Malting Barley Variety Trial
2016 Results

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Twenty five varieties of two- and six-row spring malting barley were trialed at two locations in Maine in 2016 (Table 1). The trials were conducted in collaboration with 10 other institutions as part of the Eastern US Spring Malting Barley Evaluation project, organized by North Dakota State University and funded by the Brewers Association.

Table 1. Spring malting varieties evaluated in Old Town and Presque Isle, Maine in 2016.

Variety	Type	Developer
2ND28065	2-row	North Dakota State University
AAC Synergy	2-row	Agriculture and Agri-Food Canada (Brandon)
AC Metcalfe	2-row	Agriculture and Agri-Food Canada (Brandon)
Acorn	2-row	Ackermann (Germany)
Bentley	2-row	Field Crop Development Center (Lacombe, Alberta, Canada)
CDC Copeland	2-row	Crop Development Center (University of Saskatchewan)
CDC Meredith	2-row	Crop Development Center (University of Saskatchewan)
Cerveza	2-row	Agriculture and Agri-Food Canada (Brandon)
Conlon	2-row	North Dakota State University
Explorer	2-row	Secobra (France)
Innovation	6-row	Busch Agricultural Resources, LLC
KWS Beckie	2-row	KWS (Germany)
KWS Fantex	2-row	KWS (Germany)
Lacey	6-row	University of Minnesota
LCS Odyssey	2-row	Limagrain Cereal Seeds (United Kingdom)
LCS Genie	2-row	Limagrain Cereal Seeds (United Kingdom)
ND Genesis	2-row	North Dakota State University
Newdale	2-row	Agriculture and Agri-Food Canada (Brandon)
Pinnacle	2-row	North Dakota State University
Pioneer	2-row	Secobra (France)
Quest	6-row	University of Minnesota
Robust	6-row	University of Minnesota
Steffi	2-row	Ackermann (Germany)
SY Sirish	2-row	Syngenta
Tradition	6-row	Busch Agricultural Resources, LLC

METHODS

The trials were conducted at the University of Maine Rogers Research Farm, in Old Town, and the Aroostook Research Farm, in Presque Isle. Agronomic practices for both locations are described in Table 2. Agronomic and basic grain quality data were collected by the University of Maine and grain samples were submitted to North Dakota State University for comprehensive grain and malt quality analysis.

Table 2. Agronomic practices in Old Town and Presque Isle, Maine in 2016.

	Old Town	Presque Isle
Previous Crop	Fallow/fall-planted oat cover crop	Potato
Soil Type	Nicholville very fine sandy loam	Caribou gravely loam
Fertility	20 tons/acre solid dairy manure	200 lbs/acre of 30-0-6
Planting Date, Rate	April 28, 1.25 million live seeds/acre	May 24, 1.25 million live seeds/acre
Weed Control	Tine harrow, May 17 and 21	MCPA Rhomene - 0.75 pt/acre, June 22 Harmony - 1 oz/acre, June 22
Harvest Date	August 3	August 17

RESULTS

Grain yield was well above the historical state average of 59 bu/acre at both sites (Table 3; National Agricultural Statistic Service). Three of the highest yielding varieties at both sites were SY Sirish, Bentley, and LCS Odyssey, while lower yielding varieties were Conlon, Pinnacle, CDC Meredith, and CDC Copeland.

Varieties that dry down quickly after reaching physiological maturity are advantageous in humid climates like Maine, especially for growers with limited or no capacity to dry grain after harvest. Grain moisture measured at time of harvest averaged 14.7% at the Old Town location and all of the varieties were within about 1% of each other (Table 3). In contrast, grain moisture at the Presque Isle location, which was harvested 10 days later, averaged 18.1% and there was a wider range among varieties. Conlon had the lowest moisture (15.4%); Robust, Innovation, and Tradition had the highest (20.7–22.5%).

Leaf diseases were moderate among varieties due to dry growing conditions with the exception of Pinnacle, which had severe foliar disease symptoms at both locations (Table 3). Pinnacle also exhibited extremely high levels of the DON mycotoxin produced by Fusarium head blight at the Presque Isle site, as did AAC Synergy, Bentley and ND Genesis, making these poor variety choices for Maine (Table 4).

Pre-harvest sprouting is another key challenge for growing malting barley in Maine. RVA, Falling number, and germination energy, all measures of sprouting damage, were within the acceptable range in Old Town, but not in Presque Isle where most varieties showed evidence of severe sprouting damage, most likely due to not drying down the high moisture grain samples quickly enough after harvest (Table 4). Many varieties showed greater tolerance to sprouting damage than Newdale, a popular variety in Maine. Grain from the Old Town site was suitable for malting; malt quality results are reported in Table 5.

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Table 3. Agronomic characteristics of malting barley varieties grown in Old Town and Presque Isle in 2016.

	Yield† (bu/acre)		Grain Moisture at Harvest‡ (%)		Foliar Disease Severity (1 - 9) §		Height (in)		Stem Breakage (1 - 9) §		Spike Density (num/ft^2)		Heading date (days after 5/31)	
Variety	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle
2ND28065	104	96	**15.4**	17.9	5.0	4.7	41	28	1.0	1.0	**65**	78.3	20	36
AAC Synergy	**127**	**107**	14.7	17.4	2.3	3.7	38	**29**	1.0	1.3	**67**	71.3	22	41
AC Metcalfe	93	91	14.8	18.3	4.7	4.7	38	**30**	1.0	1.3	59	66.0	22	36
Acorn	105	**114**	14.6	18.4	5.3	4.3	30	26	1.7	2.7	**78**	**102.7**	32	36
Bentley	**125**	**110**	15.0	17.4	2.3	4.7	39	**32**	1.0	1.7	58	60.7	22	36
CDC Copeland	92	78	14.8	17.3	4.3	5.0	38	**31**	1.3	2.3	46	65.3	29	48
CDC Meredith	80	85	**15.1**	18.3	4.7	3.7	36	**29**	2.0	2.7	60	60.3	32	48
Cerveza	**122**	**101**	14.5	17.0	3.0	4.7	37	27	1.0	1.0	**65**	**81.7**	27	36
Conlon	89	70	14.8	15.5	4.3	4.3	37	26	1.0	2.3	**69**	67.7	20	31
Explorer	109	94	**15.1**	18.0	5.7	5.0	29	22	1.7	1.7	**81**	77.3	29	36
Innovation	**117**	87	14.1	**20.9**	2.0	5.0	39	27	1.0	1.0	36	50.0	20	31
KWS Beckie	111	**108**	14.4	16.8	5.7	**6.0**	27	22	1.3	1.3	**84**	**95.7**	32	36
KWS Fantex	**126**	**109**	14.4	17.5	5.7	4.3	29	21	1.3	1.7	**85**	**93.3**	29	36
Lacey	**116**	89	14.9	19.0	2.0	4.3	41	**29**	1.0	1.0	35	41.3	20	31
LCS Odyssey	**125**	**114**	14.3	18.5	4.3	5.0	31	25	1.0	1.3	**82**	**92.3**	32	41
LCS Genie	108	**110**	14.6	17.5	4.7	**5.3**	30	26	1.7	2.7	**83**	**83.7**	31	41
ND Genesis	108	78	**15.4**	17.9	3.7	**5.3**	37	26	1.0	1.0	**71**	65.7	20	36
Newdale	**115**	**105**	14.6	16.7	3.7	3.7	35	27	1.3	1.7	**77**	76.3	27	41
Pinnacle	73	83	**15.2**	17.7	**9.0**	**6.3**	38	**29**	**3.0**	**4.7**	49	72.7	20	36
Pioneer	113	87	14.7	17.1	5.7	**6.3**	28	23	1.3	1.7	**72**	75.3	32	41
Quest	105	81	14.5	19.5	2.7	3.3	**43**	**31**	1.3	1.0	39	49.3	20	36
Robust	108	86	**15.1**	**22.5**	2.3	4.7	**46**	**30**	1.0	1.0	36	40.3	20	36
Steffi	110	90	14.5	16.4	4.7	**5.7**	35	25	1.3	2.3	**66**	**80.7**	22	36
SY Sirish	**130**	**112**	14.6	18.6	5.0	4.3	31	23	**2.3**	2.0	**83**	**93.3**	29	41
Tradition	110	82	14.3	**20.7**	2.7	4.3	37	**29**	1.3	1.0	41	45.3	20	36
Site average	109	95	14.7	18.1	4.2	4.8	36	27	1.4	1.7	64	71	25	38
LSD (0.05)	17	17	0.4	2.3	1.7	1.2	4	3	0.9	1.3	22	23	-	-
CV%	15.4	16.8	2.6	10.3	42.8	22.5	15.2	12.1	49.3	60.2	32.0	29.1	-	-

† Yield is reported at 13.5% moisture.

‡ Measured at time of harvest.

§ Scored visually using a scale from 1 = none to 9 = high. Disease pressure was scored on July 18 in Old Town and Aug 4 in Presque Isle. Stem breakage was scored at harvest.

Table 4. Grain quality characteristics of malting barley varieties grown in Old Town and Presque Isle in 2016.

	Test Wt. (lbs/bu)		TKW† (g)		DON‡ (ppm)		Protein§ (%)		Plump Kernels≠ (%)		RVA# (stirring number)		Falling Number# (seconds)		Germ. Energy¥ (%)	
Variety	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle	Old Town	Presque Isle
2ND28065	**53**	**48**	49	51	0.0	1.4	10.6	9.5	96	96	182	106	403	251	99	76
AAC Synergy	**52**	44	52	**54**	0.1	9.4	9.5	9.6	99	98	174	20	388	79	97	26
AC Metcalfe	**52**	**47**	46	50	0.0	0.9	10.3	10.4	93	95	176	7	393	60	99	25
Acorn	47	44	44	52	0.0	0.3	8.5	9.3	92	98	182	96	404	231	99	84
Bentley	51	45	51	**56**	0.0	7.0	9.9	10.1	98	98	190	43	419	125	99	32
CDC Copeland	48	45	47	48	0.0	0.4	9.9	8.9	93	93	192	25	424	90	98	57
CDC Meredith	48	43	45	48	0.0	2.9	10.3	9.4	91	92	129	15	297	70	99	47
Cerveza	**51**	44	47	50	0.0	3.2	10.5	9.1	92	97	135	4	311	60	100	26
Conlon	**52**	**47**	**56**	**56**	0.0	1.0	11.4	11.5	99	98	133	32	306	104	99	60
Explorer	49	43	54	**54**	0.0	2.4	9.4	10.1	95	95	142	49	323	138	99	61
Innovation	51	46	44	48	0.0	1.0	11.4	12.0	98	98	184	107	407	254	100	65
KWS Beckie	46	42	46	51	0.0	0.5	8.8	9.3	95	97	191	108	422	256	100	85
KWS Fantex	49	44	50	51	0.1	1.9	8.9	9.4	97	96	176	89	392	217	99	49
Lacey	**51**	46	43	47	0.0	1.7	10.5	10.8	97	98	172	78	384	196	100	70
LCS Odyssey	49	45	48	53	0.0	0.5	8.9	9.3	96	97	148	107	337	254	98	66
LCC Genie	48	45	46	50	0.3	2.2	8.3	9.1	94	96	157	105	355	249	97	56
ND Genesis	**53**	45	52	52	0.0	9.6	9.9	10.4	98	95	192	35	423	110	99	30
Newdale	51	46	48	50	0.0	1.8	9.8	9.6	94	94	203	47	446	133	100	51
Pinnacle	47	45	47	**54**	0.0	17.2	10.2	9.3	88	96	240	43	519	126	99	56
Pioneer	48	44	53	51	0.0	0.2	9.3	9.4	95	96	184	110	408	260	98	91
Quest	50	46	39	44	0.0	0.6	10.6	10.6	88	95	171	104	382	248	99	74
Robust	51	46	42	46	0.0	2.1	11.6	11.3	97	97	171	139	383	317	100	66
Steffi	50	**47**	50	51	0.0	2.4	9.3	10.0	96	97	173	111	385	263	99	70
SY Sirish	49	46	49	53	0.0	0.1	10.2	10.0	98	99	176	95	393	229	100	91
Tradition	51	46	43	47	0.0	1.8	10.8	11.5	97	97	210	117	460	273	100	55
Site average	50	45	48	51	0.0	2.9	9.9	10.0	95	96	175	72	391	184	99	59
LSD (0.05)	2	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CV%	4.1	3.3	8.8	6.8	-	-	-	-			-	-	-	-	-	-

† Thousand kernel weight. ‡ Deoxynivalenol (DON) is a mycotoxin caused by *Fusarium* head blight. § Protein is reported on a dry matter basis. Acceptable range is 9.5-12.5%.

≠ Kernel plumpness is measured as the percentage of barley that remains on top of a 6/64" by 3/4" slotted sieve after shaking.

Rapid Visco-Analyzer (RVA) and Falling number are both indicators of pre-harvest sprout damage. Samples with RVA>120 and Falling number >250 are considered sound with high probability of maintaining germination energy in storage. Values below these levels indicate sprout damage with severity increasing as values decrease.

¥ Germination energy is the percentage of kernels that germinate over 3 days under standard moisture and temperature conditions. >95% is considered acceptable.

Table 5. Malt quality results for malt made from the barley varieties grown in Old Town in 2016.

Variety	Friability (%)	Fine Grind Extract† (%)	Diastatic Power‡ (°L)	Alpha-Amylase≠ (DU)	Soluble Protein§ (%)	Soluble N/Total N (%)	Wort Color (ASBC)	Wort Viscosity (mPa.s)	FAN# (ppm)	Beta-glucan¥ (mg/L)
2ND28065	68.5	81.5	103.3	81.1	5.56	52.5	2.1	1.59	231	613
AAC Synergy	78.5	82.6	99.3	95.7	5.39	57.0	2.6	1.57	225	384
AC Metcalfe	70.0	81.4	131.4	98.2	5.26	51.1	2.7	1.51	217	397
Acorn	85.1	84.0	96.7	87.3	3.93	46.2	2.6	1.51	186	376
Bentley	71.8	81.9	93.7	84.0	4.88	49.4	2.6	1.60	218	547
CDC Copeland	78.5	81.0	105.2	89.7	5.93	60.2	3.3	1.49	241	248
CDC Meredith	73.3	80.5	106.0	87.3	5.62	54.6	3.5	1.51	226	434
Cerveza	60.7	82.7	103.2	87.5	4.86	46.4	2.5	1.69	190	737
Conlon	65.4	81.9	112.3	77.6	4.45	39.1	2.4	1.72	190	733
Explorer	83.3	81.4	97.4	96.2	4.81	51.4	2.8	1.47	221	260
Innovation	73.1	81.5	151.5	89.2	5.02	43.8	2.0	1.71	239	620
KWS Beckie	82.0	83.4	95.9	79.5	4.85	55.4	2.9	1.48	203	279
KWS Fantex	81.2	83.3	96.0	78.4	4.31	48.3	2.7	1.51	195	435
Lacey	82.1	81.5	137.0	69.1	4.78	45.7	2.0	1.54	222	376
LCS Genie	89.1	83.1	105.0	77.8	4.75	57.1	2.9	1.49	200	237
LCS Odyssey	78.5	82.9	94.5	85.6	4.89	54.7	2.8	1.51	200	441
ND Genesis	70.4	81.1	124.6	95.8	5.19	52.5	2.4	1.64	223	727
Newdale	73.8	81.9	105.1	90.5	4.71	48.0	2.7	1.56	205	489
Pinnacle	63.0	80.1	111.2	61.2	4.16	41.0	2.0	1.62	185	698
Pioneer	83.9	81.5	94.4	96.7	4.99	53.5	2.9	1.47	224	248
Quest	79.1	81.3	127.9	73.0	4.78	44.9	2.0	1.64	225	557
Robust	75.9	80.5	155.9	52.7	5.17	44.7	2.2	1.57	233	502
Steffi	65.3	81.3	93.6	74.5	4.55	44.5	2.5	1.51	201	476
SY Sirish	83.7	82.8	105.8	83.8	5.26	56.9	2.7	1.46	221	299
Tradition	72.4	81.1	159.7	65.8	4.84	44.7	1.9	1.72	219	602
Site average	75.5	81.8	112.3	82.3	4.92	49.7	2.5	1.56	214	469

† Indicator of the maximum yield of soluble components in the wort (hot water mixed with ground malt). Soluble components are primarily carbohydrates, the source of fermentable sugars, and proteins. Reported as a percentage of original malt weight on a dry matter basis. Minimum acceptable level is 80%.

‡ Indicator of the strength of all starch-degrading enzymes in the malt. Reported in "°Lintner".

≠ Indicator of the strength of the alpha-amylase enzyme. Reported in dextrinizing units (DU). Acceptable levels for an all-malt mash is >30%.

§ The amount of soluble proteins in the wort expressed as a percentage of malt weight. Acceptable range is 4.5-5.5%.

FAN = Free amino nitrogen. A measure of amino acids and small peptides available in the malt to support yeast during fermentation.

¥ The concentration of beta glucan (cell wall material) is associated with lautering issues.