Soil and Tissue Testing for New and Established Vineyards

Joan R. Davenport
WSU-Prosser
Steps for Soil Assessment

- Soil Survey Map
- Identify areas for pits
- Soil sampling and testing
Soil Testing

Soil testing is a rapid assessment of the soil’s ability to supply a given nutrient to plants.
Soil Testing

• How can we use soil tests?
  – Current chemical status of our soil
  – Current nutrient status of our soil
  – Short and long term effects of management practices on soil properties
  – Trouble shooting production problems
Soil Testing

• Soil Testing Does Not:
  – Determine the amount of a nutrient in a soil
  – Determine exactly when that nutrient will be available to the plant
Soil Testing

• The Process of Soil testing
  – Soil sampling
  – Soil analysis
  – Soil interpretation
  – Fertilizer or amendment recommendation
How and Where to Sample

• Collect multiple samples
• Pattern relative to site variability
  – Random
  – Grid
  – Area
Random

Use pre-determined points!
Grid
Area

Use pre-determined points!
How and Where to Sample

- Collect multiple samples
- Pattern relative to site variability
  - Random
  - Grid
  - Area
- Multiple cores per sample (min. 4)
How and Where to Sample

- Collect multiple samples
- Pattern relative to site variability
  - Random
  - Grid
  - Area
- Multiple cores per sample (min. 4)
- Depths – 1, 2, 3, > 3 feet
Now that I have my samples . . .

• Choose a test lab
  – Lab familiar with your region
  – Uses standard test procedures

http://wsprs.wsu.edu/AnalyticalLabsEB1578E.pdf
<table>
<thead>
<tr>
<th>Soil</th>
<th>Analyte</th>
<th>NAPT</th>
<th>Lab 1</th>
<th>Lab 2</th>
<th>Lab 3</th>
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<tbody>
<tr>
<td>02-109</td>
<td>Nitrate (ppm)</td>
<td>6.2</td>
<td>9</td>
<td>7</td>
<td>8</td>
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<tr>
<td></td>
<td>Ammonium (ppm)</td>
<td>6.0</td>
<td>8.0</td>
<td>2.0</td>
<td>3.2</td>
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<tr>
<td></td>
<td>Phosphorus (ppm)</td>
<td>8.2</td>
<td>11</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Potassium (ppm)</td>
<td>89</td>
<td>104</td>
<td>237</td>
<td>110</td>
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<tr>
<td></td>
<td>pH</td>
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<td>8.1</td>
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<td>02-106</td>
<td>Nitrate (ppm)</td>
<td>6.4</td>
<td>7</td>
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<tr>
<td></td>
<td>Ammonium (ppm)</td>
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<td>12.0</td>
<td>3.0</td>
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<td>Phosphorus (ppm)</td>
<td>30</td>
<td>28</td>
<td>45</td>
<td>20</td>
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<tr>
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<td>Potassium (ppm)</td>
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<td>881</td>
<td>137</td>
<td>680</td>
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<tr>
<td></td>
<td>pH</td>
<td>6.75</td>
<td>6.9</td>
<td>6.9</td>
<td>6.9</td>
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</tbody>
</table>
Now that I have my samples . .

- Choose a test lab
- Deliver to test lab
  - Send
  - Drop points

http://wsprs.wsu.edu/AnalyticalLabsEB1578E.pdf
Agricultural Testing Services
The Samuel Roberts Noble Foundation, Inc.
2880 South Highway 28
P.O. Box 2180
Mossy, OK 74452
Telephone: (918) 354-6500

Soil Test Report

Noble Foundation

Field Name: Interim 49 Wheat
Lab Number: 48201 Date: 10/7/00
County: OK-Ok

Soil Sample submitted by: John Johnson, Jr.

PLANT INFORMATION

Crop: Winter Wheat
Yield Goal: 40 Bushels/Acre
Test Pays: Test A

SOIL TEST INFORMATION

PH - 7.1 Base Saturation
ECe - 0.04
OM - 1.2

Nitrates - 0
Nitrites - 0

SOIL TEST RESULTS

Nutrient | Exchangeable | Available | % Base Saturation | Rec. Level
---------|--------------|-----------|-------------------|---------
Nitrogen | 35 | 39 | 45.0
P | 40 | 40 | 33.3
K | 79 | 79 | 100.0
Calcium | 89 | 89 | 100.0
Magnesium | 110 | 110 | 100.0

FERTILIZER RECOMMENDATIONS

K: 0 N: 28 P: 40

SOIL RECOMMENDATIONS

K: Apply 0 lbs of K2O per acre. As a guideline, at least 100 lbs of K2O per acre should be applied to achieve a 100% base saturation of K.

N: Apply 28 lbs of N per acre. As a guideline, at least 60 lbs of N per acre should be applied to achieve a 30% base saturation of N.

Ca: Apply 0 lbs of Ca per acre. As a guideline, at least 25 lbs of Ca per acre should be applied to achieve a 100% base saturation of Ca.

Mg: Apply 0 lbs of Mg per acre. As a guideline, at least 15 lbs of Mg per acre should be applied to achieve a 100% base saturation of Mg.

Ca/Mg/60


e-DM requirements by
narrow-leafed legumes.

Agrometrics Specialist
(918) 354-6500

Notes:

- Divide DM requirements by 10:
- Narrow-leafed legumes
- Apply 2 lbs of K2O per acre
- Apply 5 lbs of N per acre
- Apply 2 lbs of P2O5 per acre

Organic Matter: 3.2%
SOIL TEST REPORT
Lawn and Garden

Sample/Field Number: 1B

SOIL TEST RESULTS

| Estimated Soil Texture | Organic Matter % | Soluble Salts mmoles/cm² | pH
|------------------------|------------------|--------------------------|-----
| Medium                 | 3.5              | 0.5                      | 50  |
|                        |                  |                          | 80  |

INTERPRETATION OF SOIL TEST RESULTS

Phosphorus (P)

<table>
<thead>
<tr>
<th>Level</th>
<th>Value</th>
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<tbody>
<tr>
<td>Low</td>
<td>5</td>
</tr>
<tr>
<td>Medium</td>
<td>10</td>
</tr>
<tr>
<td>High</td>
<td>20</td>
</tr>
<tr>
<td>V. High</td>
<td>25</td>
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</table>

Potassium (K)

<table>
<thead>
<tr>
<th>Level</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>25</td>
</tr>
<tr>
<td>Medium</td>
<td>75</td>
</tr>
<tr>
<td>High</td>
<td>125</td>
</tr>
<tr>
<td>V. High</td>
<td>175</td>
</tr>
</tbody>
</table>

SOLUBLE SALTS

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>225</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>200</td>
<td>Poor Problem</td>
</tr>
<tr>
<td>150</td>
<td>Excessive Salts</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS FOR: Vegetable garden

LIME RECOMMENDATION: 0 LBS/100 SQ.FT.

TOTAL AMOUNT OF EACH NUTRIENT TO APPLY PER YEAR:

NITROGEN
0.15 LBS/100 SQ.FT.

PHOSPHATE
0 LBS/100 SQ.FT.

POTASH
0.3 LBS/100 SQ.FT.

THE APPROXIMATE RATIO OR PROPORTION OF THESE NUTRIENTS IS: 15-0-30

Use a fertilizer with the percentage of nutrients closest to the above ratio. Apply according to the instructions on the fertilizer bag or container, or determine the amount required from the instructions given on the back side of this report. Since meeting the exact amount required for each nutrient will not be possible in most cases, it is more important to apply the amount of nitrogen required and compromise some for phosphate and potash.

If a fertilizer contains phosphate and/or potash, it can be mixed in the spring or fall into the top 4-6 inches of topsoil. If a fertilizer containing only nitrogen is used, it should be applied in the spring, tilling or raking it into the surface. Nitrogen is easily leached through soil.

For sweetcorn, tomatoes, cabbage, and vine crops such as squash and cucumbers, an additional application of 1/6 lb. nitrogen per 100 sq. ft. may be desirable at midseason. This can be accomplished by applying 1/2 lb. (about one cup) of 34-0-0 fertilizer. Thoroughly water fertilizer into the soil.

County: RAMSEY. For additional information, contact your county extension educator, DOUG FOULK at (651) 704-2030.
Now that I have my samples . .

- Choose a test lab
- Deliver to test lab
- Interpretation of results
  - Based on long term developed standards
Wine Grape Soils

- pH, organic matter and CEC
- Nitrogen – especially with depth
- Phosphorus – especially if pH high
- Potassium – previous crop?
- Zinc – especially if pH high
- Boron
Now that I have my samples . .

- Choose a test lab
- Deliver to test lab
- Interpretation of results
  - Based on long term developed standards
  - Contact lab, extension, fieldman/consultant
Steps for Soil Assessment

- Soil Survey Map
- Identify areas for pits
- Soil sampling and testing
- Water source sampling and testing
Tissue to Test

- Petioles
- Leaf Blades
Tissue to Test

- Petioles
  - nutrient movement
  - position
  - time of day sensitive

- Leaf Blades
  - nutrient storage
  - position
  - insensitive to time of day
Testing Procedures

- Petioles
  - nitrate
  - phosphate
  - potassium

- Leaf Blades
  - total N
  - other macro nutrients
  - micronutrients
Choosing a Test Lab

- Lab with familiarity with crop
- Lab procedures
- Turn around time
- Cost and timing
- Trust and consistency
Tissue Collection and Challenges

• Within vineyard sampling approach
  – Zones
  – Random
  – Specific areas
  – Troubleshooting (good vs bad)
Tissue Collection and Challenges

• Sampling time
• Amount of sample
Tissue Collection and Challenges

- Sampling time
- Amount of sample
- Sampling position

Figure from Winkler et al., General Viticulture
Tissue Collection and Challenges

- Sampling time
- Amount of sample
- Sampling position

Figure from Winkler et al., General Viticulture
Tissue Collection and Challenges

- Sampling time
- Amount of sample
- Sampling position
- Sample handling
- Consistency in sampling procedure
Petioles VS Blades

• Petioles
  – nutrient movement
  – time of day dependent

• Blades
  – structural nutrients
  – better indicator of plant status

• Time of Season Preferences
  – regional
Adequate levels of grape tissue nutrient for grape petioles and blades at bloom and veraison reported in the literature.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Petioles</th>
<th>Leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ref 1-B</td>
<td>Ref 2-B</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>0.10-0.35</td>
<td>0.25-0.80</td>
</tr>
<tr>
<td>Potassium</td>
<td>1.01-3.00</td>
<td>1.8-3.0</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.26-3.00</td>
<td>1.2-2.5</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.46-1.25</td>
<td>&gt;0.4</td>
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<tr>
<td>Sodium</td>
<td>NV</td>
<td>NV</td>
</tr>
<tr>
<td>Boron</td>
<td>26-99</td>
<td>30-75</td>
</tr>
<tr>
<td>Zine</td>
<td>16-51</td>
<td>&gt;26</td>
</tr>
<tr>
<td>Copper</td>
<td>5.1-20.9</td>
<td>6-11</td>
</tr>
<tr>
<td>Iron</td>
<td>30-100</td>
<td>NV</td>
</tr>
<tr>
<td>Manganese</td>
<td>61-200</td>
<td>30-60</td>
</tr>
</tbody>
</table>

B = Full bloom sampling time  
V = Veraison sample timing

Reference 1  Christensen, P. 1963, 1984
Reference 5  Coombe, B.G. and P.R. Dry, Viticulture Vol. 2

http://www.prosser.wsu.edu/faculty/davenport.htm
Established Vineyard
Soil and Tissue Testing

- Soil Testing every 2-4 years
- Tissue Testing yearly
Soil and Tissue Testing

• Scenario 1
  – Soil and plant values agree

• Scenario 2
  – Soil and plant values disagree
  – Soil high, Plant low

• Scenario 3
  – Soil and plant values disagree
  – Soil low, Plant high