Project Title: Off-Station spring wheat variety performance trials in Central Montana – CARC

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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 2020 at Moccasin (CARC) and on farms near Denton, Geraldine, and Fort Benton. Trials consisted of both 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 29 at Moccasin, May 5, at Geraldine, and May 6, 2020 at Denton and Fort Benton. All plots were trimmed to a harvest length of approximately 12 feet and harvested with a small plot combine. Plots were harvested on August 21 at Fort Benton, August 25 at Moccasin, August 28 at Geraldine, and September 1 at Denton

Results:
The 2020 growing season at CARC started out with good recharge soil moisture and above average precipitation in September, which prevented access to the fields. Total annual precipitation was below the 110-year average (Table 1). This created favorable conditions for spring wheat growth during the mid-spring period. Average annual temperature was 0.1°F higher than the 110-year mean, with individual monthly averages 9.9°F below average in October but 5.4°F warmer in December. August was the hottest month with an average monthly temperature of 68.9°F (3.9°F above normal). Rainfall was 0.71 in above average in June while July and August were 0.68 and 1.23 in below average, respectively.

Average yield was 39.3 bu/ac at Moccasin (Table 2), 31.9 bu/ac at Denton (Table 3), and 49.2 bu/ac at Geraldine (Table 4). Differences in yield were not significant among the tested varieties at these locations. At Fort Benton, average yield was 35.1 bu/ac (Table 5). Average protein was 12.8% at Moccasin, 14.8% at Denton, 14.4% at Geraldine, and 14.1% at Fort Benton.

Summary:
While rainfall in June was above the historic average, below average rainfall in July and August may have negatively impacted yields at Moccasin, where yields were about 7 bu/ac below the 3-year average. At Geraldine and Denton, grasshopper infestations were observed which may have negatively impacted yields at these locations. 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 2021 Grant Submission Plans:
A request for continuing this project was submitted for funding consideration for the next fiscal year.

Table 1: Monthly precipitation and temperature data during the 2019-20 growing season and the long-term average at the Central Ag. Research Center in Moccasin, MT.

Month	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Year
Year	2019	2019	2019	2019	2020	2020	2020	2020	2020	2020	2020	2020	
Precipitation (inches)													Total
Average (1910-2020)	1.45	0.92	0.57	0.53	0.53	0.46	0.7	1.22	2.64	3.08	1.64	1.58	15.32
Current Year	2.87	0.85	0.78	0.30	0.26	0.56	0.43	0.77	2.68	3.79	0.96	0.35	14.60
Difference	1.42	-0.07	0.21	-0.23	-0.27	0.10	-0.27	-0.45	0.04	0.71	-0.68	-1.23	-0.72
Temperature (°F)													Average
Average (1910-2020)	55.9	34.9	31.0	30.4	26.1	26.6	30.5	36.7	50.8	59.0	64.8	68.9	43.0
Current Year	54.9	44.8	32.9	25.0	21.9	24.5	30.6	40.8	50.1	57.9	65.9	65.0	42.9
Difference	1.0	-9.9	-1.9	5.4	4.2	2.1	-0.1	-4.1	0.7	1.1	-1.1	3.9	0.1

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

Variety/Pedigree	Year of Release	Source	Heading Date	Height	Test Weight	Protein	Grain Yield (bu/ac)			
			cal	(in)	(lb/bu)	(%)	2018	2019	2020	3 yr Avg
ALUM	**2014**	**WSU**	**2-Apr**	**26.7**	**63.4**	**11.5**	**48.3**	**45.4**	**43.5**	**45.7**
BRENNAN	2009	Syngenta/AgriPro	31-Mar	24.3	62.8	**14.0**	39.2	52.2	**37.7**	43.0
CHOTEAU	**2003**	**MAES**	**3-Apr**	**25.7**	**62.3**	**13.1**	**43.1**	**47.0**	**39.3**	**43.1**
CORBIN	2006	Westbred, LLC	31-Mar	25.0	62.8	12.9	46.0	48.0	**37.3**	43.8
DAGMAR			**1-Apr**	**27.0**	**63.2**	**12.4**			**39.7**	
DUCLAIR	2011	MAES	1-Apr	27.0	62.1	12.6	50.8	48.4	**42.6**	47.3
EGAN	**2013**	**Westbred, LLC**	**3-Apr**	**28.0**	**61.8**	**13.2**	**43.5**	**57.9**	**35.5**	**45.7**
FORTUNA	1966	MAES/NDSU	3-Apr	32.3	61.6	12.8	40.5	**43.5**	34.7	39.6
LANNING	**2016**	**MAES**	**1-Apr**	**26.0**	**62.8**	**12.4**	**43.0**	**56.4**	**37.6**	**45.7**
LCS PRO	2015	LIMAGRAIN	2-Apr	30.0	62.6	12.2	42.7	55.2	**39.9**	45.9
NS PRESSER CLP	**2016**	**MAES**	**5-Apr**	**27.0**	**62.0**	**13.2**	**50.7**	**52.9**	**31.6**	**45.1**
REEDER	1999	NDSU	4-Apr	28.3	63.0	13.0	48.2	49.3	**41.9**	46.5
SY INGMAR	**2015**	**Syngenta/AgriPro**	**2-Apr**	**27.0**	**63.3**	**12.5**	**40.7**	**58.5**	**35.6**	**44.9**
SY SOREN	2011	Syngenta/AgriPro	1-Apr	26.0	62.7	13.6	**45.4**	**52.3**	36.4	44.7
VIDA	**2005**	**MAES**	**3-Apr**	**28.0**	**62.1**	**12.6**	**50.0**	**55.1**	**42.4**	**49.2**
WB GUNNISON	2011	Westbred, LLC	3-Apr	26.3	62.8	12.8	48.0	48.4	**43.0**	46.5
Mean			2-Apr	27.2	62.5	12.8	44.5	51.4	39.3	
CV%			0.0	4.4	0.5	3.3	N.S.	15.0	10.8	
LSD			3.0	2.0	0.5	0.7	11.4	4.5	7.0	
P-Value			0.0170	0.0000	0.0000	0.0000	0.0570	0.5620	0.0820	

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.
N.S. = Not Significant

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

Variety/Pedigree	Year of Release	Source	Height	Test Weight	Protein	Grain Yield (bu/ac)			
			(in)	(lb/bu)	(%)	2018	2019	2020	3 yr Avg
ALUM	**2014**	**WSU**	**24.3**	**63.6**	**13.9**	**34.1**	**37.1**	**32.8**	**34.7**
BRENNAN	2009	Syngenta/AgriPro	23.3	**63.4**	**15.5**	26.8	32.4	22.3	27.2
CHOTEAU	**2003**	**MAES**	**25.0**	**62.2**	**14.7**	**28.3**	**38.3**	**32.7**	**33.1**
CORBIN	2006	Westbred, LLC	24.3	**63.5**	14.1	29.7	34.0	**31.8**	31.8
DAGMAR			**24.7**	**62.7**	**15.1**			**37.5**	
DUCLAIR	2011	MAES	25.3	**61.9**	14.5	29.5	**41.7**	**39.3**	36.8
EGAN	**2013**	**Westbred, LLC**	**26.0**	**59.7**	**16.7**	**25.4**	**35.4**	**30.4**	**30.4**
FORTUNA	1966	MAES/NDSU	31.0	**62.4**	14.4	29.7	31.3	25.2	28.7
LANNING	**2016**	**MAES**	**23.7**	**60.6**	**15.7**	**29.6**	**43.7**	**33.9**	**35.7**
LCS PRO	2015	LIMAGRAIN	24.7	**62.5**	14.7	30.6	35.5	23.9	30.0
NS PRESSER CLP	**2016**	**MAES**	**26.0**	**60.3**	**16.4**	**29.7**	**41.9**	**35.7**	**35.8**
REEDER	1999	NDSU	26.0	**62.5**	**15.4**	27.8	**40.5**	**26.1**	31.5
SY INGMAR	**2015**	**Syngenta/AgriPro**	**24.0**	**62.7**	**16.1**	**18.1**	**35.0**	**21.1**	**24.7**
SY SOREN	2011	Syngenta/AgriPro	24.0	**62.4**	15.0	27.9	**38.6**	24.2	30.2
VIDA	**2005**	**MAES**	**25.7**	**62.9**	**13.3**	**31.5**	**44.8**	**38.6**	**38.3**
WB GUNNISON	2011	Westbred, LLC	24.3	**63.0**	14.1	30.5	39.9	**35.5**	35.3
Mean			25.2	62.3	14.8	29.1	38.2	31.9	
CV%			4.7	1.7	6.7	N.S.	7.0	26.5	
LSD			1.9	1.8	1.6	14.6	11.2	13.9	
P-Value			0.0000	0.0040	0.0160	0.0500	0.0390	0.0530	

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.

N.S. = Not Significant

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

Variety/Pedigree	Year of Release	Source	Height	Test Weight	Protein	Grain Yield (bu/ac)			
			(in)	(lb/bu)	(%)	2018	2019	2020	3 yr Avg
ALUM	**2014**	**WSU**	**30.0**	**57.2**	**13.8**	**67.2**	**47.1**	**54.9**	**56.4**
BRENNAN	2009	Syngenta/AgriPro	26.3	**55.7**	**15.9**	67.0	48.0	42.8	52.6
CHOTEAU	**2003**	**MAES**	**28.0**	**54.2**	**14.6**	**79.1**	**46.6**	**49.8**	**58.5**
CORBIN	2006	Westbred, LLC	28.0	**52.6**	14.3	**76.8**	45.4	**45.8**	56.0
DAGMAR			**28.3**	**53.6**	**14.4**			**54.0**	**54.0**
DUCLAIR	2011	MAES	27.7	**51.4**	13.6	**70.6**	47.0	**51.4**	56.3
EGAN	**2013**	**Westbred, LLC**	**31.0**	**52.9**	**15.4**	**68.1**	**48.8**	**53.6**	**56.8**
FORTUNA	1966	MAES/NDSU	35.7	**55.1**	14.5	59.1	41.7	37.5	46.1
LANNING	**2016**	**MAES**	**29.7**	**52.0**	**14.1**	**70.6**	**49.8**	**56.7**	**59.0**
LCS PRO	2015	LIMAGRAIN	30.7	**54.4**	14.4	**73.2**	47.2	42.9	54.4
NS PRESSER CLP	**2016**	**MAES**	**30.7**	**50.8**	**16.0**	**72.7**	**46.9**	**59.8**	**59.8**
REEDER	1999	NDSU	32.0	**52.8**	13.9	71.3	48.7	**48.9**	56.3
SY INGMAR	**2015**	**Syngenta/AgriPro**	**28.3**	**56.0**	**15.3**	**67.2**	**48.7**	**47.9**	**54.6**
SY SOREN	2011	Syngenta/AgriPro	26.3	**54.0**	15.0	**73.9**	48.4	**46.2**	56.2
VIDA	**2005**	**MAES**	**28.0**	**49.9**	**13.9**	**82.0**	**55.0**	**57.8**	**64.9**
WB GUNNISON	2011	Westbred, LLC	27.3	**56.3**	14.0		43.3	**47.7**	45.5
Mean			29.1	53.3	14.4	71.2	47.9	49.2	
CV%			4.4	7.1	3.3	10.5	4.5	18.1	
LSD			2.1	6.3	0.8	9	5.7	14.6	
P-Value			0.0000	0.4880	0.0000	0.0050	0.0005	0.3090	

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.

N.S. = Not Significant

Table 5: Spring wheat variety trial at Fort Benton, MT.

Variety/Pedigree	Year of Release	Source	Height (in)	Test Weight (lb/bu)	Protein (%)	Grain Yield (bu/ac) 2020
ALUM	**2014**	**WSU**	**29.3**	**60.1**	**14.3**	31.1
BRENNAN	2009	Syngenta/AgriPro	25.7	**62.5**	**15.0**	30.9
CHOTEAU	**2003**	**MAES**	**28.0**	**61.0**	14.0	**36.4**
CORBIN	2006	Westbred, LLC	27.3	**61.4**	**14.5**	**40.2**
DAGMAR			**29.0**	**61.5**	**14.5**	**34.5**
DUCLAIR	2011	MAES	28.3	60.2	13.9	34.1
EGAN	**2013**	**Westbred, LLC**	**29.3**	**59.3**	**14.8**	**35.6**
FORTUNA	1966	MAES/NDSU	32.7	59.8	**15.4**	29.9
LANNING	**2016**	**MAES**	**29.3**	**61.7**	13.7	**36.3**
LCS PRO	2015	LIMAGRAIN	30.3	60.4	13.8	31.2
NS PRESSER CLP	**2016**	**MAES**	**28.7**	**59.8**	**14.5**	**35.2**
REEDER	1999	NDSU	28.3	**62.1**	13.4	32.6
SY INGMAR	**2015**	**Syngenta/AgriPro**	**26.7**	**61.7**	**15.1**	**33.3**
SY SOREN	2011	Syngenta/AgriPro	26.7	**61.1**	**14.1**	33.5
VIDA	**2005**	**MAES**	**27.7**	**61.2**	13.4	**42.0**
WB GUNNISON	2011	Westbred, LLC	28.3	**60.8**	**15.1**	32.0
Mean			28.6	61.0	14.1	35.1
CV%			3.3	1.7	5.8	11.8
LSD			1.5	1.7	1.4	6.8
P-Value			0.0000	0.0300	0.0310	0.0060

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.

N.S. = Not Significant

Note: This is a new location for 2020