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I. Current situation:

As with last year, Spring seems to be taking an unusually long time getting here to the northern Shenandoah Valley. Temperatures on the morning of 8 April were in the high teens to mid-twenties in western and southwest Virginia, warmer near the Bay and Eastern Shore. Today it's raw and lightly snowing. While some of the flowering trees are braving the weather, the grapevines here in the northern Shenandoah Valley look pretty tight yet. We used to average 21 April for Chardonnay budburst here at the AREC, and I think we're going to be at least to that date before we see green, unless there's a very dramatic increase in temperature. As such we have more than a month before we're really out of the woods for the threat of spring frost. While not much has changed in our response to this threat, some recommendations bear repeating:

- It's mostly about site selection and putting the early-budding varieties higher on a slope (*passive* control), but there are some *active* measures that can be implemented, depending on your circumstances, such as use of wind machines (mast-mounted and helicopters), use of sprinkler frost control, and input of heat into the vineyard. Irrigation and heaters are rarely used in Virginia vineyards, but wind machines and contracting with helicopter services are used more commonly. Helicopter services (Warrenton and Richmond, for example, have helicopter services) are often based at metropolitan airports. Explore these services and their costs well in advance of a potential frosty morning if you choose to use this means of protection.
- Mow cover crops to increase soil heating during the day.
- Wind machines: Inspect, fuel and test solid-set wind machines well in advance of their need. Mobile, tractor-powered are fans and heaters are also available and offer some measure of protection for small areas. Overhead irrigation is another alternative, but requires large amounts of water and can cause more injury than protection if not correctly used.
- Avoid use of crop oils *after budburst* if you are in a frost-prone site (note, research has shown some budburst delay with some varieties when dormant oils are applied to vines in the dormant period, well before budburst)

- Efficacy of sprayable "frost protection" products is inconsistent. Growers understandably want to try something, and sprayable materials that enhance the freezing resistance of exposed green tissues, or reduce the population of ice-nucleating bacteria on the plant surfaces, might show positive results under some conditions. If you choose to use such product(s), PLEASE leave some untreated vines as a check/control.
- With some variance due to wind speed, cloud cover, and the relative dryness of the air, the temperatures (degrees F) that will damage grape buds and shoots are as follows. Note, these are likely the coolest temperatures that tissues will sustain without injury, and injury might be observed at warmer temperatures depending on the atmospheric conditions before and during the frost episode.

- dormant bud	< 20F
- dormant swollen	26F
- burst bud	28F
- one leaf unfolded	28 - 29F
- two leaves unfolded	29 - 32F

- What happens if your vines get frosted? Should you rush out and remove the frosted shoots? Not much point. I covered this (my opinion) in an earlier Viticulture Notes: (http://www.arec.vaes.vt.edu/alson-h-smith/grapes/viticulture/extension/news/vit-notes-2010/vn-june-2010.pdf) and will stick to that response.

II. Nitrogen management

Of the essential mineral nutrients used by grapevines, nitrogen (N) is the nutrient used in the greatest quantity by grapevines. Nitrogen is a structural component of nucleic acids (RNA, DNA), amino acids and protein, and is an essential component of all enzymes and the principal light harvesting pigment, chlorophyll. Whether as free amino N or as ammonia/ammonium, nitrogen is also essential for yeast metabolism, and Yeast-Assimilible Nitrogen (YAN) levels impact wine-making decisions. Whether supplied by the mineralization of N from soil organic matter, or added as fertilizer N, most of our vineyards will benefit from some added N, periodically if not annually. The need for additional N as fertilizer (including compost forms) will be governed by the net removal of N in crop and prunings (if prunings are also removed from the vineyard), the amount of organic matter in the soil, and perhaps by the inherent differences in grape varieties and whether vines are grafted. Recommendations on assessing and maintaining N status in the vineyard are covered in some detail in our Wine Grape Production Guide (Wolf, 2008). The intent here is to provide reminders on seasonal N fertilization strategies and to add commentary on how N fertilization programs might be adjusted for vineyard floor management strategies, particularly the more extensive use of under-trellis or intra-row cover crops.

We've been involved in Virginia Wine Board-funded research since 2012 to explore more efficient means of maintaining nutrient – especially N – status where vineyard cover crops are more extensively used. To digress from the central nitrogen topic a bit here, some explanation of why one would want to use intra-row cover crops might be helpful. Wine quality, of course, is intrinsically dependent upon the quality of the grapes, where quality is governed in part by grape aroma and flavor, as well as freedom from spoilage organisms. These features are intimately affected by the grapevine canopy microclimate, particularly fruit exposure to sunlight and the higher evaporative potential afforded by a relatively open canopy. Due to their inherent vigor, grafted wine grapes grown in the humid Mid-Atlantic often produce more vegetation than can be effectively accommodated by typical training systems. The consequences of this excessive vegetative growth include dense, shaded canopies that foster disease and negatively impact fruit and wine quality potential, and that invariably require increased canopy management labor to correct. There is plenty of research, some of which we've conducted here in Virginia (Zoecklein et al., 2008) that has demonstrated that the use of divided canopy training systems, such as Smart-Dyson, is an effective means of converting the high vegetative capacity of grapevines into increased crop capacity while sustaining or improving grape composition and wine quality potential. Yes, divided canopy training is not without its own management, material and other challenges, but it has a place in our industry. Canopy management practices such as shoot and leaf thinning, and shoot hedging are also used to avoid or reduce the excessive canopy density. Wine growers may also choose sites that are less likely to contribute to excess vine vigor, such as convex land forms, steeper slopes, and soils that are inherently less water-retentive. As vineyards were increasingly sited on steeper terrain, the need for effective means of stabilizing soil to avoid erosion became more acute. This contributed to a greater use of under-trellis or intra-row cover crops.

Cover crops for vigor suppression: Cover crops suppress vine vigor through direct competition with the vines for soil moisture and nutrients. Regardless of whether cover crops are intentionally planted monocultures, or mixed stands of weeds, these plants will use moisture in the soil that would otherwise be available for grapevines. The degree to which cover crops compete with grapevines for soil moisture will be a function of the extent to which the cover crops occupy the soil surface, the age and rooting depth of the grapevines, the species of cover crop, soil moisture reserves, and frequency of rains or irrigation. The vegetative growth of grapevines is directly and positively affected by the width of the weed-free soil strip maintained under the trellis. Sodded row middles also compete with vines for moisture, as grapevine roots extend into the row middles. The vineyardist will wish to minimize the competition with cover crops in those situations where vine size and vigor are inadequate (i.e., less than 0.25 pound of dormant cane prunings per foot of canopy), and may wish to increase the competition with cover crops where vine size is excessive (greater than 0.35 pound of dormant cane prunings per foot of canopy). Research has shown that grapevines can adapt to competition from perennial cover crops in some situations by root exploration of deeper soil layers where soil moisture reserves are less apt to be depleted by the cover crop. The vineyardist must balance the competitive stresses imposed by cover cropping with the benefits of regulated vine vegetative growth. This is a dynamic balance that can be affected by seasonal rainfall or irrigation within a year, and by year-to-year variation in vine performance. Thus, floor management practices of the 1 to 8 year-old vineyard might differ from practices used beyond the 8^{th} year of the vineyard.

In addition to utilizing soil moisture, cover crops will utilize nutrients, particularly nitrogen and phosphorus, which may lead to deficiencies of these essential nutrients in companion grapevines. Certain cover crops might also exert allelopathic effects on vine growth, although this has not been well documented in vineyard situations. Nitrogen deficiency symptoms include reduced depth of green coloration in leaves, reduced fruit set and crop yield, and diminished vine capacity in successive years. Phosphorus deficiency has been observed where cover crops are intensively used <u>and</u> where soil pH has slipped below about 5.3. We'll concentrate on the nitrogen response to cover crops here though.

The above discussion hopefully, for the purposes of what started out as a "seasonal reminder on nitrogen fertilization", sets the stage for why nitrogen management strategies might need to be adjusted where vineyard cover crops are used more intensively.

Assessing the need for nitrogen: Rather than using one yardstick, we ideally use several measures of vine performance to assess the vine's N status:

- *Vine capacity.* Vine capacity includes vegetative growth as well as crop yield. Are vines filling the trellis with foliage? Are average pruning weights in the range of 0.25 to 0.35 lbs/foot of canopy? Are crop yields acceptable, and averaging 1.0 to 2.0 lbs of crop per foot of canopy?

- *Foliage color.* Do well exposed leaves remain green for the season's duration or does foliage trend more yellow by mid-season, particularly with the more basal leaves of the shoot?
- *Soil test results.* Soil testing is important to monitor the full range of essential nutrients, soil pH and soil organic matter (OM), but has some limitations when used without plant-based tissue analysis, or without consideration of the visual assessments. Soil tests that include soil organic matter can provide an estimate of the available N to vines. A mineral soil with 3% OM contains about 36 tons of organic matter per acre in the top 8" of soil. If that organic matter has a 10:1 carbon/nitrogen ratio, the same 8" of soil would contain about 2.1 tons of organic N. Sounds like a lot, but plants don't just vacuum-up organic N. The rate of mineralization and conversion to forms of N that can be readily absorbed by the grapevine (principally nitrate and, to a lesser extent, ammonical N) will vary with soil microbial "health", temperature, moisture and other conditions. We can, however, figure a ballpark range of 0.5 to 1.0% conversion per year, depending on how much soil tillage is done. So our 3% organic matter soil might release 20 to 40 pounds of available N per year. That might be sufficient for relatively modest-yielding vines, but keep in mind that we remove 2 – 6 lbs of N per ton of crop from the vineyard, more if we remove prunings, and more still if we consider leaching of mobile N out of the vineyard. Inputs include a deposition of atmospheric N with rainfall (5 lbs or more per acre by one estimate) and a "fixing" of atmospheric nitrogen by symbiotic organisms in association with legumes, and free-living, non-symbiotic soil microorganisms. Collectively, the dynamics of the vineyard N budget make it difficult to pinpoint how much available N is in the soil at the optimal time for plant uptake, but knowing the soil's OM content is useful to know how much latitude one has in balancing vine N needs. Soils with more than 3% OM will need less applied N than will soils with 0.5% OM.
- *Plant tissue analysis.* The third leg of our N assessment "stool" is plant-based tissue analysis. We've formerly recommended bloom-time petiole testing for this measure, but we've been moving to a veraison (70 to 100 days after bloom) sampling of petioles from mid-shoot leaves. Recent work from the Pacific Northwest, some of which was discussed by Paul Schreiner at the 2018 Virginia Tech/Virginia Vineyards Association meeting in Charlottesville, suggests that whole leaves (blades and petioles) is superior to petioles alone, at least of N assessment. Our own data on this tissue comparison from our work in Virginia is still equivocal – probably either method is acceptable, but it is absolutely critical that you let the diagnostic lab know what the sample consists of and, if you want a third-party review of the results, that you let those advisors also know how the sample was collected. Leaf blade tissue contains more total N than do petioles. Using petiole-based benchmarks for interpreting whole-leaf tissue diagnostic results will lead to erroneous interpretations. A single plant tissue analysis test will run about $20 to $25 for processing.
- *Yeast-Assimilible Nitrogen (YAN):* The three-legged stool might be further stabilized, if you will, by using a fourth indicator of N status, and this relates to the juice or must content of nitrogen at harvest. Yeast-Assimilible nitrogen (YAN) comprises free amino nitrogen and ammonia/ammonium N, principally, that will support yeast growth during wine-making. Inadequate YAN levels can lead to sluggish fermentation and the potential for generation of off-odors or other enological flaws. Excess YAN can predispose wines to other microbial growth. The optimal YAN concentration in must is debatable, but a figure of 140 – 150 mg/L is often used as an optimal range. This is not to say that great wines aren't made at lower YAN levels, nor that any values greater than 150 mg/L will lead to microbial problems. But if your vineyard's YAN levels are chronically low and your buyer is complaining about the low YAN levels, there are vineyard options for increasing the YAN level, and there is some evidence that increasing YAN in the grapes might be superior to simply adding such nutrients to the must once the fruit is crushed.

Interpreting tissue N levels: You've collected tissue samples, rinsed them, dried them, and submitted them to a diagnostic lab (several are listed below). The results that you get back from the lab will give some guidance on how the N (and other elements) levels compare to optimal benchmarks. The benchmarks are affected by the timing of collection (e.g., bloom vs. veraison) and by the specific tissue collected (e.g. petioles only or petioles+blades). That information is absolutely necessary for an accurate interpretation of the results. Petiole N values for bloom- and veraison-sampled vines are presented in Table 1. The data of table 1 is the same that is presented in the Wine Grape Production Guide with the exceptions of potassium and nitrogen. Potassium values have been lowered (as discussed in 2016), as has the range of nitrogen concentration for veraison petioles. If your diagnostic samples are coming in lower for N than the ranges found in Table 1, consider the results in the context of perennial vine performance and visual indicators of N adequacy. Supplemental or increased maintenance levels of N fertilizer might be indicated. Short-term measures such as foliar N application might be warranted for low N levels detected at veraison sampling, particularly if this is a recurring feature correlated to historically low YAN levels in fruit from the sampled block. Post-harvest fertilization also has merit in some situations (see *When to apply nitrogen*, below).

Table 1. Sufficiency ranges for nutrient concentrations in soil and plant tissue samples and soil pH targets.

	Soil		Bloom petioles		Veraison petioles	
Nitrogen	---		1.2 – 2.2	%	0.75 – 1.0	%
Phosphorus	20 - 50	ppm	0.17 – 0.30	%	0.14 – 0.30	%
Potassium	40 - 50	ppm	≥ 1.5	%	0.8 – 1.0	%
Calcium	500 - 2,000	ppm	1.0 – 3.0	%	1.0 – 2.0	%
Magnesium	100 - 250	ppm	0.3 – 0.5	%	0.35 – 0.75	%
Boron	0.30 - 2.0	ppm	25 – 50	ppm	25 - 50	ppm
Iron	20	ppm	30 – 100	ppm	30 - 100	ppm
Manganese	20	ppm	25 – 1,000	ppm	100 – 1,500	ppm
Copper	0.5	ppm	5 – 15	ppm	5 - 15	ppm
Zinc	2.0	ppm	30 – 60	ppm	30 - 60	ppm
Molybdenum		ppm	0.5	ppm	0.5	ppm
Organic matter	3 – 5	%				
pH	5.5	V. Labrusca		PPM X 2 = lbs/acre		
	6.0	Hybrids				
	6.5	V. vinifera				

While there is interest in using whole leaves (petioles+blades) (see for example: https://tinyurl.com/PNW622), sufficiency ranges for nutrients found in whole leaf samples have not been evaluated in humid, eastern US conditions. Assuming that the sufficiency ranges would not dramatically differ due to region, optimal ranges of N might be 2.50 - 3.50% for bloom-sampled whole leaves, and 2.25 – 3.25% for veraison-sampled whole leaves (Davenport and Horneck, 2011). Note that these ranges are much greater than those (Table 1) for petiole-only samples. I believe that more work is needed in Virginia to compare tissue sampling methodology, including not only time of year, but time of day that the samples are collected. If you choose to use whole leaves (as opposed to petioles only), please make sure to communicate this fact with anyone you rely on to interpret your diagnostic results.

How much N to apply: If you've read the last section, it should be apparent that the answer to this question depends on a number of factors. Light, maintenance applications of N might range from 15 to 25 pounds of actual N per acre per year. If vine capacity is declining (again, pruning weight and crop yield are trending down), and the visual clues point to N deficiency, the "maintenance" application might need to be increased to 30 to 50 pounds of nitrogen per acre per year. And if you've been asleep at the wheel and vine size is substantially depressed, or you're growing a high-N demanding variety (Chambourcin spring to mind), you might need to apply as much as 75 pounds of actual N per acre, at least until vine capacity is restored, which may take a few years. A note of caution here: applied N will not correct more serious problems that might also be contributing to reduced vine capacity. Other nutrient deficiencies, drought, disease, winter injury, root borer infestation (the list goes on..) can all depress vine vigor and vine capacity.

When to apply nitrogen: As with other nutrients, nitrogen is generally taken up by the vine throughout the season by movement of moisture into the roots as a function of transpiration of that moisture through the leaves. Basic requirements are: active roots for uptake, transpiration to drive the uptake, and of course N being present in the soil solution. To minimize loss of N through leaching, N should be applied after budburst and once there is sufficient foliage on the vines to ensure an effective transpirational loading of N by newly forming roots. For this reason we've moved away from pre-budburst and closer to bloom for the application of N. Additional applications can be made after this point if small, incremental doses are to be applied. Post-harvest generally coincides with another flush of active root development and can be another good period for N application as long as the vines have several weeks of active canopy to drive uptake. Post-harvest N is incorporated into nitrogenous reserves available to support subsequent spring growth.

What to apply: We generally recommend applying the cheapest form of nitrogen available, although there may be special circumstances that might dictate alternatives. Low organic matter soils (e.g., those with less than 1% OM) might benefit from the addition of organic matter in the form of compost. Greg Evanylo of Virginia Tech provided a nice summary of the "hows" and "whys" of compost use at the winter technical meeting this past February. Cost, ease of application, and potassium content are practical considerations, but well prepared compost provides a long-term, slow-release form of N that can benefit the vineyard over many years. Urea is a relatively inexpensive form of N and at 46% N is an efficient way to apply N to the vineyard. Urea can be applied to the soil surface, ideally just before rains, or shallow surface incorporated to minimize volatile loss of ammonia to the atmosphere. Feed-grade urea can also be solubilized and applied to the foliage – see subsequent section on "How to apply". Ammonium-based fertilizers such as ammonium sulfate and nitrate-based fertilizer (e.g, calcium nitrate) are also available. Bear in mind that ammonical N fertilizers tend to acidify the soil whereas calcium nitrate is a more pH-neutral fertilizer. Phosphate containing fertilizers such as MAP and DAP might be useful in some situations, although the cost per unit of P_2O_5 and N should be compared to fertilizers such as triple-super phosphate (45% P_2O_5) and urea. Aside from the basic nitrogen-containing fertilizers that you can buy at your fertilizer supply center, there's a long list of proprietary materials, many of which are foliar-applied, that your fertilizer sales people would be more than happy to discuss with you. They all should contain the stated concentration of N on the label and some may do the wonderful things that they're advertised to do. They might be somewhat more expensive than the bulk fertilizer alternatives, but if you think it's money well-spent, I'm not going to argue your decision to use them.

How to apply: What to apply and how to apply it depends somewhat on what kind of response is sought. If vine capacity is insufficient, application of N fertilizer to the vineyard floor (soil) is usually needed to increase vine capacity. Roots are the principal means of getting N into the vine and the root import will be needed to get the quantity of N into the vine needed to appreciably impact vine capacity. Some of the soil-applied N will be sequestered by the vineyard cover crop and will therefore not be available to the vines. The proportion sequestered by the cover crop can be reduced by banding the N fertilizer in the vegetation-free area under the trellis. What about where cover crops are being used under the trellis (intra-row)? You have some options here. You can "burn-out" a thin band of the cover crop under the trellis and apply to this thin band. Alternatively, you can simply apply more N in a band under the trellis and accept that some will be sequestered by the cover crop, but some of the applied N will make it into the rootzone and be absorbed by the vines. Of course you can also make the argument of "Why use an intra-row cover crop if it's only going to compete with the vines for N?" A valid argument, but how are you going to avoid soil erosion on very steep sites? Are you willing to apply a mulch or other means of stabilizing the soil? You can also consider applying the N to the foliage in the form of proprietary N-containing products or as urea. Urea is a very effective form of N to apply – as are specially formulated foliar fertilizers. Urea is a small, neutrally-charged molecule that is readily absorbed by foliage. Leaves contain the urease enzyme that quickly converts urea into ammonical N, and hence into amino acids and other nitrogenous compounds. Urea is also very soluble in water – at room temperature you can dissolve about a pound of urea in a pound of water; however, we would recommend that the application rate be much more dilute. Here are some foliar urea application tips:

- Use "feed grade" or greenhouse grade urea to minimize insoluble contaminants
- Apply to actively growing or mature leaves at no more than 5 lbs of actual N per acre per application. We've gone higher, but we start to see foliar burning at around 7 lbs/acre on hot (>90F) days.
- Do not apply two consecutive sprays at less than a 10-day interval
- Generally, do not mix pesticides with a urea spray unless you're certain that a phytotoxic response will not occur. We've mixed newer, WP and WSP fungicide formulations without problem, but I can't give a blanket approval of all pesticide options.
- Five or six foliar applications of urea might sustain or even increase vine capacity, but this is probably not a very efficient means of applying N to vines that are substantially under-performing due to low N.

Applied urea is a very effective means of increasing YAN, and we've seen that as little as one or two applications just before and just after veraison (in the case of two applications) were extremely effective in increasing N. Figure 1 are data from Russ Moss and N application to mature Sauvignon blanc grapevines in 2014 and 2015. The data are juice YAN values at harvest in mg/L. Again, a benchmark target for YAN is around 140 mg/L. The benchmark was achieved by application of about 30 pounds of urea applied to foliage over the course of each season (6 sprays starting pre-bloom, each at 5 lbs actual N). This was more effective in increasing YAN than were either the same amount of N applied to soil as calcium nitrate (30 N soil) or twice that amount (60 N soil). Control vines had very low YAN levels.

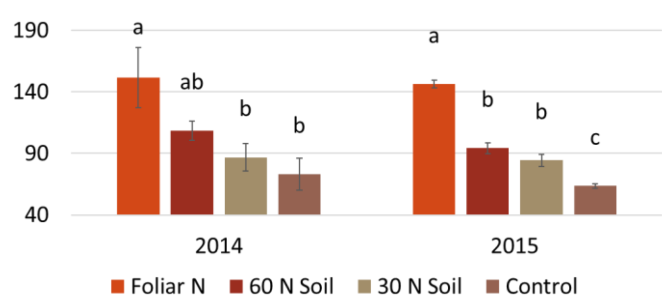

Figure 1. YAN levels (mg/L) of Sauvignon blanc juice at harvest as a function of nitrogen fertilization treatments.

Hopefully this discussion will provide some motivation and guidance on getting a better handle on your vine's nitrogen status. We are continuing the work with Vidal blanc that Tremain Hatch discussed at the Winter Technical Meeting which includes a comparison of both synthetic and organic (compost) forms of N fertilizer.

References:

Davenport, J.R., and D.A. Horneck. 2011. Sampling Guide for Nutrient Assessment of Irrigated Vineyards in the Inland Pacific Northwest. Pacific Northwest Extension publications, PNW622. 6 p. (available online at this intentionally shortened URL: https://tinyurl.com/PNW622

Wolf, T.K. (editor). 2008. Wine Grape Production Guide for Eastern North America. NRAES -145. Natural Resource, Agriculture, and Engineering Service (NRAES), Ithaca, NY. 336 p.

Zoecklein, B.W., T.K. Wolf, L. Pelanne, M.K. Miller and S.S. Birkenmaier. 2008. Effect of Vertical Shoot-Positioned, Smart-Dyson, and Geneva Double-Curtain Training Systems on Viognier Grape and Wine Composition. Am J Enol Vitic. 59: 11-21.

Labs conducting plant tissue analysis:

Waypoint Analytical
http://www.waypointanalytical.com/PlantTissues

Penn State's Agricultural Analytical Services Lab
(fees will vary depending on whether you're a PA resident or not)
http://agsci.psu.edu/aasl/plant-analysis/plant-tissue-total-analysis
Phone: 814-863-0841
Email: **aaslab@psu.edu**

Brookside Laboratories (http://www.blinc.com/)

III. Pest management reminders:

2018 PMG's available: The 2018 Pest Management Guides from Virginia Cooperative Extension specialists are available on-line at: https://pubs.ext.vt.edu/456/456-017/456-017.html

If you're not familiar with the Grape PMG's, the annually updated reference provides a detailed listing of chemical (pesticide) options for disease, insect, mite and weed management in commercial vineyards. Product efficacy and registrations are subject to change; what you used five years ago in the vineyard might still be useful, registered for commercial use, and available locally from your chemical supply company. On the other hand, some materials, such as certain fungicides, may no longer be recommended due to resistance issues. There are usually a few new products each year, which makes another good reason to review the PMG.

Dr. Mizuho Nita's Grape Disease blog: Take a look at Dr. Nita's disease website: (http://grapepathology.blogspot.com/). There is a lot of useful information here and his seasonal blogs are good reminders of what to be looking for in your own disease management program.

Dr. Doug Pfeiffer's Insect Google Group: Dr. Pfeiffer sends out notes on a Google Group in the same fashion that you currently receive my Viticulture Notes. If you'd like to join Doug's Google Group to receive his insect notes, send an email to Dr. Pfeiffer (pcurculio@gmail.com) and ask to be added to his grape pest Google Group.

Climbing cutworms: A brief (again, annual) reminder that climbing cutworms can cause damage in vineyards at this time of year. Cutworms are the larval stage of several different moth species; the adults are inconsequential in terms of feeding. Doug Pfeiffer lists six separate moth species whose larvae can be found in Virginia vineyards (http://www.virginiafruit.ento.vt.edu/cutwormsgrape.html). The larvae feed on swollen grapevine buds and can cause significant destruction of buds and recently emerged shoots (Figure 1). Injured buds appear hollowed-out. Grape flea beetles cause similar damage, so don't assume that the damage is necessarily only caused by cutworms. Cutworm larvae feed at night and seek shelter in soil and debris during the day. Thus, if you observe damaged buds, and cannot locate the pest, chances are that climbing cutworms are at work. If flea beetles (http://www.virginiafruit.ento.vt.edu/GFB.html) are the culprits, chances are good that you'll see some of these insects on the vines during your scouting. In my experience, cutworms are usually the greater problem.

Cutworm larvae are about an inch long. They are smooth, brown or gray, and have stripes running the length of their bodies. A quick search around the base of an affected vine can usually reveal the pest. Some of the most heavily damaged vineyards are those where either mulch or weed debris exists around the base of vines. This offers a refuge for the larvae during the day. Feeding begins in the spring when buds begin to enlarge. The extent of damage depends on the cutworm population but also on the duration of budburst. During cool weather, when the period from bud-swell to budburst is delayed, damage can be extensive. Conversely, during hot weather, shoots emerge quickly and damage is minimal. One of the most damaging aspects of cutworms occurs when they feed on cane-pruned vines. Such canes that are deprived of uniform shoot emergence by cutworm feeding may need to be retrained the following year in order to provide uniform spur placement. On the other hand, older vineyards, that normally crop well, may tolerate 5% or more bud injury without adverse impact on yield. Regardless, you need to walk the vineyard routinely after buds begin to swell to monitor for cutworm activity.

Figure 1. Cutworm damage to swollen grape bud. A tertiary shoot might develop from such a bud, although extensive feeding can eliminate all bud primordia within the compound structure.

Management: Let's cover the cultural (non-chemical) approaches first. Experienced grape growers often note that damage is concentrated in hotspots in the vineyard – often along a vineyard edge or in areas where the debris under the trellis is substantial. I know of some growers who walk their vineyards with headlamps after dark and physically spot and remove the cutworms from vines by hand. It's one option, although a very time-consuming one. We rarely find more than one larva per vine, so the task is not insurmountable. Chemical control, if needed, is based on a number of older grape insecticides, such as Sevin, Dipel (*Bacillus thuringiensis* [B.t.]) and Intrepid 2F, as well as more recently registered materials such as Altacor (chlorantraniliprole), all of which are included in the 2018 Grape Pest Management Guide (http://pubs.ext.vt.edu/456/456-017/456-017.html). Cutworm control can be improved by spraying one of these products in the late afternoon or early evening to ensure that fresh residues are present when feeding commences. Read the insecticide label to determine the correct rate of product application, the restricted entry interval, and other application requirements.

IV. Upcoming meetings:

17 April 2018
Vineyard IPM workshop
Early Mountain Vineyards (Central Virginia)
11:00 am – 4:00 pm
Early Mountain Vineyards (https://www.earlymountain.com/hours-directions)

Review pest management strategies and develop a plan for the coming season with Virginia Tech's pest management specialists. Spanish translations will be available. This is a classroom-based workshop. *Bring a bagged lunch.* There is no fee for this workshop; however, please register for handouts and a seat.
Registration: https://goo.gl/forms/0lRowOzgJ5djaRE32

Agenda:
11:00 am Welcome and vineyard management reminders- Tremain Hatch, Virginia Tech
11:30 Weeds and vineyard floor management – Jeff Derr, Virginia Tech
12:30 Lunch *bring a bagged lunch*
1:00 Worker Protection standards update – Micah Raub, VDACS
1:45 Insect management for the vineyard – Doug Pfeiffer Virginia Tech
2:30 Pathogen management in the Vineyard – Mizuho Nita Virginia Tech
3:15 Grape IPM tool and scheduling exercise –Mizuho Nita VT
4:00 clean up and adjourn

If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please contact Tremain Hatch, AHS Jr. AREC at (540) 232-6032 during business hours of 9 a.m. and 5 p.m. to discuss accommodations 10 days prior to the event.

6 June 2018
Introduction to Mid-Atlantic wine grape production
Virginia Tech's AHS Jr. Agricultural Research and Extension Center
595 Laurel Grove Rd., Winchester VA 22602
Winchester, VA (Frederick County)
(https://www.arec.vaes.vt.edu/arec/alson-h-smith.html)

Team-taught program designed for those either exploring grape production or recently engaged in wine grape production. On-site registration will occur from 8:00 to 8:30 am.
Registration required: $100 per person (includes lunch). Note – online registration via a secure website will be available later in April. We will also have an option for "paper" registration and payment by check.

Tentative program (may be subject to slight changes.
8:30 am: Introduction and market opportunities
Tony Wolf, Virginia Tech
9:00 am: Natural Resources Conservation Service (NRCS) support for new vineyards
Brent Barriteau, NRCS
9:30 am: Vineyard business planning, Vineyard Financial Calculator, and predicted cash flows

Tremain Hatch, Virginia Tech

10:00 am: Lender's perspective on vineyard enterprises
Ryan Clouse, Mid-Atlantic Farm Credit

10:30 am: Vineyard site evaluation and environmental challenges
Tony Wolf

11:15 am: Vineyard design considerations
Tremain Hatch

12:00 pm: Lunch (provided by registration)

12:30 pm: Walk to vineyard and review vineyard design
Tony Wolf and Tremain Hatch

2:00 pm: Variety/clone/rootstock considerations for the mid-Atlantic
Tony Wolf

2:45 pm: A grower's perspective of vineyard management
Tom Kelly, Kelly Vineyard Services and Past-President, VA Vineyards Association

3:30 pm: Fundamentals of grape integrated disease management
Mizuho Nita, Virginia Tech

4:15 pm: Virginia Cooperative Extension resources
Beth Sastre, VCE

4:45 pm: *Depart AREC for James Charles Vineyard and Winery*

5:00 pm: Post Workshop Social & Winery Perspective
Jim Bogaty, Veramar, Bogati Bodega and James Charles Vineyard and Winery
Overview of Virginia Wine Industry and informal wine tasting

If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please contact Tremain Hatch, AHS Jr. AREC at (540) 232-6032 during business hours of 9 a.m. and 5 p.m. to discuss accommodations 10 days prior to the event.

13 June 2018
Hold the date!
Virginia Vineyards Association's annual summer technical meeting.
Details will be provided in a subsequent newsletter and will appear on the VVA website: http://www.virginiavineyardsassociation.com/?

Potential vineyard land:
Land available for vineyard development: I am subdividing my 100-acre farm in the Shenandoah Valley into smaller parcels that are ideal vineyard sites. Two of these parcels, currently in pasture, are of 10 and 55 acres, all or most of which is plantable. Both sites are available for purchase or lease-to-own. The property is on Route 42, about 10 miles southwest of Woodstock in Shenandoah Co. Because I live on the property, I could make arrangements to do the spraying and/or mowing of vineyards on the property. For more information, contact Jeanette Smith: jeanette@vinesmith.com