Effect of Rootstock on Norton Nutrient Status

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Norton (*Vitis aestivalis*)

- Most widely planted grape in Missouri
- Discovered in 1835 near Richmond, VA
- State grape of Missouri
- Small clusters
- Small blue-black berries
- High disease resistance
- Cold tolerance
- Late budburst
- Produces high quality wine
Challenges of Growing Norton Grapevines

- Excessive vegetative growth
- Lower yields
- Intolerance to high pH & wet soils
- Phytotoxicity to sulfur-based pesticides
- Difficult to propagate
Challenging Fruit Composition

<table>
<thead>
<tr>
<th></th>
<th>Norton</th>
<th>Red Wine Grapes</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>3.5-3.8</td>
<td>3.3-3.6</td>
</tr>
<tr>
<td>Malic acid</td>
<td>4-6 g/L</td>
<td>1-2 g/L</td>
</tr>
<tr>
<td>Titratable acidity</td>
<td>8.3-13 g/L</td>
<td>5.5-8.5 g/L</td>
</tr>
</tbody>
</table>

- High pH – poor color, wine stability, acid stability, & flat palate
- High malic – harsh acid
- Current solution – amelioration in winery

Own rooted vs. Grafted Grapevines

- **Own rooted**
  - Grapevine grown on its own root system
  - $3.75 - $4.00/vine

- **Grafted**
  - Two different grapevine species grafted one onto the other
    - Scion - fruiting cultivar
    - Rootstock - root system
  - $5.00/vine
Anatomy of a Grafted Grapevine

Image courtesy of Eli Bergmeier
Why use Rootstocks?

- Rootstocks were first used for grapevines to combat the phylloxera epidemic that spread throughout Europe in the late 1800’s
  - Solution – grafted Vitis vinifera (European) vines to American rootstocks
  - Rootstock – resistance to phylloxera
  - Scion – high quality wine grape

- Current use of rootstocks
  - Tolerance to a variety of biotic & abiotic stresses
  - Impact viticultural characteristics

Source: www.ces.ncsu.edu
<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Parentage</th>
<th>Source: <a href="http://plantgrape.plantnet-project.org/porte-greffes">http://plantgrape.plantnet-project.org/porte-greffes</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Own rooted Norton</td>
<td><em>V. aestivalis</em></td>
<td></td>
</tr>
<tr>
<td>3309C</td>
<td><em>V. riparia</em> x <em>V. rupestris</em></td>
<td></td>
</tr>
<tr>
<td>101-14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schwarzmann</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5BB</td>
<td><em>V. riparia</em> x <em>V. berlandieri</em></td>
<td></td>
</tr>
<tr>
<td>SO4</td>
<td></td>
<td></td>
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<tr>
<td>110R</td>
<td><em>V. rupestris</em> x <em>V. berlandieri</em></td>
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</tr>
<tr>
<td>1103P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>140Ru</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1616C</td>
<td><em>V. riparia</em> x <em>V. acerifolia</em></td>
<td></td>
</tr>
<tr>
<td>44-53M</td>
<td><em>V. riparia</em> x <em>(V. cordifolia x V. rupestris)</em></td>
<td></td>
</tr>
</tbody>
</table>
Plot Details

- **Location:** St. James Winery, Phelps County, Missouri
- **Training:** Geneva Double Curtain (GDC) trained on 2 x 3 m (vine x row) spacing
- Four replications of 3 vine plots
  - RCBD
- Drip Irrigated
- Planted in 2004
- **Dates of Study:** 2010-2011
- **Soil Type:** Union silt loam
Cultural Practices

- Winter
  - Prune based on pruning weight
  - 50+10 balanced pruning formula

- Spring
  - Shoot thin at 20-25 cm shoot length

- Summer
  - Downward shoot position
  - 3-4 four times as necessary

- Fall
  - Harvest – Mid September
  - Mounding – Late October
Data Collection

• **Fruit Composition**
  o % soluble solids
  o pH
  o Titratable acidity
  o Anthocyanin
  o Tannin
  o Total phenolics
  o Organic acids (malic, tartaric, citric)
  o Sugars (glucose, fructose)

• **Yield**
  o Cluster weight per vine
  o Clusters per vine
  o Cluster weight
  o Berries per cluster
  o Berry weight
Data Collection

• Vegetative Growth
  o Pruning weight
  o Shoots per vine
  o Retained nodes per vine
  o Pre-shoot thin shoots per vine

• Vine Nutritional Status
  o Petiole nutrient content
  o Juice mineral content

• Statistical Analysis
  o SAS 9.2 - ANOVA. Mean separation by Least Significant Difference (LSD) test

Historical Average
- \( \text{GDD}_{10} \): 3594
- Rainfall: 639 mm

2010
- \( \text{GDD}_{10} \): 3934
- Rainfall: 970 mm

2011
- \( \text{GDD}_{10} \): 3738
- Rainfall: 859 mm
Fruiting characteristics and vegetative growth of Norton on selected rootstocks and own-rooted vines in 2010 and 2011.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (lbs/vine)</th>
<th>T/A</th>
<th>Cluster wt. (g)</th>
<th>Clusters/ shoot</th>
<th>Pruning wt. (lbs/vine)</th>
<th>Ravaz Index</th>
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<tbody>
<tr>
<td>Rootstock</td>
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<tr>
<td>Own-rooted</td>
<td>26.5 c</td>
<td>8.7</td>
<td>65.9 e</td>
<td>2.3 c</td>
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<td>2.7 ab</td>
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<td>20.0</td>
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<td>76.7 bcd</td>
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<td>73.3 d</td>
<td>2.6 abc</td>
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<td>82.3 a</td>
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Macronutrient content of P in petioles of Norton grapevines on selected rootstocks and own-rooted vines grown in 2010 and 2011.
Macronutrient content of K in petioles of Norton grapevines on selected rootstocks and own-rooted vines grown in 2010 and 2011.
Macronutrient content of Ca in petioles of Norton grapevines on selected rootstocks and own-rooted vines grown in 2010 and 2011.
Mean yeast assimilable nitrogen (YAN) concentration in juice of Norton grapes produced from vines on selected rootstocks grown in 2010 and 2011.
Mean P concentration in juice of Norton grapes produced from vines on selected rootstocks grown in 2010 and 2011.
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Conclusions

• Rootstock affected petiole minerals Ca, P, & K.
• Calcium content was insufficient in petioles for 101-14, 1103P, 140Ru, and 1616C rootstock in 2010 & 2011.
• Petiole P was inadequate for 5BB & 44-53M rootstocks, & own rooted vines in both years, & for 3309C, 101-14, 140Ru, & 1616C in 2011.
• Petiole K was excessive for vines on 101-14 & 1616C rootstocks in 2010.
• Rootstock affected juice minerals N, P, Ca, & Mg.
• Although juice minerals varied by rootstock, all were within acceptable ranges.
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Questions