PROJECT TITLE: Evaluation of malt barley varieties under irrigated and dryland conditions – 2005

PROJECT LEADER:

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PROJECT PERSONNEL:

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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.

RESULTS:

Dryland site:

Soil type: Williams clay loam
Previous crops: 2004 - fallow, 2003 - safflower. 2002 - small grain plots
Residual soil N to 3 ft: 65 lb N/ac
Residual soil P to 6 in: 34 ppm
Applied fertilizer: None
Herbicides: 1.5 pt/ac Bronate applied June 7
Precipitation April – August, 2005: 9.01 inches
Ave (57 yr) precipitation April – August: 9.45 inches
Precipitation September 2004 – August 2005: 12.95 inches
Ave (57 yr) precipitation September – August: 13.83 inches

Sprinkler irrigated site:

Previous crops: 2004 – sugarbeets, 2003 – small grain, 2002 – potatoes
Residual soil N to 3 ft: 42 lb N/ac
Residual soil P to 6 in: 36 ppm
Applied fertilizer: 80 liquid N (28-0-0) applied November 8, 2004
Irrigated (sprinkler) on: May 4 and June 20
Herbicides: 1.75 pt/ac Bronate applied June 3
Fungicide: Tilt 2 oz and Folicur 3 oz applied July 5

Flood irrigated site:

Previous crops: 2004 – grain corn, 2003 – dry beans, 2002 – small grain plots
Residual soil N to 3 ft: 20 lb N/ac
Residual soil P to 6 in: 28 ppm
Applied fertilizer: 80 lb liquid N (28-0-0) applied November 1, 2004
Irrigated (flood) on: June 11
Herbicides: 1.75 pt/ac Bronate applied June 3
Fungicide: Tilt 2 oz and Folicur 3 oz applied July 1
Precipitation April – August, 2005: 10.04 inches
Ave (57 yr) precipitation April – August: 9.45 inches
Precipitation September 2004 – August 2005: 14.48 inches
Ave (57 yr) precipitation September – August: 13.83 inches

Dryland: Agronomic data from a dryland malt barley yield trial conducted in cooperation with the barley breeder in Bozeman are shown in Table 1. Haxby and Stellar yielded significantly more than the check variety, Harrington. Hays yielded significantly less than Harrington. Five-year summaries for yield, test weight, protein content and percent plump seed are shown in Tables 2-5.

Irrigated: Agronomic data from an irrigated malt barley yield trial conducted in cooperation with the barley breeder in Bozeman are shown in Table 6. Seventeen lines and varieties yielded significantly more than the check variety, Harrington. Five-year summaries for yield, test weight, protein content, percent plump, and lodging are shown in Tables 7-11.

A malt barley yield trial was grown under sprinkler (Table 12) and flood (Table 13) irrigated conditions in cooperation with barley breeders from North Dakota State University in Fargo. Lacey, Stellar and Conlon were the highest-yielding named varieties under sprinkler irrigation and Lacey, Conlon and Drummond were the highest-yielding named varieties under flood irrigation. Protein contents were higher under sprinkler irrigation than under flood irrigation.

SUMMARY: The experiments reported under this project are all of the replicated small plot type. Twenty-three lines and varieties of malt barley were tested under dryland conditions and 22 lines and varieties were tested under sprinkler irrigation in cooperation with the barley breeder at Montana State University in Bozeman. Twenty-five lines and varieties were tested under flood and sprinkler irrigation in cooperation with the barley breeders from North Dakota State University in Fargo.

FUTURE PLANS: New experimental lines and varieties of malt barley will continue to be tested under dryland and irrigated conditions to identify those which will perform best in eastern Montana. Closer cooperation with North Dakota State University will allow testing of experimental lines from North Dakota as well as from Montana, so that when those lines are released as varieties, information will be available as to their performance in this region.

Table 1. Agronomic data obtained from a statewide malt barley yield trial grown under dryland fallow conditions at the MSU Eastern Agricultural Research Center, Sidney, MT
Planted: April 13 Harvested: July 29

Entry	heading*	height, inches	grain protein	test weight	% plump	% regular	yield, bu/a	
Haxby	68.7	29.4	10.71	50.3	85	13	84.5	a
Steller	65.3	30.0	9.99	47.5	86	13	83.8	a
Eslick	70.0	26.8	9.86	48.2	79	19	81.9	
Legacy	66.3	28.5	10.18	46.0	66	31	80.1	
Conrad	71.3	24.5	9.83	47.8	92	7	77.8	
Kendall	70.0	27.2	10.01	47.5	94	6	77.1	
Xena	70.3	27.3	10.37	48.5	84	14	76.7	
Craft	67.3	29.4	10.96	50.7	89	9	76.4	
Geraldine	72.0	25.7	10.23	49.7	80	17	75.2	
Harrington	70.3	27.0	10.12	45.8	86	12	74.7	
Metcalfe	68.3	29.0	10.48	47.7	88	11	74.5	
Morex	65.0	31.0	11.28	46.0	67	29	74.4	
Calgary	71.7	22.8	9.94	47.0	70	26	74.3	
MT970229	70.3	27.1	10.86	50.8	93	7	73.7	
Drummond	65.7	29.6	10.51	47.5	80	18	73.1	
Hockett	68.0	25.9	9.70	50.0	94	5	72.7	
Copeland	70.3	28.2	10.10	45.5	86	12	72.5	
Robust	65.7	29.9	10.97	48.5	80	18	72.4	
Baronesse	71.3	26.1	10.07	48.5	79	18	71.1	
Tradition	67.3	27.5	9.54	48.3	88	11	71.0	
Merit	70.7	26.4	10.58	45.5	89	9	70.2	
Boulder	69.7	24.4	10.34	51.3	94	5	67.3	
Hays	70.0	24.6	11.49	46.8	76	20	63.6	x
Average	68.9	27.3	10.35	48.1	1 rep	1 rep	74.7	
Probability	<0.001	<0.001	0.013	<0.001			0.001	
CV (S/mean)	1.0	5.5	5.7	1.5			6.6	
CV (SE/mean)	0.6	3.2	3.3	0.9			3.8	
LSD (0.05)	1.1	2.5	0.98	1.2			8.2	

* days from planting
a indicates significantly greater yield than check variety, Harrington, at probability of 0.05
x indicates significantly lower yield than check variety, Harrington, at probability of 0.05

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

Variety	2001	2002	2003[1]	2003[2]	2004	2005	Ave	as % of Harrington
Stellar	--	--	--	--	--	83.8	83.8	112.2
Haxby	--	--	85.3	--	111.4	84.5	93.7	111.7
Eslick	--	--	--	--	--	81.9	81.9	109.6
Craft	69.8	57.9	89.3	76.6	104.0	76.4	79.0	108.4
Baronesse	69.2	62.5	85.4	74.9	106.1	71.1	78.2	107.3
Hockett	--	--	87.1	--	107.8	72.7	89.2	106.3
Tradition	63.4	53.2	91.9	--	103.0	71.0	76.5	105.0
Conrad	--	--	--	--	--	77.8	77.8	104.1
Kendall	--	56.5	--	76.5	105.2	77.1	78.8	103.8
Xena	--	--	--	--	--	76.7	76.7	102.7
Metcalfe	--	59.6	--	72.7	103.8	74.5	77.7	102.2
Geraldine	--	--	--	--	--	75.2	75.2	100.7
Legacy	55.4	47.1	78.6	70.9	107.5	80.1	73.3	100.5
Harrington	61.3	51.3	72.2	72.9	104.9	74.7	72.9	100.0
Calgary	--	--	--	--	--	74.3	74.3	99.5
Drummond	--	57.7	--	68.8	101.4	73.1	75.3	99.1
MT970229	--	--	--	--	--	73.7	73.7	98.7
Robust	58.9	57.3	--	66.3	98.9	72.4	70.8	96.9
Copeland	--	--	--	--	100.6	72.5	86.6	96.4
Merit	59.4	51.1	77.7	61.0	98.2	70.2	69.6	95.5
Morex	44.4	62.6	--	62.3	101.7	74.4	69.1	94.6
Boulder	--	--	--	--	--	67.3	67.3	90.1
Hays	--	--	--	--	--	63.6	63.6	85.1

[1] Intrastate trial [2] malt barley trial

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 as compared to Harrington when grown under dryland conditions at the EARC, Sidney, Montana.

Variety	2001	2002	2003[1]	2003[2]	2004	2005	Ave	as % of Harrington
Boulder	--	--	--	--	--	51.3	51.3	112.0
MT970229	--	--	--	--	--	50.8	50.8	110.9
Haxby	--	--	52.3	--	52.8	50.3	51.8	108.6
Geraldine	--	--	--	--	--	49.7	49.7	108.5
Craft	48.7	49.5	51.5	51.3	51.7	50.7	50.6	107.7
Hockett	--	--	50.8	--	51.0	50.0	50.6	106.1
Xena	--	--	--	--	--	48.5	48.5	105.9
Eslick	--	--	--	--	--	48.2	48.2	105.2
Conrad	--	--	--	--	--	47.8	47.8	104.4
Drummond	--	47.0	--	50.3	50.0	47.5	48.7	104.0
Stellar	--	--	--	--	--	47.5	47.5	103.7
Baronesse	48.7	47.5	48.3	48.0	50.0	48.5	48.5	103.3
Metcalfe	--	47.0	--	48.2	50.0	47.7	48.2	103.0
Calgary	--	--	--	--	--	47.0	47.0	102.6
Robust	45.1	45.8	--	51.0	50.0	48.5	48.1	102.6
Hays	--	--	--	--	--	46.8	46.8	102.2
Tradition	45.5	47.3	49.5	--	49.7	48.3	48.1	102.1
Kendall	--	44.3	--	48.0	49.8	47.5	47.4	101.2
Morex	45.2	46.3	--	48.8	49.3	46.0	47.1	100.6
Legacy	45.2	46.7	47.7	48.5	48.7	46.0	47.1	100.4
Harrington	47.0	45.3	47.3	46.2	50.0	45.8	46.9	100.0
Copeland	--	--	--	--	48.5	45.5	47.0	98.1
Merit	45.8	44.3	46.7	44.0	45.8	45.5	45.4	96.6

[1] Intrastate trial [2] malt barley trial

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 as compared to Harrington when grown under dryland conditions at the EARC, Sidney, Montana.

Variety	2001	2002	2003[1]	2003[2]	2004	2005	Ave	as % of Harrington
Hays	--	--	--	--	--	11.5	11.5	113.9
MT970229	--	--	--	--	--	10.9	10.9	107.9
Craft	10.6	12.8	12.6	13.3	13.1	11.0	12.2	107.5
Morex	11.4	12.6	--	12.3	12.8	11.3	12.1	105.8
Metcalfe	--	12.6	--	13.3	12.5	10.5	12.2	105.2
Haxby	--	--	11.5	--	12.7	10.7	11.6	104.8
Baronesse	10.7	12.5	12.6	12.9	12.5	10.1	11.9	104.4
Kendall	--	13.8	--	12.0	12.3	10.0	12.0	103.4
Xena	--	--	--	--	--	10.4	10.4	103.0
Robust	10.4	12.5	--	12.4	12.4	11.0	11.7	102.8
Merit	10.9	12.8	11.7	12.3	11.9	10.6	11.7	102.8
Boulder	--	--	--	--	--	10.3	10.3	102.0
Geraldine	--	--	--	--	--	10.2	10.2	101.0
Harrington	10.6	12.3	11.2	12.1	12.0	10.1	11.4	100.0
Copeland	--	--	--	--	12.0	10.1	11.1	100.0
Drummond	--	11.3	--	12.3	12.4	10.5	11.6	100.0
Tradition	10.2	11.6	12.0	--	12.6	9.5	11.2	99.5
Legacy	11.0	12.2	11.7	11.2	11.6	10.2	11.3	99.4
Stellar	--	--	--	--	--	10.0	10.0	99.0
Hockett	--	--	11.6	--	11.6	9.7	11.0	98.8
Eslick	--	--	--	--	--	9.9	9.9	98.0
Calgary	--	--	--	--	--	9.9	9.9	98.0
Conrad	--	--	--	--	--	9.8	9.8	97.0

[1] Intrastate trial [2] malt barley trial

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 Harrington when grown under dryland conditions at the EARC, Sidney, Montana.

Variety	2001	2002	2003[1]	2003[2]	2004	2005	Ave	as % of Harrington
Craft	91	82	72	73	94	89	83.5	111.6
Boulder	--	--	--	--	--	94	94.0	109.3
MT970229	--	--	--	--	--	93	93.0	108.1
Conrad	--	--	--	--	--	92	92.0	107.0
Kendall	--	62	--	58	94	94	77.0	106.9
Drummond	--	65	--	74	86	80	76.3	105.9
Robust	79	67	--	77	84	80	77.4	104.3
Hockett	--	--	73	--	95	94	87.3	102.7
Copeland	--	--	--	--	94	86	90.0	101.7
Tradition	97	69	70	--	89	88	82.6	101.0
Harrington	83	71	78	40	91	86	74.8	100.0
Metcalfe	--	66	--	42	92	88	72.0	100.0
Stellar	--	--	--	--	--	86	86.0	100.0
Merit	80	69	73	40	88	89	73.2	97.8
Xena	--	--	--	--	--	84	84.0	97.7
Haxby	--	--	63	--	91	85	79.7	93.7
Geraldine	--	--	--	--	--	80	80.0	93.0
Legacy	83	74	57	56	80	66	69.3	92.7
Eslick	--	--	--	--	--	79	79.0	91.9
Hays	--	--	--	--	--	76	76.0	88.4
Morex	76	42	--	57	80	67	64.4	86.8
Baronesse	82	63	36	23	88	79	61.8	82.6
Calgary	--	--	--	--	--	70	70.0	81.4

[1] Intrastate trial [2] malt barley trial

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 statewide malt barley yield trial grown under sprinkle irrigated conditions at the MSU Eastern Agricultural Research Center, Sidney, MT
Planted: April 28 Harvested: August 15

Entry	heading*	height, inches	lodging index	grain protein	test weight	% plump	% regular	yield, bu/a	
Conrad	59.0	31.8	0.3	13.35	51.0	95	4	129.3	a
Copeland	59.0	36.6	1.3	12.12	49.3	90	8	128.7	a
Geraldine	59.3	31.9	0.7	13.30	50.8	84	13	128.5	a
Xena	59.7	35.5	0.0	13.10	49.7	89	7	125.3	a
Eslick	58.7	35.7	1.3	13.62	50.3	89	7	125.2	a
Calgary	58.3	27.4	0.0	14.60	49.2	83	13	125.1	a
Baronesse	58.7	31.6	1.0	13.70	50.2	93	5	121.6	a
Boulder	58.0	34.0	0.0	14.22	51.0	93	6	121.0	a
Haxby	57.0	34.9	0.0	13.95	51.2	91	7	120.8	a
Metcalfe	58.3	35.3	0.3	12.82	50.2	94	4	120.8	a
Drummond	55.7	37.1	0.0	14.44	47.5	94	5	118.4	a
Legacy	56.7	35.5	0.0	14.13	48.3	97	3	117.6	a
Hockett	57.0	33.6	0.3	13.18	50.8	95	4	115.0	a
Kendall	59.3	33.7	0.3	13.48	50.5	94	4	114.9	a
Craft	57.0	37.9	1.3	14.19	50.7	92	5	113.5	a
Tradition	56.0	35.7	0.0	14.15	49.0	96	4	113.2	a
MT970229	57.0	34.1	0.0	14.10	50.3	91	7	112.6	a
Merit	59.3	36.1	1.0	12.68	47.7	90	8	108.4	
Morex	55.0	37.5	1.3	14.46	47.7	92	6	107.0	
Robust	56.3	37.8	0.0	14.49	48.8	95	4	106.6	
Harrington	58.3	34.3	6.0	12.70	47.0	85	12	97.2	
Hays	58.3	32.4	4.4	13.28	46.0	78	17	94.2	
Average	57.8	34.6	0.9	13.64	49.4	1 rep	1 rep	116.6	
Probability	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	
CV (S/mean)	0.9	4.1	103.6	4.1	1.5			6.079	
CV (SE/mean)	0.5	2.3	59.8	2.4	0.9			3.51	
LSD (0.05)	0.8	2.3	1.5	0.92	1.3			11.7	

*days from planting
a indicates significantly greater yield than check variety, Harrington, at probability of 0.05

Table 7. Relative yielding abilities of malt barley varieties grown under irrigation at the Eastern Ag Research Center, Sidney, Montana.

Cultivar	2001	2002	2003[1]	2003[2]	2004	2005	Ave	as % of Harrington
Conrad	--	--	--	--	--	129.3	129.3	133.0
Xena	--	--	--	--	--	125.3	125.3	128.9
Eslick	--	--	--	--	--	125.2	125.2	128.8
Calgary	--	--	--	--	--	125.1	125.1	128.7
Boulder	--	--	--	--	--	121.0	121.0	124.5
Stellar	--	--	--	--	--	123.2	123.2	121.3
Legacy	92.8	94.2	130.4	142.3	151.2	117.6	121.4	119.8
Baronesse	82.4	86.0	137.3	144.2	138.4	121.6	118.3	116.7
Tradition	90.5	89.0	131.0	--	141.8	113.2	113.1	116.0
MT970229	--	--	--	--	--	112.6	112.6	115.8
Geraldine	--	--	131.3	128.2	--	128.5	129.3	115.3
Haxby	--	--	128.3	--	144.4	120.8	131.2	114.7
Drummond	--	98.1	--	130.2	138.2	118.4	121.2	113.9
Copeland	--	--	--	--	126.9	128.7	127.8	113.9
Craft	--	--	137.0	131.1	128.1	113.5	127.4	109.9
Robust	80.7	87.3	--	119.5	127.4	106.6	104.3	106.5
Morex	75.2	88.2	--	123.4	127.5	107.0	104.3	106.5
Hockett	--	--	121.6	--	127.9	115.0	121.5	106.2
Kendall	79.5	80.0	--	118.5	125.6	114.9	103.7	105.9
Merit	72.5	77.2	121.6	122.9	139.4	108.4	107.0	105.5
Metcalfe	--	78.8	--	117.5	122.2	120.8	109.8	103.2
Harrington	64.0	80.4	118.6	120.8	127.3	97.2	101.4	100.0
Hays	--	--	--	--	--	94.2	94.2	96.9

[1] Intrastate trial [2] malt barley trial

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.

Table 8. Relative test weights of malt barley varieties grown under irrigation at the Eastern Ag Research Center, Sidney, Montana.

Cultivar	2001	2002	2003[1]	2003[2]	2004	2005	Ave	as % of Harrington
Conrad	--	--	--	--	--	51.0	51.0	108.5
Boulder	--	--	--	--	--	51.0	51.0	108.5
Haxby	--	--	52.8	--	53.7	51.2	52.6	108.2
Eslick	--	--	--	--	--	50.3	50.3	107.0
MT970229	--	--	--	--	--	50.3	50.3	107.0
Craft	--	--	53.0	52.8	52.5	50.7	52.3	106.7
Hockett	--	--	51.3	--	52.0	50.8	51.4	105.8
Xena	--	--	--	--	--	49.7	49.7	105.7
Geraldine	--	--	51.3	52.5	--	50.8	51.5	105.2
Baronesse	43.8	47.2	52.0	51.7	51.0	50.2	49.3	104.9
Calgary	--	--	--	--	--	49.2	49.2	104.7
Kendall	43.9	46.0	--	50.0	50.7	50.5	48.2	103.7
Robust	42.5	48.2	--	50.2	49.7	48.8	47.9	103.0
Metcalfe	--	47.0	--	49.0	51.3	50.2	49.4	102.8
Copeland	--	--	--	--	49.2	49.3	49.3	102.6
Tradition	41.6	46.3	50.0	--	48.8	49.0	47.1	101.6
Stellar	--	--	--	--	--	47.3	47.3	100.6
Harrington	40.3	46.0	49.7	50.2	49.0	47.0	47.0	100.0
Drummond	--	46.7	--	48.3	48.8	47.5	47.8	99.5
Legacy	41.8	45.8	48.2	48.5	48.0	48.3	46.8	99.4
Merit	41.3	43.8	49.2	49.5	49.0	47.7	46.8	99.4
Morex	41.3	45.0	--	48.5	48.0	47.7	46.1	99.1
Hays	--	--	--	--	--	46.0	46.0	97.9

[1] Intrastate trial [2] malt barley trial

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.

Table 9. Relative protein contents of malt barley varieties grown under irrigation at the Eastern Ag Research Center, Sidney, Montana.

Cultivar	2001	2002	2003[1]	2003[2]	2004	2005	Ave	as % of Harrington
Calgary	--	--	--	--	--	14.6	14.6	115.0
Haxby	--	--	11.8	--	11.7	14.0	12.5	112.6
Craft	--	--	11.3	12.1	12.0	14.2	12.4	112.0
Boulder	--	--	--	--	--	14.2	14.2	111.8
MT970229	--	--	--	--	--	14.1	14.1	111.0
Drummond	--	12.6	--	11.2	11.5	14.4	12.4	109.0
Kendall	12.6	12.6	--	11.8	12.0	13.5	12.5	108.5
Morex	11.7	12.7	--	11.1	12.4	14.5	12.5	108.3
Robust	12.4	12.2	--	11.2	11.4	14.5	12.3	107.1
Eslick	--	--	--	--	--	13.6	13.6	107.1
Stellar	--	--	--	--	--	13.4	13.4	105.5
Metcalfe	--	12.7	--	11.5	10.9	12.8	12.0	105.0
Conrad	--	--	--	--	--	13.3	13.3	104.7
Hays	--	--	--	--	--	13.3	13.3	104.7
Tradition	10.6	12.3	10.5	--	11.6	14.2	11.8	104.0
Hockett	--	--	10.7	--	10.6	13.2	11.5	103.6
Xena	--	--	--	--	--	13.1	13.1	103.1
Baronesse	12.1	12.0	10.4	10.6	11.0	13.7	11.6	102.8
Legacy	12.5	11.7	10.0	10.0	10.6	14.1	11.5	101.5
Merit	12.1	11.7	10.2	11.3	10.9	12.7	11.5	101.5
Geraldine	--	--	10.2	11.0	--	13.3	11.5	101.5
Copeland	--	--	--	--	11.1	12.1	11.6	100.9
Harrington	12	11.6	10.3	11.0	10.3	12.7	11.3	100.0

[1] Intrastate trial [2] malt barley trial

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.

Table 10. Relative plump percent of malt barley varieties grown under irrigation at the Eastern Ag Research Center, Sidney, Montana.

Cultivar	2001	2002	2003[1]	2003[2]	2004	2005	Ave	as % of Harrington
Stellar	--	--	--	--	--	97	97.0	114.1
Conrad	--	--	--	--	--	95	95.0	111.8
Boulder	--	--	--	--	--	93	93.0	109.4
MT970229	--	--	--	--	--	91	91.0	107.1
Hockett	--	--	92	--	97	95	94.7	106.8
Kendall	82	84	--	91	95	94	89.2	105.2
Copeland	--	--	--	--	94	90	92.0	105.1
Haxby	--	--	92	--	96	91	93.0	104.9
Drummond	--	92	--	93	94	94	93.3	104.8
Xena	--	--	--	--	--	89	89.0	104.7
Eslick	--	--	--	--	--	89	89.0	104.7
Craft	--	--	94	93	95	92	93.5	104.2
Tradition	65	89	94	--	94	96	87.6	103.8
Metcalfe	--	89	--	88	95	94	91.5	102.8
Baronesse	77	93	85	90	90	93	88.0	102.5
Merit	92	78	93	87	87	90	87.8	102.3
Robust	64	92	--	91	90	95	86.4	101.9
Legacy	65	93	91	91	87	97	87.3	101.7
Harrington	68	88	91	93	90	85	85.8	100.0
Calgary	--	--	--	--	--	83	83.0	97.6
Geraldine	--	--	85	89	--	84	86.0	95.9
Morex	51	84	--	88	86	92	80.2	94.6
Hays	--	--	--	--	--	78	78.0	91.8

[1] Intrastate trial [2] malt barley trial

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.

Table 11. Relative lodging indices of malt barley varieties grown under irrigation at the Eastern Ag Research Center, Sidney, Montana.

Cultivar	2001	2002	2003[1]	2003[2]	2004	2005	Ave	as % of Harrington
Morex	6.7	4.2	--	5.7	2.7	1.3	4.1	176.1
Harrington		1.7	4.7	3.3	0.7	6.0	3.3	100.0
Kendall	5.2	0.3	--	3.3	0.0	0.3	1.8	77.8
Hays	--	--	--	--	--	4.4	4.4	73.3
Robust	6.0	0.3	--	0.3	1.0	0.0	1.5	65.0
Merit	6.3	1.3	0.7	1.3	0.0	1.0	1.8	64.6
Legacy	6.2	0.0	0.0	1.0	2.3	0.0	1.6	57.9
Tradition	5.0	--	0.3	--	1.3	0.0	1.7	57.9
Baronesse	5.3	0.3	0.3	1.0	0.0	1.0	1.3	48.2
Metcalfe	--	1.0	--	3.7	0.0	0.3	1.3	42.7
Eslick	--	--	--	--	--	1.3	1.3	21.7
Haxby	--	--	2.3	--	0.0	0.0	0.8	20.2
Copeland	--	--	--	--	0.0	1.3	0.7	19.4
Craft	--	--	0.0	1.3	0.0	1.3	0.7	17.7
Hockett	--	--	1.0	--	0.0	0.3	0.4	11.4
Geraldine	--	--	0.3	0.3	--	0.7	0.4	9.3
Conrad	--	--	--	--	--	0.3	0.3	5.0
Drummond	--	0.0	--	0.0	0.0	0.0	0.0	0.0
Xena	--	--	--	--	--	0.0	0.0	0.0
Calgary	--	--	--	--	--	0.0	0.0	0.0
Boulder	--	--	--	--	--	0.0	0.0	0.0
MT970229	--	--	--	--	--	0.0	0.0	0.0
Stellar	--	--	--	--	--	0.0	0.0	0.0

[1] Intrastate trial [2] malt barley trial

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.

Table 12. Agronomic data obtained from a malt barley yield trial grown under sprinkle irrigated conditions at the MSU Eastern Agricultural Research Center, Sidney, MT, in cooperation with breeders from NDSU.
Planted: April 28 Harvested: August 15

Entry	heading*	height, inches	grain protein	test wt, lb/bu	% plump	% regular	yield, bu/ac	
ND20299	54.3	34.6	12.46	47.3	96.3	3.3	130.8	a
6B00-1328	54.7	37.0	14.30	49.0	97.0	2.7	128.4	a
Lacey	54.3	34.4	13.81	49.0	96.7	2.7	128.1	a
M109	54.0	34.2	13.13	48.7	94.3	5.0	127.7	a
6B00-1323	55.7	33.9	13.89	48.0	94.7	4.3	123.6	a
Stellar	54.3	32.9	13.28	47.5	97.3	5.7	121.9	a
Conlon	54.0	34.1	13.86	49.7	96.7	3.0	120.0	a
Tradition	54.0	32.9	13.68	48.3	95.7	3.7	118.8	a
Bowman	54.0	31.6	14.32	49.0	91.3	7.0	118.0	a
ND20314	54.0	36.1	14.68	46.5	95.3	4.0	117.6	a
ND20664	54.3	30.8	13.92	47.0	97.3	2.7	117.4	a
ND20303	54.0	34.0	12.91	46.7	95.7	3.3	117.2	a
Stander	55.0	33.1	13.68	48.0	95.0	4.0	116.9	a
Drummond	54.3	34.7	14.15	46.7	95.7	4.3	116.6	a
Legacy	55.7	34.3	14.14	48.0	96.0	4.0	116.4	a
Foster	54.0	34.5	12.97	46.8	95.3	4.3	116.3	a
ND19655	54.0	31.1	12.59	48.0	95.7	4.0	116.3	a
ND19620	54.0	34.6	13.62	48.0	96.3	3.0	112.9	a
Robust	54.3	33.3	14.01	47.2	94.3	5.0	111.5	a
ND20448	54.0	37.5	13.82	48.2	97.0	2.7	110.1	a
ND20508	54.7	33.6	13.42	48.0	94.3	4.7	103.4	
ND20666	54.7	32.3	14.76	47.0	97.0	3.0	100.5	
AC Metcalfe	57.0	33.2	13.37	48.3	88.7	10.0	99.3	
Morex	54.0	38.1	14.25	45.8	85.3	12.3	99.1	
ND19119	54.0	32.2	12.82	46.2	93.3	6.0	85.0	x
Average	54.5	34.0	13.67	47.7	94.9	4.6	115.0	
Probability	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
CV (S/mean)	0.7	4.0	3.2	1.7	2.4	47.7	5.3	
CV (SE/mean)	0.4	2.3	1.8	1.0	1.4	27.5	3.1	
LSD (0.05)	0.6	2.2	0.72	1.3	3.7	3.6	10.0	

*days from planting
a indicates significantly greater yield than check variety, Morex, at probability of 0.05
x indicates significantly lower yield than check variety, Morex, at probability of 0.05

Table 13. Agronomic data obtained from a malt barley yield trial grown under flood irrigated conditions at the MSU Eastern Agricultural Research Center, Sidney, MT, in cooperation with breeders from NDSU.
Planted: April 28 Harvested: August 8

Entry	heading*	height, inches	grain protein	test wt, lb/bu	% plump	% regular	yield, bu/ac	
M109	56.0	33.2	10.59	47.0	88.7	10.3	138.0	a
ND20299	55.7	34.1	10.67	45.8	94.3	5.0	134.6	a
Lacey	55.3	34.9	10.87	47.5	92.0	7.3	131.0	a
Conlon	53.3	33.5	12.44	49.8	97.0	3.0	128.7	a
Drummond	56.0	34.9	12.29	46.7	91.0	8.0	126.8	a
6B00-1323	55.7	32.4	12.74	46.8	89.7	9.3	126.5	a
ND19620	54.7	36.3	11.98	47.5	93.3	5.7	125.8	a
Foster	55.0	34.6	11.33	46.0	91.7	7.3	124.7	a
ND20314	53.7	34.4	12.15	46.8	92.0	7.0	124.1	a
ND20303	55.3	35.6	11.41	46.7	95.0	4.3	123.9	a
ND19655	56.0	32.8	10.83	46.0	91.3	7.7	123.5	a
Tradition	54.7	34.0	11.52	47.0	91.0	8.0	123.5	a
Stellar	57.0	32.6	11.65	45.8	94.3	5.0	123.1	a
ND20664	57.3	31.9	11.55	46.2	95.7	4.0	121.9	a
Stander	55.0	34.4	11.35	46.8	93.3	6.0	119.8	
Legacy	54.3	35.0	11.54	45.2	89.3	9.7	119.7	
ND20666	56.7	32.7	12.24	46.3	96.0	3.7	119.1	
6B00-1328	56.7	34.2	12.88	47.3	91.7	7.7	115.4	
ND20448	54.7	34.8	11.49	46.7	95.7	4.3	114.0	
ND20508	56.3	33.9	11.76	47.5	93.0	6.0	112.0	
Bowman	54.0	33.1	12.21	48.8	92.0	7.0	110.3	
AC Metcalfe	59.0	33.2	12.63	47.5	86.7	11.3	110.3	
Morex	54.0	35.0	12.43	46.3	85.7	13.3	108.9	
Robust	54.7	35.4	12.51	46.3	86.3	11.7	108.2	
ND19119	58.0	32.2	12.58	46.2	95.7	3.7	107.1	
Average	55.6	34.0	11.83	46.8	92.1	7.1	120.8	
Probability	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
CV (S/mean)	2.2	3.4	4.7	1.4	1.8	22.2	5.5	
CV (SE/mean)	1.3	2.0	2.7	0.8	1.1	12.8	3.2	
LSD (0.05)	2.0	1.9	0.91	1.1	2.8	2.6	10.9	

*days from planting
a indicates significantly greater yield than check variety, Morex, at probability of 0.05