59	24.42	1.25	1.84
0.5 lb B begin + mid season	19.74	0.56	24.68	1.32	1.88
1 lb B begin + mid season	21.56	0.81	25.09	1.31	2.12
2 lbs B begin season	20.31	0.67	26.05	1.40	2.06
LSD	ns	ns	ns	ns	ns
$Pr>F_{(0.05)-B}$	0.4312	0.0854	0.7620	0.8398	0.4581

Table 4. Effects of water on alfalfa yield

	1st Harvest - Jul 27		2nd Harvest -Sep 17		Harvest Total
	HT	YLD	HT	YLD	YLD
Treatment	in	T/A	in	T/A	T/A
Dryland/Rainfed	18.68	0.56	19.61	0.93	1.49
Half Irrigation (50 ET)	20.28	0.64	26.83	1.53	2.16
Full Irrigation (100 ET)	21.36	0.66	28.82	1.48	2.14
LSD	1.08	0.12	0.93	0.06	0.19
$Pr>F_{(0.05)-ET}$	0.0004	0.0341	<.0001	<.0001	<.0001

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

Table 5. Effects of boron on hay quality

	1st Harvest -Jul 27					
	CP	ADF	NDF	TDN	RFV	B
Treatment	%	%	%	%	%	ppm
0 lbs B	29.03	24.52	36.67	72.22	178.58	30.42
0.25 lb B begin + mid season	28.38	25.66	37.58	70.98	173.42	32.67
0.5 lb B begin + mid season	28.18	25.58	35.04	71.08	185.50	33.58
1 lb B begin + mid season	29.53	28.33	40.56	68.11	156.42	38.92
2 lbs B begin season	28.87	26.65	37.98	69.92	170.08	42.00
LSD	ns	1.72	2.45	1.86	ns	2.39
$Pr>F_{(0.05)-B}$	0.5295	0.0424	0.0483	0.0430	0.0672	<.0001

	2nd Harvest -Sep 17					
	CP	ADF	NDF	TDN	RFV	B
Treatment	%	%	%	%	%	ppm
0 lbs B	28.36	30.65	35.51	65.61	172.58	29.67
0.25 lb B begin + mid season	26.84	30.26	35.93	66.04	171.75	38.75
0.5 lb B begin + mid season	27.39	30.07	36.80	66.23	168.17	42.42
1 lb B begin + mid season	27.21	31.45	37.19	64.74	164.42	48.58
2 lbs B begin season	26.66	30.86	37.68	65.38	160.75	43.25
LSD	ns	ns	ns	ns	ns	5.5
$Pr>F_{(0.05)-B}$	0.1999	0.7640	0.3606	0.7596	0.4952	<.0001

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

Table 6. Effects of water on hay quality

	1st Harvest - Jul 27					
	CP	ADF	NDF	TDN	RFV	B
Treatment	%	%	%	%	%	ppm
Dryland/Rainfed	28.71	26.35	38.31	70.26	168.65	32.60
Half Irrigation (50 ET)	29.20	26.59	37.73	69.99	171.25	35.70
Full Irrigation (100 ET)	28.48	25.52	36.65	71.14	178.50	38.25
LSD	ns	ns	ns	ns	ns	ns
$Pr>F_{(0.05)-ET}$	0.3546	0.5045	0.4391	0.5081	0.3958	0.1333

	2nd Harvest - Sep 17					
	CP	ADF	NDF	TDN	RFV	B
Treatment	%	%	%	%	%	ppm
Dryland/Rainfed	29.22	27.90	33.63	68.58	188.55	27.75
Half Irrigation (50 ET)	26.63	31.74	38.17	64.42	157.55	43.80
Full Irrigation (100 ET)	26.03	32.33	38.07	63.81	156.50	50.05
LSD	1.24	0.90	3.01	0.98	14.76	5.45
$Pr>F_{(0.05)-ET}$	0.0001	0.0002	0.0011	0.0002	0.0002	0.0002

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

Project Title: Yield evaluation of various cover crops - 2016

Objective: To evaluate various cover crops for forage yield performance in Northwestern Montana.

Results:

Significant difference in forage yield was observed for cool season cover crops, with an average of 0.9 T/A. Alsike clover and Purple top turnip did not produce any biomass. Otana Oat produced the highest biomass at 2.5 T/A for (Table 3).

Significant difference in forage yield was observed for warm season crops, with an average of 1.1 T/A, ranging from 0.5 T/A for TEFF to 2.1 T/A for both Sorghum-CARC and Indian Corn (Table 4).

Summary:

Cereal type forages consistently produced the highest biomass for either early or late planted cover crops.

Table 1. Materials and Methods — Cool season.

Seeding Date:	4/27/2016	Harvest Date:	6/23/2016
Julian Date:	118	Julian Date:	175
Seeding Rate:	NA	Soil Test:	116-11-125
Previous Crop:	Barley	Fertilizer:	50-25-60
Tillage:	Conventional	Pesticide:	NA
Irrigation:	None		
Soil Type:	Creston Silt Loam		

Table 2. Materials and Methods — Warm season.

Seeding Date:	6/3/2016	Harvest Date:	8/3/2016
Julian Date:	155	Julian Date:	216
Seeding Rate:	NA	Soil Test:	116-11-125
Previous Crop:	Barley	Fertilizer:	50-25-60
Tillage:	Conventional	Herbicide	Cornerstone 12 oz/A
Irrigation:	None		
Soil Type:	Creston Silt Loam		

Table 3. Cool season cover crop agronomic data.

Cultivar	YLD T/A
Otana Oat	2.50
Triticale	2.10
DKL 30-42 Canola	1.70
Omega Flax	1.30
6Mix Cool Season Early[1]	1.30
10Mix Diversity Early[2]	1.10
Arvika Spring Pea	1.00
Baldy Spineless Safflower	0.80
6Mix Warm Season Early[3]	0.30
7Mix Alternative Cool[4]	0.30
Hairy Vetch	0.20
Ground Hog Radish	0.10
Purple Top Turnip	0.00
Alsike Clover	0.00
Mean	0.90
CV	30.61
LSD	0.28
Pr>F	0.0001

YLD: yield.

[1] Ground Hog Radish, Purple Top Turnip, Arvika Spring Pea, DKL 30-42 Canola, Baldy Spineless Safflower, Otana Oat.

[2] Ground Hog Radish, Purple Top Turnip, Arvika Spring Pea, SSNS-1 FabaBean, Frontier ChickPea, DKL 30-42 Canola, Baldy Spineless Safflower, Peredovik Sunflower, Oatana Oat, Sorghum-CARC.

[3] Ground Hog Radish, Purple Top Turnip, Frontier ChickPea, SSNS-1 FabaBean, Peredovik Sunflower, Sorghum-CARC.

[4] Ground Hog Radish, Purple Top Turnip, SSNS-1 FabaBean, Loreto Black Bean, TEFF, Indian Corn, Sorghum-CARC.

Table 4. Warm season cover crop agronomic data.

Cultivar	YLD T/A
Sorghum-CARC	2.10
Indian Corn	2.10
6Mix Cool Season Late[1]	1.90
10Mix Diversity Late[2]	1.70
Golden German Millet	1.40
7Mix Alternative Warm[3]	1.00
Loreto Black Bean	0.90
Purple Top Turnip	0.80
SSNS-1 FabaBean	0.80
6Mix Warm Season Late[4]	0.80
Peredovik Sunflower	0.70
Frontier ChickPea	0.70
Ground hog Radish	0.60
Sheyenne Soybean	0.60
Berseem Clover	0.60
TEFF	0.50
Mean	1.08
CV	51.36
LSD	0.79
Pr>F	0.0001

YLD: yield.

[1] Ground Hog Radish, Purple Top Turnip, Arvika Spring Pea, DKL 30-42 Canola, Baldy Spineless Safflower, Otana Oat.

[2] Ground Hog Radish, Purple Top Turnip, Arvika Spring Pea, SSNS-1 FabaBean, Frontier ChickPea, DKL 30-42 Canola, Baldy Spineless Safflower, Peredovik Sunflower, Oatana Oat, Sorghum-CARC.

[3] Ground Hog Radish, Purple Top Turnip, SSNS-1 FabaBean, Loreto Black Bean, TEFF, Indian Corn, Sorghum-CARC.

[4] Ground Hog Radish, Purple Top Turnip, Frontier ChickPea, SSNS-1 FabaBean, Peredovik Sunflower, Sorghum-CARC.