Acid Management in the Vineyard

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Wine Grape Team

2008 Spring Workshop
Factors affecting acidity

- Variety
- Temperature (esp. during ripening)
- Shade/exposure
- Crop level/balance
- Plant nutrition/soil fertility/soil moisture
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Fruit Composition

• Organic Acids
  – tartaric, malic, citric, others
  – Ratio of tartaric to malic depends on variety and temperature during ripening (0.6 to 3.4)
  – Breakdown of malic acid during ripening accounts for decreasing titratable acidity
    • High temps = low TA, esp. malic acid levels
  – Tartaric acid is converted to $K^+$ salt forms (Extent of Exchange) which causes pH to increase
## Effect of Variety

<table>
<thead>
<tr>
<th>Variety</th>
<th>Harvest Date</th>
<th>Yield lb/vine</th>
<th>Clst Wt (g)</th>
<th>Berry Wt (g)</th>
<th>SS</th>
<th>pH</th>
<th>TA</th>
<th>PW (lb)</th>
<th>Crop Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontenac</td>
<td>9/17</td>
<td>7.2*</td>
<td>78.1</td>
<td>1.0</td>
<td>22.1</td>
<td>3.28</td>
<td>1.73</td>
<td>0.9</td>
<td>9.5</td>
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<tr>
<td>Frontenac Gris</td>
<td>9/15</td>
<td>8.3</td>
<td>84.7</td>
<td>1.1</td>
<td>24.3</td>
<td>3.38</td>
<td>1.37</td>
<td>0.9</td>
<td>11.2</td>
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<tr>
<td>LaCrescent</td>
<td>9/6</td>
<td>11.5</td>
<td>84.3</td>
<td>1.2</td>
<td>22.3</td>
<td>3.46</td>
<td>1.22</td>
<td>1.3</td>
<td>9.9</td>
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<tr>
<td>Marquette</td>
<td>9/10</td>
<td>5.6*</td>
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<td>1.0</td>
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<td>3.38</td>
<td>0.95</td>
<td>1.0</td>
<td>6.4</td>
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<tr>
<td>Cayuga White</td>
<td>9/5</td>
<td>23.8</td>
<td>148.1</td>
<td>2.7</td>
<td>18.9</td>
<td>3.21</td>
<td>0.92</td>
<td>1.0</td>
<td>24.0</td>
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<tr>
<td>Chardonel</td>
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<td>14.2</td>
<td>146.2.</td>
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<td>22.4</td>
<td>3.23</td>
<td>0.94</td>
<td>0.7</td>
<td>24.2</td>
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<tr>
<td>Seyval</td>
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<td>10.6</td>
<td>110.5</td>
<td>1.7</td>
<td>21.8</td>
<td>3.36</td>
<td>0.75</td>
<td>0.5</td>
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<td>Vidal</td>
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<td>23.4</td>
<td>3.26</td>
<td>0.77</td>
<td>1.0</td>
<td>19.5</td>
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<tr>
<td>Vignoles</td>
<td>9/22</td>
<td>7.1</td>
<td>89.9</td>
<td>1.2</td>
<td>24.4</td>
<td>3.31</td>
<td>1.04</td>
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<td>14.0</td>
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<td>Foch</td>
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<td>7.8</td>
<td>53.1</td>
<td>0.9</td>
<td>23.1</td>
<td>3.35</td>
<td>0.89</td>
<td>0.8</td>
<td>13.7</td>
</tr>
<tr>
<td>Norton</td>
<td>10/1</td>
<td>8.1*</td>
<td>61.6</td>
<td>1.0</td>
<td>23.2</td>
<td>3.28</td>
<td>1.09</td>
<td>1.4</td>
<td>5.9</td>
</tr>
<tr>
<td>Corot noir</td>
<td>9/17</td>
<td>17.5</td>
<td>143.3</td>
<td>2.2</td>
<td>18.9</td>
<td>3.46</td>
<td>0.61</td>
<td>1.2</td>
<td>14.6</td>
</tr>
<tr>
<td>Noiret</td>
<td>9/29</td>
<td>14.3</td>
<td>143.7</td>
<td>2.1</td>
<td>19.8</td>
<td>3.20</td>
<td>0.67</td>
<td>2.5</td>
<td>5.7</td>
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<tr>
<td>Steuben</td>
<td>9/23</td>
<td>21.1</td>
<td>177.8</td>
<td>3.2</td>
<td>20.2</td>
<td>3.43</td>
<td>0.47</td>
<td>1.0</td>
<td>21.1</td>
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</table>

(Throckmorton Purdue Ag Center 2002-2006)
Interaction of Variety Ripening Season and Temperature

Fruit quality is best when ripened under warm days and cool nights

- Early ripening grapes in a long season, hot area:
  Excess heat (especially night temps >60˚F)
  Low sugar, low acid, high pH, poor color, poor flavor & aroma
- Late ripening grapes in a short season, cool area:
  Insufficient heat (especially daytime temps <70˚F)
  Low sugar, high acid, low pH, unripe herbaceous flavors
- Some varieties have a tendency for high pH and high TA
  • GR-7 (Laf) pH: 3.55 TA: 0.90
  • St Croix (Laf) pH: 3.42 TA: 1.09 (SWPAC) pH: 3.57 TA: 1.04
  • LaCrescent (Laf) pH: 3.46 TA: 1.22
## Relative Time of Ripening

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early</strong></td>
<td>Foch, Leon Millot, Marquette, St. Croix, Valvin Muscat, Vignoles*</td>
</tr>
<tr>
<td><strong>Mid</strong></td>
<td>Frontenac, LaCrescent, Seyval, LaCrosse, Chardonel, Cayuga White, Vignoles, DeChaunac, Traminette, Noiret, Corot noir, etc.</td>
</tr>
<tr>
<td><strong>Late</strong></td>
<td>Chambourcin, Norton, Vidal, Cabernet sauvignon, Cabernet franc</td>
</tr>
</tbody>
</table>
Harvest Dates

- **Northern Indiana**:
  - Early varieties: Mid-September
  - Mid varieties: Late September
  - Late varieties: Mid-October?

- **Central Indiana**
  - Early varieties: Late August
  - Mid varieties: Mid-September
  - Late varieties: Early October

- **Southern Indiana**
  - Early varieties: Mid-August
  - Mid varieties: Late August
  - Late varieties: Mid-September
Appropriate Harvest Decisions

- Sugar, acid and pH?
- Flavor, aroma?
- Skin and seed maturity?

- Problem with MN varieties and high acidity.
  - As we wait for TA to drop, flavors are lost, fruit shrivels…

- Problem with NY varieties: low sugar and acid
  - What guidelines will be used to harvest these? pH?
Effect of Sun & Shade on Acidity

• TA
  – Excessive exposure of clusters leads to low TA
  – Shaded canopy leads to low TA
  – Shaded clusters leads to high TA

• pH
  – Shaded canopy (3+ leaf layers) leads to high pH
  – Well exposed canopy (1-2 layers) leads to low pH
High Cordon Training
Downward shoot positioning is critical to reducing shading of the cordon.
Shading is a major concern
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Effect of Crop Load on Acidity

• TA
  – High crop load (>10) leads to high TA
  – Low crop load (<5) leads to low TA

• pH
  – High crop loads (>5) leads to low pH
  – Low crop loads (<5) leads to high pH
Soil and Plant Nutrition

- Soils deficient in K\(^+\) lead to plant health problems (poor growth, reduced cold hardiness, increased disease susceptibility, etc)
- K\(^+\) levels in soils are indirectly related to K\(^+\) levels in plants
- Excess K\(^+\) in soils will not lead to excess K\(^+\) levels in plants
  - Active uptake, enzyme site saturation
- Large rootstock effect
  - *V. champinii* (Ramsey, Dogridge, Freedom, Harmony) increase K\(^+\) up to 2x
- Soil pH can be important
  - K is less available at low soil pH
  - High K and high pH can lead to excess K and Mg deficiency.
- Soil moisture is important… K\(^+\) must be in solution for uptake
# Nutrient Availability and Soil pH

<table>
<thead>
<tr>
<th>strongly acid</th>
<th>medium acid</th>
<th>slightly acid</th>
<th>very slightly acid</th>
<th>very slightly alkaline</th>
<th>slightly alkaline</th>
<th>medium alkaline</th>
<th>strongly alkaline</th>
</tr>
</thead>
<tbody>
<tr>
<td>nitrogen</td>
<td>phosphorus</td>
<td>potassium</td>
<td>sulphur</td>
<td>calcium</td>
<td>magnesium</td>
<td>iron</td>
<td>manganese</td>
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<td>boron</td>
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Summary

• Managing Acidity in the Vineyard:
  – Variety effects
  – Temperature effects (matching variety to site)
  – Shading effects (training, canopy management)
  – Crop load effects (pruning to balance)
  – Soil nutrition, K⁺ availability
  – Combined effects of each….

• Vineyard management should take into account each of the variables above and address them as needed.