Winter Grape School 2015  
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Lessons Learned on Soil Sampling

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Today’s Plan:  
Today, we are going to discuss:

• Soil pH, and why it is important in relation to all of the other Soil Nutrients.
• Test reports of 3 different Soil Labs for the same soil sample.
• Pros and Cons (in my opinion) of each.
• Next Steps.

Vineyard Nutrient Management  
pH isn’t just a thing…. it is everything!

• You will notice on this chart on the right, the availability of most nutrients changes with pH.
• They have different patterns, but you will see there is a “sweet spot” around 6.5 pH where most of them are available near their maximum amounts.
• If we can get our soil to this point, many of our vineyard nutrient issues either disappear, or are MUCH more easily managed!
• If your pH is too far away from 6.5, you can spend a lot of money and time struggling with nutrient additions that might ultimately fail anyway.
Vineyard Nutrient Management

Soil pH: I found this cool World Soil pH Map you might find interesting:

[Map Image]


Soil Test Report Comparison

It would be interesting to take the same soil samples and send them to all 3 labs to see what their results/recommendations would be!... so we did!

- A larger than normal soil sample was taken from a vineyard block due to be retired at the Ashtabula Agricultural Research Station (AARS) in Kingsville.
- The soil was broken up and mixed thoroughly so that it was homogenous.
- The soil was divided up into 3 portions and sent to 3 different Soil Laboratories:
  - Spectrum Analytic
  - Brookside Laboratories
  - Penn. State University’s Ag. Lab

Soil Test Report Comparison

- Soil Test Results will vary depending on the Lab they were sent to! To make things a little more complicated, there are SEVERAL methods of expressing the soil’s “Acid Buffer”, with two being more popular around here.
  - Method #1*: Woodruff (1948) – Originally was used in the US Midwest. It was found to underestimate lime requirements and has since given way to...
  - Method #2*: SMP (Shoemaker, McLean, and Pratt) (1961) – developed for Ohio Silt loam Soils. This was modified in 2006 by Sikora. It is now also referred to as SMP/Sikora, or just Sikora. They give accurate readings in the North East US, but not so much in the SE US.
  - Method #3*: Mehlich (I (1939), II (1953), or III (1976)) – Used in some NE and NCentral US States for their high acid soils. Mehlich III is also very popular in this region.
  - Method #4*: Adams-Evans – I have not researched this method at all. They are used in Alabama, Florida, Georgia, Tennessee, South Carolina, and Virginia.

* - All of these methods have been modified, so you might see them referred to as the “Modified Woodruff” or “Modified Mehlich” methods!
- Also, new methods are likely to be developed in the future. These new methods are developed for higher accuracy, lower testing cost/speed, or to eliminate hazardous chemicals from the testing process and eliminate the need for special handling and disposal.
Soil Test Report Comparison

- Included in your materials, you should find:
  - The Soil Test Reports from the 3 Labs:

- A spreadsheet comparing the different tested parameters in an “Apples to Apples” format (some calculation was required in some cases):

- I’ll summarize my likes/dislikes for each:

Soil Test Report Comparison

Spectrum Analytic Pros:
- The form was easy to fill out, and could accommodate many different samples.
- The test report was the fastest of the three. The sample/form was mailed on the Wednesday before Thanksgiving, and the test report was returned by e-mail the following Monday!
- The tests included results for almost everything one would want, including most of the Micronutrients.
- The report included the suggested ranges.
- The report included recommendations for 3 years of cropping.
- The report was very easy to read.
- They have an extraordinary amount of information resources available (although, these are available on-line regardless if you are a customer or not):
  - The report includes the K/Mg and Ca/Mg ratios (saving you from doing the math)
  - If the K/Mg ratio is too high or too low, the ability of the plants to utilize the deficient element is affected. The Ca/Mg ratio isn’t too important as long as there are sufficient amounts of either element for the plants.

Spectrum Analytic Cons:
- The Report didn’t include tests for Aluminum or Sodium. Even though Aluminum is the THIRD MOST COMMON ELEMENT ON THE FACE OF THE EARTH, when levels are higher than about 1000ppm and in acidic soil, it can damage the vine roots. Sodium levels also might be nice to know if you suspect a problem.
- It cost more than the Penn State Test ($14 vs. $9).

Soil Test Report Comparison

.... Also, at the Spectrum Analytic Site, in addition to all of the informative articles, they something of a “one stop shop” for all of the supplies you will probably need for your soil sampling activities – including free sample bags!

- Long after this seminar is over, and all you can remember is “Lime, Lime, Lime!”,... but you need to quickly figure out how adjust your soil, go to their website:

- Also, by clicking on the “up” button on this website, there are other articles which give a good, concise review of other soil related issues.
Soil Test Report Comparison

Brookside Laboratories Pros:
• The form was reasonably easy to fill out, and could accommodate many different samples, but the test descriptions were a little confusing.
• The tests included results for almost everything one would want, including most of the Micronutrients.
• The report included results reported in both PPM and Lbs/Acre.
• The report included tests for Aluminum and Sodium.

Brookside Laboratories Cons:
• The Report took a couple of days longer than the Spectrum Analytics Report.
• The Report included no suggested nutrient applications.
• It cost more than the Penn State Test ($14 vs. $9).

Soil Test Report Comparison

Penn State University Ag Labs Pros:
• The form was reasonably easy to fill out, but there are 2 different forms – 1 for a single sample, and 3 for multiple samples... and the instructions are slightly different between the 2 (and unnecessarily so, I think).
• They give recommendations for N-P-K and Lime.

Penn State University Ag Labs Cons:
• The Report took a couple of days longer than the Spectrum Analytics Report.
• There is only 1 real option for the type of tests you wanted performed...
• ... and this option did not include any Micronutrients...
• ... and the report had an odd mix of Lbs/Acre of the elements and their Oxides, as well as mg/100g. In order to convert to ppm, there is LOT of math involved.
• The Report did not report the Buffer pH, but rather the "Extractable Acidity" in the Exchangeable Ion List. The equation to calculate the lime requirements with this data is:
  $$\text{CaCO}_3 \text{ tons/acre} = \frac{\text{AC (desired pH - soil pH)}}{6.6}$$
• The report did not include any of the other Macro or Micronutrient recommendations.
• It cost less than the other two ($9 vs. $14), but costs $5 more for an Organic Matter Test which was included with the other two ... in addition to several other tests.

Lime Estimates (or why your $9-14 soil test may not give you an exact picture)

• The non-linear nature of pH may be difficult to express with the parameters of pH, buffer pH, and CEC. For example, a single acid pH curve will look like this:

  ![Lime Curve](image)

  - The amount of base/alkaline needed to change the pH a fixed amount is different at nearly every point on the pH curve!

  ... and this is for a very simple system!
Lime Estimates (or why your $9-14$ soil test may not give you an exact picture)

- For an acid with $2 \text{[H}^+\text{]}$ ions to donate, or for a solution with $2$ different acids in it, the pH curve gets even more complicated:

![Diagram of pH curve for an acid with 2 [H+] ions to donate.

- The pH curve of your soil will be the result of many, many compounds, and will be very complicated. Your $9-14$ soil test will give you a single point on this curve (the soil pH), and it will give you the average slope of the curve above that point (the buffer pH). The Cation Exchange Capacity (CEC) refers to the ability of the soil to exchange one cation for another on the surface of the soil, and is an indication of the soil's ability to "hold onto" the lime. These values will be used to estimate a lime requirement for a particular soil.

- Depending on where your Soil pH and Buffer pH land on your Soil pH Curve affect how accurate your lime estimate will be.
Lime Estimates (or why your $9-14 soil test may not give you an exact picture)

- Once you apply the lime in your soil lime estimate, you may test later and see that the result was not what was predicted by the lime estimate. This will be because the lime you added did not result in a straight line change, but only moved you along the pH curve according to what the soil would allow.
- Your new soil test will get you a new pH and buffer pH for that part of the pH curve, as well as a new estimate of your lime requirement. The greater the error between your soil pH and your target pH, the greater the chance your lime estimate will be inaccurate.

Soil Management For Vineyards

Lime – what kind am I being sold?:

- There is no standard definition. Some states regulate lime definitions, and some don’t.
- Some terms you will encounter (but check the numbers!)
  - “High Cal” – high in calcium
  - “High Mag” – high in magnesium
  - “Dolomitic” – some magnesium content... around 8.5%
  - Other “Dolomitic” definitions in some states include:
    - “Lower Dolomitic” – 4.3% Mg
    - “Higher Dolomitic” – 5.8% Mg
    - “Standard Dolomitic” – 10.4% Mg
- Some lime is expressed as % Ca & % Mg, and some is expressed as % CaCO3 & MgCO3.
- You might have to do some math to convert between the two.
If you only remember ONE THING...

• In NE Ohio Growing Regions, your pH will likely be LOW. You will need to spread Lime.
• It will almost never be easier or cheaper to spread lime than BEFORE YOU PLANT.
• In low pH soil, spreading lime before planting will likely more than pay for itself 30 months later at the first harvest.

Lime Spreading After Planting

• Many soils in NE Ohio need liming periodically over the life of the vineyard. You will need a plan to accomplish this.
• For many soils in NE Ohio, spreading “too much” lime isn’t generally an issue...
• ... but be careful, nevertheless.

• LIME, LIME, LIME!

Lime Spreading 10 Tons at a Time
Soil Management For Vineyards

A note about Alkaline Soils:

• Alkaline Soils can also present problems. In the USA, these occur in some locations in the West, as well as parts of Northwest Ohio.
• Usually due to:
  – Saline (salt). Salts are metal-halogen compounds including NaCl, KCl, CaCl₂, CaSO₄, MgSO₄, Na₂SO₄, etc.
  – Sodium (Na⁺)
  – Both
• The solution for Saline Soils usually involves using water to leach the salts away from the vine root area.
• The solution for other Alkaline Soils usually involves the spreading of Sulfur to drop the pH.

Questions?

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