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Recent findings in: Calcium tartrate instability

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Introduction

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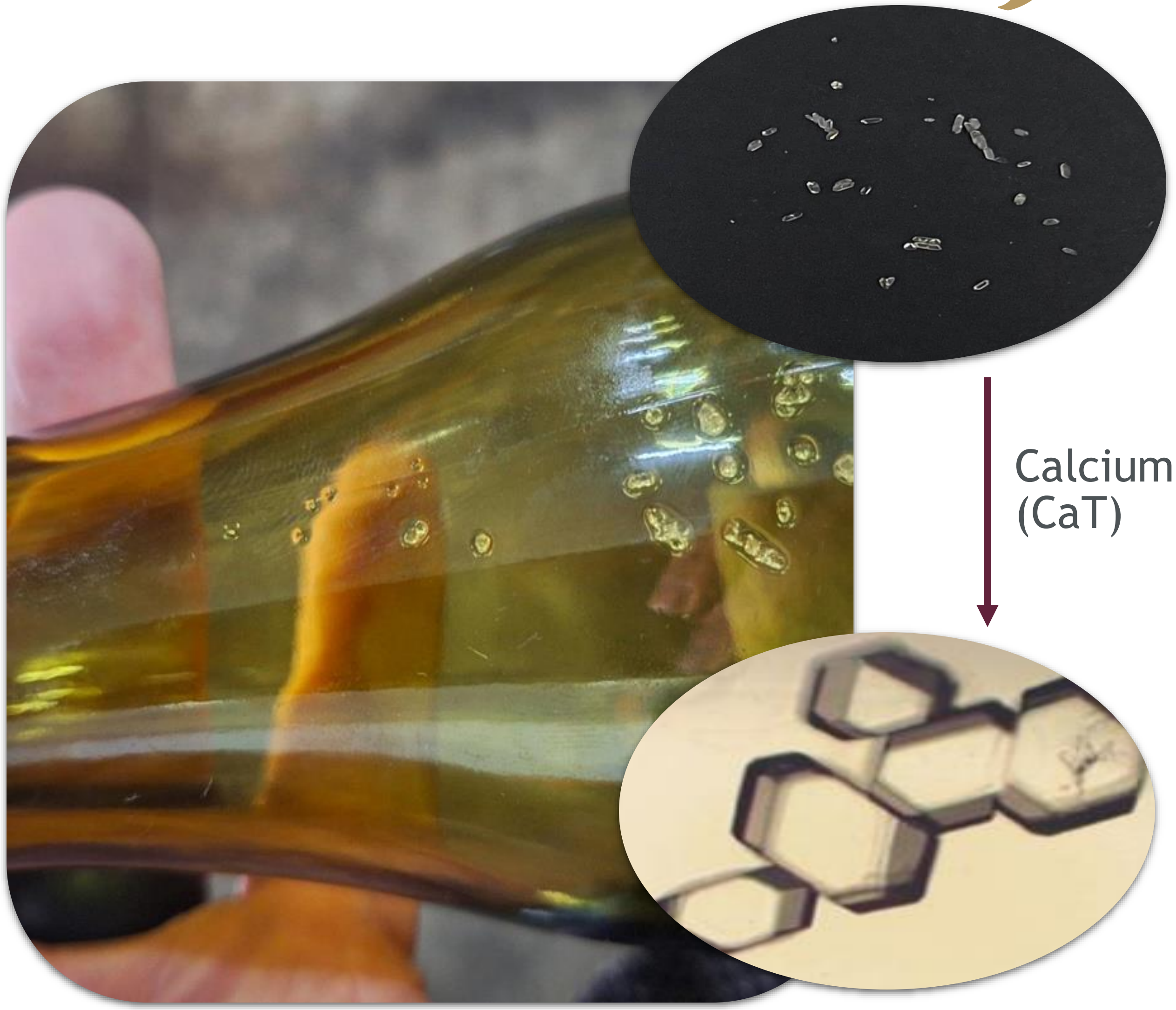
- CaT instability has been neglected in wine research.
- Climate change is increasing CaT issues
- Difficult to control and predict.
- Limited knowledge exists on factors influencing CaT formation compared to KHT.

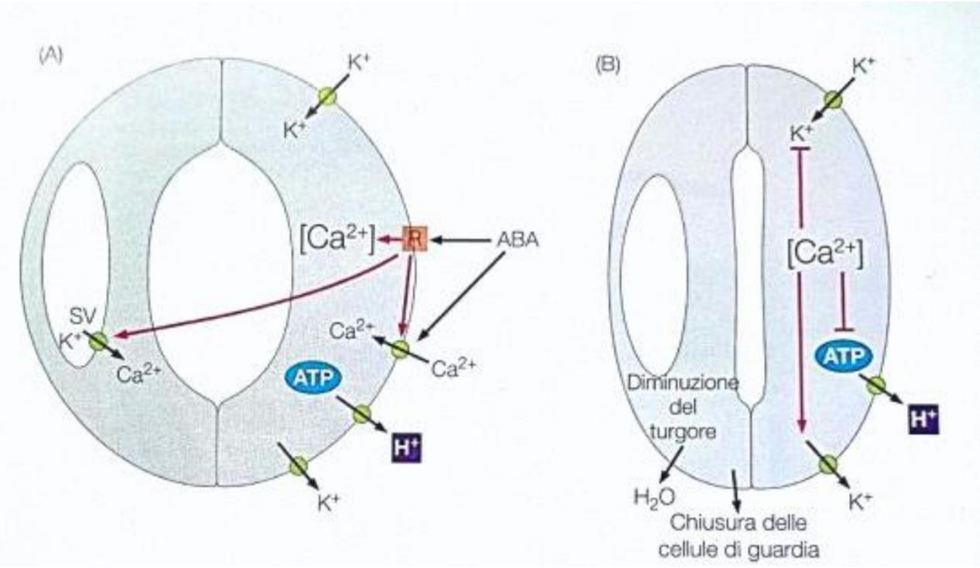


Calcium tartrate (CaT)

Introduction:
Water Stress & Rootstock-Scion Effects on Metal Uptake and CaT Instability

- Water stress can affect grapevine physiology, altering nutrient and metal uptake.
- Rootstock-scion combinations can impact how grapevines respond to water availability and accumulate metals.

Element	Role in CaT formation
Ca^{2+}	Substrate
K^{+}	Compete
Mg^{2+}	Inhibit



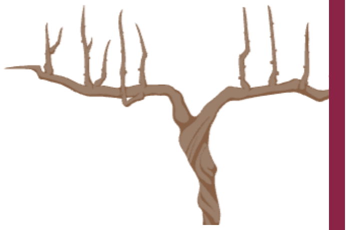
Control
Water stressed

Quinterno *et al*, Coetzee,2023

Methodology
Sample Preparation

Scion:

- Pinotage (near-is
- Cabernet Sauvign
(intermediate / N
anisohydric)
- Shiraz (strong ani



Rootstock:

Stress level:

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our

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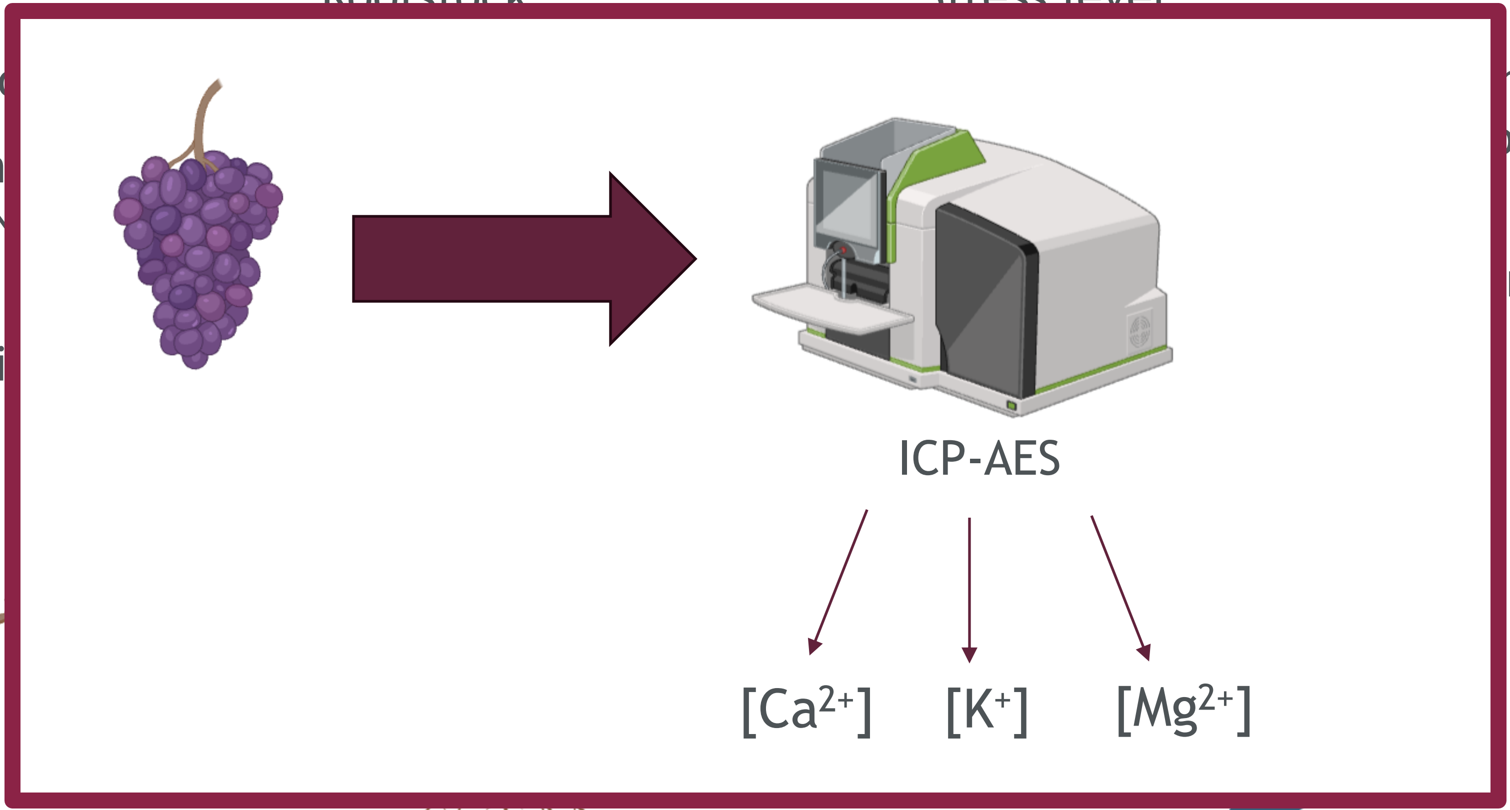
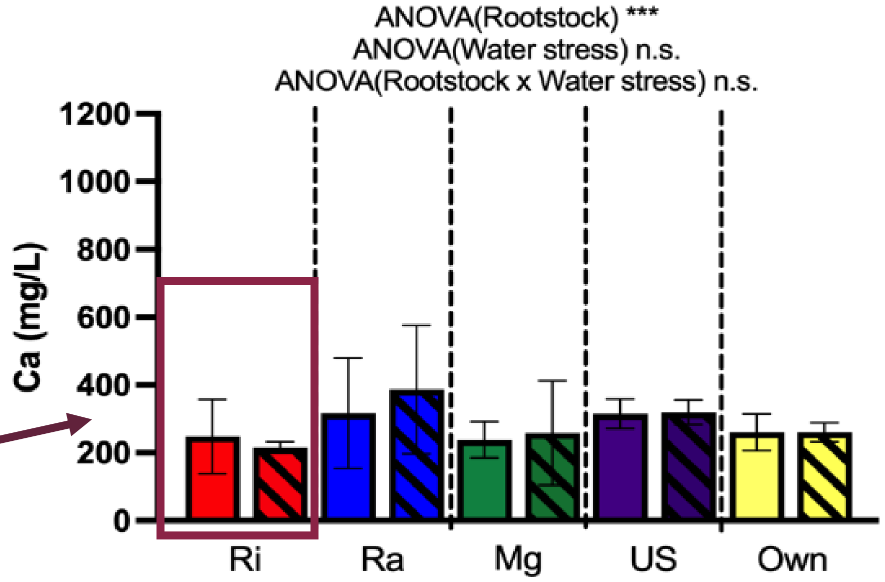
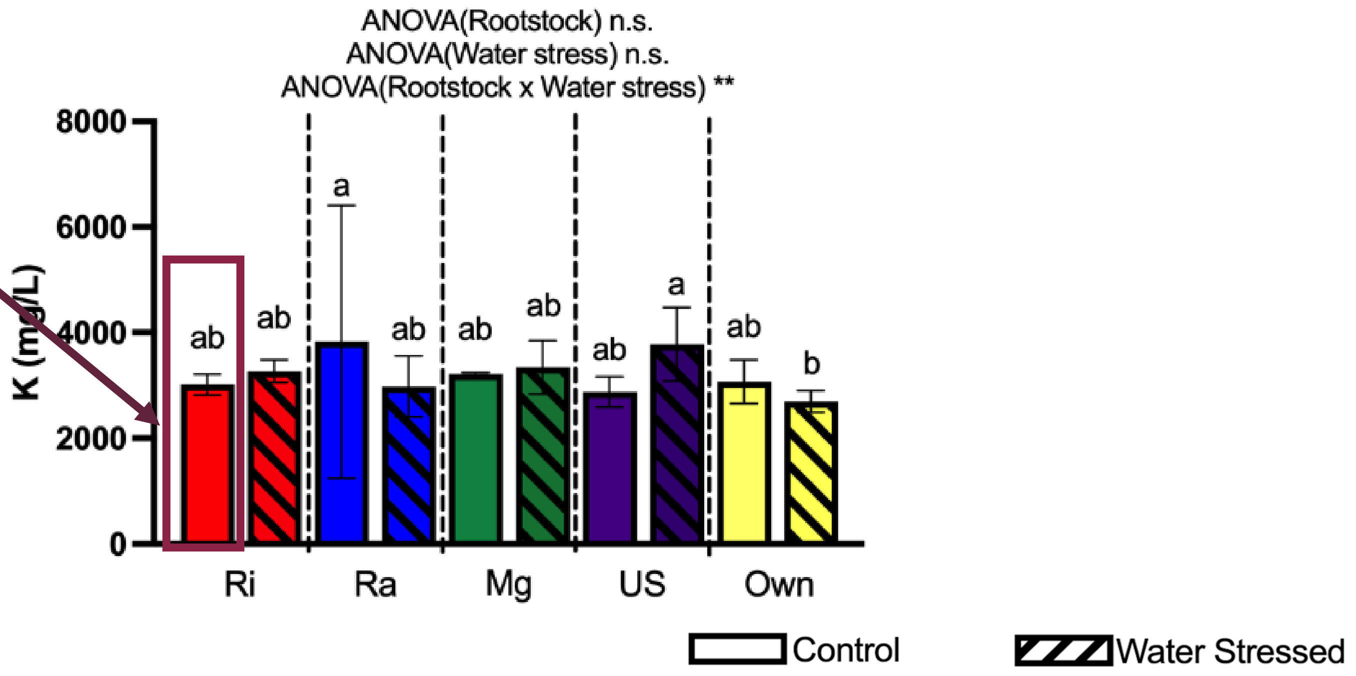


1 sample of scion/rootstock/stress level combination

Pinotage Results

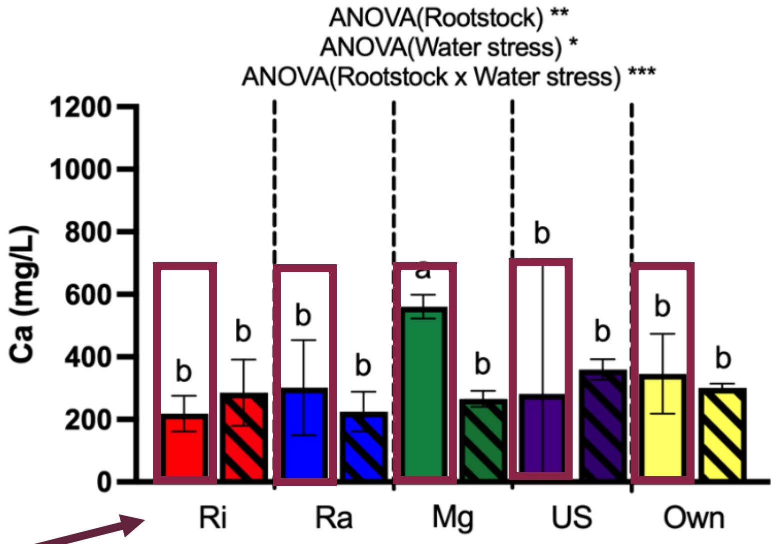
	Rootstock	Water stress	Rootstock x Water stress
Ca^{2+}	***	N/A	N/A
K^{+}	N/A	N/A	**
Mg^{2+}	N/A	N/A	N/A

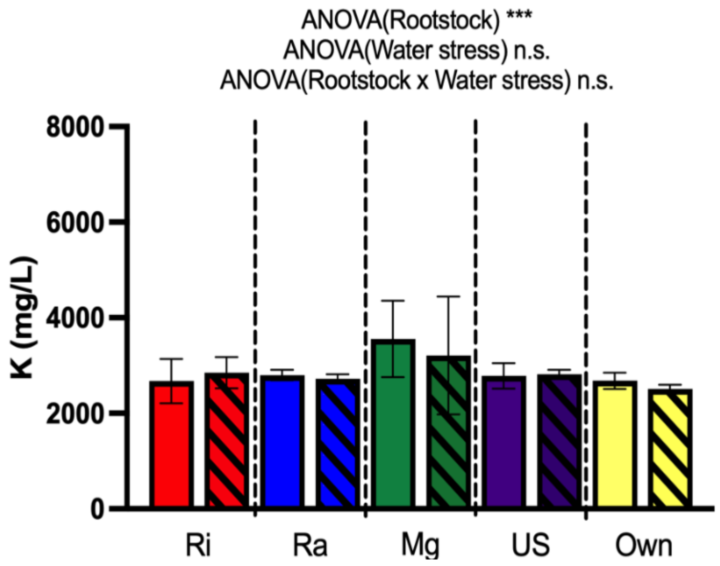


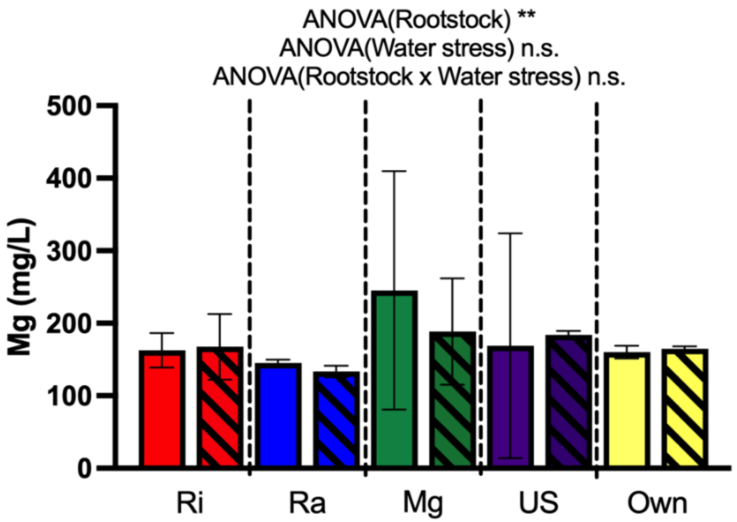


Results
Cabernet Sauvignon

	Rootstock	Water stress	Rootstock x Water stress
Ca^{2+}	**	*	***
K^{+}	***	N/A	N/A
Mg^{2+}	**	N/A	N/A







Control
Water Stressed

Introduction
Calcium movement from grape must to wine

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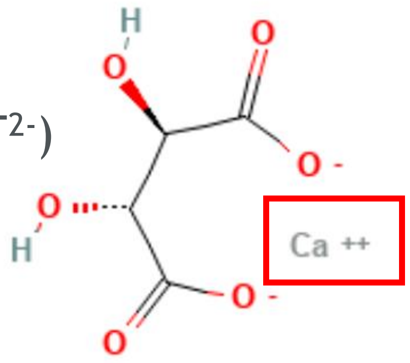
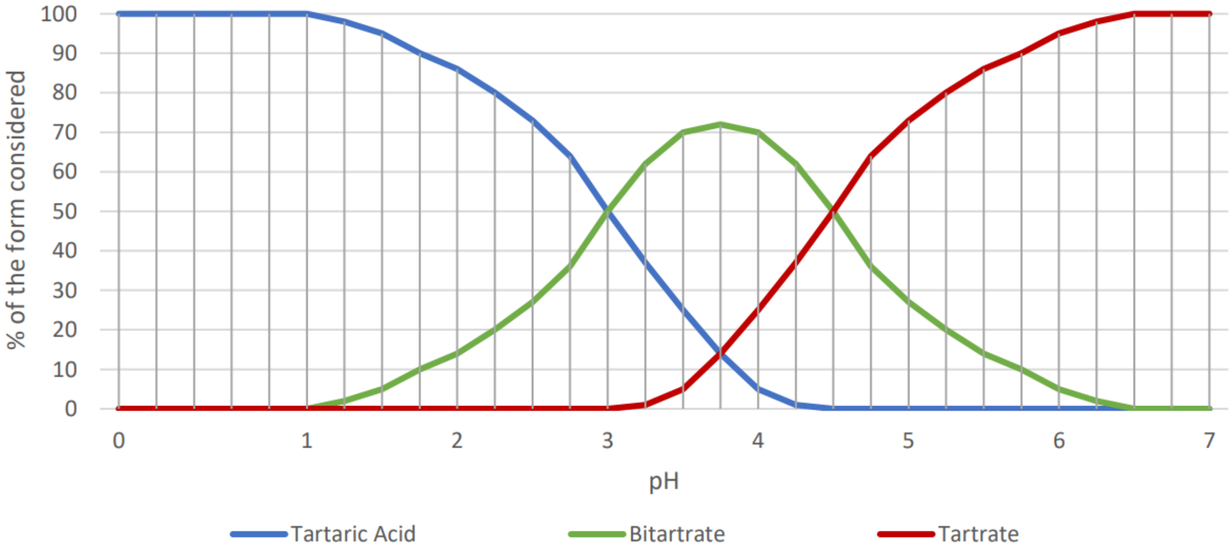
- Calcium content in grape must
  = **62.8-238.1 mg/L**
  - Average of 154.2 mg/L in 75 samples
- Calcium content in wine
  = **38.0 -123.0 mg/L**
  - Average of 112 mg/L in 177 samples

- pH plays a key role in CaT formation
  - Regulates the dissociation equilibrium of tartaric acid
- **↑ pH = ↑ % Tartate ions = ↑ CaT formation**

Tartrate ion (T^{2-})



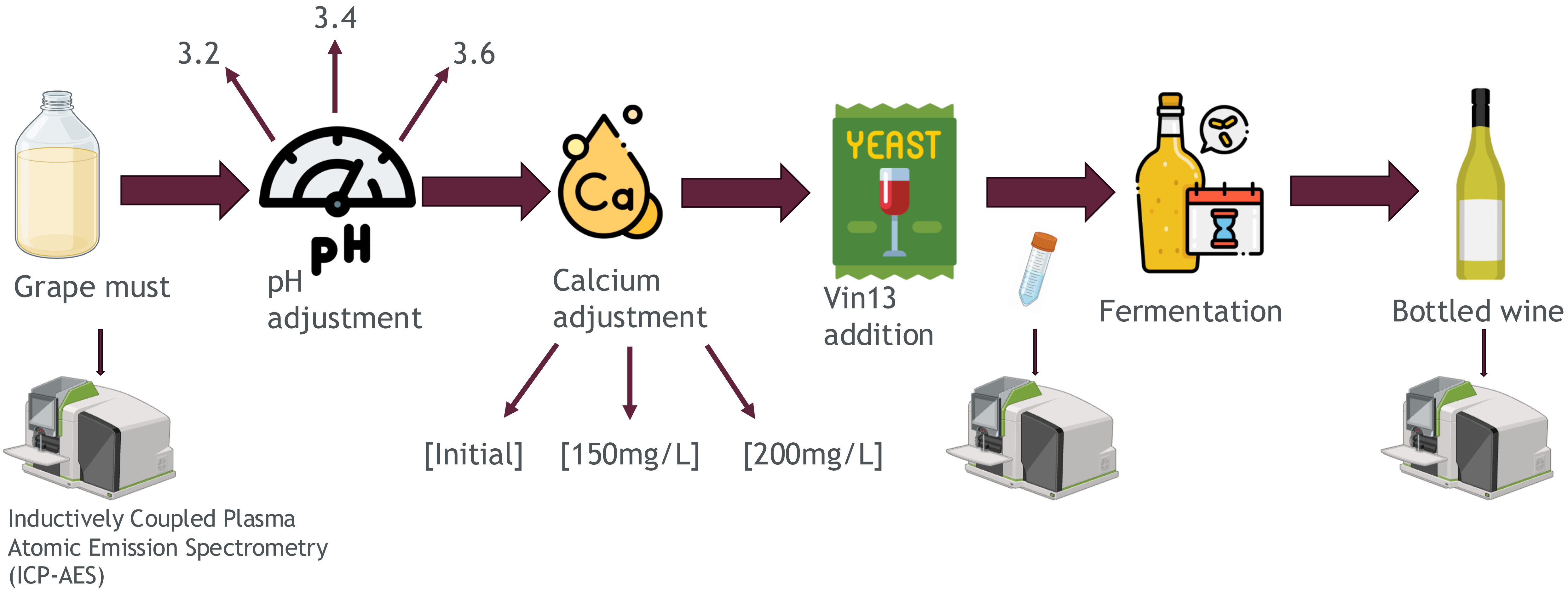
Calcium (Ca^{2+})



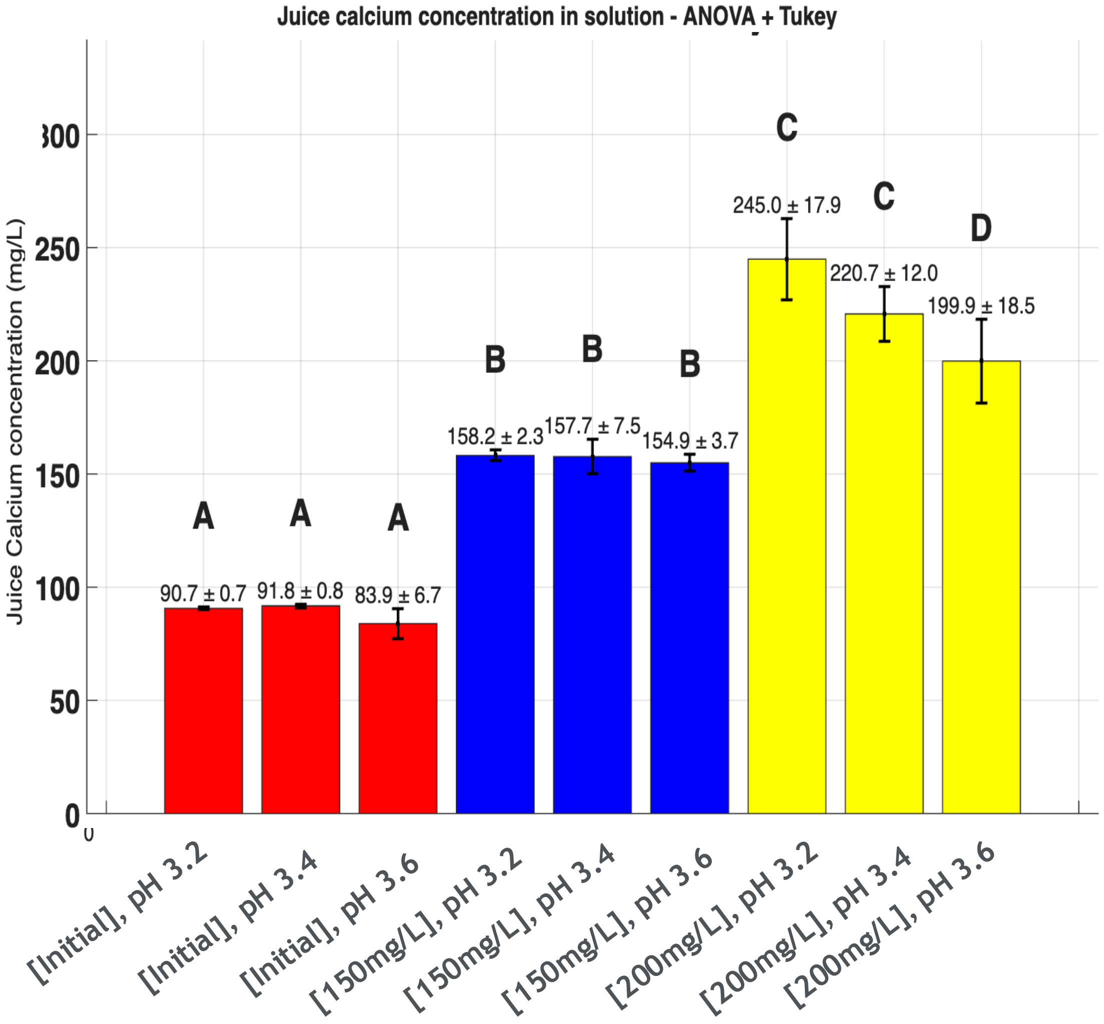
Dissociation equilibrium of Tartaric acid

Vestia et al., 2019, Quinterno *et al.*, Cui *et al.*,2024, Coetzee 2023, Enartis

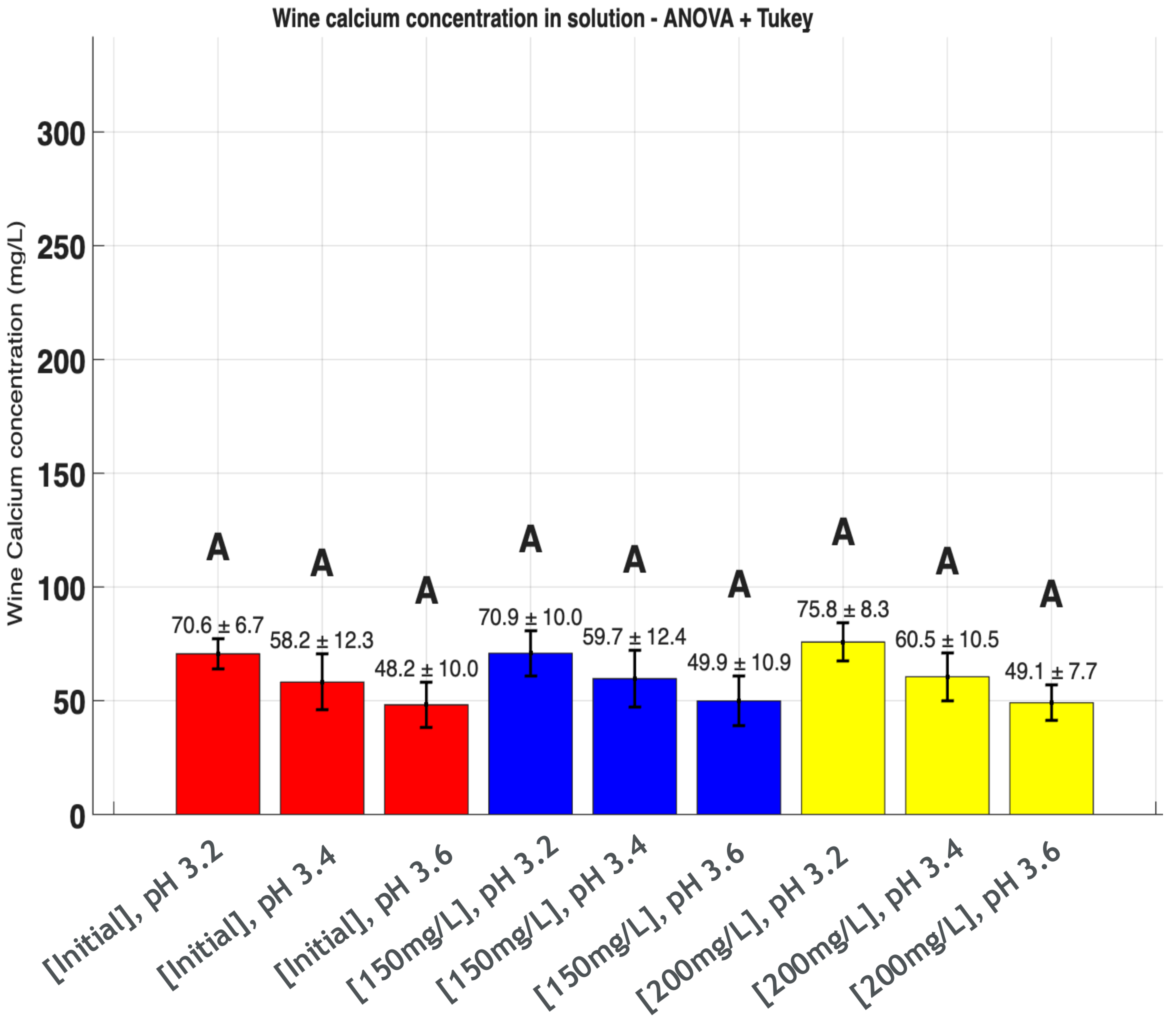
Methodology



Results



Juice calcium concentration in solution - ANOVA + Tukey
Juice Calcium concentration (mg/L)
0
50
100
150
200
250
300
A
A
A
B
B
B
C
C
D
90.7 ± 0.7
91.8 ± 0.8
83.9 ± 6.7
158.2 ± 2.3
157.7 ± 7.5
154.9 ± 3.7
245.0 ± 17.9
220.7 ± 12.0
199.9 ± 18.5
[Initial], pH 3.2
[Initial], pH 3.4
[Initial], pH 3.6
[150mg/L], pH 3.2
[150mg/L], pH 3.4
[150mg/L], pH 3.6
[200mg/L], pH 3.2
[200mg/L], pH 3.4
[200mg/L], pH 3.6



Wine calcium concentration in solution - ANOVA + Tukey
Wine Calcium concentration (mg/L)
0
50
100
150
200
250
300
A
A
A
A
A
A
A
A
A
70.6 ± 6.7
58.2 ± 12.3
48.2 ± 10.0
70.9 ± 10.0
59.7 ± 12.4
49.9 ± 10.9
75.8 ± 8.3
60.5 ± 10.5
49.1 ± 7.7
[Initial], pH 3.2
[Initial], pH 3.4
[Initial], pH 3.6
[150mg/L], pH 3.2
[150mg/L], pH 3.4
[150mg/L], pH 3.6
[200mg/L], pH 3.2
[200mg/L], pH 3.4
[200mg/L], pH 3.6

Key Findings

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- **Experiment 1 - Water Stress & Rootstock-Scion Effects on Metal Uptake and CaT Instability**
  - Mineral uptake responses to rootstock and water stress may be **cultivar-dependent**
  - Further studies needed such as in using **white grape cultivars**
- **Experiment 2 - Calcium movement from grape to wine**
  - Fermentation **negates** differences in grape must
  - **Slight** pH trend
  - Juice calcium seems **not predictive**

Acknowledgements

Stellenbosch University
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Universiteit

SAGWRI South African Grape and Wine Research Institute

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discover diversity in a glass

Thank you
Enkosi
Dankie