Yeasts Flavour & The Evolution of Beer Styles

Robert Percival
Lallemand Brewing

Content

- Contribution of yeast to beer flavour
- Development of beer styles
- The role of yeasts in beer styles
- Commercial availability and application of dried brewing yeasts

Contribution to Beer Flavour

Yeast?

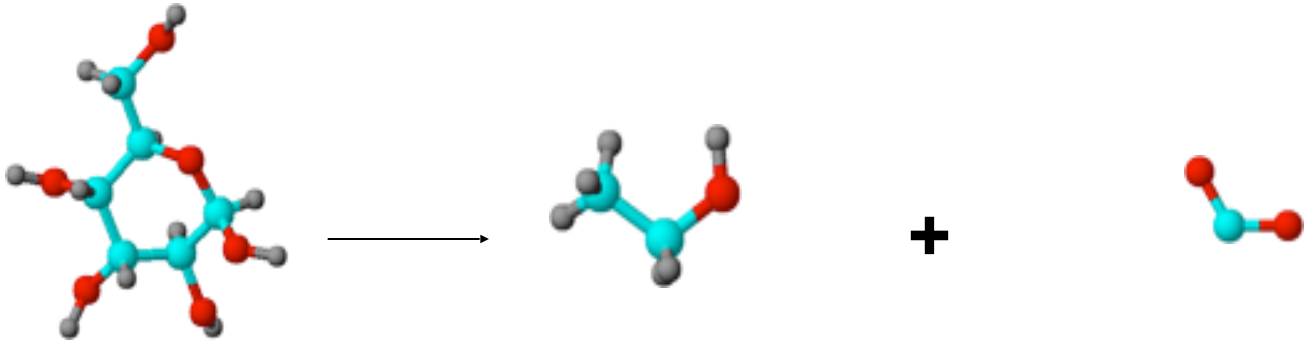
Importance Of Yeast In Brewing

“Yeast can be the single most important ingredient the brewer selects.

The joke around the brew house is that in reality we work for the yeast.”

- Garrett Oliver

Primary Chemical Change During Fermentation



$C_6H_{12}O_6 \longrightarrow 2\ CH_3CH_2OH + 2\ CO_2$

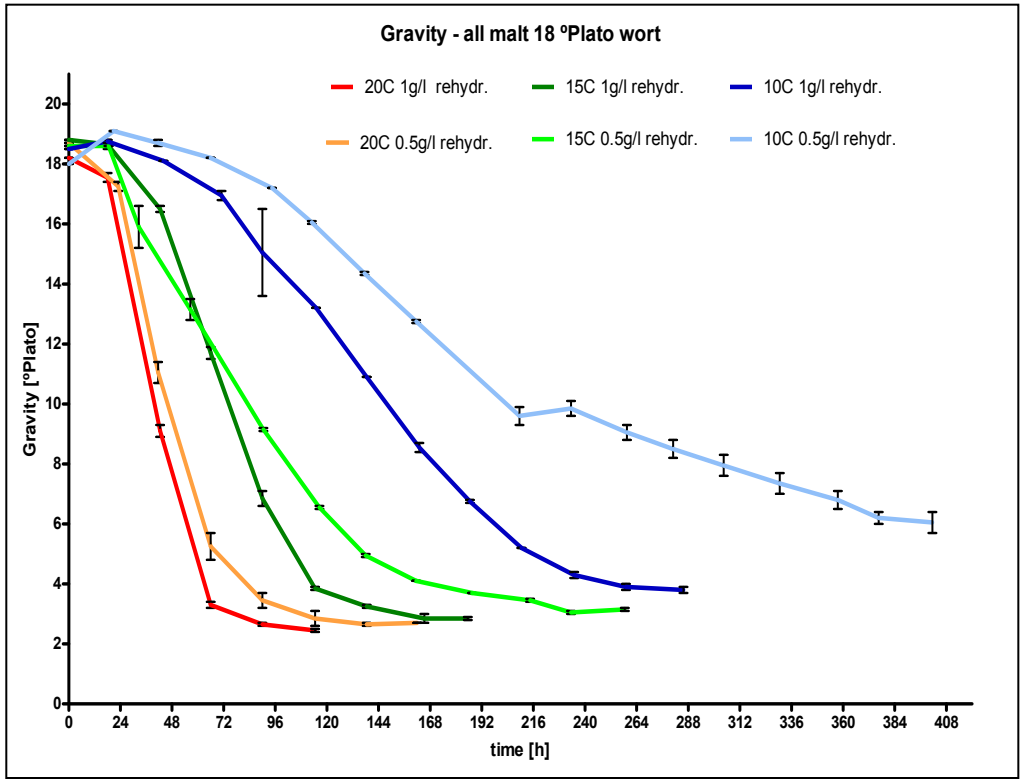
Glucose ⟶ Ethanol + Carbon Dioxide

Important Reaction Products From Yeast Metabolism

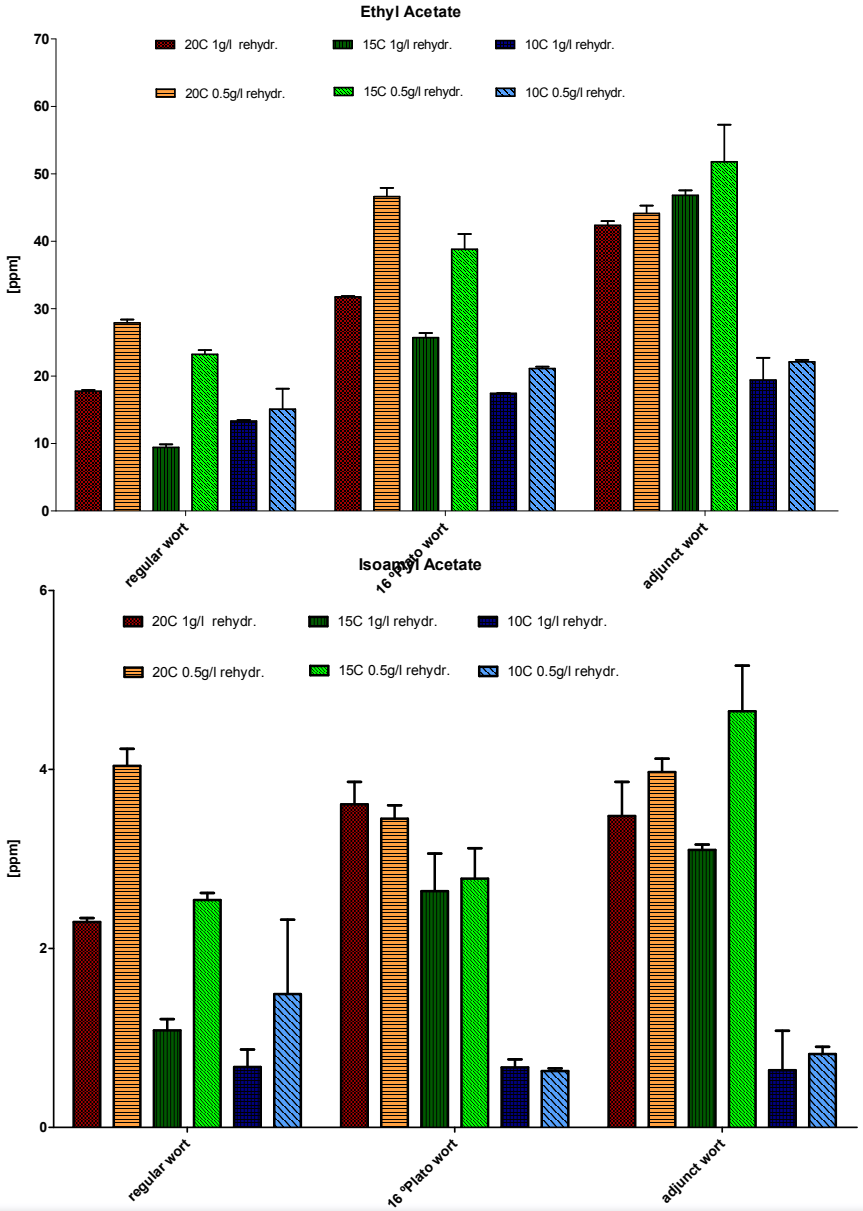
- Higher alcohols
- Organic acids
- Aldehydes and ketones
- Esters
- Lipids
- Sulphur compounds
- Phenols

Variables Affecting Fermentation

- Wort composition & pH
- Wort dissolved oxygen (DO)
- Yeast strain
- Yeast pitch rate
- Yeast quality
- Temperature
- Pressure
- Vessel geometry

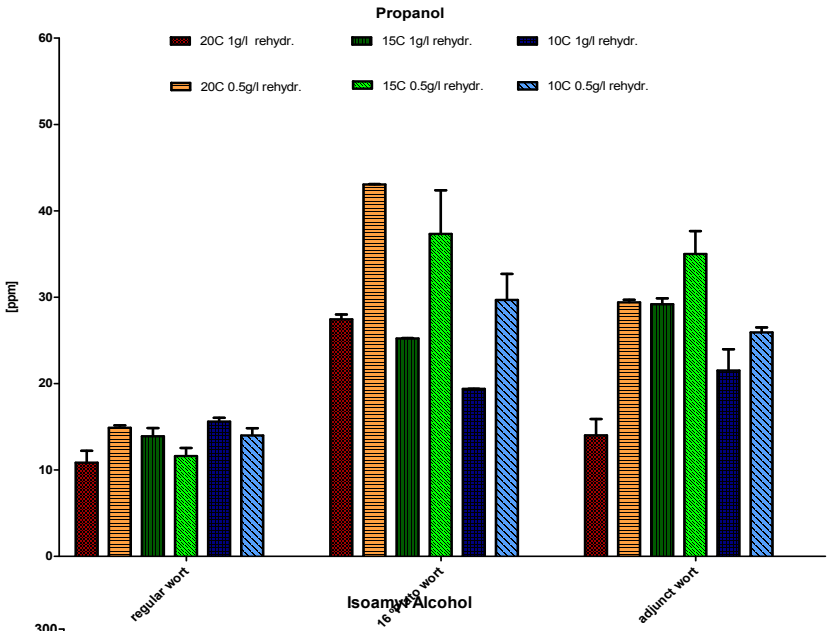


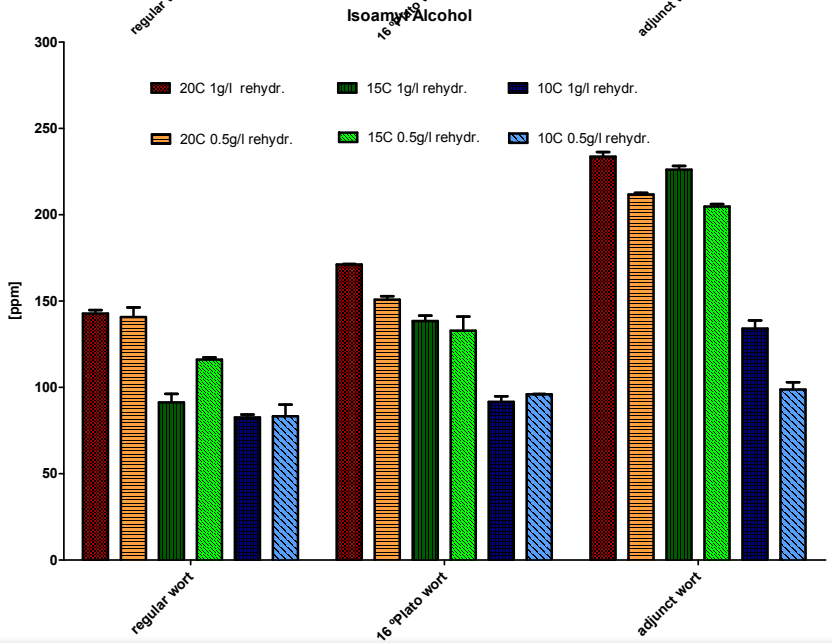
Esters



- Lower pitching rate resulted in higher ester production
- Higher temperature led to higher ester production
- Higher gravity resulted in higher ester concentrations

Higher Alcohols



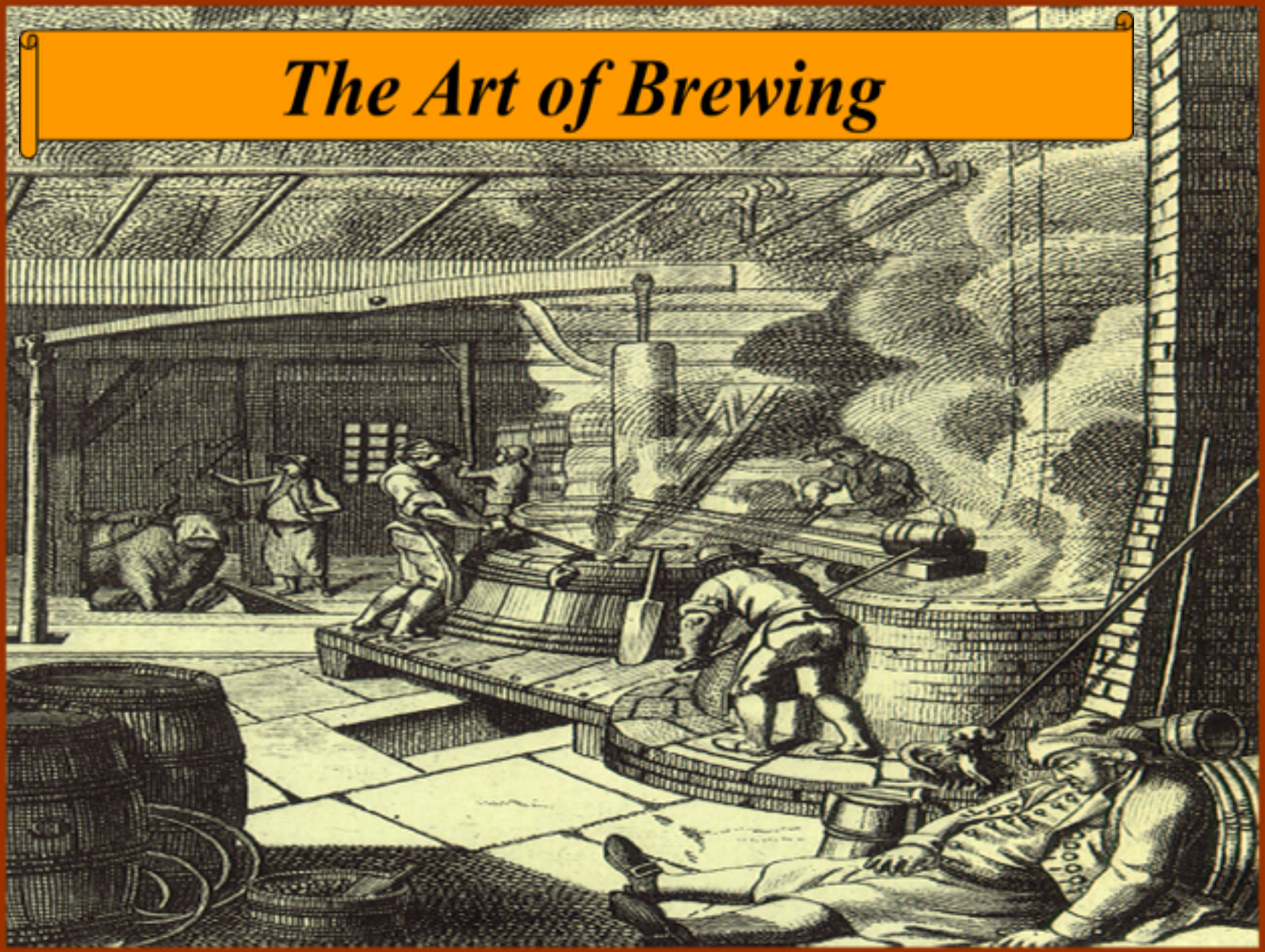


- Higher gravity and higher temperature resulted in increased higher alcohol concentrations

Manipulation Of Variables

- From just one yeast strain a brewer can manipulate fermentation conditions to produce a vast spectrum of flavours!

The Art of Brewing



Craft Brewing

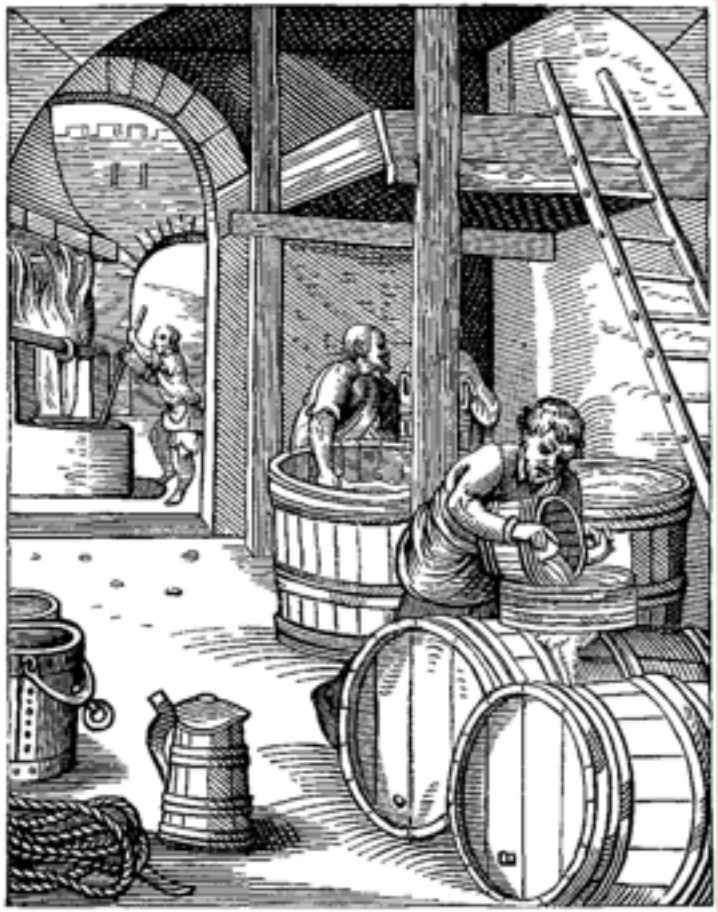
- Brewing market consolidated => beers were “homogenous”
- In the 80’s a counter movement started in the US

Craft Brewing

- Reviving old beer styles and recipes
- Experimenting with new raw materials

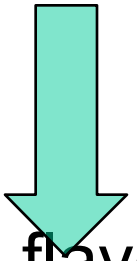
How Did Styles Develop?

- Local barley types
- Different ways of making malt
- Local water source
- Different yeast strains, shared yeast strains
- Different temperature ranges – ability to store cold
- Different cross-cultural influences
- Introduction of hops

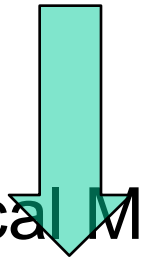


Development of beer styles

Availability of materials



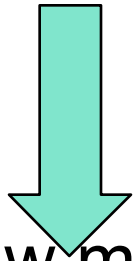
Grist, Hops (and flavourings), Liquor



Fermentation by local Microbiological Flora

Refinement of beer styles

Purification and selection of strain(s)

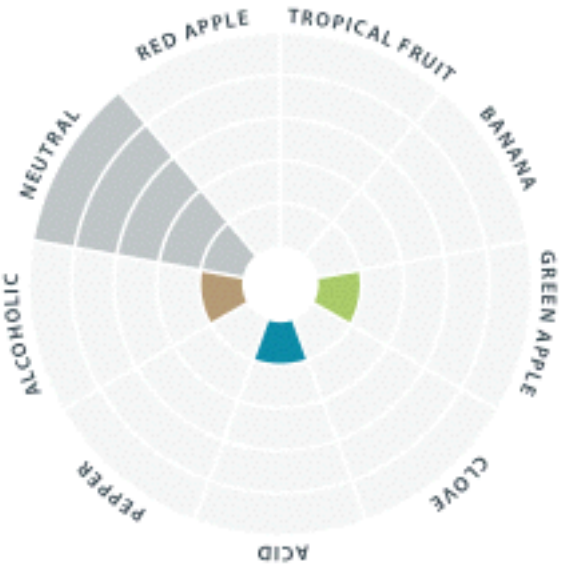


Standardisation of raw materials and brewing conditions

Established beer style

Lager Yeast

- Bavarian origin.
  - 1400s in Munich - cool fermentations (selective pressure)
  - Taken to Pilsen and Copenhagen in 1840s
- Became very popular - displaced ale yeast
- Popularity fueled by advances of Industrial Revolution
  - Steam power, refrigeration, railroads, pasteurization and filtration technology
- Cool fermentation temperatures: 5 to 12 ºC
- Natural Hybrid



Characteristics of Lager Beer

- Strains are closely related - common origins
- Beers are more delicate, clean, drinkable, and less aromatic.
- Low bitterness, simple grist composition.

Lager Yeast

Lager	Pilsner	Helles	Vienna	Bock
Schwartzbier	*Märzen*			

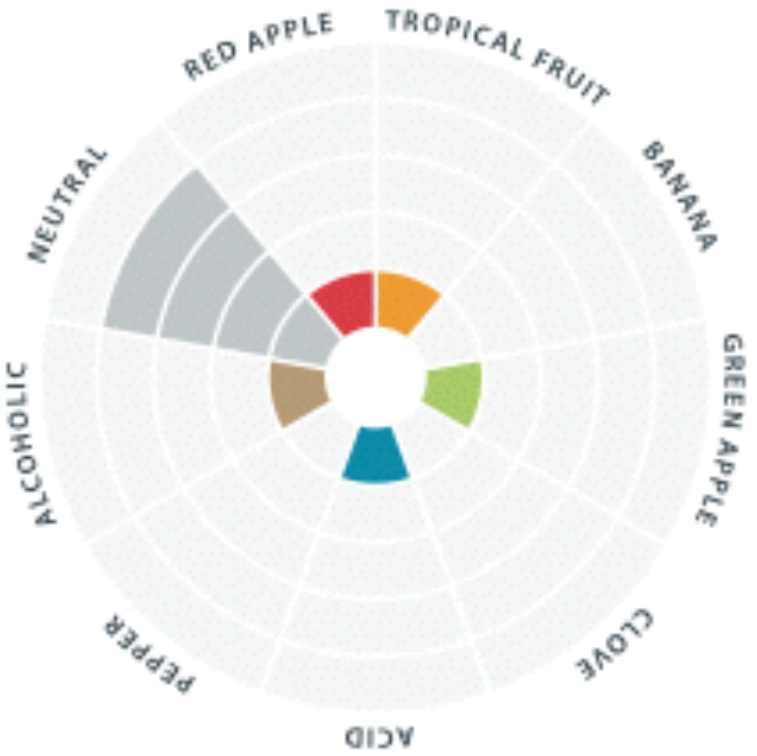
SUMMARY

DIAMOND LAGER YEAST

Attenuation	Flavor	Bottle Conditioning	Flocculation	Propagation	Beer
High	Neutral	No	Strong	Yes	Lager

Characteristics of West Coast Ale Yeast

- Aroma: Neutral with a slight ester
- High attenuation
- Fermentation range: 15 – 22C
- Flocculation: Medium to High
- Popular modern style



Characteristics of West Coast Ale

- 4.5 - 5.5% abv
- Straw like golden to deep amber colour
- Complex malty, bready/biscuity
- Moderate/strong USA hops, citrus & pine
- Medium bodied, moderate/high carbonation

American West Coast Ale

American Barleywine	American Pale Ale	American Amber Ale	American Brown Ale	American IPA
American Wheat	***Blonde Ale***	***Cream Ale***	***Kölsch***	***Imperial IPA***
Irish Red Ale	ESB	Scottish Ale	Strong Scottish Ale	Strong Ale

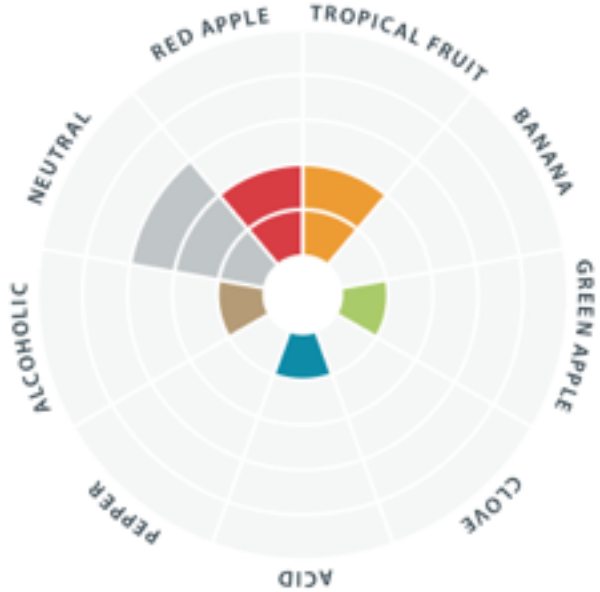
SUMMARY

BRY-97 AMERICAN WEST COAST ALE YEAST

Attenuation	Flavor	Bottle Conditioning	Flocculation	Propagation	Beer
High	Slightly estery, almost neutral	Yes, for beers up to 12% ABV	Strong	Yes	Ale

Characteristics of British Ale Yeast

- Aroma: Fruity/ester
- Attenuation: Medium
- Fermentation temp: 18-22C
- Flocculation: Medium - High



Characteristics of British Ale (ESB)

- Strong (5-6% abv),
- Full-bodied, mahogany-coloured
- Mellow bitterness
- Complex malty notes- biscuit flavours and soft malt toffee, brewed with Pale Ale and Crystal malts

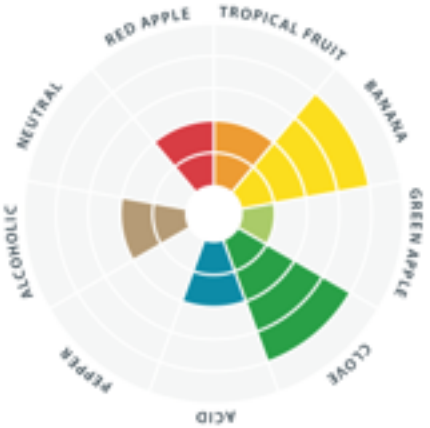
British Ale

ESB	Cream Ale	Blonde Ale	Bitter	Special/Best Bitter
Scottish Ale	***Irish Red Ale***	***Brown Ale***	***Porter***	***Sweet Stout***
English IPA	Old Ale	Mild		

- **Fermentation: Vigorous fermentation complete within 3-5 days.**
- **Attenuation: Medium attenuation preserves some beer complexity**
- **Flavour: Well balanced aromatic profile, moderate ester.**

Beer styles based around yeast: Weissbier/Hefeweizen

- Origins in C16th Bavaria.
- Favoured by royals, later gaining widespread popularity.
- Nearly dies out by C19th but revived by G.Schneider.
- Top fermenting ale yeast, fermented at warm temps.



Characteristcs of Bavarian Wheat Beers

- Unique yeast with complex flavour profile.
- Prominent esters – Banana, vanillia, bubblegum, apple.
- Phenols often present – 4VG (clove, ferulic acid), spices.
- Low hopping, simple grist composition.

Wheat Beer Yeast

Weizen	Hefeweizen	Dunkelweizen	Weizenbock	American Style Hefeweizen

MUNICH CLASSIC WHEAT BEER YEAST

NATURAL | KOSHER (500G) | GMO FREE

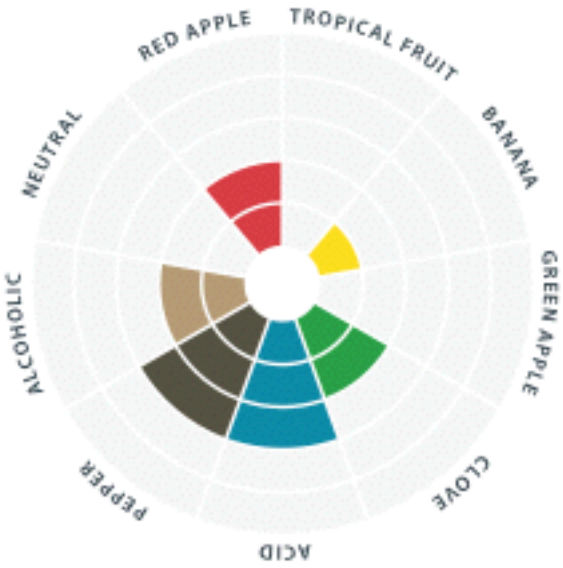
Commercial and Technical Inquiries: BREWING@LALLEMAND.COM

Beer styles based around yeast: Saison

- French/Belgian origins (Wallonia).
- Farm house ales traditionally brewed in winter, stored until summer.
- Seasonal farm workers ‘Saisonniers”.
- Top fermenting, warm temps.

Characteristics of Saison Beers

- Robust yeast with complex ester flavour profile (lemon/orange).
- Prominent ‘earthy’ yeast notes and spices (pepper).
- Very dry finish; high attenuation.
- Low hopping, simple grist composition.



Belgian Saison Style Beer yeast

Saison	Bière de Garde	Belgian style beers		

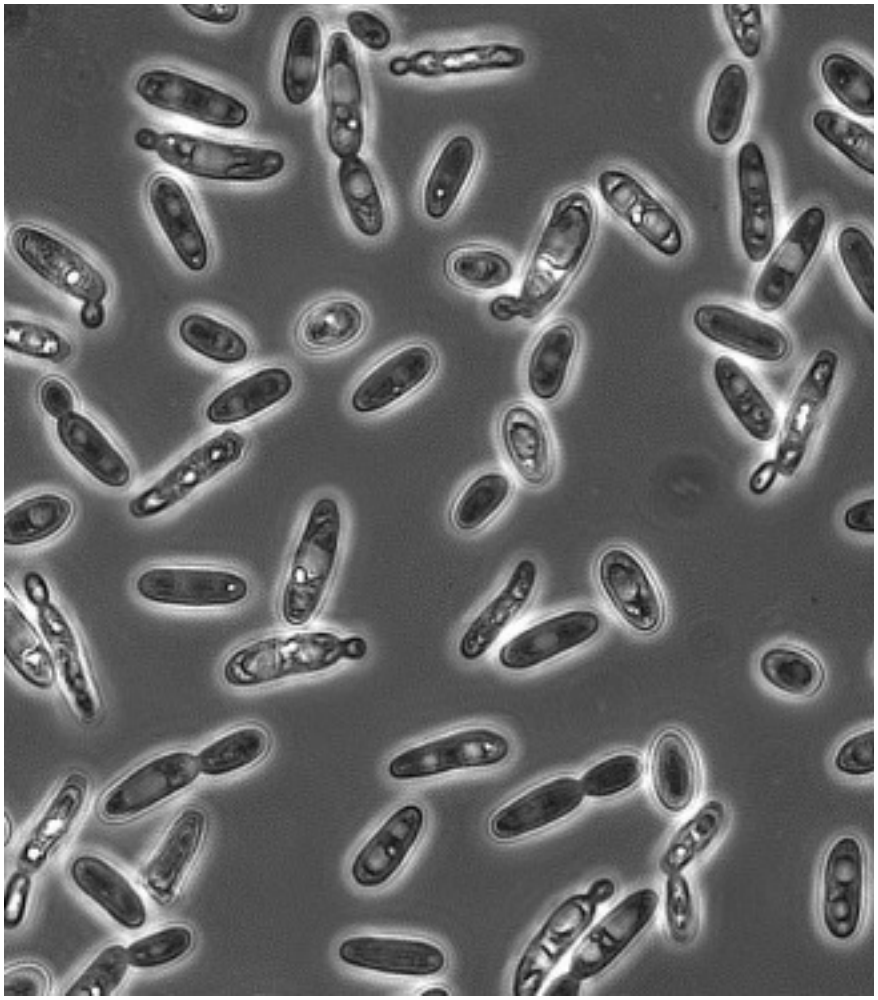
SUMMARY

BELLE SAISON BELGIAN *SAISON*-STYLE BEER YEAST

Attenuation	Flavor	Bottle Conditioning	Flocculation	Propagation	Beer
High	Fruity, spicy, peppery	Yes, for beers up to 14% ABV	Strong	Yes	Ale

Wild Yeast: Brettanomyces

- Can utilise broad range of sugars (inc. dextrins)
- Diverse sub species
- Does not contribute a lot of acidity on its own
- Slow acting
- Secondary Fermentation



Characteristics of ‘Wild’ Beers

- Robust yeasts with complex flavour profile (species dependent)
- Prominent ‘funky’ yeast notes and spices (phenolics).
- Typically dry finish; high attenuation.
- Low hopping, often used in sour beer styles.

Brettanomyces

Saison	Bière de Garde	American Wild	Sour Beer Styles	Imperial Stout
Trappist beer				

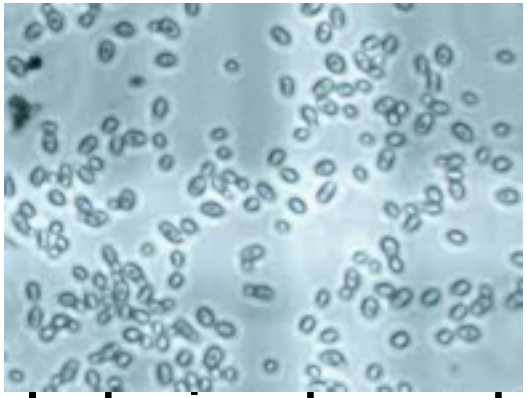
Yeast hybrids – potential

- Development of Interspecific hybrids:

S. cerevisiae

X

S.euybayanus, S.mitakae, S.kudriavzevii



= Novel strain characteristics

Yeast hybrids – potential

- Greater fermentation efficiency
  - + Fermentation speed
  - + Thermal tolerance
  - + Ethanol tolerance

- Greater diversity in sensory expression
  - + Flavour
  - + Aroma

Yeast hybrids – potential

Origin	Efficiency	Aroma	POF	Temp
S. *cerevisiae X S. eubayanus*	--	Clean, slightly fruity aroma	-	Low/High
S. *cerevisiae X S. eubayanus*	--	Clean, fruity aroma	+ (slight)	Low/High
S. *cerevisiae X S. eubayanus*	++	Neutral to slightly fruity aroma	+ (slight)	Low/High
S. *cerevisiae X S. mikatae*	++	Extremely fruity	+ (slight)	Low/High

Are there New Styles to be developed?

- Yes! Beer styles are changing as we speak
- Brewers (and Marketers) like to try new things
- Driven by home-brewers, beer enthusiasts and pro brewers
- Brewers want to sell more beer, want to keep consumers interested in their brands
- Consumers want an experience in drinking, not just beer as a thirst quencher
- Brewers must still bear in mind “drinkability”

Commercial Availability of Yeast

- **Anyone can brew any style!**

LALLEMANDBREWING.COM