

Project Title: Evaluation of spring wheat cultivar performance under continuous crop and crop-fallow systems in central Montana

Project Leader: P.M. Carr (pre-March 6) and J.O. Eberly (post-March 6)

Project Personnel:

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Objectives:

Identify top performing spring wheat cultivars in central Montana.

Methods:

Standard spring wheat variety performance trials were conducted on chemical fallow or minimal tillage during 2017 at Moccasin (CARC) and on farms near Denton and Highwood. Trials consisted of 18 named varieties of spring wheat and additional experimental lines. Each variety was seeded in three 5 row, 16 foot plots in a randomized experimental design. Seeding dates were April 17 at Moccasin, April 19, at Highwood, and May 4 at Denton. All plots were trimmed to a harvest length of approximately 12 feet and harvested with a small plot combine. Plots were harvested on August 9 at Moccasin, August 16 at Denton, and August 22 at Highwood.

Results:

The 2017 growing season at CARC started out with good recharge soil moisture and above average precipitation through June 14, followed by exceptionally dry conditions. Total annual precipitation was above the 108-year average, despite exceptionally low rainfall in the months of June (55% of average), July (40% of average), and August (20% of average). The 2017 crop year was characterized by above-average temperatures. Average annual temperature was 1.7°F higher than the 106-year mean, with individual monthly averages exceeding long-term averages by greater than 6°F in the months of November and March. July was by far the hottest month with an average monthly temperature of 71.4°F (5.4°F above normal), and a total of 14 days above 90°F. By August, central Montana was considered to be in a severe drought based on the Palmer Drought Severity Index monitoring by the National Oceanic and Atmospheric Administration (NOAA).

Dry conditions existed in June (1.7 inches vs. a long-term average of 3.1 inches) and July (0.7 inch vs. a long-term average of 1.65 inches), during the critical grain-fill period. The relatively dry conditions, when combined with warmer-than-average temperatures during June (60°F vs. 58°F) and July (71°F vs. 66°F), resulted in relatively light test weights across cultivars included in the trial at Moccasin. Test weight averaged 55.5 lb/bu across the commercial cultivars at Moccasin and Denton (Tables 2 and 3). In contrast, grain test weight averaged 60 lb/bu Highwood (Table 4).

Average grain yield across the 18 cultivars presented in Tables 2 through 4 ranged from 20 bu/ac at Denton to 32.5 bu/ac at Highwood. Lanning and SY Ingmar, two new lines in this year's trial, along with Brennan were among the top performing varieties for yield at Moccasin. Cheville, which was also a new variety this year, was the top yielding variety at Denton with an average yield of 35.8 bu/ac. Lanning and Oneal were among the top performers at Highwood. Average percent protein ranged from less than 15.6% across cultivars at Highwood to 17.2% at Denton. Top varieties for protein at Moccasin and Denton were Alum, Egan, and SY Soren. The top variety for protein at Highwood was Camaro, which was another new entry for 2017. Gross returns integrated protein concentrations (premiums and discounts)

and grain yield into a single ranking criterion. Cheville was among the top-ranked cultivars using this ranking criterion at Moccasin and Denton while Lanning and Oneal were among the top at Highwood. Note that gross return calculations do not take into account any expenses.

Summary:

A wet spring combined with drier and warmer conditions through June and July at Moccasin led to lower yields and test weights. While average annual rainfall was slightly above the historic average during the 2016-2017 growing season, lower than average precipitation during June and July negatively impacted yield and test weight. No single variety performed best at all of the locations in central Montana. This work has been strongly supported by producers at the off station locations and by the Central Agricultural Research Center Advisory Council. With budget and other resources allowing, plans are in place to continue off-station cereal variety investigation throughout the central Montana region.

Funding Summary:

An expenditure summary will be provided by OSP. No additional grant support was provided for this project.

MWBC FY 2018 Grant Submission Plans:

A request for continuing this project was submitted for funding consideration for the next fiscal year. Funding was awarded. Thank you!

Table 1: Monthly precipitation and temperature data during the 2016-17 growing season and the long-term average at the Central Ag. Research Center in Moccasin, MT.

Month/Year	Temperature			Growing Degree Days			Precipitation		
	2017	2012-2017	Δ	2017	2012-2017	Δ	2017	2010-2017	Δ
	----- F -----			----- GDD ₃₂ -----			----- in -----		
September 2016	55.4	54.9	0.5	700	695	5	3.37	1.42	1.95
October 2016	46.3	44.9	1.4	475	459	16	2.76	0.93	1.83
November 2016	42.9	32.9	10.0	398	227	170	0.14	0.56	-0.42
December 2016	15.6	24.9	-9.3	56	136	-80	0.43	0.54	-0.11
January 2017	19.1	21.8	-2.7	105	119	-14	0.23	0.54	-0.31
February 2017	26.9	24.8	2.1	172	125	48	0.39	0.44	-0.05
March 2017	37.2	30.6	6.6	307	196	111	0.37	0.70	-0.33
April 2017	42.2	40.9	1.3	352	344	8	2.20	1.22	0.98
May 2017	52.4	50.1	2.3	636	574	61	2.93	2.62	0.31
June 2017	60.0	57.9	2.1	840	777	63	1.68	3.06	-1.38
July 2017	71.4	66.0	5.4	1220	1051	169	0.66	1.65	-0.99
August 2017	65.9	65.0	0.9	1052	1019	33	0.31	1.59	-1.28
Average/Total	44.6	42.9	1.7	526	477	49	15.47	15.27	0.20

Table 2: Spring wheat variety trial at Moccasin, MT.

Variety/Pedigree	Year of Release	Source	Heading Date		Yield (bu/ac)		Test Weight	Protein	Gross Return
			cal	jul	2017	2016	(lb/bu)	%	(\$/ac)
+ Alum	2014	WSU	25-Jun	176	29.6	<u>37.5</u>	54.3	<u>18.5</u>	188.10
+ Camaro	--	Meridian Seeds	23-Jun	175	33.4	--	58.2	16.8	211.40
+ Cheville	--	Meridian Seeds	23-Jun	174	33.8	--	55.8	16.3	222.90
+ Brennan	2009	Syngenta/AgriPro	23-Jun	175	35.2	31.1	58.9	16.4	227.40
Choteau	2003	MAES	24-Jun	176	28.3	35.9	55.1	17.3	177.90
Corbin	2006	Westbred, LLC	22-Jun	173	31.1	30.3	55.9	17.3	200.60
Duclair	2011	MAES	23-Jun	174	32.1	35.4	53.2	17.4	206.10
Egan	2013	Westbred, LLC	25-Jun	176	32.5	37.4	54.3	18.5	206.70
Fortuna	1966	MAES/NDSU	25-Jun	176	30.5	35.1	55.8	16.7	191.50
+ Lanning	--	--	23-Jun	174	33.8	--	53.8	16.9	215.90
+ LCS Pro	--	--	25-Jun	176	30.1	--	53.0	17.3	193.30
+ NS Presser CL+	--	--	25-Jun	176	32.1	--	52.7	17.3	207.60
+ Oneal	2008	Westbred, LLC	25-Jun	177	32.1	33.1	56.4	17.4	200.30
+ Reeder	1999	NDSU	25-Jun	176	33.0	36.3	56.1	16.9	205.90
+ Sy Ingmar	--	Syngenta/AgriPro	25-Jun	176	33.7	--	55.6	17.3	211.80
+ Sy Soren	2011	Syngenta/AgriPro	24-Jun	176	31.2	32.4	55.3	18.1	196.40
Vida	2005	MAES	26-Jun	177	31.1	33.5	54.2	16.9	204.10
WB Gunnison	--	Westbred, LLC	23-Jun	175	32.7	33.2	55.7	16.3	215.50
Average			24-Jun	175	32.0	33.9	55.5	17.1	204.8
C.V. (%)			0.003	0.665	8.4	14.5	1.3	2.5	9.4
LSD (0.05)			1.9	1.9	N.S.	8.1	1.2	0.7	N.S.
P-value			0.001	0.001	0.3672	--	<0.0001	<0.0001	0.3012

+ = new for 2017

Bolded and underlined values are the highest mean. Bolded values are not different from the highest value based on the Least Significant Difference (LSD) test.

Note: Study averages include experimental lines not listed here.

Note: Yellowstone plots, for 2017, were planted with varying amounts of 'Warhorse' seed depending on location.

N.S. = Not Significant

Table 3: Spring wheat variety trial at Denton, MT.

Variety/Pedigree	Year of Release	Source	Yield (bu/ac)		Protein	Gross Return
			2017	(lb/bu)	%	(\$/ac)
Alum	2014	WSU	18.2	55.2	17.8	114.20
Camaro		Meridian Seeds	26.0	61.8	17.3	164.50
Cheville		Meridian Seeds	35.8	61.4	16.3	223.80
Brennan	2009	Syngenta/AgriPro	20.5	56.6	17.4	127.50
Choteau	2003	MAES	20.1	54.7	17.0	127.10
Corbin	2006	Westbred, LLC	18.2	54.5	17.6	115.30
Duclair	2011	MAES	21.8	53.8	16.6	142.80
Egan	2013	Westbred, LLC	18.6	53.9	18.5	118.30
Fortuna	1966	MAES/NDSU	16.9	55.1	17.1	106.50
+ Lanning			21.5	54.1	17.1	136.60
+ LCS Pro			19.0	54.5	16.8	124.20
+ NS Presser CL+			16.6	53.5	17.0	109.10
Oneal	2008	Westbred, LLC	19.6	56.6	17.3	122.10
+ Reeder	1999	NDSU	17.2	55.8	17.3	107.90
+ Sy Ingmar		Syngenta/AgriPro	16.1	53.3	18.5	103.00
Sy Soren	2011	Syngenta/AgriPro	17.5	53.7	18.1	112.10
Vida	2005	MAES	19.8	55.2	16.5	132.20
WB Gunnison		Westbred, LLC	19.3	54.7	16.6	124.30
Average			20.0	55.5	17.2	127.3
C.V. (%)			15.2	1.7	3.1	15.4
LSD (0.05)			N.S.	1.5	0.9	32.4
P-value (Varieties)			<0.0001	<0.0001	<0.0001	<0.0001

+ = new for 2017

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Note: Study averages include experimental lines not listed here.

Note: Yellowstone plots, for 2017, were planted with varying amounts of 'Warhorse' seed depending on location.

N.S. = Not Significant

Table 4: Spring wheat variety trial at Highwood, MT.

Variety/Pedigree	Year of Release	Source	Yield (bu/ac)		Test Weight	Protein	Gross Return
			2017	2016	(lb/bu)	%	(\$/ac)
Alum	2014	WSU	37.7	<u>46.4</u>	59.1	15.0	231.80
Camaro		Meridian Seeds	17.1		57.2	<u>17.2</u>	109.20
Cheville		Meridian Seeds	18.6		56.4	15.3	117.80
Brennan	2009	Syngenta/AgriPro	27.6	27.6	61.4	16.2	169.90
Choteau	2003	MAES	37.7	35.1	59.7	16.0	231.50
Corbin	2006	Westbred, LLC	28.6	35	60.3	14.8	175.90
Duclair	2011	MAES	32.0	37.2	58.1	15.6	202.00
Egan	2013	Westbred, LLC	37.5	42.2	57.5	16.5	231.60
Fortuna	1966	MAES/NDSU	30.1	28.7	59.1	15.3	185.20
+ Lanning			40.3		59.4	15.1	247.50
+ LCS Pro			31.2		59.0	15.5	197.50
+ NS Presser CL+			34.7		57.5	15.2	220.60
Oneal	2008	Westbred, LLC	38.9	30.4	59.8	14.6	238.80
+ Reeder	1999	NDSU	37.0	37.8	58.8	16.1	228.30
+ Sy Ingmar		Syngenta/AgriPro	37.8		60.6	15.6	232.90
Sy Soren	2011	Syngenta/AgriPro	34.2	29.3	59.2	15.6	210.60
Vida	2005	MAES	34.9	33.9	59.9	15.0	228.00
WB Gunnison		Westbred, LLC	29.7	29.5	60.3	14.5	185.00
Average			32.5	32.4	59.2	15.6	202.2
C.V. (%)			13.1	9.3	1.5	1.8	13.7
LSD (0.05)			7.0	4.9	1.5	0.5	N.S.
P-value			<0.0001		<0.0001	<0.0001	<0.0001

+ = new for 2017

Bolded and underlined values are the highest mean. Bolded values are not different from the highest value based on the Least Significant Difference (LSD) test.

Note: Study averages include experimental lines not listed here.

Note: Yellowstone plots, for 2017, were planted with varying amounts of 'Warhorse' seed depending on location.

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