PROJECT TITLE: Evaluation of malt barley varieties under irrigated and dryland conditions – 2010 (4W2756)

PRINCIPAL INVESTIGATOR:
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OBJECTIVE: To select the best adapted experimental lines for release and to determine the best adapted varieties of malt barley for eastern Montana.

Methods:
Dryland site:
Planted: April 20 Harvested: August 9
Soil type: Williams clay loam
Previous crops: 2009 - fallow, 2008 – safflower, 2007- small grain plots
Residual soil N to 3 ft: 89 lb N/ac
Residual soil P to 6 in: 38 ppm
Applied fertilizer: none
Herbicides: Brox M, 1.5 pt/ac, applied June 15
Precipitation April – August, 2010: 15.32 in
Ave (61 yr) precipitation April – August: 9.48 in
Precipitation September 2009 – August 2010:20.25 in
Ave (61 yr) precipitation September – August: 13.90 in

Irrigated:
Planted: May 12 Harvested: August 25
Soil type: Savage silty clay
Previous crops: 2009 – safflower, 2008 – sugarbeet, 2007 – small grain
Residual soil N to 4 ft: 138 lb N/ac
Residual soil P to 6 in: 22 ppm
Applied fertilizer: 200 lb/ac 18-46-0
Irrigated (sprinkler) on: May 20, July 7, 1 inch each application
Herbicides: Brox M, 1.5 pt/ac, applied June 15
Precipitation April – August, 2010: 14.09 in
Ave (61 yr) precipitation April – August: 9.48 in
Precipitation September 2009 – August 2010:18.98 in
Ave (61 yr) precipitation September – August: 13.90 in

Comments:
It was generally a cool and very wet summer.

RESULTS:

Dryland: Agronomic data from the dryland malt barley yield trial are shown in Table 1. Nine lines and varieties yielded significantly less than the check variety, Haxby. Five-year summaries for yield, test weight, protein contents and percent plump seed are shown in Tables 2-5.

Irrigated: Agronomic data from the irrigated malt barley yield trial are shown in Table 6. Three lines and varieties yielded significantly less than the check variety, Haxby. Five-year summaries of yield, test weight, protein contents, percent plump, and lodging indices are shown in Tables 7-11.

SUMMARY: In a dryland barley yield trial, nine lines and varieties yielded significantly less than the check variety, Haxby. In an irrigated trial, three lines and varieties yielded significantly less than the check variety, Haxby.

FUNDING SUMMARY: Expenditure information to be provided by OSP. No other grants support this project.

MWBC FY2011 GRANT SUBMISSION PLANS: It is planned to submit this project for funding consideration in the next fiscal year.

Table 1. Agronomic data obtained from a malt barley yield trial conducted under dryland fallow conditions at the Eastern Agricultural Research Center, Sidney, Montana.

entry	heading*	heignt, cm	grain protein	test wt, lb/bu	percent plump	percent regular	yield, bu/ac	
Champion	67.7	70.0	11.77	50.5	88	10	76.1	
Haxby	67.7	71.0	13.76	49.0	81	17	73.2	
Conrad	68.0	61.3	11.60	48.5	91	8	70.5	
MT020155	66.0	71.0	11.97	49.0	87	10	67.2	
Goldeneye	65.3	72.3	12.78	47.0	64	32	67.1	
MT030042	66.7	67.7	11.45	50.5	81	15	67.0	
MT010158	67.3	68.3	11.78	50.5	89	9	66.6	
MT050030	70.0	73.3	12.51	48.5	84	13	65.4	x
MT010160	67.7	74.7	15.15	45.0	55	39	65.3	x
Pinnacle	66.3	66.0	16.21	50.0	92	7	65.0	x
BZ596117	68.7	68.7	14.91	50.0	84	13	65.0	x
Geraldine	69.7	70.7	13.26	50.0	83	14	64.8	x
Harrington	69.0	73.3	13.89	45.0	78	19	63.7	x
Metcalfe	68.3	73.0	12.61	47.0	81	17	62.5	x
Gallatin	67.0	72.0	15.01	47.0	70	25	60.8	x
Hockett	66.0	68.7	11.70	49.0	88	10	59.7	x
Average	67.6	70.1	13.15	48.5	81	16	66.2	
probability	<0.001	0.072					0.014	
CV (S/mean)	1.3	6.1					6.9	
CV (SE/mean)	0.8	3.5					4.0	
LSD (0.05)	1.5	7.1					7.7	

*days from planting

x indicates significantly lower yield than check variety, Haxby

Table 2. Relative yielding abilities of malt barley varieties in bu/ac as compared to Haxby when grown under dryland conditions at the EARC, Sidney, Montana.

Variety	2006	2007	2008	2009	2010	Ave	as % of Haxby
Champion	--	--	66.9	59.2	76.1	67.4	115.2
MT030042	--	--	--	60.0	67.0	63.5	112.8
Conrad	82.3	86.7	60.5	47.7	70.5	69.5	104.9
MT010158	--	--	64.4	53.0	66.6	61.3	104.8
MT020155	--	--	65.4	50.7	67.5	61.2	104.6
Gallatin	--	--	--	56.7	60.8	58.8	104.4
Pinnacle	--	--	52.8	61.9	65.0	59.9	102.4
Goldeneye	--	--	--	47.0	67.1	57.1	101.3
Geraldine	76.4	81.8	60.6	49.5	64.8	66.6	100.5
Haxby	81.1	74.8	62.9	39.4	73.2	66.3	100.0
Metcalfe	85.8	75.3	49.6	47.7	62.5	64.2	96.8
Hockett	81.6	67.8	57.1	48.7	59.7	63.0	95.0
Harrington	73.5	71.8	54.2	47.1	63.7	62.1	93.6
MT050030	--	--	--	--	65.4	65.4	89.3
MT010160	--	--	--	--	65.3	65.3	89.2
BZ596117	--	--	--	--	65.0	65.0	88.8

NOTE: Average yields in this summary should not be compared to each other since they are not grown in the same years. Compare only to the check variety.

Table 3. Relative test weights of malt barley varieties in lb/bu as compared to Haxby when grown under dryland conditions at the EARC, Sidney, Montana.

Variety	2006	2007	2008	2009	2010	Ave	as % of Haxby
BZ596117	--	--	--	--	50.0	50.0	102.0
MT030042	--	--	--	52.0	50.5	51.3	102.0
Haxby	53.0	52.0	50.2	51.5	49.0	51.1	100.0
MT050030	--	--	--	--	48.5	48.5	99.0
Champion	--	--	46.8	50.7	50.5	49.3	98.2
Pinnacle	--	--	47.7	50.2	50.0	49.3	98.1
Gallatin	--	--	--	51.0	47.0	49.0	97.5
MT020155	--	--	47.7	50.2	49.0	49.0	97.5
MT010158	--	--	47.0	49.2	50.5	48.9	97.3
Hockett	50.8	50.7	47.0	50.2	49.0	49.5	96.9
Metcalfe	50.5	50.2	45.5	50.0	47.0	48.6	95.1
Goldeneye	--	--	--	48.5	47.0	47.8	95.0
Conrad	48.7	50.0	45.7	49.8	48.5	48.5	94.9
Geraldine	48.0	50.7	44.8	48.7	50.0	48.4	94.7
Harrington	46.8	50.0	44.5	49.0	45.0	47.1	92.0
MT010160	--	--	--	--	45.0	45.0	91.8

NOTE: Average test weights in this summary should not be compared to each other since they are not grown in the same years. Compare only to the check variety.

Table 4. Relative protein contents of malt barley varieties in percent as compared to Haxby when grown under dryland conditions at the EARC, Sidney, Montana.

Variety	2006	2007	2008	2009	2010	Ave	as % of Haxby
MT010160	--	--	--	--	15.2	15.2	110.1
BZ596117	--	--	--	--	14.9	14.9	108.0
Gallatin	--	--	--	13.6	15.0	14.3	101.1
Haxby	12.8	13.0	14.7	14.5	13.8	13.8	100.0
Pinnacle	--	--	13.6	11.8	16.2	13.9	96.7
Metcalfe	12.2	11.1	16.0	14.2	12.6	13.2	96.1
Harrington	11.8	10.5	15.0	14.4	13.9	13.1	95.3
Geraldine	12.2	10.9	15.9	13.2	13.3	13.1	95.2
Conrad	12.3	11.9	16.1	13.0	11.6	13.0	94.3
Hockett	11.3	11.3	14.4	14.0	11.7	12.5	91.1
MT050030	--	--	--	--	12.5	12.5	90.6
Goldeneye	--	--	--	12.8	12.8	12.8	90.5
MT020155	--	--	13.0	13.6	12.0	12.9	89.8
MT010158	--	--	13.6	13.1	11.8	12.8	89.5
Champion	--	--	13.1	12.7	11.8	12.5	87.4
MT030042	--	--	--	12.8	11.4	12.1	85.5

NOTE: Average protein percents in this summary should not be compared to each other since they are not grown in the same years. Compare only to the check variety.

Table 5. Relative percent plump of malt barley varieties as compared to Haxby when grown under dryland conditions at the EARC, Sidney, Montana.

Variety	2006	2007	2008	2009	2010	Ave	as % of Haxby
Pinnacle	--	--	74	99	92	88.3	118.3
Hockett	87	88	55	94	88	82.4	108.7
Metcalfe	89	87	47	97	81	80.2	105.8
MT010158	--	--	54	94	89	79.0	105.8
Conrad	81	88	43	95	91	79.6	105.0
MT020155	--	--	54	94	87	78.3	104.9
Champion	--	--	48	97	88	77.7	104.0
MT050030	--	--	--	--	84	84.0	103.7
BZ596117	--	--	--	--	84	84.0	103.7
Harrington	74	89	49	95	78	77.0	101.6
MT030042	--	--	--	97	81	89.0	100.6
Haxby	73	82	47	96	81	75.8	100.0
Gallatin	--	--	--	95	70	82.5	93.2
Geraldine	60	76	37	91	83	69.4	91.6
Goldeneye	--	--	--	90	64	77.0	87.0
MT010160	--	--	--	--	55	55.0	67.9

NOTE: Average plump percents in this summary should not be compared to each other since they are not grown in the same years. Compare only to the check variety.

Table 6. Agronomic data obtained from a malt barley yield trial conducted under flood irrigated conditions at the Eastern Agricultural Research Center, Sidney, Montana.

entry	heading*	height, cm	lodging index	grain protein %	test wt, lb/bu	% plump	% regular	yield, bu/ac	
MT050030	50.0	76.3	1.7	12.19	49.0	90.0	8.0	117.2	
Conrad	50.7	71.0	1.0	12.10	49.0	93.0	6.0	117.0	
MT020155	47.7	76.7	3.0	11.59	48.0	85.0	13.0	113.4	
Champion	49.3	73.7	1.7	12.47	50.0	93.0	6.0	112.8	
Haxby	49.0	68.3	1.7	12.13	50.5	90.0	8.0	112.3	
Gallatin	49.0	76.3	2.3	11.55	49.5	86.0	11.0	111.6	
Geraldine	51.0	71.7	0.3	10.94	50.0	90.0	8.0	111.0	
BZ596117	50.0	72.7	1.0	12.92	51.0	94.0	5.0	109.8	
Hockett	49.0	74.0	3.0	11.24	49.5	90.0	8.0	107.3	
Metcalfe	50.0	78.3	2.0	12.32	49.5	91.0	8.0	105.5	
MT030042	48.7	69.7	3.3	10.91	49.5	86.0	12.0	102.3	
Harrington	50.3	74.0	3.3	11.61	48.5	92.0	7.0	101.5	
Pinnacle	49.0	73.0	1.3	11.39	48.5	97.0	3.0	100.9	
Goldeneye	48.0	73.0	2.0	11.79	47.0	82.0	16.0	95.5	x
MT010160	51.0	79.0	4.3	11.12	49.0	89.0	9.0	92.2	x
MT010158	50.0	73.3	2.7	13.08	48.0	88.0	11.0	83.1	x
Average	49.5	73.8	2.2	11.8	49.2	89.8	8.7	105.8	
probability	<0.001	0.240	<0.001					<0.001	
CV (S/mean)	0.8	6.0	41.2					6.8	
CV (SE/mean)	0.5	3.5	23.8					3.9	
LSD (0.05)	0.7	7.4	1.5					12.0	

*days from planting

x indicates significantly lower yield than check variety, Haxby

Table 7. Relative yielding abilities of malt barley varieties in bu/ac as compared to Haxby grown under irrigation at the Eastern Agricultural Research Center, Sidney, Montana.

Cultivar	2006	2007	2008	2009	2010	Ave	as % of Haxby
Champion	--	--	150.9	143.5	112.8	135.7	106.5
MT050030	--	--	--	--	117.2	117.2	104.4
Geraldine	98.8	56.8	139.4	136.7	111.0	108.5	100.7
Haxby	97.6	59.0	122.1	148.0	112.3	107.8	100.0
Conrad	109.2	62.0	119.4	129.7	117.0	107.5	99.7
BZ596117	--	--	--	--	109.8	109.8	97.8
MT020155	--	--	122.4	133.3	113.4	123.0	96.5
Hockett	98.9	52.1	132.5	126.2	107.3	103.4	95.9
Metcalfe	94.1	52.0	115.2	138.2	105.5	101.0	93.7
Harrington	93.5	67.2	110.0	131.3	101.5	100.7	93.4
Pinnacle	--	--	109.1	142.6	100.9	117.5	92.2
Gallatin	--	--	--	127.1	111.6	119.4	91.7
Goldeneye	--	--	--	136.7	95.5	116.1	89.2
MT030042	--	--	--	125.4	102.3	113.9	87.5
MT010158	--	--	120.9	122.7	83.1	108.9	85.4
MT010160	--	--	--	--	92.2	92.2	82.1

NOTE: Average yields in this summary should not be compared to each other since they are not grown in the same years. Compare yields only to the check variety. Hail damage in 2007.

Table 8. Relative test weights of malt barley varieties in lb/bu as compared to Haxby grown under irrigation at the Eastern Agricultural Research Center, Sidney, Montana.

Cultivar	2006	2007	2008	2009	2010	Ave	as % of Haxby
BZ596117	--	--	--	--	51.0	51.0	101.0
Haxby	49.8	49.5	54.3	52.2	50.5	51.3	100.0
Champion	--	--	53.2	51.3	50.0	51.5	98.4
Geraldine	48.0	49.2	53.2	51.3	50.0	50.3	98.2
Gallatin	--	--	--	51.2	49.5	50.4	98.1
MT050030	--	--	--	--	49.0	49.0	97.0
MT010160	--	--	--	--	49.0	49.0	97.0
Pinnacle	--	--	53.0	50.8	48.5	50.8	97.0
MT030042	--	--	--	50.0	49.5	49.8	96.9
Metcalfe	47.8	47.3	51.8	50.8	49.5	49.4	96.4
Conrad	48.8	46.8	51.7	50.2	49.0	49.3	96.2
Hockett	48.3	46.5	52.2	50.0	49.5	49.3	96.2
MT010158	--	--	51.7	50.0	48.0	49.9	95.4
MT020155	--	--	52.5	49.0	48.0	49.8	95.2
Harrington	47.7	47.3	51.0	49.3	48.5	48.8	95.1
Goldeneye	--	--	--	48.8	47.0	47.9	93.3

NOTE: Average test weights in this summary should not be compared to each other since they are not grown in the same years. Compare test weights only to the check variety. Hail damage in 2007.

Table 9. Relative protein contents of malt barley varieties in percent as compared to Haxby grown under irrigation at the Eastern Agricultural Research Center, Sidney, Montana.

Cultivar	2006	2007	2008	2009	2010	Ave	as % of Haxby
BZ596117	--	--	--	--	12.9	12.9	106.6
Conrad	12.4	13.2	11.5	13.7	12.1	12.6	101.5
MT050030	--	--	--	--	12.2	12.2	100.8
Haxby	12.0	12.4	12.2	13.3	12.1	12.4	100.0
Metcalfe	12.2	13.1	11.3	12.4	12.3	12.3	98.9
Champion	--	--	11.4	13.2	12.5	12.4	98.7
Geraldine	11.8	13.3	12.3	12.0	10.9	12.1	97.3
Harrington	11.0	12.6	11.4	12.9	11.6	11.9	96.0
Hockett	10.9	11.9	12.1	13.0	11.2	11.8	95.3
Gallatin	--	--	--	12.5	11.6	12.1	94.9
MT010158	--	--	11.5	11.0	13.1	11.9	94.7
MT030042	--	--	--	13.1	10.9	12.0	94.5
MT010160	--	--	--	--	11.1	11.1	91.7
MT020155	--	--	10.1	12.1	11.6	11.3	89.9
Goldeneye	--	--	--	11.0	11.8	11.4	89.8
Pinnacle	--	--	10.4	11.0	11.4	10.9	87.2

NOTE: Average protein contents in this summary should not be compared to each other since they are not grown in the same years. Compare protein contents only to the check variety. Hail damage in 2007.

Table 10. Relative plump percent of malt barley varieties as compared to Haxby grown under irrigation at the Eastern Agricultural Research Center, Sidney, Montana.

Cultivar	2006	2007	2008	2009	2010	Ave	as % of Haxby
BZ596117	--	--	--	--	94	94.0	104.4
Pinnacle	--	--	96	94	97	95.7	104.0
Conrad	89	87	93	88	93	90.0	103.9
Metcalfe	87	84	92	91	91	89.0	102.8
Harrington	90	83	89	84	92	87.6	101.2
Hockett	87	81	91	88	90	87.4	100.9
Champion	--	--	94	90	93	92.3	100.4
Geraldine	79	81	92	92	90	86.8	100.2
Haxby	76	81	94	92	90	86.6	100.0
MT050030	--	--	--	--	90	90.0	100.0
MT010160	--	--	--	--	89	89.0	98.9
MT010158	--	--	91	93	88	90.7	98.6
MT020155	--	--	94	88	85	89.0	96.7
Gallatin	--	--	--	87	86	86.5	95.1
MT030042	--	--	--	84	86	85.0	93.4
Goldeneye	--	--	--	87	82	84.5	92.9

NOTE: Average protein contents in this summary should not be compared to each other since they are not grown in the same years. Compare protein contents only to the check variety. Hail damage in 2007.

Table 11. Relative lodging indices of malt barley varieties as compared to Haxby grown under irrigation at the Eastern Agricultural Research Center, Sidney, Montana.

Cultivar	2006	2007	2008	2009	2010	Ave	as % of Haxby
MT010160	--	--	--	--	4.3	4.3	252.9
Harrington	0.3	0.0	0.3	4.5	3.3	1.7	210.0
Hockett	0.0	0.0	0.7	3.7	3.0	1.5	185.0
Goldeneye	--	--	--	3.7	2.0	2.9	154.1
MT010158	--	--	2.0	1.0	2.7	1.9	154.1
MT030042	--	--	--	2.3	3.3	2.8	151.4
MT020155	--	--	0.7	1.3	3.0	1.7	135.1
Gallatin	--	--	--	2.5	2.3	2.4	129.7
Metcalfe	0.0	0.0	0.0	2.3	2.0	0.9	107.5
Haxby	0.3	0.0	0.0	2.0	1.7	0.8	100.0
MT050030	--	--	--	--	1.7	1.7	100.0
Conrad	0.0	0.0	0.3	2.0	1.0	0.7	82.5
Champion	--	--	0.3	0.7	1.7	0.9	73.0
BZ596117	--	--	--	--	1.0	1.0	58.8
Pinnacle	--	--	0.0	0.0	1.3	0.4	35.1
Geraldine	0.0	0.0	0.3	0.3	0.3	0.2	22.5

NOTE: Average lodging indices in this summary should not be compared to each other since they are not grown in the same years. Compare protein contents only to the check variety. Hail damage in 2007.