Biological De-acidification

WI Fresh Fruit and Vegetable Conference 2020

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April Petite Pearl Field Day

- 2019 WMARS
  - ~35 attendees and ~12 wines (Crimson Pearl)
- Next and final field day:
  - April 6, 2020 Ziegler Winery
- Contact me if you have Petite Pearl wine available for purchase

- Bob Borucki, has some small scale wine items available

De-acidification

- Acid Management Strategies

- Importance of de-acidification, and technical issues
- Types of de-acidification
- Review of chemical de-acidification
- Biological methods of de-acidification
- Multi-method approaches

Acid Reduction – Why Biological Methods?

- Many cool climate grapes exhibit:
  - Low pH
    - Some high pH, particularly in reds
  - High TA
  - High concentrations of malic acid
  - High levels of potassium
- Achieving desired acid balance in wine is complicated
- Every acid management option has some potential challenges and negatives

Acid Reduction

- Two general methods:
  - Chemical de-acidification
    - Carbonates, water, blending
  - Biological de-acidfication
    - Microbes, yeasts

Chemical Methods

- Review:
  - 3 main compounds used
    - Potassium Bicarbonate
    - Calcium Carbonate
    - Double Salts (Acidex)
  - Other options:
    - Amelioration
    - Blending
    - Masking, add more sugar

Chemical Methods

- Potassium Bicarbonate
  - Best for high acid low pH juices/musts
  - Reacts with tartaric acid to form potassium bitartrate
  - Will require cold stabilization
  - Increases malic acid ratio
  - Possible sensory impact
  - Easy to use
  - Limited based on pH and buffering capacity
    - Bench trials with pH measurement
  - 1 – 4 g/l reduction, depending on initial pH
    - Sensory issues

Chemical Methods

- Calcium Carbonate
  - Reacts with tartaric acid to form calcium tartrate
  - Often used in high pH high acid juice/musts
  - Difficult to stabilize
  - Increases malic acid ratio
  - Possible sensory concerns
  - Easy to use
  - Use pre-fermentation

Chemical Methods

- Double Salts (Acidex)
  - Still available?
  - Incorporates calcium malate tartrate
  - Partial precipitation of calcium tartrate
  - More complicated to use
  - Does it work?

Biological Methods

- Yeast – *Saccharomyces*
- Bacteria - MLB
- Yeast – *Schizosaccharomyces*

Biological Methods

- Yeasts
  - Certain strains capable of partial malic acid consumption
    - 71B, popular for cool climate hybrids
    - 71B has been seen to reduce overall TA by 0.5 to 2 g/L
    - Lalvin C
    - Maurivin B
    - ML01
- What are you using?

Biological Methods

- Yeast
  - Effectiveness varies
  - Use recommended fermentation temperatures and fermentation conditions
    - Accurate TA measurements

Biological Methods

- Bacteria
  - Using MLB, typically *O. oeni*, to convert malic acid to lactic acid via malolactic fermentation
  - Many different considerations
    - Strain
    - Timing
  - Style
    - Dry vs. sweet
    - MLF impact on wine character

MLF

- Use co-inoculation when minimal sensory impact is desired
  - Diacetyl management
  - Not functional where arresting fermentation is desired
    - Acid reduction takes places following AF
    - Cool temps inhibit MLB
- Analytical capability helpful
  - True of any biological method

Co-inoculation Considerations

- Red and White Wines
  - Must be able to ferment wine to completion
  - Use appropriate yeast/MLB combinations
  - Lower initial sulfur usage
  - Lower pH juice highly recommended

Co-inoculation Considerations

- White wines
  - Lower initial SO2 use, greater potential of browning
  - Best suited for dry wines
  - ML bacteria may need higher fermentation temperatures
  - May be problematic in high malic acid wines (La Crescent)
    - Large pH increase
    - Large production of lactic acid
  - Use Lysozyme on ML incomplete wines
    - Haze formation, La Crescent and Front gris have high levels of heat instability
  - Low pH wines may need a longer time delay before the addition of MLB

MLF and Sweet Wine

- Tricky!
- pH is critical
  - High pH requires high SO2
  - High pH in reds/rose impacts color
    - Bleaching, stability
  - MLB will consume:
    - Acids, sugars, and sorbate
      - Resulting in:
        - Diacetyl
        - Acetaldehyde
        - Acetic acid
        - Carbonated and gushing wine
        - Haze
        - Geranium taint

LALLEMAND

Table II: Yeast/Bacteria Compatibility

Compatibility*	MOST COMPATIBLE: 5	4	3	2	LEAST COMPATIBLE: 1
	++	+	+/-	-	-
Yeast Strain	QA23™ ICV D254® 71B® AMH™ W15™ VRB®	R2™ M2™ CY3079® RC212® 43® ICV GRE™ ICV D47™ CEG BC™ DV10™ L 2056® ICV D80® Rhône4600® R-HST®	EC1118™ PdM ICV D21® BDX™ BRL97™ CrossEvolution® BGY™ CSM™ RP15™ T306® Syrah™	RA17® L2226™ BM45™ BM4x4® BA11™	M1™ K1(V1116)™ ICV Opale®

http://www.practicalwinery.com/summer2011/ferment1.htm Nichola Hall, Scott Labs

Yeast, *Schizosaccharomyces*

- *S. pombe*, Pro-Malic
  - Normally considered a spoilage organism
  - Encapsulated in an alginate shell
  - Performs malo-ethanol fermentation
  - Utilizes some sugar
  - Increase in pH

  - Order well in advance of intended use (Scott Labs)

Yeast, *Schizosaccharomyces*

- Use:
  - Proper inoculation procedure
    - 30C incubation temperature
  - Benefits from some level of circulation
  - Low ethanol tolerance
    - Timing:
      - Promalic then alcoholic fermentation
      - Promalic, CI with alcoholic fermentation
      - Promalic, CI with alcoholic fermentation and MLF

Yeast, *Schizosaccharomyces*

- Use:
  - Timing
    - Pro-malic first
      - Appropriate SO_2
      - Regular monitoring and stirring
      - Be wary of oxidation in whites
      - Strict sanitation and observation of indigenous fermentations
      - Remove beads at desired time, then start alcoholic fermentation
  - *S. pombe* may produce off-flavors

Yeast, *Schizosaccharomyces*

- Use:
  - Co-inoculation with yeast
    - Add Pro-malic first, then add yeast 1 to 2 days later
    - Alcohol concentration will eventually inactivate ProMalic
    - Important to use yeast that will be compatible with Promalic and vice versa
      - QA23 has worked

Yeast, *Schizosaccharomyces*

- Issues:
  - Currently available in one quantity, relatively expensive
    - Should be used immediately or soon after opening
  - Contributes to alcohol content
    - Large malic acid reductions may cause small alcohol increases
  - Ability to measure and monitor TA, malic acid
  - Some increase in pH
  - Spoilage risk, oxidation

Yeast, *Schizosaccharomyces*

- Red Wine
  - Bead pores can become plugged
    - Re-energize
      - Remove beads and place in warm sugar solution for about an hour each day

Yeast, *Schizosaccharomyces*

- Malate reduction is possible and dramatic

Biological Methods, Considerations

- High malic acid
  - pH increase
  - High lactic acid concentrations
  - Sensory contributions
- Uncertain acid reduction results
- Slower results

Multi-Method Approaches

- Using multiple products and techniques to achieve desired acid concentration and balance
  - Common practices include k-bicarb after fermentation
- One objective is to reduce malic acid concentrations for improved biological deacidification

Multi-Method Approaches

- Malic acid metabolizing yeasts with MLF
  - Co-inoculation of 71B with Beta
- Partial Promalic, alcoholic fermentation, MLF

Questions?

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