

BYO Boot Camp '23

Malt Workshop

Ashton Lewis

BYO's Technical Editor & Mr. Wizard Columnist





Ashton Lewis

BSG Manager of Training & Technical Support

BYO Technical Editor/Mr. Wizard

- ✓ Started homebrewing in 1986
- ✓ BS in Food Science from Virginia Tech in 1991
- ✓ MS in Food/Brewing Science from UC Davis in 1994
- ✓ Joined BYO Team in 1995
- ✓ SBC Master Brewer 1997 - 2019
- ✓ Paul Mueller Company 1997-2016
- ✓ BSG 2016 - Present
- www.bsgcraftbrewing.com || www.byo.com

What is Malt and Why is Important to Brewers?

- Grain that has been germinated and dried
- Barley, wheat, oats, rye, and spelt are examples of malts used by brewers
- Barley malt is synonymous with “malt”
- Enzymes and starch for use in mashing
- Husk for use in lautering
- Color and flavor compounds used by brewers like artists use paint



Why Make Malt?

Move grain, not
water, closer to
the beer
consumer



Malting Barley Attributes

- Grown on all continents except Antarctica
- Growing region plays a major role in malt qualities, such as:
 - Yield
 - Protein content
 - Starch content
 - Damage due to pests and disease
 - Consistency
 - Agronomics
 - Beer flavor



Farm to Brewery Journey

- Barley breeding research
- Malting variety approval
- Maltster contracts with grower
- Brewer contracts with maltster or
Distributor contracts with maltster
- Brewer buys from distributor or maltster





The Malting Process

- Steeping
- Germination
- Kilning



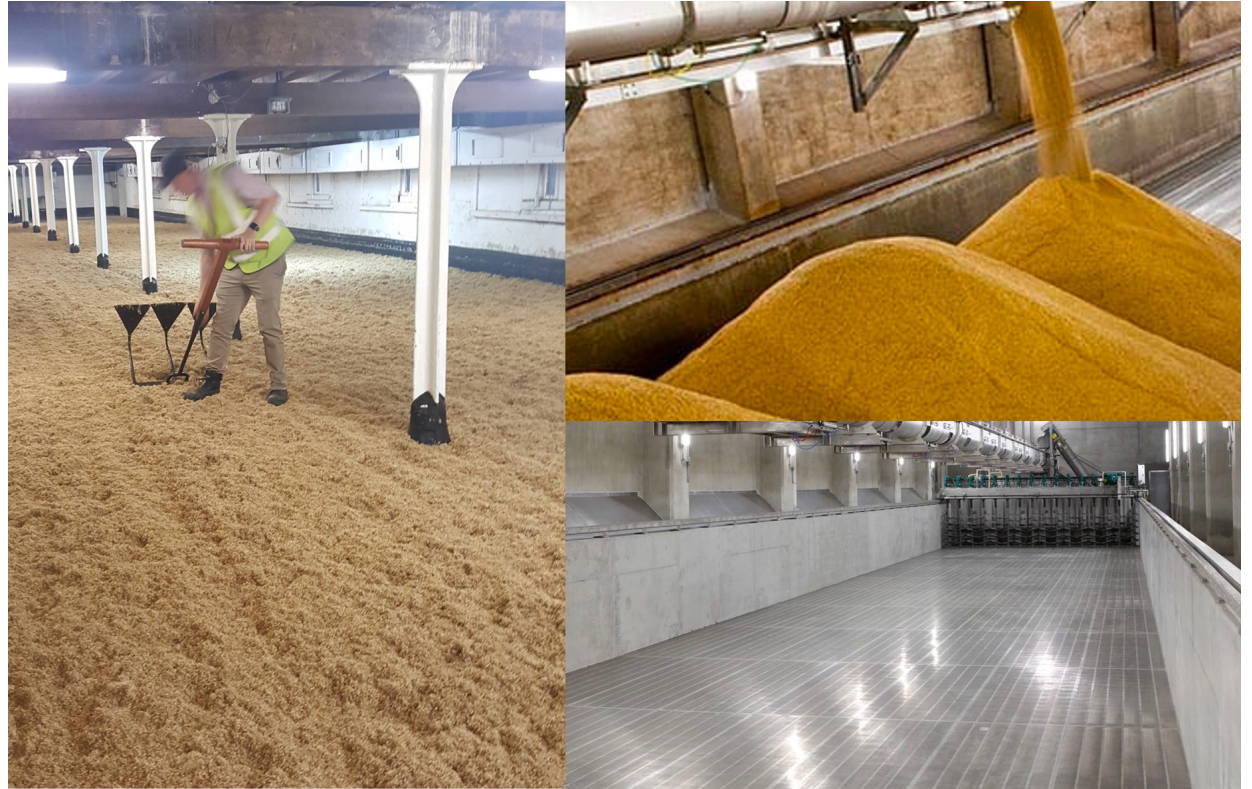
Steeping

- Wetting the grain gets things moving
- Takes about 2 days to increase the moisture content to ~48%
- Uniform hydration sets the stage for uniform germination
- Several steeping methods and all include carbon dioxide removal



Germination

- Several methods used
- All involve turning germinating grain
- Insufficient oxygen suffocates growth
- Germination rate and evenness affected by temperature
- Relatively easy to do on small scale
- Acrospire length is indicator of progress



Kilning

- Stops activity, preserves enzymes, & develops flavor
- Kilning schedule varies with malt type:
 - Base malt
 - High kilned
 - Crystal
 - Roasted



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Overview of Malt Specifications and COA

What are Specifications?

- A detailed description used to minimize miscommunication
- Examples include:
 - Product specifications, e.g., malt specifications
 - Engineering/design specifications
 - Functional specifications



How Are Specifications Used by Buyers?

- Communicate requirements & expectations to supplier
 - Bid packages
 - Purchase orders
 - Acceptance criteria
- Understand how to use a product
 - New beer formulation
 - Ingredient substitutions
 - Equipment installation

How Are Specifications Used by Suppliers?

- Define products
 - Manufacturing control
 - Marketing & sales
 - Acceptance criteria
- Explain how to use a product
 - New beer formulation
 - Ingredient substitutions
 - Equipment installation

Same Specification, Different Products



Malt Specification vs. Certificate of Analysis

- A specification applies to a type of malt, for example Rahr Pale Ale malt
- A Certificate of Analysis applies to a particular lot of malt
- Many brewers refer to a complete set of malt analyses as “malt specs.” This can lead to confusion about what is being discussed.

Overview of Specs

Physical & Biochemical Analyses

- Assortment
- Bushel Weight
- Friability
- Moisture Content
- Diastatic Power (DP)
- Alpha Amylase (DU)
- Deoxynivalenol (DON)

Overview of Specs

Compositional Analyses

- Extract – Fine Grind
- Extract – Coarse Grind
- Fine/Coarse Difference
- Color
- Total Protein
- Soluble/Total (Kolbach Index)
- Free Amino Nitrogen (FAN)
- Beta Glucan
- Viscosity



Issued: 06 Apr, 2023

RAHR MALTING CO.
RAHR MALTING CO. SHAKOPEE, MN 55379
952-496-7115 (Theresa Kukar)

Certificate Of Analysis

Customer	Ship Date	Car Number	Grade	Destination
BREWERS SUPPLY GROUP	3/29/2023		North Star Pils	BSG SHAKOPEE WAREHOUSE
Shipment Wt. Lbs.				Rahr Ref No
160,076				0081535BSG

Crop Year	Variety	Percent
Approved Malting Varieties		100

Assay	Methodology	Shipment	Min Spec	Max Spec
Moisture, %	ASBC-Malt-3	4.13		5.00
Fine Grind, As Is, %		78.5		
Fine Grind, Dry Basis, %, %	ASBC-Malt-4	81.9	79.0	
Fine/Course Difference, %	ASBC-Malt-4	0.6		2.0
Course Grind, As Is, %		77.9		
Course Grind, Dry Basis, %	ASBC-Malt-4	81.3		
Color, SRM	ASBC-Wort-9	1.76	1.50	2.00
Diastatic Power, °Lintner	ASBC-Malt-6C	125	110	180
Alpha Amylase, DU, DU	ASBC-Malt-7D	62.1	50.0	70.0
Total Protein (Leco), %	ASBC-Malt-8B	11.37		12.5
Soluble Protein, %	ASBC-Wort-17	4.74		
S/T Ratio		41.7	37.00	44.00
Viscosity, cP	ASBC-Wort-13B	1.50		1.55
Beta Glucan, mg/L	ASBC-Wort-18B	98		150
Don, mg/L		0.40		0.50
FAN, mg/L	ASBC-Wort-12B	190	150	215
pH	ASBC-Wort-8	6.03		
7/64	ASBC-Malt-2B	71.8		
6/64	ASBC-Malt-2B	20.9		
5/64	ASBC-Malt-2B	6.3		
Thru	ASBC-Malt-2B	1.0		2.0
Turbidity, NTU		12.6		
Friability	ASBC-Malt-12	91.2		
Friability %WK	ASBC-Malt-12	0.78		
bushel Weight, lb/bu	ASBC-Malt-2A	40.8		

A COA document is specific to a lot of malt. This document also shows the malt specifications.



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bushel Weight, lb/bu	ASBC-Malt-2A	40.8		

Making sense of a lot of information ... What this brewer looks for when reading a COA

- Color
- Coarse Grind, As Is
- S/T and Total Protein
- FAN
- pH
- Assortment (commercial)

ASBC Hot Steep

Material, Method, and Notes provided as a reference. Modified wort separation method will be demonstrated as a rapid alternative to filtration.

Hot Steep Evaluation - Materials

- 16-ounce canning jar with lid
- Immersion heater or oven
- Hot water bath maintained at 65°C/150°F or oven set to ~150°F
- Plastic funnel with ~500 ml volume
- Fluted filter paper, fluted, 32 cm in diameter (Ahlstrom No. 515 or similar)
- Electric coffee/spice grinder
- Graduated cylinder to measure water
- Kitchen scale capable of weighing 50.0 g
- Deionized water
- Whole kernel malt samples

Hot Steep Evaluation - Method

- Place approximately 52 g of malt in electric grinder.
- Close lid and grind for 10 seconds or until a course flour consistency is achieved.
- Weigh 50 ± 0.1 g of malt flour into canning jar.
- Pour 400 mL of 65°C water into canning jar.
- Cap and vigorously shake for 20 seconds to ensure malt grist is completely wetted and mixed
- Place canning jar in hot water bath or oven and let rest for 15 minutes.
- During this time, place filter paper inside funnel and wet paper with deionized water to minimize aroma contribution.
- Position filter and funnel into empty canning jar and leave until use for wort collection.
- When 15-minute hold is complete, vigorously swirl contents of canning jar for 20 seconds to bring settled particles back into solution, uncap, and quickly pour all of mash liquid into filter (see Note 3).
- Collect and pour first 100 mL of filtrate back into canning jar used for sample preparation.
- Swirl wort with sample residuals, then gently repour back into filter. Allow wort to filter to completion (see Notes 4–6).
- Evaluate the samples using sight, smell, and taste.

Hot Steep Evaluation - Notes

1. Evaluate base malts with 50 g of sample (100% inclusion), specialty malts with 25 g of sample and 25 g of base malt (50% inclusion), and dark-roasted specialty malts with 7.5 g of sample and 42.5 g of base malt (15% inclusion).
2. If different malts are to be milled, clean electric grinder with a dry rag in between samples to prevent cross-contamination.
3. The entire contents must be poured through the filter at once so that the grain bed can settle without being disturbed. Filter paper should be free of aromas and large enough to hold the entire contents of the canning jar.
4. Filtration rate and sample yield will be influenced by malt type and modification level. Approximately 300 mL of wort can be collected in 30-45 minutes (serves six to eight tasters).
5. Perform wort sensory evaluation within 4 hours of filtration. Serve at room temperature.

Malt Calculation

The metric system is used as the international language for brewing recipes. And the grist bill is always expressed in terms of % of total extract. This language is very easy with a little practice.

Calculating Extract

- Extract tells us how much “stuff” is contained in wort.
- Carbohydrate represents about 90% of total extract and protein makes up the remaining 10%.
- °Plato and specific gravity are both used to calculate wort extract.

Given:

- 10 l cold wort volume
- 12.15°Plato / 1.049

Question:

- How many kg of extract are present?

Key Information Needed:

- ❑ Liters of wort
- ❑ Wort strength and density

Long-Hand Extract Calculation

Solution:

Volume = 10 liters

Density = $1 + (^\circ\text{Plato} \div (258.6 - ^\circ\text{Plato} \times 0.8796))$
= $1 + (12.15 \div (258.6 - 12.15 \times 0.8796))$
= $1 + (12.15 \div (247.9129))$
= $1 + (0.049)$
= 1.049 kg wort /l wort

Long-Hand Extract Calculation

Solution:

Volume = 10 liters

Density = $1 + (^\circ\text{Plato} \div (258.6 - ^\circ\text{Plato} \times 0.8796))$
= $1 + (12.15 \div (258.6 - 12.15 \times 0.8796))$
= $1 + (12.15 \div (247.9129))$
= $1 + (0.049)$
= 1.049 kg wort / l wort

12.15 $^\circ$ Plato = 0.1215 kg extract / kg wort

*Also need to throw
some units on $^\circ$ Plato to
be able to make the
units all agreeable!*



Long-Hand Extract Calculation

Solution:

Volume = 10 liters

Density = 1.049 kg wort / l wort

12.15°Plato = 0.1215 kg extract / kg wort

kg extract = $\frac{10 \text{ l wort}}{1 \text{ wort}} \times \frac{1.049 \text{ kg wort}}{1 \text{ wort}} \times \frac{0.1215 \text{ kg extract}}{\text{kg wort}}$

kg extract = 1.28 kg extract

Kilos Extract Allow for Grist Calculations

For Example:

10 hl cold wort volume | 12.15°Plato | 1.28 kg extract

85% brewhouse yield (actual vs. laboratory)

80% Pils malt with 75.2% extract (cg, as-is)

10% Vienna malt with 76% extract (cg, as-is)

5% Light Munich malt with 78% extract (cg, as-is)

5% Carahell malt with 72% extract (cg, as-is)

Question:

How many kg of each malt are required?



Kilos Extract Allow for Grist Calculations

Solution:

$$\begin{aligned}\text{Pils Extract} &= 1.28 \text{ kg extract} \times \frac{0.80 \text{ kg Pils extract}}{\text{kg extract}} \\ &= 1.02 \text{ kg Pils extract}\end{aligned}$$

$$\text{kg Pils Malt} = \frac{1.02 \text{ kg Pils extract} \times \text{kg Pils Malt} \times \text{kg extract}}{0.752 \text{ kg Pils extract} \times 0.85 \text{ kg extract}}$$

$$\text{kg Pils Malt} = \underline{1.60 \text{ kg Pils Malt}}$$

1/(CG-as is)

1/(Brewhouse Yield)

Kilos Extract Allow for Grist Calculations

Solution:

$$\begin{aligned}\text{Vienna Ext.} &= 1.28 \text{ kg extract} \times \frac{0.10 \text{ kg Vienna extract}}{\text{kg extract}} \\ &= 0.13 \text{ kg Vienna extract}\end{aligned}$$

$$\begin{aligned}\text{kg Vienna} &= \frac{0.13 \text{ kg Vienna extract} \times \text{kg Vienna Malt} \times \text{kg extract}}{0.76 \text{ kg special ext.} \times 0.85 \text{ kg extract}} \\ &= \underline{0.20 \text{ kg Vienna Malt}}\end{aligned}$$

Kilos Extract Allow for Grist Calculations

Solution:

$$\begin{aligned}\text{Munich Ext.} &= 1.28 \text{ kg extract} \times \frac{0.05 \text{ kg Munich extract}}{\text{kg extract}} \\ &= 0.64 \text{ kg Munich extract}\end{aligned}$$

$$\begin{aligned}\text{kg Munich} &= \frac{0.64 \text{ kg Munich extract} \times \text{kg Munich Malt} \times \text{kg extract}}{0.78 \text{ kg special ext.} \times 0.85 \text{ kg extract}} \\ &= \underline{0.97 \text{ kg Munich Malt}}\end{aligned}$$

Kilos Extract Allow for Grist Calculations

Solution:

$$\begin{aligned}\text{Carahell Ext.} &= 1.28 \text{ kg extract} \times \frac{0.05 \text{ kg Carahell extract}}{\text{kg extract}} \\ &= 0.64 \text{ kg Carahell extract}\end{aligned}$$

$$\begin{aligned}\text{kg Carahell} &= \frac{0.64 \text{ kg Carahell extract} \times \text{kg Carahell Malt} \times \text{kg extract}}{0.72 \text{ kg special ext.} \times 0.85 \text{ kg extract}} \\ &= \underline{1.05 \text{ kg Carahell Malt}}\end{aligned}$$