AMERICAN CIDER ASSOCIATION

Brewer's Yeast in Cider for Unique Flavor & Branding

PRESENTED BY:

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AGENDA

1. How New Strains Are Brought to Market
2. Traditional Methods
3. Hybridization
4. Genetic Engineering
5. Brewer’s Yeast Trial Summary
6. Tasting (at various points throughout)

HOW NEW YEAST STRAINS ARE DEVELOPED

LALLEMAND

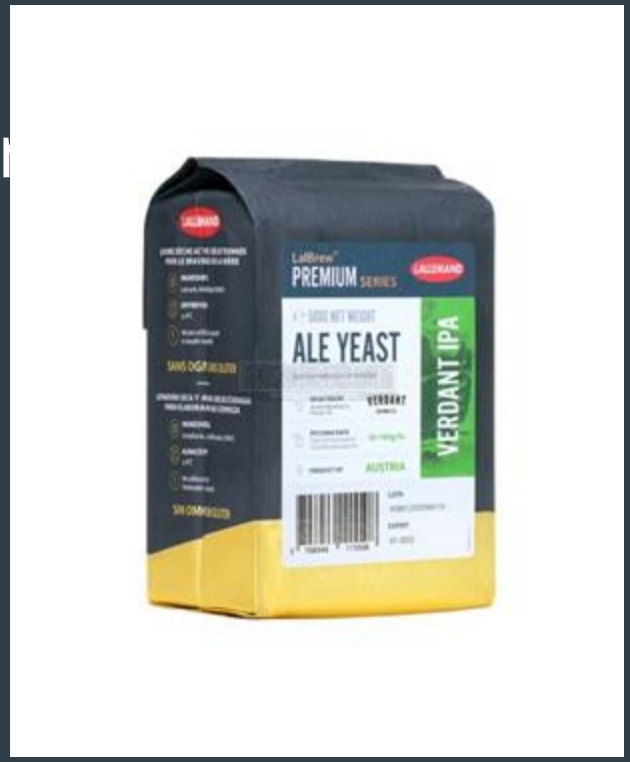
TRADITIONAL METHODS

Existing yeast strain banks

- Lallemand Yeast Culture Collection
  - 5500 yeast strains
  - <600 in production
- Many of these are ‘commoditized’:
  - Chico
  - Augustiner lager

PARTNER BREWERIES

Discovering a unique strain that has mutated in a brewer over time



TASTING #1

Green Bench Brewing Co. St. Petersburg, FL

Yeast – WL 644 Saccharomyces brux-like Trois

This Belgian strain, traditionally used for wild yeast fermentations, produces a slightly tart beer with delicate mango and pineapple characteristics. This wild yeast has grown in popularity for styles like American IPA, American pale and blonde ales due to its tropical and stone fruit flavors and aromas.

BIOPROSPECTING

Site Sampling

Yeast isolation & screening

Streaking for purity

Testing

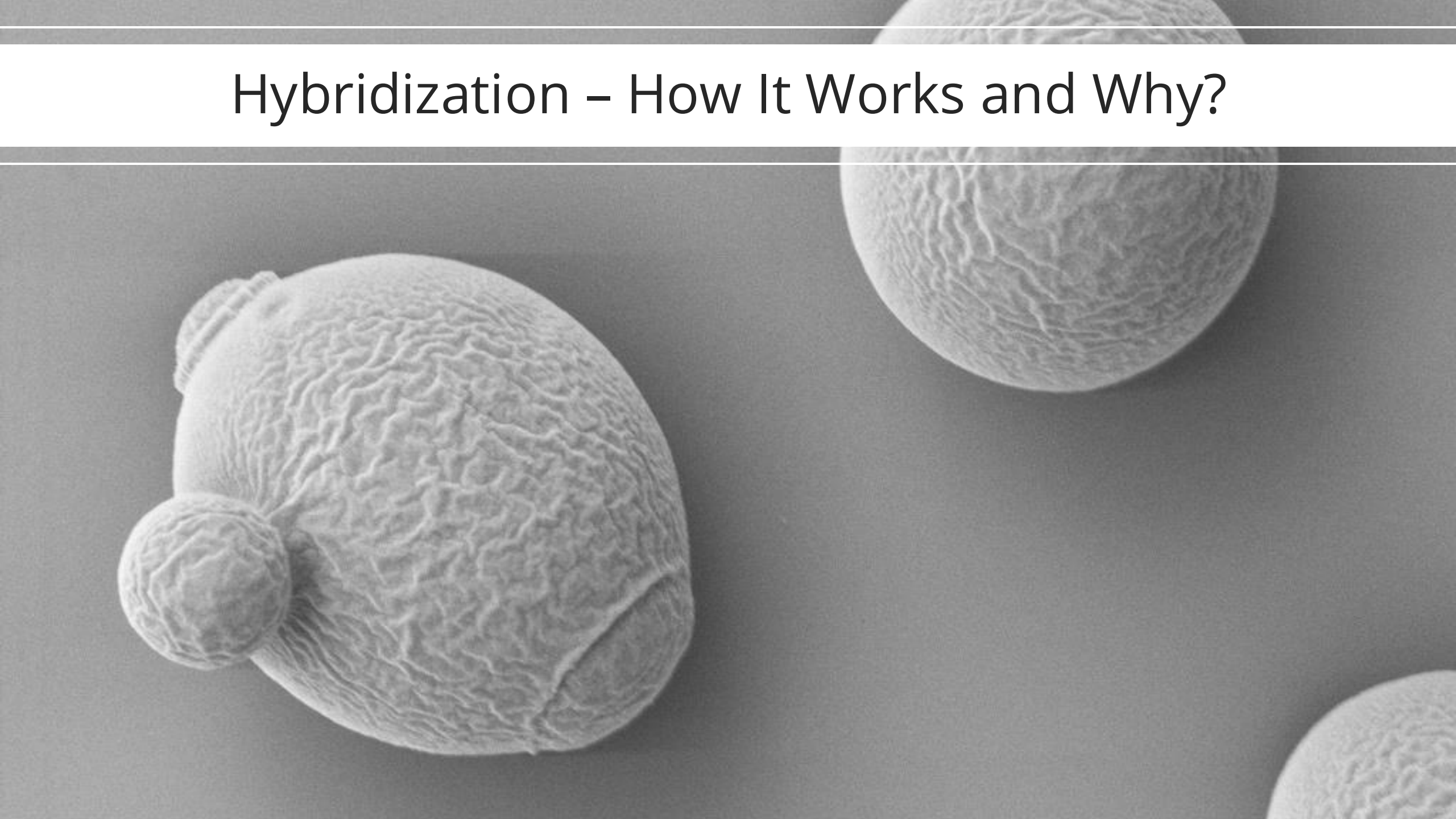
Commercialization

Use in fermentation

KVEIK STRAINS

- Traditional Northern European farmhouse brewing strains
- Ferment at very high temps without producing a lot of phenolic character
- Very clean and very fast fermentations
- ‘Rediscovered’ and reintroduced in the past 15 years

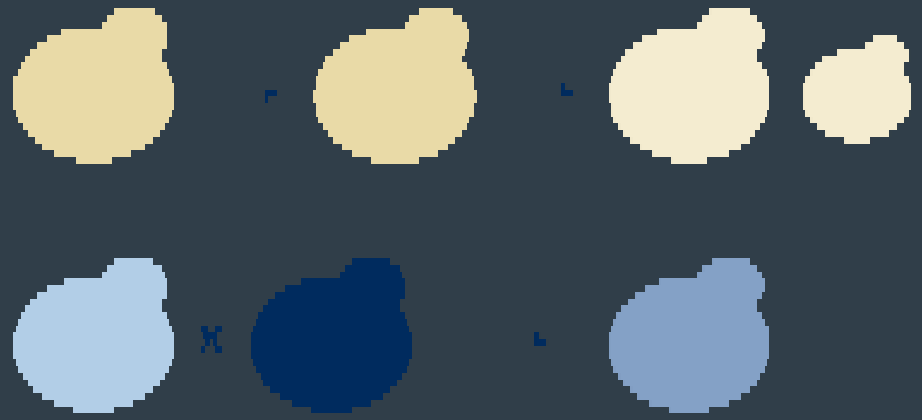
Hybridization – How It Works and Why?



HYBRIDIZATION

Budding (asexual)

Mating (sexual)



Harnessing sexual reproduction to exploit genetic diversity

Asexual reproduction yields “clones” – genetically identical offspring

Sexual reproduction mixes genetic material between parents and creates genetic diversity

TASTING #2 – STRAY CIDER TITLE TRACK

Yeast – LalBrew Farmhouse

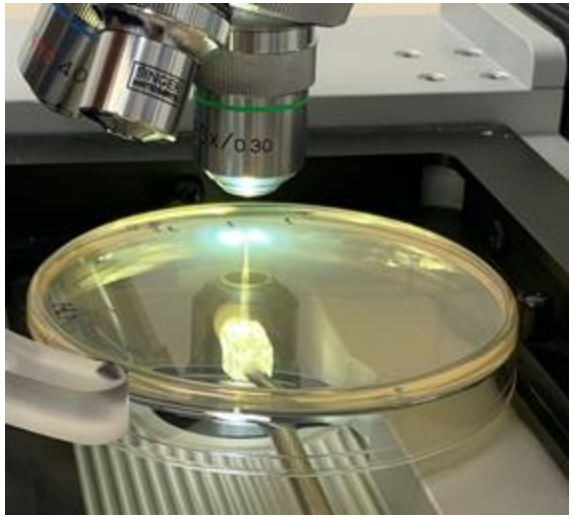
LalBrew Farmhouse™ is a non-diastatic hybrid that has been selected to make saison-style and farmhouse style beers. Additionally, the patented technology from the UC Davis ensures that the strain will not produce hydrogen sulfide (H_2S) off-flavors

How it Works

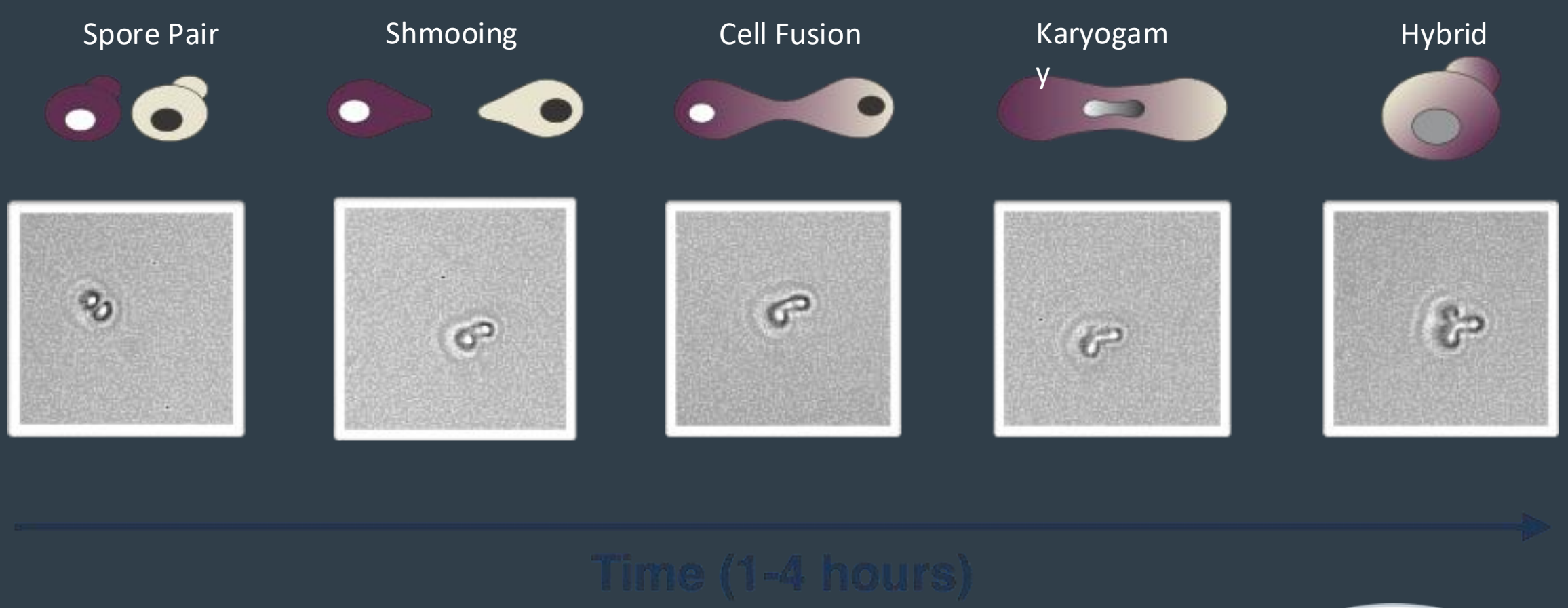
A specially designed microscope with motorized joystick (micromanipulator) allows scientists to pickup and move a single yeast cell!

Hair-like needles move yeast beside one another on agar plates

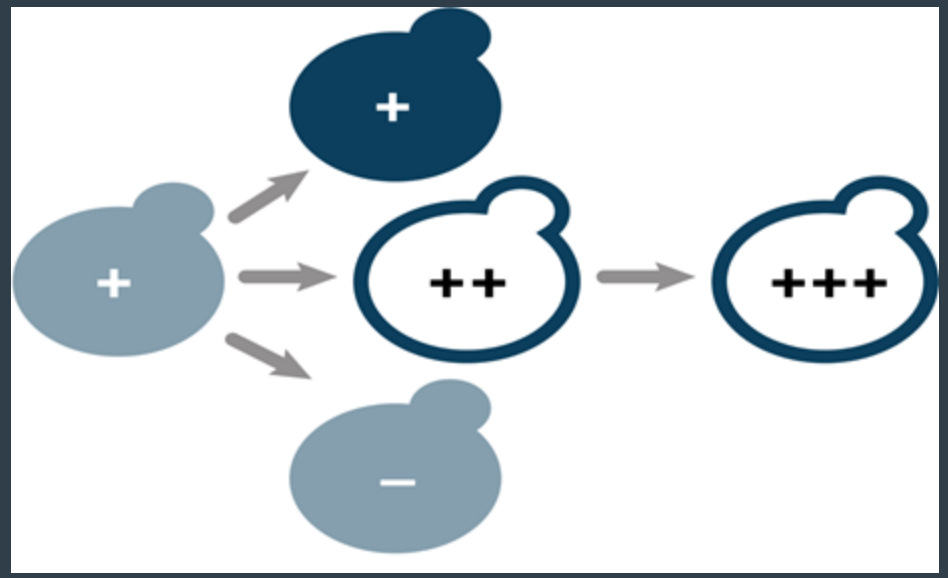
If the cells are of opposite mating type sexual reproduction may proceed



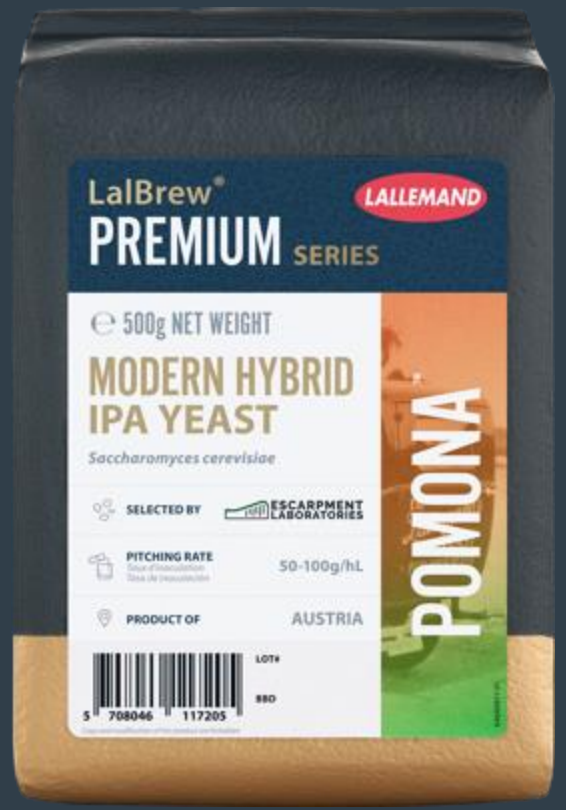
HYBRIDIZATION



ADAPTIVE LAB EVOLUTION

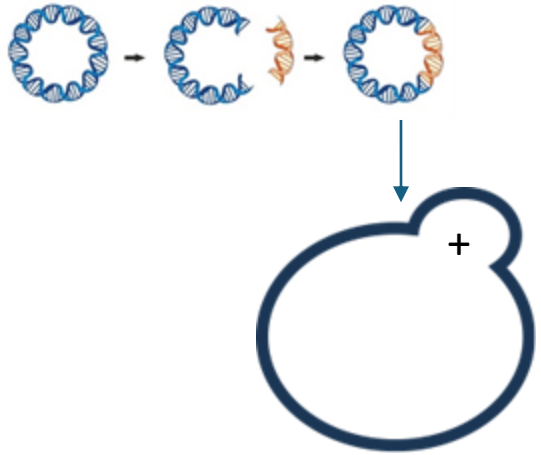


Adaptation of yeast strains to environmental conditions



GENETIC ENGINEERING

Genetic Engineering – Allows selected individual genes to be transferred from one organism into another



COMMERCIAL GMO STRAINS

OMEGA YEAST

BERKELEY YEAST

TASTING #3 – BAUMAN'S YARLINGTON MILL CONTROL

Control Yeast – AC4

Intensely fresh aromatic profile (apple, floral) with a crisp mouthfeel enhancing cider structure.

ORE. 1895
BAUMAN'S
CENTURY FARM
CIDER

TASTING #3 – BAUMAN'S YARLINGTON MILL TRIAL

ORE. 1895
BAUMAN'S
CENTURY FARM
CIDER

Yeast – Sourvisiae

Sourvisiae® is a bioengineered (GMO) strain of *Saccharomyces cerevisiae* capable of producing lactic acid in addition to alcohol during fermentation. Sourvisiae® contains a single genetic modification, a lactate dehydrogenase gene from a food microorganism, which enables the yeast to produce high levels of lactic acid when used as a pure culture, or lower levels when blended with another brewing yeast strain.

TRIAL SUMMARY

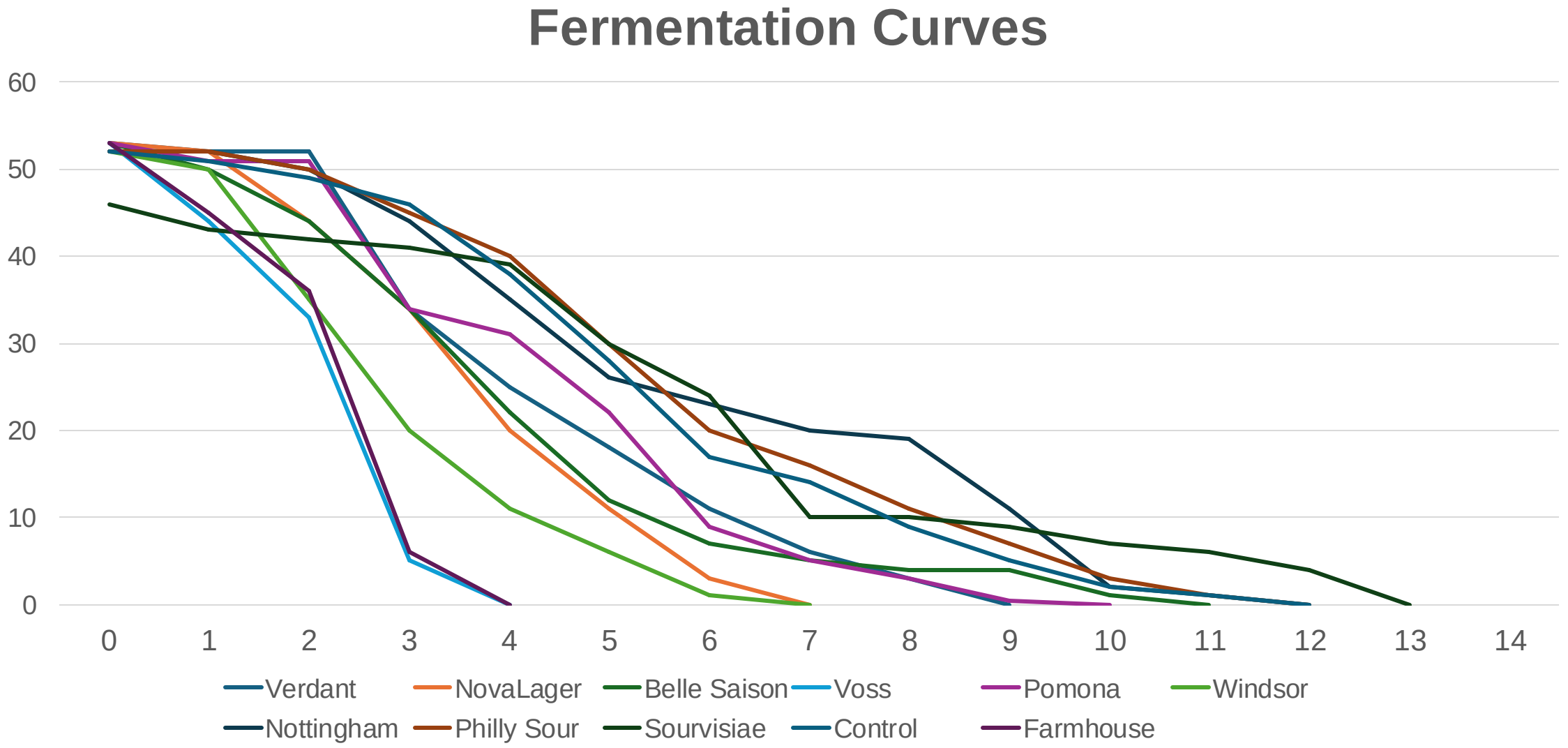
Yeasts trialed

- Farmhouse
- Verdant
- NovaLager
- Belle Saison
- Voss
- Pomona
- Nottingham
- Philly Sour
- Sourvisiae
- Control
- Windsor

Fermentation parameters:

- Juice: FruitSmart Culinary Blend
- TA: 4.5g/l
- Pitch Rate: 50g/hl
- Nutrition: 16g/hl at pitch
  - 20g/hl at 1/3 sugar depletion
- Temp: pitched at 68F

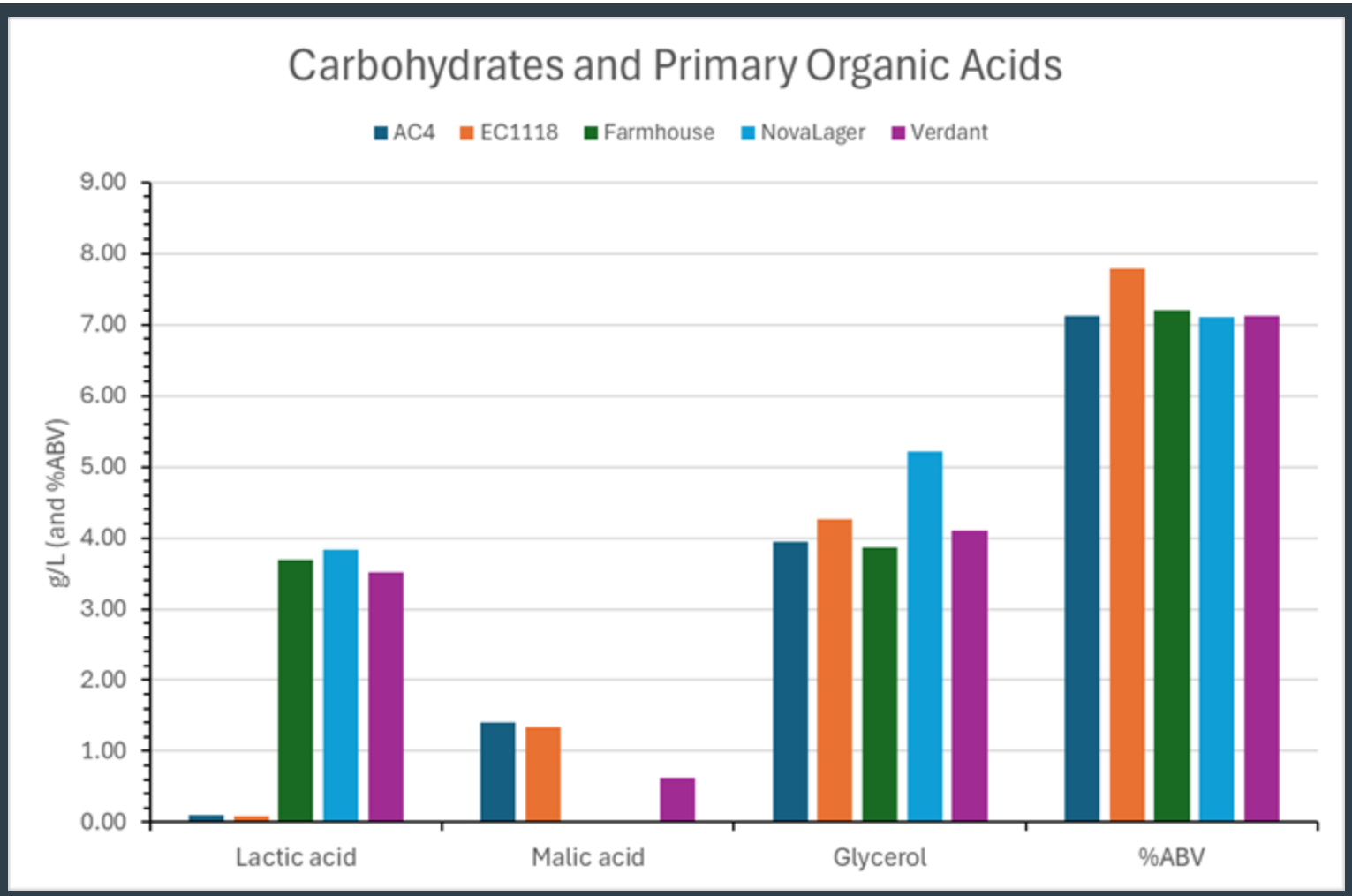
TRIALS


Fermentation Curves
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Verdant
NovaLager
Belle Saison
Voss
Pomona
Windsor
Nottingham
Philly Sour
Sourvisiae
Control
Farmhouse

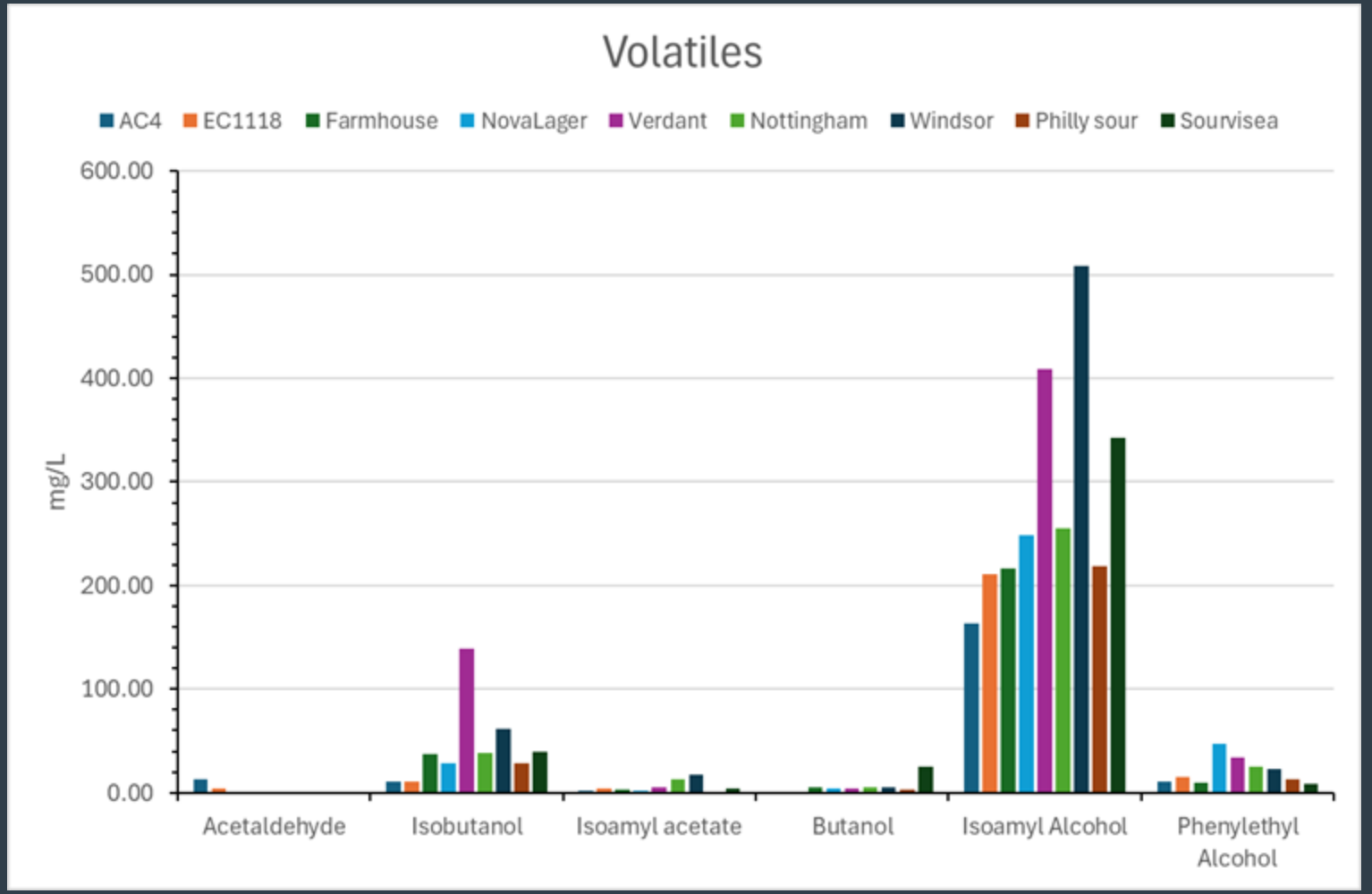
COMPOUNDS ANALYZED

Compound	Sensory Threshold (general)	Descriptor
Acetaldehyde	100–125 mg/L	Green apple, tart,
Isobutanol	5–8 mg/L	Musty, fruity
Isoamyl acetate	0.6–1.2 mg/L	banana, pear, tutti-fruitti
Butanol	0.8 mg/L	sweet, fruity, rancid (in high concentrations)
Isoamyl Alcohol	5 mg/L	banana oil/peel, "hot", alcoholic
Phenylethyl Alcohol	highly variable	rose, honey, woody, whiskey
Lactic acid	400 mg/L	tart, smooth
Malic acid	2.6 mg/L	tart, sharp, puckering
Acetic acid	0.16-0.74 g/L	vinegar
Pyruvic acid	Not well studied in wines	
Butyric acid	1.5-15 mg/L	Pineapple, guava, vomit, feces
Succinic acid	~0.08% v/v	sour, medicinal, umami, salty, metallic - dosage dependent
Citric acid	~60 mg/L	Pleasant tart, fruity sharpness, citrusy

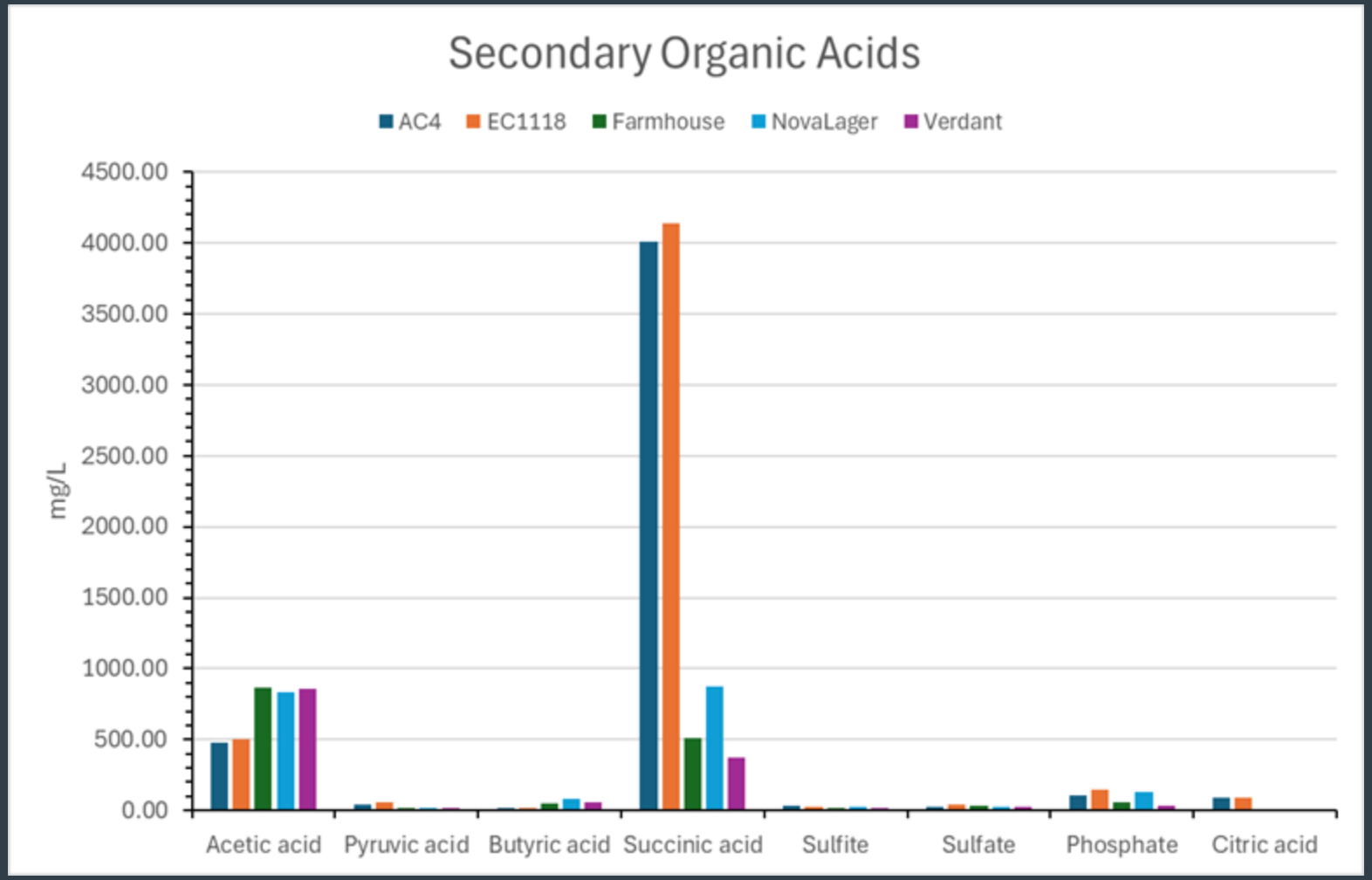
CARBOHYDRATES AND PRIMARY ORGANIC ACIDS



VOLATILES


Volatiles
AC4
EC1118
Farmhouse
NovaLager
Verdant
Nottingham
Windsor
Philly sour
Sourvisea
600.00
500.00
400.00
300.00
200.00
100.00
0.00
mg/L
Acetaldehyde
Isobutanol
Isoamyl acetate
Butanol
Isoamyl Alcohol
Phenylethyl Alcohol

SECONDARY ORGANIC ACIDS



CONSIDERATIONS WHEN CHOOSING A YEAST STRAIN

- SO_2 tolerance
- Nutrient requirements
- Fermentation temperature range
- O_2 requirements

- Maltose negative strains
  - Non-H_2S
- Non-saccharomyces strains
- Sake strains
- Non-traditional wine strains
- Further exploration of these trials – Pomona, etc.
- Co-pitching different strains
  - Talk to your supplier
  - Trial and error

WHERE TO GO FROM HERE

Farmhouse Yeast

- Fast fermenter
- Cannot produce H2S
- Great body and acid

Voss Kveik Yeast

- Super fast fermenter
- Does not need temp control
- Neutral flavor profile

Sourvisiae

- High acid profile
- Will not produce flavor compounds with LAB
- Powerful blending tool

SHOUT OUTS

Thank you to:

Jen Curs and Christine Walter – Bauman's Cider

Deron Davenport – Stray Cider

Brian Wing – Green Bench Brewing & Cider

Avi Shayevitz – Lallemand Brewing

Mascoma LLC

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