Making Wine with Northern Grapes

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Issues:

- High color
- Low tannins
- Hybrid character
- High/low soluble solids
- High titratable acidity
Basic Winemaking Philosophy:

Interfere as little as possible.

Source: wikipedia.com
Basic Winemaking Philosophy:

• Wine should reflect varietal
  – Trueness to type
• Practice good science:
  – Try one treatment at a time
  – Perform small-scale trials
Phenolic compounds

- Flavonoids
  - Anthocyanins
- Tannins
- Measurement?
Color

• Anthocyanins (Flavonoids)
  – Cyanidin, peonidin, delphinidin, petunidin, malvidin
    • Blue $\rightarrow$ red (degree of methylation)
  – Mono- and di- glucosides
Color

• Red grapes with *V. riparia* ancestry
  – Colored pulp
  – Blue or purple tint to color
    • Anthocyanins
      – types, glucosides?
  – Aging
    • Little change
High Color

• Decrease skin contact
  – 3-5 days for reds; no skin contact for rosés
  – Tannin extraction

• Filtration
  – Tight depth filter (polishing filter)
    • Lightens color w/o changing hue
  – DE
High Color

• Fining
  – Activated carbon
    • Strips color
    • Flavor stripping and off-flavors
  – Gelatin
    • Removes larger polymeric pigments
      – Shifts hue → ruby
    • Lowers astringency
High Color

• Marketing
Low Color

- Blending
- Co-fermentation
Low Tannins

- Oak aging
  - Vanilllin, lactones
  - Barrels, staves, chips, etc.
- Tannin addition
  - Enological tannins
  - Add as early as possible
  - ‘stick out;’ disharmonious
Hybrid Character

• Herbaceousness, foxiness
  – Saint Croix, Sabrevois, Edelweiss, Frontenac (early)
• Proper viticultural practices
  – Harvest time
• Yeasts?
• Malolactic fermentation
Soluble Solids

• Issues:
  – *V. riparia* offspring: 23-29°Brix
  – White Swenson cultivars: 16-18°Brix

• Amelioration or Chapitalization
  – Pre- or post fermentation?

• Reserving juice

• Trials
  – Sensory evaluation
Soluble Solids and Acid

*In general, perceived balance in wines can be expressed as:*

Sweetness $\leftrightarrow$ Acidity + Astringency + Bitterness

- Sugar and ethanol mute acids, increasing acid thresholds
- Phenols may enhance acidity, decreasing acid thresholds
Acids in Grapes

- Tartaric acid
  - 2-19 g/L in must (5-10 g/L *V. vinifera*)
  - 1/3 to ¼ of acid found in wine
  - Concentration cultivar dependent
  - Affected little by yeast, LAB
Acids in Grapes

- **Malic acid**
  - 1-8 g/L in must (2-4 g/L *V.vinifera*)
  - Concentrations dictated by cultivar and temperature
  - Fermentation reduces concentrations 20-30%
  - Completely consumed in malolactic fermentation
Wine Acids: Measurement

• Why measure both pH and TA?
• Musts and wines act as buffer solutions (musts >> wines)
• Thus, changes in acidity may not result in changes in pH
• Variability due to degree of maturity, cultivar, crop level, season, soil moisture and mineral composition
pH: Importance

• Affects chemical reactions, physical properties and microbial stability of juice and wines

• Can affect perception of ‘freshness,’ ‘greenness,’ or ‘thinness’ of wines

• Wine pH generally ranges from 2.8 – 4.0

• pH 3.7-3.9 may affect palate structure

• pH > 3.8 may encourage microbial growth
Titratable Acidity: Importance

• Considerable sensory impact
  – Saliva in mouth partially titrates acidity (bicarbonate ions)
  – Saliva flow increases in proportion to neutralization required

• Wine TA: 4-17 g/L
### pH and Titratable Acidity

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- Leave alone or acidify
- Deacidify, protect pH
- Leave alone or deacidify
Acid in Cold-Climate Grapes

- Cultivars with *V. riparia* ancestry (tartaric)
- Climatic effects
  - Lower respiration rates (malic, tartaric to lesser extent)
- Viticultural practices
- Aging potential
- Aroma/flavor

Frontenac gris at the HRC.
Photo by Peter Hemstad
Methods of Deacidification

- **Biological**
  - Viticultural practices
  - Carbonic maceration
  - Yeast metabolism
  - Malolactic conversion

- **Mechanical**
  - Amelioration
  - Blending

- **Chemical**
  - Cold stabilization
  - Carbonate additions
Deacidification: Viticultural

- Proper trellising
- Leaf pulling
- Cluster thinning
Yeast consume some malic acid during fermentation.

Yeast selection:
- Acid-reducing yeasts
  - 71B, Lalvin AC
- Schizosaccharomyces pombe
  - ProMalic (*lallemand*)
  - Uses malic acid in fermentation
  - May over-deacidify
Deacidification: Carbonic Maceration

• Fermenting whole grapes under CO₂ or N₂ gas
• Pros:
  – Malic acid decreased by up to half during maceration
• Other effects:
  – Distinct sensory character
• Cons:
  – May require equipment purchase
  – Reduced tannin extraction
Malolactic Fermentation: Theory

• At equivalent levels of acidity, perceived acidity varies:

  Most acidic

  Malic
  Tartaric
  Lactic

  Least acidic
Deacidification: Malolactic Fermentation

• Pros:
  – Complete conversion of malic acid to lactic acid
  – Complete degradation of citric acid
  – TA reduction equaling approx. ½ malic contribution
    • Change: 1-3 g/L in TA; 0.1-0.3 in pH
  – Favorable sensory changes
  – Protects wine against further microbial degradation
Malolactic Fermentation

• Cons:
  – Time and labor
  – ML cultures fastidious
  – Stuck MLF can result in severe off-odors
  – Reaction with potassium sorbate produces geranium note
Deacidification: Amelioration

- Addition of water, sugar
- **Pros:**
  - Increases product yield
  - Dilutes intense aroma, flavor, color
- **Cons:**
  - Dilutes aroma, flavor, color
  - Perceived reduction in body
  - TA reduction is unpredictable
- **Legal Considerations (TTB):**
  - Final fixed acidity $\geq 5$ g/L
  - Total allowable addition $\leq 35\%$ v/v
Deacidification: Blending

• Blending high acid and low acid wines
• Pros:
  – Easy
  – Fairly predictable
• Cons:
  – Biological and chemical stability may be affected
• Legal:
  – Label considerations
Deacidification: Cold Stabilization

- Precipitation of salts of tartaric acid
  - Potassium bitartrate
  - Calcium tartrate
- Soluble in water; less soluble in alcohol
- Solubility decreases in cool temperatures
- pH affects precipitation- max. at pH 3.7
Deacidification: Cold Stabilization

• Salt precipitation changes acid equilibrium:
  • pH < 3.65 = reductions in pH and TA
    – 1 proton generated for each molecule potassium bitartrate
    – pH reduction up to 0.2 units
    – TA decrease up to 2 g/L
  • pH > 3.65 = increase in pH; reduction in TA
    – 1 proton removed per tartrate anion precipitated
Deacidification: Cold Stabilization

- Precipitation of potassium bitartrate
  - 1 g/L reduction of TA for each 2.5 g/L formed
- Precipitation of calcium tartrate
  - Only occurs if calcium carbonate added
  - No reduction in TA
  - At pH 3.5-4, 0.2 reduction of pH possible
Deacidification: Carbonate Additions

- Neutralization by addition of potassium carbonate, calcium carbonate, or potassium bicarbonate
- Neutralizes tartaric acid
- Malic acid not affected
Deacidification: Carbonate Additions

• Pros:
  – Range of products- small to large corrections possible
  – Juice or wine corrections (based on product)
  – Relatively fast (K Bicarb)

• Cons:
  – Sensory effects
  – Different products needed for different levels of acidity
Cold Climate Grapes: Summary

• Is manipulation absolutely necessary?
• Test everything before making adjustments...then test again afterwards
• Proper viticultural practices essential
Winery Planning and Design Workshop & New Cold-Hardy Grape Cultivars

June 24-25, 2006
UM Landscape Arboretum

Registration opens 4 February 2006
Contact: UM Enology Lab

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