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

Project Leader: D.M. Wichman (pre-July 8) and P.M. Carr (post-July 8)

Project Personnel:
J. Sherman MAES barley breeder, Bozeman
L. Elmore MAES Res. Assoc. barley breeder, Bozeman
S. Briar MAES/CARC Res. Assoc., Moccasin

Objectives:
Identify top performing spring barley cultivars in central Montana.

Results:
The 2015-16 growing season at CARC was drier (13.1 inches) than the long-term average (15.3 inches; Table 1). Less-than-average amounts of precipitation occurred each month from September through March, but timely precipitation in April along with greater than average amounts of precipitation in May (4.5 vs. 2.6 inches) created favorable conditions for spring growth during the mid-spring period. Dry conditions developed again in June (1 inch vs. a long-term average of 3.1 inches) while average amounts of precipitation (1.7 inches) was received during July. August was slightly drier than average, with 87% of the long-time average (1.6 inches) received. Mean air temperature was warmer than the long-term average (46°F vs. 43°F); months in 2016 with an average temperature ≥4°F warmer than the long-term average included January (+6°F), February (+11°F), March (8°F), and April (4.5°F). More favorable growing conditions occurred at Geraldine than at Moccasin, and these are reflected in grain yield differences between the two locations. Grain yield of barley cultivars averaged 80 bu/ac at Geraldine compared with 51 bu/ac at Moccasin (Tables 2 and 3). These same cultivars were planted at Denton but a hailstorm forced abandonment of the study. Grain yield of 15 cultivars evaluated at Highwood averaged only 35 bu/ac and reflect the acid soil conditions (pH ~ 4.5) that occurred at that site (Table 4).

Eslick was among the highest-yielding cultivars at both Geraldine and Moccasin; only Moravian, Overture, and Hays produced grain yields comparable to those produced by Eslick at Geraldine. The environment at Geraldine favored production of high-quality malting barley in 2016, based on performance of the barley cultivars – many of which are not approved malting types – at that location. Grain protein concentration averaged ~11% and plump kernel percentage averaged ~90% across the cultivars that were included. In contrast, barley protein concentration averaged over 14% at Moccasin and only three cultivars (Eslick, Pinnacle, and Rawson) produced kernels with a plump percentage >90%. Grain protein concentration across all cultivar entries averaged only 10.5% at Highwood; Craft, Hockett, and Moravian all produced grain with a plump percentage >90% at that location.

Summary:

Less than average precipitation was received during the 2016 growing season at Moccasin, excellent growing conditions occurred at Geraldine, acidic soils were encountered at Highwood, and hail destroyed the study at Delton. Results at Geraldine demonstrate that high-quality malt barley can be grown under dryland management in central Montana in some environments, while results at Moccasin demonstrate the challenges that persistent drought pose to malt barley growers. Results of the study at Highwood can be used to help identify cultivars best suited for production in acidic soils.

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

MWBC FY 2017 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 2015-16 growing season and the long-term average at the Central Ag. Research Center in Moccasin, MT.

Month	Year	Precipitation, in		Air Temperature, °F	
		Current Year	*1909-2016*	*Current Year*	*1911-2016*
Sep	*2015*	0.8	1.4	57.8	54.9
Oct	"	0.6	0.9	48.7	44.9
Nov	"	0.5	0.6	33.4	32.8
Dec	"	0.4	0.5	27.2	25.0
Jan	*2016*	0.3	0.5	27.9	21.8
Feb	"	0.3	0.4	35.8	24.7
Mar	"	0.6	0.7	38.4	30.6
Apr	"	1.2	1.2	45.3	40.8
May	"	4.5	2.6	50.4	50.1
Jun	"	1.0	3.1	61.7	57.9
Jul	"	1.7	1.7	66.0	65.9
Aug	"	1.4	1.6	64.3	64.9
Total\Average		13.3	15.3	46.4	42.9

Table 2. CARC Moccasin dryland spring barley variety trial

Variety	Grain Yield (bu/ac)			Protein (%)	Test Weight (lb/bu)	Plump (%)
	2016	2015-16	2014-16	2016		
Champion	57.6	54.4	49.7	14.4	55.3	85.1
Conlon	41.5	…	…	15.2	53.2	76.8
Conrad	46.5	46.6	47.0	16.3	54.2	65.3
Craft	40.5	43.7	43.2	14.9	56.3	75.9
Eslick	70.9	…	…	13.4	55.8	90.6
Genesis	42.2	…	…	13.3	54.7	84.4
Harrington	46.8	44.8	46.7	15.3	53.7	40.8
Haxby	60.0	55.3	54.9	13.6	56.5	87.6
Haybet	36.7	39.7	…	16.4	52.3	30.2
Hays	53.4	…	…	15.9	53.9	74.8
Hockett	59.3	52.4	50.0	13.8	56.1	32.3
Lavina	59.8	54.5	…	14.3	53.0	21.0
Merit	52.2	47.6	….	16.5	53.7	43.3
Metcalfe	48.4	44.9	47.8	15.3	55.4	89.2
Moravian115	39.1	38.8		15.4	52.7	73.4
Overture	58.8	…	…	13.2	55.2	86.9
Pinnacle	48.9	…	…	13.6	55.7	96.5
Rawson	49.5	…	…	13.3	56.3	94.3
Stepford	45.8	…	…	13.8	49.2	89.7
Stockford	64.1	54.4		13.1	54.7	93.0
Average	51.38	48.1	48.5	14.3	54.6	73.0
CV %	19.22	…	…	8.33	2.39	30.19
LSD (0.05)	21.63	…	…	…	3.66	…

Table 3. CARC Geraldine dryland spring barley variety trial.

Variety	Grain Yield (bu/ac)			Protein (%)	Test Weight (lb/bu)	Plump (%)
	2016	2015-16	2014-16	2016		
Champion	87.7	73.6	69.0	10.1	57.4	91.4
Conlon	67.7	…	…	11.9	54.9	94.7
Conrad	86.9	70.9	64.6	11.9	55.0	94.2
Craft	64.3	58.7	57.1	12.1	56.3	92.7
Eslick	106.0	…	…	11.2	55.6	88.7
Genesis	75.8	…	…	10.4	55.9	90.0
Harrington	78.2	66.6	59.4	11.6	56.5	92.0
Haxby	79.3	70.5	64.6	10.9	57.1	91.7
Haybet	58.1	52.5	…	12.1	54.7	69.7
Hays	89.1	…	…	10.9	54.1	87.2
Hockett	84.1	67.8	60.0	10.5	58.3	95.1
Lavina	87.0	68.7		10.9	53.4	76.7
Merit	84.1	74.0		11.2	56.2	87.9
Metcalfe	79.1	67.0	57.5	11.7	56.1	91.9
Moravian115	91.5	67.8	…	10.8	55.9	92.2
Overture	90.9	…	…	11.4	57.3	93.5
Pinnacle	75.8	…	…	10.8	56.1	94.0
Rawson	63.5	…	…	12	56.6	89.0
Stepford	69.6	…	…	11.7	50.7	93.1
Stockford	84.1	65.7		10.9	54.0	93.7
Average	80.35	67.0	61.8	11.07	55.6	90.1
CV %	8.09	…	…	…	1.19	…
LSD (0.05)	14.23	…	…	…	1.85	…

Table 4. CARC Highwood dryland spring barley variety trial.

Variety	Grain Yield (bu/ac)	Protein (%)	Test Weight (lb/bu)	Plump (%)
Champion	38.5	8.4	55.5	89.0
Conlon	26.4	11.1	52.0	76.8
Conrad	36.3	10.2	54.8	86.2
Craft	39.1	10.2	56.2	90.1
Harrington	46.1	9.7	56.3	89.1
Haxby	38.6	10.1	56.0	90.1
Haybet	32.3	11.8	54.2	69.1
Hays	40.9	9.9	54.2	78.7
Hocket	40.2	11.3	55.6	86.3
Hockett	42.1	10.6	56.3	94.0
Lavina	37.6	9.7	54.7	70.0
Merit 57	42.9	8.9	55.8	86.3
Metcalfe	31	9.5	55.7	90.3
Moravian	31.7	9.3	54.8	95.2
Stockford	18.6	12.3	50.3	93.6
Average	34.64	10.48	54.5	86.3
CV %	16.57	12.54	2.0	8.1
LSD (0.05)	12.92	…	3.2	…