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The Montana MiniMalter: A Tool for Applied Brewing Research

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Abstract: We are exploring the contributions of barley variety, agronomic practices and environmental constraints to beer flavor. The Oregon State University barley improvement program grew five malting barley varieties at three locations, using three levels of fertilization. We are now malting these malt barley samples using the Montana MiniMalter, a system that permits malting eight 7.0Kg samples of barley every two days. We are brewing beer using these malts using Picobrew Zymatic brewing systems.

Introduction: As the craft brewing industry revitalized approaches to brewing, the nascent craft malting industry holds promise to reinvigorate malting. Advantages to small, local malting include 1) helping to redistribute malting grain production 2) providing a larger number of malting platforms to evaluate novel grain varieties, novel grain production practices, and underutilized grain production environments. This collaborative project aspires to demonstrate a pilot experiment to determine whether barley variety, production location or fertility level impact malt quality and beer flavor. We utilize the Montana MiniMalter (Patent Pending) a 4-tank, 4-station malting system (Fig. 1) designed to enable the production of a relatively large number of malt samples that are sufficiently large to permit replicated brews. Each tank can be subdivided into 8 compartments, permitting 32 7.0Kg samples to be malted over an 8 day timespan (Fig. 2). For brewing, we are employing four Picobrew Zymatic automated wort production systems. These produce carefully controlled worts (10l/brew) which are then fermented, carbonated and canned for sensory evaluation.

Experimental lines are grown at 3 locations in Oregon

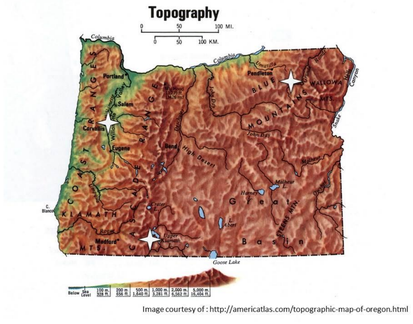

Image courtesy of : http://americatlas.com/topographic-map-of-oregon.html

Introduction While substantial effort has helped identify flavor compounds important to both malt and beer (e.g. Beal and Mottram, 1994, Guido et al., 2007) less effort whas been expended to explore the impact of variety, environment and production system on flavor.

Methods: Five barley varieties, (Genie, Full Pint, Copeland. Expedition and Explorer,) grown at three locations (Corvallis, Grand Ronde and Tule Lake) under three Nitrogen fertility rates (100 lbs/ac, 150 lbs/ac, 200 lbs/ac) in 2015. A similar set of trials has been planted for harvest in 2016. These were grown under the supervision of the Oregon State University barley improvement program. Large plots (200 ft^2) were grown at each location to permit the harvest of ~100Kg of grain from each treatment combination. A complete summary of the 2015 agronomic performance results is available at: http://barleyworld.org/sites/default/files/bobb_3_loc_sum.pdf.

We are now malting the 2015 samples, and will malt the 2016 samples when available. Our standard malting regime is: 4 8 hour steeps with vigorous aeration at 57ºF followed by 4 hour air rests; 4 days' germination using aeration with water-saturated air at 65ºF. Kilning follows germination with air-on temperature of 135ºF (20h) and finished for four hours at 150ºF. Cleaned malt was ground to both fine and coarse grinds, moisture determined, and friability, extract and color measured using ASBC methods. Following malting, we will brew each sample using our Picobrew array (Fig. 3) and will can our beers (thanks Todd Scott and Bozeman Brewing) for our tasting panels at Bozeman, MT, Corvallis OR and Seattle WA.

Results: Table 1 shows results from malts made from the experiment grown near Corvallis, OR in 2015. Expected relationships between grain protein percentage, friability and extract appeared. As negative controls, we included two of the malts (a Vienna malt and a caramel malt) we produced an our malthouse in Bozeman, MT. These were made using Hockett barley, and showed expected extracts and conversion times.

Conclusions: The combination of the Montana MiniMalter and Picobrew Zymatic brewing systems enables rapid malt analysis and flavor analysis in finished beers barleyworld.org/breeding-genetics/malting-brewing . In coming years, we plan to add volumes of data and analyses on barley varietal contributions to malt and beer flavor to the published literature.

Literature Cited:

Guido, LF, Curto AF, Bolvin, P, Benismail, N, Goncalves CR, Barros AA. 2007. Correlation of malt quality parameters and beer flavor stability: multivariate analysis. J. Agric Food. Chem. 55(3) 728-733.

Beal AD, Mottram DS. 1994. Compounds contributing to the characteristic aroma of malted barley. J. Agric. Food Chem. 42(12) 2889-2884.

Fig. 1. The MiniMalter

Fig.2. The Tank Dividers

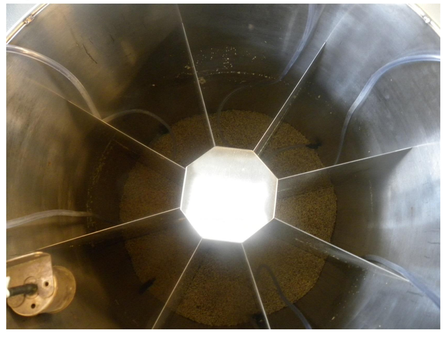

Fig. 3. Picobrew Zymatics (2 of 4)

Table 1. A sample of data from this experiment.

Variety	Treatment	KWt DMB	% Water	Cleaned Wt (lbs)	Malt Loss %	Friability	Conversion Time	% Extract	Lovibond
Genie	Low N	39.43	0.56	9.8	12.50	91.1	>20	85.94	1.56
Full Pint	Low N	39.90	0.53	12.95	8.16	92.2	10-15	83.00	1.06
Copeland	Low N	43.94	0.45	9.53	10.09	94.8	10-15	77.19	0.90
Explorer	Low N	46.79	0.47	9.2	14.02	90.8	10-15	77.45	0.68
Expedition	Low N	45.36	0.46	12.9	7.86	92.4	<5	70.84	1.12
Genie	Med N	39.90	0.53	12	8.40	86.8	10-15	83.00	1.70
Full Pint	Med N	40.61	0.52	9.92	10.63	85.3	10-15	80.09	1.19
Copeland	Med N	38.24	0.55	12.53	5.79	93.4	10-15	80.09	1.46
Hockett	Vienna	42.20	0.48				>20	25.59	3.41
Hockett	Caramel	42.20	0.47				<5	54.70	3.02

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