

Specialty Malt for Brewers

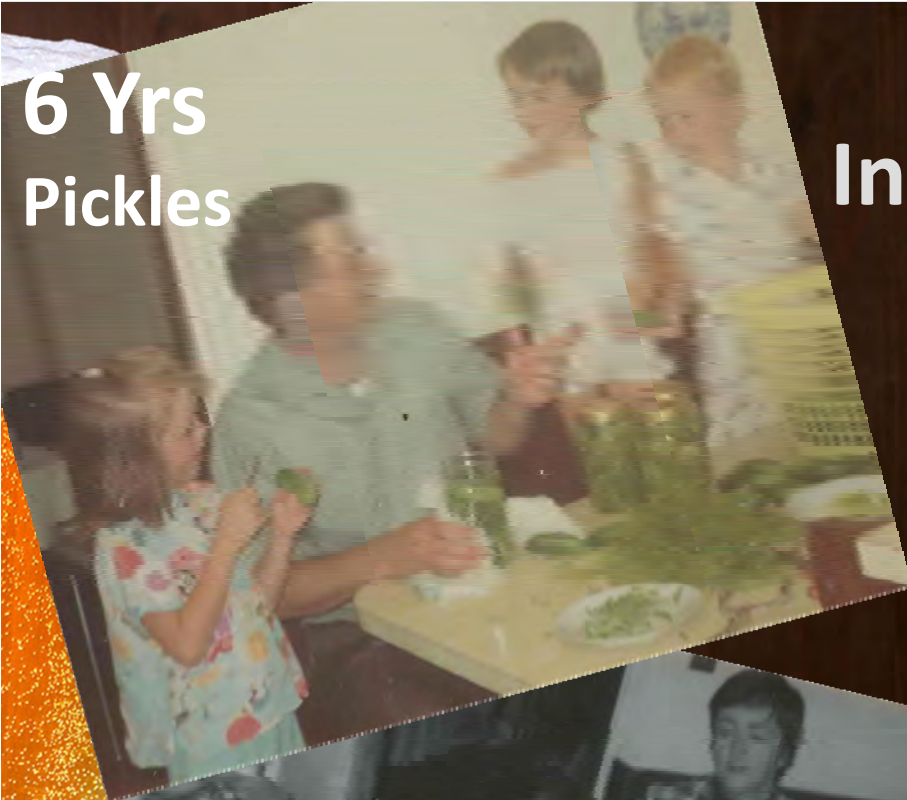


Teri Fahrendorf
Malt Innovation Center Manager
Great Western Malting Company

Photo Disclaimer

- I took photos from the Internet!
- If I used your photo:
- Please accept my apologies and consider it a complement on **your good taste, visual aptitude, and design skills!**





**6 Yrs
Pickles**

Early Influences



**10 Yrs
Bread**



**14 Yrs
Rootbeer**



**19 Yrs
Wine**



My Background

- 19 Years Brewmaster & Regional Brewmaster
 - Siebens, Golden Gate, Triple Rock, Steelhead.
- 5 months Gypsy Brewer – www.roadbrewer.com
- 1 year Beer Store Clerk – Belmont Station
- 6 Years Beer Ingredient Sales – GWM & CMG
- 6 months: Brewery install & brewing again!
 - GWM Malt Innovation Center Manager

Great Western Malting



Malt Innovation Center

2016 – Pilot Malting Unit & Pilot Malt Roaster
2017 – Pilot Distillery (pending Liquor Board)

Additional Background

- GABF Judge since 1991
- WBC Judge since 1994
- Founder of Pink Boots Society (2007)
- Co-Founder of Barley's Angels (2011)
- Speaker, Educator, Author
- Winner of 8 GABF Medals at Steelhead
- Brewers I trained won 16 more for Steelhead



Great Western Malting Company – Since 1934

(Since the Repeal of Prohibition)





GWM & Quality

- Safety is Job #1.
- Barley Selection (Buyers and Field Techs)
- QA, QC, Innovation & Pilot Batch Services
 - 4 full time Lab Techs
 - Malt Innovation Center & Pilot Brewery
- Local Barley – Local Malt – Local Beer !
- Environment
 - Recycling & reusing: Water & Energy
 - Organic Malt program

What is Beer?



What is Beer?

As opposed to other beverages?



What is Beer?

As opposed to other beverages?

Beer is a fermenting or
fermented grain-based
beverage.



Four Pillars of Beer Flavor



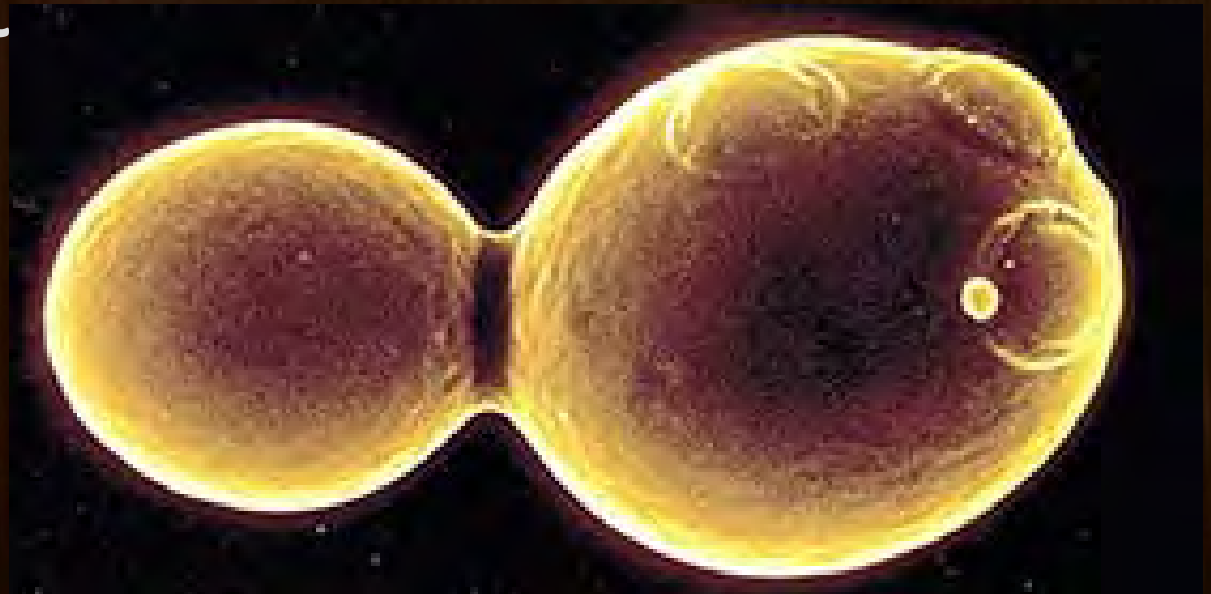
Four Pillars of Beer Flavor

- Hops



Four Pillars of Beer Flavor

- Hops
- Yeast



Four Pillars of Beer Flavor

- Hops
- Yeast
- Water, Adjuncts,
Process (Wood or Casks,
Filtration, Decoction, etc.)



Four Pillars of Beer Flavor

- Hops
- Yeast
- Water, Adjunct, Process, etc.
- MALT !!!



What is Malt?

- Barley or other grain that has been **germinated (sprouted) and dried.**
- Source of carbohydrates, proteins, and other nutrients which are fermented by yeast to produce beer.
- Malt for beer is mainly produced from barley.





Why Barley?

1. Contains **enzymes** (which break down starch, proteins etc). More enzymes than other grains.
2. Contains **starches** (carbohydrate) which ferments to alcohol.
3. Natural source of **color**.
4. Unique source of **malty flavors and aromas** traditionally associated with craft beer.
5. **Husk material** provides a filter bed for **wort** clarification.

Types of Malted Grains

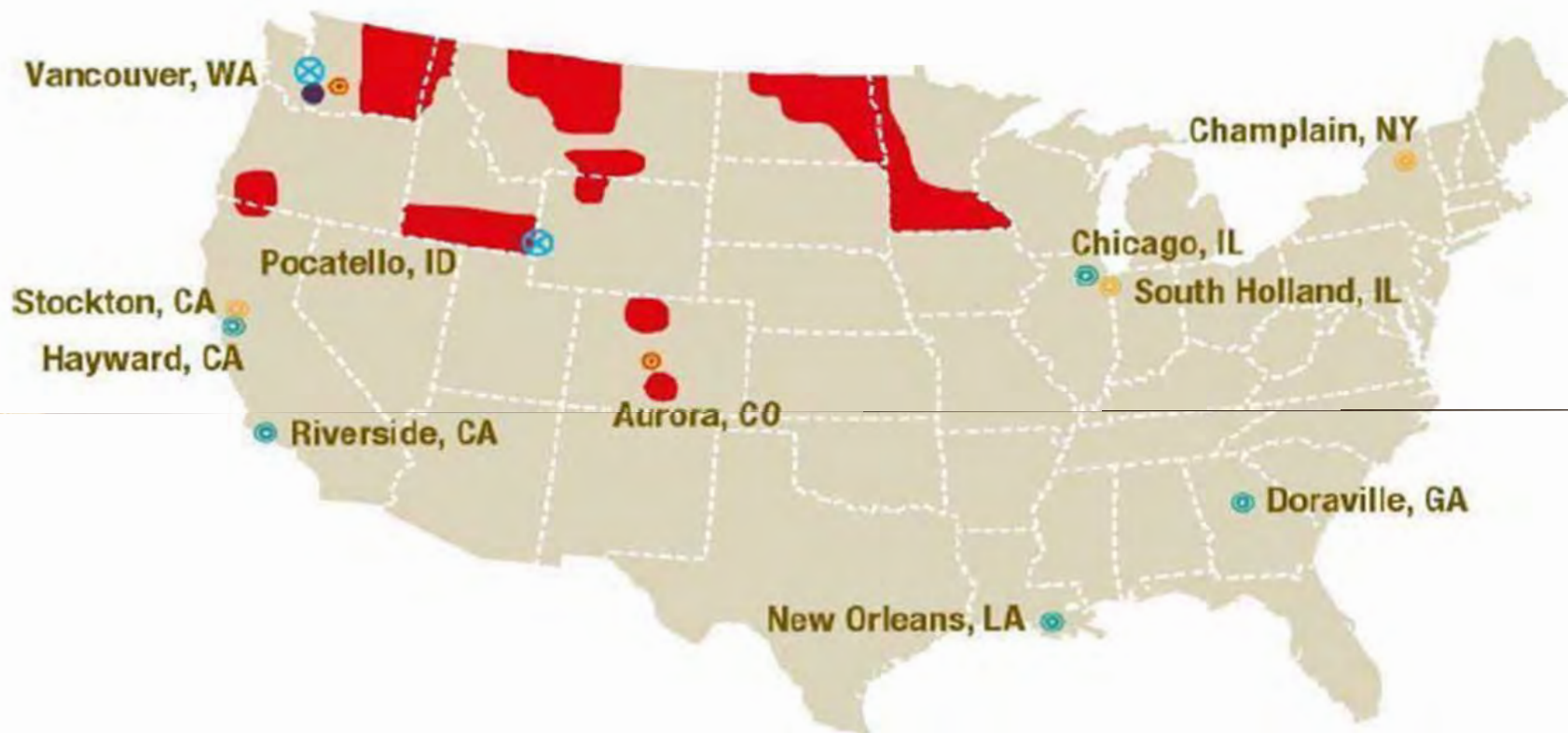
- Traditional:
 - Barley, Rye, Wheat.
- Becoming More Common:
 - Oats, Spelt, Triticale, Heritage Grains.
- Gluten Free:
 - Millet, Buckwheat, Corn, Rice, Lentils.



Barley is Unique

- All grains are commodities.
- Only commodity grain that must remain alive to remain valuable.
- Has favorable flavor and enzyme properties for fermentation.





●	Key barley growing regions
⊙	Great Western Malting head office
⊗	Malt house
●	Country Malt warehouse
⊙	Malt rail transload facility

Malting Grade vs Feed Barley

- Protein, diastatic power, dormancy, viability, weather damage, diseases, pests, inclusions, kernel size, low carbohydrate (extract), etc.

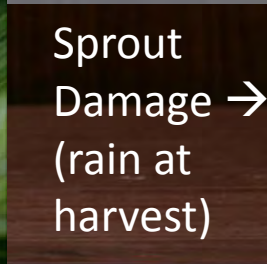
Fusarium Head Blight



Under Ripe (no sun)

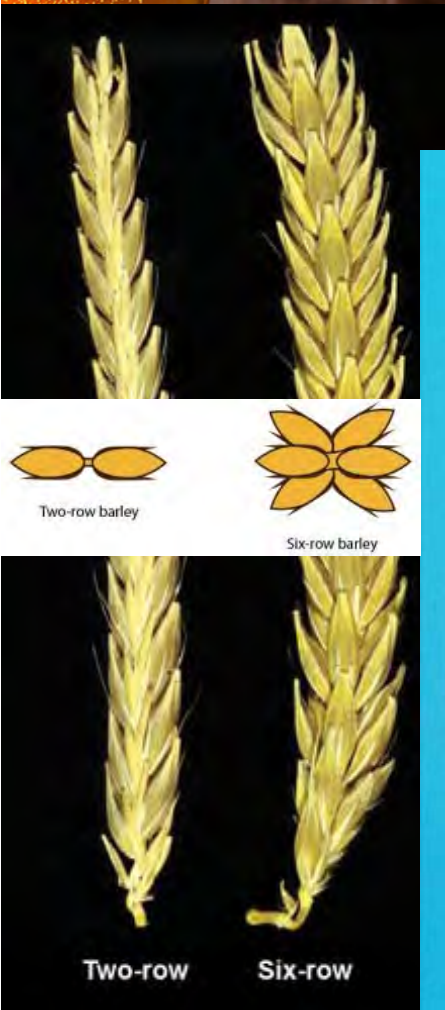


Sprout
Damage →
(rain at
harvest)

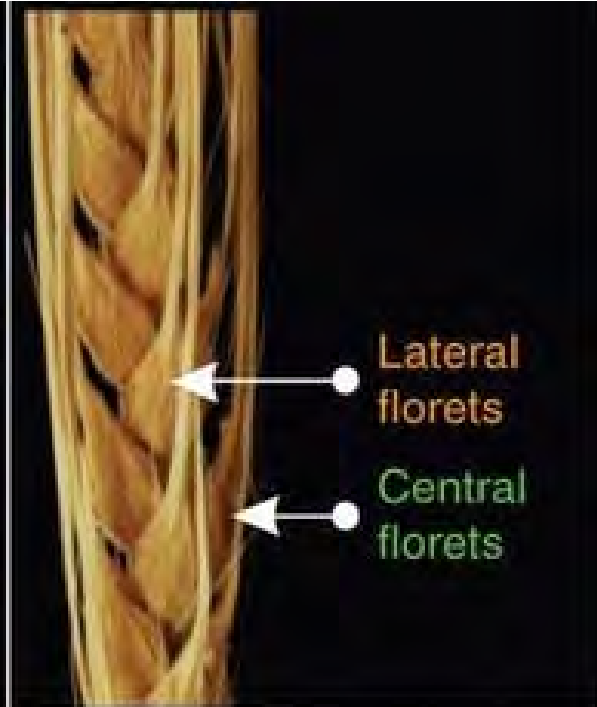
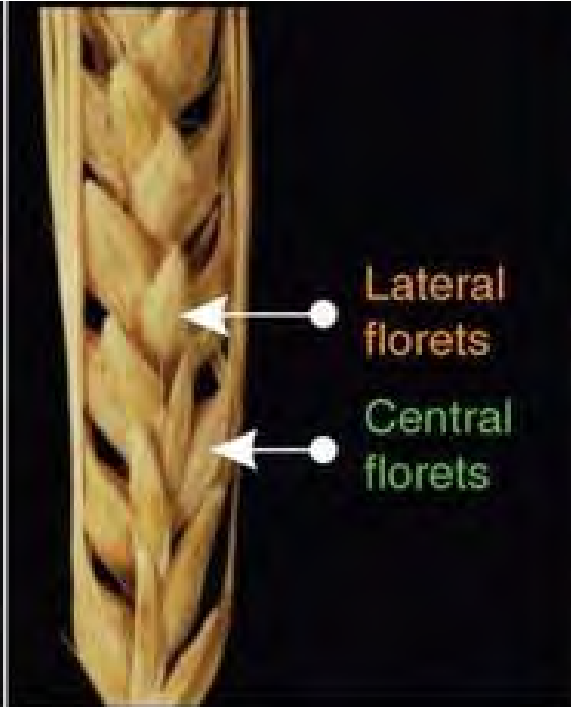
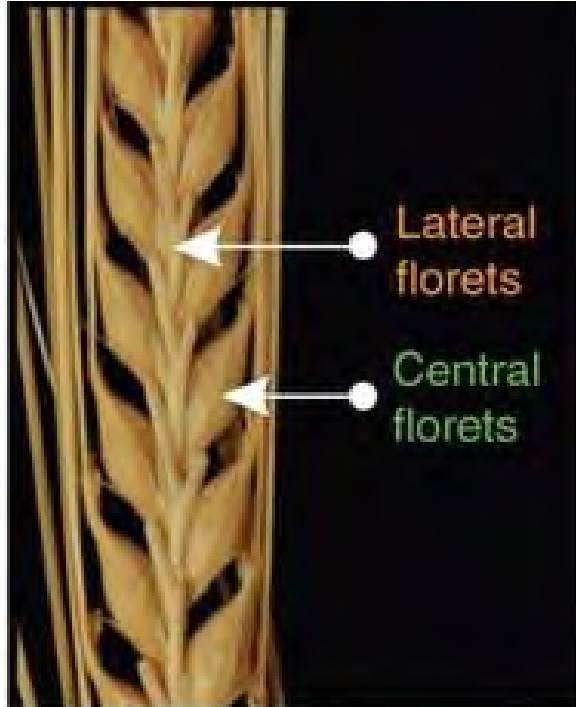


2-Row vs. 6-Row Barley

- Layout of kernels on plant, size and number of kernels, diastatic power, husk level, etc.



Quiz:



Why is 2-Row so Popular?

- Higher Extract Potential.
- Diastatic Power is “good enough” for all malt beers.
- Less husk = less tannins.
- More uniform kernel size for milling.
- Other reasons?





Where would 6-Row Shine?

- Higher DP for adjunct conversion in USA lagers.
- Higher DP for non-barley conversion in spirits.
- Better filter bed in high-adjunct mashes.
- Plumper in certain years than 2-Row because of different growing region, therefore weather.
- 6-Row better adapted to grow in some regions.
- Higher protein, and protein is a color driver, so could be beneficial for high colored malts, because generally more color = more flavor.

Farmers

- Altitude or Sea Level?
- Dry land or Irrigated?
- Every farm is its own microclimate.
- Every barley farmer is also a wheat farmer. Many are also potentially corn or canola farmers.
- Farmers are “incentivized” to grow barley.
- Wheat yield nearly quadruple barley yield per acre.
- Barley is riskiest grain (drought=protein).
- New corn varieties encroaching on barley.



Farm to Glass?

- Nope!
- Beer is made with Malt, not Barley.
- Unless you add Enzymes...



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- Which forfeits Flavor!



Farm to Glass?

- Nope!
- Beer is made with Malt, not Barley.
- Unless you add Enzymes...
- Which forfeits Flavor!
- AND there's a brewery involved!





Varieties of Barley (AMBA)

- ***2-Row Varieties:***
- Traditional: Maris Otter, Klages, Harington.
- Modern: Copeland, Metcalfe, Charles, Conlon, Conrad, Endeavor, Expedition, Hockett, Meredith, Merit, Moravian, Genesis, Pinnacle, Scarlett, Synergy, Voyager, Wintmalt, Full Pint.
- ***6-Row Varieties:***
- Celebration, Innovation, Lacey, Legacy, Quest, Stellar, Thoroughbred, Tradition, Morex, Excel.

New Varieties Are Developed

- Avoid disadvantages listed previously!
- Flavor
- Acreage Yield
- Drought Tolerance
- Disease Tolerance
- Flood & Rain Tolerance
- Frost Tolerance





What about Maris Otter?

- Developed in 1966.
- First “modern” malting variety:
- More consistent for
 - Farmer
 - Maltster
- Marketed to brewers like crazy.
- Not drought tolerant: Climate Change!
- More Maris Otter is sold than is grown.



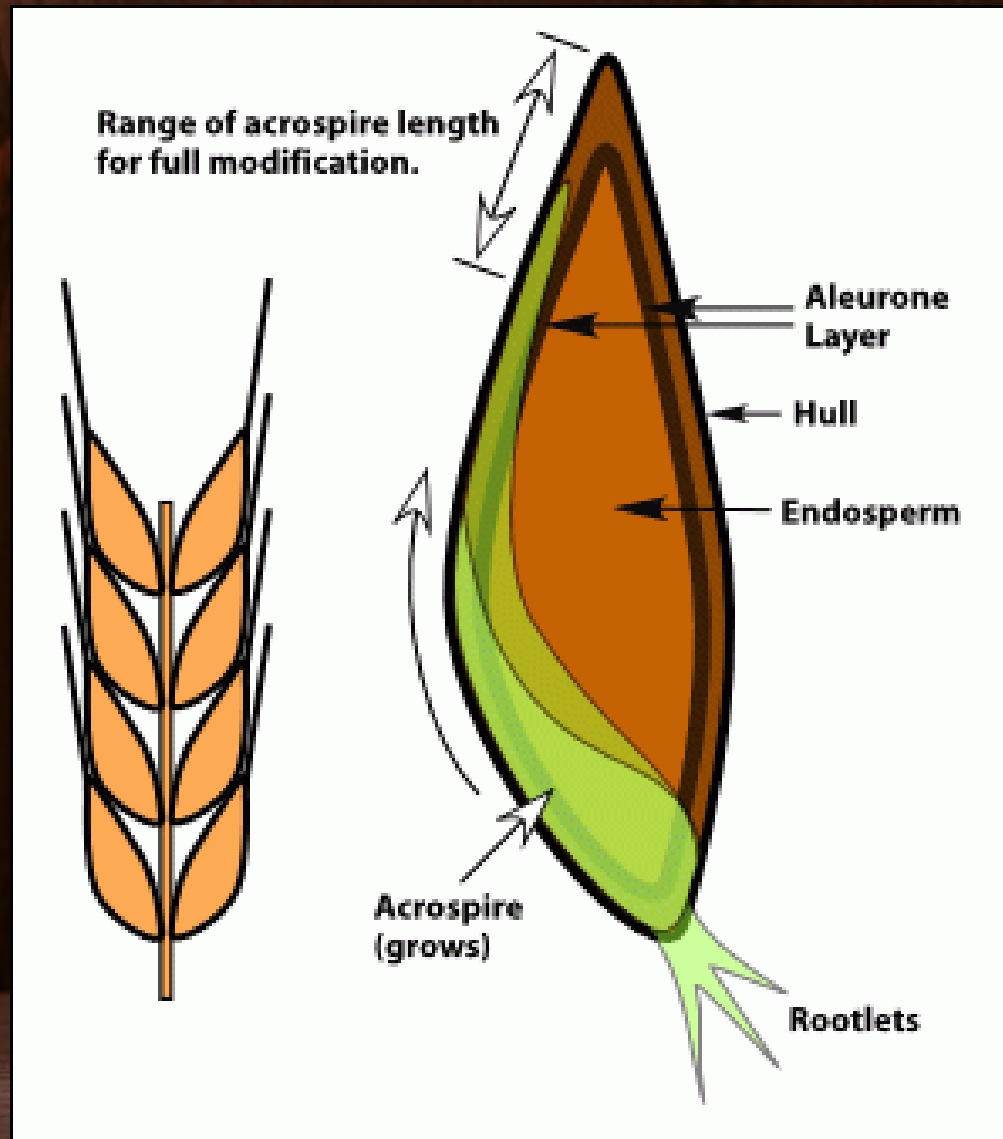
How is Barley Malted?

- Like growing sprouts in your kitchen.
- Proprietary Recipes and guidelines.
- Specific Processes (three stages).
- Additional Processes (heat, time, temperature, air flow).
- Process stopped at exact time.
- Large scale (brewers need a lot).

Barley Sprouts – Too Far!



Sprouted Just Right!



Progress of Modification

DAY 1

Chit - some modification parallel to scutellum.

DAY 2 - 3

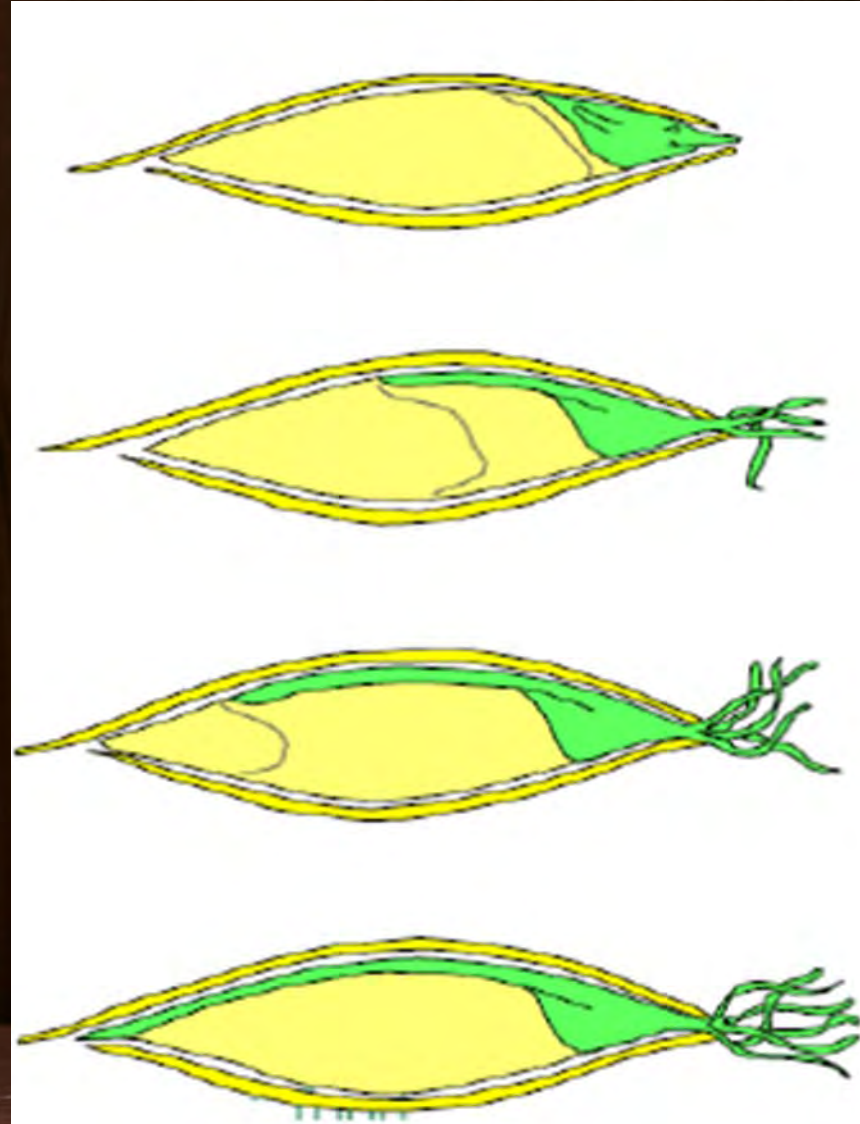
Rootlets, modification parallel to scutellum and inwards from aleurone.

DAY 3 - 5

Rootlet, modification proceeding with acrospire.

DAY 4 -6

Rootlets withering, most of endosperm modified.



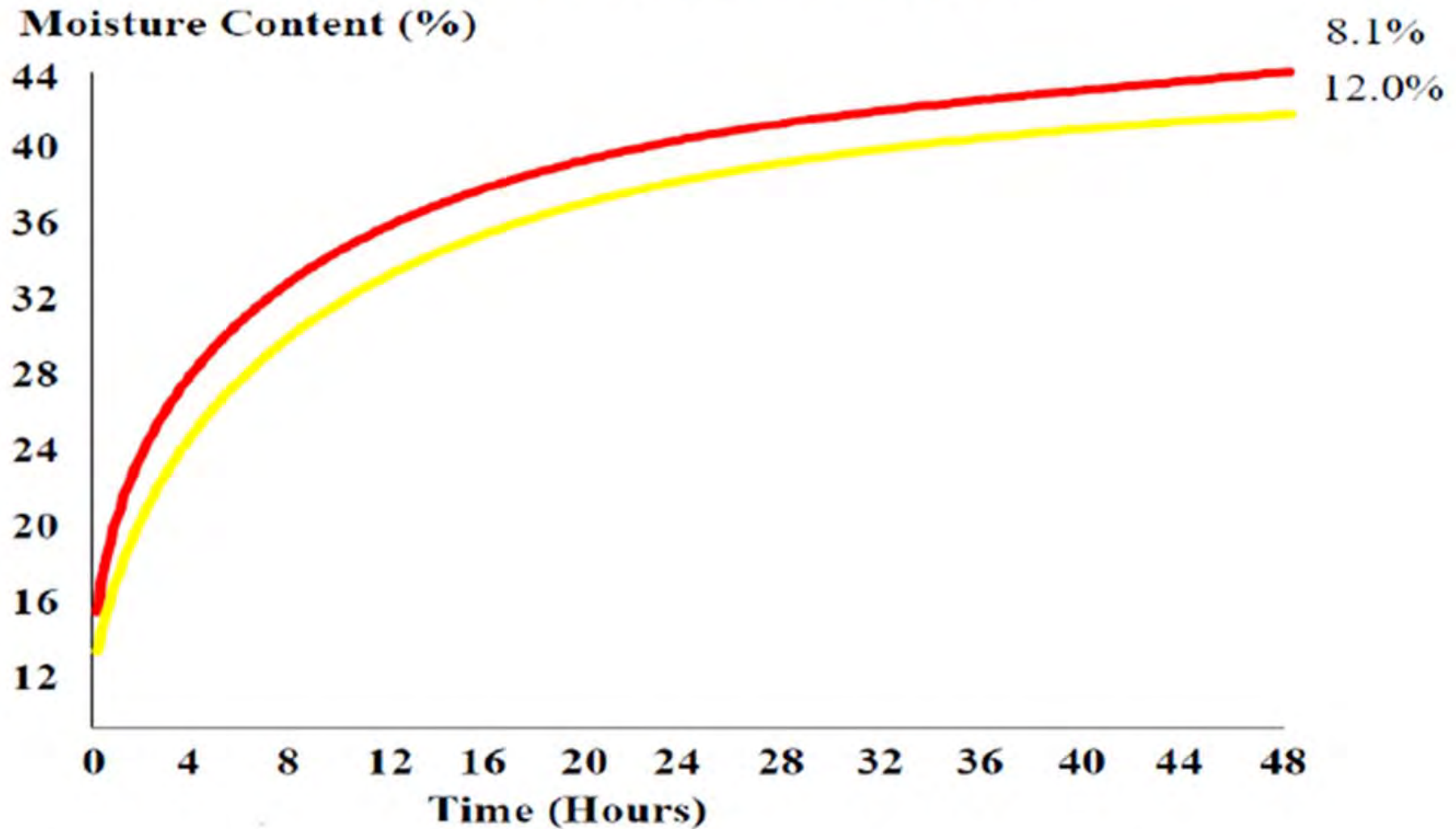
Maltsters Have it Harder

- Barley from divergent microclimates.
- Barley can't talk, "I'm thirsty, cold, suffocating."
- Different malt recipes for different
 - Regions, altitudes, growing conditions.
 - Varieties.
 - Weather.
- Brewers take a consistent uniform raw material and brew whatever they want with it!



Example: Maltsters have it Harder

Effect of Protein Content



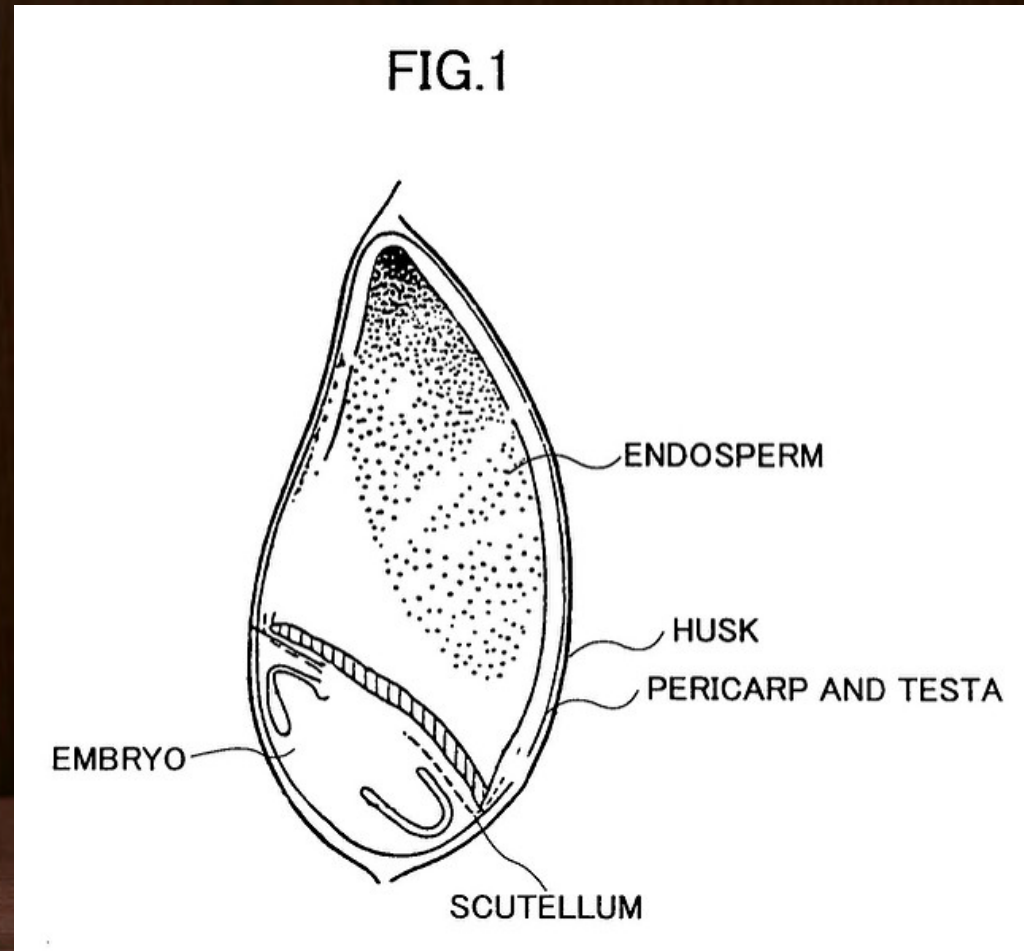


Terminology

- Acrospire
- Aleurone Layer
- Hull
- Endosperm
- Scutellum
- Rootlets
- Modification
- Microclimate
- Piece of barley/ malt
- Green Barley
- Green Malt
- Friability
- Diastatic Power (DP)
- Lovibond
- Maillard Reaction
- Saccharification

Requirements for Malting

- Viable Barley Kernel
- Water
- Oxygen





Three Stages of Malting

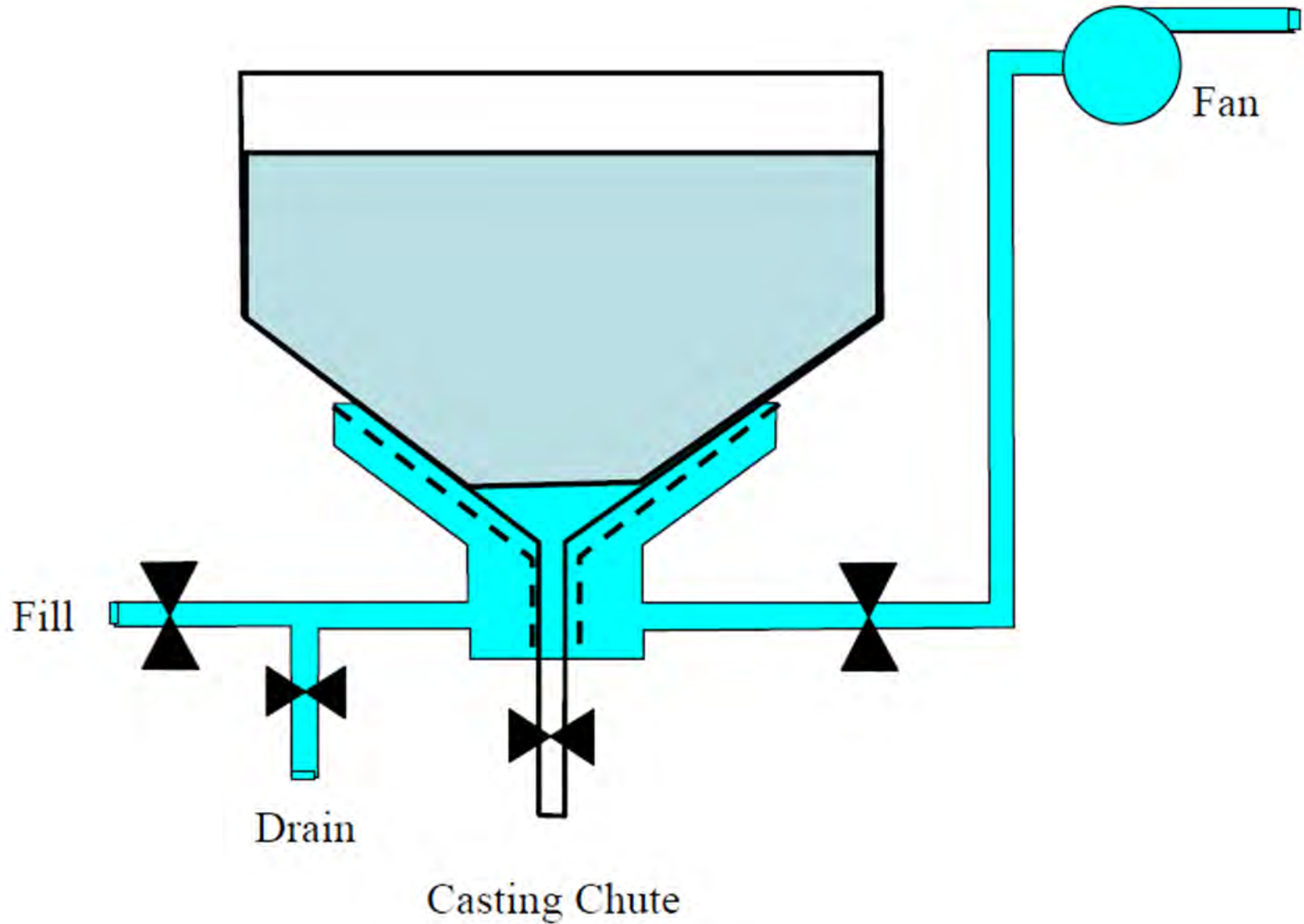
- **Steeping (36-54 hrs)**
- Germination (80-120 hrs)
 - Kilning (18-48 hrs)



Steeping

- Good malt is made or lost in the steep!
- Mainly to Hydrate the Grain.
- Embryo is “activated”.
- Water & O₂ uptake.
- Heat & CO₂ generated.
- Disappearance of simple sugars.
- Enzymes produced.

Conical Steep Tank













Three Stages of Malting

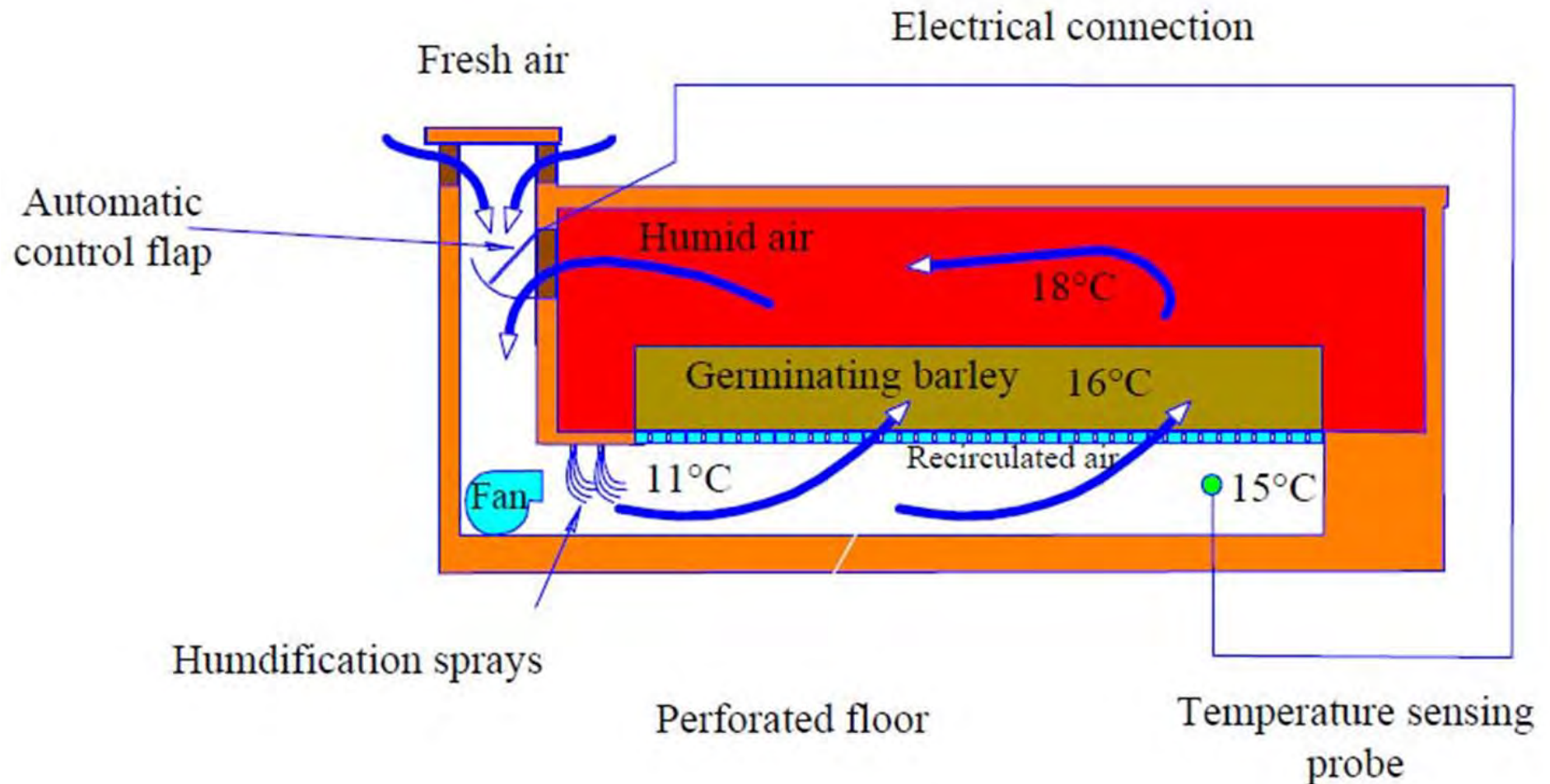
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Germination

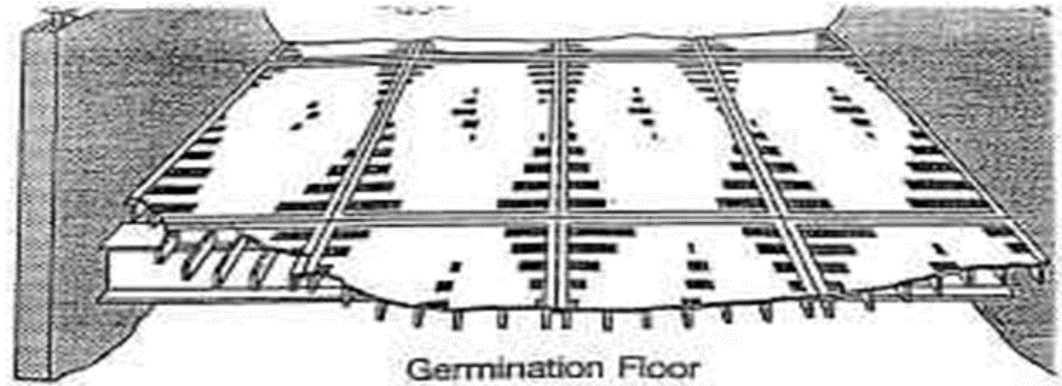
- Mimic best field growing conditions.
- Four day germination.
- Temperature Air Applied 57-63°F (14 - 17°C).
- Temperature Exhaust Air 63-68°F (17 - 20°C).
- Humidity 100%.
- Airflow 6 - 10 cfm/bu.
- Exhaust Air recirculation.
- **Green Malt** moisture ~45% prior to kilning.

Saladin Box Germination Bed



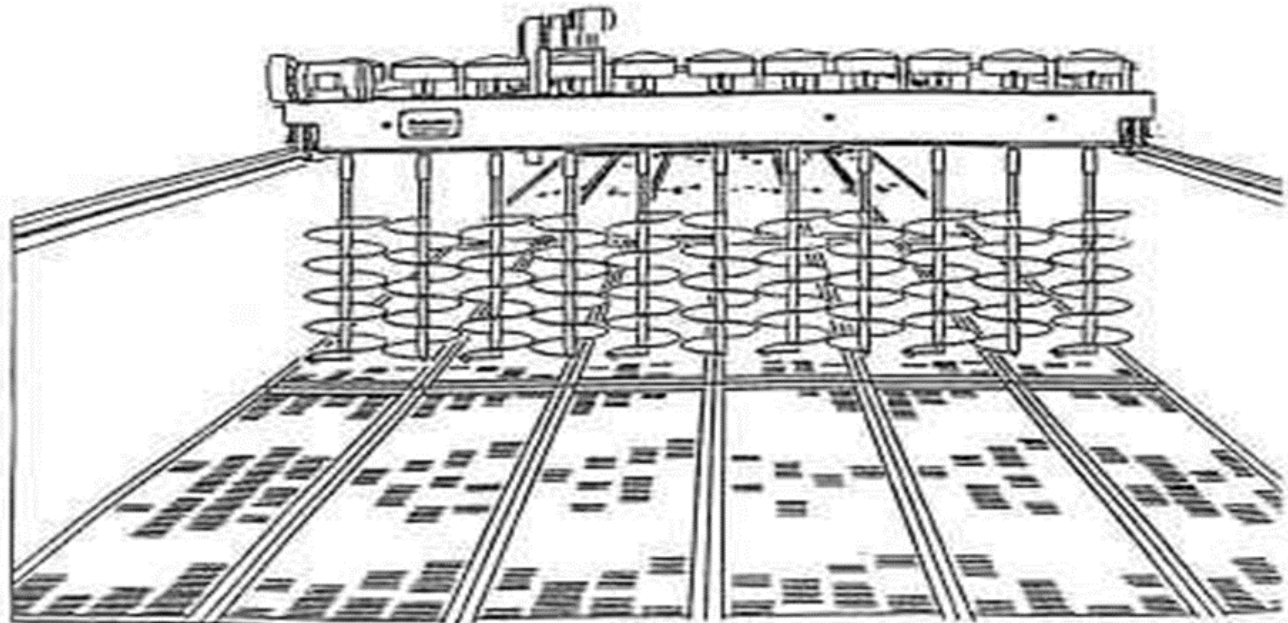
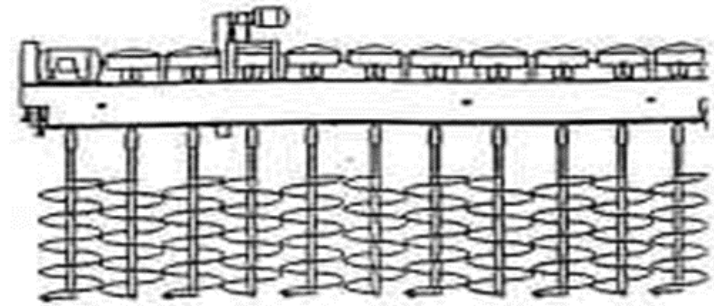






Germination Floor

Germination compartment
Turning machines.



Circular Malt House









Three Stages of Malting

- Steeping (36-54 hrs)
- Germination (80-120 hrs)
- **Kilning (18-48 hrs)**



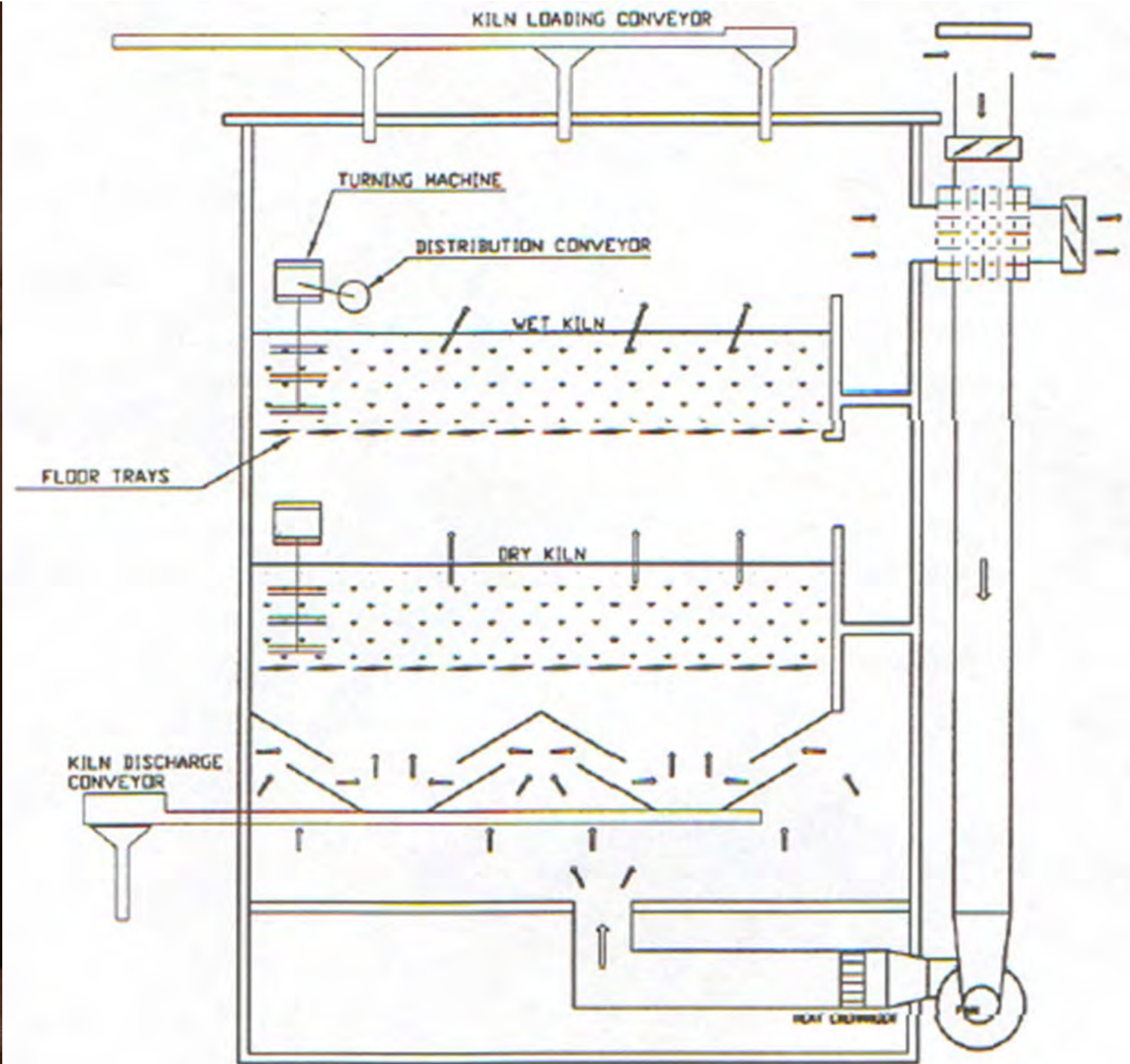
Kilning

- Reduce moisture to ensure **friability**.
- Stabilize malt for storage:
 - Stop growth yet preserve enzymes.
- Color, flavor and aroma development:
 - through Maillard Reactions.

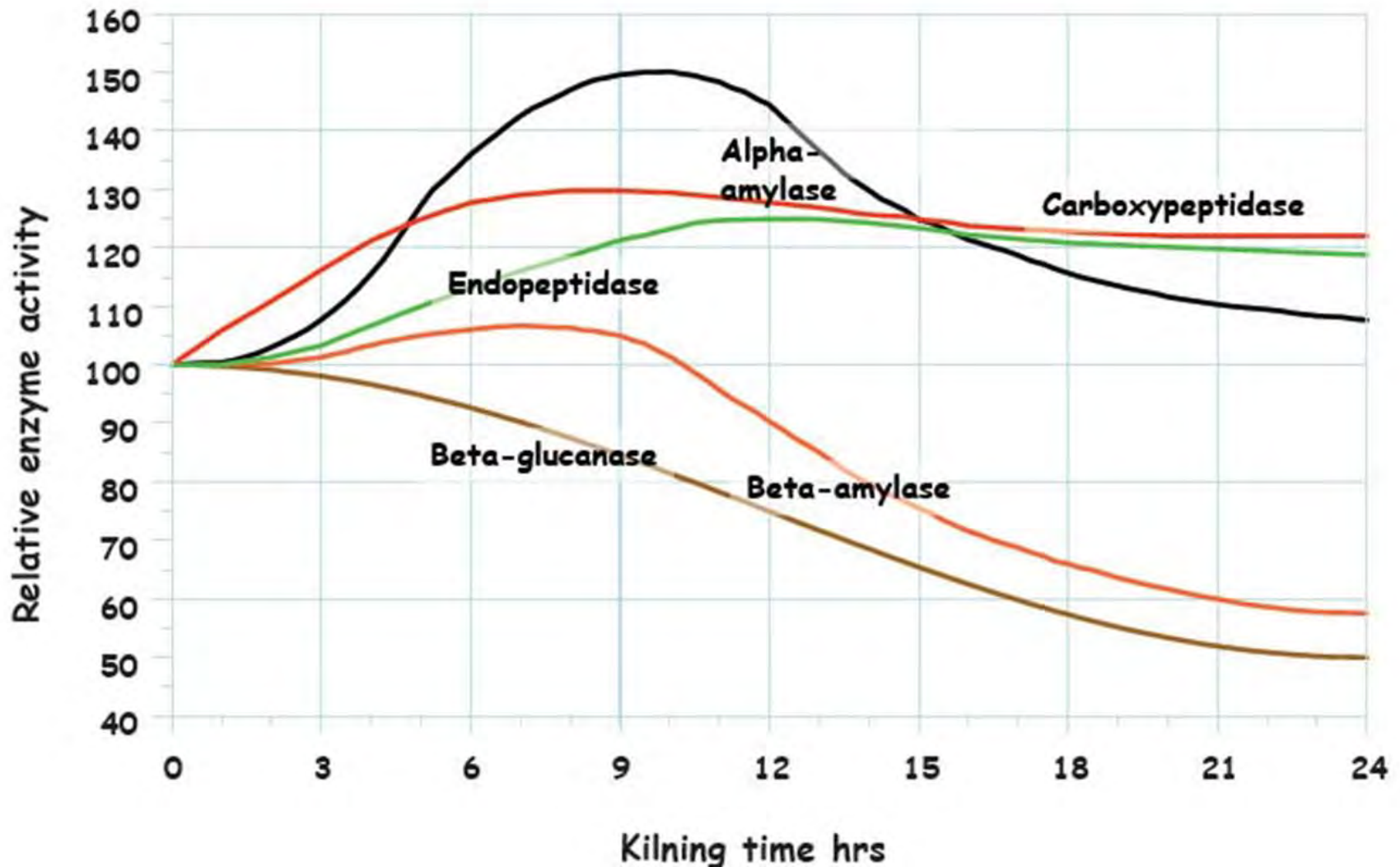


Typical Kilning

- Dry gently to preserve enzymes and avoid color.
- High volumes of Air Flow.
- Temperature Ranges 104-212+ °F (40-100+ °C)
- Reduction of moisture in green malt from ~45% **to about 5%** as finished malt.



Kilning: Enzyme Activity







Enzyme Stability in Kilning

Enzyme	Lethal temperature	Comment
α -amylase	$> 80^{\circ}\text{C}$	Most stable enzyme. Activity increases during kilning.
β -amylase	$65\text{-}70^{\circ}\text{C}$	Very sensitive enzyme. Ca. 40% is destroyed.
β -glucanase	$65\text{-}70^{\circ}\text{C}$	Most sensitive enzyme. Ca. 50% is destroyed.
β -glucan solubilase	70°C	Relatively stable.
Endopeptidase	$60\text{-}65^{\circ}\text{C}$	Fairly sensitive.
Carboxypeptidase	75°C	Relatively stable.
Dipeptidase	55°C	Very sensitive.

Overview: Barley → Malting → Malt

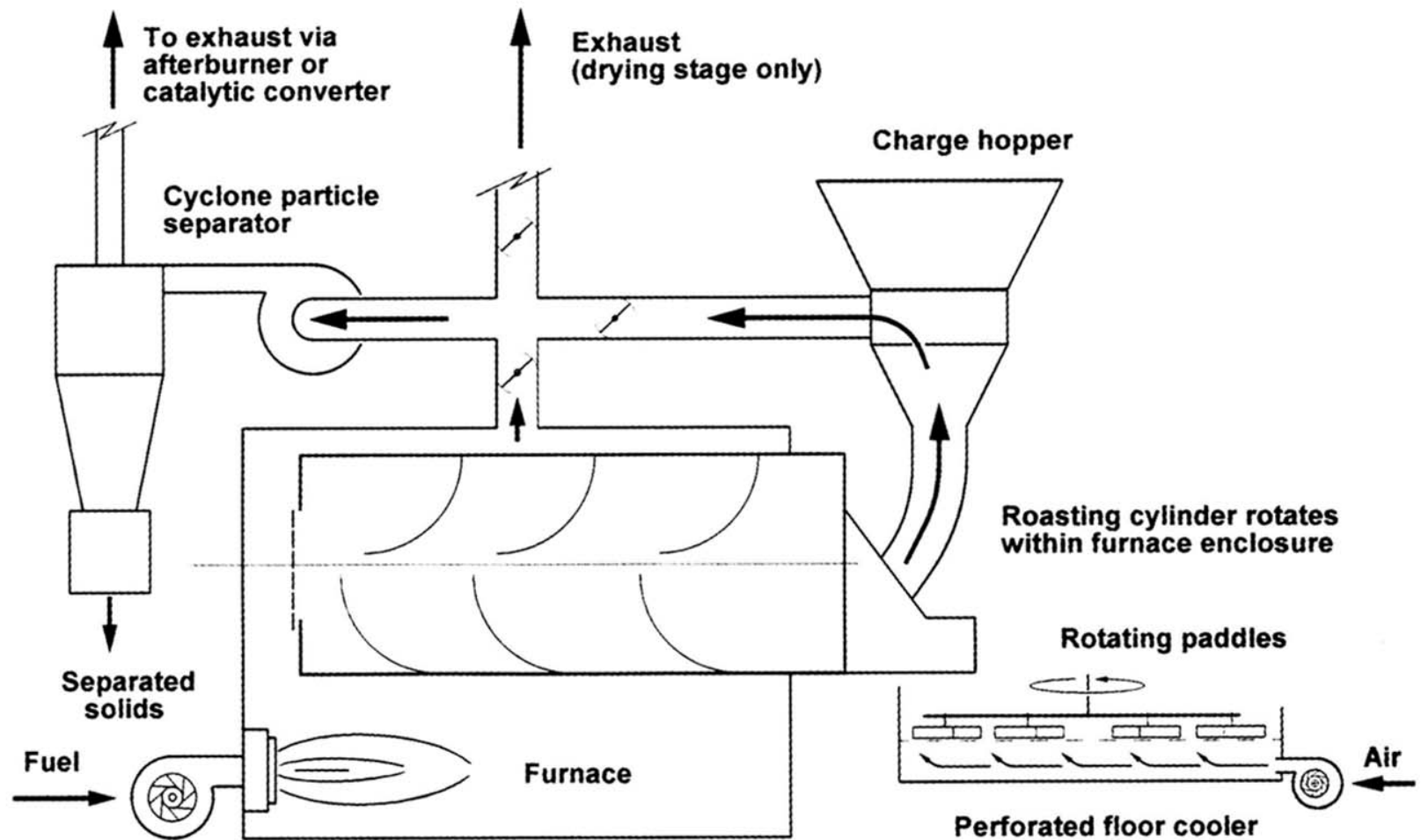
Parameter	Barley	Germination	Malt
Moisture	About 12% after drying on the farm or after intake.	About 44% after steeping	<ul style="list-style-type: none"> 4 - 5% after kilning
Extractable carbohydrate	Virtually zero because the starch is protected.	Very high because the starch granules have been released. They are now accessible to enzymes that convert starch into sugar.	<ul style="list-style-type: none"> Kilning does not change the level of extractable carbohydrate but it does <u>fix</u> it by reducing moisture and stopping germination.
Colour	Very low.	Very low.	<ul style="list-style-type: none"> Colour is produced when sugars and soluble protein react together at high temperature. An increase in colour occurs depending on the degree of kilning and the levels of sugar and soluble protein present.
Protein (measured from the Total Nitrogen content/ $\%w/w \text{ TN} \times 6.25 = \% \text{ Protein}$)	 2 Row 10.5% to 13.0% 6 Row Up to 14% 	Protein levels reduce slightly during germination as rootlets and shoots are produced. Much of the protein is solubilised by enzyme activity. Important parameter is ratio of the total Soluble Nitrogen (TSN) to the Total Nitrogen (TN) in the malt Known as Soluble Nitrogen Ratio (SNR) or Kolbach Index	<ul style="list-style-type: none"> Kilning does not change the nature of the proteins and carbohydrate but it does fix them by stopping germination. Kilning temperature will reduce some enzyme activities by denaturing the protein. Lighter kilned malts (lower colour) tend to have higher enzyme levels. Roasted malts have no enzyme content.



Additional Treatments

- Normally involve heat and/or moisture.
- Various methods drive various:
 - Flavor
 - Aroma
 - Color
 - Mouth-feel
 - Foam

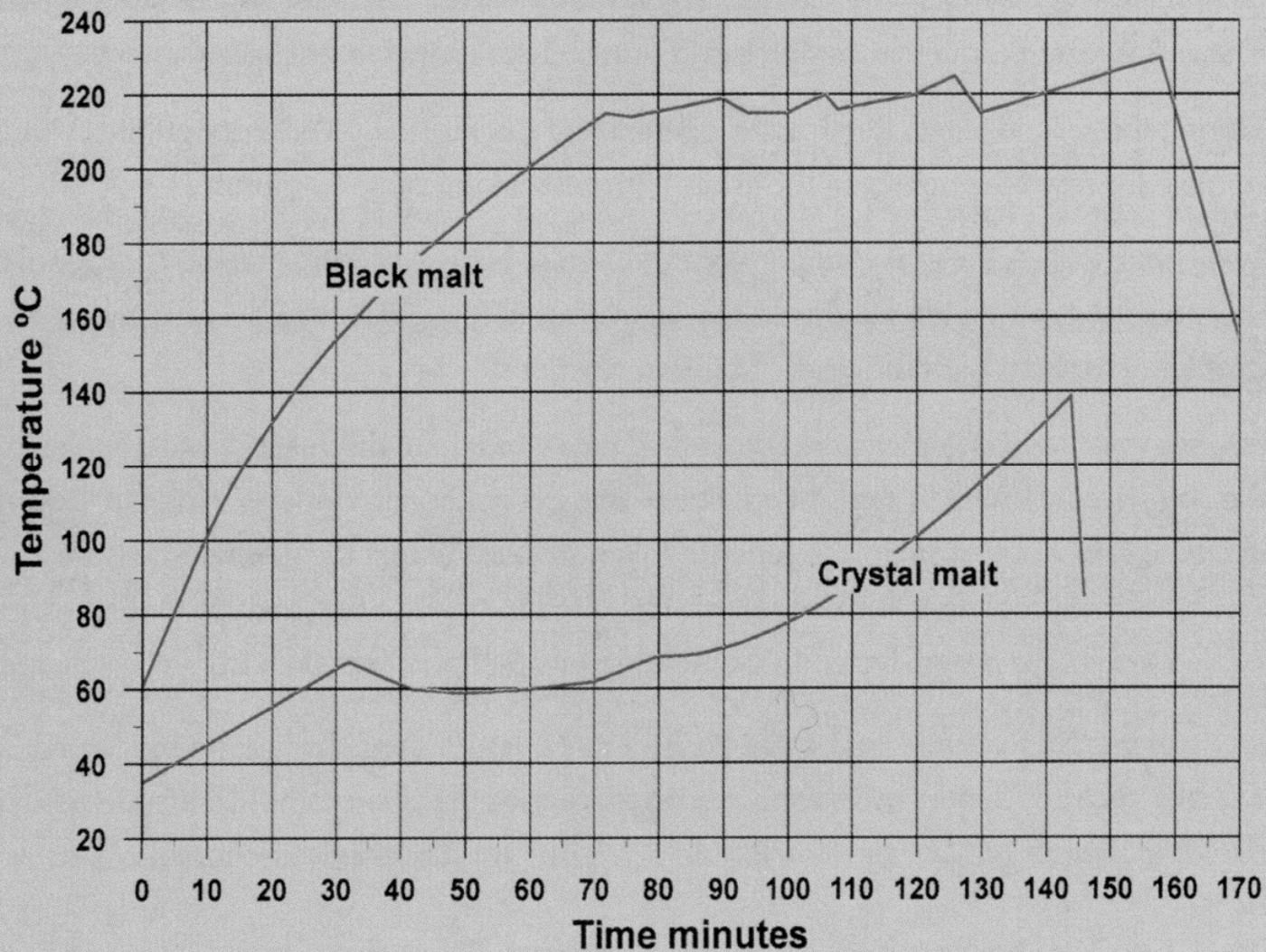
Drum Roaster



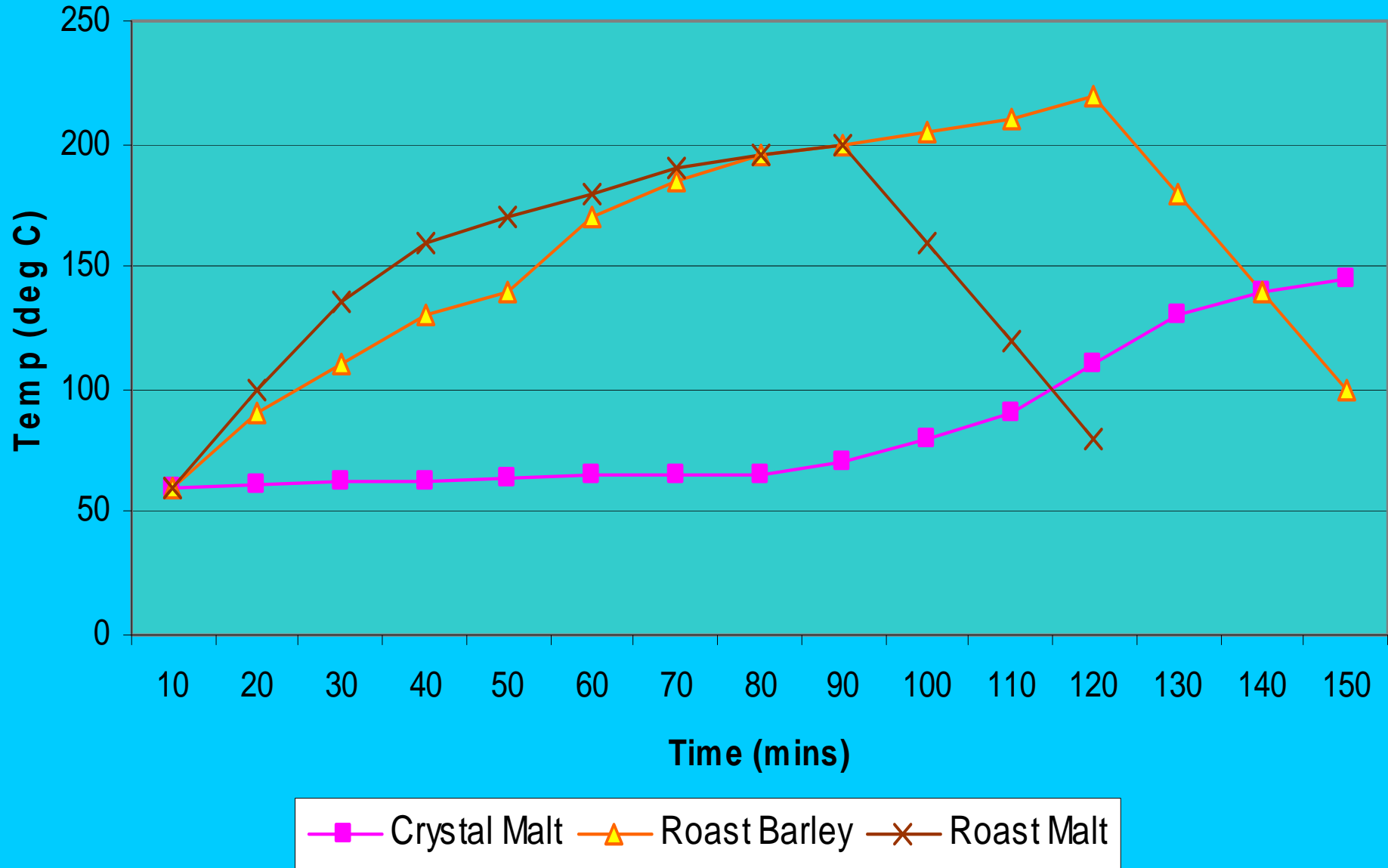
Furnace gases pass around drum during drying operations and through drum during roasting operations.



Roaster Cycles Crystal vs Black



Typical Roasting Cycles





The Five Families

- 1: Base Malts
- 2: Stewed Malts
- 3: Wet Roasted Malts
- 4: Dry Roasted Malts
- 5: Miscellaneous
 - Don't fit in above categories.



The Five Families

- 1: Base Malts
 - 2-Row, Pale, Pilsner, Vienna, State Select.
- 2: Stewed Malts
 - Munich, Melanoidin, Caramel, Sacchra®.
- 3: Wet Roasted Malts
 - 10°L to 160°L Crystals.
- 4: Dry Roasted Malts
 - Biscuit, Brown, Chocolate through Black Malts.
- 5: Miscellaneous
 - Acidulated to Peat Smoked plus unmalted.

1: Base Malts

- 40-100% of grist bill for beers.
- Brewers want to know about **Protein, DP, Beta Glucans, Extract** (sugar).
 - GWM Superior Pilsen
 - (1.6-1.9 °L), <10% Protein
 - GWM Premium 2-Row & State Select Malts
 - (1.8-2.2 °L), <11.5% Protein
 - GWM Northwestern Pale Ale Malt
 - (2.6-3.0 °L), <12 % Protein
 - Vienna Malt
 - (2.5-5.0 °L), <12 % Protein



2: Stewed Malts

- Stewed in the Kiln.
- Used for **color, sweetness, malt complexity & body.**
- Up through about 13°L, still enough DP for a 100% barley wash or beer to convert itself.
- Melanoidin up to 80°L, but is generally 20–30°L.
- Includes Caramel & Sacchra® Malts which have added moist heat processing for conversion.
 - Munich 9–12°L
 - Melanoidin 20–40°L
 - (30°L Taste Test at Brewcraft Booth)*
 - Sacchra® 40–100°L



3: **Wet** Roasted Malts

- Called **Crystal** malts (sometimes Caramel).
- Produced in Probat Drum **Roaster**.
- Green Malt ~45% moisture is used.
- Roaster temp ~850°F (Grain Temp ~450°F).
- Three stages: **Saccharification, Drying & Cure**.
- Sugars liquefy inside each kernel.
- Generally 10°L to 160°L.
 - Crystal C-30 (***30°L Taste Test at Brewcraft Booth***)



4: **Dry** Roasted Malts

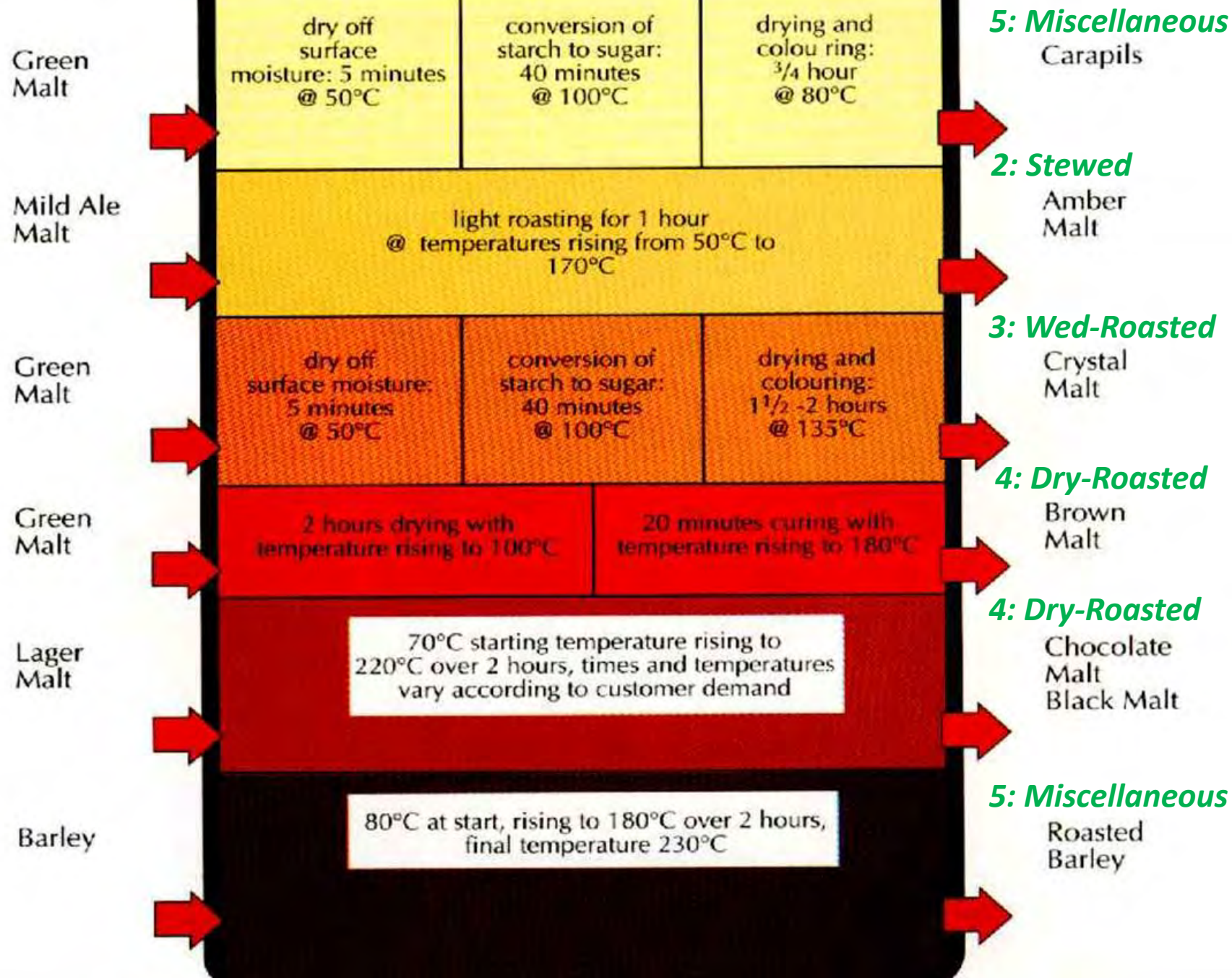
- For a dry **Roasty** non-crystal flavor.
- Produced in a Probat Drum Roaster.
- Only two malt roasters in North America!
- Finished kilned base malt is used.
- Roaster temp ~850°F (Grain Temp ~350°F).
 - Biscuit Malt (*30°L Taste Test at Brewcraft Booth*)
 - Brown Malt
 - Chocolate Malt
 - Black Malt





5: Miscellaneous

- **Dextrin malt** (DextraPils[®], to add body without color or flavor.)
- **Smoked malts** (including peat, cherry wood & beech wood.)
- **Acidulated malt** (to adjust pH of mash, add crispness to beer.)
- **Non-barley malts** (rye, wheat, spelt, oat, millet, etc. malt.)
- **Roasted non-barley malts** (crystal rye, roasted rye, crystal wheat, Vienna millet, crystal millet, roasted buckwheat malts.)
- **Non-malted grains** (raw barley, rolled oats, flaked grains, torrefied wheat, roasted barley)
- **Huskless roasted malts** (Briess Black Prinz[®] & Midnight Wheat[®])
- **Combination roasted malts** (Briess Extra Special Malt[®])
- **Other fermentables made from grain** (Brown Rice syrup, White Sorghum syrup, Brewer's Crystals, Dextrose and Malto Dextrin are all made from corn.)





Learn more about Colored Malts

- Taste 3 same-Lovibond MALT samples:
 - At **Brewcraft** Booth= All **30** degrees Lovibond.
 - **2**: Stewed = **GWM Melanoidin Malt**.
 - **3**: Wet-Roasted = **GWM C-30 Crystal Malt**.
 - **4**: Dry-Roasted = **Briess Victory Malt**.
- Taste a BEER sample:
 - Did you taste **Bader's** twin PNWHC Pale Ales last night? (11% GWM Sacchra 50)
 - Vote: Could you determine which was the All-Malt vs. Extract beer?



Take Home Samples & Learn More

- Take home a sample:
 - At **Great Western Malting** Booth (5 malts)
 - **2: Stewed = GWM Melanoidin Malt**
 - **2: Stewed = GWM Sacchra 50 Malt**
 - **3: Wet-Roasted = GWM Crystal C-30 Malt**
 - **3: Wet-Roasted = GWM Crystal C-150 Malt**
 - **5: Miscellaneous = GWM DextraPils Malt**
- Make a tea for quick aroma evaluation.
- Brew a congress wort for best flavor evaluation.
- Ask your local Homebrew Shop.



Resources

- Handout! And www.terifahrendorf.com
- Homebrew Supply Shops – can ask their rep.
- FOR SPECIFICS:
- HBS might have lot numbers to look up at...
- <http://coa.countrymaltgroup.com/maltlot.asp>
- FOR GENERAL:
- www.greatwesternmalting.com/gwm/Products/products#gWMSpecialtyMalts



HOW TO PARTICIPATE:

- 1) FIND A GROUP
- 2) PLAN
- 3) REGISTER
- 4) BUILD YOUR EVENT
- 5) **BREW!** (AND TWEET AND SHARE)
- 6) PROMOTE
- 7) DONATE
- 8) COME BACK NEXT YEAR!



Ladies

Little Boots Brew Day
on

Saturday closest to March 8th:

International Women's
Collaboration Brew Day

Everybody

Support Pink Boots Society

Buy Pink Boots Gose or any other
Pink Boots Beer starting in just a
few weeks. Thank you!

Thank you to my awesome Employer!



Great Western Malting Co.

THE
**Country
Malt
Group**



BREWCRAFTUSA



Questions?

