Developing Effective Plant Nutrition Programs for North Coast Vineyards

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OFAC & North Coast CAPCA
Sustainable /Organic Production in The Vineyards
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Basic strategies for organic winegrowing soil fertility

• Increased soil organic matter to improve CEC
• Improve soil structure and rooting area
• Improve water holding capacity, infiltration
• Create and maintain adequate fertility for production so as not to be a limiting factor
• Increase biotic activity of both macro and micro organisms
North Coast Soil Issues

Problems

• Low pH
• Low calcium
• High magnesium
• Low potassium
• High clay, poor soil structure
• Phosphorus deficiency (when pH > 8, <5

Solutions

• Apply gypsum or lime
• “
• “
• Potassium sulfate
• Initial ripping, cover crops, reduced tillage
• Rock phosphorus, compost high in P, bone meal
Soil Sampling is Critical

- Determine nutrient and soil chemical status
- Sample multiple spots, composite samples
- Examine soil profiles
- Minimum one pit/5 acres
- If obvious soil differences in spots, sample those, too
Don’t Forget the Vines!

- Visual assessment
- Petiole sample, tissue analysis
Deep Tillage is Important Initially

- Rip to rooting depth
- Don’t destroy soil structure
- Apply amendments and nutrients that are difficult to leach before ripping

*Dr. Al Cass images*
The Importance of Organic Matter

• Source of nutrients, recycling, energy efficiency, sequestering carbon
Documented Benefits of Increased SOM

• Limited research in vineyards
• Improved soil quality under biodynamic and organic growing
• Reduced number of root pathogens
• Vineyard root health, tolerance of phylloxera
Soil Structure and Organic Matter
### Vineyard Organic Matter Per Year, Tons Per Acre

<table>
<thead>
<tr>
<th>Item</th>
<th>Conventionally Farmed</th>
<th>Organic, BD Farmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prunings</td>
<td>900 lbs.</td>
<td>900 lbs.</td>
</tr>
<tr>
<td>Leaves</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>Weeds/Cover Crops</td>
<td>1000</td>
<td>1000-10,500</td>
</tr>
<tr>
<td>Compost</td>
<td>0</td>
<td>2000-4000</td>
</tr>
<tr>
<td><strong>Total, tons/acre</strong></td>
<td><strong>1.5 tons</strong></td>
<td><strong>1.5-8.5 tons</strong></td>
</tr>
</tbody>
</table>
On Farm Composting
# Aerobic Composting—Typical Changes

<table>
<thead>
<tr>
<th>Decreases:</th>
<th>Increases:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>Density</td>
</tr>
<tr>
<td>Particle size</td>
<td>Mineral concentrations</td>
</tr>
<tr>
<td>Porosity</td>
<td>pH</td>
</tr>
<tr>
<td>Total C &amp; N</td>
<td>Humus</td>
</tr>
<tr>
<td>Mineral N</td>
<td>Chemical stability</td>
</tr>
<tr>
<td>C:N Ratio</td>
<td>Organic bound nitrogen, other nutrients</td>
</tr>
<tr>
<td>Ammonia</td>
<td>Disease suppression</td>
</tr>
<tr>
<td>Pathogens and Weeds</td>
<td></td>
</tr>
</tbody>
</table>
## Typical Analysis of “Fresh” Green Waste and Manure

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Green Waste</th>
<th>Manure</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1-5%</td>
<td>1-5%</td>
</tr>
<tr>
<td>P</td>
<td>0.1-5%</td>
<td>0.5-6%</td>
</tr>
<tr>
<td>K</td>
<td>0.5-1.5%</td>
<td>0.5-4%</td>
</tr>
<tr>
<td>Salts</td>
<td>1-2%</td>
<td>1-8%</td>
</tr>
<tr>
<td>C:N</td>
<td>20-40/1</td>
<td>15-20/1</td>
</tr>
<tr>
<td>Phytotoxins</td>
<td>Often</td>
<td>Not usually</td>
</tr>
<tr>
<td>Weed Seed</td>
<td>Often</td>
<td>Often</td>
</tr>
<tr>
<td>Pathogens</td>
<td>Plant, often</td>
<td>Human, potentially</td>
</tr>
</tbody>
</table>
Nitrogen in Compost

• Available N = mineral N in the root zone
• Mature composts: typically 1-3 %
• About 20- 60 lbs N per ton
• Apply unincorporated broadcast to cover crops in fall
• When mixed in the soil, N release is usually temperature dependent. Some is released right away, some takes time
Other Minerals in Compost

- 0.5-1% P (10-20 lbs/ton)
- 0.5-3% K (10-60 lbs/ton)
- Numerous micronutrients
- Held in organic matrix, which may be more exchangeable than clay micelles
Compost Applications: Beneath Vines or Across the Vineyard Floor
Immediate Effect of Cover Crops

- Plant tissue is the primary source of OM
- Soil life is stimulated from root exudates
- Cover crops serve as food sources for vertebrates, invertebrates and microbes
- Soil respiration rates and microbe numbers increase
Grass and Legume Mixes

• Very complimentary
• Important to have N to build SOM
• Much of biomass is respired into the atmosphere as cover crops decompose
Carbon: Nitrogen Ratios in Organic Materials and Decomposition Rates

• C:N ratios < 20:1, materials decompose rapidly
• C:N ratios > 24:1, materials decompose slowly
• Microbes composed of 8 parts C for 1 part 1
• One third of the C is assimilated, the rest is respired
• One gram of N is used for 24 grams C metabolized by microbes
Cover Crop Decomposition Rates

• If left on the surface, OM will oxidize
• Need soil moisture, warmth when incorporating
• Finer pieces decompose quicker (more surface area
• More SOM accumulates in finer textured soil
• Organic matter may have easier exchange rates for P and K (less likely to bind to other soil colloids)
Crop Maturity, Decomposition Rates

- More mature the cover, the greater the C:N ratio
- Mature covers should be left on the soil surface for mulches
- For N, shred and incorporate at bloom time
What Can You Expect from Cover Crops in Terms of Nitrogen?

<table>
<thead>
<tr>
<th>Cover Crop Type</th>
<th>Lbs N per Planted Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vetches</td>
<td>50--200</td>
</tr>
<tr>
<td>Medics (bur clover)</td>
<td>50-100</td>
</tr>
<tr>
<td>Sub clovers</td>
<td>185-250</td>
</tr>
<tr>
<td>Rose clover</td>
<td>50-100</td>
</tr>
<tr>
<td>White clover*</td>
<td>115-200</td>
</tr>
<tr>
<td>Strawberry clover *</td>
<td>100-300</td>
</tr>
<tr>
<td>Berseem clover</td>
<td>100-300</td>
</tr>
</tbody>
</table>

*expect gophers, too
## Typical Average Nutrient Inputs, Pounds Per Acre

<table>
<thead>
<tr>
<th>Inputs (source of minerals)</th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Ca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composted pomace and manure, 2 T/A</td>
<td>49</td>
<td>8</td>
<td>62</td>
<td>59</td>
</tr>
<tr>
<td>Rainfall deposition (EPA estimates)</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>N from cover crops (half of rows, every other row), annual self reseeding legume</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soil tillage and mineralization from soil organic matter</td>
<td>10</td>
<td>1?</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total Input</strong></td>
<td>80</td>
<td>9</td>
<td>67</td>
<td>66</td>
</tr>
</tbody>
</table>

**Estimated Available For Current Season** *(Compost availability estimated at N=15%, K= 85%, Ca=85%)*

<table>
<thead>
<tr>
<th>Estimated Available For Current Season</th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Ca</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>38</td>
<td>6</td>
<td>57</td>
<td>56</td>
</tr>
</tbody>
</table>

# Mineral Removal in an Organic Vineyard, Pounds per Acre

<table>
<thead>
<tr>
<th>Outputs (based on 3 ton wine grape yield)</th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Ca</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wine grapes</td>
<td>8</td>
<td>4.3</td>
<td>21</td>
<td>12</td>
<td>1.6</td>
</tr>
<tr>
<td>Trunk, stems and leaves</td>
<td>15</td>
<td>1</td>
<td>1.8</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Leaching and mineralization</td>
<td>15</td>
<td>0</td>
<td>5</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td><strong>Estimated Total Mineral Removal</strong></td>
<td>38</td>
<td>5.3</td>
<td>28</td>
<td>33</td>
<td>4.6</td>
</tr>
</tbody>
</table>
Concentrated Organic Fertilizers

- Most based on processed proteins
- Fish proteins expensive, work quickly
- Spray dried animal protein
- Feather meal: used by pet food industry, easy to source
- Expensive per unit of N
Organic Fertigation

Requires The Right Material

• Spray dried animal protein
• Suspended fertilizers
• Must be able to pass through a 200 mesh filter
• May require agitation to keep material suspended
• Best used often in small amounts
• Concerns about microbial contamination of food crops
Organic Foliar Sprays

• Lots of products
• Expensive
• May be helpful at bloom time
• Calcium, Boron, Potassium most important
Compost Tea

- Mixed research results
- Probably not worth the expense and effort
- There are true believers!
- Concerns about microbial contamination of food products, wine?
Helpful Resources

Thanks for Your Attention!

DEATH BY POWERPOINT

more awesome pictures at THEMETAPICTURE.COM