Optimizing deacidification methods for cold climate cultivars

Geneva, NY

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Background and Rationale: Wines made from cold-hardy hybrid grapes often require significant deacidification to achieve stylistic goals. One method traditionally believed to produce significant acid reduction with minimal impact on other wine sensory characteristics is the so-called 'double-salt' deacidification. Unlike deacidification with potassium bitratrate or calcium tartrate, which remove only tartaric acid from the wine matrix, the double-salt method is alleged to remove both tartaric and malic acids. The kinetics behind this reaction, however, are poorly understood. A series of trials were completed in 2015 to determine the best modified double-salt method for malic acid precipitation in La Crescent and Frontenac gris.

Treatments:

Malic acid removal, bench-top trials:

- Calcium malate concentrations: 0.01 g/mL, 0.03 g/mL, 0.05 g/mL
- Ethanol concentrations: 5, 19, 15, 20%
- Concentration soluble solids: 5, 10, 15, 20, 25°Brix
- pH: 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0
- Temperature: 4 & 21°C

Malic acid removal, wine trials:

- 8 concentrations of calcium carbonate ($CaCO_3$)
- 2 treatments with calcium carbonate followed by tartaric acid addition
- 2 treatments of $CaCO_3$ additions stirred for 8 hours, and then resting for 12 hours
- 1 treatment with $CaCO_3$ addition to the wine
- 4 treatments with $KHCO_3$ addition to reach pH 5.1 followed by different concentrations of CaCl

Methods: All benchtop samples were analyzed for tartaric, malic, and lactic acid concentrations via high pressure liquid chromatography (HPLC) 23 hours after treatment; wine samples were analyzed 8 and 20 hours after treatment.

Results: The limiting factor in malic acid removal is solubility of calcium malate. In benchtop trials, pH had the greatest impact on solubility, followed by concentration of soluble solids and ethanol. Temperature had some effect, but no major trends were observed. In wine trials, initial ratios of malic to tartaric acid had a greater impact on percent malic removed than cultivar or temperature. With the cultivars tested, an initial addition of calcium carbonate, followed by a tartaric acid addition after complete precipitation of endogenous tartaric acid, resulted in the most efficient malic acid removal. This method was used for a scaled-up wine trial with both La Crescent and Frontenac gris at ambient temperature (21°C) and in cold storage (4°C). It is notable that malic acid

loss was slightly higher at 21°C in Frontenac gris, but at 4°C in La Crescent (Figures 1 & 2.) Data analysis of consumer sensory studies of both wines is underway.

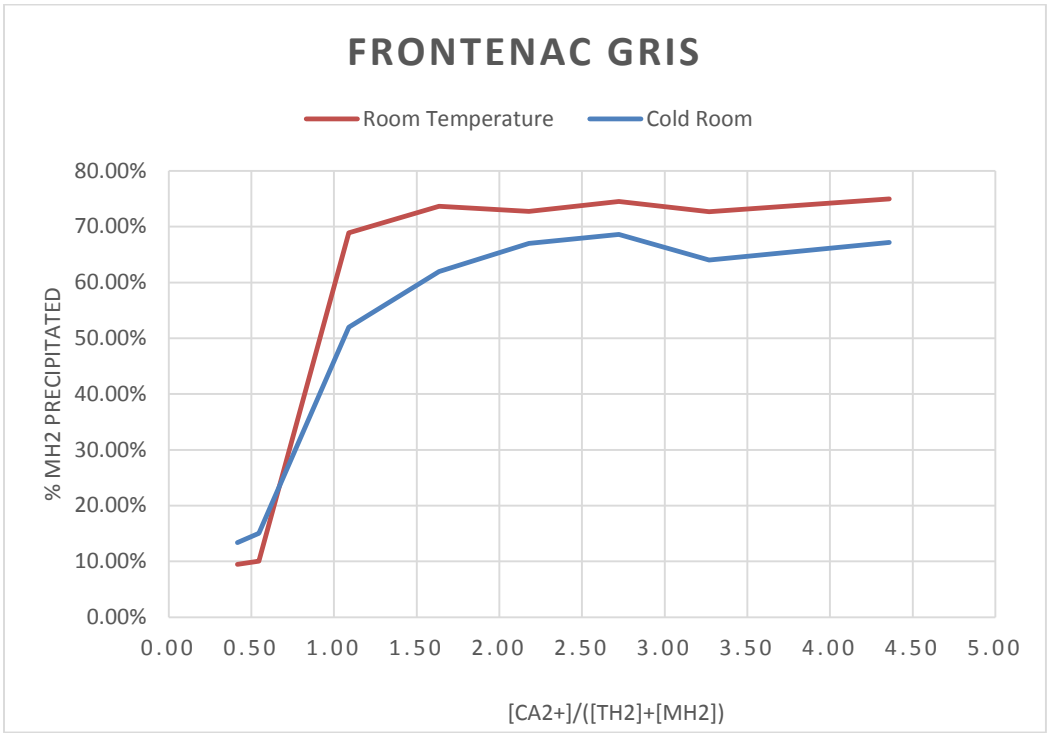

Figure 1: Percent precipitation of malic acid in Frontenac gris wine at room temperature and in cold storage

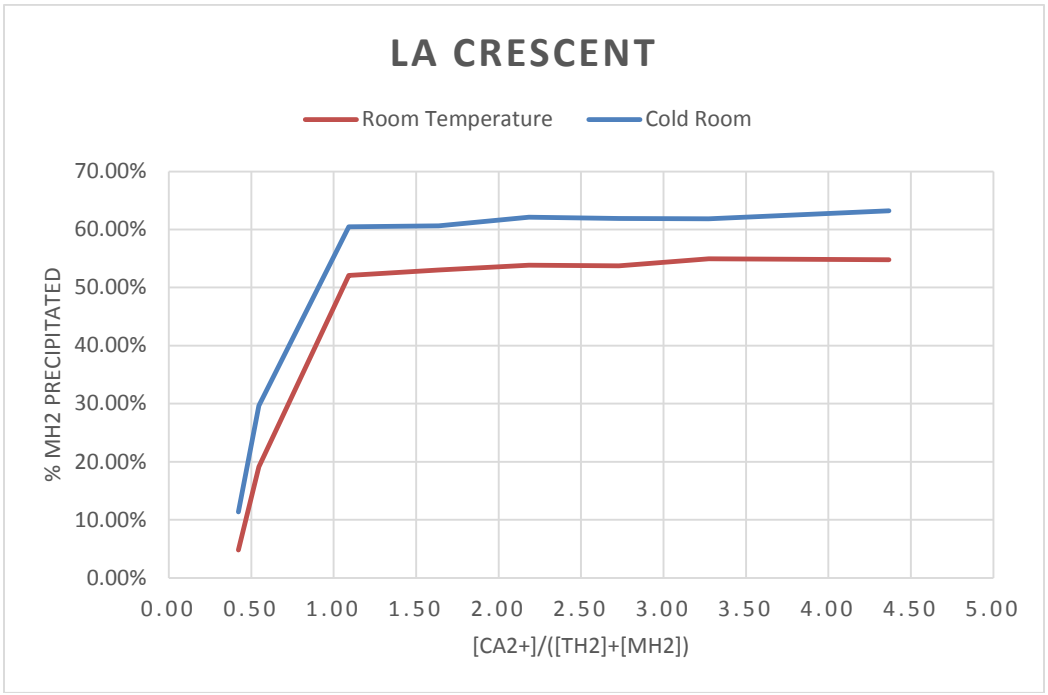

Figure 2: Percent precipitation of malic acid in La Crescent wine at room temperature and in cold storage

What the results mean:

- Of all variables studied, pH had the greatest impact on malic acid precipitation.
- The impact of temperature on precipitation is variable, though further statistical analysis is underway.
- None of the methods studied allowed preferential removal of malic acid.