Anne Flesch – Fermentis Technical Sales Support - The Americas
Aaron Homoya – Co. Founder - Ash and Elm Cider Co.

Cider Yeast-Derived Characteristics

and Hands-On Blending

CIDERCON 2022

WHO ARE WE?

Anne Flesch

- Technical Sales Support Manager – the Americas.

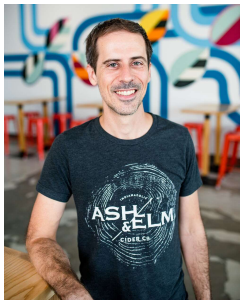
Fermentis by Lesaffre

- Lesaffre BU dedicated to all Beverage fermentation:
  - Wine, Beer, Spirits, Cider & other!

Aaron Homoya

A&E CIDER CO.

- Ash & Elm Cider Co. is an urban cidery located in Indianapolis, IN, opened in 2016.
- Quality ciders, both modern and traditional, using apples from around the Midwest and to help cultivate the market for craft cider throughout Indiana.



- Co-founder of Ash & Elm Cider Co., where he does a little bit of everything, sometimes even cidermaking… But mostly trying to keep up with his two young boys.
- He is especially interested in forging long-term partnerships with Indiana's apple producers and hopes to one day have an orchard of his own.

TODAY'S AGENDA

1

Understand the impact of Yeast on Cider

With a focus on:

- Yeast & fermentative aromas
- Yeast & mouthfeel
- Yeast & acidity

2

A quick overview of the diversity of yeast strains available to cidermakers

3

Introduction to trials and tasting

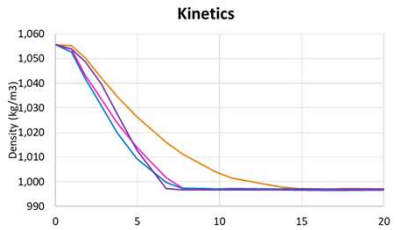
- Raw material and process
- Interactive tasting!
- Conclusion

1- Understand the impact of Yeast on Cider

The Science behind it & examples of trials from the 4 strains of the Fermentis SafCider™ portfolio

Why is Yeast Choice important for your Cider?

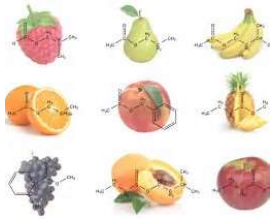
YEAST TECHNICAL CHARACTERISTICS



Kinetics
Nutrient needs
Ethanol tolerance
pH resistant
Temperature tolerance
Ability to ferment the sugars in your juice
Analytical: SO_2 resistance/production, etc…

MATCH YOUR CIDER STYLE & TARGET

YEAST FLAVORS & AROMAS CHARACTERISTICS



Fruity profile
Acidity profile
No/low off-flavors
Roundness/mouthfeel
Releasing apple varietal precursors

How to generate diversity with Yeast?

Focus today

1. Select new yeast strain / new yeast hybrids with new targeted traits
2. Co-fermentations or sequential fermentations
3. Manage fermentation parameters and process
4. Change the combination raw material/yeast (+/-bio conversion)
5. Blend the lots post fermentation

Main fermentation-related choices that can affect Ciders' sensory analysis

Raw material parameters

<u>Type of Apples + other substrates</u>

Tannin /Acid ratio

Varietal aromatic precursors

Type of sugars (+added substrate)

Quantity of sugars and potential ABV

Yeast Available Nitrogen

pH

Fermentation management parameters

Addition Sulfites before fermentation

pH adjustment

Yeast choice

Yeast Pitching rate

Fermentation temperature

Nutrition regime

End of fermentation/arrested

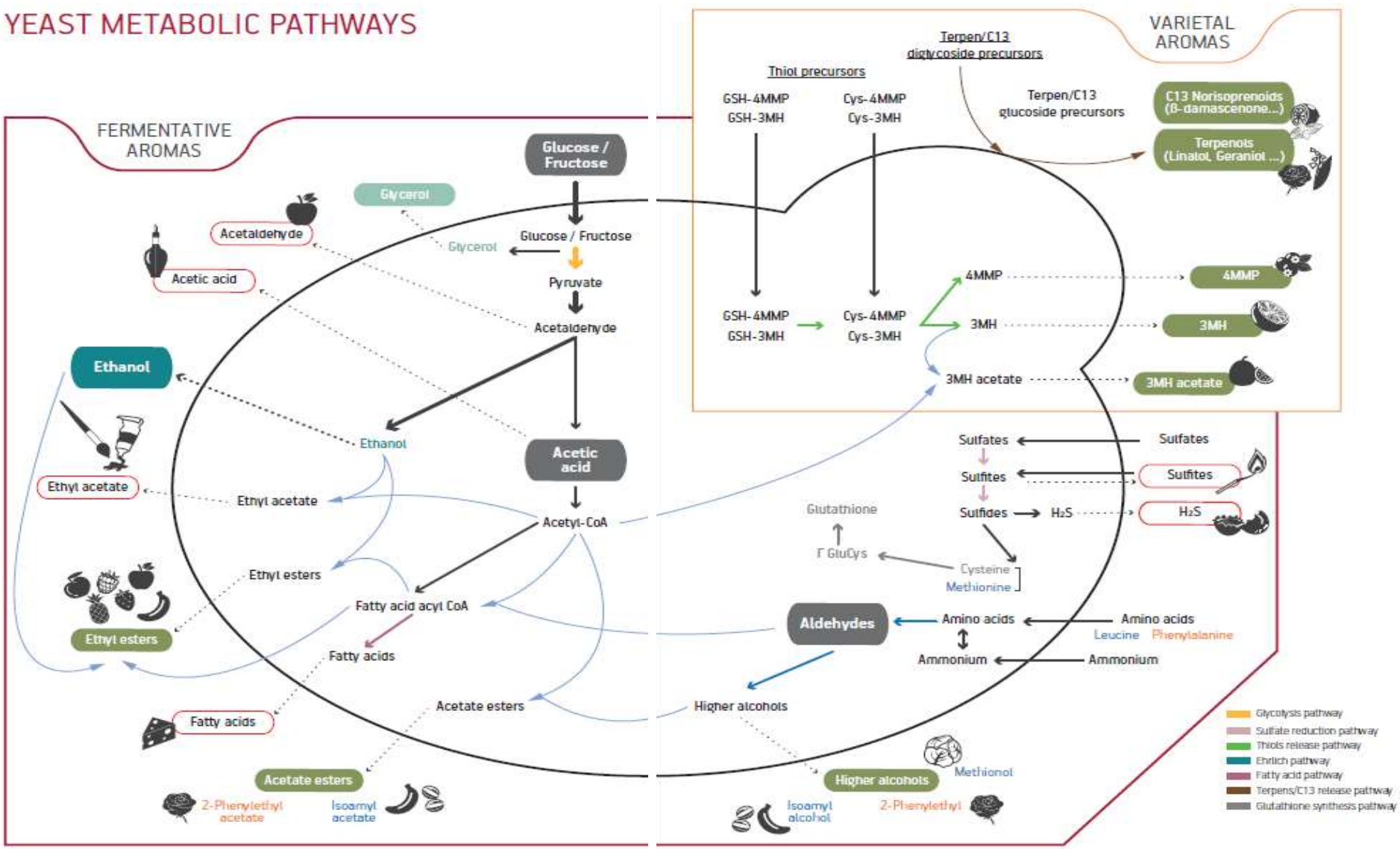
Malolactic fermentation

Focus today

Affecting

Kinetics	Analytic profile	Aromatic analysis	Sensory analysis
Lag phase, speed, end fermentation	ABV, Sugar, Acidity,SO2, Acetaldehyde	Ethyl esters, Acetate esters, etc…	Flavors & aromas, nature/ intensity / complexity, mouthfeel,

YEAST IMPACT ON FLAVORS AND AROMAS



YEAST & FERMENTATIVE AROMAS

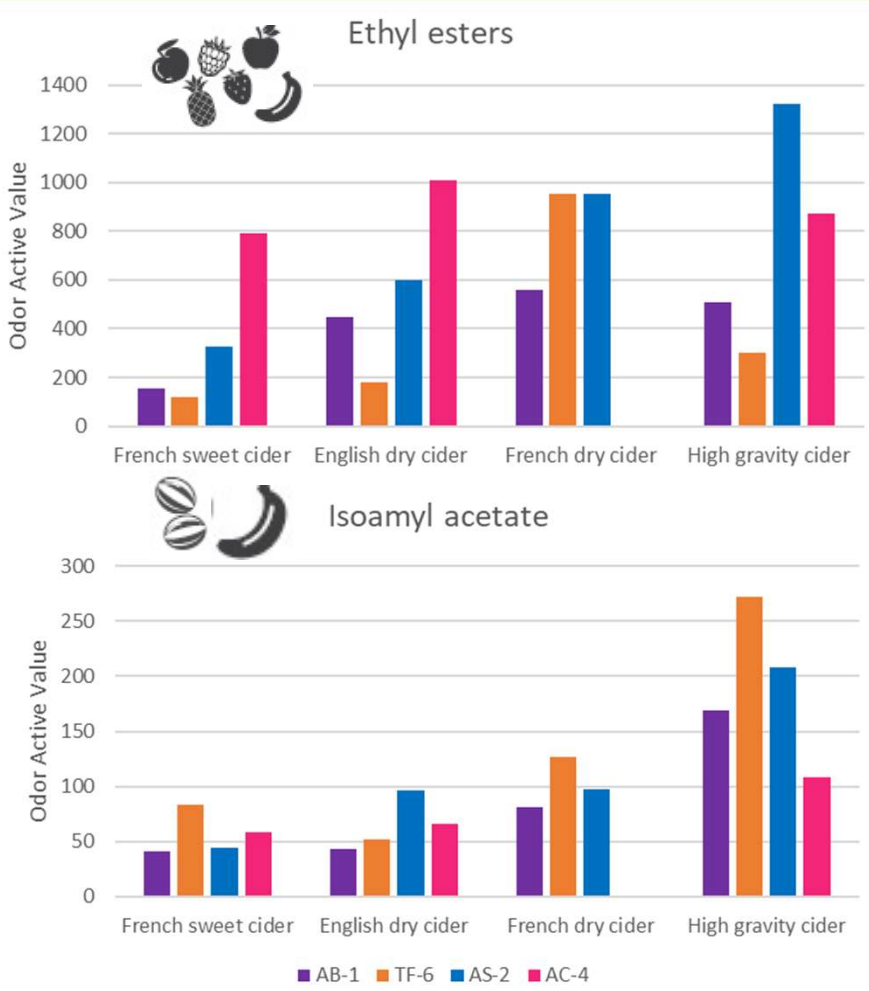
CONCEPT: Aromas produced by the yeast in different amount and proportion, often dependent on density and nitrogen content/nature in juice

	HIGHER ALCOHOLS	ACETATE ESTERS	ETHYL ESTERS
AROMAS	MAIN ONES Isoamyl alcohol 2-Phenylethyl alcohol	esterification MAIN ONES Isoamyl acetate (flavor enhancer) 2-Phenylethyl acetate	EXAMPLES Ethyl butanoate, hexanoate, octanoate and decanoate, etc..
CIDER STYLE	- Strongly fruity aromatic -Towards banana, candy and strawberry & sometimes perfumy - Ciders with additional flavors		-Elegant and complex ciders -Usually lower in aromatic intensity but balanced

WITH OPTIMAL TEMPERATURE <15C/59F

Fermentis by Lesaffre

YEAST & FERMENTATIVE AROMAS – ANALYTICAL DATA



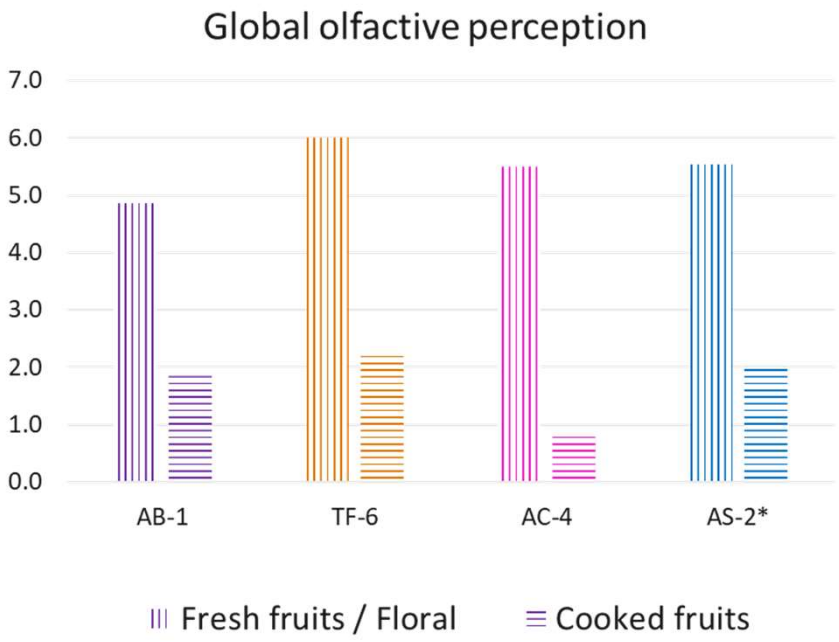
- Important differences between SafCider™ strains
- Also strongly impacted by the recipe (density and temp)
- SafCider™ TF-6 : Except for the English cider (lower stress) it showed a higher production of isoamyl acetate.
- SafCider™ AC-4 showed particularly high and stable ethyl esters production, reliable complexity in the flavors.
- SafCider™ AB-1 and especially SafCider™ AS-2 increased their ester production along with the difficulty of the recipe.
- SafCider™ AB-1 with low aromatic production →Emphasis on the raw material aromas.

YEAST & FERMENTATIVE AROMAS SENSORY ANALYSIS

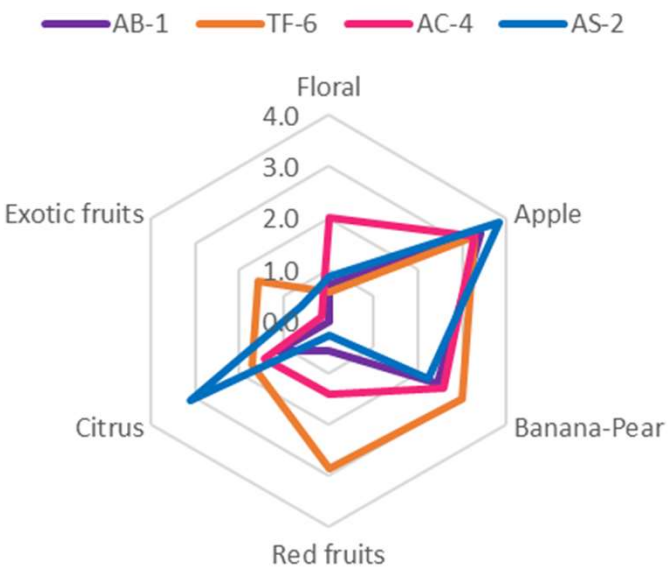
FRENCH SWEET CIDER
- Bittersweet apples
- 119.5g/L sugar stopped at 32g/L
- Ferm temp: 10C/50F
- PR: 10g/hl
- YAN/Sugar ratio: 0.98

○ Trained professional panel from the IFPC

1-Ratio of fresh fruit& floral VS cooked/jammy fruity aromas



2- Description of the type of fruit/floral aromas



○ SafCider™ TF-6 highest intensity, with high fresh and cooked fruit, banana & complex fruit.

○ SafCider™ AS-2 high intensity, with medium high fresh and cooked fruit.

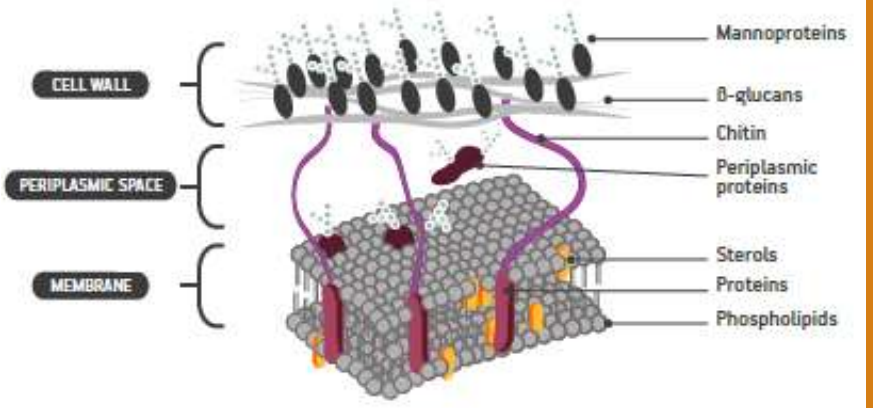
○ SafCider™ AC-4 less intense and more toward fresh fruit, red fruits and floral.

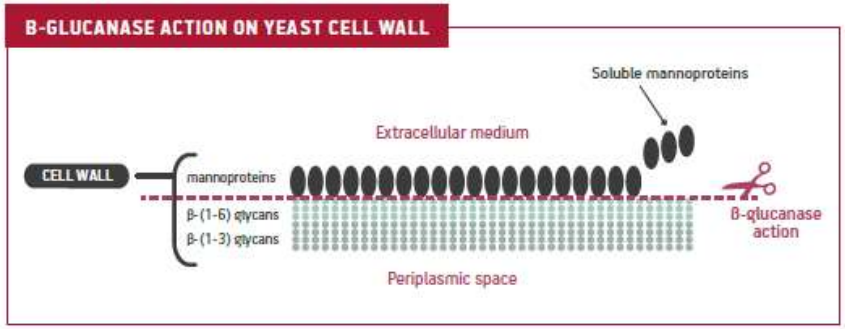
○ SafCider™ AB-1 the least intense and balanced aromas .

YEAST & MOUTHFEEL

CONCEPT: Yeasts release different molecules and in different amounts that can affect the mouthfeel perception of the cider:

- **Proteins** with fining properties → Astringency decrease
- **Small peptides** with sweetness power→ Sweetness increase
- **Glycerol** (must be in high amount to perceive) → Roundness increase
- **Polysaccharides** (such as mannoproteins)→ Astringency decrease / Roundness increase





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YEAST & RESIDUAL SUGAR: TRIALS

- **Yeast have more or less affinity for fructose / ability to ferment fructose (up to 70% sugar in apple juice)**
- **Fructose has a greater sweetening capacity than glucose**

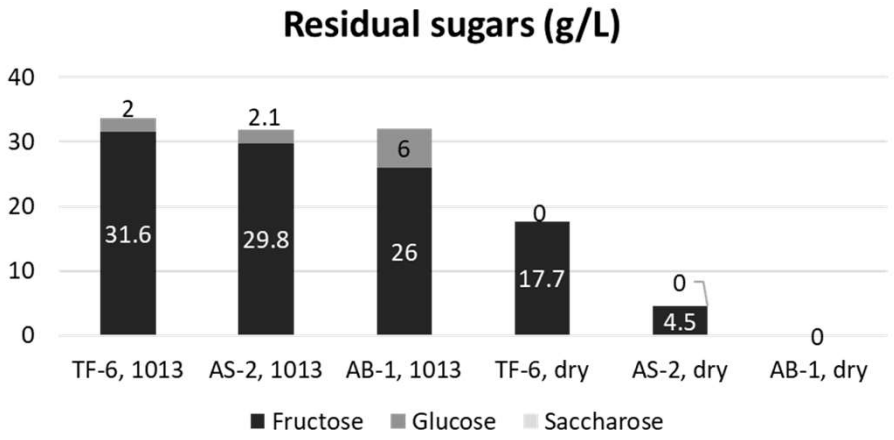
FRENCH DRY CIDER RECIPE

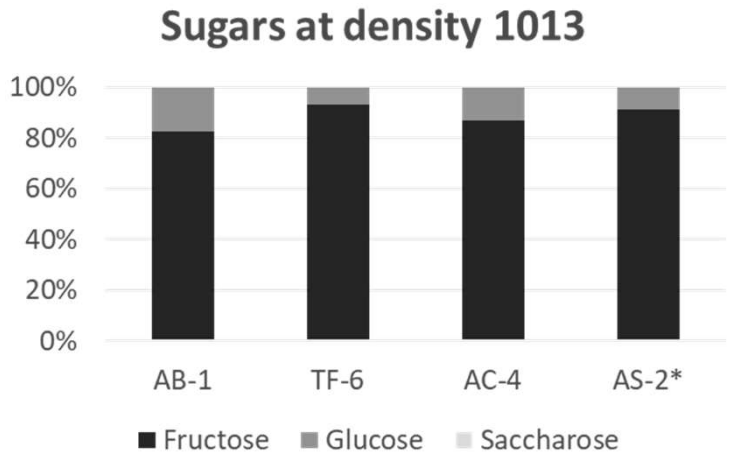
- Bittersweet apples
- 145.3 g/L sugar to dryness
- Ferm temp: 10C/50F
- PR: 10g/hl
- YAN/Sugar ratio: 0.86

- Safcider TF-6 the least fructophilic
- SafCider AS-2: Medium
- SafCider AC-4 fructophilic +
- SafCider AB-1 the most fructophilic

FRENCH SWEET CIDER

- Bittersweet apples
- 119.5g/L sugar stopped at 32g/L
- Ferm temp: 10C/50F
- PR: 10g/hl
- YAN/Sugar ratio: 0.98





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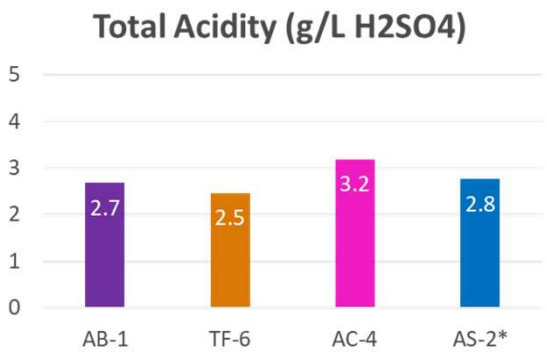
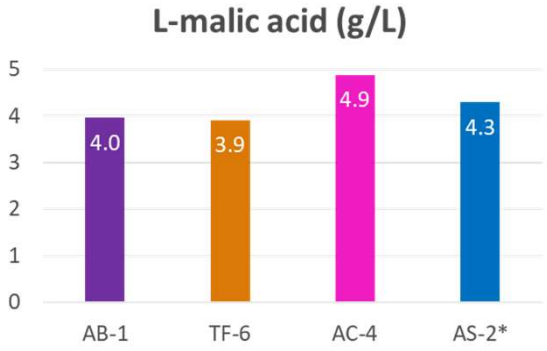
YEAST & ACIDITY

FRENCH DRY CIDER RECIPE

- Bittersweet apples
- 145.3 g/L sugar to dryness
- Ferm temp: 10C/50F
- PR: 10g/hl
- YAN/Sugar ratio: 0.86



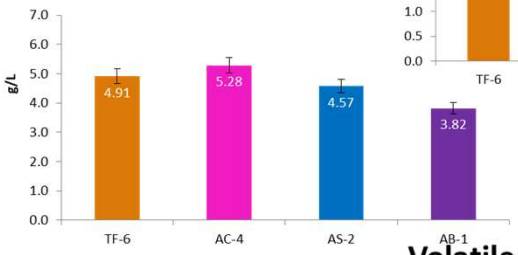


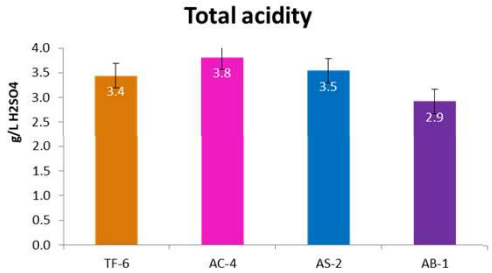
- **Malic acid**: some strains significantly maintain better the acidity with - consumption malic acid.
- **Volatile acidity** is condition and strain dependent.

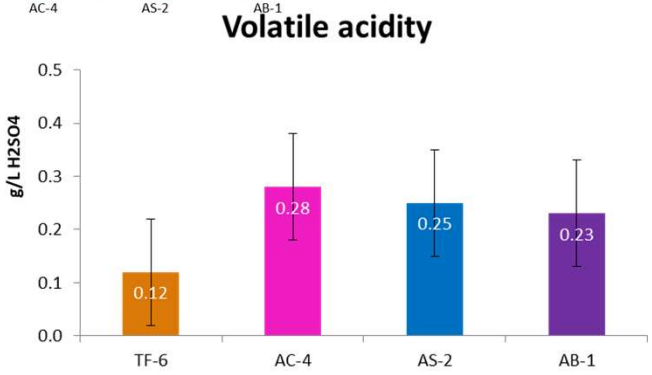
- SafCider AC-4: the most acid, maintains most malic acid
- SafCider AB-1: consumes more malic acid
- SafCider AS-2: average for acidity and very clean
- SafCider TF-6: the cleanest strains (TSO2, Acetaldehyde) even in challenging conditions

ENGLISH DRY CIDER

- 70% Sweet/ 30% Bittersweet apples
- 129.9g/L sugar to dryness
- Ferm temp: 18C/64.5F
- PR: 10g/hl
- YAN/Sugar ratio: 0.98 → 1.06 (with nutrition program)

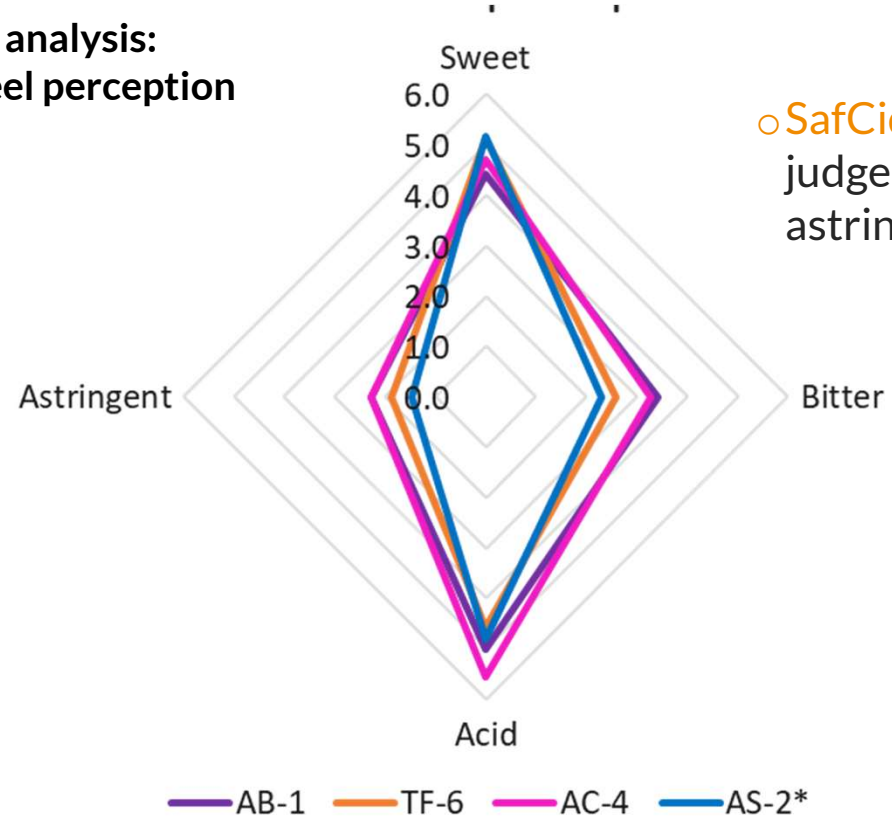






YEAST & MOUTHFEEL PERCEPTION
SENSORY ANALYSIS

Sensory analysis:
Mouthfeel perception



- SafCider™ TF-6 and SafCider™ AS-2 judged as sweeter mouthfeel, less bitter, astringent and acid

- SafCider™ AC-4 and SafCider™ AB-1 judged as more structured (bitterness, astringency) or acid for AC-4

FRENCH SWEET CIDER
- Bittersweet apples
- 119.5g/L sugar stopped at 32g/L
- Ferm temp: 10C/50F
- PR: 10g/hl
- YAN/Sugar ratio: 0.98

2- The diversity of yeast strains available to cidermakers

YEAST DIVERSITY

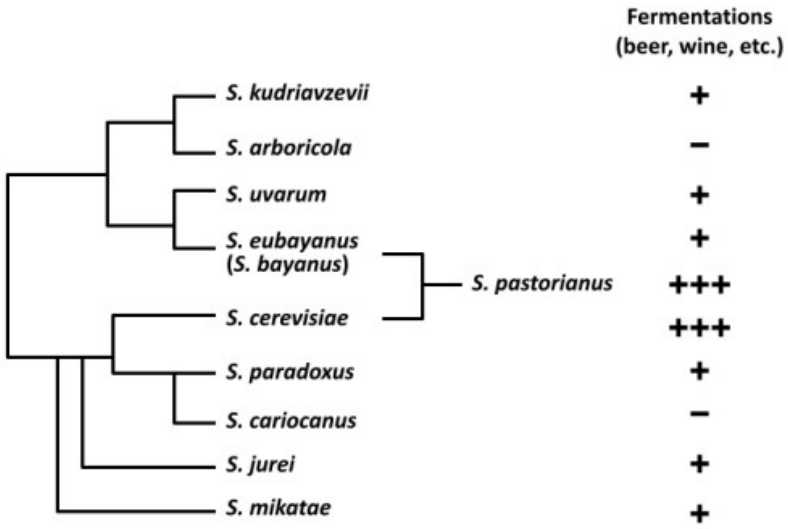
Fermentation power of Some Yeast Species

.

TABLE 61.3 Fermentation Power (w/v) of Some Yeast Species[1]

<2%	2–5%	5–8%	>8%
Candida emobii	*Hanseniaspora uvarum*	*Candida stellata*	*Saccharomyces bayanus/*
C. guilliermondii	*Pichia fermentans,*	*Lachancea thermotolerans*	*uvarum S. cerevisiae*
C. melinii	*Lachancea kluyveri*	*Saccharomyces kudriavzevii*	*S. pastorianus*
C. parapsilosis	*Schwannyomyces*	*S. mikatae*	*S. paradoxus*
C. sake	*occidentalis*	*Saccharomycodes ludwigii*	
C. tropicalis	*Torulaspora pretoriensis*	*Schizosaccharomyces pombe*	
C. valida	*Zygotorulaspora mrakii*	*Torulaspora delbrueckii*	
Debaryomyces castellii		*Zygosaccharomyces bailii*	
Lindnera saturnus		*Z. rouxii*	
Metschnikowia pulcherrima		*Zygotorulaspora florentinus*	
M. reukafii			
Pichia membranifaciens			
Schwanniomyces polymorphus			
+>300 ca. fermenting species, including about 50 that exhibit slow or retarded fermentation			

Saccharomyces species in beverage fermentation



Bruner and Fox, UC Davis, Diverse publications in 2020 and 2021

.

Overall characteristics of strains from different portfolio/selection origin

Portfolio of origin	Typical yeast species	Technical characteristics *Characterization on beverage from origin portfolio*	Aromatic characteristics
Ale strains	*Saccharomyces cerevisiae*	**Wide range** of kinetics and attenuations, flocculation and sedimentations, etc… **Lower resistance to difficult conditions (vs wine strains).**	**Very important diversity. Neutral to very diverse types of fruitiness/Phenolics** Some with very good interaction with aromatic precursors.
Lager Strains	*Saccharomyces pastorianus*	**Less diversity in behaviors.** Selected to ferment at low temperature but versatile.	**Low diversity. Neutral to slightly floral** and fruity. Possible slight sulfur notes.
Wine Strains	*Saccharomyces cerevisiae*	**Diverse fermentation kinetics, nutrient requirements** and other traits.	**Important diversity in fermentative aromatic profiles**. More interaction with varietal precursors.
	Saccharomyces bayanus	**Fast fermenters, Fructophilic +,** high resistance to difficult condition, low nutrient requirement, high EtOH tolerance.	**Less Diverse. Neutral to fruity**. Some low interactions with varietal aromatic precursors.
	Hybrids	Usually selected to have **strong resistance** to hard conditions.	**Selected to reach specific target/profiles.**
Cider Strains	**Diverse!**	**Selected to handle conditions from different cider making process.**	**Selected based on fermentative aromas, acidity and mouthfeel to match different cider styles.**

3- Trial & Tasting

Trial: the raw material & fermentation conditions

The Apples: basic blend of dessert apples from Michigan, including Jonagold, Golden Delicious, Empire, etc.

The Juice:

- **12 brix**
- **Around 3.7 pH**

Fermentation conditions:

- **5 gal batches, fermented in carboys**
- **Fermentation ran at 60 F**
- **Nutrition program: organic N additions at start of fermentation and 1/3 completion AF**

- **The Yeast**
- **4 yeast chosen from the market by Ash and Elm Cider Co.**
- **To display different types of aromatics (fermentative and varietal) and mouthfeel characteristics in the cider**
- **To highlight the potential to blend different lots**

CIDER 1: LET'S DO AN INTERACTIVE TASTING

- **1- SCAN QR CODE ON YOUR PHONE**

2- 3 MIN TO ANSWER TASTING QUESTIONS CONCERNING:

- **Description of the type of fruit/floral aromas**
- **Mouthfeel perception**

3- LET'S LOOK AT THE ROOMS SENSORY FEEDBACK TOGETHER

4- THE FEEDBACK FROM THE CIDERMAKER!

CIDER 2: : LET'S DO AN INTERACTIVE TASTING

- 1- SCAN QR CODE ON YOUR PHONE

2- 3 MIN TO ANSWER TASTING QUESTIONS CONCERNING:

- Description of the type of fruit/floral aromas
- Mouthfeel perception

3- LET'S LOOK AT THE ROOMS SENSORY FEEDBACK TOGETHER

4- THE FEEDBACK FROM THE CIDERMAKER!

CIDER 3 : LET'S DO AN INTERACTIVE TASTING

- 1- QR CODE

- 2. TASTE AND ANSWER….

CIDER 4: LET'S DO AN INTERACTIVE TASTING

- **YOU KNOW THE RULES BY NOW ☺**

BLENDING POSSIBILITIES

- **What Ciders would you preferably blend together to build complexity?**

CONCLUSIONS

- Yeast is a great tool to bring diversity to your ciders!
- When choosing a strain make sure it is technically fit to your cider.
- Only in the optimal conditions yeast will show its best potential…
- So much more to explore: fermentation conditions (temperature, nutrition, etc..), raw material & yeast interaction, etc…

Thank you for your attention

Question?
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