

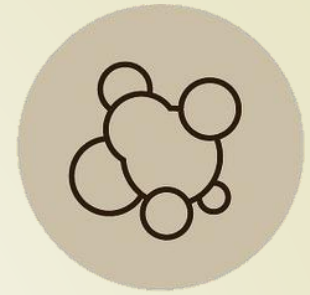
# Brewing Lager Beer

► Paul Konopelski





# Ingredients



## ▶ Water

- ▶ RO with added salts
- ▶ Carbon filtered, adjusted for pH and  $\text{SO}_4^{2-}:\text{Cl}^-$  ratio
- ▶ Depends on color: lighter beers want lower alkalinity and less ions in general

## ▶ Hops

- ▶ Noble varieties
- ▶ New European varieties: Bavaria Mandarina, Huell Melon, etc
- ▶ Exception – IPL

## ▶ Malt

- ▶ Pilsner: Light (1.5-2 L), less toasted, more moisture, more DMS precursor (SMM)
  - ▶ Should boil for more than 60 min.
- ▶ Vienna: darker (3-3.5 L), can be used for 100% of grist, can add a honey flavor
- ▶ Munich: darker (5-6, 9-10 L), used in high amounts for certain lagers

## ▶ Yeast

- ▶ Any lager yeast
- ▶ Hybrid yeast : Cry Havoc, Kolsch, Alt, etc.

# Mashing

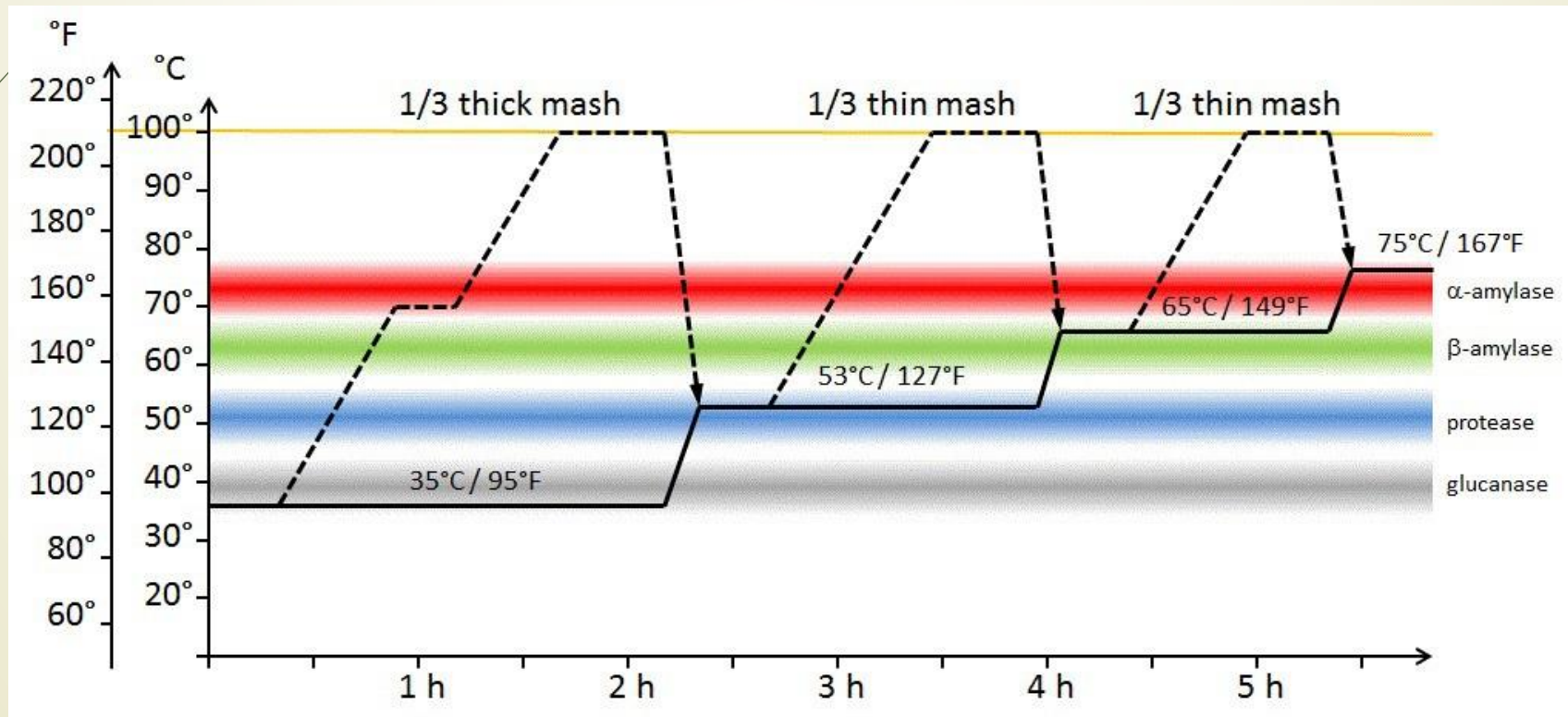
- ▶ Single infusion
  - ▶ 1 temp, will make good lagers
- ▶ Temperature Program
  - ▶ More temperature rests can extract more flavor, protein, sugar, etc. from malt
  - ▶ Types of rests:
    - ▶ Acid rest: 95-113 F (35-45 C)
    - ▶ Protein rest: 113-138 F (45-59 C)
    - ▶ Conversion:  $\beta$  - 140-149 F (60-65 C)  
 $\alpha$  - 150-158 F (66-70 C)
    - ▶ Mash Out: 162-169 F (72-76 C)



# Mashing

## ▶ Decoction Mash

- ▶ Involves separating part of the mash and boiling it
- ▶ Benefits
  - ▶ ability to do temp rests without being able to heat mash
  - ▶ Flavor development: Maillard Reaction, caramelization



# Fermentation

## ➤ Lager yeast

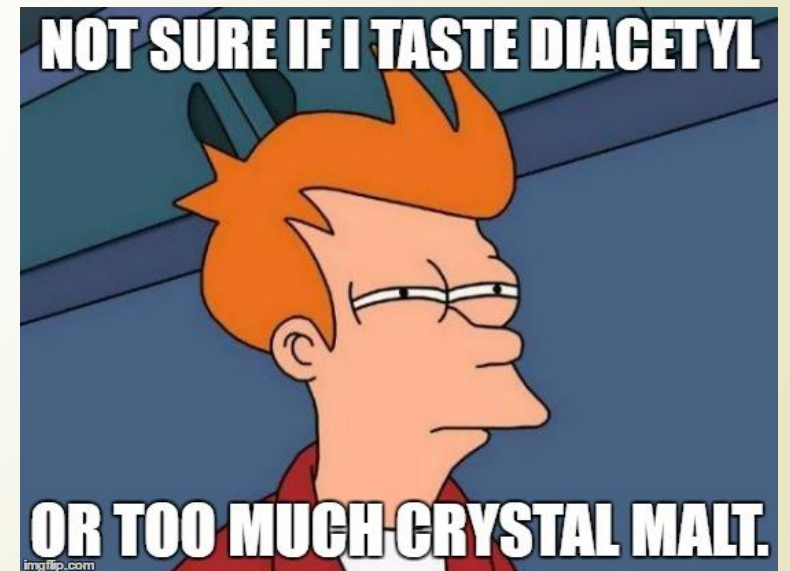
- Ferment cold 45-55 F (7-13 C)
- Should be pitched higher (1.2 mill. cells/ml/°P)
- Produce less flavor molecules (esters, phenols)
- Produce more Sulphur
  - Driven off by active ferment
  - Yeast nutrient will help

## ➤ Hybrid strains

- Kolsch, Alt, Steam, etc.
- Can produce clean lager-like beers
- Great if you cant ferment at lager temps

## ➤ Diacetyl

- Produced by all yeast
- Lager strains generally produce more and don't reduce it as well
- Let warm to above 60 F (15.5 C)



# Lagering

- Means “storehouse”
- Long period of cold storage
  - Minimum: 2 weeks
- Around freezing temps (30-38°F)
- Outcomes:
  - Clarification
  - Flavor change



# Who's Stoked to Brew a Lager?



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