Virginia Cooperative Extension
Virginia Tech • Virginia State University

Viticulture Notes ..... Vol. 30, July 2015

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I. Current situation:

Some observations on the 2015 season in a nutshell: we dodged the spring frost bullet for the most part; more cloudy, rainy periods than average; temperatures trending above average since 1 April; still observing problems (crown gall, discolored foliage, collapsing vines) dealing with winter injury of the last 2 years, no drought conditions at this point. On the meteorological side, growing degree days (GDD) for our AREC are trending higher than the previous two years. Using 10C as the base (50F), GDDs for the period 1 April to 15 July were 666 in 2013, 846 in 2014, and 914 in 2015. Solar irradiance measured during the same period was 1945 kW/m^2 (kiloWatts/square meter) in 2014 and 1603 kW/m^2 in 2015 (I don't have 2013 data readily available). Solar irradiance is an indication of cloudiness. If we look at a potential maximum solar irradiance for the 1 April to 15 July period (~ 2600 units), the 2014 period would equate to about 75% of maximum irradiance while the 2015 season would be down around 61% of potential irradiance. If you think that we've had a lot of cloudy weather thus far in 2015, you'd be correct.

We've had a lot of wetting periods over the past 2 months and ample opportunity for downy mildew (DM) infections. Surprisingly, while we've had some reports of DM, many vineyards are surprisingly clean. One of our research-cooperating vineyards did have some early downy back in late-May, but seemed to have gotten on top of it quickly. Black rot (BR) is starting to appear on berries in some vineyards. We had some foliar BR lesions here and there in our vineyard back in May but I've not seen evidence of the disease on berries. If you are not tuned-in yet, please follow Dr. Mizuho Nita's grape disease blog: http://grapepathology.blogspot.com/. That and the pre-season IPM sessions that he and Tremain Hatch organize have kept many of us from disease disasters.

Japanese beetles (JB) arrived early for us this year and I applied two different sprays specifically for these insects. There are some still about at Winchester but I'd categorize the season (for us) as a "mild" pressure season. Tremain reports that the JB pressure has been stiffer and more persistent in their vineyard east of the Blue Ridge.

On a bright note, a number of Viognier growers are reporting a significant uptick in crop levels on Viognier this year. Wish it were due to some active intervention of vine or vineyard management, but it's likely just season variation. Across the variety board, and with a few exceptions such as some plantings of Malbec, I've seen pretty high crop levels in most varieties this year. Come to think of it, why plant Malbec?

Recovery from winter injury of the past 2 years has been an on-going contest in certain vineyards, with some growers rethinking the quality of their sites for varieties such as Tannat or Tempranillo (love these varietal wines but oh yes, they are cold-tender varieties!). If anything, the last 2 winters have reinforced the importance of properly matching sites with the thermal requirements of the proposed variety. But even areas of the state, including those close to the Chesapeake Bay, that are usually immune to extreme cold weather, got a dose of extreme low temperatures and experienced some cold injury over the past 2 winters. Recovering from the cold injury includes assessment of injury, fundamental decisions on retraining vs. replanting, and retraining new trunks if that's the prudent course of action. The process is going to vary from vineyard to vineyard and will involve subjective assessments/decisions by the vineyard owner, so it's difficult to offer more than a generalized strategy. Unfortunately, many vineyards simply don't have healthy new shoots arising from above graft unions of injured vines, so the retraining is constrained in those situations. Severely damaged vines should be flagged for removal and plans made now to order replacement vines for spring 2016. Injured vines -- even those with some evidence of crown gall development on the trunks – are not necessarily destined to prematurely die. We do see some examples of injured vines that repair and recover from such injury. Damage to the trunks does not go away, but if there is some healthy vascular cambium, and the vines are not further stressed, new vascular tissue can develop and support the vine into future years. My advice here would be to take a "wait and see" approach on these injured, "iffy" vines. Flag them and monitor them. If the canopy appears reasonably sound and the vine size/capacity is near normal for its space, the vines might survive and be productive in following years. If, on the other hand, the shoots are severely stunted, discolored and/or they have already collapsed, and no renewal suckers are emerging low on the damaged trunks, the vine should be written off.

II. Pre-harvest considerations:

August is typically our slowest summer month in vineyard management, and it's a good time to look ahead at and prepare for the coming harvest season. We're seeing the first indications of color change associated with véraison in early reds (e.g., Merlot) in northern VA, so points further south are likely already into véraison. A check-list of pre-harvest activities would include the following, at minimum:

Canopy management: Do a final check of the vine canopy. Prematurely senescing, yellowing leaves should be removed from the fruit zone. They do not contribute carbohydrates to fruit maturity and may in fact contribute potassium to ripening fruit. Elevated potassium in fruit can, under certain conditions, lead to elevated fruit pH. Leaves also retard the drying of clusters when those leaves are in contact with clusters, and they can promote botrytis development on fruit in both direct and indirect ways. You needn't denude the fruit zone of leaves, but *most* clusters should be getting *some* direct sun exposure at *some* point during the course of a day. Aim to keep leaf layers in the fruit zone of the canopies down to 1 or 2 on average: a real or imagined probe run through the canopy should contact no more than 1 or 2 leaves on average as the probes passes from one side of the canopy to the other. While there is still a chance of causing fruit sunburning by being too aggressive with leaf-pulling, in my experience, the sunburning is more apt to occur closer to the summer solstice. Look for congestion at the tops of hedged VSP-trained canopies. If the hedging was not done in a timely fashion, the shoot tops might be growing horizontally along the top wires. Normal hedging can also produce several laterals where there was originally only one growing point. Collectively, this lateral growth can create very dense regions at the top of the canopy. It is often in these shaded, poorly ventilated regions that downy mildew gains a foothold on young, susceptible leaves.

Crop management: It's not too late to reduce crop levels on vines that are carrying a heavy crop. Clusters at 50% véraison weigh about 80% of their harvest weight and fruit at 15 to 17°Brix will essentially represent final weight, with some variation due to precipitation extremes. If you failed to collect mid-

season cluster weight data you can still estimate crops and make downward adjustments to the crop if you feel the crop level is excessive. As I've used in previous communications, a good range of desired crop is about 1.5 to 2.0 pounds of crop per foot of canopy, irrespective of vine density in the vineyard. Methods of crop estimation and crop level management are discussed in greater detail in our Wine Grape Production Guide for Eastern North America.

Pest management: The frequent wetting periods of the 2015 season have increased the pressure from phomopsis, black rot and downy mildew. So imagine our surprise when we found occasional powdery-infected berries in our Petit Manseng! Speaking with Mizuho Nita about this occurrence we more or less agreed that the infections might have occurred back around bloom in early June. The infections were, for the most part, single berries, and we're not seeing disease on secondary clusters, and we were able to get on top of the occurrence very quickly and effectively. I'm sure there are some dire disease situations out there, but I've been pleasantly surprised by how clean the vineyards have been that I've visited over the past 6 weeks. If you've done a good job with disease control up until now, you will find it much easier making it all the way through harvest; if not, you may still have a fight on your hands. Berries are less susceptible to PM infection once they attain about 8° Brix. Fruit may, however, continue to show lesion development from infections that occurred up to one month ago. Low levels of PM may exist on fruit, even with apparent "good" prevention programs. The "inconspicuous" mildew can increase fruit susceptibility to botrytis and other rots later in the season. Powdery mildew fungicide options in the pre-harvest period are constrained by label pre-harvest intervals (PHIs) and the need (or at least desire) to avoid sulfur residue on harvested fruit, which can occasionally lead to sulfide production and off-odors in wine. It is advisable to avoid sulfur application within 6 weeks of harvest if at all possible. Fungicide and other pesticide options are provided in the Virginia Cooperative Extension Pest Management Guide (https://pubs.ext.vt.edu/456/456-017/456-017.html).

Botrytis: Botrytis incidence varies from year-to-year, but we tend to have greatest problems in large, compact clustered varieties such as Seyval and Chardonnay. Culturally, the incidence of botrytis can be reduced by removing leaves that are directly touching clusters, and opening the eastern side of N/S-oriented rows to aid air movement and spray coverage. It's certainly not too late to do some follow-up leafing in botrytis-prone cultivars, but avoid pulling too many leaves that could result in sunburning of fruit (see comments above under *canopy management*). Fungicide options, specific for botrytis, are provided in the Virginia Cooperative Extension Pest Management Guide (https://pubs.ext.vt.edu/456/456-017/456-017.html).

Downy mildew: Conditions that favor the spread of downy mildew (DM) are temperatures of 65 to 77°F and free moisture. A summer late-day shower followed by a humid evening creates the perfect scenario for a downy infection. Fruit becomes resistant to infection as it develops; however, young leaves (such as on laterals) are highly susceptible, and this is often where late-summer infections develop. To avoid a potential defoliation, continue a downy mildew protection program through harvest. Fungicide options are provided in the Virginia Cooperative Extension Pest Management Guide (https://pubs.ext.vt.edu/456/456-017/456-017.html). And, as noted above, Dr. Nita provides good disease updates along the seasonal pathway towards harvest. In our own vineyard, we bank a little heavier on the use of the phosphorus acid materials, and an occasional use of captan in late-summer, trying to lay off applications within 30 days of harvest. Watch the Pre-Harvest Intervals (PHIs): some of the insecticides and even a couple of fungicides (e.g., Ranman and Reason, both of which offer DM protection) have 30-day PHIs, while Ridomil+Copper has a 42-day PHI. Don't get caught out on this technical label restriction.

Birds: Be ready for bird control. Once we start seeing color change in our reds, we want to be prepared to

put up bird exclusion netting. We've used the round hay bale netting over the past 10 years or so and for us it works. We pin the bottom of the two panels, sandwiching the fruit zone of the VSP-trained vines. Birds don't seem to mind flying *up* into the fruit zone through openings in the panels, but I've not seen them fly *down* into the sandwiched canopy, so we pay more attention to closing the bottoms of the panels than worrying about the tops. We play out the 51" wide netting from a vertically-mounted spool in the back of a 'Gator. If you want photos, just ask (vitis@vt.edu). Nothing fancy, but it works for us.

Grow tubes: As a reminder to anyone using grow tubes, the tubes should be removed from vines by 1 September to allow vines to normally acclimate to fall conditions. DO NOT leave the tubes on over winter. We have seen ample evidence that vines can be severely damaged by winter temperatures if the vines remain in tubes over winter.

III. Nitrogen management for fruit quality

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It's no secret that vintners in the Eastern US often have to contend with excessive vegetative growth in their vineyards. Excessive vine vigor can lead to depressions in phenolic concentration and the pleasant varietal aromas. High vigor can also lead to increases in: fungal diseases, vegetal aromas (arising from methoxypyrazines), juice/wine pH, potassium concentration, and the malic/tartaric acid ratio.

Many in the East have successfully employed cover cropping as a strategy to mitigate the threat posed by excessive vine vigor. Extensive (including the use under-trellis) use of cover crops is also important with hillside vineyards which are otherwise subject to severe soil erosion when soil is left bare. Such cover cropping, however, does not come without drawbacks. Cover crops directly compete with the vine for water, which is the main driver of vegetative growth. Water is the medium through which soil nutrients are transported into the plant. Therefore, if the cover crop competes for water, it is also competing for nutrients. The most important plant macronutrient is nitrogen. This decrease in water and nitrogen availability caused by a cover crop can lead to depressions in: yield, perennial nitrogen reserves in the vine and yeast assimilable nitrogen (YAN) in the harvested fruit.

Vines of low to moderate vigor may produce wines of higher aromatic intensity when compared to vines with excessive vegetation. However, low fruit nitrogen (YAN) status brought on by cover cropping can lead to lesser aromatic intensity in the resulting wine. Therefore, even though vine vigor may be successfully diminished by cover cropping, the issue of limited aromatic intensity has not been addressed with this strategy. When YAN is limiting (<150ppm for a must at 24°Brix fermented to dryness) it can lead to fermentative off aromas and even a stuck or sluggish fermentation.

As part of a larger USDA/NIFA funded project (http://www.arec.vaes.vt.edu/alson-h-smith/grapes/viticulture/research/scri-index.html), and with financial support from the Virginia Wine Board for the initial 2 years of this work (DeAnna D'Attilo's work), we have been exploring nitrogen fertilization strategies specific for vineyards that are intensively (inter- and intrarow) cover-cropped. While some of the original intention of cover cropping was to *reduce* vine size and vigor, we have seen commercial situations where vine capacity (vine size + vine crop yield potential) has been excessively reduced while juice YAN levels have been concomitantly severely depressed. Part of our rationale for the foliar application of N was to direct more of the fertilizer N to the grapevine, and less to the cover crop.

Following up on similar work conducted and reported by DeAnna D'Attilio of our lab (check for a web-based presentation), we conducted 4 field experiments in 2014 to look at combinations of soil and foliar-

applied nitrogen both with and without under-trellis cover crops used. The work used Petit Manseng grown at the AHS AREC in Winchester, Sauvignon blanc grown at Glen Manor Vineyard in Warren Co., and Vidal blanc grown at Indian Springs Vineyard in Shenandoah County. Response data for juice YAN levels from one of those experiments is shown in Figure 1. This experiment used P. Manseng, grown with under-trellis cover crops at the AREC vineyard. The vines have been chronically low in N as measured by bloomtime tissue analysis (0.50 to 0.70% N at bloom). Nitrogen was applied to soil at three rates (30, 45 and 60 kg/ha) as calcium nitrate, with the medium rate supplemented with two foliar applications of N; the first applied just before véraison and the second applied about 2 weeks later, after véraison was completed. As shown by DeAnna's earlier work, the foliar application of urea had a pronounced and significant enhancement of juice YAN at harvest. This response was greater even than the highest rate of strictly soil-applied N (Figure 1).

We presented this work at the Advanced Grapevine nutrition workshop held on June 8th of this year at King Family vineyards. That talk can be found here: http://www.arec.vaes.vt.edu/alson-h-smith/grapes/viticulture/extension/presentations/index.html [incidentally – Tremain has uploaded most of the presentations from the nutrition workshop to this page – there are also a lot of other presentations here if you're interested in perusing some of our presentations over the past few years].

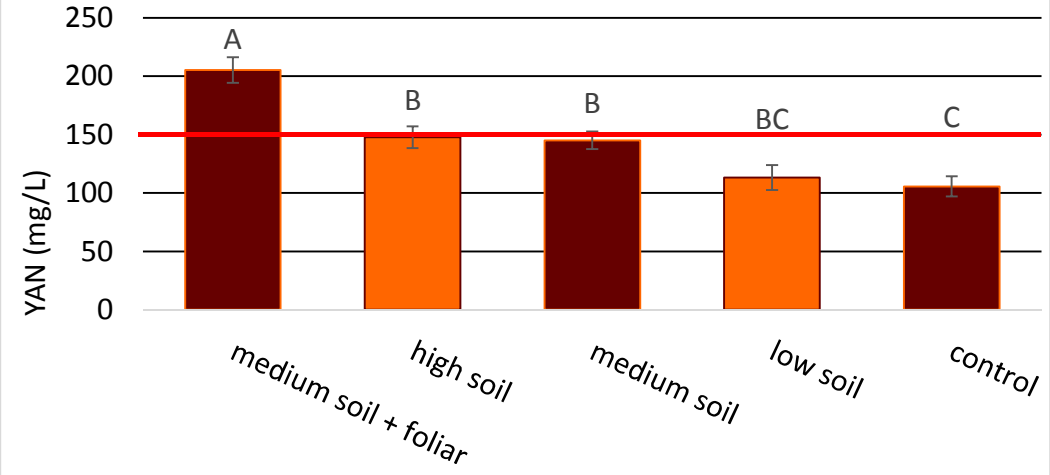

Figure 1: Soil and foliar nitrogen treatment effects upon YAN in Petit Manseng in 2014

It is commonly understood within the winemaking community that organic forms of nitrogen (i.e. those arising from amino acids) are a superior N source to ammonia, as amino nitrogen leads to wines with more preferable aromas. Also, the addition of diammonium phosphate (DAP) may even exacerbate an H_2S issue if organic nitrogen is limited in the must. Table 1 breaks down the YANs shown in figure 1 into their inorganic and organic compounds. Both inorganic and organic components of YAN increased significantly through the application of foliar urea around véraison. The foliar application (13 lbs. N/acre as urea) combined with the medium soil application (45 lbs. N/acre as calcium nitrate) increased organic nitrogen within the berry by 39% when compared to the medium soil-only treatment.

Table 1: Soil and foliar nitrogen treatment effects upon YAN in Petit Manseng in 2014. Letters following means refer to statistical analysis of data. Means followed by the same letter are not significantly different from each other.

Treatment	Ammonia (mg/L)	Amino N (mg/L)	YAN (mg/)
control	40.9 c	64.7 b	105.6 c
low soil	45.6 bc	67.6 b	113.2 bc
medium soil	65.2 b	79.9 b	145.1 b
high soil	64.8 b	82.9 b	147.7 b
medium soil + foliar	93.8 a	111.6 a	205.4 a

Practical application: Foliar nitrogen should be applied in the form of urea. Due to the nature of urea (high solubility and small molecular size), it will be rapidly absorbed by the plant. However, urea can burn the foliage, so in order to avoid this potential problem, one should use a relatively high water to urea ratio. In this study, I have used water rates of approximately 107 gallons/acre with no more than 6.7 lb N/acre as urea in the tank. With that ratio, I have seen minimal, but not significant leaf burning. The high water rate allows for not only dilution of the urea and lesser chance of leaf burn, but it also facilitates greater absorption of the urea by the plant. Lower water rates can be used, however one may increase the risk of burning the foliage. In order to lessen losses due to volatilization and foliar burn, one should apply urea to the foliage during the cooler hours (i.e. early morning, in the evening or night). Also, one should avoid applying urea with horticultural oils or Captan, as to avoid a detrimental phytotoxic response. Urea is likely compatible with other commonly used fungicides, however one should always check with the manufacturer before mixing urea with another chemical. In our work, we have successfully mixed urea with sulfur without significant burning.

It should be noted that the best time to apply foliar urea is around véraison. Véraison marks a period when the fruit becomes a major "sink" for nutrients and carbohydrates, therefore the nitrogen taken up around this time will be much greater than if urea is applied prior to this period. In the experiment shown in this article, we applied two treatments of foliar urea at a rate of 6.7 lbs./acre separated by 2 weeks at véraison.

A caveat: Higher YAN concentrations can lead to a greater risk of fruit botrytis infection. It would be wise to monitor closely for botrytis after spraying urea and consider including a botrytis-specific fungicide following the completion of urea sprays. Anecdotally, we have not seen a greater severity of botrytis infections within the foliar applied urea plots when compared to other treatments.

Conclusion: Nitrogen management in a cover cropped vineyard can be tricky. However, if done utilizing foliar applied urea around véraison, the clever vintner can cost effectively make significant improvements to the resulting wine. If one is to apply foliar urea then the following parameters should be adhered to in order to minimize risk and maximize potential benefit:

1. Apply no more than ~6.7 lbs. N/acre at any one time (make multiple applications as needed)
2. Use high water rates when making applications (~100 gallons/acre preferred)
3. Make applications during cool hours to avoid leaf burn
4. Do not mix urea with oils or Captan
5. Make applications close to véraison
6. Monitor for botrytis and consider applying a botrytis-specific fungicide if weather is conducive to botrytis development

II. Worker Protection Standards:

Wine grape producers are subject to inspections by VDACS's Office of Pesticide Services. In addition to a review of storage, containment and handling of pesticides, the inspectors are also authorized to review compliance with the Worker Protection Standard. 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). For information on the Worker Protection Standard, please visit the EPA's Web site.

Here is a link to the VDACS website/factsheet that explains WPS and then offers additional links to other resources and to the EPA's site. http://www.vdacs.virginia.gov/pesticides/wps.shtml

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 the information above and review the WPS requirements.