# Making Wine with Northern Grapes

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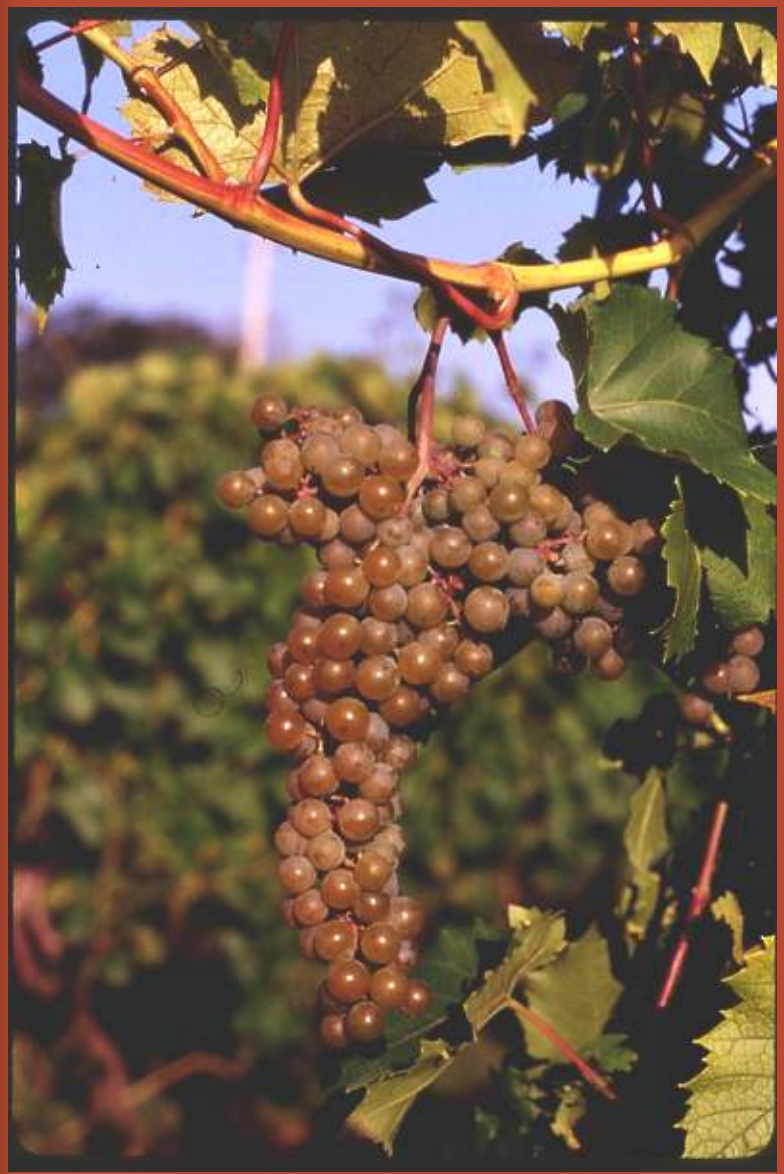
# Issues:



- **High color**
- **Low tannins**
- **Hybrid character**
- **High/low soluble solids**
- **High titratable acidity**

# Basic Winemaking Philosophy:

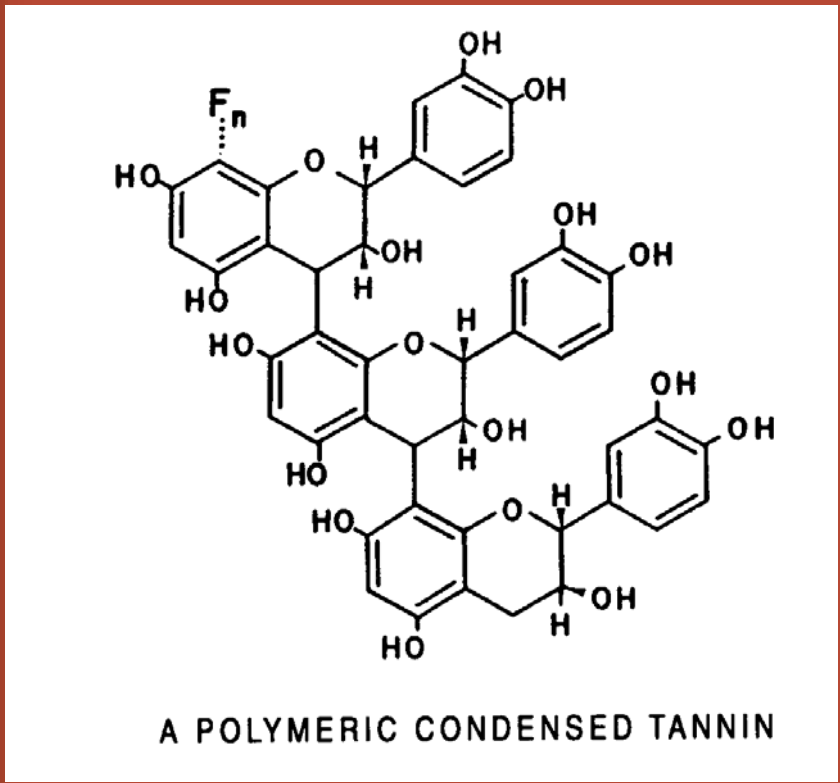
**Interfere as little as possible.**

*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**

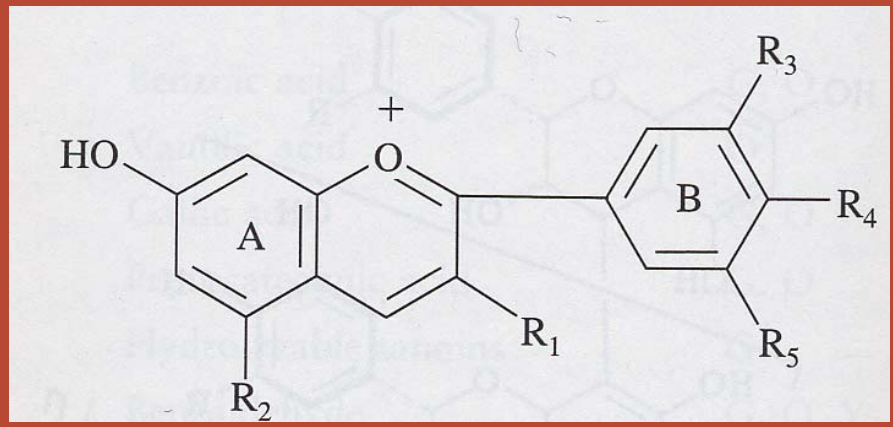
# Phenolic compounds




A POLYMERIC CONDENSED TANNIN

- **Flavonoids**
  - **Anthocyanins**
- **Tannins**
- **Measurement?**

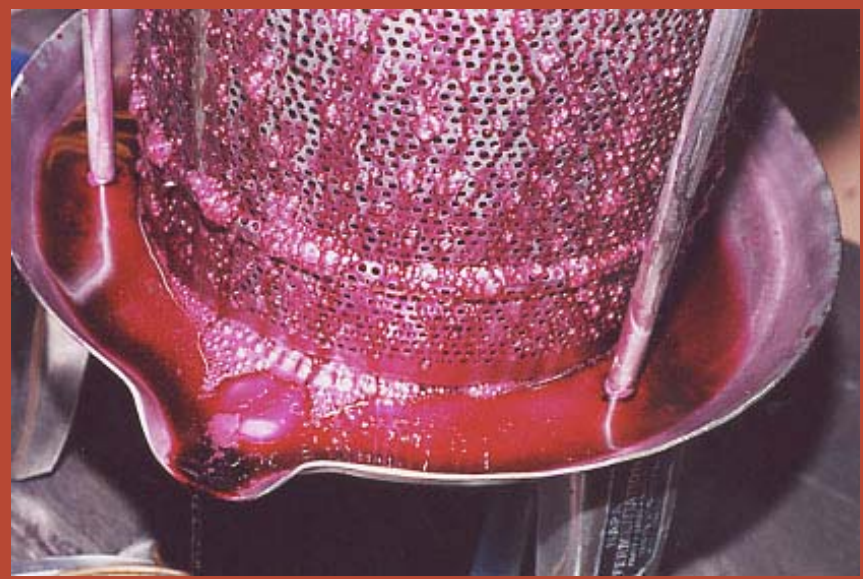
# Color




- **Anthocyanins (Flavonoids)**
  - **Cyanidin, peonidin, delphinidin, petunidin, malvidin**
    - **Blue → 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**
  - **Vanillin, 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

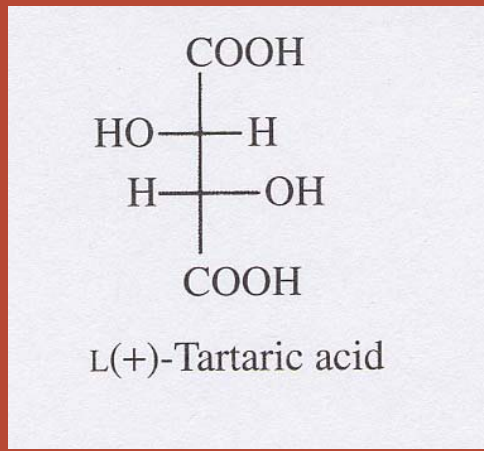
***In general, perceived balance in wines can be expressed as:***

**Sweetness ⟷ Acidity + Astringency + Bitterness**

- **Sugar and ethanol mute acids, increasing acid thresholds**
- **Phenols may enhance acidity, decreasing acid thresholds**

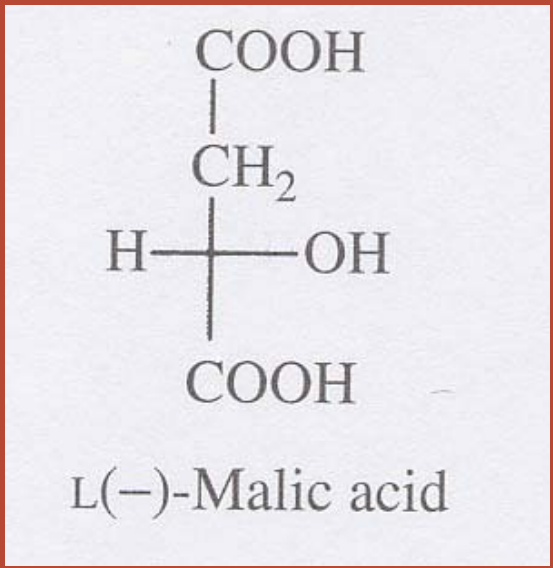
# Acids in Grapes

- **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**



L(+)-Tartaric acid

# 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

**Deacidify, protect pH**

**Leave alone or acidify**

| | |
|---|---|
| High pH<br>High TA | High pH<br>Low TA |
| Low pH<br>High TA | Low pH<br>Low TA |

**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**

# Deacidification: Yeast Metabolism

- **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 $CO_2$ or $N_2$ 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 ≥ 5 g/L**
  - **Total allowable addition ≤ 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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