
Malts and Malting

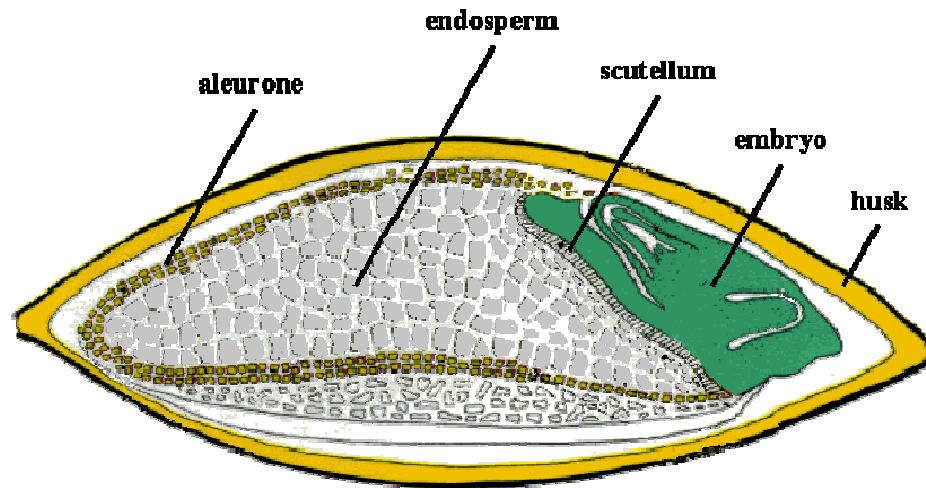
Andy Hejl

Why Malt Grains?

- Unmalted grains (alone) are unacceptable for brewing
- Malting performs two critical activities
 - Necessary enzymes are formed or activated
 - Starches become accessible



Anatomy of a barley grain



- Endosperm
 - Contains the starches and proteins in a glassy matrix
- Embryo
 - Where the growth is initiate
- All contained within the husk

Malting Process – Steeping

- At beginning raw barley is ~12% moisture
 - Steeping raises the moisture content to ~45%
 - Water is added at 50 to 65F
 - Water is drained and refilled several times
 - Oxygen is introduced to aerate the liquor
 - Total time for this step is 2 to 4 days
 - Steeping is complete when rootlets begin to show
 - “Chitted” barley
 - Enzymes are activated or synthesized
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Malting Process – Steeping

- Water infusion of steeping malt



Malting Process – Steeping

- Full malt steep tank



Malting Process – Germination

- Properly hydrated barley transferred to germination area
 - Saladin box
 - Floor malting
 - Germination continues and barley undergoes modification
 - Critical control points
 - Moisture content (~45% moisture)
 - Temperature (50 to 70F)
 - Time (3 to 8 days)
 - Oxygen uptake
 - Germinating malt is also called “green malt”
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Malting Process – Saladin Box

- Modern malting facilities use a rectangular box for the germination stage
 - Air can pass through the bottom
 - Introduces oxygen to the malt
 - Carries off other gaseous byproducts
 - Rotating screws level and turn the malt
 - Gives precise temperature and humidity control
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Malting Process – Saladin Box

- Saladin box loaded and being leveled



Malting Process – Saladin Box

- Helical turners of type used in Saladin box



Malting Process – Floor Malting

- Traditional method of malting
- Spread a thin layer of the malt on the floor
 - Depth could be varied to control temperature
- Used lower temperatures and longer germination times
- A much more variable process



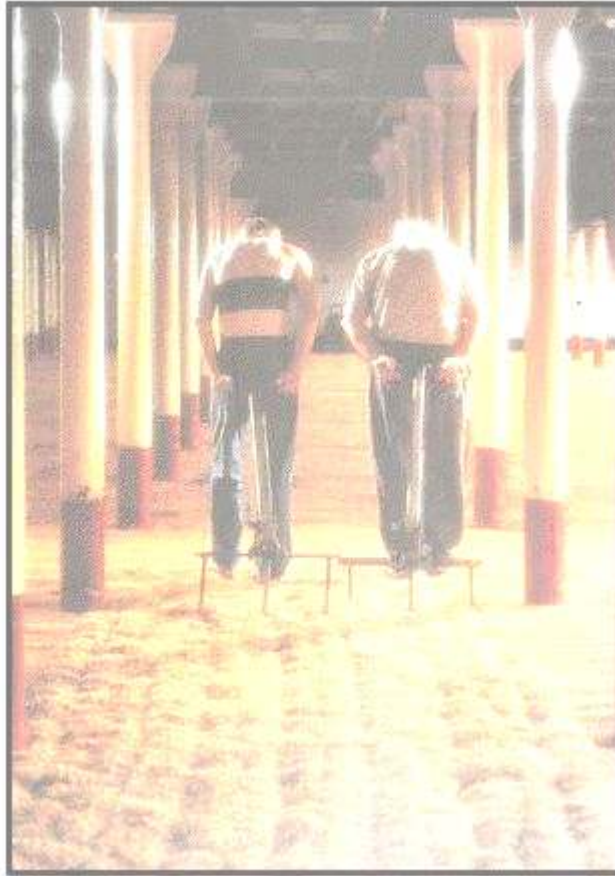
Malting Process – Floor Malting

- Picture of a floor malting (Laphroaig Whiskey distillery)



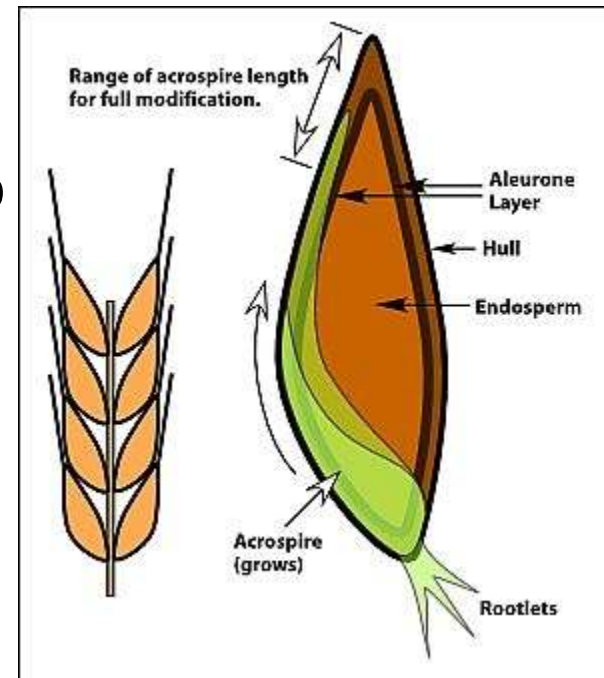
Malting Process – Floor Malting

- Turning floor malting with a rake



Malting Process – Modification

- Changes to the kernel during germination
 - Endosperm breaks down
 - New enzymes created
 - Acrospire grows from embryo
 - Acrospire length ratio
 - <75% undermodified
 - 75-100% fully modified



Malting Process – Modification

- Modification of malt helped distinguish brewing techniques and styles
 - British brewers have always used fully modified malts
 - German brewers often had undermodified malts
 - Protein rest
 - Decoction
 - Most malts today are fully modified

 - Maltsters do not want to overmodify malts because this reduces the potential extract of the malt
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Malting Process – Drying

- Following completion of germination the malt is kilned
 - First step of kilning is drying
 - Reduces moisture content to ~5%
 - Slow drying with temperature below 120F
 - Halts the germination process
 - Protects enzymes from denaturation
 - Forced air is used to carry off moisture
 - Kiln typically has several floors to accommodate malt
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Malting Process – Drying

- Malt kiln



Malting Process – Curing

- After drying the malt is cured to give it its character
 - Temperature ranges vary greatly
 - Palest malts – 180F
 - Darkest malt – 500F
 - Time and temperature combine to give the malt its character
 - Darker malts also frequently use drum roaster
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Malting Process – Drum Roaster

- Drum roaster for darker colored malts



Malt Color Scales

- 2 separate scales for measuring color
 - SRM – Standard Reference Method
 - Used interchangeable with °Lovibond
 - °Lovibond is used for malt color
 - European Brewing Convention – EBC
 - Rule of thumb is that EBC is twice SRM
 - Lower numbers lighter / higher numbers darker
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Classes of Malts – Base Malts

- Grainy, graham cracker, biscuity
 - Color contribution – yellow, gold
 - **European Pilsner** – 1-2°L
 - Lightest base malts, kilned 130-180°F
 - German lagers, Belgian styles
 - **US 2-row** – 2-3°L
 - Intermediate base malt, kilned 130-180°F
 - Most US styles
 - **British Pale Malt** – 2-4°L
 - More robust flavor, kilned 200-220°F
 - Most UK styles
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Classes of Malts – High Dried Malts

- Can be used as base malts in lager styles
 - Drying stage usually done at a higher temperature
 - More melanoidin content – bready, toasty
 - Color contribution – amber, copper
 - **Vienna** – 4°L
 - Kilned 210 to 230°F
 - Vienna lagers
 - **Munich** – 5-10°L
 - Kilned 210 to 240°F
 - Oktoberfest, Munich Dunkel, Bock
 - Others – **Victory, Aromatic, Brown Malt**
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Classes of Malts – Crystal Malts

- Different process than other types of malts
 - Kilned while still wet (~50% moisture) at ~150-160°F
 - No ventilation to dry out the malts
 - Completes a “mash” while still in the husk
 - After this rest, they are kilned to get desired color/flavor
 - Color contribution amber to red/brown
 - Range of Colors and Flavors
 - Crystal 10 – honeylike sweetness
 - Crystal 60 - caramel
 - Crystal 120 – dark caramel, raisin, burnt sugar
 - Crystal Malts very common in British styles
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Classes of Malts – Roasted Malts

- Kilned very high 400-500°F
 - Roasted, chocolate, coffee, burnt flavors
 - Color contribution brown to black
 - Reddish hue at very low levels
 - Common in Porters and Stouts
 - **Chocolate** – 300 to 400°L
 - **Black Patent** – 500 to 600°L
 - **Roasted Barley (unmalted)** – 500°L
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Other Malted Grains

- **Wheat Malt**
 - Characteristic spicy, tart flavor
 - High protein content
 - Helps head retention
 - Causes haze
 - Many wheat beer styles
 - **Rye Malt**
 - Spicy character
 - Roggenbier is a classic example
 - Sorghum
 - Not very common, gluten-free
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Adjunct Grains

- Other grains that are not malted but added to mash
- Need to be treated differently to access starches
 - Cereal mash
 - Flaked, torrified raw grains
- Often have different protein content
 - Lower protein – reduce flavor contributions
 - rice, corn
 - Higher protein – aid head retention, body
 - barley, wheat, oats



Other sugar additives

- Other sugars can be added to provide fermentables
 - Simple sugars do not contribute much to body, flavor
 - Simple sugars
 - Corn sugar, table sugar
 - Common in Belgian styles to reduce body
 - Other fermentables
 - Honey, molasses, maple syrup
 - Belgian Candi Syrups
 - Light and Dark syrups
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