

Beer and Beer Flavor

Hops ✓
Water ✓
Yeast ✓

Barley?



Barley malt – yes!



Barley?

Barley flavor from base malt in a subset of beer styles



Evidence against

Experience

“Prior to retirement I tasted malt worts from all of XXXXX suppliers and internal malt plants two to three times per week. This tasting included all International malt supplies from malt plants all over the world. This was a wider selection of barley varieties and malt plants than any other brewer in the world normally see. I can say without hesitation that malt wort flavor had a malt plant signature, not a barley variety signature. Without question the same varieties from different malt plants tasted differently, different barley varieties from the same malt plant tasted the same.”

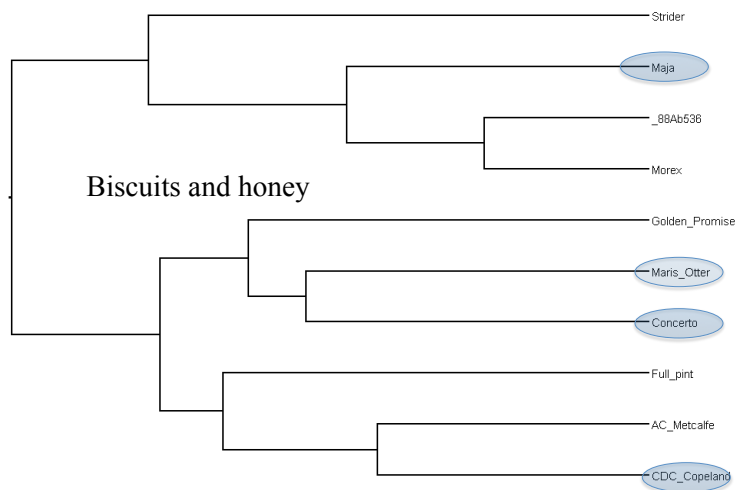
Evidence for

Golden Promise and Maris Otter

“Quest for the Next Flavourful Barley Breed or What’s the Science/Myth Behind Maris Otter? & Summary of Attempt to Breed “Craft” Barley”



MBAA Austin, Texas 2013



Evidence for

“Brew-offs” published and anecdotal



The Full Pint Story:

Tom Nielsen – Sierra Nevada

“Full Pint is very fermentable and had a very nice extract... Full Pint wort also tasted very good, pre and post boiled. I picked up a very pleasant and strong fresh salted popcorn note. A very positive clean sweetness as well, with no harshness or astringency... The fermented Full Pint beer was clean, slightly estery, a bit tart and bready.”



The Full Pint Story:

Tim Matthews – Oskar Blues

“Salty caramel popcorn and sweet agape nectar”



The Full Pint Story:

Dave Kuskey – Briess Malting

“Batch 2 is in the lab right now – preliminary results look awesome! We got the color up to 2.0 L and the Beta Glucan down from 200+ first batch to about 110 on this batch – the flavor and aroma have much more malty character and the sweetness and extra mouth-feel on the wort carried through.

Batch 1 was more of a middle of the road malting parameter check to see how the variety responded, but I still do like the results – it just may not be exactly what some of the drivers of this project were looking for – I’m not worried – it still tastes fantastic and we’ll find a way of marketing it and making use of it.

Flavor Diversity

Full Pint

Maris Otter

Golden Promise



Diversity in malt specs
Low to high enzymes and FANs
Modest extracts
Moderate beta glucans

Flavor Uniformity

Meredith

Metcalf

Copeland

Homogeneity in malt specs
High enzymes and FANs
High extracts
Low beta glucans

Are flavor and malt specs separable?

Is flavor an intrinsic property of the variety?

What is the role of environment?

Is there terroir?



“If I were to venture a guess as to what role variety might play in flavor formation in malt, I would imagine it has a lot to do with the genetics which impact the degradation process of protein and carbohydrate reserves during germination, as the endosperm is modified. Since much of the flavor which is produced during kilning is derived from Maillard browning, the concentration and distribution of amino acids and reducing sugars would certainly have a role to play. And if these factors would be different in two barleys, for instance, which are germinated in exactly the same way in all respects, then it is possible that the flavor active Maillard browning reaction products resulting from kilning could be distributed in a little different way. There are so many different combinations between the essential amino acids and a whole lot of different reducing sugars, that it's easy to see how the spectrum of end products could be skewed in one direction or another.”

“And maybe genes that govern metabolic processes which determine the amount and types of organic acids produced in the germinating grain could play a role as well, since Maillard browning is pH dependent. There are lots of options on which to speculate with this whole subject.”

Tom Flores, M.S., Brewmaster
 Brewer's Alley and Monocacy Brewing
 Frederick, Maryland



“Characterizing novel and positive contributions of barley to beer flavor, and then developing new varieties with these attributes, is a new frontier for barley breeders....”

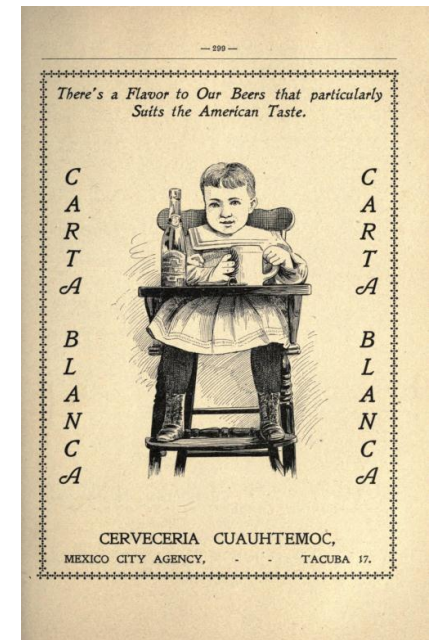


Funding for the project

- Bell's Brewery
- Firestone Walker Brewing
- New Glarus Brewing
- Russian River Brewing
- Sierra Nevada Brewing
- Summit Brewing

In kind for this project:

- Rahr Malting



Flavor projects at OSU

- World core (OR, MN, SASK)
- 3³ (OR, MN, SASK)
- Oregon Promise and Oregon Otter (JHI)



World Core

2062 grown
 709 harvested
 114 malted (Rahr)
 Analysis (Sierra Nevada)



3³

- 3 varieties (Full Pint, Klages, Metcalfe)
- 3 locations (OR, MN, SASK)
- 3 data sets (malt spec, wort, beer)
- Malt spec – Extract to Beta Glucan: Rahr
- Wort – sensory, amino acid analysis, metabolic profiling: Sierra Nevada
- Beer – nano-brew sensory: New Glarus



Oregon Promise and Otter

Full Pint x Golden Promise

Full Pint x Maris Otter

F1

F1

Doubled haploids

Doubled haploids



Oregon, Scotland

Agronomics (Yield, disease resistance)
 Malting quality (protein, extract, enzymes, beta glucan, etc.)

Flavor

You want barley FLAVOR in your beer?

Test brew with available varieties (or advanced lines) until one strikes your fancy
Then run with it!

1. World Core exotics ...e.g. Pelileo and be prepared to get into the seed business
2. AMBA Pilot/Plant Scale candidates that failed...e.g. Full Pint
3. Out-of-area malt varieties: e.g. Europe, Australia, Asia...e.g. Concerto

Support Barley Research



Barley Day 2014
Friday May 16

Details at Barleyworld (web and facebook)

Beer donations for the evening social are welcome



Support Barley Research

The OSU Malt Lab

Make base malts
Analyze base malts
Make beers
Assess beer flavors



Malting barley variety development

Grain to Glass 11 – 13 years

