Kelly J. Kuehl – National Sales Director
The Country Malt Group

MALT & THE MALTING PROCESS

*BARLEY ORIGIN
*MALTING PROCESS
*MALT ANALYSIS

BARLEY ORIGIN

- North American barley production has historically been centered in the “Grain Belt” – Iowa, Nebraska, Minnesota and southern Wisconsin.
- Disease and competition for from corn and soybeans led to the eventual decline of barley in this region.
- Today, North Dakota and Minnesota produce the majority of the six-row malting barely in the United States.
- Two-row production is predominately grown in Montana, Idaho and Colorado. The majority of this production is under contract with specific brewers and maltsters.
- Canada is a world leader in growing 2-Row malting barely.

BARLEY GROWING REGIONS

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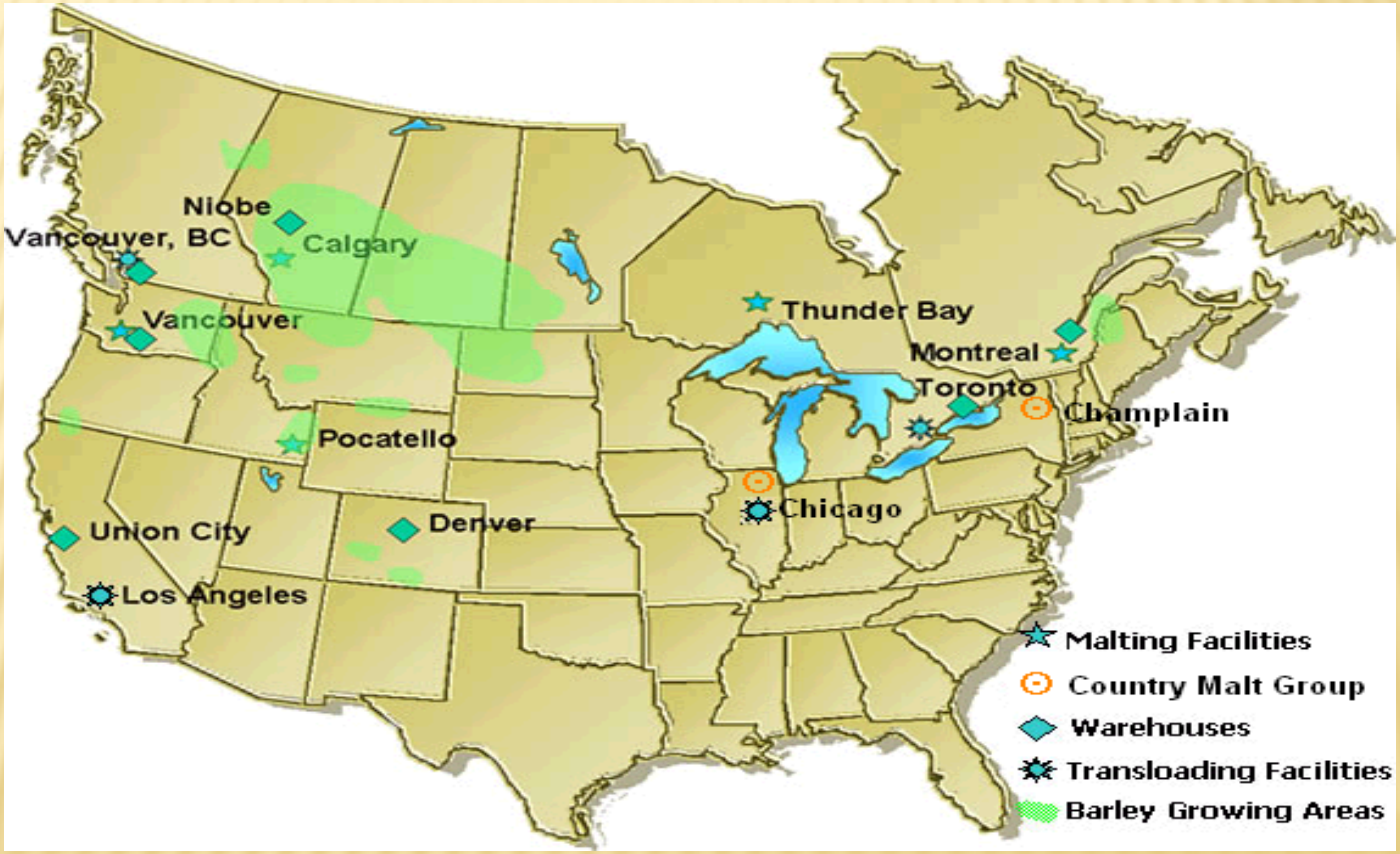
North American Barley



2-ROW VS. 6-ROW

2-ROW VS. 6-ROW

- 2-row barley has a lower enzyme content, less protein, more starch, and a thinner husk than six-row barley. American two-row barley has greater enzyme potential than most European two-row barley. The protein content of U.S. two-row barley is comparable to that of continental Europe, while barley grown in the U.K. is generally lower in protein.
- 6-row barley has a higher enzyme content for converting starch into fermentable sugars, more protein, less starch, and a thicker husk than two-row barley. The higher level of diastatic power makes six-row barley desirable for conversion of adjuncts.

WHY BARLEY?

- Malting barley has a high complement of enzymes for converting its starch supply into simple sugars and contains protein, which is needed for yeast nutrition.

MALTING PROCESS

- Malting serves the purpose of converting insoluble starch to soluble starch, simplifying proteins, generating nutrients for yeast and the development of enzymes.
- In other words, malting is the process of modifying (force germinating) the grain in order to make the sugars trapped inside the kernel available for mashing.
- The three main steps of the malting process are steeping, germination, and kilning.

MALTING PROCESS

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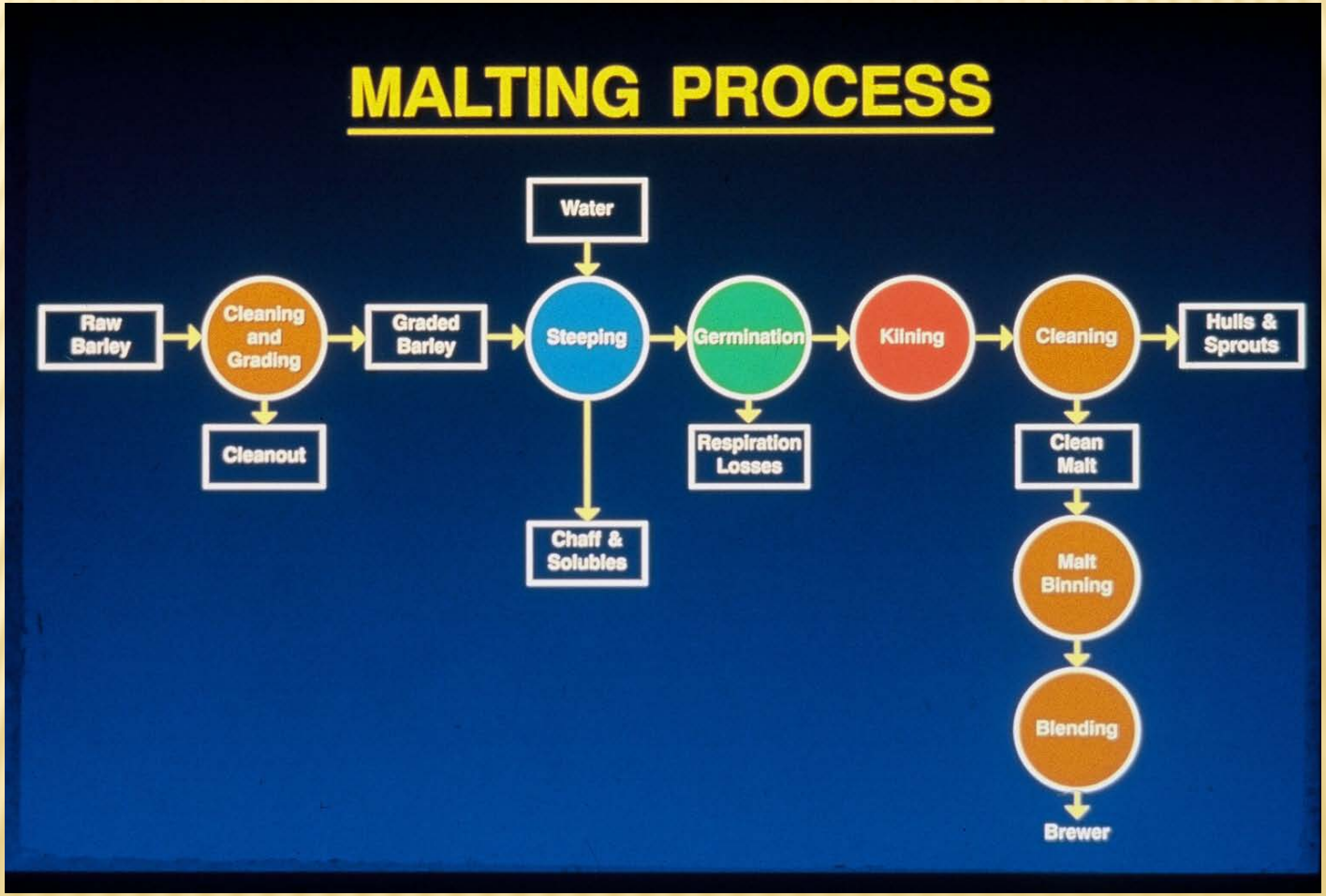

STEEPING

- The purpose of steeping is to evenly hydrate the endosperm in the raw barley kernel.
- Steeping will raise the moisture content of the grain from approximately12% to 45% which will help in the promotion of germination.
- The steeping process typically 36-48 hours depending on the moisture content going into steep.

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Steep Tank

STEEPING

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Steep Tank

GERMINATION

- After steeping, the kernels are spread out on a false bottom “bed” so that the grains can comfortably sprout.
- Some malthouses use pneumatic type germination beds, while others use traditional floor malting methods.
- Regardless of the method, the germinating grain must be aerated periodically, by hand or by machine. Floor malted beds are aerated by hand.
- Pneumatic beds are mechanized to “walk” the grains along a track. This motion automatically aerates the grain and prevents the rootlets from twining together.
- The malt’s protein modification and enzyme content is set over the next three to six days as the grain’s rootlets develop.
- The longer the germination period, the more highly modified the malt.
- Post germination, pre-kilned barley is called “green malt”

GERMINATION

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From Steep

GERMINATION

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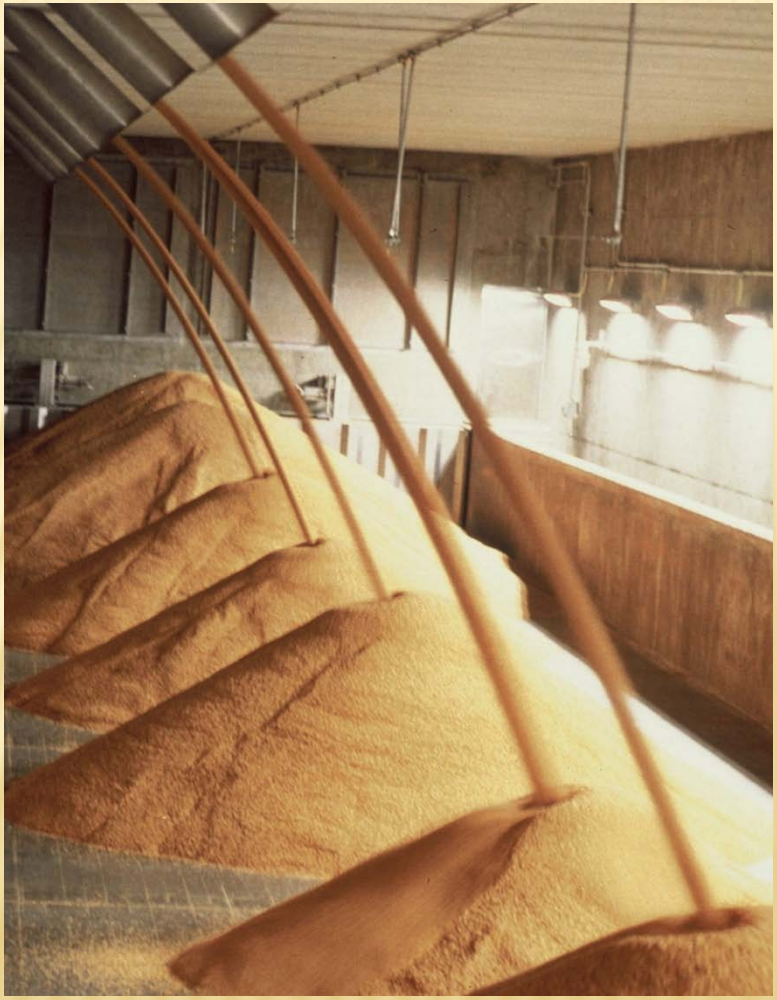
Casting In



GERMINATION

Pneumatic Germination Bed

GERMINATION

Pneumatic Germination Bed

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Floor Germination Bed

FLOOR GERMINATION

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- Floor Germination Bed

FLOOR MALT HOUSE

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The Leuven malt factory uses the mechanised "Floor Maltings" process. The beds of germinating barley do not exceed 15 cm, thereby favouring the malt's homogeneity and modification. The germination areas are the biggest in the world and measure each 200 meters long. The impressive building was built in 1963. It was enlarged in 1971 and houses a 55,000 ton silo.

KILNING

- The moist, sprouted malt – or “green malt” is then moved to the kiln to dry.
- This step arrests further modification of the kernel.
- The main goal is to dry the malt as much as possible at lower temperatures (around 90°F) which helps preserve the enzymes in the malt.
- The first drying period typically takes about 24 hours.
- The second drying period which typically last about 12 hours will be at a slightly higher temperature (around 120°F).
- A third and final “curing” process will occur over the next 24-48 hours at approximately 180-220°F.
- The curing process influences the malt taste, aroma (DMS) and stability.
- The malt style determines the temperature and length of the kilning and the roasting process to follow.

KILNING

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Circular Kiln

FINISHED MALT

- Malt is divided into two different groups –
  - Brewer's or Base Malt
  - Specialty Malt
- Base malts have enough diastatic power to convert their own starch and usually that of some amount of starch from unmalted grain (adjuncts)
- Specialty malts have little diastatic power; they are used to provide flavor, color, or "body" (viscosity) to the finished beer.

MALT ANALYSIS

6 Critical Points

- Color
- Moisture
- Extract (DBCG)
- (DP) Diastatic Power
- Protein (Total)
- Kernel Size

MALT ANALYSIS

	Color	Moisture	Extract (FG)	DP	Malt Protein	Size 2.8
North American Pilsner	1.42	4.4	82.3	129	10.5	78.9
German Pilsner	2.3	4.5	82.7	39	10.0	93.0
North American Crystal 60	62	6.0	80.0		11.06	
UK Crystal 60	68	4.0	72.0		11.06	

COLOR

- Varies from lot to lot (batch to batch)
- Malthouse/brand specific
- Expressed as degrees Lovibond in North America
- Expressed as degreed EBC (European Brewing Convention) outside of North America
- °EBC = (°L x 3.65) – 1.2

MOISTURE

- Base malt target should be 1.5%
- Color malts should never be over 4%
- Moisture content over 6% is unacceptable

EXTRACT (DBCG)

- Extract DBCG (Dry Basis Coarse Grind)
- Gives an indication of the degree of starch modification that the grain underwent during malting.
- Provides an indication of how much yield you can target in your brewhouse.
- Actual yield will be 5-15% less than lab analysis.

DIASTATIC POWER (DP)

- The strength of starch-reducing enzymes in malt.
- Indicates how well a malt will respond to mashing.
- A DP range of 35-40 is typical for European malts.
- A DP range of 125-160 is typical for North American malt.
- Higher DP malts have more protein and thus more enzymes to convert “other” materials.

TOTAL PROTEIN

- As a general rule, European barley tends to be lower in nitrogen (protein).
- The growing season will have a significant impact on barley protein.
- US barley varieties are typically in the 10-12% total protein range.
- European varieties may go as low as 9%.

KERNEL SIZE

- Plump vs. Thin
- Plump kernels are easier to mill.
- North American barley varieties typically fall in the 80% range (+/- 2) on the top screen.
- European varieties are typically plumper.

OTHER CONSIDERATIONS

- Chew your malts for an idea of freshness.
- Smell, taste, inspect!
- Do not be sold on brand names.
- Always ask for a specific malt analysis.
- Don’t be afraid to ask questions!

ACKNOWLEDGEMENTS

- Slide 5 – 2-Row/6-Row picture captured from Wikipedia - http://en.wikipedia.org/wiki/Barley
- Malt analysis notes referenced from "Understanding Malt Analysis Sheets – How To Become Fluent in Malt Analysis Interpretation" by Greg Noonan. Published in 1997 Brewers' Market Guide published by Brewing Techniques Magazine.