



# Homebrew Club Lecture - Chicago

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# Who am I ?



**Hugo Picard**

Home Division Manager



- ❑ 5 years Master's Degree food industry & Agriculture - ISA France
- ❑ 5 years Master's Degree International Marketing - Lille University
- ❑ Several experiences in brewing and winemaking in France & New Zealand



01

# Welcome in the Fermentis Academy Universe



# OUR GROUP

The infinite potential of microorganisms (yeasts, bacteria...) enables us to position ourselves in the bread making, food taste and pleasure, healthcare and industrial biotechnology markets.

In each of these domains, Lesaffre's ambition is to be **one of the active leaders in the fermentation of microorganisms to better nourish and protect the planet.**

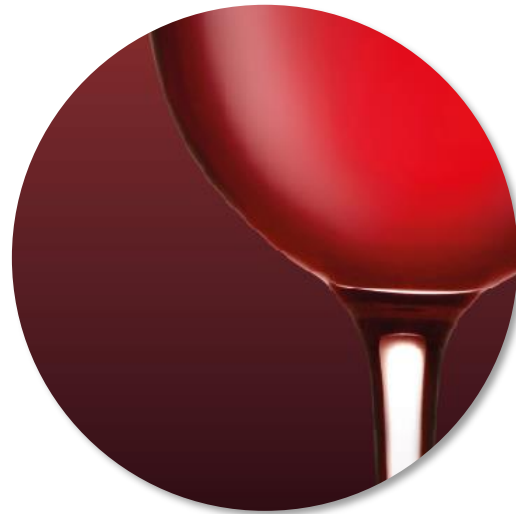


# Focus on Fermentis activities

Industrial – Craft – Home



Spirits



Wine



Beer



Other  
beverages

# Fermentis Academy Universe

1



LOGO

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FERMENTIS  
ACADEMY

2



MISSION

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« Explore & share the art  
of developing quality  
fermented beverages »

3



OBJECTIVES

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LEARN  
SHARE  
EXCHANGE

# Travel with us inside Fermentis Academy Universe



02

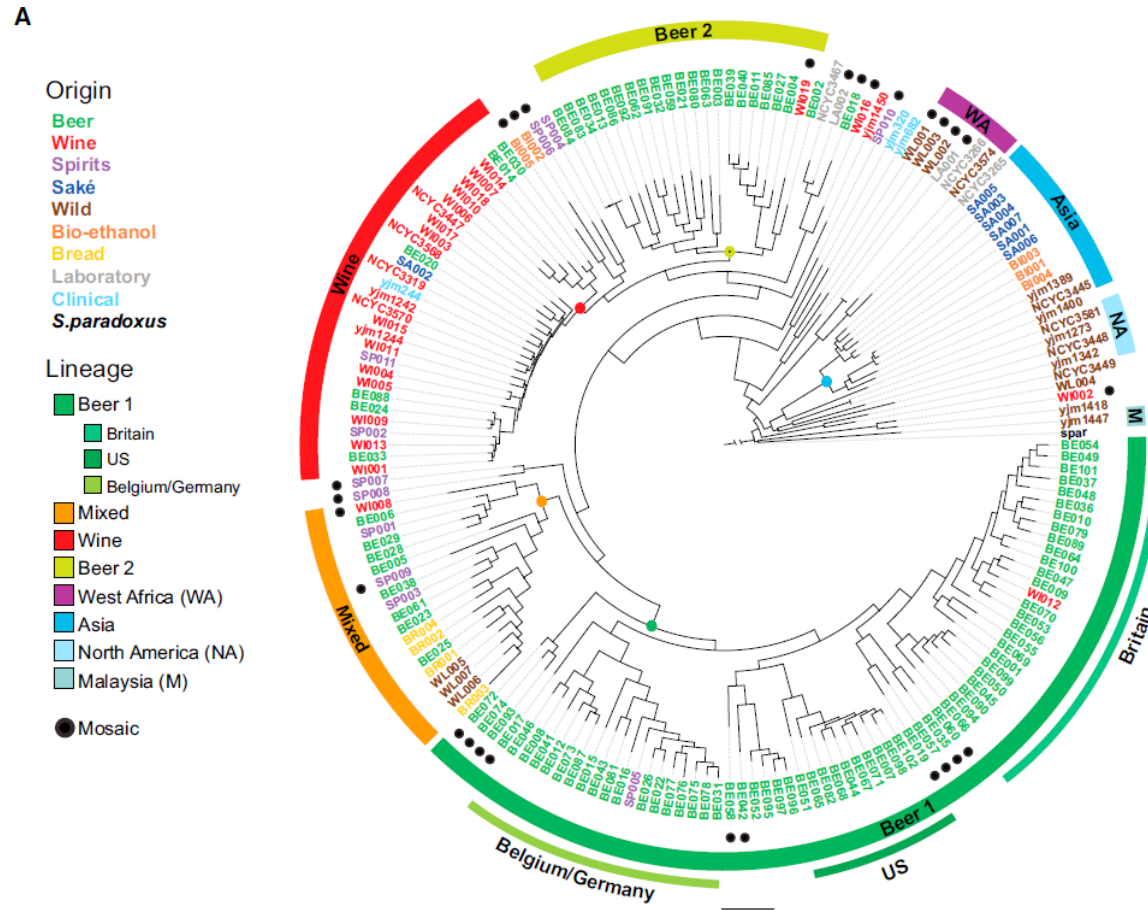
## Yeast & fermentation basics





A bit of scientific history

# Beer yeast diversity & domestication

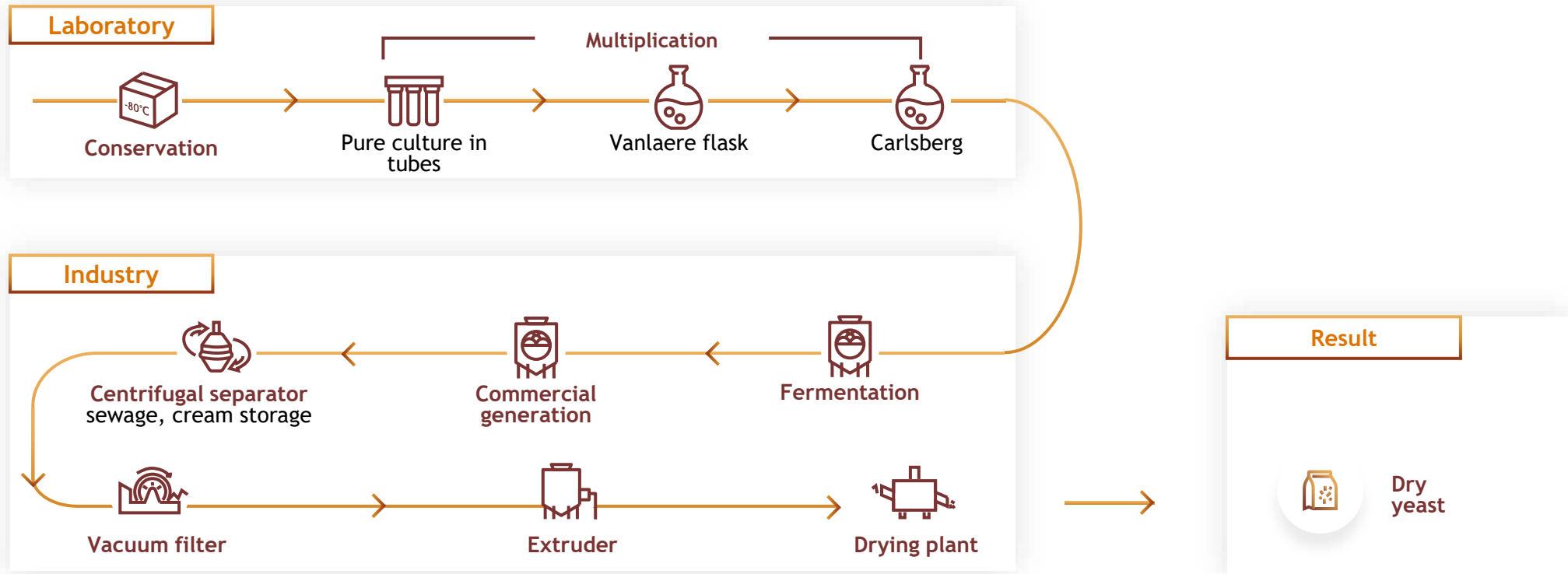


Domestication and Divergence of *Saccharomyces cerevisiae* Beer Yeasts

Brigida Gallone, Jan Steensels, Troels Prah, ..., Guy Baele, Steven Maere, Kevin J. Verstrepen. *Cell* 166, 1397-1410, September 8, 2016.

Quick look at the plant

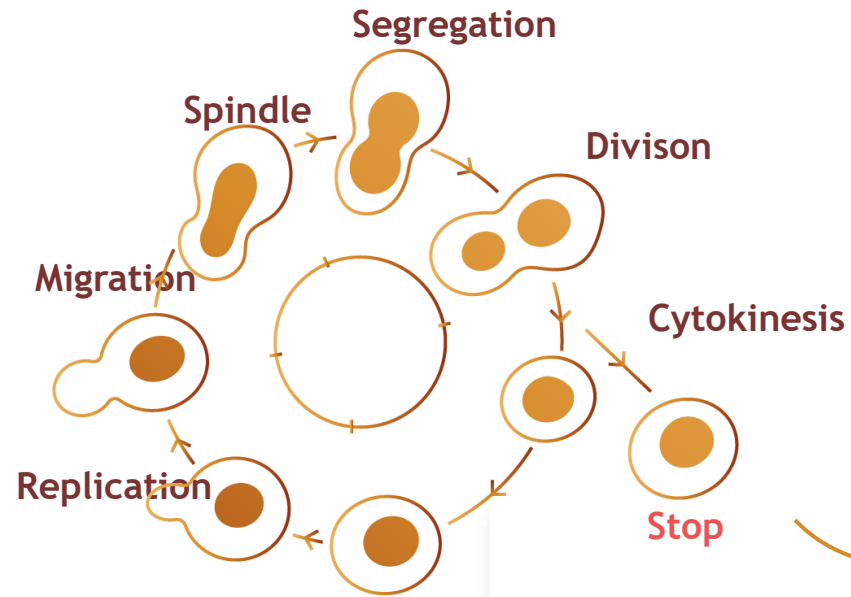
# Manufacturing process



Quick look at the plant

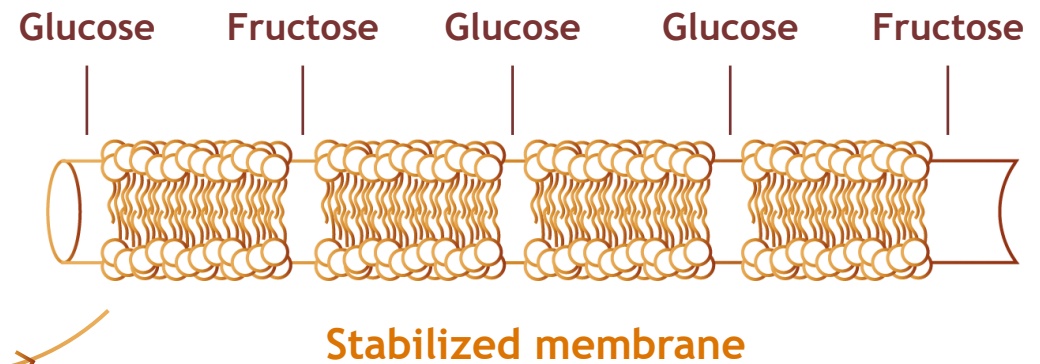
# Yeast Multiplication

## Yeast shaping



“Doors” are open for sugar assimilation. Fresh yeast, dried ready to go

## Sugar transport



Quick look at the plant

## Drying process



### Before drying

25-30% Dry Matter

Smooth Cell Surface

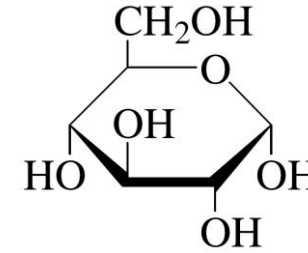
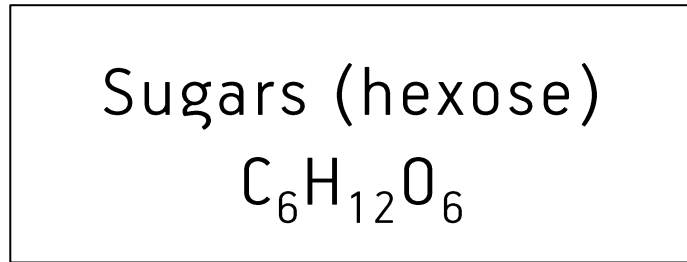


### After drying

94-96.5% Dry Matter

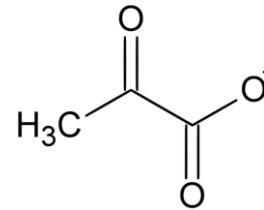
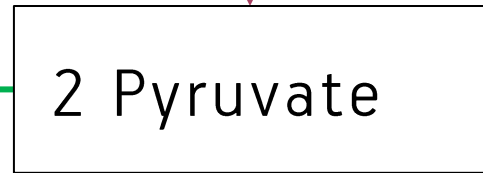
Uneven Cell Surface

# Energy production by the yeast



Glucose

Glycolysis



Respiration

Oxygen



+ 28 ATP =

204 kCal (854 kJ)

Fermentation

Oxygen



+ 2 ATP =

14.57 kCal (61 kJ)

# Introduction to yeast metabolism

## Fermentative Aromas

### Ethanol

### Ethyl acetate

### Ethyl esters

### Fatty acids

### Acetate esters

### 2-Phenylethyl acetate

### Isoamyl acetate

## Glucose / Fructose

### Pyruvate

### Acetaldehyde

### Ethanol

### Acetic acid

### Acetyl-CoA

### Fatty acid acyl CoA

### Fatty acids

### Acetate esters

### Higher alcohols

### α-acetolactate

### diacetyl

### Glycerol

### Acetaldehyde

### Ethyl acetate

### Ethyl esters

### Fatty acids

### Acetate esters

### Higher alcohols

### α-acetolactate

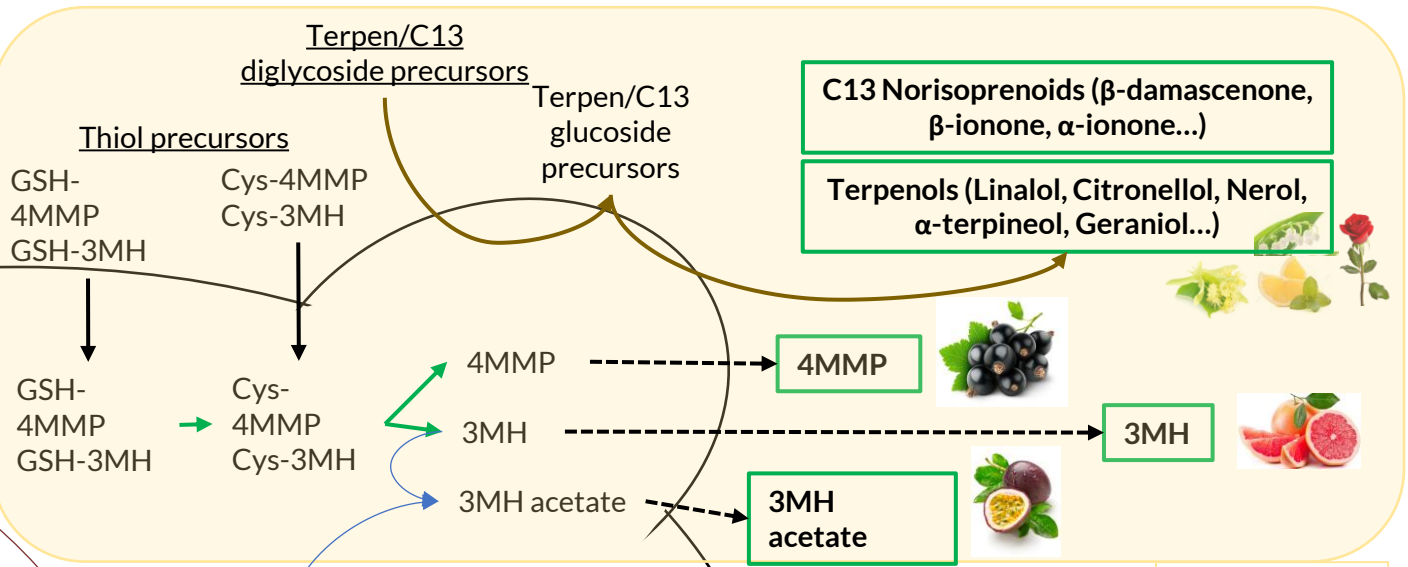
### 2,3-pentanedione

### acetoin

### 2,3-pentanedione

### α-acetolactate

### diacetyl

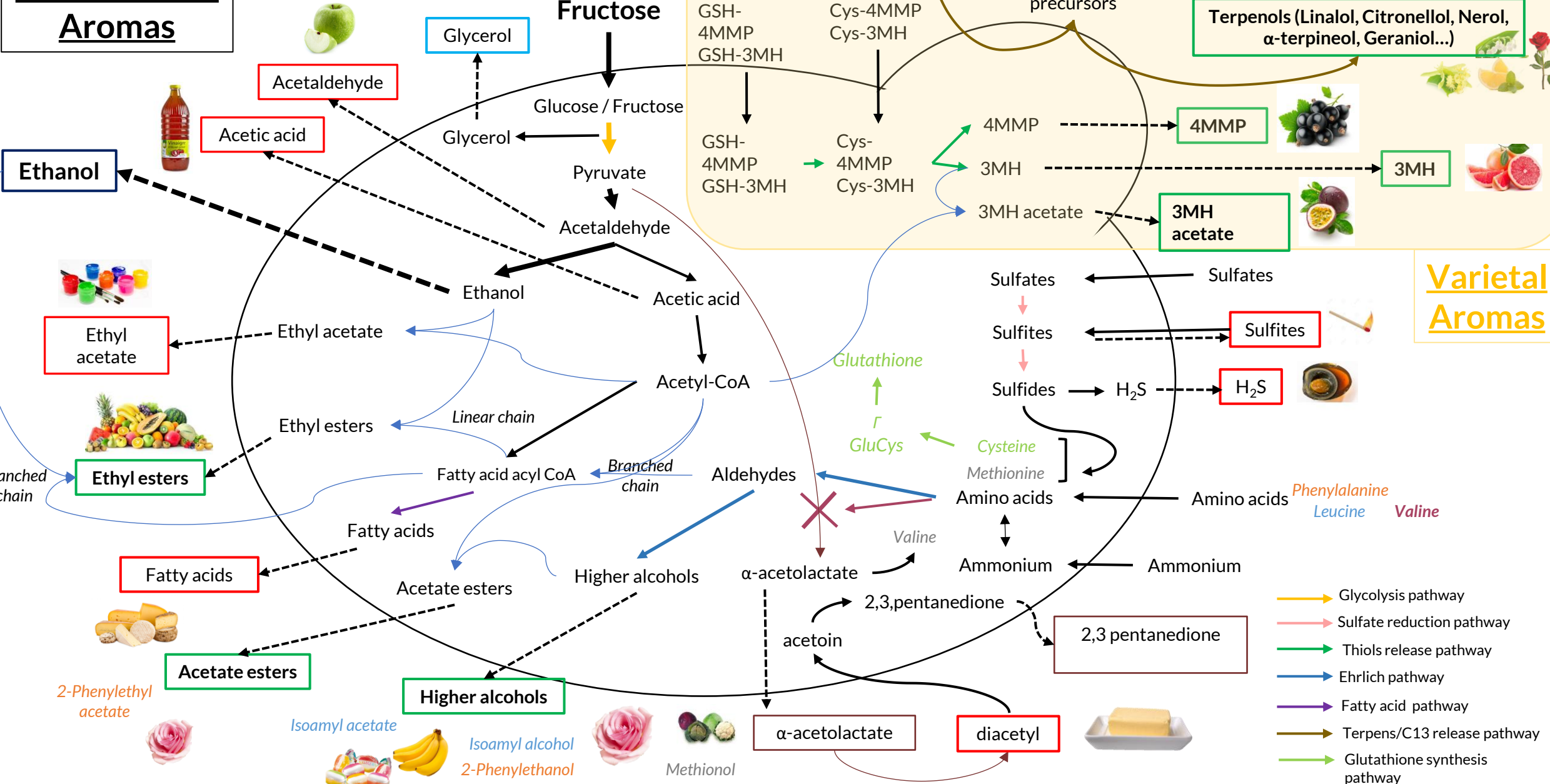


## Varietal Aromas



Amino acids: Phenylalanine, Leucine, Valine

- Glycolysis pathway
- Sulfate reduction pathway
- Thiols release pathway
- Ehrlich pathway
- Fatty acid pathway
- Terpenes/C13 release pathway
- Glutathione synthesis pathway

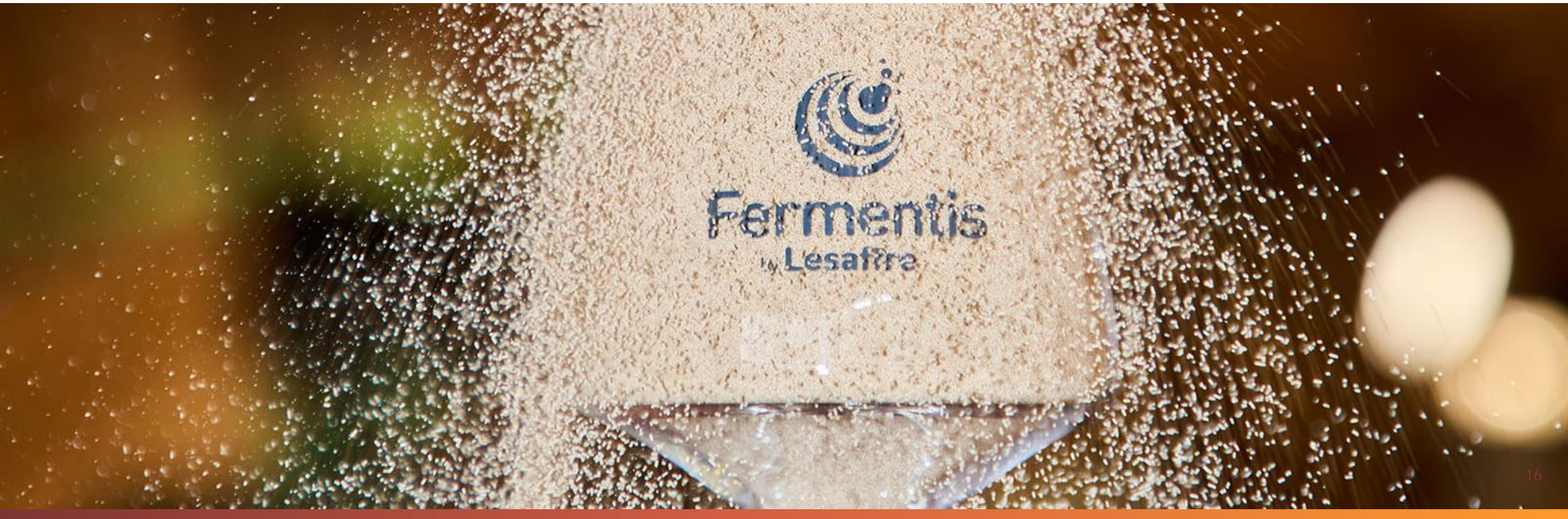


## Key points to remember

- Yeasts are living micro-organisms which produce alcohol (ethanol) to produce energy and grow
- Yeast produce aromas and off-flavor as by-products
- The goal of the yeast is to replicate and ensure its survival
- We exploit these properties to produce fermented beverages

# 03

## Focus on Lager Yeasts





# Content

**A** Objectives and Characteristics

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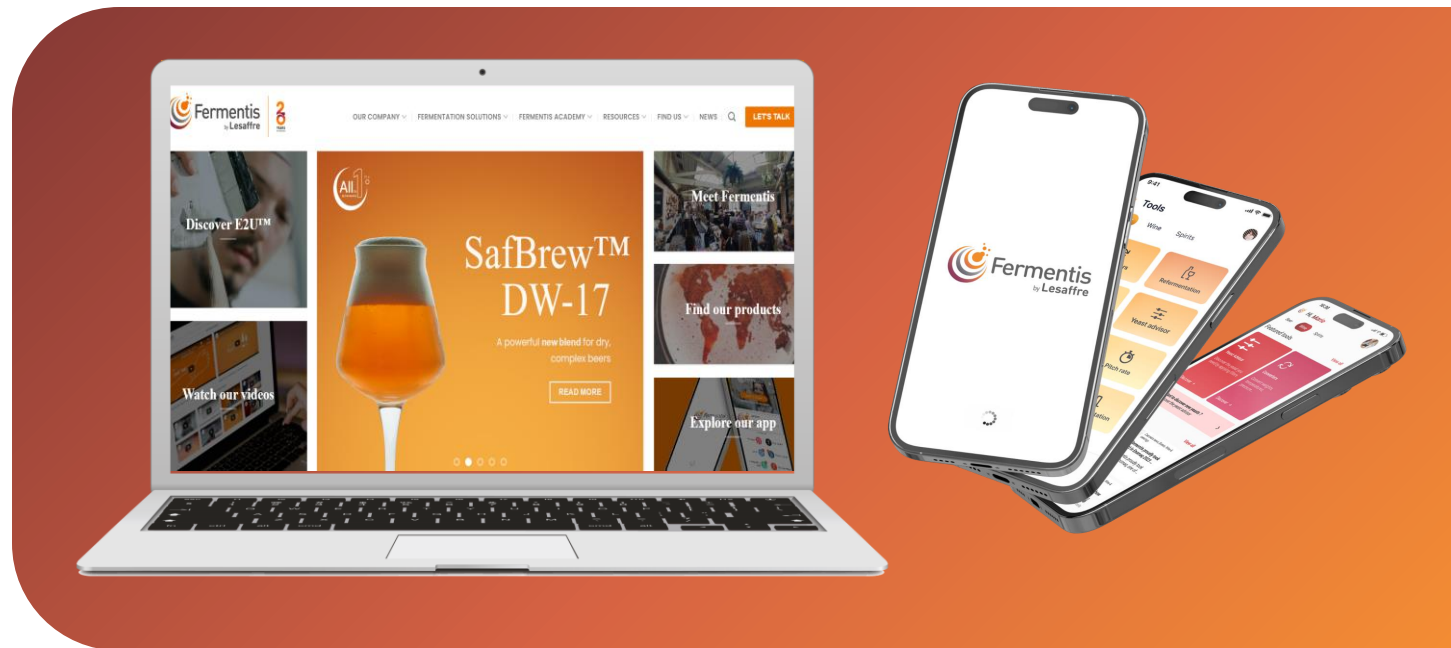
**B** Product Performances

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**C** Key Learnings

# Where do you find the information you need?

- Always try to favorize information source coming directly from Fermentis
- Prioritize digital tools such as App' or website
- Generally speaking, always cross information sources

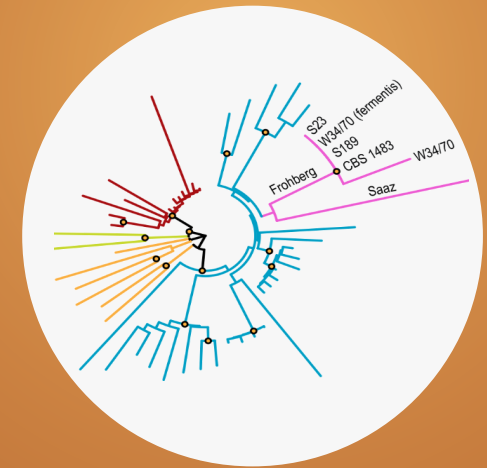
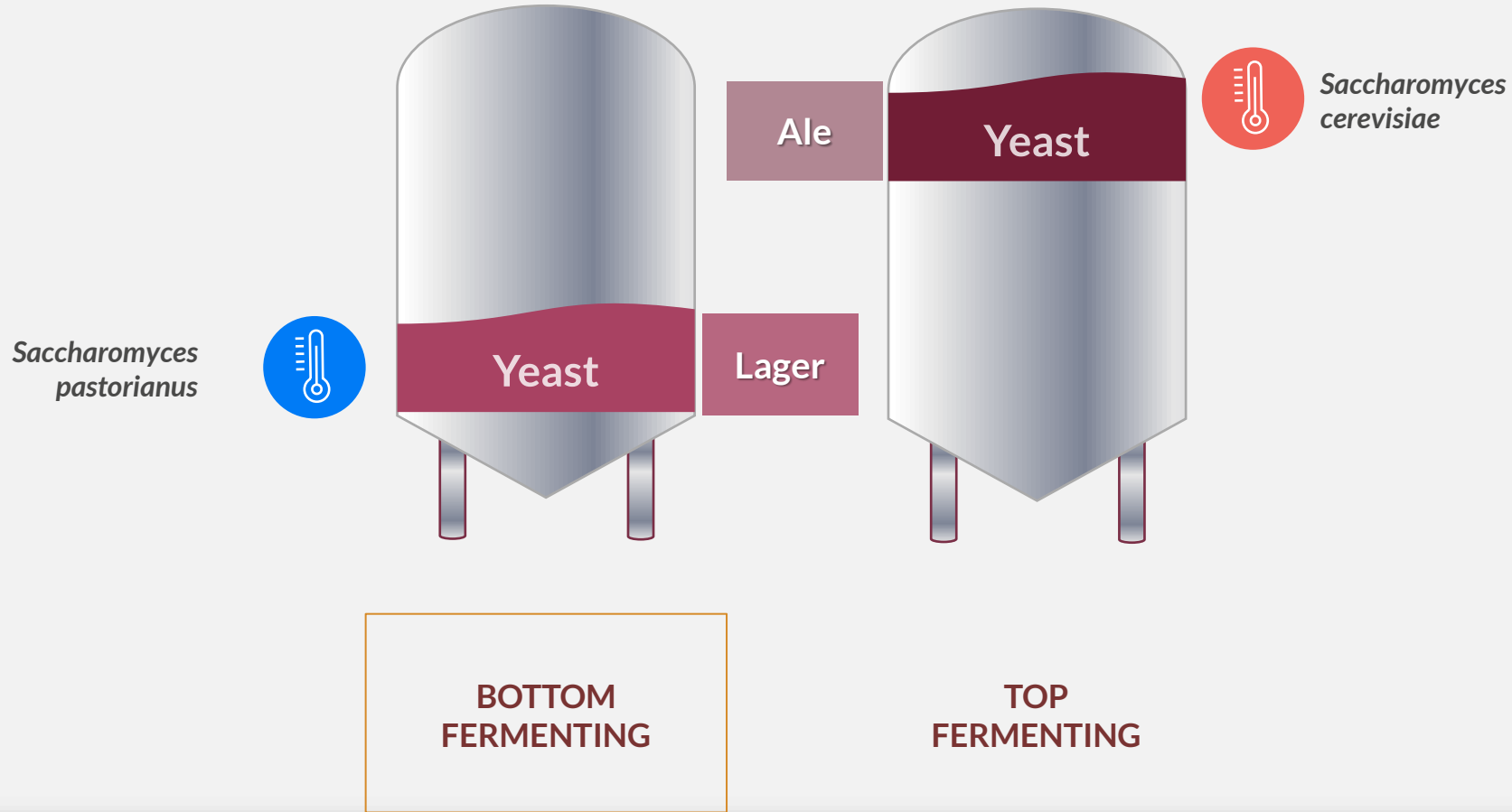


A

# Objectives and Characteristics



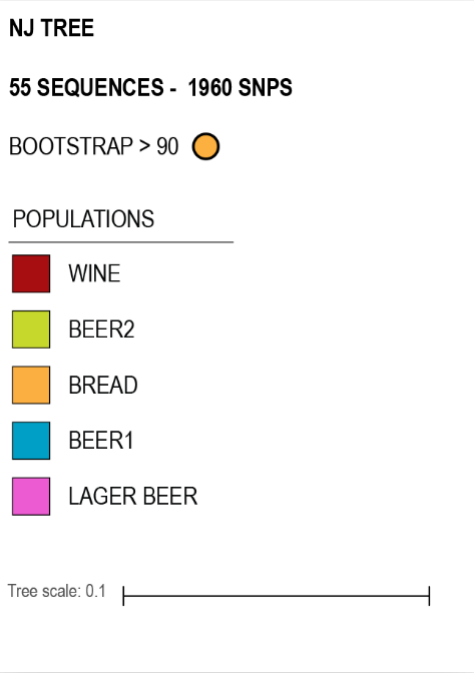
# EXPLORE FURTHER Classical Beer Yeasts



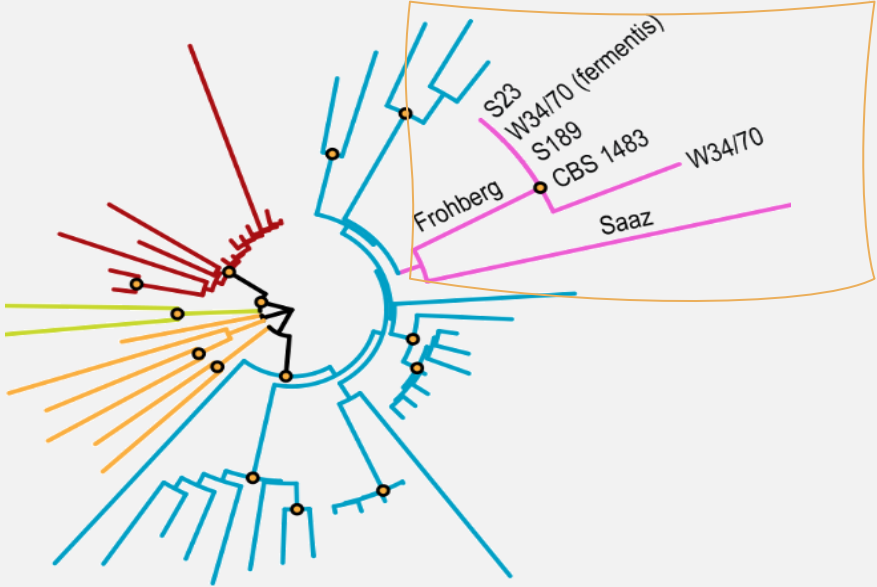
BEER1  
LAGER BEER

# Phylogenetic placement of Fermentis Lager beer strains

(Fermentis genomic yeast analysis 2017)



## SACCHAROMYCES PASTORIANUS



### Lager Strains

Generally, all strains of *S. pastorianus* exhibit **minimal** genomic variation.

### Two Lager Phylogenetic Families

Frohberg and Saaz are the two lager phylogenetic families existing.

SafLager™ W-34/70, SafLager™ S-23 and SafLager™ S-189 come from FROHBERG type

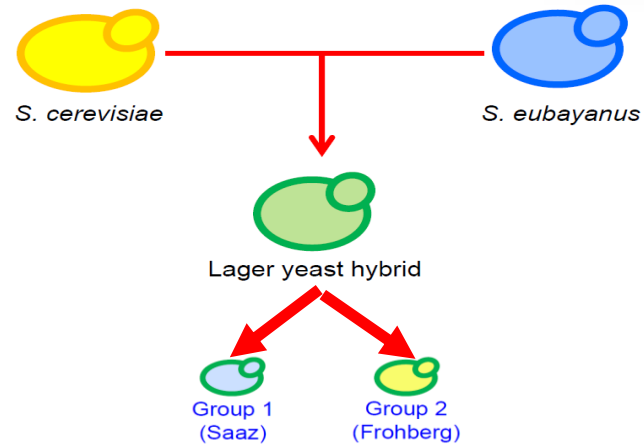
**Figure 3.** Phylogeny constructed using the *cerevisiae* sub-genome of *S. pastorianus* and depicting the placement of **Fermentis** *S. pastorianus* strains S-23, S-189 and W-34/70. The tree was constructed using the Neighbor-Joining method. Support values from bootstrap replicates above 90% are shown. The analysis includes representatives of different types of beer starter cultures and wine strains. Note that for lager strains, the two types Frohberg and Saaz are depicted.

A bit of scientific history

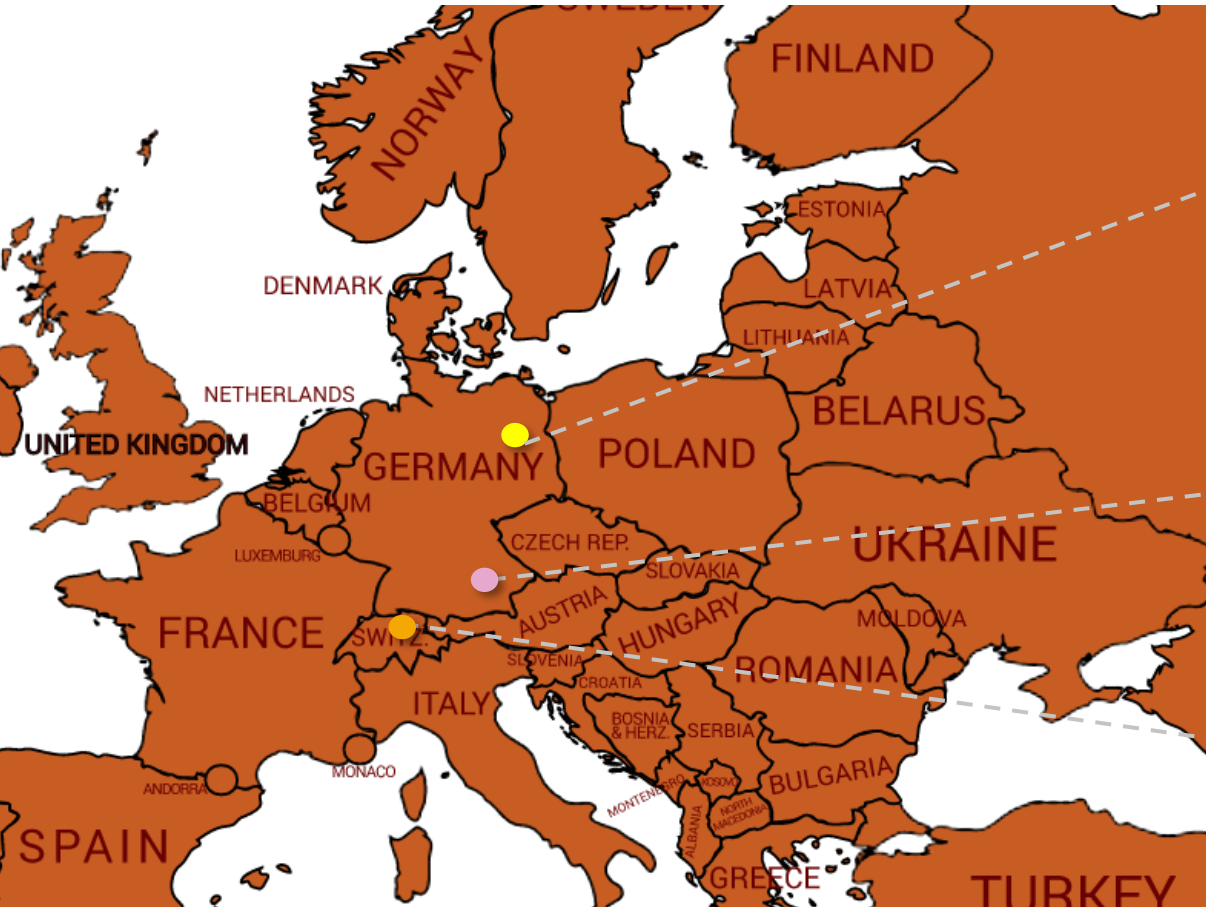
# The example of Lager yeasts

The Lager yeasts we know today are the results of:

- Explorations
- Chance
- Selection



# The “historic” Fermentis lager yeasts



SafLager™ S-23



SafLager™ W-34/70



SafLager™ S-189

# Explore “new wave” Lager styles

## SafLager™ E-30



*Add a slightly fruity note to your Lager*

## SafBrew™ LD-20



*An all-in-one yeast & enzyme blend for dry lager beers*



# Objectives and Characteristics

## Characterization of the SafLager™ Yeasts in Standard Conditions



### Wort

Brewing wort with pils malt  
at 15°P and 25BU (Magnum P90)



### Pitching rate

100 g/hl (0.12 oz/gal)



### Fermentation

Temperature of 14°C (57,2°F)



### Maturation & Filtration

Temperature of 0°C (32°F)  
during 14 days

## Experimental Conditions in 50 Liters Pilot Scale

# SafLager™ Yeast Range

## Product

SafLager™ W-34/70

SafLager™ S-23

SafLager™ S-189

**SafLager™ E-30**



## Description

*S. pastorianus*

*S. pastorianus*

*S. Pastorianus*

*S. pastorianus*



## Aromatic Intensity

Neutral

Medium fruity

Medium fruity & floral

**Medium-High fruity**



## Typical beer style

The famous, reliable & neutral yeast for your lager beers

The perfect yeast for fruity and hoppy lagers

A great yeast for elegant lagers with noble hop or floral notes

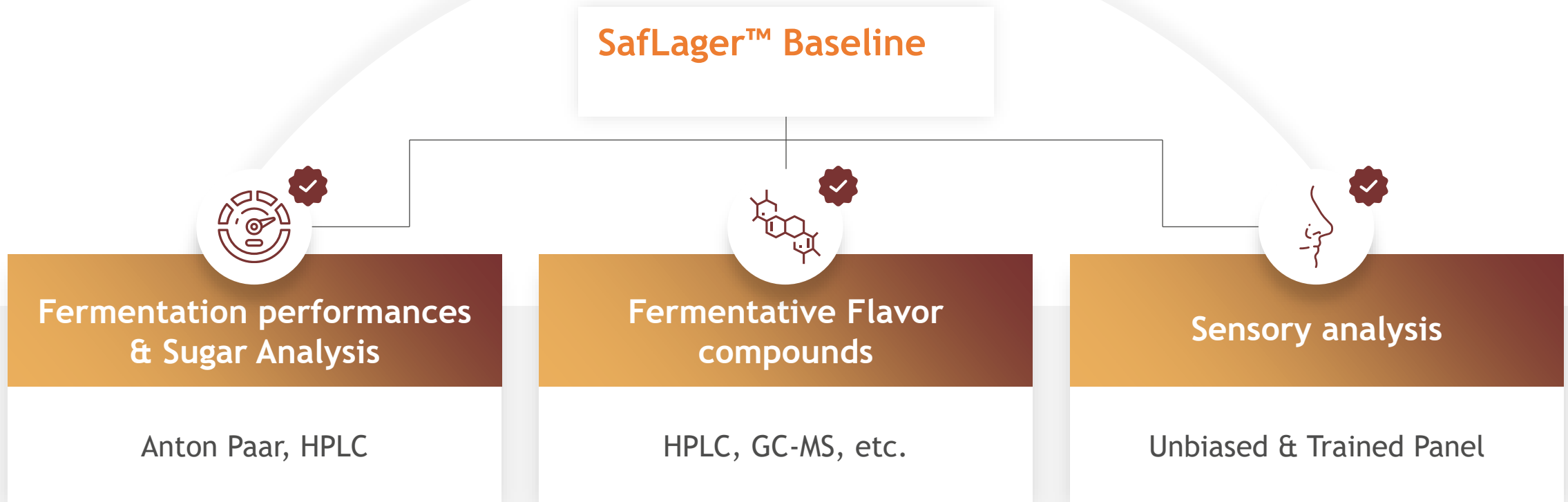
**The optimal yeast to reveal the esters of lager beers**

**B**

# Product Performances



# Performed Analysis



# Experimental Conditions in 50 liters: Kinetics



## Wort

Brewing wort with pils malt at 15,0 P



## Pitching rate

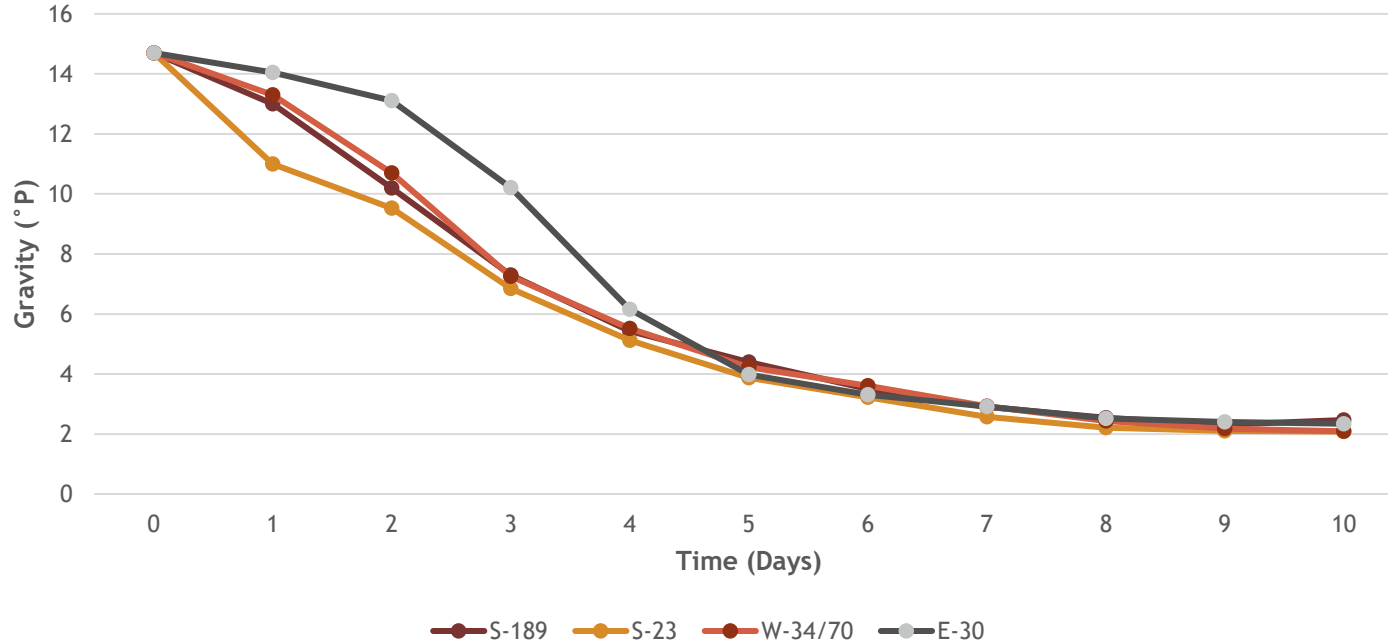
100 g/hl (0.12 oz/gal)



## Fermentation

Temperature of 14°C (57,2°F)

Fermentation Kinetics (Scott. B)



SafLager™ E-30 starts slowest and SafLager™ S-23 fastest but all Saflager™ strains finish fermentation at the same time.

# Experimental Conditions in 50 liters: ADF (%)



## Wort

Brewing wort with pils malt  
at 15,0 P



## Pitching rate

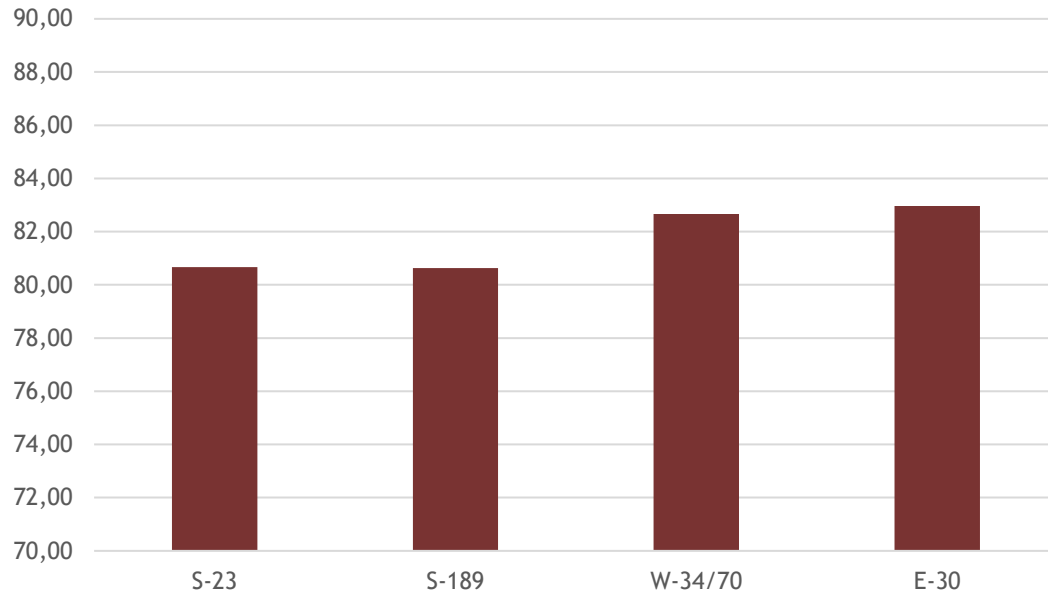
100 g/hl (0.12 oz/gal)



## Fermentation

Temperature of 14°C (57,2°F)

App. Degree end of Fermentation (ADF %)



**Both SafLager™ W-34/70 & SafLager™ E-30  
present slightly higher ADF.**

# Experimental Conditions in 50 liters: Analysis of Sugars



## Wort

Brewing wort with pils malt at 15,0 P



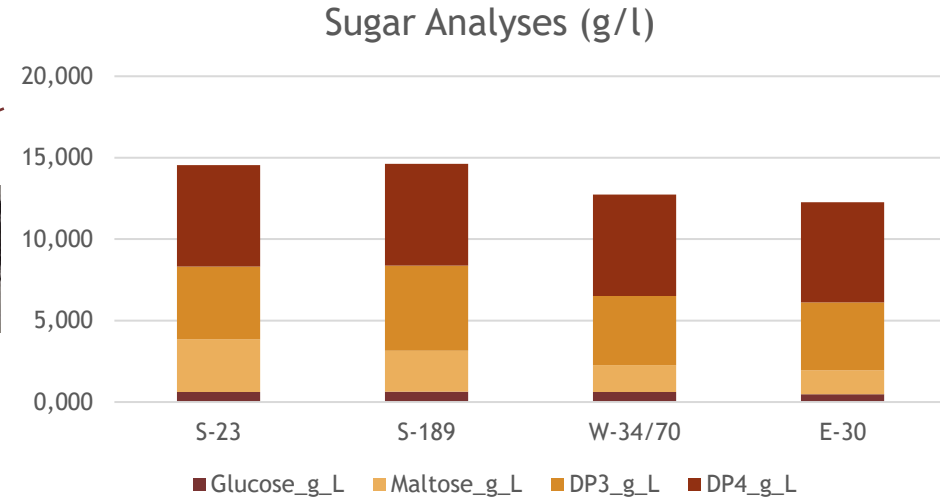
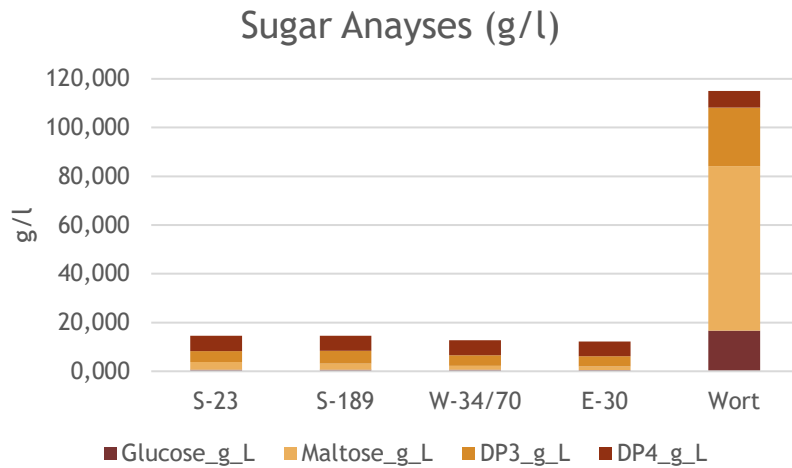
## Pitching rate

100 g/hl (0.12 oz/gal)



## Fermentation

Temperature of 14°C (57,2°F)



**Both SafLager™ W-34/70 & SafLager™ E-30 consume slightly more sugars; mainly maltose & maltotriose.**

# Experimental Conditions in 50 liters: Higher Alcohols & Diacetyl



## Wort

Brewing wort with pils malt at 15,0 P



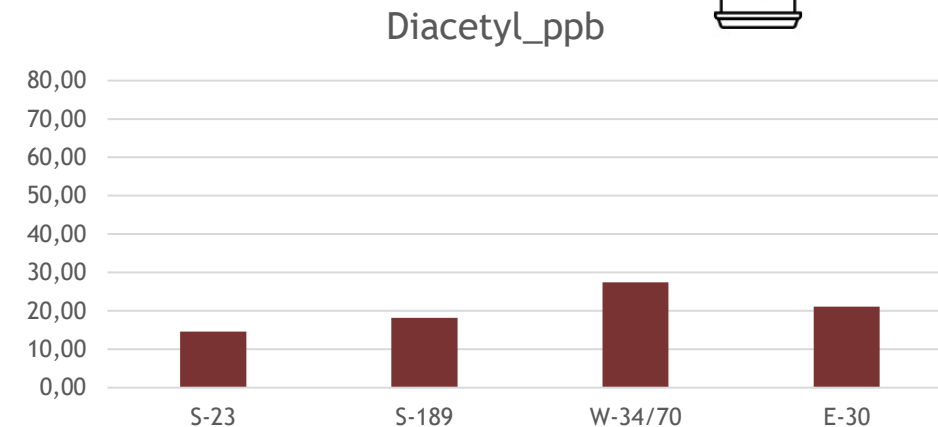
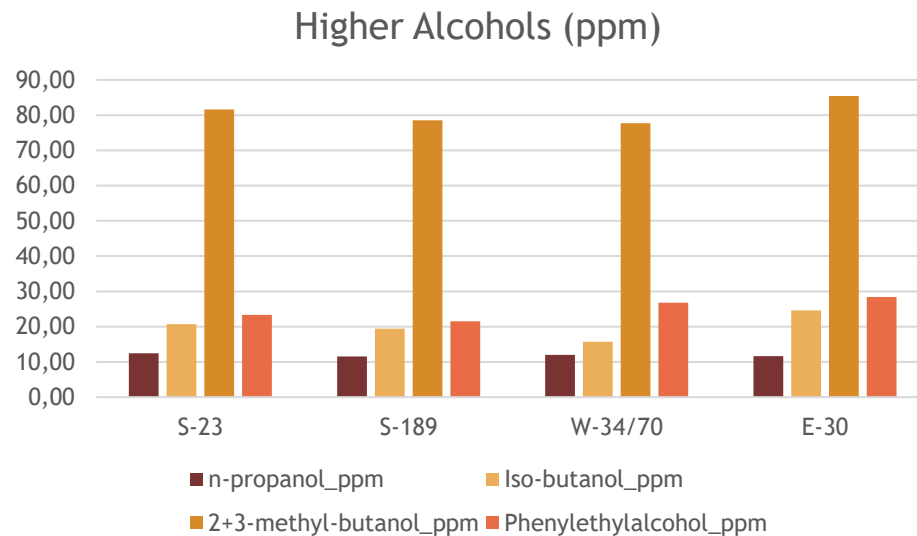
## Pitching rate

100 g/hl (0.12 oz/gal)



## Fermentation

Temperature of 14°C (57,2°F)



**SafLager™ yeast strains produce similar amounts of Higher Alcohols.**

**SafLager™ yeast strains reduce similarly the diacetyl level below the threshold.**



# Experimental Conditions in 50 liters: Esters



## Wort

Brewing wort with pils malt at 15,0 P



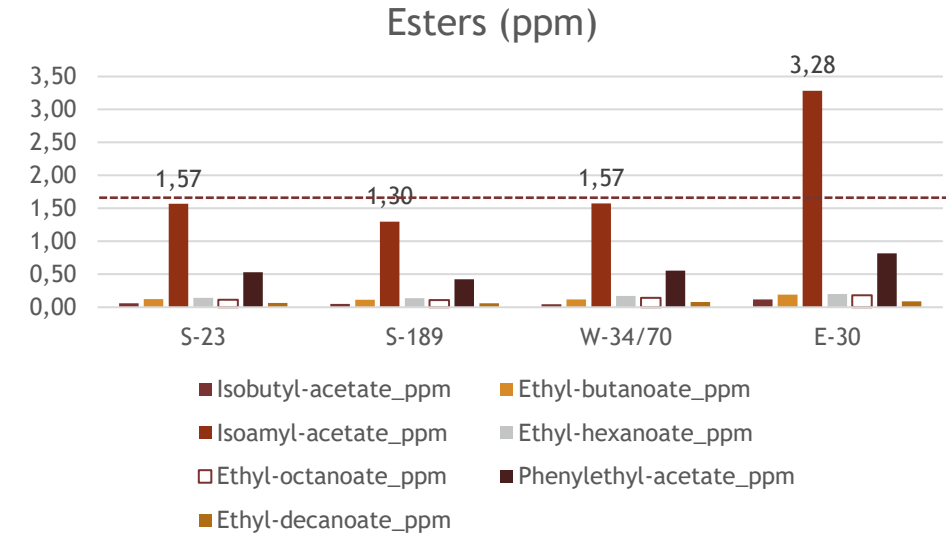
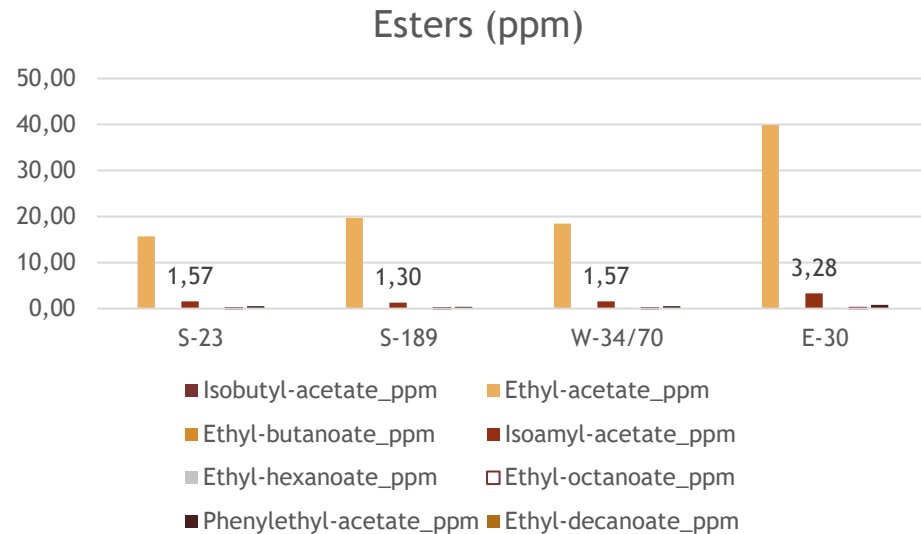
## Pitching rate

100 g/hl (0.12 oz/gal)



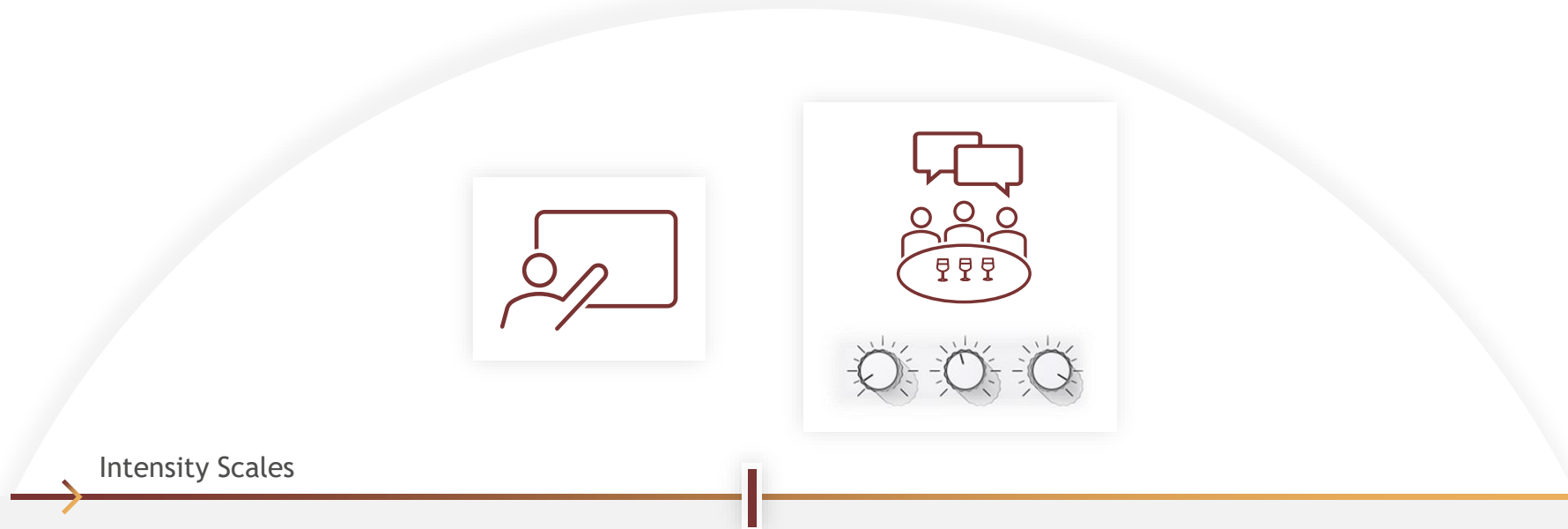
## Fermentation

Temperature of 14°C (57,2°F)



SafLager™ E-30 produces more esters, mainly Isoamyl acetate, typical of banana flavor.

# Sensory analysis by Quantitative Descriptive Analysis (QDA)



- Trained Panel, av. 15 tasters
- Random & 3-digit Blind Tasting
- Black Glasses, controlled temperature
- Digital data collection
- Statistical & performance analysis

1

**Trainings upon references**  
**Trainings upon product universe**  
**Vocabulary generation**  
**Consensual descriptors**

2

**Evaluation & repetition**

# Sensory analysis

FERMENTIS TRAINED PANEL



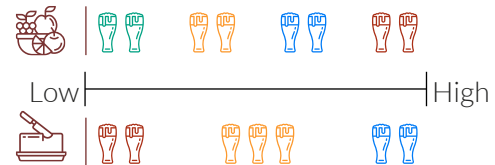
## Training

Ensure a descriptive and consensual analysis



## Rating

Evaluate the intensity of descriptors for each product



## Statistics & report

Analyze differences between products and correlation with fermentation parameters

**Sensory analysis =** Science allowing the interpretation of information perceived by the sensory receptors to obtain an objective result.

# Experimental Conditions in 50 liters: Sensory Data



## Wort

Brewing wort with pils malt at 15°P and 25BU (Magnum P90)



## Pitching rate

100 g/hl (0.008 oz/gal)



## Fermentation

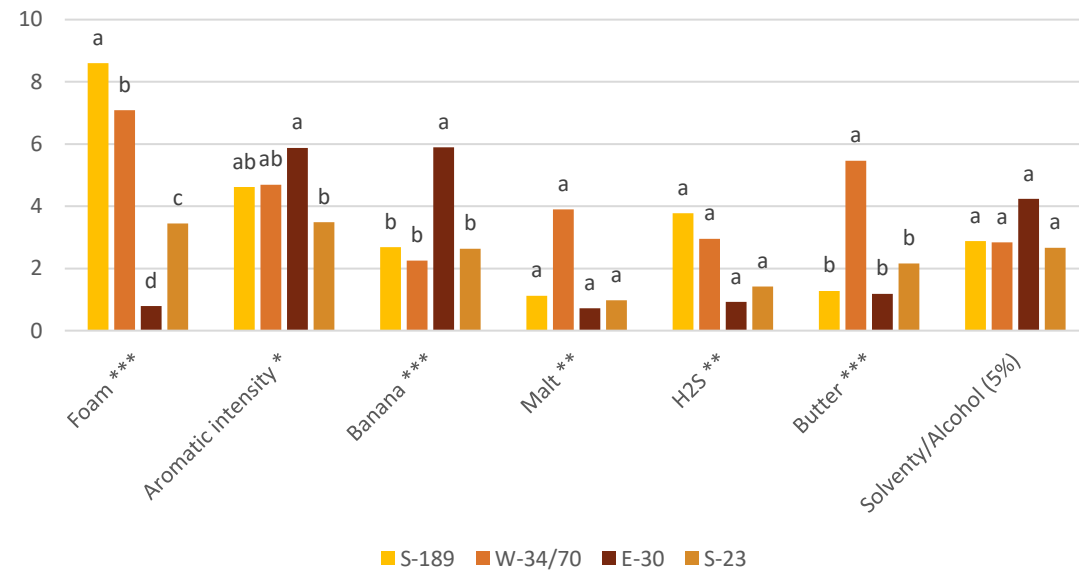
Temperature of 14° C (57,2° F)



## Maturation & Filtration

Temperature of 0° C (32° F) during 14 days

Means by significant descriptors



**Saflager™ E-30 shows higher aromatic intensity; with banana flavor being the main descriptor.**

# Understanding a Principal Component Analysis (PCA) chart

## Break Down

### What is it?

- A form of statistics
- 3D chart that is flattened to 2D to show the most relevant data possible

### Why use it?

- Simplifies pattern recognition in data analysis with graphics

### How & When to use it?

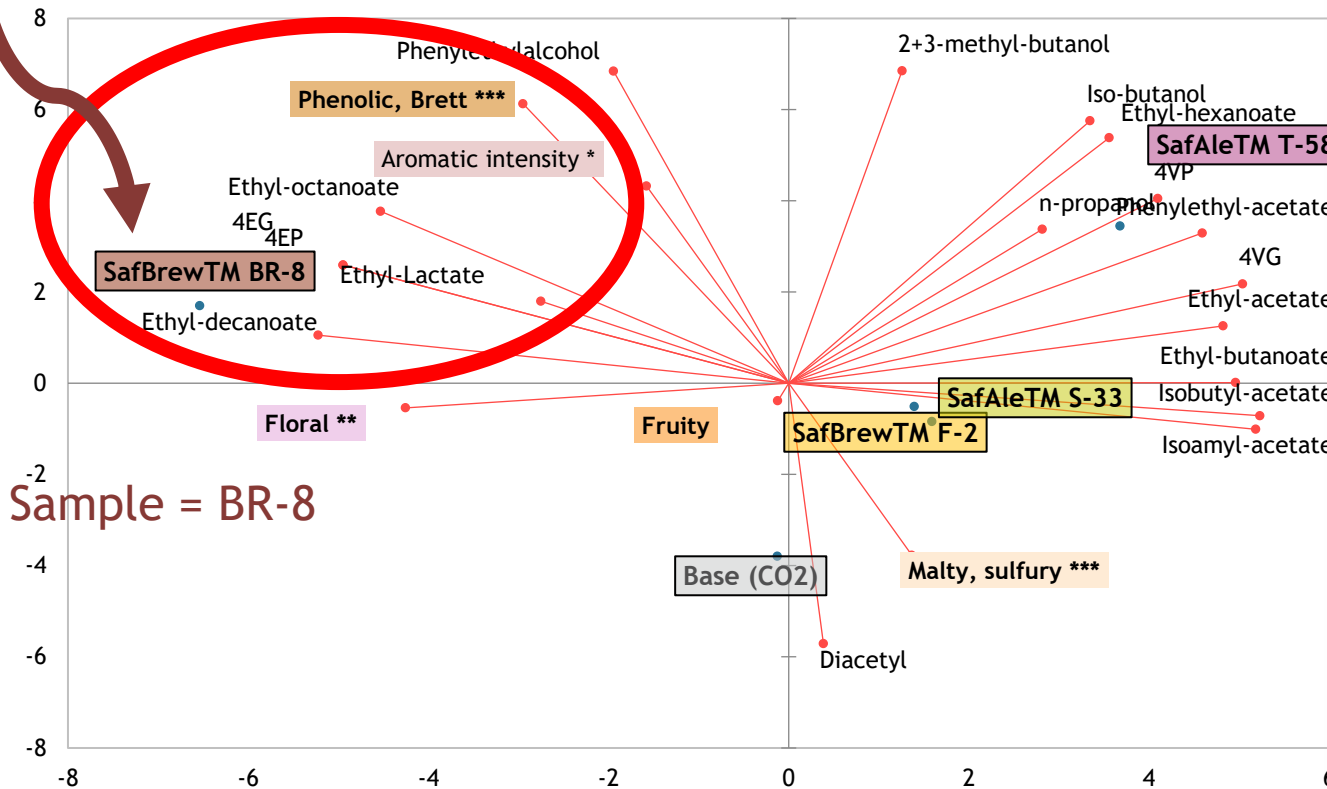
- Best used for large data sets like metabolism or 'omic data
- Samples (yeast strains) become placed with metrics (flavors) that are associated with each other.

### Understanding the data

- If the metrics and samples are close to each other, associate them together
- The higher the % on the axis, the stronger the association

Metrics = 4EG, 4EP, Ethyl-decanoate, Phenolic

Biplot (axes F1 and F2: 78.99 %)



# Understanding a Principal Component Analysis (PCA) chart

## Comparison with hypoglycemia

The method chosen to verify our results is a Principal Component Analysis or PCA. It consists in transforming our correlated variables in non-correlated variables called principal components or principal axes. In statistics, we consider that we have to keep a sufficient number of axes to explain at least 50% of the total inertia of the study. Once it's done, you can see which variables are correlated with the axes. Coefficients are from one of the axes, better it is explained by this same axis.

# Experimental Conditions in 50 liters: Sensory Data

## SafLager™ W-34/70

- Quite intense foam
- More intense for malty and buttery aromas
- Medium aromatic intensity
- Low intensity in banana

## SafLager™ S-189

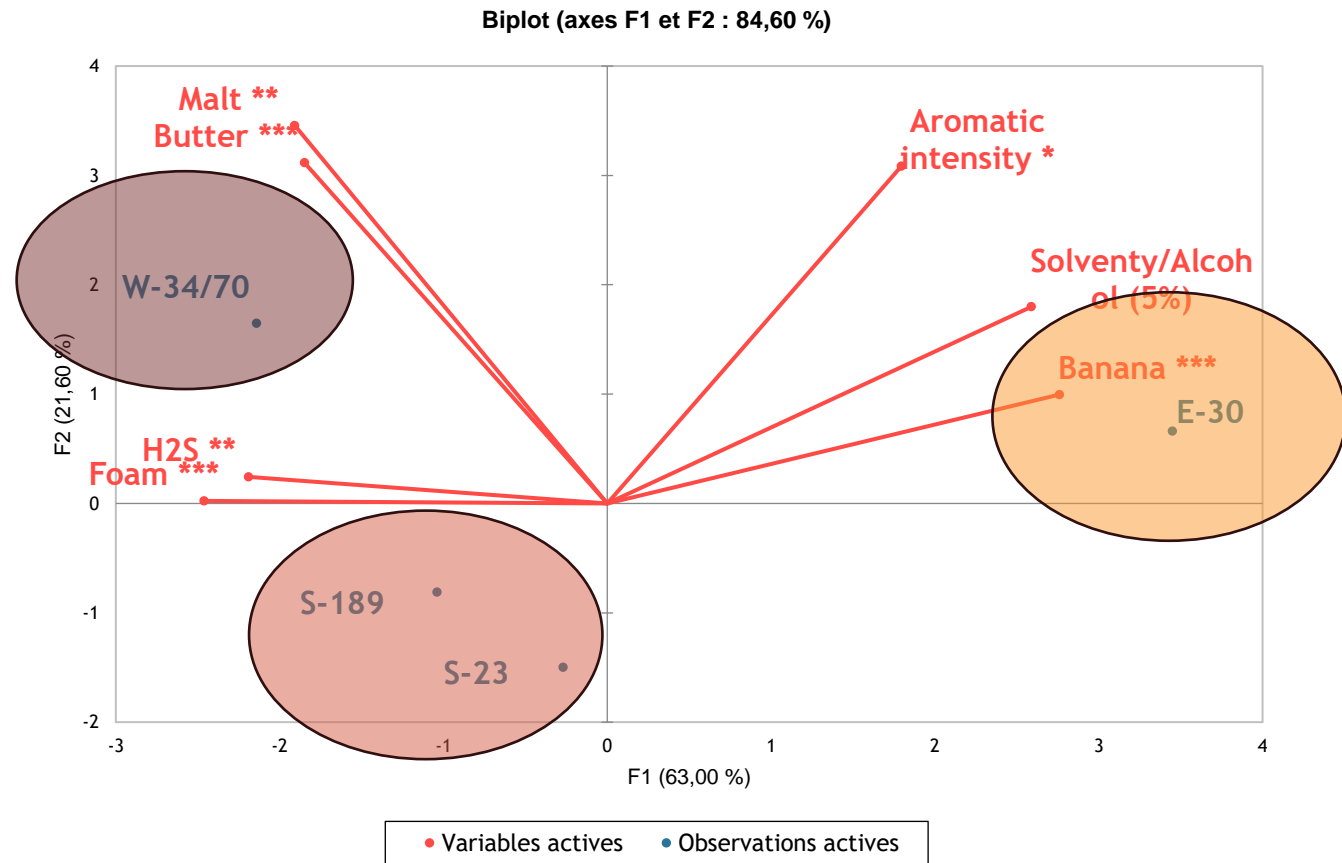
- More intense foam
- More intense for H<sub>2</sub>S with few other aromas
- Medium aromatic intensity (floral notes)
- Medium intensity in banana

## SafLager™ S-23

- More intense for H<sub>2</sub>S perception
- Few other aromas
- Medium aromatic intensity
- Medium intensity in banana

## SafLager™ E-30

- Less intense for H<sub>2</sub>S perception
- Less intense foam
- More aromatic intensity
- More intensity in banana



**SafLager™ yeast strains are distributed across three different flavor groups.**

C

# Key Learnings





# Key Learnings

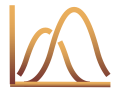
SafLager™ E-30 is:



High attenuating yeast:  
*S. pastorianus*



Ferments well at 14°C with  
good diacetyl reduction



Assimilate more maltose &  
Maltotriose



Pitching rate:  $\approx 100\text{g/hl}$   
ADF close to 83% on  
standard wort



Produces higher  
**fruitiness character**



Production of Isoamyl  
Acetate (i.e. Banana flavor)



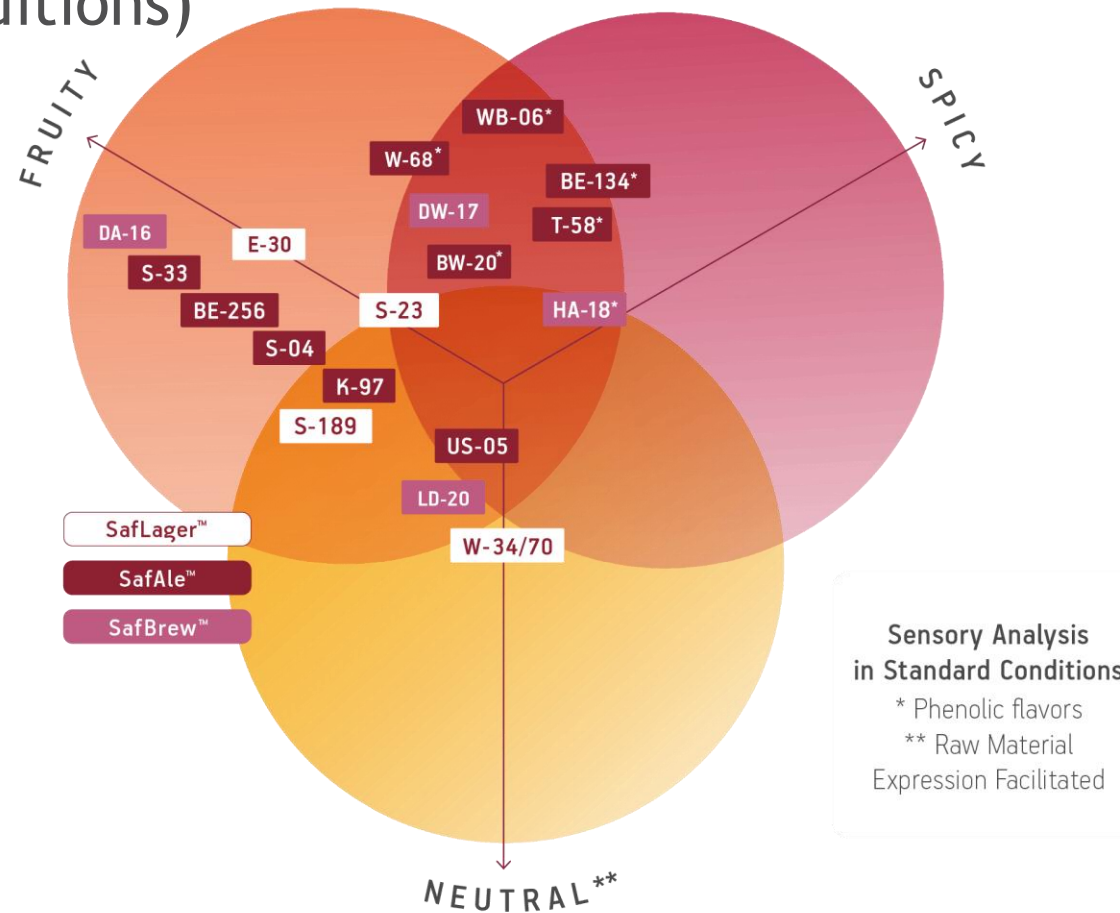
**CAN BE** reusable  
(cropping/repitching)



**NOT** for  
refermentation  
(bottle or keg conditioning)

# Sensory placement\* of Fermentis Lager beer strains

(Baseline, lager conditions)



\*Schematical spatial view

D

# Yeasts in action



# Experimental Pilot Trial - Recipe & Process



## Hoppy Lager

## Dark Lager



### Wort

10°P (50% Pils ; 50% Munich 15)

10°P (96% Pils ; 4% Mroost900)



### Hopping

35 target BU with Hallertau Perle  
Late Hopping - Whirlpool with Saaz

25 target BU with Hallertau Perle



### Fermentation & Maturation

50L

Fermentation Temperature 12°C at Atm. P.  
Maturation Temperature 0°C for 14 days

Fermentation Temperature 12°C at Atm. P.  
Maturation Temperature 0°C for 14 days



### Filtration

Sheet filter

Sheet filter



### Pitching Rates

100g of pure yeast/HI vs  
200g of yeast-enzyme mix/HI

100g of pure yeast/HI vs  
200g of yeast-enzyme mix/HI

50L fermentors



# Sensory Analysis by Quantitative Descriptive analysis



Intensity Scales

- Trained Panel, av. 15 tasters
- Random & 3-digit Blind Tasting
- Black Glasses, controlled temperature
- Digital data collection
- Statistical & performance analysis

1

- ✓ TRAININGS UPON REFERENCES
- ✓ TRAININGS UPON PRODUCT UNIVERSE
- ✓ VOCABULARY GENERATION
- ✓ CONSENSUAL DESCRIPTORS

2

EVALUATION & REPETITION

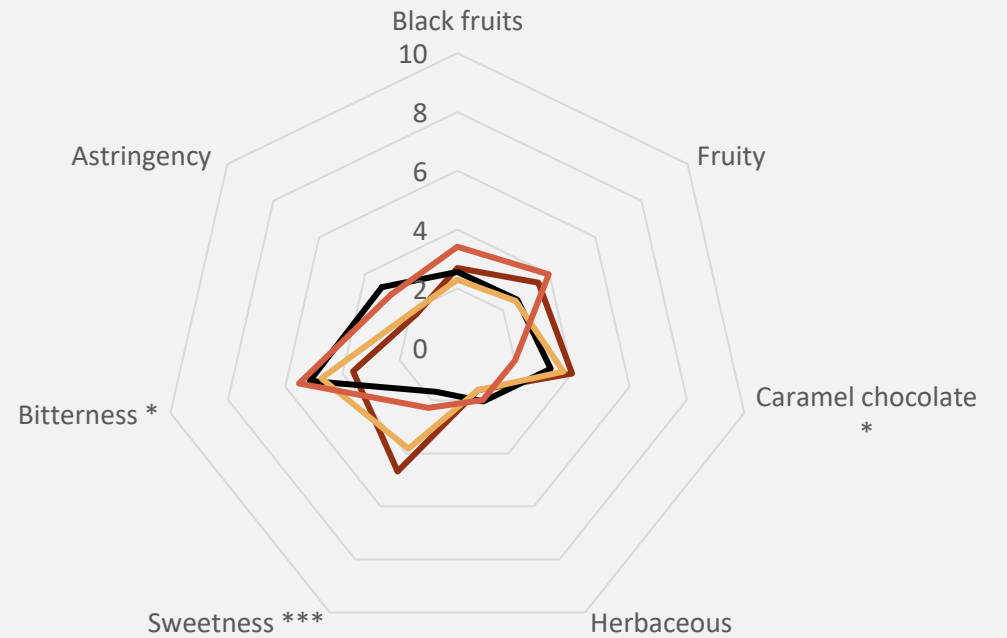
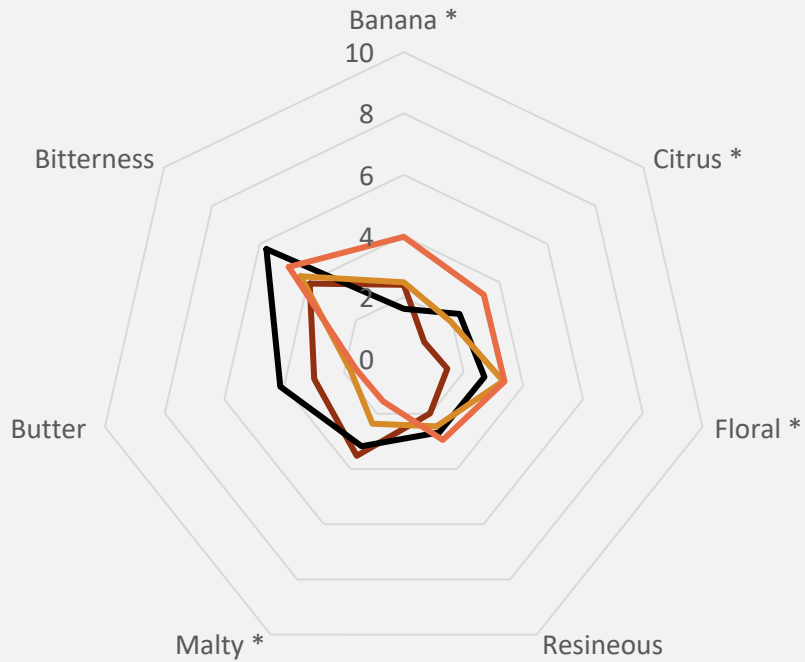


# Sensory Analysis

- SafLager™ S-23
- SafLager™ W-34/70
- SafLager™ S-189
- SafBrew™ LD-20

## Hoppy Lager

## Dark Lager



# Sensory Profile - Conclusions

## Hoppy Lager

SafBrew LD-20 brought forth a greater presence of aromatics and fruity notes, including citrus and banana, while SafLager S-189 exhibited a cleaner profile with a predominant floral character.

In this trial, diacetyl led to a buttery flavor when fermenting with SafLager W-34/70, along side with SafLager S-23, both strains contributed to a more pronounced malty flavor in the final product.

## Dark Lager

Malty flavors, including caramel and chocolate, were prominent when using SafLager W-34/70, S-23, and S-189. However, when fermenting with LD20, the dark lager's flavor profile shifted towards a fruitier and black fruits character.

Sweetness perception was more pronounced when using SafLager S-23 and SafLager S-189, with SafLager S-23, in particular. Exhibiting notably low bitterness levels.

# General Recommendations for Specialty & Traditional Lagers



- **Hop flavors** are distinct in different beers recipes, while **SafLager™ S-189** and **SafLager™ E-30** will pronounce better this characters.
- **SafLager™ S-23** and **SafLager™ W-34/70** emphasize both **black and general malt attributes**.
  - Supplementary **fruity notes** are showed when using **SafLager™ E-30** and evident when using **SafBrew™ LD-20** - in addition to higher level of **dryness** and a reduced carb profile.



# Time for your questions!

- ❑ No wrong questions
- ❑ Good mood only here
- ❑ It's also the moment to share your experiences and feedbacks with Fermentis products



# Keep in touch with us!





Thank you for  
your attention!



[www.fermentis.com](http://www.fermentis.com)

