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Vineyard and Winery Information Series:

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I. Nitrogen nutrition

One recurring theme that I've seen with plant tissue analysis results of the last several years is precipitously low nitrogen levels, particularly with mid-summer collected samples. Where this is most acute has been in vineyards where I'm aware that the owners are experimenting with under-trellis cover crops to regulate the vine's vegetative vigor and growth. I know this is particularly true because we've also seen the trend in our own experimental blocks where we've been using under-trellis cover crops. It's not a universal problem, but it bears some discussion. The following discussion highlights the issues related to vine nutrition, including assessing N fertilizer need and timing of fertilization. A more in-depth discussion is provided in the "Nutrient Management" chapter of the new Wine Grape Production Guide for Eastern North America (Wolf, 2008).

Nitrogen (N) is one of 16 essential nutrients required for normal grapevine growth and development. It is a structural component of amino acids, and hence proteins and enzymes, and is also a component of chlorophyll, the green pigment of plants. Thus, deficiency of N is often first apparent as a fading of the green color of plants. With increased stress/deficiency, we also can see a reduction in the vine's capacity for growth and crop production; both vine size and yields suffer. Added to those viticultural issues, N deficiency can also cause low levels of yeast-assimilable nitrogen in harvested fruit and must, leading to sluggish or stuck fermentation, and possible sensory flaws with the resultant wines. For these various reasons, it's wise to maintain an *optimal* N level in vines. The emphasis on optimal means that as with most of the vine's essential nutrients, there is a desirable range of concentration in the tissue, below which we'd expect to see deficiency symptoms, and above which we might start to see symptoms of excessive supply. In the case of N, the latter might be expressed as unusually dark green foliage, overly vigorous shoot growth, and perhaps an increase in certain disorders such as poor fruit set.

So, if we need to avoid both deficiency and

excess, how do we determine the happy medium? Soil testing can give an indirect measure of N availability through quantification of soil organic matter and, if the extra testing is warranted, a direct measure of nitrate-N, the principal form of N taken up by the vines. Soil organic matter exists in varying stages of decomposition, including the relatively stable humus, which is about 5% N. Think of soil organic matter as a pool of relatively slow-release N fertilizer. Through decomposition and subsequent mineralization of organic N to inorganic N, the vines will be able to extract this N over extended periods. The release rate of N (mineralization) will depend on the overall microbial health of the soil, temperature, moisture, and other conditions. Broadly, each one percent organic matter concentration of soil may provide 10 to 30 pounds of available N to vines per acre per year. The principal losses of N from this system are runoff of N-containing materials (organic matter and surface water with dissolved inorganic N), leaching of inorganic N out of the rootzone, and harvesting crop, which can remove 10 to 20 pounds of N per acre. So, knowing the organic matter concentration of your soil can help calibrate how much added N will be needed to *maintain* the vine's optimum N concentration. Most Virginia vineyard soils that I've seen soil analysis results for range from about 2% to 3% organic matter. While that's helpful to know, the more relevant figure that we need to know is how much additional N is needed annually or less periodically to *maintain* the vine's N status? For this, we use a visual examination of the vine's canopy and growth characteristics, coupled with plant tissue analysis. Visually, there are a range of characteristics that we equate with optimal N status, including uniformly green leaf color, canopy fill of the trellis space by mid-summer, cane pruning weights of 0.3 to 0.4 pounds per linear foot of canopy, and acceptable crop yields. Plant tissue analysis results are the other part of the equation, and this starts with a routine sampling of leaf petioles at bloom time followed by an interpretation of results and possible fertilizer application/response based on the results. Plant analysis and visual vine inspection are, of course, helpful for assessing the status of other vine essential nutrients, but we'll focus on N here. Although different tissues and different collection times can be used, a generally accepted and standardized approach to plant tissue analysis for grapes utilizes leaf petioles collected from leaves located opposite a flower cluster and collected at or very close to full-bloom. Petioles are the small stems that attach the leaf blade to the shoot stem. For average-sized petioles, an appropriate sample size would be about 75 petioles. These should be collected from representative shoots of representative vines of the vineyard block being tested. It's wise to sample different varieties and different plantings separately, particularly if there are visually apparent differences in the growth or foliage color of the different blocks. The samples are dried and submitted to an analytical lab for analysis (see below).

The results of the lab analysis will include a determination of the percent N (and other essential nutrients) in the sample. The lab may provide an interpretation of this data; however, the interpretation and recommended action is discussed in more details in the above-referenced Nutrient Management chapter of the Wine Grape Production Guide. In brief, optimal petiole N concentrations for bloom-sampled grapevines are in the range of 1.20% to about 2.20%. I rarely see values greater than 2.00% for Virginia vines. Tissue concentration N values found at bloom-time often decrease over the course of summer and may drop below 1.00% at veraison (if one were to sample tissues at this point). Unless N fertilizer adjustments, or additions of organic matter are being made to the vineyard, you can expect that N concentration of vines to decrease over time (years), as crop is removed. Cover crops, whether restricted to the row middles or extended under the trellis, may temporarily reduce the vines' supply of N, but may ultimately increase soil available N through increased soil organic matter, as long as the cover crop clippings are being retained in the vineyard. The choice of plant used as a cover crop – a grass versus a

nitrogen-fixing legume – may also affect the relative supply of N to vines.

Assuming that proper pre-plant soil amendments were made, we normally wait until the 3rd or 4th growing season to begin plant tissue analysis of vines to augment nutrient status monitoring. If analytical samples suggest the need for N (< 1.20% N at bloom or < 0.80% late-summer) and this corroborates our visual assessment, corrective measures (fertilizer application), are often warranted. The practical questions then come down to: How much to apply? When to apply? What to apply? and Where to apply it? Let's briefly consider each:

How much N: We use a graduated response of fertilizer N based on the degree of deficiency identified by visual observation and plant tissue analysis results. A reasonable starting point for annual additions of N to most vinifera vineyards, cropped at 2.5 to 5.0 tons per acre per year, would be in the range of 20 to 30 pounds of actual N per acre per year. Soils with more than 4% organic matter might get away with less, if organic matter is returned to the vineyard in the form of cane prunings, pomace or other material. For non-grafted hybrids and American-type varieties, rates of 50 to 80 pounds of actual N per acre per year may be warranted. Modify rates from year-to-year as necessary to maintain vine size, canopy quality and crop yield as described in the Wine Grape Production Guide referenced here.

When to apply: Research has shown that the vines' need for N in the first 30 to 45 days of growth is heavily dependent upon N reserves in the vine from the previous season. Post-bloom there is a greater dependence upon root-uptake of N. A more concise understanding of N uptake and utilization of N by vines has led away from a bud-break application of N, moving more towards bloom or post-bloom applications. Small, maintenance applications of N (e.g., 20 pounds/acre N) can be applied 2 weeks before to 2 weeks after bloom. This window of application is rather wide and one might target an application immediately prior to forecast rain to help move the N into the soil. Heavier rates of N should be split into at least 2 applications, with one-half occurring between bud-break and bloom, and the other half occurring 2 or more weeks after bloom. If irrigation and fertilizer injection is an option, several smaller applications over this period would be appropriate. We have also recommended post-harvest applications of N in some cases, as long as the vine canopy remains functional for several weeks after harvest. This is possible with early-harvested varieties (September) in warm regions such as Virginia. In this and all other aspects of vineyard management, one must balance the optimal strategy with the demands on one's time. But if you miss the post-bloom N application or if you only recognize N deficiency late in the summer, the post-harvest application (up to 20 pounds of N per acre) can be very efficient.

What to apply: I tend to recommend application of the cheapest material available and this is often urea (46% N). Other commonly used forms of *synthetic* N include ammonium sulfate and calcium sulfate. Nitrogen fertilizer is manufactured from natural gas, first as anhydrous ammonia and then to urea and/or nitrate forms. Nitrogen fertilizer prices, therefore, increase with increased natural gas prices, and the nitrate forms tend to be more expensive than the ammonia forms. In cases where phosphorus (P) may be low/deficient in the vineyard, we have occasionally recommended diammonium phosphate application to supply both P and N; however, this product is fairly expensive to apply as a basic source of nitrogen. An alternative to these synthetic N forms is to apply additional organic matter (crude, such as straw, wood chips, cane prunings; or composted). Organic matter, depending upon the extent of composting, will provide N slowly over time (years). Thus, synthetic N or well-composted organic matter is recommended if a rapid N response is necessary.

Where to apply: Place the N where the grapevines roots are concentrated. This will normally be in the weed-free strip under the

trellis. “Banded” applications favor utilization of applied N by grapevine roots and less uptake by row middle cover crops. The situation with under-trellis cover crops requires some compromises. We are banding in this case too, and the vegetation under the trellis will be stimulated by that added N as well. Application immediately before rainfall and/or application via an irrigation system may help move the applied N into the soil profile. Another strategy being used by some who are experimenting with under-trellis cover crops is to burn back the cover crop (but not kill it) with a low rate of glyphosate herbicide or a contact herbicide at the time the N is applied. This would conceivably result in a more favorable utilization of the applied N by grapevine roots as opposed to the cover crop’s use.

While the above discussion has centered on nitrogen, the use of visual examination of the vines and routine use of plant tissue sampling and analysis can provide a comprehensive assessment of vine nutritional status. Maintenance of an optimal range of essential nutrients in the vine is one of many components of an effective vine management plan.

Analytical labs: Some states support plant tissue analysis testing through their land-grant university extension services. In Virginia, most growers are using either the Penn State tissue analysis lab or A&L Eastern Laboratories in Richmond. You can submit plant tissue samples directly to either of these labs with the appropriate submission forms: Penn State plant analysis forms are available at: http://www.aasl.psu.edu/. Click on “submitting samples” on the menu on the left-hand side of screen. A&L Eastern Laboratories also has submittal forms for plant tissue samples at their website (http://www.al-labs-eastern.com/agricultural.html). Interpretation of tissue analysis results and strategies for fertilizer application, if necessary, are found in the Wine Grape Production Guide.

Wolf, T. 2008. (Editor) Wine Grape Production Guide for Eastern North America. Available from: http://www.nraes.org/nra_index.taf?pr_new=1

II. Eastern US winegrape fungicide and insecticide posters

VineSmith, Inc. has an updated 2009/2010 Eastern US Winegrape **Fungicide** Guide as well as an Eastern US Winegrape **Insecticide** Guide. Additional information is available on commonly used vineyard **herbicides**. Collectively, the products are referred to by VineSmith as the pest management tool kit. The "at-a-glance" color-coded posters help vineyard managers plan a responsible, effective and economical grape pest management program. In addition to a pest development calendar and the relevant application information and restrictions, the posters cover 30 fungicides and insecticides with information on:

- product chemical and representative trade name (where multiple labels exist)
- manufacturer of representative label
- EPA registration number of representative label
- OMRI (Organic Materials Review Institute) certification for use in organic production
- approximate costs per acre per application

While much of the information that VineSmith has used on the posters is available on product labels, the posters are unique in providing a single-source comparison of products, including the relative efficacy of the project against the intended target pest, and a general comparison of material cost per acre. I have found the last feature (costs) to be particularly helpful in formulating our own spray program. The Guides can be obtained directly from VineSmith Inc. (www.vinesmith.com) (540-869-5188).

III. VDACS Pesticide Inspections:

Tom Burke is a Pesticide Inspector with the Virginia Department of Agriculture and Consumer Service's (VDACS) Office of Pesticide Services. If you attended the Virginia Vineyards Association's annual technical meeting in Charlottesville in February, you would have heard Mr. Burke talk about his efforts to ensure that vineyards (and other pesticide using operations in his district) are in compliance with the Environmental Protection Agency's (EPA) Worker Protection Standards (WPS) and pesticide label directions. The WPS manual can be downloaded from: http://www.epa.gov/oecaagct/htc.html

Mr. Burke offered the following constructive advice: "I am increasing WPS efforts in my assigned area and am trying to assist in educational preparation as much as possible before implementing my additional enforcement efforts. I will perform Tier II inspections this spring at as many vineyards, greenhouses, and orchards as possible for me, which are "off-season" WPS inspections, and allow for much more flexibility. After the "flexibility period" this season, I'll be forced to perform stricter enforcement, whether I performed a Tier II at a given location or not… I will start Tier I inspections (in July/August) and stricter enforcement. WPS Owners/operators may also be reminded that although there are WPS exemptions for owners and immediate family, they are still subject to WPS inspection to confirm validity regarding exemption claims and any WPS items not exempted by their status."

Mr. Burke is one of about a dozen VDACS Pesticide Inspectors in Virginia, and he covers the Warrenton area specifically. Mr. Burke's message at the VVA meeting and with the reminder here is that he would sooner help ensure that you are WPS-compliant rather than cite you for a violation of Worker Protection Standards. You can learn who your Pesticide Inspector is by contacting your local Virginia Cooperative Extension office, or you can visit VDACS's Office of Pesticide Service's website: http://www.vdacs.virginia.gov/pesticides/ . The following information is taken directly from VDACS's website and offers a synopsis of WPS issues:

The Worker Protection Standard (WPS) is a regulation issued by the U.S. Environmental Protection Agency (EPA) and enforced by the Virginia Department of Agriculture and Consumer Services' Office of Pesticide Services. It covers pesticides that are used in the production of agricultural plants on farms, forests, nurseries, and greenhouses. WPS requires that you take steps to reduce the risk of pesticide-related illness and injury if you 1) use pesticides, or 2) employ workers or pesticide handlers who are exposed to such pesticides.

If you are an agricultural pesticide user and/or an employer of agricultural workers or pesticide handlers, the WPS requires you to provide to your employees and, in some cases, to yourself and others: Information about exposure to pesticides; Protections against exposures to pesticides, and; Ways to mitigate exposures to pesticides.

You need this information if: You own or manage a farm, forest, nursery, or greenhouse where pesticides are used in the production of agricultural plants; You hire or contract for services of agricultural workers to do tasks related to the production of agricultural plants on a farm, forest, nursery or greenhouse (this includes labor contractors and others who contract with growers to supply agricultural laborers); You operate a business in which you (or the people you employ) apply pesticides that are used for the production of agricultural plants on any farm, forest, nursery or greenhouse; You operate a business in which you (or the people you employ) perform tasks as a crop advisor on any farm, forest, nursery or greenhouse. If you are in any of these categories, you must comply with the Worker Protection Standard (40 CFR Part 170).

To further assist you, the Office of Pesticide Services has developed a Summary Guide

for the EPA Worker Protection Standard for Agricultural Pesticides. This guide is designed to summarize the EPA Worker Protection Standard Requirements and provides sample forms and guidance documents developed by OPS to assist growers with compliance. Click here for a copy of this guide.

Worker Protection Standard Training Available: Under an agreement with VDACS, Telamon, Inc. offers FREE WPS training in English and Spanish for employers anywhere in Virginia. For more information contact Marlene Larios at Telamon's Richmond Office at 804.381.6082 or by email at: mlarios@telamon.org.

Worker Protection Standard Information at a Central Location: One of the more common violations VDACS has seen while doing recent WPS inspections is the requirement for "Information at a Central Location". WPS requires that you establish a location giving your employees unrestricted access. This might be the break room, the shop area where they receive instructions for the day, or a bulletin board by the time clock or office. The following items must all be displayed:

- EPA Pesticide Safety Poster or you can make your own poster following the guidelines in the EPA WPS How to Comply manual.
- The name, address, and phone number of the nearest medical facility. You can put this information on the EPA safety poster or use a separate sign.
- Information about all of the pesticide applications done at your establishment. There is no required form or format for this information, however you must record, in some manner:
  - The location and description of the area to be treated
  - Product name
  - EPA registration number
  - Active ingredient (s) of the pesticide
  - Time and date the pesticide is scheduled to be applied
  - Restricted entry interval (REI) for the pesticide

This information must be displayed for 30 days after the restricted entry interval, or if there is no REI, 30 days after the application. We encourage you to sit down with the "How to Comply" manual and this short article and review the WPS requirements. If you have questions about this or any other WPS issues call Micah Raub at 804.786.4845.

IV. Other news:

A. Grapes for Sale postings: We have provided a service in the past five years for those seeking to sell or to purchase Virginia-grown grapes by listing such want-ads on our Viticulture Notes listserv. We will resume this service for 2009 and I will post such notes on a bi-weekly basis through August 2009 for Virginia growers. Please email me (vitis@vt.edu) with your full name, phone number, Virginia county name where your vineyard is located, email address, and the tons, by variety, that you either wish to contract for sale or for purchase. Interested parties can communicate directly with each other. Please do not use special formatting -- just provide the information requested here in normal text. The first posting will be sent out before the first of May. I will also put this information on my website.

B. Pest Management Guides: Virginia Cooperative Extension's annually-revised Grape Pest Management Guides are available online now at: http://www.ext.vt.edu/pubs/pmg/. The 2009 PMG includes recently registered fungicides, insecticides and herbicides as well as information on pesticide safety and legal restrictions.

C. Guidelines for Developing an Effective Fungicide Spray Program for Wine Grapes in Virginia, 2009: Dr. Mizuho Nita, our grape pathologist (http://faculty.vaes.vt.edu/nita24) has written an instructive guide to tailoring a disease management program to Virginia growing conditions. We've attached a copy of the Guide to the transmittal of this newsletter, and will post the Guide to Dr. Nita's website shortly.

D. Wine Grape Production Guide for Eastern North America: This 336-page book has been available now since February. The book's 16 chapters provide a comprehensive guide for beginners and seasoned grape producers. A description of the book and ordering information is available at: http://www.nraes.org/nra_index.taf?pr_new=1 .

V. Upcoming meetings:

A. Vineyard meetings in Virginia

A number of vineyard meetings, arranged by Virginia Cooperative Extension Agents, have been arranged for the period from April through early August. The meetings generally include one to several grape specialists with Virginia Tech and the Cooperative Extension agents and vineyard host(s) may provide presentations as well. The following meetings are scheduled for the 2009 growing season. Specific topics and travel directions will follow where those details are not presented here. Unless specified differently (such as the meeting on 29 April at Hortons), the meetings are scheduled from 11:00 am – 2:00 pm. The first hour will be a tour of the vineyard, followed by a lunch discussion. Everyone is asked to bring a bag lunch. Presentation topics may be modified slightly depending upon unique seasonal issues.

April 29th **Horton Vineyard and Winery, Gordonsville (meet at the Winery)**
Dennis and Sharon Horton
***** This meeting will start at 2:00 pm *****

- Topics – Seasonal disease management considerations: – Dr. Mizuho Nita, Virginia Tech grape pathologist
- Seasonal viticultural management strategies – Dr. Tony Wolf, Viticulturist
- Additional topics may be added

Directions From Culpeper: Take 29 South to Ruckersville, then left onto 33 East; the winery is 8 miles on the left.
For more information: contact Kenner Love, Rappahannock County Cooperative Extension klove@vt.edu (540) 675-3619

May 13th **Glen Manor Vineyards (http://www.glenmanorvineyards.com/)**
Jeff White

- Topics – Seasonal disease management considerations: – Dr. Mizuho Nita, Virginia Tech grape pathologist
- Seasonal viticultural management strategies – Dr. Tony Wolf, Viticulturist
- Additional topics may be added

Directions: See Glen Manor website (http://www.glenmanorvineyards.com/)
For more information: contact Kenner Love, Rappahannock County Cooperative Extension klove@vt.edu (540) 675-3619

June 3rd **Linden Vineyards (http://www.lindenvineyards.com/linden/)**
Jim Law

- Topics – TBD

Directions: See Linden Vineyards website (http://www.lindenvineyards.com/linden/)
For more information: contact Kenner Love, Rappahannock County Cooperative Extension klove@vt.edu (540) 675-3619

June 24th **Doukenie Winery (http://www.doukeniewinery.com/index.cfm)**
George Bazako, Sebastien Marquet (winemaker)

- Topics – Canopy and crop management

***** Meeting will be in the evening – contact Leslie Blischak for details *****

Directions: (Loudoun County) See Doukenie Winery website (http://www.lindenvineyards.com/linden/)

For more information: contact Leslie Blischak, Loudoun County Cooperative Extension (703)-737-8978 lblischa@vt.edu

Others Several other vineyard meetings are planned but details are sketchy at this point. Dates are 20 May, 5 June, 16 July, and 5 August. We will provide details in future mailing.