ACID MANAGEMENT AND ADJUSTMENT

TERMS AND DEFINITIONS
pH vs. TA (titratable acidity)
 TA is approximately amount of acid in wine (slightly less than total acidity).
 Measured as percent or grams/L.
 pH is a measure of dissociated protons: strength or effectiveness of acid.
 Measured as the negative log of the moles of hydrogen ions (H⁺)/L.
 1/10³ = 10⁻³ = pH 3. The lower the pH, the stronger the acid.

Strong Acid vs. Weak Acid
 Strong acid—complete dissociation of protons (H⁺).
 Weak acid (all organic acids)—partial dissociation of protons.
 Acid group COOH → COO⁻ + H⁺

Buffer Capacity (see illustration)
 Definition: amount of OH⁻ or H⁺ to obtain change of one pH unit.
 Ability of solution to keep constant pH.
 Testing for buffer capacity.

PH AND ACID IN WINE
 All acids in wine are weak: tartaric, malic, citric, lactic, acetic, succinic.
 Tartaric and malic most common.
 Malic may be higher in short season and/or cool climate.
 Wine pH range generally 3.0-4.0.
 Low pH generally associated with high acid, cool climate.
 High pH generally associated with low acid, warm climate.
 Nightmare situation: high acid and high pH, exacerbated by high potassium.
 Very low pH and high acid corrected by deacidification (carbonate or Acidex).
 High pH and low acid corrected by acidification.

EFFECTS OF PH
Low pH.
 Anti-microbial protection.
 Makes SO₂ more effective as anti-microbial agent (see SO₂/pH chart).
 Moves color toward red.
 Very low pH (<pH 3.1) may inhibit fermentation and MLF.
 <3.65, pH remains stable or lowers with potassium bitartrate precipitation.

High pH
 More susceptible to microbial infection.
 SO₂ less effective as anti-microbial agent.
 Moves color toward blue.
 >3.5, lactic acid bacteria more apt to produce VA.
 >3.65, pH moves up with potassium bitartrate precipitation.
ACIDIFICATION OF HIGH PH WINES

Used to lower pH, brighten flavors, help structure.
Tartaric acid used at juice stage.

Tartaric is strongest of grape acids with greatest impact lowering pH.
[Strength of grape acids: 1) Tartaric, 2) Malic, 3) Citric].
[Perception of sour: 2) Malic, 2) Tartaric, 3) Citric].

If high addition is needed, some prefer tartaric/malic combination.

Inexact rule: one gram/L tartaric acid addition results in 0.1 pH drop.

Depends on pH buffer.

Post-fermentation addition:
Tartaric acid—most effective lowering pH, but increases potential tartrate instability.
Citric acid—will not form insoluble crystals, but may add citrus character and be substrate for bacteria.
Malic acid—higher acid perception; will not form insoluble crystals at wine pH; needs sterile filtration because it is substrate for bacteria.

DEACIDIFICATION IN HIGH ACID WINES

Carbonates (removal of tartaric acid)
Potassium bicarbonate (removal of H⁺ and KHT).
Used for low pH, high acid wine/juice.
Neutralizes H⁺; potassium creates insoluble potassium bitartrate.
Reduction of 1.0 g/L TA requires 0.9 g/L potassium bicarbonate.

Calcium carbonate (removal of H⁺ and CaT).
Used for high pH, high acid wine/juice (Zoecklein et al, Wine Analysis...).
May create calcium tartrate crystals, which are hard to control.
Reduction of 1.0 g/L TA requires 0.62 g/L calcium tartrate.

Double Salt Deacidification (removal of tartaric and malic acids)
Calcium carbonate mixed with calcium tartrate and calcium malate.
Carbonate raises pH above 4.5, followed by calcium malate and tartrate precipitation.
Theoretically, maintains original tartrate/malate ratio.

Malolactic Fermentation
Bacterial conversion of malic to lactic acid, lowering TA and raising pH.

Malic-consuming Saccharomyces
Certain Sacch. species convert malate to ethanol (e.g., 71B, Enoferm C, Exotics).

Schizosaccharomyces pombe
Converts malic acid to ethanol (used in combination with Saccharomyces).

Cold stabilization
Drops out potassium bitartrate crystals (potassium⁺ + bitartrate anion⁻).
Lowers TA.
At pH <3.65, may lower pH to follow equilibrium curve.
At pH >3.65, may raise pH to follow equilibrium curve.

Other: ion exchange, electro-dialysis.