

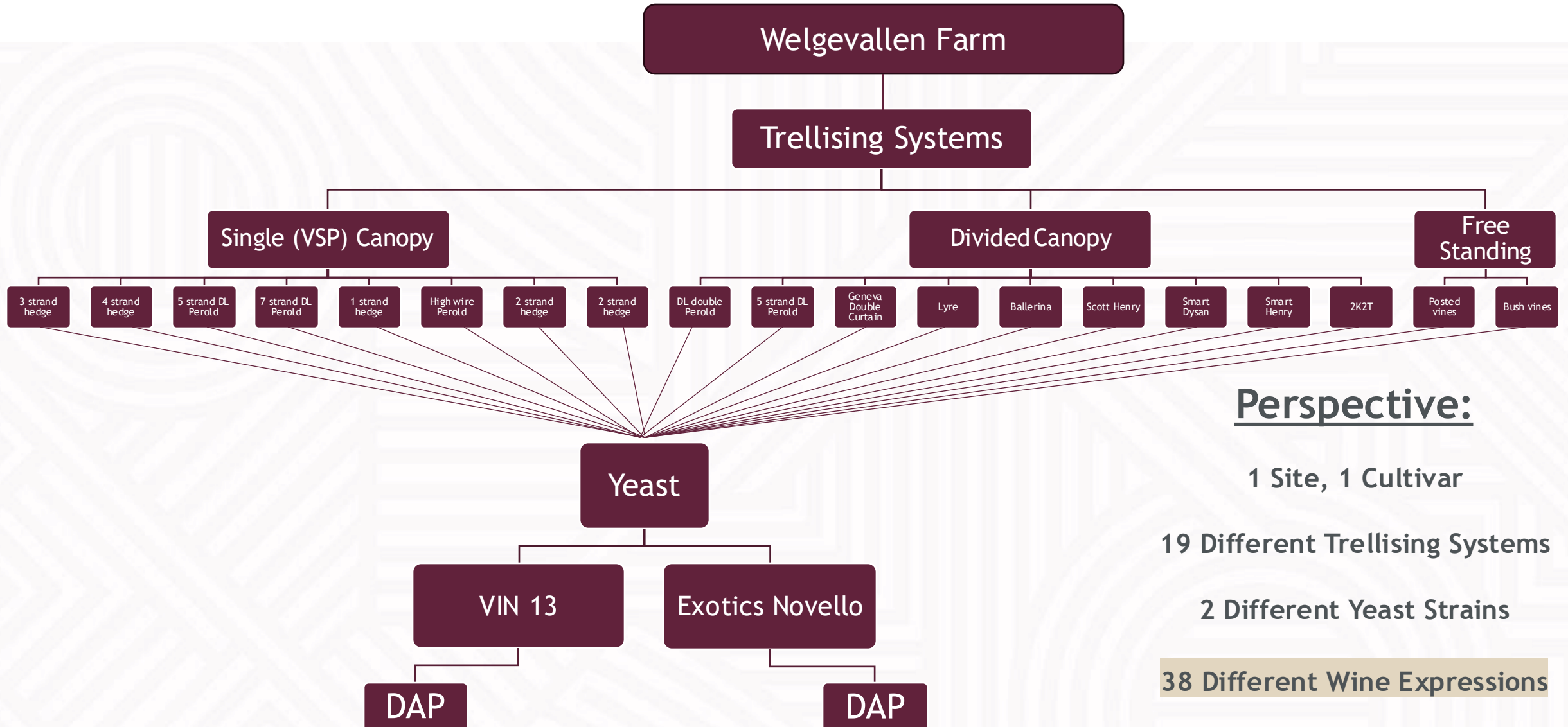
"Evaluating the impacts of different trellis systems and yeast strains on fermentation kinetics and wine quality impact factors of Chenin blanc"

- Vine to Wine: *The Endless Expressions of Chenin blanc Wine*

GJ Smook, M.A. Vivier, M. Du Toit

44th SASEV Conference
24-26 November

Transitioning into the Cellar



Perspective:

1 Site, 1 Cultivar

19 Different Trellising Systems

2 Different Yeast Strains

38 Different Wine Expressions

Grapevine trellising systems

Free-standing vines



Divided canopies



Single (VSP) canopies



What grapevine Trellising is, and its effect?

- Grapevine trellising is a method for manipulating the way the vine grows
- Controlling vine structure affects many parameters, including:
 - Temperature, Sunlight exposure and Aeration (*Strack and Stoll, 2021*)
 - Photosynthesis and phenology (*Somkuwar and Dhole, 2025*)
 - Flower bud differentiation, fruit development, yield, and quality (*Xiaohao et al., 2025*)
- The effects of these parameters are closely linked to the various microclimates created by different vine structures within the vine's canopy

Yeast metabolism influences wine characteristics

Main purpose:

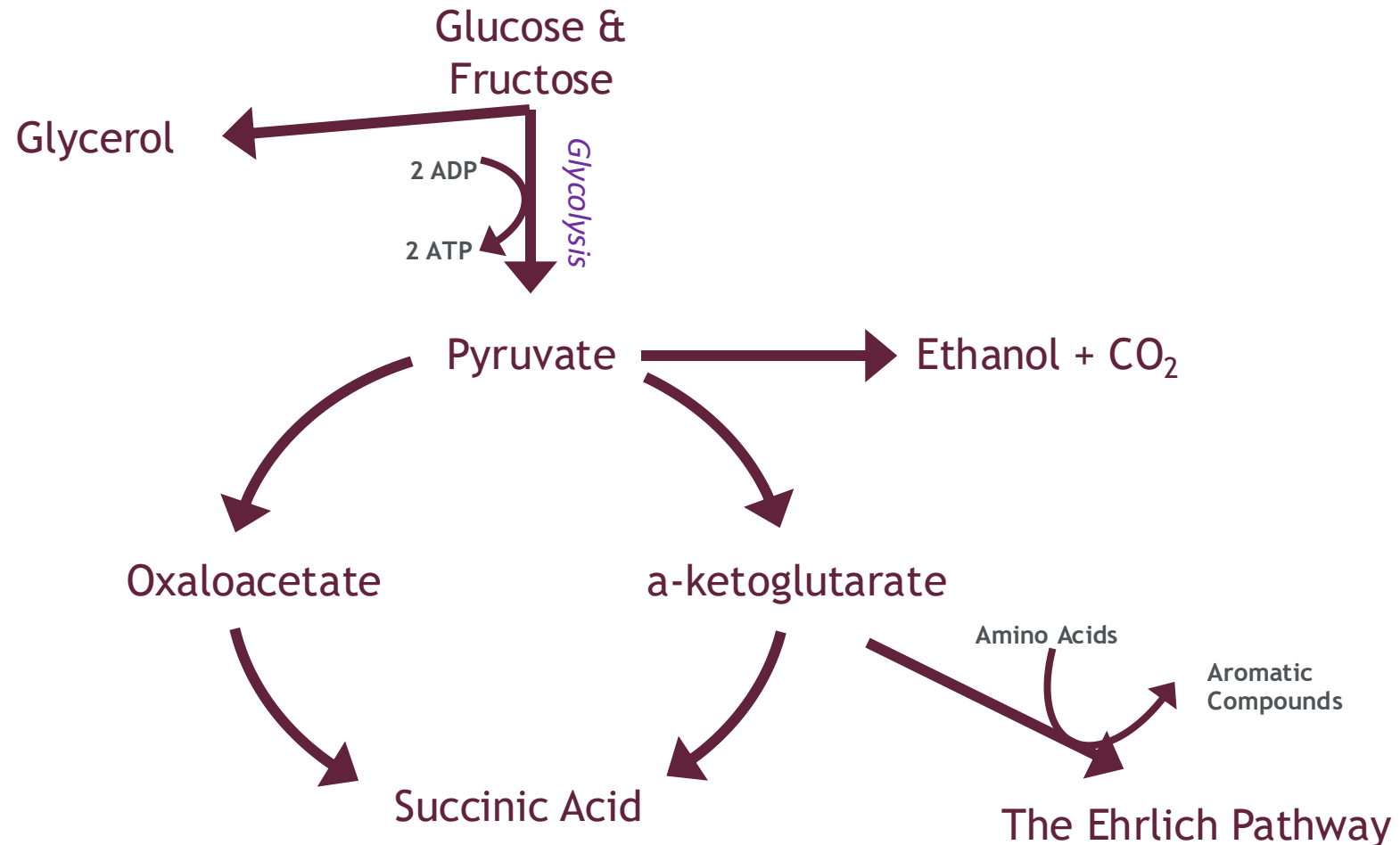
Sugars → Ethanol and CO₂

Primary Metabolites

- Essential for cellular functions
- Ethanol, carbon dioxide, glycerol, organic acids, amino acids, and sugars.

Secondary Metabolites

- Influences **wine aroma, flavour, and sensory profile** (Carpena et al., 2020)
- Esters, Higher Alcohols, and Thiols
- Generated as by-products of yeast metabolic activity (Martin et al., 2016)



*TCA cycle under anaerobiosis:
Accumulation of succinic acid*

Chenin blanc Experimental Block

A model vineyard, established in 2020 at the Welgevallen Experimental Farm of Stellenbosch University, South Africa (187m above sea level)

- One clone → SN 220,
- One Rootstock → Richter
- 19 different trellising systems



Trellis system characteristic	Trellising System names
Free-standing vines	Bush vine
	Posted vine
Single canopy (VSP)	3-strand hedge trellis
	4-strand hedge trellis
	5-strand double-lengthened Perold
	7-strand double lengthened Perold
Single canopy (sprawling)	1 strand hedge trellis (high wire)
	High Wire Perold
	2-strand hedge with simulated mechanical pruning (small box)
	2-strand hedge trellis with simulated mechanical pruning (large box)
Horizontally divided single canopy	Double-lengthened double Perold
Horizontally divided double canopy	Tramlines (5-strand double lengthened Perold)
	Geneva Double Curtain
	Lyre
Vertically divided single canopy	Ballerina
Vertically divided double canopy	Scott Henry
	Smart Dysan
	Smart Henry
	2K2T

Winemaking Process

Objective 1: An oenological analysis of Chenin blanc wines made from 19 different trellising systems in a model vineyard



Created by Rafic Creative Studio from Noun Project



Created by Iconair from Noun Project



Created by Jurij Setlak from Noun Project



Created by Iconair from Noun Project



Created by Iconair from Noun Project



Created by elasticstudio from Noun Project



Created by Iconair from Noun Project

Harvest

- @ 06:00
- 2 x crates per row (Pooled together)
- Stored overnight at 4°C

Destemming & Crushing

- The following morning
- Added 40ppm SO₂ after crushing
- **Sampling before and after SO₂ was added**

Pressing

- Pressed directly after crushing
- Added settling enzymes

Settling

- Allowed pressed juice to settle overnight at 15°C
- Racked the clean juice off the lees the following day
- **Divided into 3 x 4 L replicates**
- **Sampling of clear juice after settling**

Fermentation

- Inoculated each replicate with Anchor VIN13 Yeast
- Added 50mg/L DAP
- Monitored by weighing the replicates every day
- Temp. controlled @15°C for fermentation duration

Cold stabilization

- After fermentation, the wines were all stabilized in -4°C

Bottling

- No filtration
- Racking of clean wine into bottles
- Filled head space with CO₂ gas
- For each replicate - 4 bottles
- **Sampling of each replicate just prior to bottling**

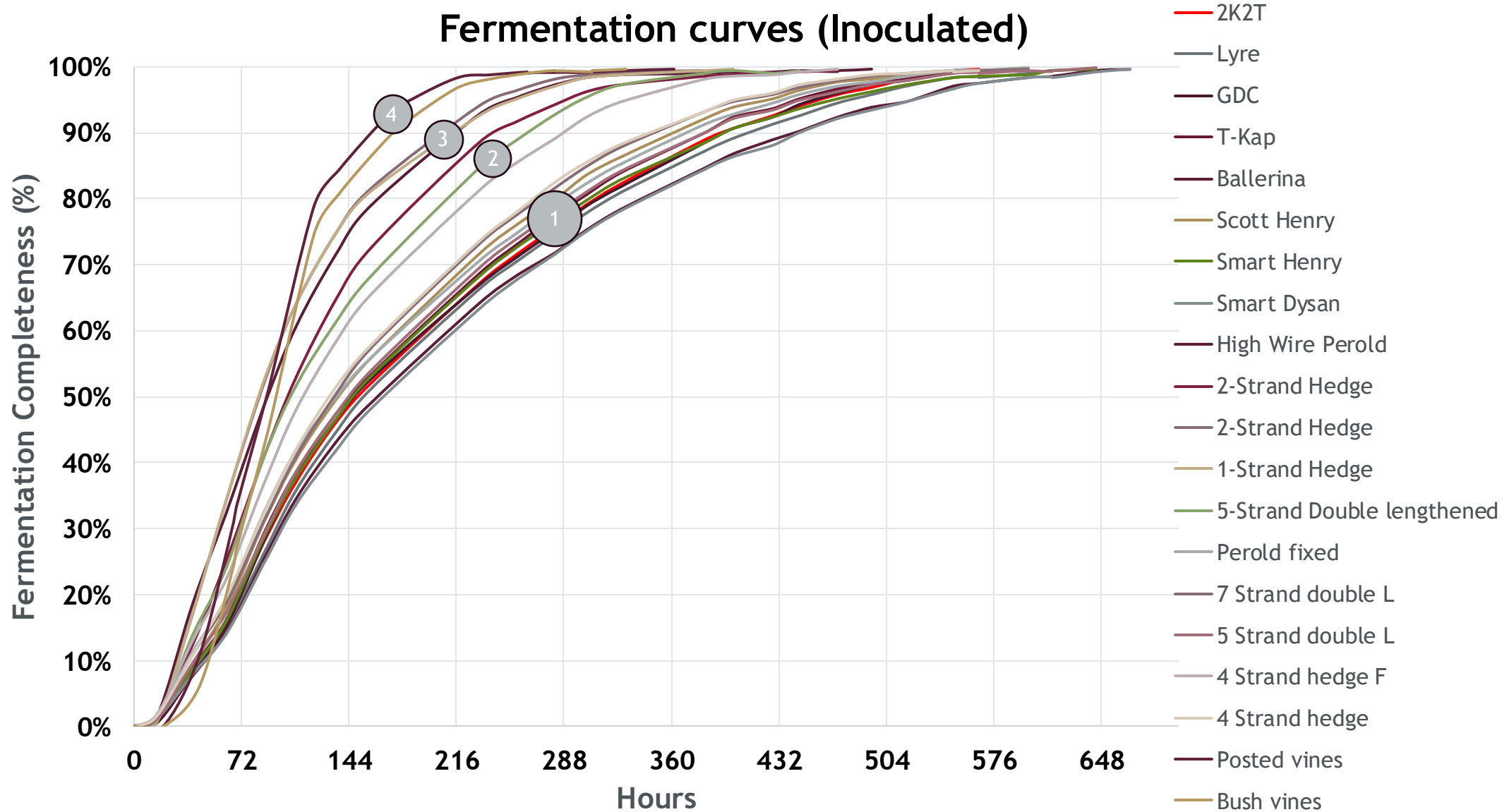
Sample volume (stored in -20°C)

2 x 50 ml **no SO₂**
 1 x 15 ml **no SO₂**
 +
 1 x 50 ml **with SO₂**
 1 x 15 ml **with SO₂**

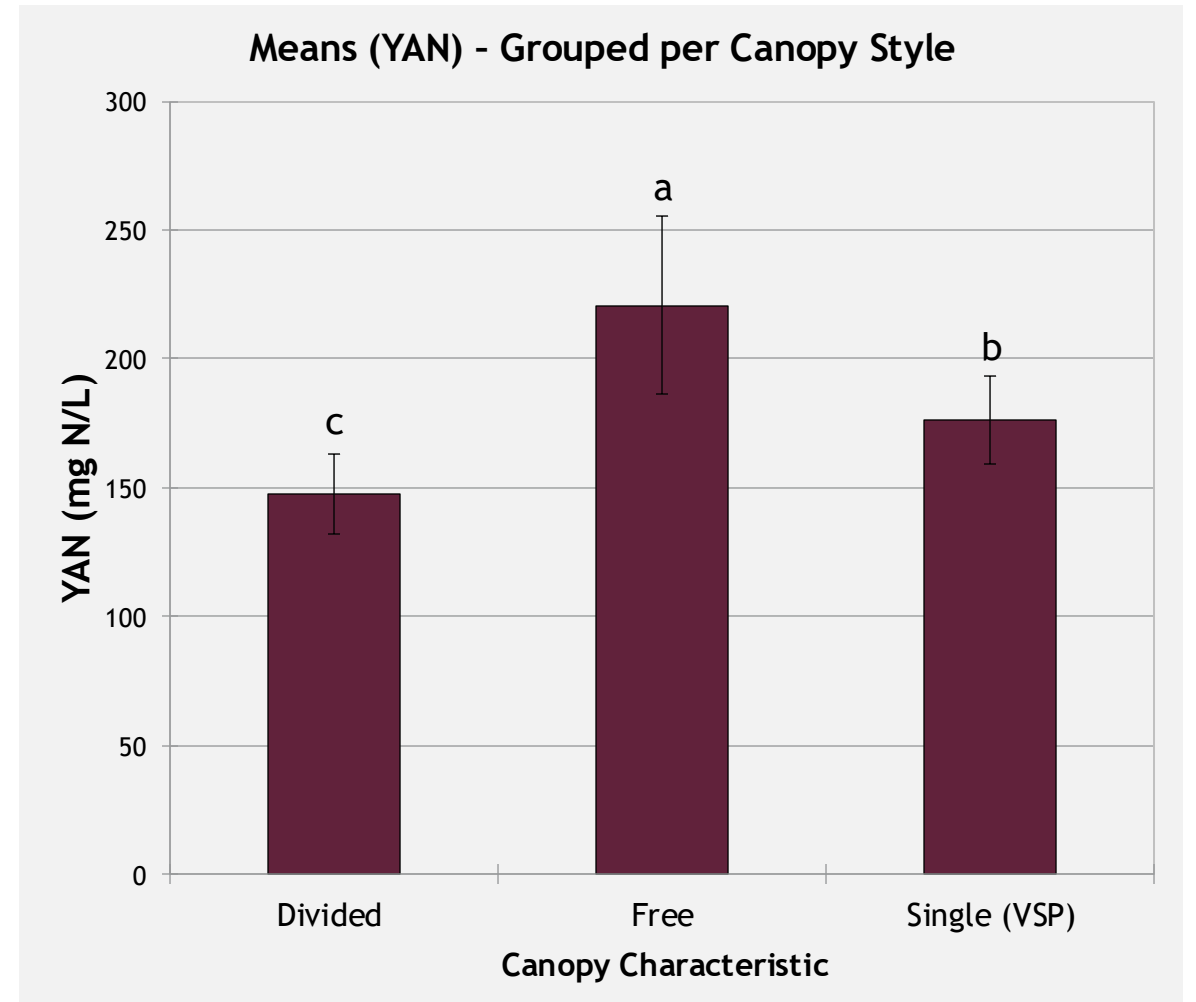
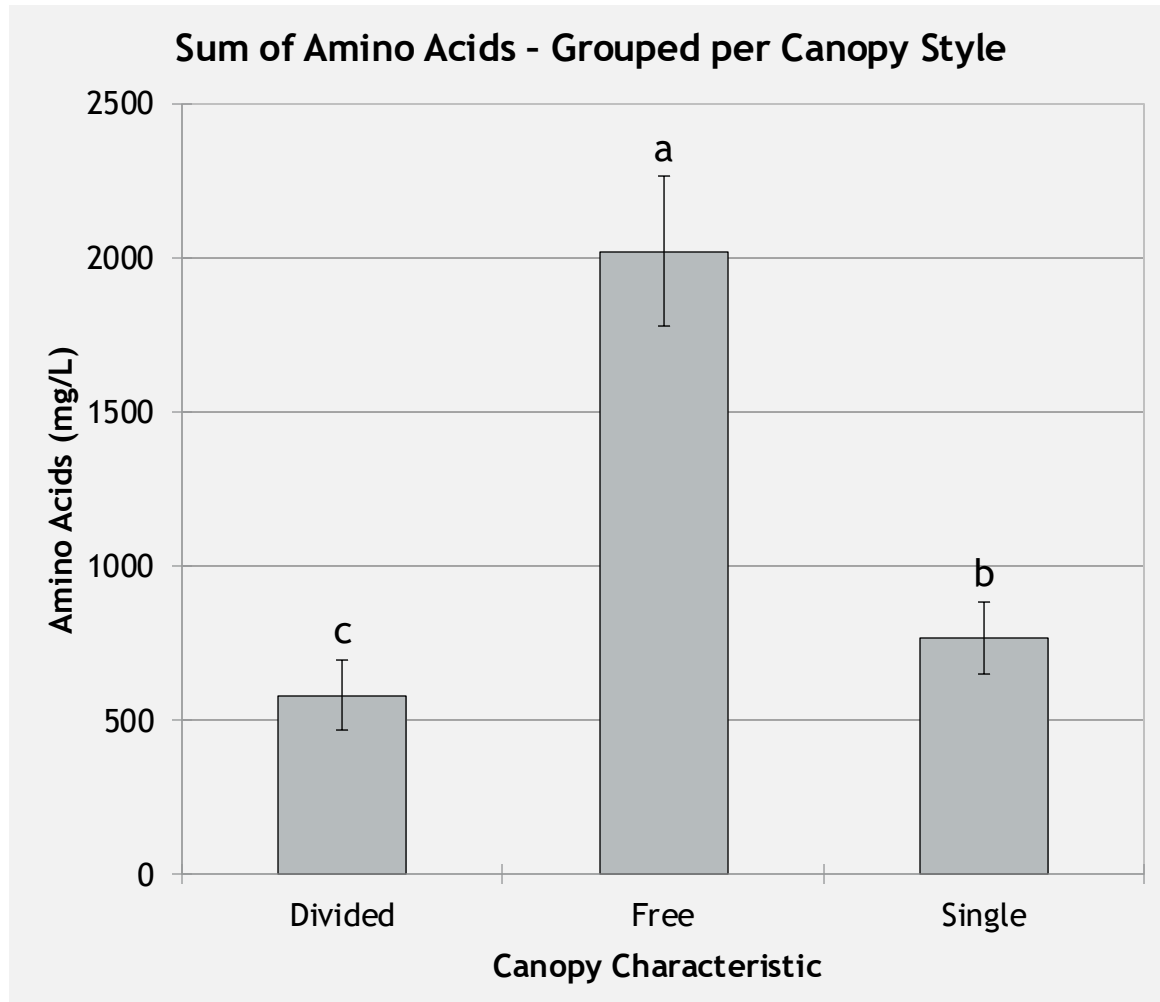
1 x 15ml
 3 x 50ml

1 x 50 ml

Variability in fermentation speed between different trellising systems

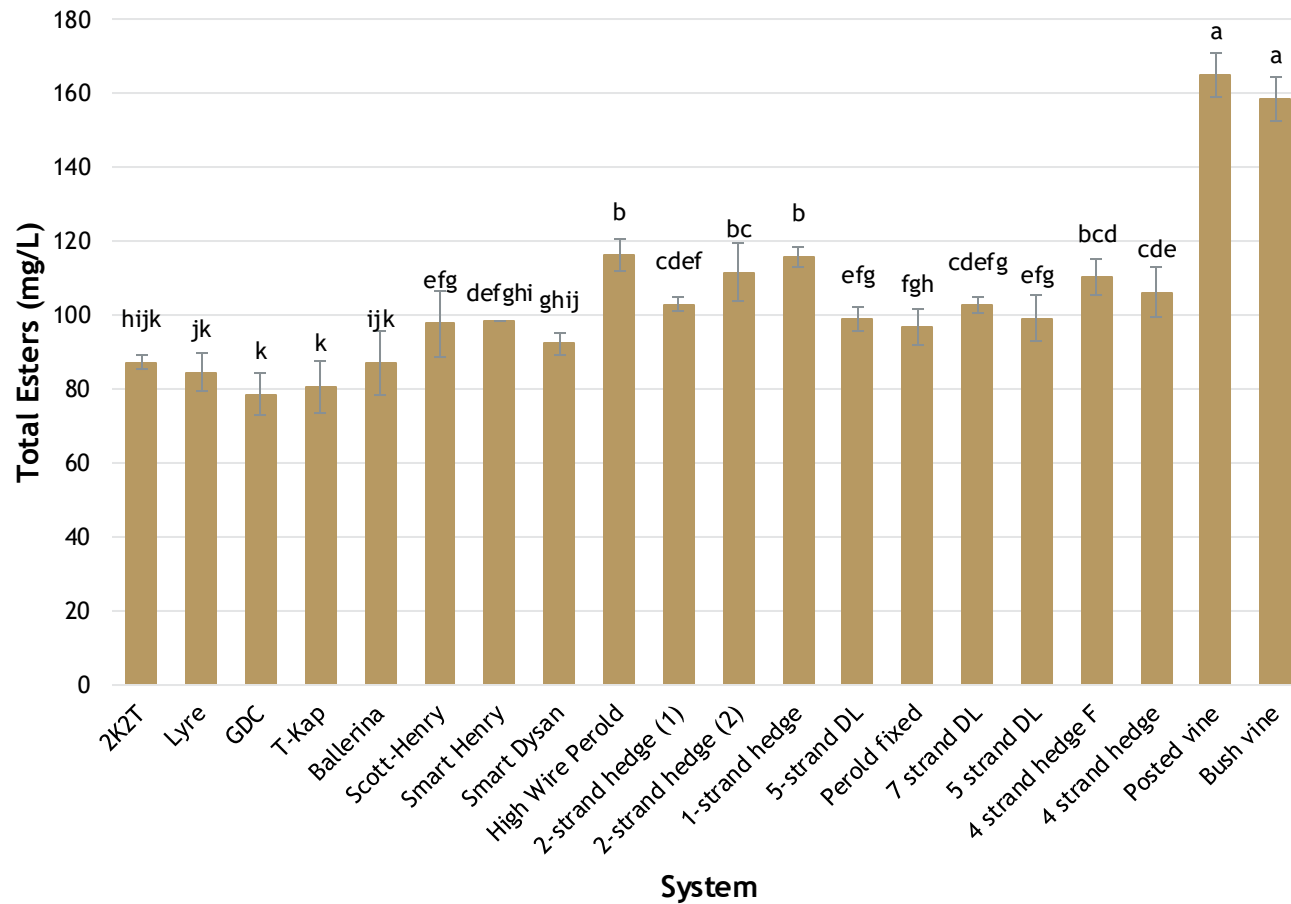


Relationship between Amino Acids and YAN



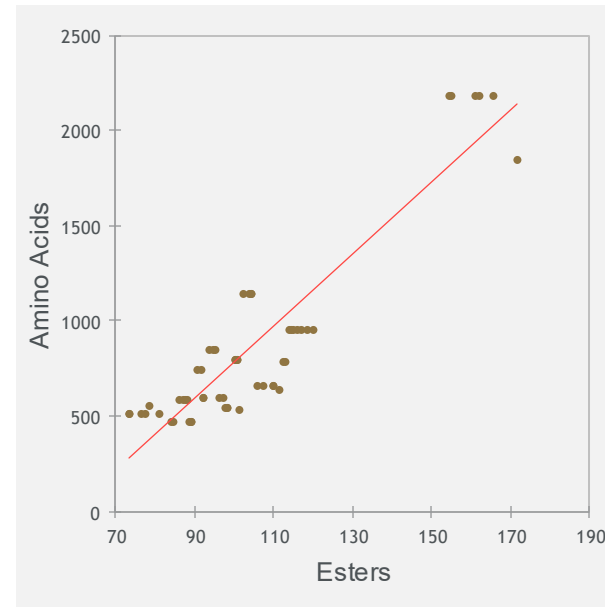
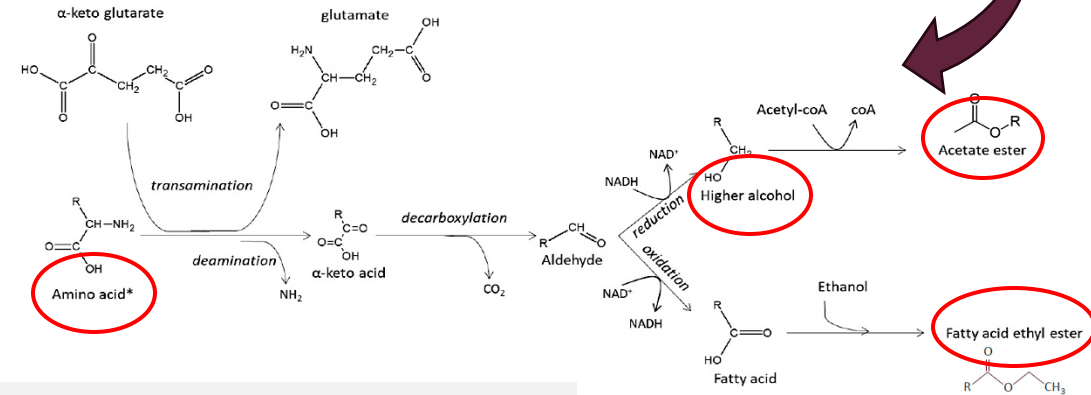
Volatile compounds (Esters)

Total Esters in final wine



Specific Amino acids can be catabolized via the Ehrlich pathway

- Production of Aromatic Compounds



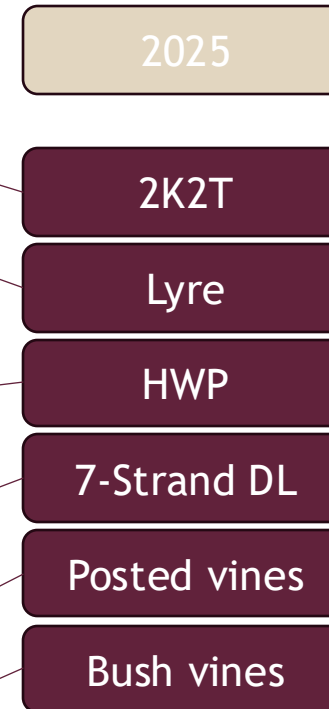
Positive Correlation

↑ Amino acids = ↑ Esters

Model vineyard Training systems

Category	Row	Training System
Divided Canopies	4	2K2T
	5	Lyre
	7	GDC
	8	T-Kap
	10	Ballerina
	12	Scott-Henry
	14	Smart-Henry
	16	Smart Dysan
	24	5-Strand double lengthened
Single Canopies	18	High Wire Perold
	20	2-Strand hedge
	22	2-Strand hedge
	23	1-Strand hedge
	26	Perold fixed
	28	7-Strand double L
	30	5-Strand double L
	32	4-Strand hedge F
	33	4-Strand hedge
Free	Free-standing	Posted vines
	Free-standing	Bush vines

Based on the Viticulture and Winemaking data:



Objective 2: An oenological and sensory analysis of Chenin blanc wines made from 6 distinct trellising systems in a model vineyard, with different winemaking approaches promoting premiumization.



Created by Rafic Creative Studio from Noun Project



Created by Iconair from Noun Project



Created by Jurij Setlak from Noun Project



Created by Iconair from Noun Project



Created by Iconair from Noun Project



Created by elasticstudio from Noun Project



Created by Iconair from Noun Project

Harvest

- @ 06:00
- Entire system (Pooled together)

Destemming & Crushing

- Processed directly after harvest
- Added 30 ppm SO₂ after crushing
- **Sampling before and after SO₂ was added**

Pressing

- Pressed directly after crushing
- Added settling enzymes

Settling

- Allowed pressed juice to settle for 48h at 15°C
- Racked the clean juice off the lees
- **Divided into 6 x 20 L replicates**

Fermentation

- Inoculated 3 replicates with **Anchor VIN13 Yeast**; and other 3 with **Anchor Exotics Novello**
- Added 50mg/L DAP @ 1/3 of fermentation
- Monitored fermentations daily
- Temp. controlled @15°C for fermentation duration

Cold stabilization

- After fermentation, the wines were all cold stabilized in -4°C for 2 weeks

Bottling

- No filtration
- Racking of clean wine into bottles
- Filled head space with CO₂ gas
- **Sampling of each replicate just before bottling**

Sample volume (stored in -20°C)

2 x 50 ml **no SO₂**
1 x 15 ml **no SO₂**
+
1 x 50 ml **with SO₂**
1 x 15 ml **with SO₂**

Juice Amino Acids

2 x 50 ml
***Major Volatiles**
***Organic Acids & Sugars**
***Thiols**

Overview:

Impact on grape juice matrix:

1. pH varied from 3.3-3.7
2. TA varied from 6.8-7.8
3. YAN similar compared to variation of 2024 season

Harvest Timing:

Earliest harvests: HWP and 7-Strand DL – February 10

Mid-harvests: 2K2T and Lyre – February 12

Later harvests: Posted vines – February 17

Bush vines – February 24

Key Takeaways:

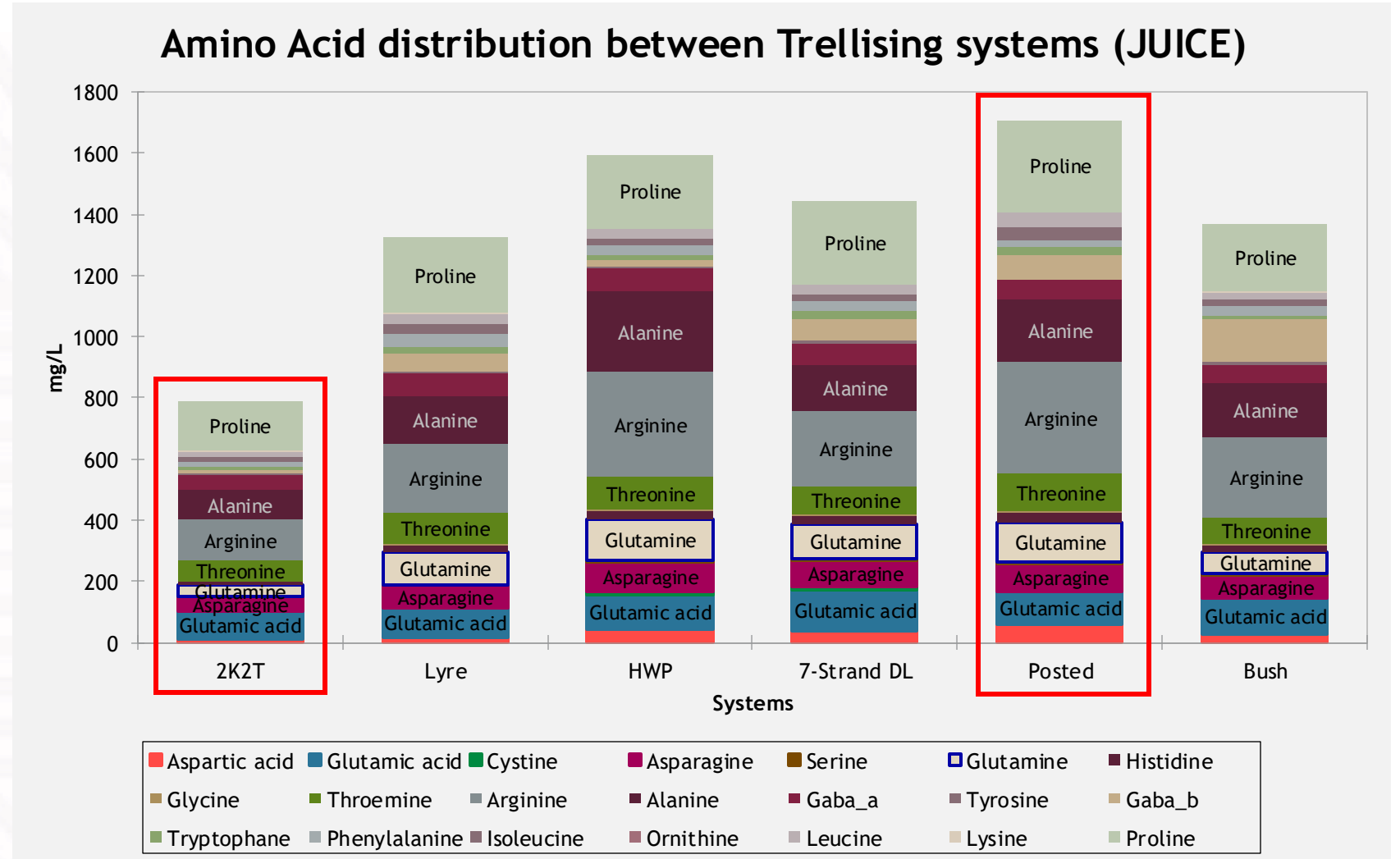
- Smaller or more open canopies (like Bush and Posted vines) ripened later, likely due to differences in sunlight exposure and microclimate
- YAN levels were stable, suggesting consistent nitrogen availability for fermentation across systems

Basic Juice Analysis 2025

<i>System</i>	<i>TA (g/L)</i>	<i>pH</i>	<i>FSO₂</i>	<i>TSO₂</i>	<i>°Brix</i>	<i>YAN</i>
<i>2K2T</i>	7.8	3.29	6	19	22.1	176.4
<i>Lyre</i>	6.8	3.41	8	25	23.1	162.4
<i>High Wire Perold</i>	7.8	3.33	22	51	22.6	182
<i>7-Strand double L</i>	7.5	3.24	21	44	22.8	168
<i>Posted vines</i>	7.2	3.68	13	30	22.1	168
<i>Bush vines</i>	7.7	3.49	16	37	22.4	182

Amino Acids in grape juice (2025)

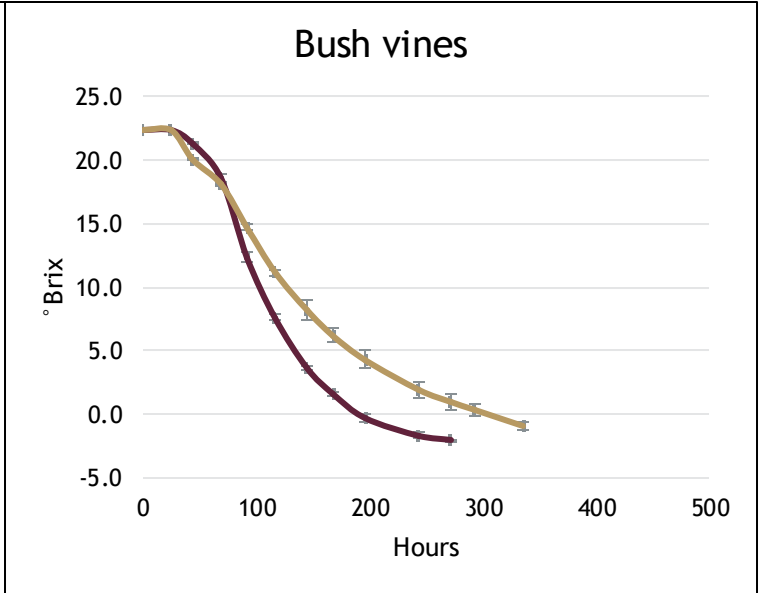
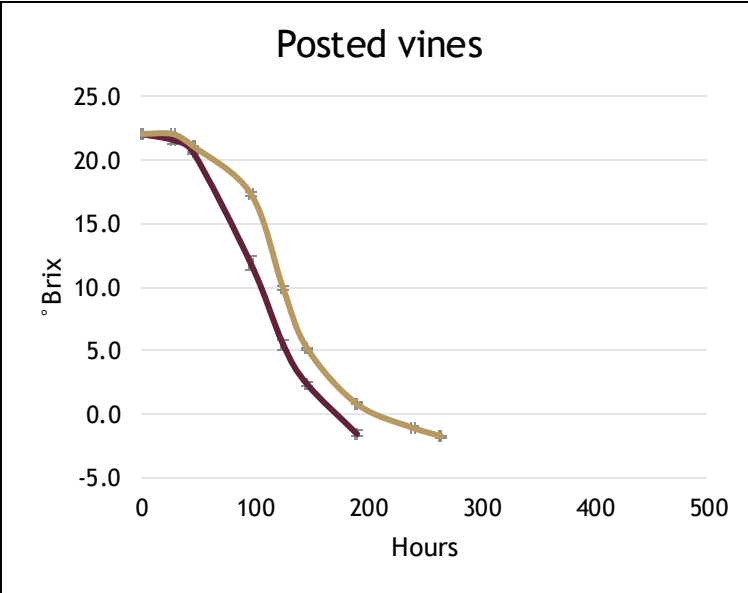
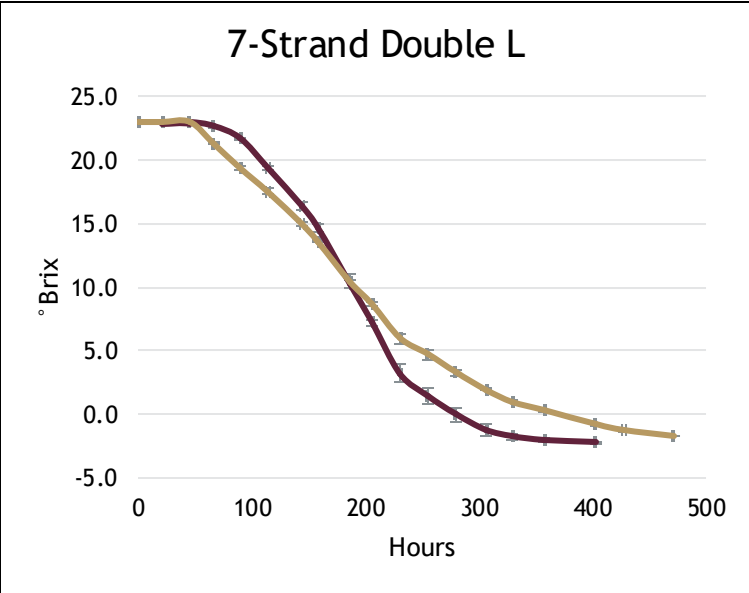
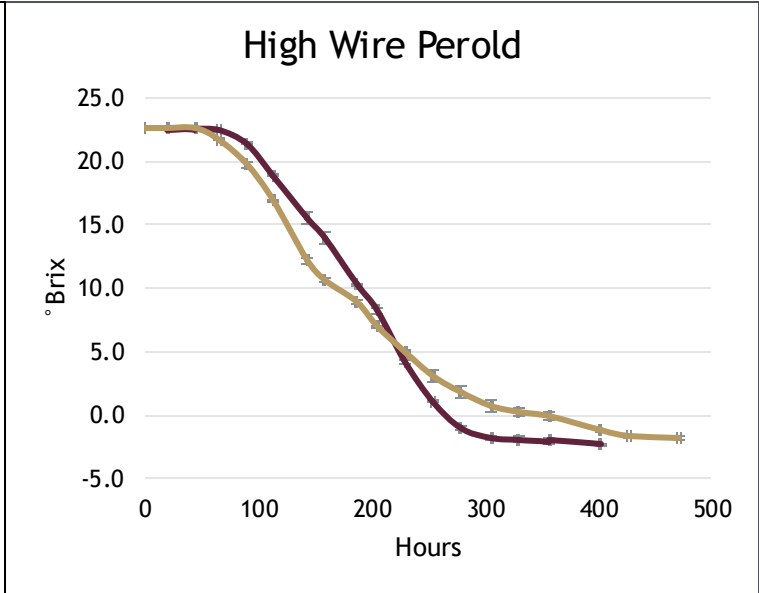
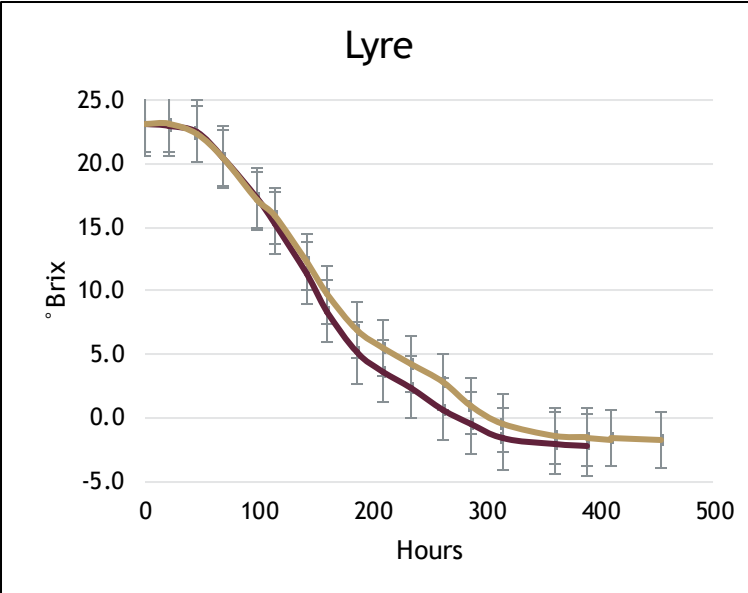
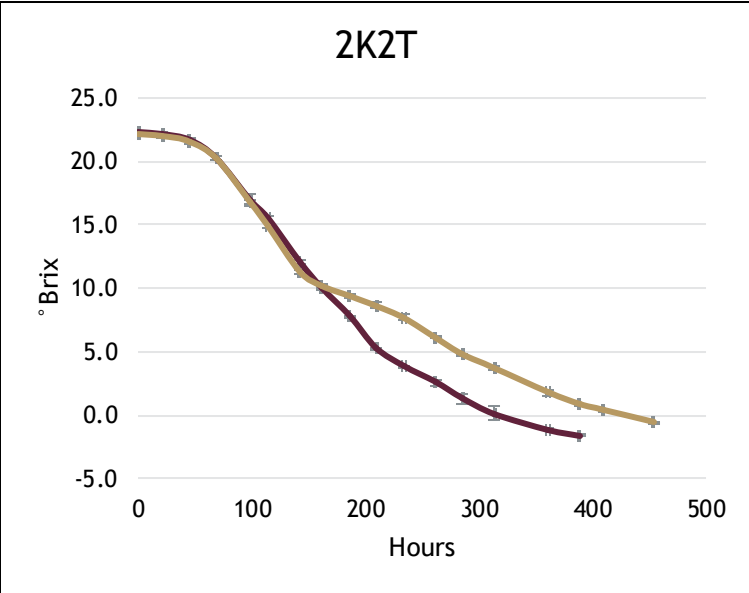
Proline	High in must and wine, not utilized by yeast, may affect mouthfeel
Alanine	Supports growth well, part of main amino acids in grapes
Arginine	Supports growth well, high in must, consumed by yeast, low in wine
Threonine	Contributes to propanol, butanol, propionic acid; related to fatty acid byproducts
Glutamine	Supports growth well, part of protein synthesis
Glutamate	Supports growth well, shortest lag phase, highest growth rate



Posted vines ↑

2K2T ↓

Fermentation dynamics of 6 distinct trellising systems



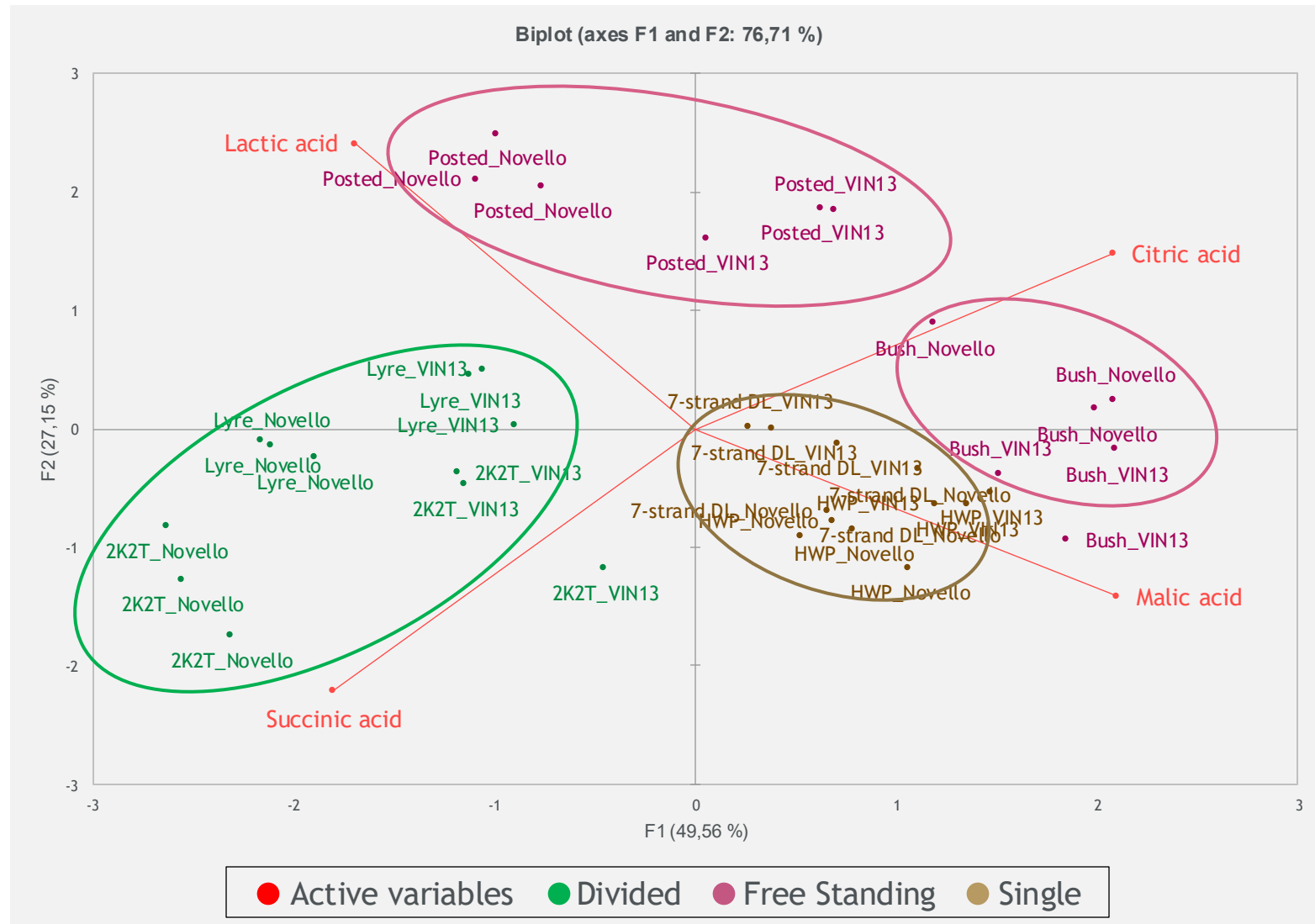
4 Organic Acids

Observation:

- **Significance between canopy size ↗**
 - **Bigger canopies ↗**

Category	Divided	Single	Free Standing	Significant
Citric acid	0.099 c	0.185 b	0.223 a	Yes
Malic acid	2.815 b	3.052 a	3.089 a	Yes
Succinic acid	3.932 a	2.949 b	2.517 c	Yes
Lactic acid	1.141 a	0.572 b	1.162 a	Yes
Total	7.987 a	6.758 b	6.992 b	Yes

Biggest contributor → Succinic acid



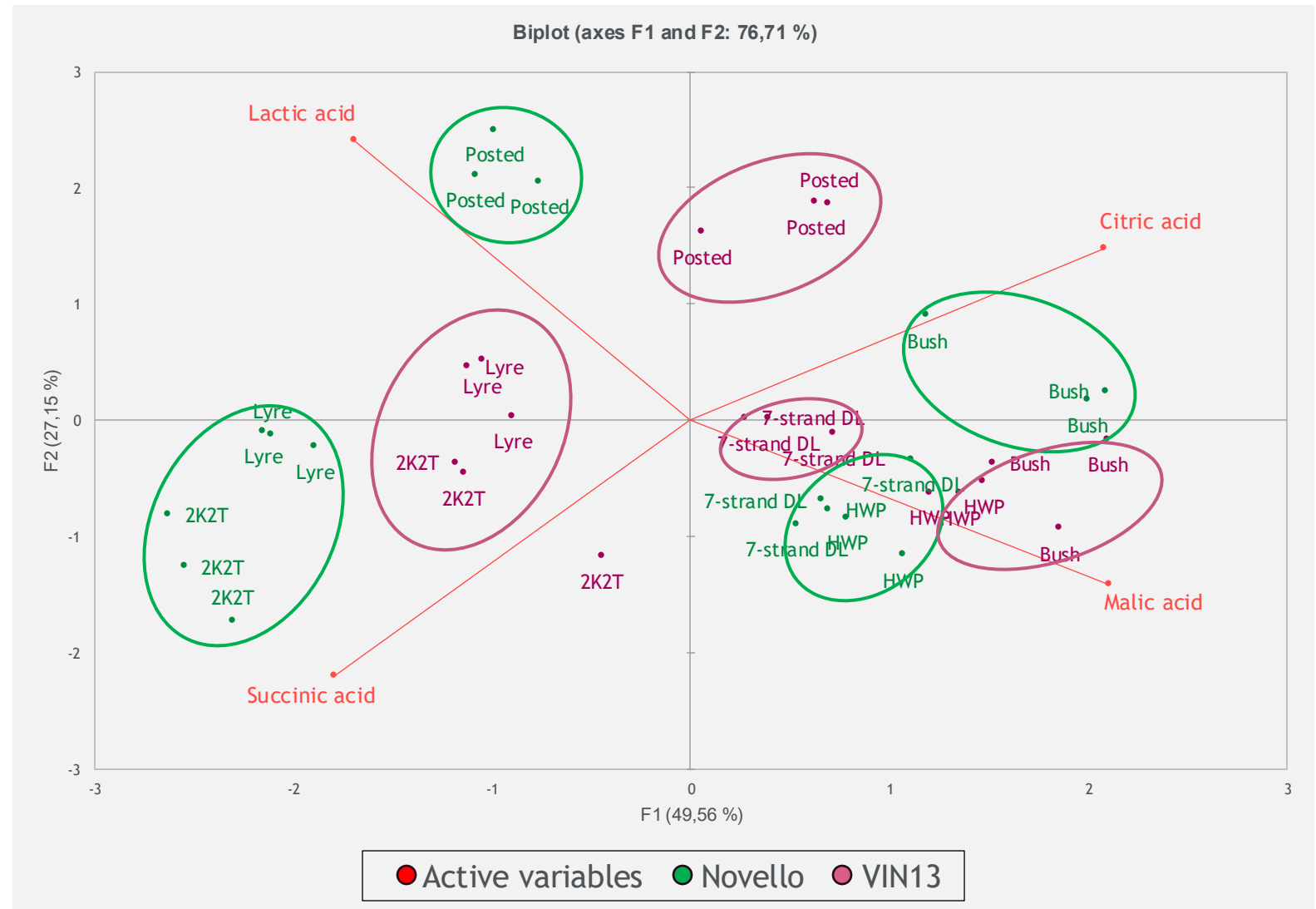
4 Organic Acids

Observation:

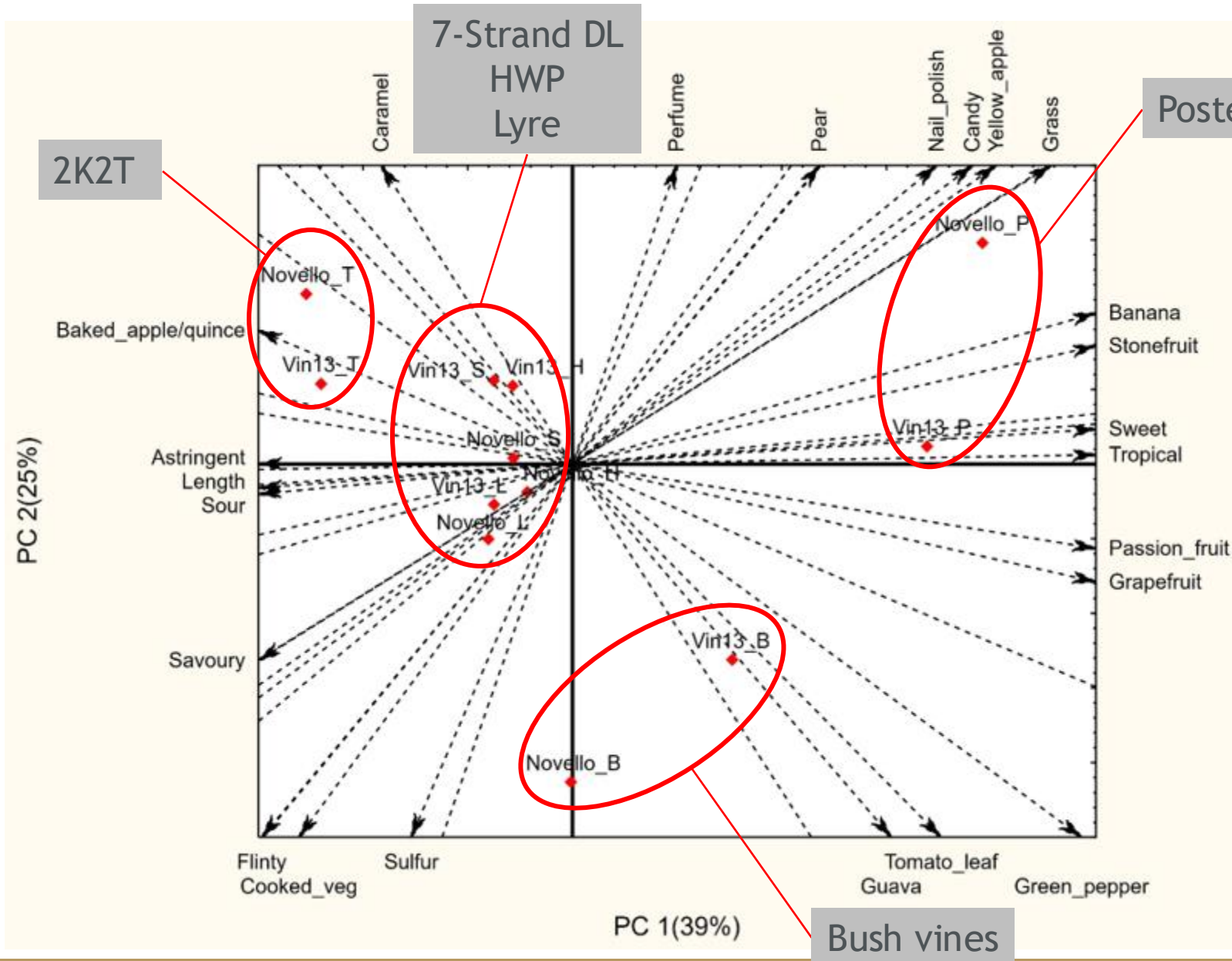
- **Significance between Yeast strains ↗**
 - **ONLY because of Succinic acid**
 - **Bigger canopies ↗**

Category	Novello	VIN13	Pr > F(Model)	Significant
Citric acid	0.178 a	0.160 a	0.455	No
Malic acid	2.936 a	3.034 a	0.280	No
Succinic acid	3.524 a	2.742 b	0.001	Yes
Lactic acid	1.027 a	0.891 a	0.261	No
Total	7.664 a	6.827 b	0.001	Yes

Biggest contributor → Succinic acid



Sensory analysis



• Strong associations:

• Posted Vines

- Fruity and sweet aromas

• Bush vines

- Green pepper, guava, tomato leaf

• 2K2T

- Baked apple, Caramel, Sour, Astringent

Moderate associations :

• 7-Strand DL

- Baked apple, Quince, Caramel

• High Wire Perold

- Caramel, Baked apple, Savoury

• Lyre

- Savoury, Flinty, Sour

Conclusion



Trellising systems significantly impacts final wine profiles

1. Amino acid buildup
 - Fermentation kinetics + Sensory Profiles
2. Acid concentrations (Juice and Final Wine)

Yeast strains significantly affect fermentation outcome

1. Differences in Nutrient Requirements
2. Aromatics and mouthfeel

Yeast * Trellising system = greatest effect on wine

Which Trellising System suits your wine style best?

A system where you manipulate the wine the most?

OR

A system that expresses your wine style the most?



ACKNOWLEDGEMENTS

- Supervisor: Prof Melané Vivier
- Co-Supervisor: Maret Du Toit
- Doctoral and Master's students
- SAGWRI Chemical Analytical Laboratory
- Experimental Cellar
- SA Wine



Thank you!

