



Base Malts

Single Malt Beer Experiment

CR Beer Nuts Tech Topic

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July 2014





Outline



- Goals
- Background
- Recipe
- Process
- Stats
- Tasting & Evaluation



Goals



- Compare Base Malts and provide meaningful insight on relative merits of each
- Minimize process, ingredient, and packaging variation
- Collect data to share with others
- Accomplish all this within a short time frame to ensure fresh beer and within a manageable project size



Background



Similar prior experiments

1. <http://mtlehmanbrewery.wordpress.com/2013/01/18/the-great-base-malt-experiment/>
 - Pilsen, Pale, ESB, Vienna
2. <http://www.homebrewtalk.com/English-Base-malt-comparison.html>
 - 2Row, Marris Otter, Golden Promise, Pearl, Optic, Halcyon
3. <http://www.homebrewtalk.com/f12/base-malt-experiment-404932/>
 - 2Row, Belgian Pils, Mild, Kolsch, Golden Promise, Marris Otter
4. <http://sciencebrewer.com/category/experiments/base-malt-experiment/>
 - Pale, Marris Otter, Vienna

Room For Improvement

- Broader Set of base malts
- Process Control
- Brewday & Fermentation Stats
- Group Tasting & Data Collection



Background



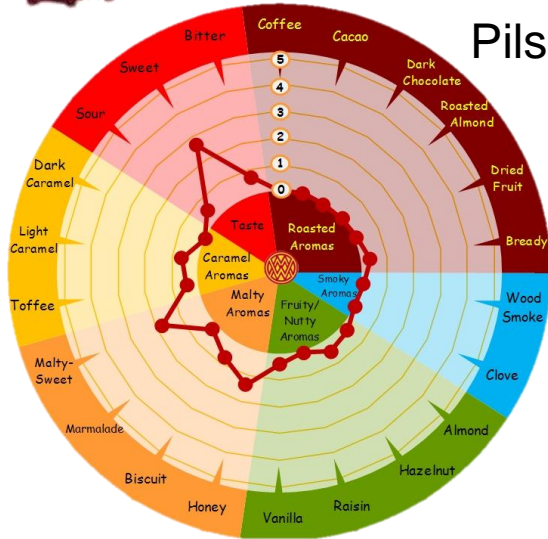
- Tons of info on flavor and aroma profiles for yeast and hops, very little info given on Malts
- Personal Assumptions Going In
 - Pilsner – light & sweet, good for light lagers, can produce DMS
 - 2-Row – Neutral & Malty, backbone for most American Ales
 - 6-Row – Probably the same as 2-Row, but harsher
 - American Pale Ale – maltier 2-Row, backbone for big malty beers
 - Marris Otter – Biscuity, more expensive American Pale Ale, good for IPAs
 - Golden Promise – Same as Marris Otter
 - Wheat – Similar to 2-Row, but fuller bodied and softer due to no husk
 - Vienna – Rich & Malty, good for Octoberfests
 - Munich – Richer & Maltier, good for Bocks, blend with Pale to make M.O.
- Questions Going In
 - Are Pale, Marris Otter, and Golden Promise the same?
 - Are 6-Row and 2-Row any different?
 - Is Munich just a maltier Vienna?
 - How many of the raw grain differences carry through into the glass?



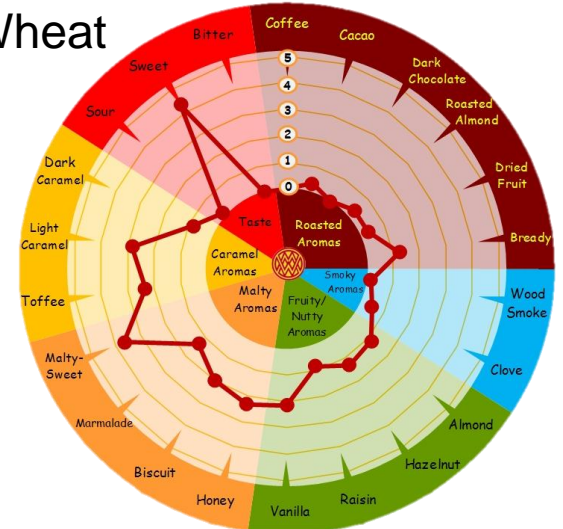
Weyermann Malt Profiles



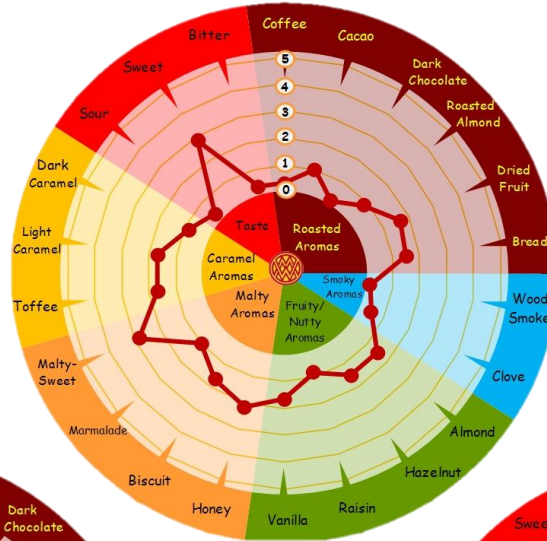
Pilsner



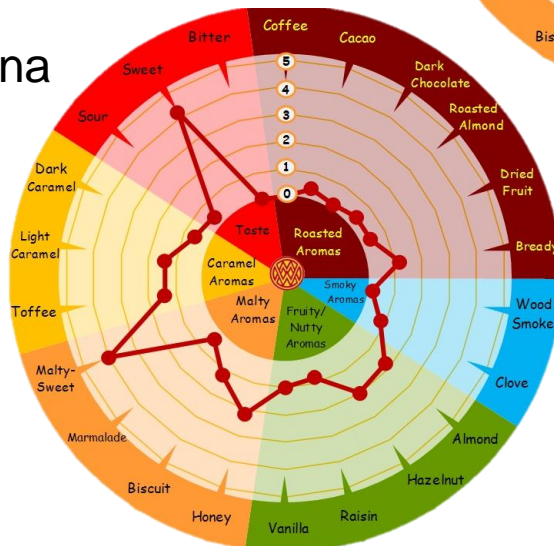
Wheat



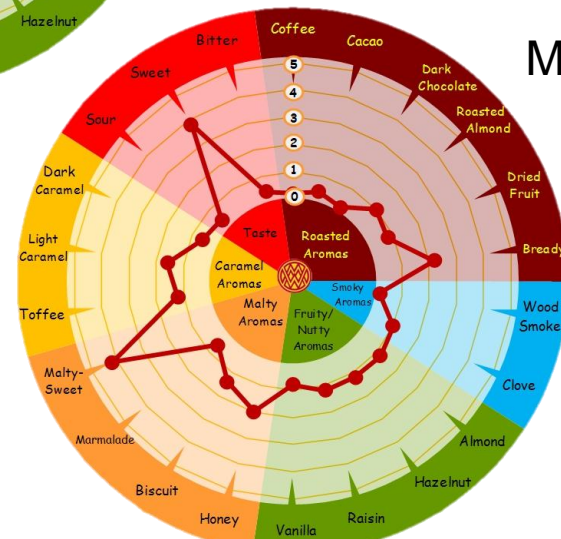
Pale Ale



Vienna



Munich





Exemplary Grain Profiles



Pale Ale Breiss North America

Briess Pale Ale is an American, ale-style base malt. It has a rich malt flavor with hints of biscuit and nut, and contributes a rich, golden color to wort. Made from 2-row barley varieties, Briess Pale Ale has a slightly lower protein content and a slightly higher yield than 6-row base malts. Although its diastatic power is lower than some base malts, it has sufficient enzymes to support the inclusion of even the most demanding specialty malts. It is very versatile can be used as a base malt for any beer style.

Pilsen Breiss North America

Briess Pilsen is an American lager-style malt. It is very light in color and produces a light, clean, crisp wort with a delicate malty flavor. Made from 2-row barley varieties, Briess Pilsen has a slightly lower protein content and a slightly higher yield than 6-row base malts. Briess Pilsen is a suitable base malt for all styles and an excellent choice for lager beers. The light character allows the the full flavor of specialty malts or other ingredients to shine through.

Golden Promise Simpsons UK

Golden Promise pale malt, made from the eponymous spring barley variety, is a UK classic. Historically the Scottish analog to English Maris Otter malts, Golden Promise is well used in any English or Scottish style ale. The sweet, robust malt flavor of Golden Promise has also made it a choice base malt for American IPAs, lagers, and several famous whiskeys

Vienna Weyermann Germany

full bodied, golden colored smooth tasting beers.
Vienna Beer Style, "Maerzenbier", "Maibock", Amber Lager, Home Brew Beer , Golden Ale, October Beer

2-row Rahr North America

Rahr Standard 2-Row is a light-colored base malt made from a blend of American 2-Row barley varieties. It is darker than most lager malts, but lighter than most pale ale malts. It has moderate protein levels, and good extract yield. Its neutral characteristics make it extremely versatile, and it is widely used by American craft breweries as a choice base malt for any beer style.

6-row Rahr North America

Rahr Standard 6-Row is a light-colored base malt made from a blend of American 6-Row barley varieties. 6-row barley has a much higher protein content and enzymatic power than 2-row barley. Inclusion of Standard 6-Row is therefore very advantageous for recipes calling for large proportions of specialty malts, wheat malts, or adjuncts, which have little or no enzymatic power themselves. 6-row barley is also used to match historical beer styles from settings where 2-row barley was not widely available. High proportions of 6-row barley may necessitate the use of adjuncts or require protein rests in mashing.

Munich Light Chateau Belgium

Château Munich Light® is a Belgian, Munich-style malt. It provides a modest color increase toward a nice, golden orange wort. It adds a pronounced, grainy, malty flavor without affecting head retention or body. Light Munich malts are often used in small quantities with lager malt to produce light-colored beers with rich malt flavor and bright color. But Munich malt is suitable for use in any style beer and has enzymatic activity comparable to some base malts. Crisp Maris Otter is an English, ale-style malt made from the famous Maris Otter barley variety. English Maris Otter is recognized worldwide Base Malts

Marris Otter Crisp UK

as the benchmark barley for the best ale malt. Harvest to harvest, Maris Otter produces a consistent, flavorful base malt. The low protein content and high degree of modification are considered ideal by expert ale-brewers, and are very forgiving to the novice when mashed. A classic, high-quality choice for English ales, Maris Otter is also used as a base malt for continental and American ales, and occasionally lagers.



Recipe



OVERVIEW

Brew Method: Brew In A Bag
Boil Time: 60 min
Batch Size: 1 gallons (fermentor volume)
Boil Size: 1.5 gallons
Boil Gravity: 1.035
Efficiency: 70%

STATS

Original Gravity: 1.052
Final Gravity: 1.015
ABV (standard): 4.9%
IBU (tinseth): 35
SRM (morey): 3.6

YEAST

Safale US-05
Pitch 5.75 gm (~50B cells, ~1B cells/mL/°P)
Rehydrate in 75 gm of water at ~100F
Fermentation Temp: 64-66 F

FERMENTABLES

2 lb - American - Pale 2-Row

HOPS

3 g – Centennial (10%), Boil for 60 min
4 g – Centennial (10%), Boil for 0 min
4 g – Amarillo (9%), Boil for 0 min

MASH

1. Infuse 4 qt to settle at 148 F. Hold for 30 min
2. Heat to 162 F. Hold for 30 min

SPARGE

Batch sparge grain bag with ~165F water

OTHER INGREDIENTS

2 Gallons – RO Water
0.25 tsp – Calcium Chloride – Add to strike water
0.25 tsp – Gypsum – Add to strike water
0.5 each – whirlfloc, Boil for 30 mins
0.125 tsp – Yeast Nutrient, Boil for 30 mins
12 ppm Oxygen – Purge & Shake Fermentor 3x

(5 Gal Equivalent)
(10 lb)

(0.5 oz)
(0.7 oz)
(0.7 oz)



Base Malt Variations



- Great Western 2-Row
- Best Malz Pilsner
- Simpsons Golden Promise
- Thomas Fawcett Marris Otter
- Briess 6-Row
- Rahr Pale Ale
- Weyermann Vienna
- Best Malz Munich
- Best Malz Wheat

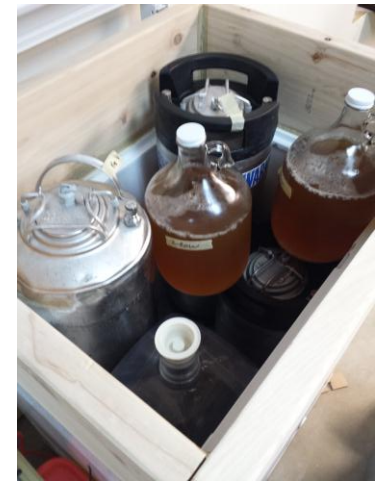




Process Control



- All yeast purchased at same time
- All hops from same package (stored under CO2 in freezer)
- RO Water
- Stove Top BIAB
- Post-boil filtering
200 μ m, 400 μ m, 600 μ m
- Dry Yeast Proofing
- Controlled O2 Levels
- Controlled Ferm Temps 65F
- Secondary Fermentor
Biofine & Lagering
- Bottle priming & controlled conditioning temps (75F)





Batch Stats



Malt	Conv Efficiency	Mash Gravity	Pre-Boil Vol (gal)	Pre-Boil Efficiency	Pre-Boil Gravity	Post-Boil Vol (gal)	OG	Lag Time (hrs)	FG	Attenuation	ABV
2-Row	0.95	63	1.5	0.83	41	0.95	58	12	13	77.59%	5.90%
Pilsner	0.94	64	1.55	0.84	41	0.9	61	12	13	78.69%	6.29%
Golden Promise	0.82	55	1.5	0.83	41	0.9	64	8	14	78.13%	6.55%
Marris Otter	0.94	64	1.5	0.85	43	1.1	59	8	14	76.27%	5.90%
6-Row	0.89	52	1.6	0.82	36	1.15	50	12	13	74.00%	4.85%
Pale Ale	0.85	57	1.8	0.8	33	1.15	51	4	13	74.51%	4.98%
Vienna	0.88	54	1.5	0.83	41	1.1	56	12	12	78.57%	5.76%
Munich	0.83	56	1.6	0.8	37	1.05	56	12	13	76.79%	5.63%
Wheat	0.61	42	1.5	0.65	32	1	50	8	16	68.00%	4.45%

Notes:

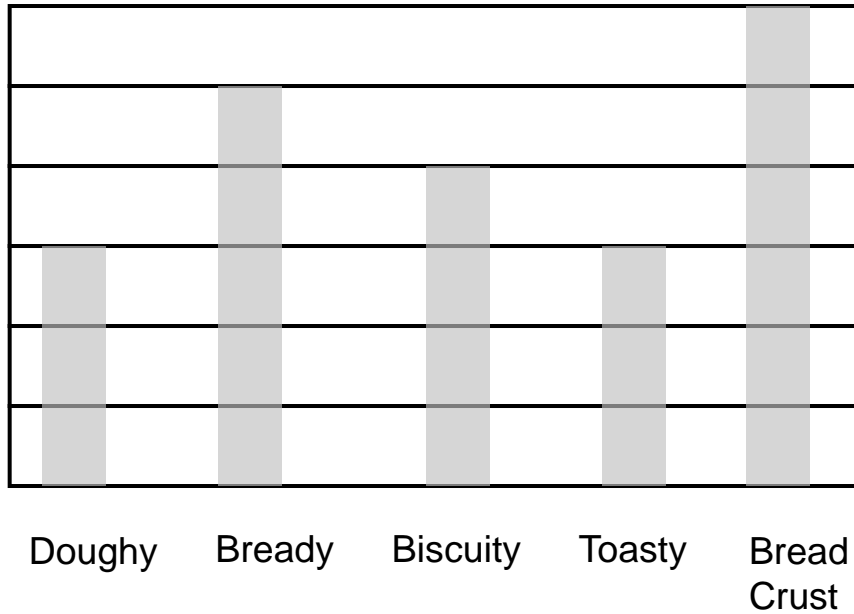
- Volume calculated via ruler & calibration scale (calibrated using weight of room temp water – 8.335 lbs / gal)
- OG measured with Refractometer
- FG measured with Precision Finishing Hydrometer
- All Efficiencies Calculated via Brewer's Friend software



Beer Profiling Tools

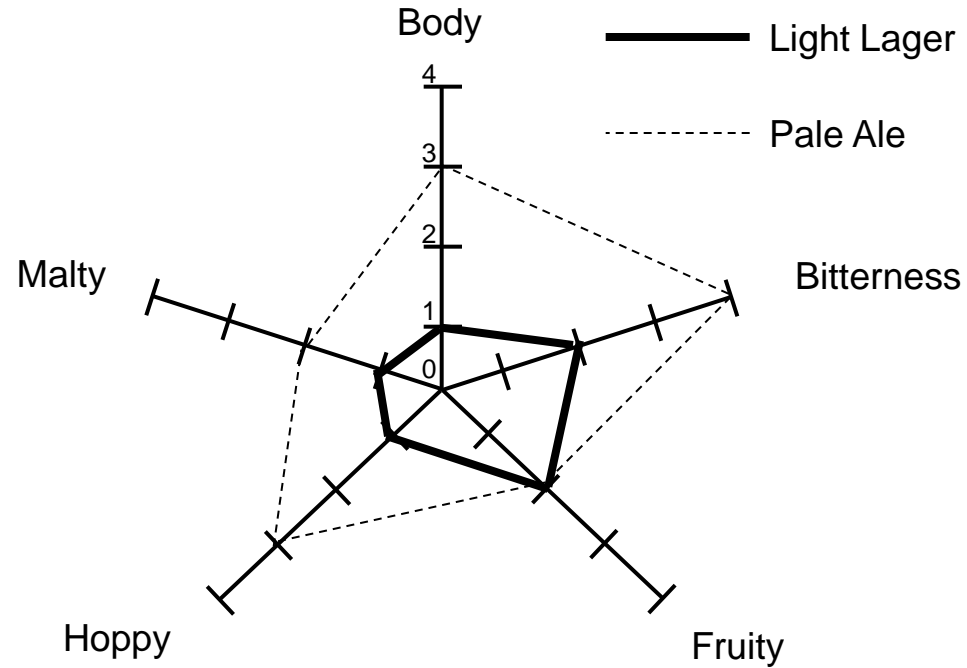


Histogram



From: *Brewing Classic Styles* by Jamil Z & John P

Radar Plot



From: *Brewing* by Michael Lewis



Data Collection Checklist



BEER SCORESHEET
 AHA/BJCP Sanctioned Competition Program
 Use Regular BJCP Scoresheet for Full Evaluation and Feedback

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Judge Name (print) _____ Style/Category _____ Ent
 Judge BJCP ID/Rank _____ Special Ingredients: _____
 Judge Email _____ Other Notes: _____

INSTRUCTIONS: '■' or '☑' boxes for attributes you perceive. Circle any boxes where style expectation

AROMA				Malt	Hops	Esters	Other	
Aspect	☉	L	M	H	<input type="checkbox"/> Grainy	<input type="checkbox"/> Citrusy	<input type="checkbox"/> 'Fruity'	<input type="checkbox"/> Brett.
Malt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Caramel	<input type="checkbox"/> Earthy	<input type="checkbox"/> Apple/Pear	<input type="checkbox"/> Fruit
Hops	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Bready	<input type="checkbox"/> Floral	<input type="checkbox"/> Banana	<input type="checkbox"/> Lactic
Esters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Rich	<input type="checkbox"/> Grassy	<input type="checkbox"/> Berry	<input type="checkbox"/> Smoke
Phenols	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Dark Fruit	<input type="checkbox"/> Herbal	<input type="checkbox"/> Citrus	<input type="checkbox"/> Spice
Alcohol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Toasty	<input type="checkbox"/> Piny	<input type="checkbox"/> Dried Fruit	<input type="checkbox"/> Vinous
Sweetness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Roasty	<input type="checkbox"/> Spicy	<input type="checkbox"/> Grape	<input type="checkbox"/> Wood
Acidity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Burnt	<input type="checkbox"/> Woody	<input type="checkbox"/> Stone Fruit	<input type="checkbox"/>
Comments								

APPEARANCE				Color Specifiers							
Aspect	☉	L	M	H	Beer	Straw	Yellow	Gold	Amber	Copper	Brown
Clarity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Head	(Will capture with pictures)					
Head Size	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other						
Head Retention	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments >						
Head Texture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							

FLAVOR				Malt	Hops	Esters	Other	Balance	
Aspect	☉	L	M	H	<input type="checkbox"/> Grainy	<input type="checkbox"/> Citrusy	<input type="checkbox"/> 'Fruity'	<input type="checkbox"/> Brett.	<input type="checkbox"/> Malty
Malt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Caramel	<input type="checkbox"/> Earthy	<input type="checkbox"/> Apple/Pear	<input type="checkbox"/> Fruit	<input type="checkbox"/> Hoppy
Hops	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Bready	<input type="checkbox"/> Floral	<input type="checkbox"/> Banana	<input type="checkbox"/> Lactic	<input type="checkbox"/> Even
Esters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Rich	<input type="checkbox"/> Grassy	<input type="checkbox"/> Berry	<input type="checkbox"/> Smoke	
Phenols	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Dark Fruit	<input type="checkbox"/> Herbal	<input type="checkbox"/> Citrus	<input type="checkbox"/> Spice	
Sweetness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Toasty	<input type="checkbox"/> Piny	<input type="checkbox"/> Dried Fruit	<input type="checkbox"/> Vinous	
Bitterness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Roasty	<input type="checkbox"/> Spicy	<input type="checkbox"/> Grape	<input type="checkbox"/> Wood	
Alcohol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Burnt	<input type="checkbox"/> Woody	<input type="checkbox"/> Stone Fruit	<input type="checkbox"/>	
Acidity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments >				
Harshness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					

MOUTHFEEL				Flavor	Finish	Comments	
Aspect	☉	L	M	H	<input type="checkbox"/> Flat	<input type="checkbox"/> Cloying	
Body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Gashed	<input type="checkbox"/> Sweet	
Carbonation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Flat	<input type="checkbox"/> Medium	
Warmth	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Harsh	<input type="checkbox"/> Dry	
Creaminess	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Slidy	<input type="checkbox"/> Biting	
Astringency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comments		

“Crisp vs Round” and “Dry vs Sweet” seem like important differentiators but aren’t captured well in the baseline sheet.



Data Collection Checklist



Base Malt:

Name:

Malt Aroma

L		M		H
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Descriptors

- Grainy
- Caramel
- Bready
- Biscuity
- Rich
- Dark Fruit
- Toasty
- Roasty
- Honey Sweet
- Nutty
- Other:

Flavor

	L		M		H
Malt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hops	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sweetness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bitterness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Harshness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Descriptors

- Grainy
- Caramel
- Bready
- Biscuity
- Rich
- Other:
- Dark Fruit
- Toasty
- Roasty
- Honey Sweet
- Nutty

Mouthfeel & Finish

	L		M		H
Body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Creaminess	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Round				Crisp
Crispness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Dry				Sweet
Finish Sweetness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments



General Observations



- Write down any other notes you may have observed (e.g. “Pale Malt tastes a lot like Marris Otter”)



Ideas For Future Work



- Compare Base Malts vs Continents/Suppliers
- Search commercial descriptions of base malts & build word clouds
- Compare mash profiles for a given base recipe
 - Single Infusion vs Multi-Rest vs Decoction
- Single Recipe, multiple yeasts
 - American vs British vs Belgian vs Australian
 - Lager vs Ale vs Belgian