WINE QUALITY: YEAST SELECTION & DEACIDIFICATION

The Northern Grapes Project is funded by the USDA's Specialty Crops Research Initiative Program of the National Institute for Food and Agriculture, Project #2011-51181-30850

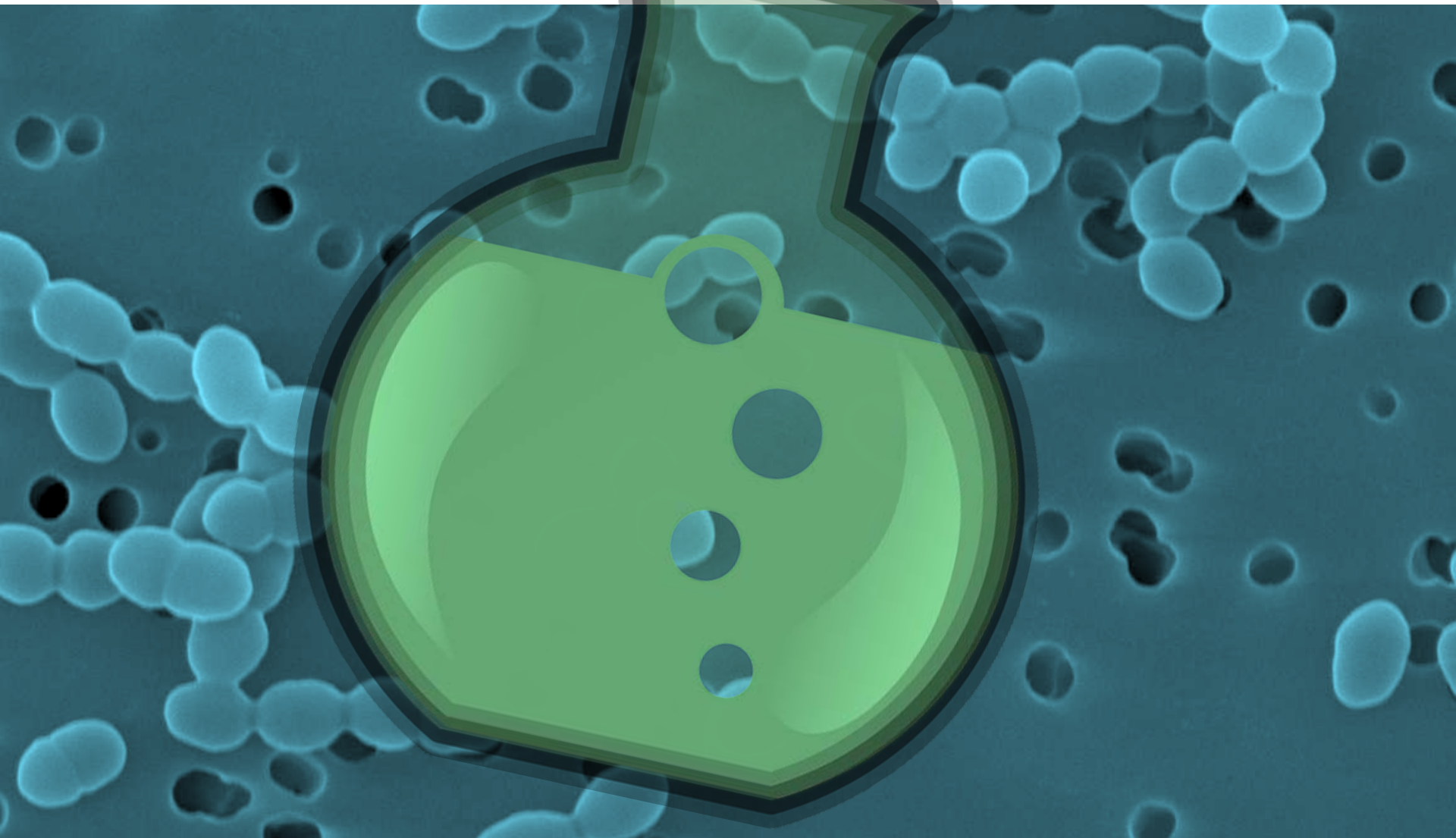
Anna Katharine Mansfield
Associate Professor of Enology
Cornell Enology Extension Lab

OBJECTIVES:

To achieve wine balance by reducing titratable acidity (TA)

To preferentially remove malic (rather than tartaric) acid.

DEACIDIFICATION METHODS



DEACIDIFICATION METHODS

- Biological
  - Malolactic fermentation
    - Malic acid conversion to lactic acid
  - Yeast demalication
    - Malic acid conversion to ethanol, succinic acid
- Chemical
  - Carbonate additions
    - Consumes tartaric acid
  - Double-salt additions
    - Consumes tartaric and malic?

YEAST DEMALICATION

Yeast	Malic Reduction	Sensory
ICV-GRE	18-25%	Melon, apricot
71B	33%	Esters; fruity
Lalvin C	45%	Neutral
SVG	25%	Citrus; spicy
Exotics	17%	Tropical fruit
Opale	0.1-0.4 g/L	Aromatic

2012 FRONTENAC GRIS

Yeast	Wine TA*	Wine Malic acid
DV 10	10	4.3
Lalvin C	9.1	23% 3.5
Exotics	9.6	15% 3.7
Exotics + *T. delbrueckii*	9.4	20% 3.5

*g/L TAE

2012 LA CRESCENT

Yeast	Wine TA*	Wine Malic acid
DV 10	9.9	4.8
Opale	9.4	4.7
Exotics	9.2	4.3
Opale + *T. delbrueckii*	9.4	4.7

12%

*g/L TAE

2014 LA CRESCENT

Yeast	°Brix	Juice pH	Juice TA*	Wine pH	Wine TA*
DV 10	22.7	3.0	15.4	3.2	13.5
71B				3.2	11.7
Lalvin C				3.2	12.2
SVG				3.2	12.7

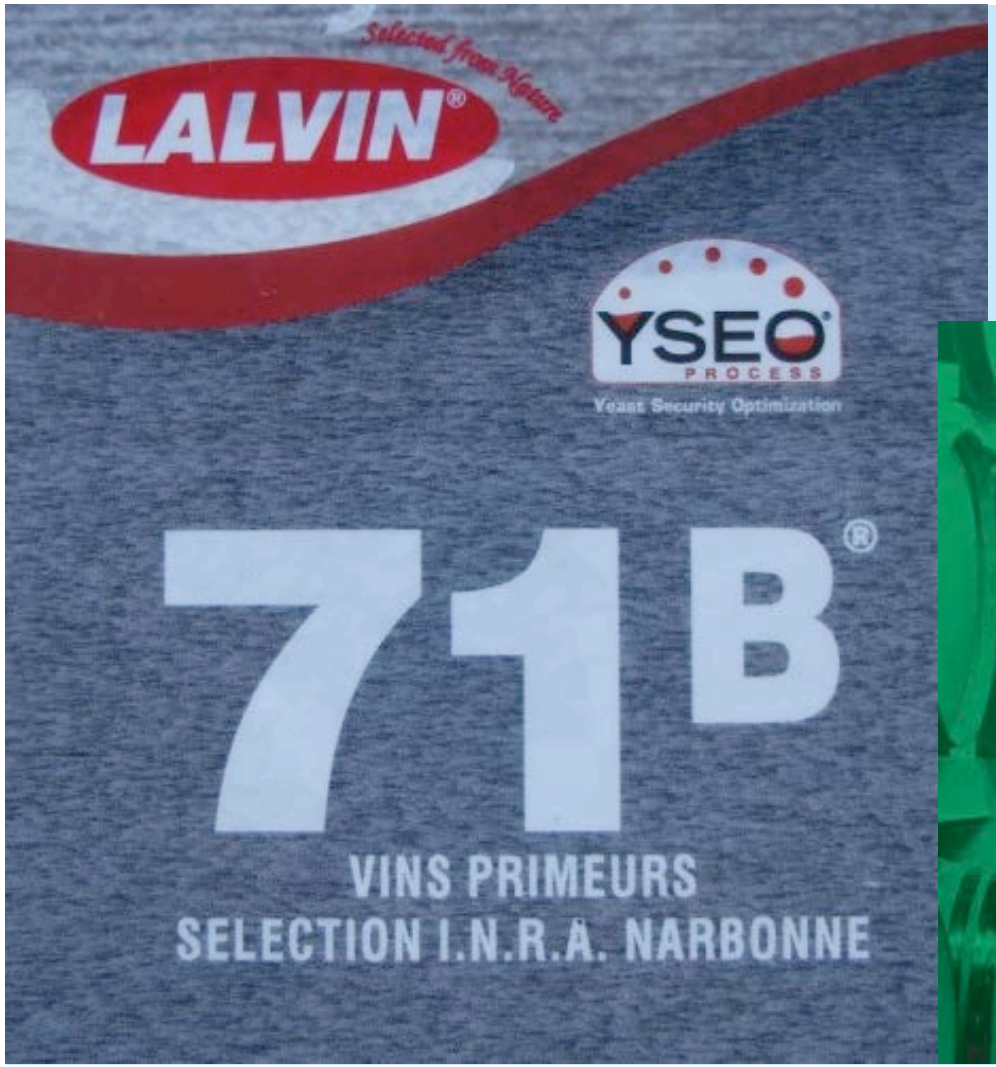
*g/L TAE

2014 FRONTENAC ROSÉ

Yeast	°Brix	Juice pH	Juice TA*	Wine pH	Wine TA*
DV 10	25	3.1	16.2	3.2	13.6
71B				3.2	12.4
Lalvin C				3.2	12.8
SVG				3.2	12.9

*g/L TAE

2014 FRONTENAC ROSÉ



1

2

3

CARBONATE ADDITIONS

- Neutralization through addition of:
  - potassium bicarbonate ($KHCO_3$)
  - calcium carbonate ($CaCO_3$)

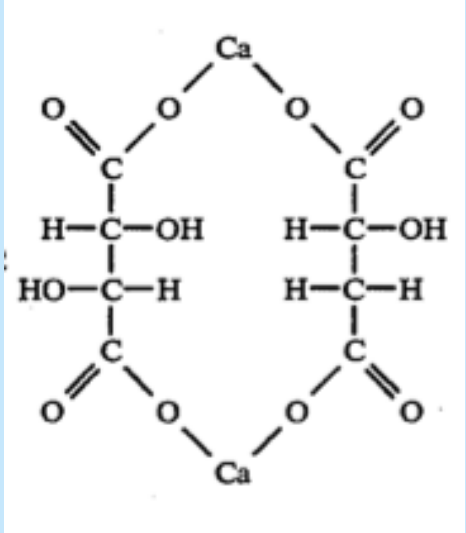
- Reacts with Tartaric acid (limiting factor)
- Malic acid not affected

CALCIUM CARBONATE ($CaCO_3$)

- Addition: 1 g/L ≈ 1.5 g/L drop in TA
- Pros:
  - Corrects very high acidity
- Cons:
  - Best used in juice/must
  - Saturates wine with calcium salt
    - bitter, chalky
  - Precipitates over long periods…very long periods

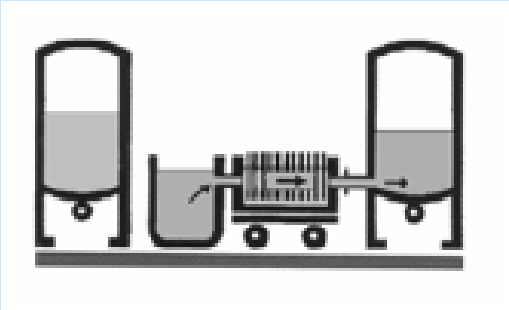
DOUBLE-SALT ADDITION

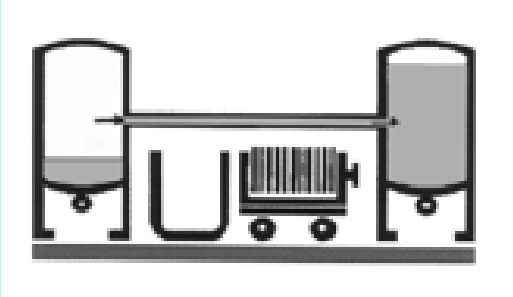
- **Claims:**
  - Larger acid reductions
  - Calcium carbonate completely consumed
    = no lingering instability
  - Removes both tartaric and malic acids
  - Acid reduction due to action of
    'double salt' – calcium tartro-malate



Can we use double-salt on high-malic wines?

DOUBLE-SALT ADDITION





Erbsöh

- **Measure TA and tartaric acid concentration.**
- Remove 1-5% total juice volume.
- Add calcium carbonate with constant stirring.
- Add calculated amount of tartaric acid + calcium carbonate with constant stirring
- Filter deacidified portion
- Return to tank with stirring

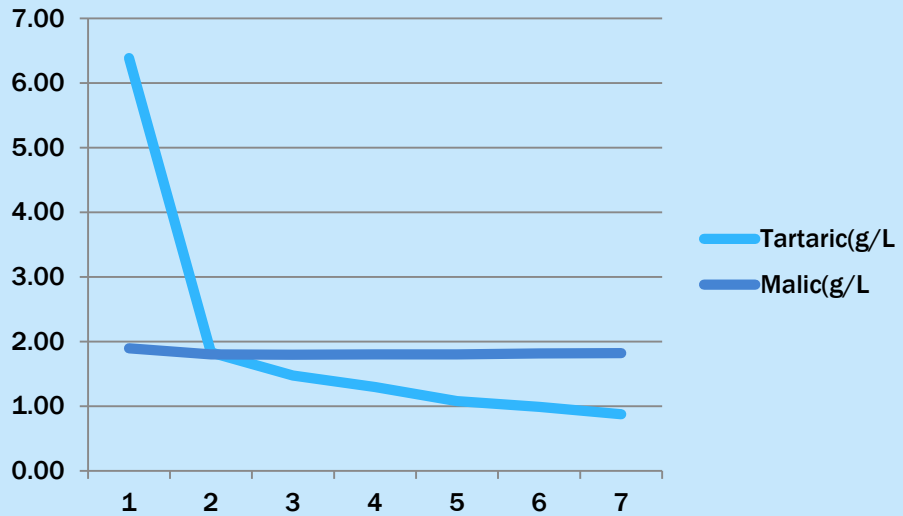
CHEMICAL DEACIDIFICATION

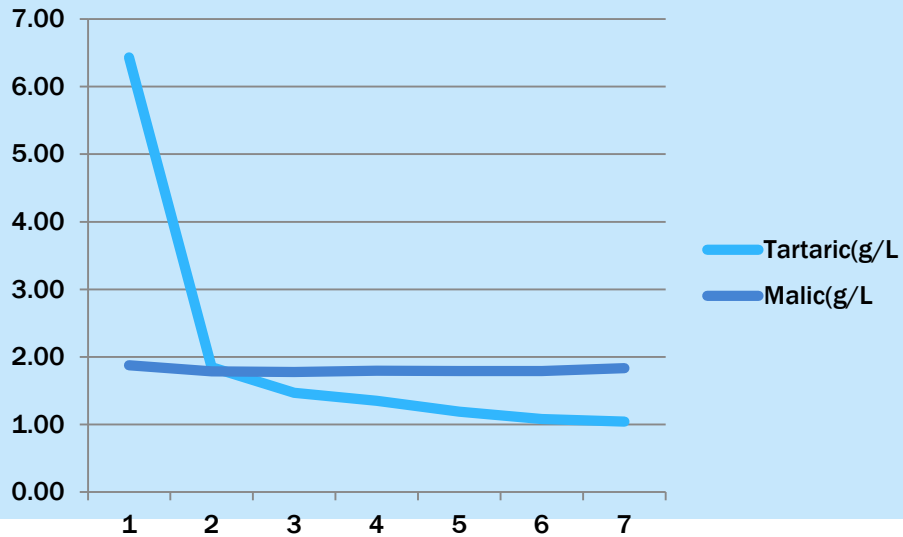
Explore preferential removal of malic acid through modified 'Double Salt' deacidification.

- Modeling trials
- Juice double-salt
- Wine double-salt

MODELING, SCENARIO 1

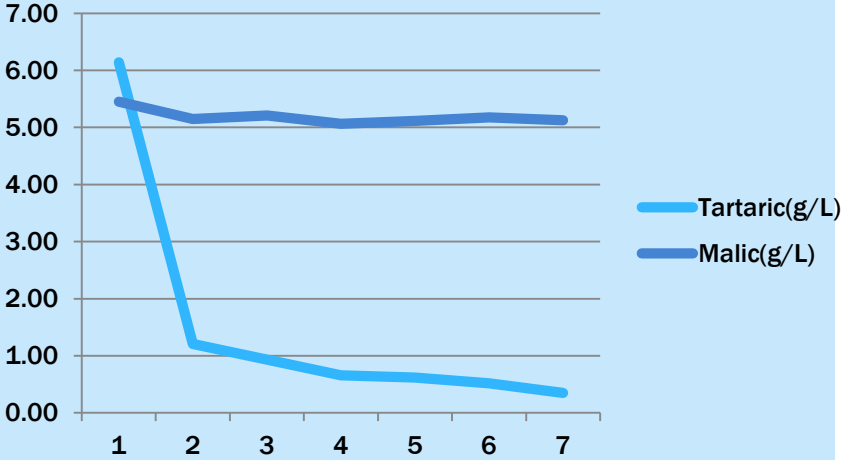
- Does order of operation matter?
  - Theory: adding juice to $CaCO_3$ will allow for a higher pH, favoring malic removal.
  - Compare "juice first" to "$CaCO_3$ first."

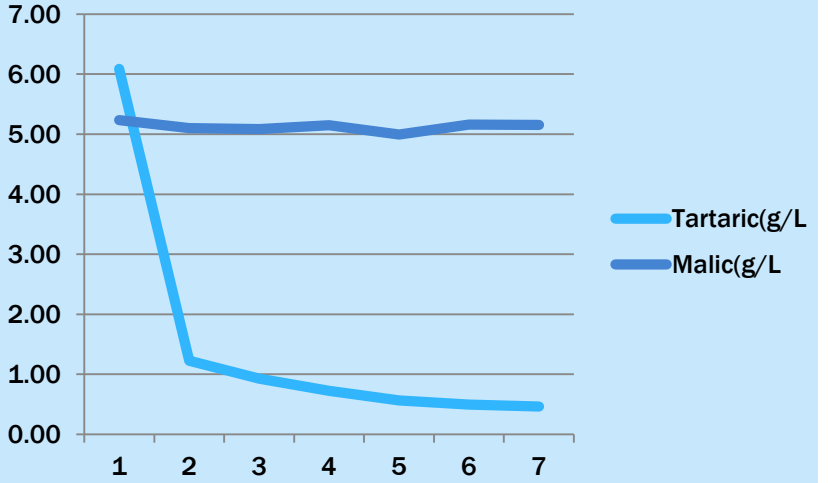




MODELING, SCENARIO 2

- Does relative concentration matter?
  - Theory: More malic acid will allow for better removal.
  - Add malic acid to create roughly 1:1 ratio.
  - Also compare order of operations as in Scenario 1.





FERMENTATION TRIALS

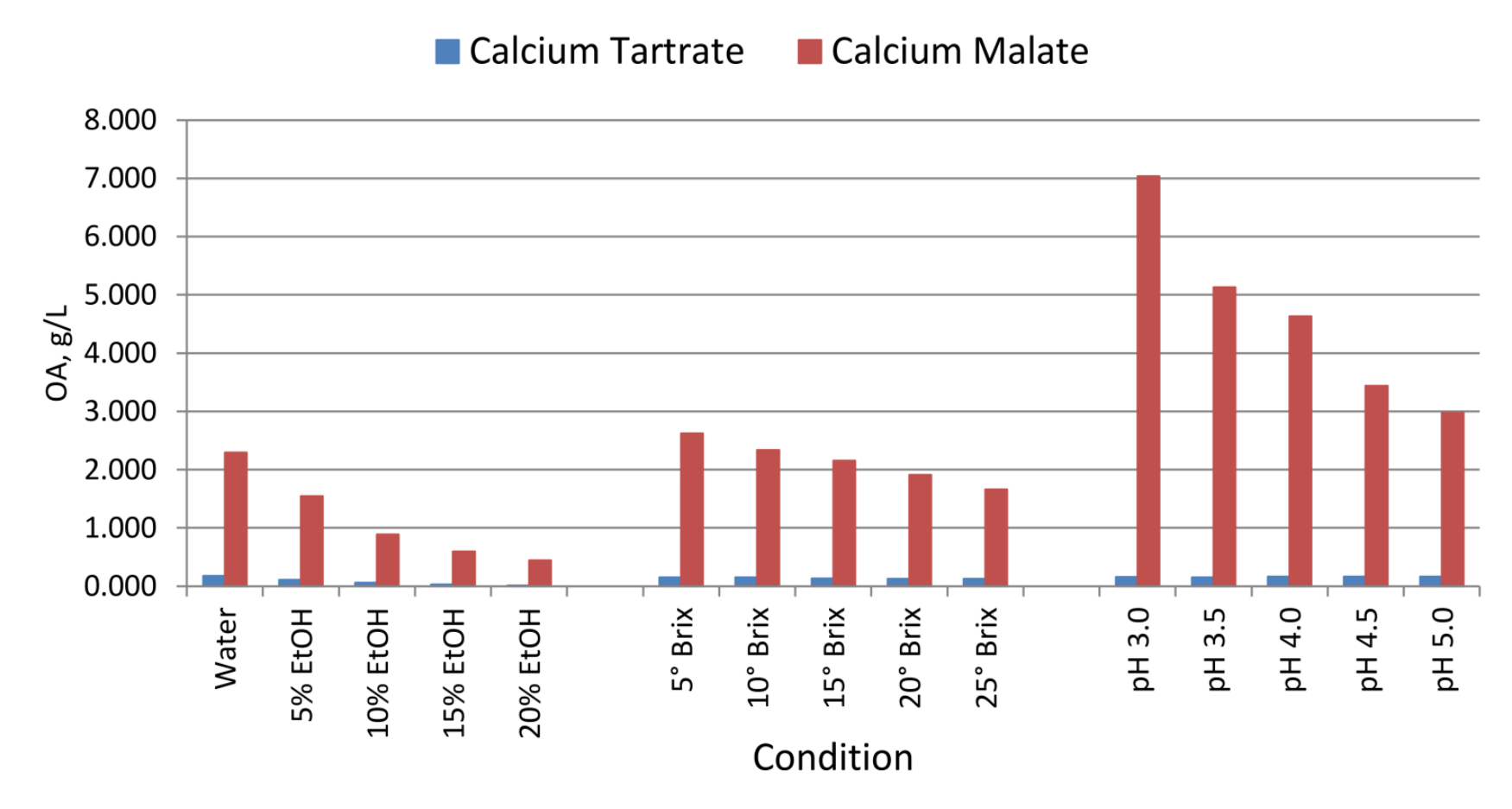
Juice at harvest

Cultivar	Brix	pH	TA	Tartaric	Malic
La Crescent	24.8	3.06	14.3	8.0	7.8
Front Gris	25.3	3.08	14.6	9.6	5.6

Wines following treatment & cold stabilization

Cultivar	pH	TA	Tartaric	Malic
La Crescent Control	3.10	11.9	2.8	7.1
La Crescent Deacidification	3.31	10.4	1.9	6.9
Frontenac Gris Control	3.06	11.8	4.0	5.5
Frontenac Gris Deacidification	3.24	10.1	2.6	5.6

PARAMETER TRIALS

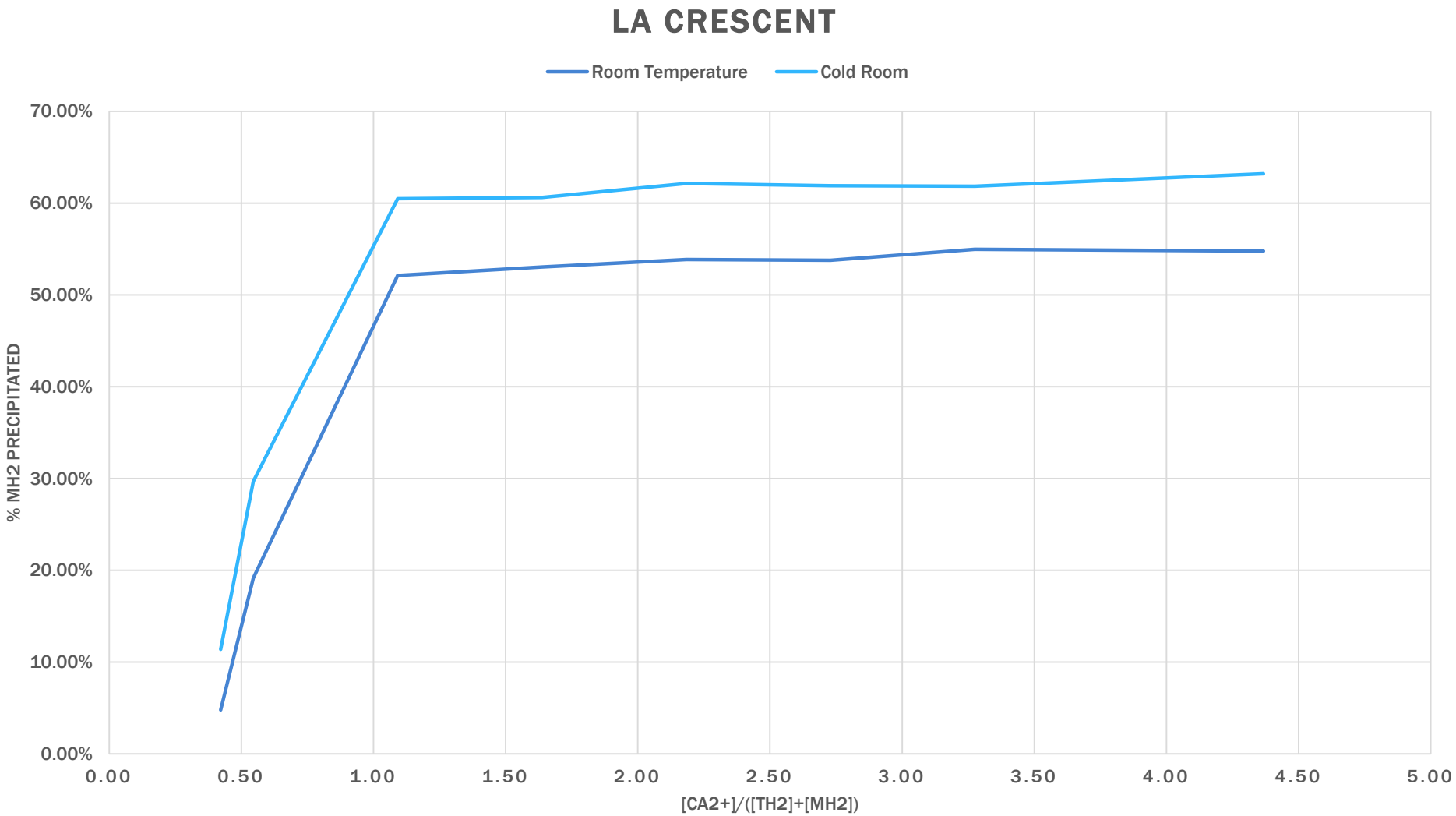


PARAMETER TRIALS

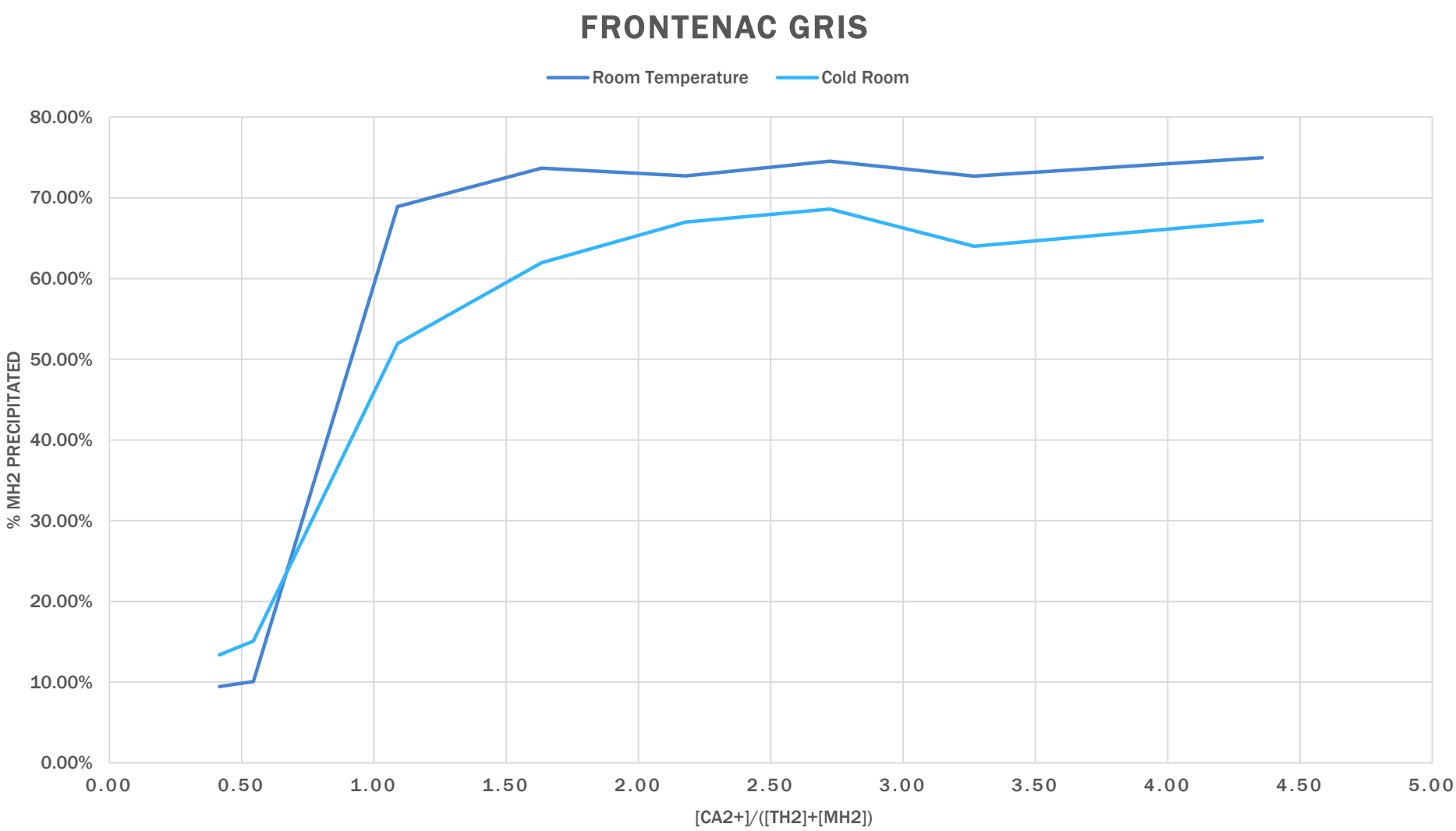
- Temperature (39°F & 70°F)
- % Ethanol (5-20)
- °Brix (5-25)
- pH (3-6)
- ratio of tartaric to malic acid

pH > °Brix > %EtOH

TEMPERATURE EFFECTS

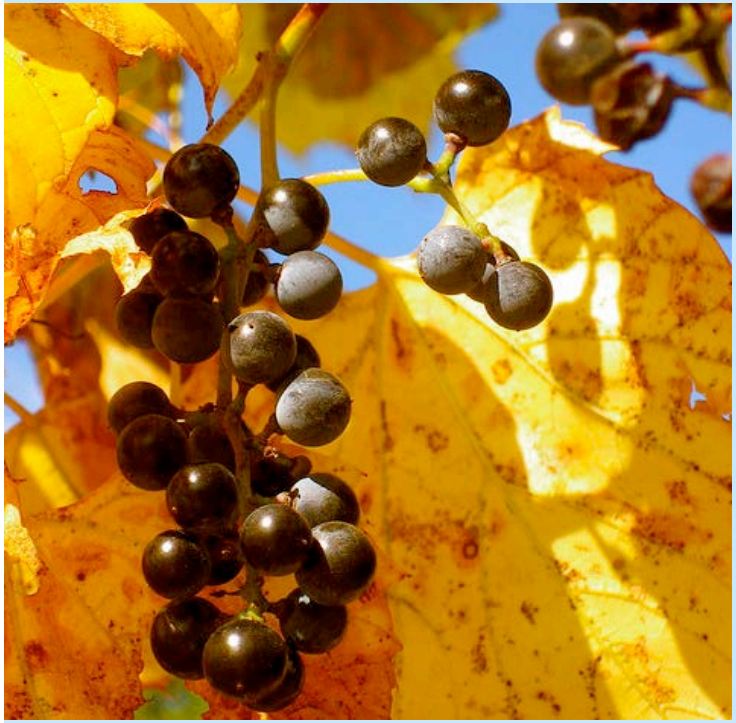


TEMPERATURE EFFECTS



CONCLUSIONS

- Demalication varies by yeast strain
- Lalvin C = temperature dependent



Wild riparia grapes, Chaska, MN

- Chemical deacidification driven by calcium malate solubility
- Temperature effects vary
- Consider wine additions

ACKNOWLEDGMENTS

- Chris Gerling
- Katie Cook
- Nick Smith
- Dr. David Manns
- Edmond Guidault
- Luann Preston-Wilsey
- Pam Raes