Colored Malt Products
June 23, 2012
Robert Seggewiss
What is Malt?

• Malt is a source of carbohydrates, proteins and other nutrients which are fermented by yeast to produce beer

• Malt for brewing is usually produced from barley
Why Barley?

• Economic source of starch (carbohydrate)
• Economic source of enzymes (which break down starch, proteins etc)
• Natural source of color
• Unique source of malty flavors and aromas traditionally associated with beer
• Husk material provides a filter for wort clarification
Malt can also be made with:

- Rye
- Wheat
- Triticale
- Corn
- Spelt
- Sorghum
There are many types of Barley Malt

- Pilsen Malt
- Select Malts
- Pale Malt
- Vienna Malt
- Munich Malt
- Melanoidin/Brumalt
- Aromatic Malt
- Black/Chocolate Malt
- Smoked Malt
- Acidulated Malt
- Chit Malt
- Distillers Malt
- Crystal/Caramel Malt
- Dextra Pils
Three Stages of Malting

Steeping (36-54 hrs)

Germination (80-120 hrs)

Kilning (18-48 hrs)
Select any steep tank, germination compartment, or kiln floor to view additional detail.
Minimum Requirements for Malting

- Viable Barley Kernel
- Water
- Oxygen
Steeping

Steeping parameters dependant on following factors:

• Customer specifications
• Grain plumpness
• Protein content
• Variety
• Water sensitivity
• Crop year
• Resulting malt analysis
• Growing Region
Physiological Consequences of Steeping

• Embryo “activated”
  • Water and Oxygen Uptake
  • Disappearance of simple sugars
  • Generation of heat, carbon dioxide
  • Production of “gibberellins”
  • Stimulation of Aleurone
  • Production of Hydrolytic Enzymes
Conical Steep Tank
Flat Bottom Steep Tank Schematic
Saladin Box Germination Bed
Germination Floor

Germination compartment
Turning machines.
Typical Germination Conditions

- Four day germination
- Temperature Air Applied  57-63°F (14 - 17°C)
- Temperature Exhaust Air  63-68°F (17 - 20°C)
- Typical Delta T  34 – 37°F (1-3°C)
- Humidity  100%
- Airflow  6 - 10 cfm/bu
- Exhaust Air recirculation
- Green Malt moisture 44-46% prior to kilning
Germ/Kiln Hellices
PROGRESS OF MODIFICATION

**DAY 1**
Chit - some modification parallel to scutellum

**DAY 2 - 3**
Rootlets, modification parallel to scutellum and inwards from aleurone

**DAY 3 - 5**
Rootlet, modification proceeding with acrospire

**DAY 4 - 6**
Rootlets withering, most of endosperm modified
Summary of Germination
Starting Materials: Viable Barley Kernel + Oxygen + Water

Embryo → GA → Aleurone

β-Amylase Protease

Central Endosperm

α-Amylase
β-Glucanase Proteases

Respiration

Growth

Solubilized Walls

Degraded Protein

Partially Degraded Protein

Small Hydrolytic Products + Enzymes

Modified Endosperm

Shoots & Rootlets
Fig. 7  Diagram indicating some of the metabolic interrelationships occurring in malting barley.
Purposes for Kilning

Reduce moisture to ensure friability

Stabilize malt for long term storage

Colour and flavour development
Typical Kilning Parameters

• High Volumes of Air Flow

• Temperature Ranges 104-212+ °F (40-100+ °C)

• Reduction of moisture in green malt from 48% to 4-6% as finished malt.
Double Deck Kiln
**Kiln Load Parameters**

- **Current Grain Level**: 30 cm
- **First Pass Level**: 30 cm, 50%
- **Second Pass Level**: 20 cm, 50%
- **Third Pass Level**: 0 cm, 66%
- **Residual Pass's**: 5 cm, 50%
- **Kiln Load Time**: 00:39

**Germ Unload Parameters**

- **Auger Into Grain for**: Compt.1: 30, Compt.2: 35, Compt.3: 30, Compt.4: 30, Compt.5: 35, Compt.6: 30
- **Turn Helices Over Pit for**: Compt.1: 35, Compt.2: 5, Compt.3: 35, Compt.4: 35, Compt.5: 15, Compt.6: 35
Twin Kiln System
Different Varieties are Processed Differently
Know Your 2011 MALTING BARLEY VARIETIES

Two-Rows
- AC Metcalfe (2005)
- CDC Copeland (2007)
- Charles+ (2009)
- Conion (2000)
- Conrad (2007)
- Harrington (1989)
- Hockett (2010)
- Merit (2000)
- Merit 57 (2010)
- Moravian 37 (2010)
- Moravian 69 (2010)
- Pinnacle (2011)
- Scarlett (2008)

Six-Rows
- Celebration (2011)
- Lacey (2000)
- Legacy (2001)
- Quest (2011)
- Rasmusson (2009)
- Robust (1984)
- Stellar-ND (2006)

*Winter

These malting varieties listed in alphabetical order are recommended by AMBA for planting in 2011. When delivered to market in pure carlots of sound, bright, plump, low moisture barley in an acceptable protein range, they may command premium prices over feed barley. Growers are encouraged to contact their local elevator, grain handler or processor to gauge market demand for any variety grown in their region prior to seeding. 2010 crop plantings by variety are included at the end of this publication.

Prepared and distributed by
AMERICAN MALTING BARLEY ASSOCIATION, INC.
740 N. Plankinton Avenue, Suite 830, Milwaukee, WI 53203
http://www.AMBAINC.org
Barley Variety Survey - 2011

PERCENT OF ACREAGE BY CROP REPORTING DISTRICTS

COLORADO

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STATISTICS ABSTRACTED FROM USDA STATE BARLEY SURVEY REPORTS

2011 Preliminary
2016 Revised
BARLEY ACREAGE PLANTED IN EACH DISTRICT IN 2011 IS INDICATED BENEATH THE DISTRICT LIST OF VARIETIES.

July, 2011

American Malting Barley Association, Inc.

MAP PREPARED AND DISTRIBUTED BY:
American Malting Barley Association, Inc.
740 N. Plankinton Ave., Suite 830
Milwaukee, WI 53203 / (414) 272-4940

Compiled by United States Department of Agriculture/National Agriculture Statistics Service and cooperating state agencies. Supporting funds provided by American Malting Barley Association, Inc., Idaho Barley Commission; Montana Wheat & Barley Committee; North Dakota Barley Council; and Washington Barley Commission.
Wheat Malt

• Produced from white spring wheat
  – AC Andrew: Canada
  – Madsen: US
    • Hulless
    • Used in production of wheat beers at 25 – 50% wheat malt inclusion

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<th>Moist.</th>
<th>F.G.</th>
<th>F/C Diff.</th>
<th>Color EBC Spectro</th>
<th>DP</th>
<th>A.A.</th>
<th>Tot Protein</th>
<th>Sol Pro</th>
<th>S/T</th>
<th>pH</th>
<th>VISC</th>
<th>Beta Glucan</th>
<th>FAN</th>
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<td>1.65</td>
<td>48</td>
<td>177</td>
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Protein

Different protein levels are processed differently to produce different types of malts or the same malts.
Protein Impact

**Maltster**
- Processing
- Malt Analysis
- Sizings

**Brewer**
- Extract Drop
- Conversion changes
- Flavor is impacted
- Head Retention changes
- Fermentation
Sizing Impact

Maltster
- Process
- Malt Analysis

Brewer
- Milling
- Fermentation Problems
- Conversion Issues
Peeled and Broken

Peeled kernels impact everything from steeping in malting to fermentation in the brewery. High peeled counts are an indication to the Maltster that the handling of the barley has been poor and the barley is now conditioned to lose more husk.
Peeled Impact

Maltster
• Processing
• Malt Analysis
• Appearance

Brewer
• Milling
• Extract yields
• Flavor
• Fermentations
Staining/Weathering

Staining of barley is generally an aesthetic issue with both maltster and brewer. But can impact processing.
Uncleaned Excel Barley
Maturity

Immature barley impacts the appearance of our finished product. It also represents additional yield loses in the cleaning and processing of the barley.
Base Malts or Foundation Malts

- Base malts (foundation 40 – 100% of grist bill)
  - Superior Pilsen (1.6-1.9 L), <10% Protein
  - Pilsen Malt (1.8-2.2 L), <11.5% Protein
  - North Western Pale Ale Malt (2.6-3.0 L), <12% Protein
  - Vienna Malt (3.5-4.1 L), <12% Protein
Specialty Malts

- Dextrin Malt
- Munich
- Brumalt/Melanoidin
- Roasted Barley
- Roasted Malt
- Roasted Green Malt
Specialty Malts

- **Dextra Pils**
  - Color < 3.0 EBC
  - Adds body to beer
  - Residual sweetness
  - Starch adjunct
  - Protein source
Specialty Malts

• Vienna, Munich, Melanoidin

– Produced on a traditional single deck kiln.
– Typically a high degree of kiln recirculation, early in the drying phase is employed to enhance color formation. Bed temperature to 60 – 65 °F (16 - 18 °C) during recirculation.
– Less recirculation for Vienna, more for Melanoidin.
– Recirculation promotes sugars and amino nitrogen which combine to form Melanoidins.
– Cure temperatures to 205 °F (96 °C)
– Limited conversion and liquefaction occurs.
Specialty Malts: Kilned Specialties

- Vienna, Munich, Melanoidin
  - Typical EBC color
    - Vienna 2.5 – 5 ASBC
    - Munich 9 – 12 ASBC
    - Melanoidin 20 – 40 ASBC
  - These products are used to add color to beer for a range of darker color beers.
  - Adds sweeter flavor with more body
  - Also used to add color to beers low malt inclusion ratio’s to results in a typical Lager color.
Specialty Malts: Kilned Specialties

- **Melanoidin/Brumalt**
  - Highly modified in steeping and germination
  - Germination there is restricted air flow to produce low molecular weight sugars and AA
  - **Cure temperature 212 – 230 °F (100 – 110 °C)**
  - **Used to add color without any additional sweetness**
Specialty Malts: Kilned Specialties

- **Melanoidin/Brumalt**
  - Produced on traditional single deck kilns
  - Highly recirculated with higher applied temperatures > 95 °C.
  - Some conversion occurs, but typically little crystallization
  - 20 – 30 ASBC color typical, up to C 80 possible.
  - Used to add color to beer and caramel flavor depending on inclusion rate.
  - Improves beer stability due to anti-oxidant properties.
Specialty Malts: Roasted Specialties

- **Crystal/Caramel**
  - Produced in Probat Drum Roaster
  - Green malt at 44 – 46% moisture transferred to the Roaster
  - Highly recirculated with higher applied temperatures 800 - 900 ºF (420 - 480 ºC)
  - Three essential stages Stewing or Saccharification phase, Drying phase and Cure or Color Phase.
  - Complete conversion occurs with high degree of crystallization.
  - 10 – 160 ASBC color, C 30, C60, C 80 , C120, C150, C 240, C 300.
  - Organic or non-Organic
Specialty Malts: Roasted Specialties

• *Brown/ Double Brown/Chocolate/Black*
  – Produced in Probat Drum Roaster
  – Finished Base Malts transferred to the Roaster
  – 850 F applied temp
  – Malt internal temp 300 – 403 °F (149 - 206 ºC)
  – *Organic or non-Organic*
Specialty Malts: Roasted Specialties

Used to add:
- Colour
- Body
- Flavour
- Sweetness
- Improves beer stability due to anti-oxidant properties.
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<tr>
<th>Malt Type</th>
<th>Color Range (ºL. ASBC)</th>
<th>Organoleptic (0-Low, 5-High)</th>
<th>Comments</th>
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<td>Foundation</td>
<td>1.8-2.20</td>
<td>2 Sweet, 2 Malty, Clean</td>
<td>Pilsen and NW Pale malt, 40-100%</td>
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<tr>
<td>Dextrin</td>
<td>&lt;1.5</td>
<td>0 Sweet, 1 Malty, 1 Dry, 1 Full</td>
<td>&lt;20%, Adds body, residual sweetness</td>
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<td>Vienna</td>
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<td>2 Sweet, 2 Malty, Full,</td>
<td>Typically used in Marzen style beer.</td>
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<td>Munich</td>
<td>9-11</td>
<td>3 Sweet, 2 Malty, 1 Roasted</td>
<td>Dark Beer Character, up to 40% intensifies aroma.</td>
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<td>Melanoidin</td>
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<td>4 Sweet, 2 Malty, 1 Dry</td>
<td>Dark Beer Character, up to 40% intensifies aroma.</td>
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<td>Light Crystal</td>
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<td>5 Sweet, 3 Malty, 4-5 Roasted, 3 Caramel, 1 Toffee</td>
<td>&lt;40% used to create ale color, improve foam and palate fullness.</td>
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<td>Pale Crystal</td>
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<td>5 Sweet, 3 Malty, 5 Roasted, 3 Caramel, 3 Toffee</td>
<td>&lt;40% used to create palate fullness, intensify malt aroma and beer color</td>
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<td>Dark Crystal</td>
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<td>5 Sweet, 2 Malty, 3 Roasted, 4 Caramel, 5 Toffee</td>
<td>Intensifies palate fullness, malt aroma, full flavor and beer color.</td>
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<td>Brown, Double Brown</td>
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<td>0 Sweet, 1 Malty, 4 Dry, 4 Roasted,</td>
<td>Dry finish, roasted notes, little sweetness.</td>
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<td>Chocolate</td>
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<td>&lt;10, adds coffee bean notes</td>
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<td>&lt;10, adds slight bitterness notes</td>
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<td>Roasted Barley</td>
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<td>0 Sweet, 0 Malty, 0 Dry, 5 Roasted, 4 Burnt, Thin mouth feel, acrid bitterness.</td>
<td>&lt;10, lends a burnt bitterness flavor.</td>
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Colored Malt Products

- Know the final organoleptic profile desired
- Request samples
- Inspect, smell and chew samples
- Ask questions
“Corn feeds the world but Barley keeps it happy!” Lyn Dahleen