Cornell University
Cooperative Extension
Finger Lakes Grape Program

April 2017

Vineyard Notes

Nitrogen Management in the Vineyard

By: Hans Walter Peterson

When I first came to work for Cornell in western New York, it was common practice for most Concord growers to apply 100 pounds of nitrogen to their vineyards just before budbreak. The reasoning often was some version of “the fertilizer needs to be there when the vine starts growing.” Since that time, we have gained a lot more knowledge about the proper timing and rates for nitrogen fertilizers, which has helped to cut down the amount that growers need to purchase and still have an effect on the vines, while also reducing the potential for leaching of excess fertilizer into ground water.

Sources of N

Grapevines can obtain nitrogen primarily from three sources:

- internal reserves stored in woody tissues (roots, trunks, canes)
- the breakdown of organic matter in the soil by microbes, and
- supplemental fertilizer applied to the soil or the foliage

The relative importance of each of these sources for vine growth depends on the time of season and, to some extent, the supply coming from the other two pools. Early in the year, from budbreak until just prior to bloom, the vines’ own reserves are the primary source of N for early growth. As new roots begin to grow and the soil warms, microbial activity in the soil increases, breaking down organic matter in the soil and releasing nitrogen in forms that plants can take up. For every 1% of organic matter in the soil, about 15-20 lbs of nitrogen is made available to plants each season. The use of nitrogen-containing fertilizers, then, is only beneficial when the vines’ nitrogen needs are not being met by these first two sources. As a result, vineyards that are planted on soils with low organic matter content (<2.0%) may require regular additions of nitrogen in order to meet the vines’ needs, depending on the cultivar and yield and canopy size goals of the grower.

Vine demand for nitrogen

The total amount of nitrogen in the grapevine remains relatively static until bloom (Figure 1). Before this point, nitrogen is mostly being relocated from woody portions of the vine to the newly growing shoots, leaves and clusters, with a small amount of N from fertilizer and/or organic matter being imported into the vine through the roots.

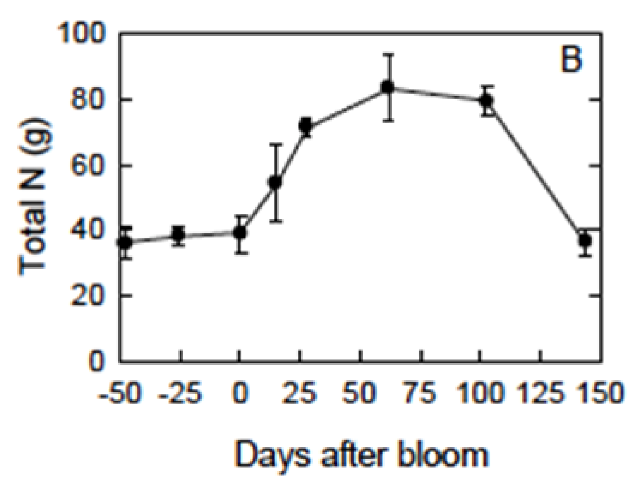


Figure 1. Total N content of a grapevine (cv. Concord) over the course of a growing season. From Cheng et al. 2007.

Nitrogen Management (cont.)

Beginning at bloom, however, the vines' demand for nitrogen increases dramatically due to the continued growth of shoots, leaves and the newly formed berries on clusters. Therefore, the recommendation is generally made that nitrogen fertilizer should be applied within the first 2-4 weeks after bloom during this period of highest demand. Results from trials using isotopically-labeled nitrogen (^{15}N) have shown that uptake efficiency of N (the highest percent of applied fertilizer actually being taken up by the vine) is highest when made during this period.

Much of our understanding of nitrogen dynamics in eastern vineyards is based on research conducted on Concord. Native and bulk hybrid varieties are usually managed to maximize cropping level and production, and therefore have a high nitrogen demand. Even in these cases, though, there is no yield or vine size response to fertilizer rates greater than 50 lbs N/acre. Nitrogen requirements for *V. vinifera* and premium hybrid cultivars are generally lower because they are managed for more moderate yields and smaller vine size, and therefore require less N overall and may be able to meet their needs without any supplemental fertilizer at all.

Assessing vine nitrogen needs

Assessing the nitrogen status of a vine can often be done simply by visual observation over the course of a few growing seasons:

Indicator	Deficient N status	Excessive N status
Shoot length	Short shoots that fail to fill the trellis space by veraison	Shoots fill the trellis space rapidly with excess leaf area
Leaves	Mature leaves are yellow and small	Mature leaves are deep green and excessively large
Internodes	Short internode length	Internodes are long and possibly flattened in shape
Pruning weight	<0.2 lbs/foot of canopy	>0.4 lbs/foot of canopy

It should be noted, however, that these symptoms, particularly those of nitrogen deficiency, can be caused by other factors, such as amount of water supply, trunk disease or injury, or other causes.

If the visual symptoms suggest a deficiency or excess of nitrogen, the best way to make that determination is by taking a petiole test. The suggested time to take the petiole test to analyze for nitrogen is at bloom based on the notion that, if a deficiency is identified, it can still be corrected that season. The recommended target values for N content in a petiole sample collected at bloom is 1.2 – 2.2%.

Nitrogen fertilizer options

Synthetic/inorganic sources. If vines are showing deficiency symptoms or a petiole test indicates low nitrogen levels, there are a number of options for materials that will supply N to the vines. In the case of synthetic fertilizers, the general recommendation is to use the material with the lowest cost per unit of N. In the Finger Lakes, the most commonly used synthetic fertilizers are calcium ammonium nitrate (CAN), urea, and liquid formulations containing all three forms (urea, ammonium, and nitrate).

Nitrogen Source	Cost per ton*	Cost per pound of N
Urea (46% N)	$365	$0.40
Calcium ammonium nitrate (27% N)	$353	$0.65
Liquid formulation (32% N)	$265	$0.41

* Costs provided by Hall Fertilizer, April 12, 2017.

Based on these prices, the most economical choices are either urea or the liquid N fertilizer. Some growers prefer the liquid formulation because it can be applied with a weed sprayer, while granulated urea needs to be spread using separate equipment such as a pendulum or spinning disc spreader.

Nitrogen Management (cont.)

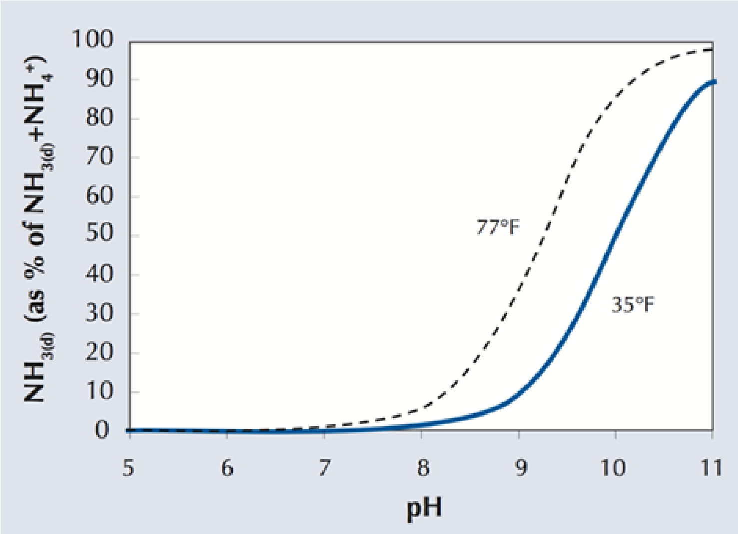


Figure 2. Percentage of NH3 in total of NH3 and NH4+ after urea application. Higher percentage of NH3 in the soil solution can result in higher rates of volatilization. Rates increase above soil pH of 8.0 and with warmer temperatures. From Jones, C.A. et all, 2007.

One of the hesitations some growers have about urea is the potential for some of the material to volatilize and lose some of the nitrogen to the atmosphere. All ammonium-based fertilizers have the potential to volatilize to some extent, but urea generally has the greatest potential for N losses due to volatilization of ammonia gas (NH_3). The amount of volatilization is dependent on the temperature and soil pH. The percentage of ammonia dissolved in the soil water (which is the form that can escape into the atmosphere) increases dramatically if the soil pH is 8.0 or higher (Figure 2), which we see very little of in the Finger Lakes. Once it is applied to the soil surface, urea breaks apart and converts to ammonium (NH_4^+) and carbon dioxide. This can occur in 2 to 4 days and happens more quickly on high pH soils. In general, our conditions here are not overly favorable to high amounts of volatilization.

Growers who are concerned about reducing the potential for volatilization can consider timing their unhilling pass, or a cultivation pass, for right after applying urea. Covering the material with soil will help to reduce the escape of any ammonia that does form during the conversion process. Applying urea during a period of cooler weather will also help to reduce the potential for volatilization. Various additives that can be mixed with urea are available, such as Agritain and others, which can slow the volatilization process for several days if the material is left exposed to the atmosphere, but obviously add to the cost of the fertilizer. Scott McCaig at Hall Fertilizer indicated that Agritain would add approximately $63 to the cost of each ton of urea.

Organic sources. It is common for growers to spread grape pomace back into their vineyards, usually after it has had a change to "age" or mixing it with other organic material such as manure in order to create compost. Winery pomace or compost tend to be low in nitrogen content (~0.5-2% N), so if large amounts of nitrogen addition are required by the vines, it may not be a cost-effective method of fertilization. The only way to know the nutrient content of any pomace or compost prior to addition in the vineyard is to have it tested by a lab.

In many cases, including most premium *vinifera* and hybrid vineyards, very little if any nitrogen is required. In these cases, the addition of compost can fulfill that need, in addition to providing other benefits to vineyard soil. Organic sources of nitrogen need to be broken down by soil microbes (similar to the organic matter in soils) into forms that the plant can take up, and therefore release the nitrogen much more slowly than synthetic fertilizers. This can reduce the potential for N to leach out of the root zone and remain within the vineyard ecosystem, either in the vines, the cover crop, or soil organic matter.

Resources:

Bates, T., R. Dunst and P. Joy. 2002. Seasonal dry matter, starch, and nutrient distribution in 'Concord' grapevine roots. HortScience 37(2): 313-316.

Cheng, L. et al. 2007. Nitrogen uptake, partitioning and utilization of Concord grapevines. Final Report to the Viticulture Consortium-Eastern Grants Program and NY Wine & Grape Foundation. https://nygpadmin.cce.cornell.edu/uploads/doc_48.pdf

Hawk, J. and T. Martinson. "Optimizing Nitrogen Use in Vineyards". *Sustainable Viticulture in the Northeast,* May 2006. *http://www.vinebalance.com/pdf/newsletters/SustainableViticulture1.pdf*

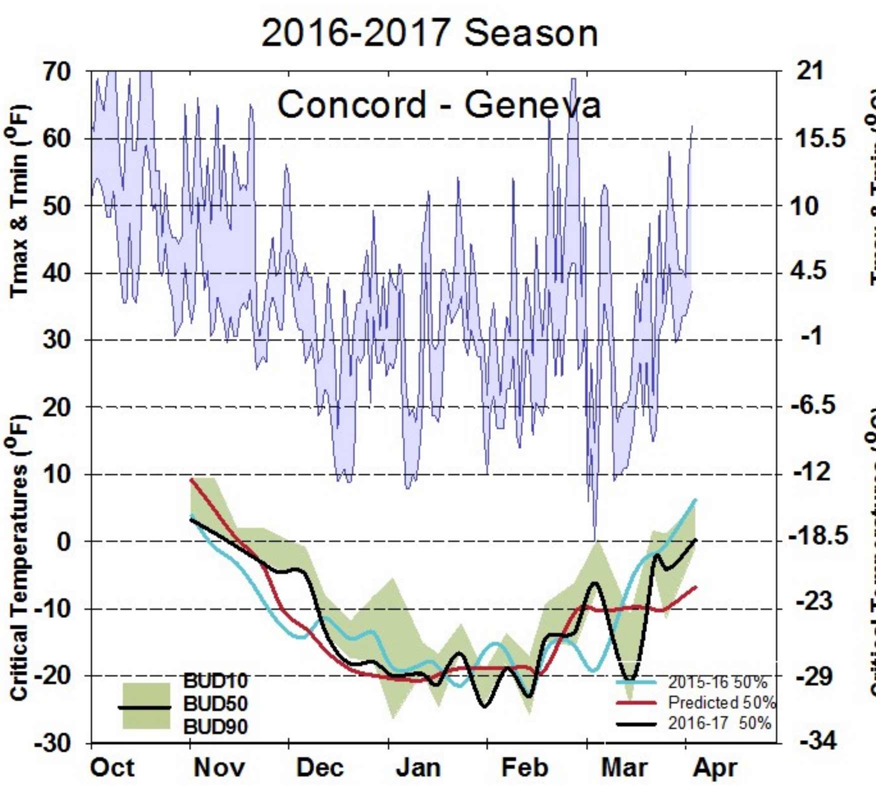
Jones, C. A., R. T. Koenig, J. W. Ellsworth, B. D. Brown, and G. D. Jackson. 2007. Management of Urea Fertilizer to Minimize Volatilization. Montana State University, Bozeman MT. http://www.extension.uidaho.edu/swidaho/nutrient management/pnwureamanagement.pdf.

Sánchez, E.S. and T.L. Richard. 2009. "Using Organic Nutrient Sources". Pennsylvania State University, State College, PA. http://extension.psu.edu/publications/uj256/view

Bud Hardiness 2017

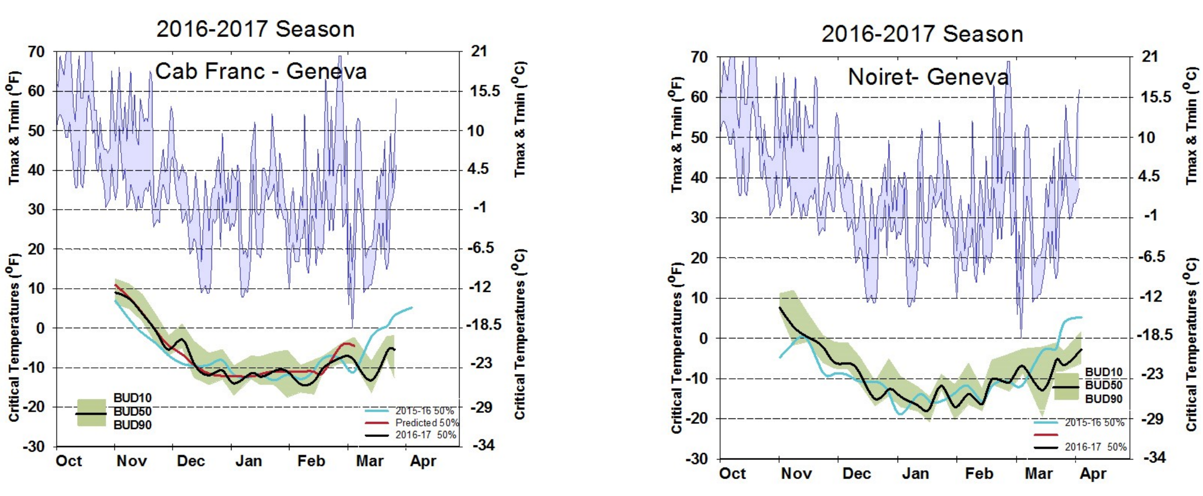
By: Gillian Trimber

Every other Monday from the beginning of January until the end of March, I've looped from Geneva to Sodus, to South Bristol, to Branchport, to Barrington, to Dundee, and back to Geneva again. In each place I've snipped some canes from collaborating commercial vineyards, tied them up with flagging tape, and just like other extension agents across the state, dropped them off for Bill Wilsey to cut from the cane, hook up to a tiny sensor, and stick in a freezer. As the temperature in the freezer steadily drops, each bud emits a tiny burst of energy at the precise moment it freezes, and a computer captures this event. Then, Bill interprets the results, and produces the charts you can find on the Cornell Bud Hardiness page: https://grapesandwine.cals.cornell.edu/extension/bud-hardiness-data.



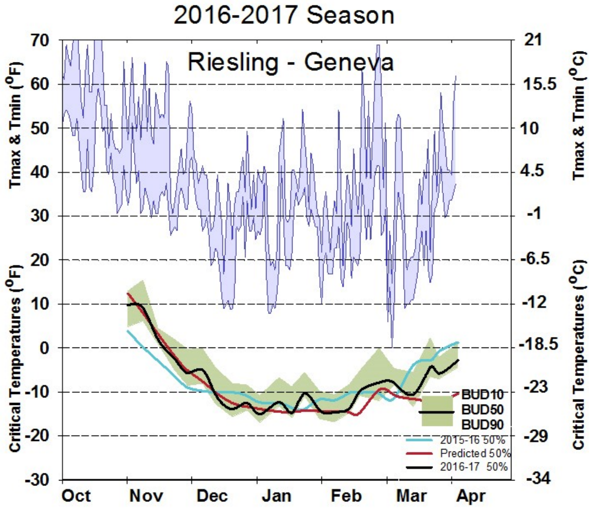
Bud Hardiness chart for Concord Vines at the New York State Agricultural Experiment Station

There's a lot going on in these charts. The purple zig-zags represent the temperature as recorded by weather stations and by data loggers out on the field, hung on the trellis wire. The chartreuse-green color represents the range of temperatures within which most of the buds froze. It starts at the temperature where the first 10% of buds died (Lethal Temperature 10, or LT_{10}), and stops at the temperature at which 90% of the buds in the sample were frozen (LT_{90}). The black line shows the temperature at which 50% of the buds in the freezer were killed (LT_{50}). Grapevines are influenced by the outdoor temperature, and their resistance to cold changes with the weather. Commercial damage occurs when the purple lines—the actual temperature in the vineyard—intersect with the green zone and particularly the black line, as this indicates that a significant portion of the buds would be injured given their cold hardiness at the time. The blue line represents last year's LT_{50} value, and the red line represents the LT_{50} predicted by a forecasting model.



Bud Hardiness charts for Cabernet Franc and Noiret vines at the New York State Agricultural Experiment Station

Bud Hardiness 2017



Bud Hardiness chart for Riesling vines at the New York State Agricultural Experiment Station

This year, the charts don't show much overlap between the air temperatures recorded and the temperature at which the buds would be damaged. The vines stayed hardy enough to handle all of the temperature swings that came our way, which fortunately were fewer and more gradual than we had predicted a few weeks ago. We're not out of the woods yet, but for the most part we expect to see little evidence of winter injury to buds come budbreak in a few weeks. (Frost damage, of course, is still a risk until around the end of May). Some time spent cutting buds confirms this- canes from most locations showed few dead buds, and cultivars known to be more cold sensitive aren't looking any worse off than more hardy varieties.

Observed Bud Damage 2017

Location	Variety	Percent Bud Injury
Teaching and Demonstration Vineyard	Cayuga White	5.33
	Riesling	8.20
	NY 81	2.68
	Chardonnay	2.83
	Chenin Blanc	1.71
	Lemberger	3.77
	Marquis	0.97
	Jupiter	3.00
Barrington	Riesling	15.63
Branchport	Concord	8.16
	Riesling	15.31
South Bristol	Concord	6.00
	Riesling	15.09
	Niagara	10.78
Dundee	Concord	5.00
	Cab Franc	8.33
	Riesling	13.22
	Cayuga white	10.87
Sodus	Riesling	2.00
	Cab Franc	1.89
	Noiret	3.85

LT50 Values for the Finger Lakes on March 27, 2017

Variety	Average LT50 (˚F) for Finger Lakes	Location						
		East Keuka	***East Seneca***	***Sodus***	***West Keuka***	***West Seneca***	***West Canandaigua***	***West Cayuga***
Cab Franc	**-4.8**	-7	-2.8	-5.2		-5		-4
Cayuga White	**-7.3**	-6				-8.9		-7.1
Concord	**-9.7**	-8.8	-8.3		-6.5	-9.9	-14.9	
Riesling	**-8.2**	-7.1	-7.5	-8.2	-7.6	-9	-9.9	-8
Noiret	**-9.8***			-9.8				
Niagara	**-8.3***						-8.3	
Catawba	**-5.9***							-5.9

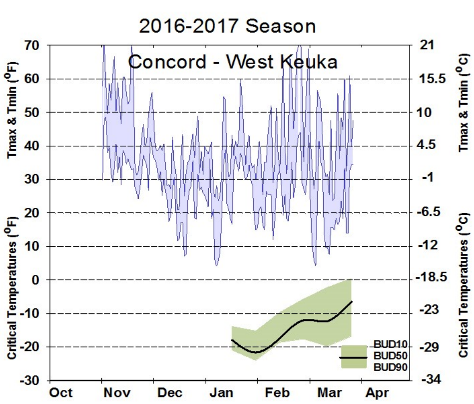
**Samples only taken from one location*

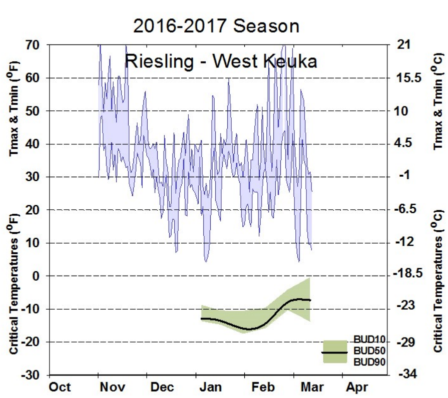
At this point in the spring, we're not seeing large differences between LT50 values for each variety. This is likely due to the different rates at which cultivars deacclimate in the winter. For example, Concord in Branchport was hardy to around -21˚F at the beginning of February, but by the end of March was only hardy to -6.5˚F. Riesling, on the other hand, reached an LT50 value of around -15˚F at the beginning of February, but now can handle about the same level of cold as the Concord, if not a bit more (-7.5˚F). The distance between the LT10 value and the LT90 value also widens as the vines deacclimate; at least in Branchport, this pattern holds when we look at Concord and Riesling. In addition, we can see variation in the extent cold hardiness is moved by changes in temperature, with the LT50 values for some varieties tracing a rollercoaster's path through March, and others showing only gradual shifts.

Data logger in the Noiret block we sampled near Sodus, NY.

The data we've collected this year is fairly reassuring—the vines are behaving in a predictable way, and the weather hasn't thrown us too many curveballs so far (March snowstorms not withstanding). At all locations but Geneva, we've stopped collecting data for the year, since most growers are finishing up pruning, and are well underway with tying. However, we're now better able to compare the trajectory the vines have taken this winter compared to the previous two hard winters… and it looks like at least as far as low temperatures and hardiness are concerned, Finger Lakes Vineyards have come out in good shape.

This project extends beyond the Finger Lakes- it is coordinated through Tim Martinson's statewide grape extension program, and is supported financially by the New York Wine and Grape Foundation and the Kaplan fund.





Upcoming Events

Tailgate Meetings

The FLGP's annual series of Tailgate Meetings will start this year on Tuesday, April 25. All meetings will take place from 4:30 – 6:00 PM, and 0.75 pesticide recertification credits will be available. Please see the schedule below for dates and locations.

Airy Acres Vineyard
Tuesday, May 9th 2017
4:30-6:00pm
8011 Footes Corners Road
Interlaken, NY 14847

Fox Run Vineyards
Wednesday, June 7th 2017
4:30-6:00pm
670 State Route 14
Penn Yan, NY 14527

Barron's Pratt Barn Vineyard
Tuesday June 20th, 2017
4:30-6:00pm
4990 State Route 21
Canandaigua, NY 14424

Atwater Estates Vineyard
Wednesday July 5th, 2017
4:30-6:00pm
5055 State Route 414
Hector, NY 14841

Keuka Lake Vineyards
Tuesday July 18th, 2017
4:30-6:00pm
8882 County Road 76
Hammondsport, NY 14840

Belle Terre Farm
Tuesday August 1st, 2017
4:30-6:00pm
8142 Champlin Road
Sodus, NY 14551

Gridley Vineyards
Tuesday August 15th, 2017
4:30-6:00pm
3711 Pepper Road
Bluff Point, NY 14478

Upcoming Events

Tailgate Meetings Cont.

Lamoreaux Landing Wine Cellars
Tuesday August 29th, 2017
4:30-6:00pm
9224 State Route 414
Lodi, NY 14860

Spring Grape IPM Meeting

Tuesday, May 23
4:30 – 6:00 PM
Vine Country Farm
8907 Stone Road
Prattsburgh, NY 14874

Registration link: https://flgp.cce.cornell.edu/event_preregistration.php?event=292 or call the FLGP office at (315) 536-5134.

Don't forget to register for the Spring Grape IPM Meeting on Tuesday, May 23, which will be hosted by Roy and Gordon Taft at their farm, Vine Country Farm, at the corner of Stone Road and County Road 74 in Prattsburgh. The program will provide growers with updated information on insect and disease management, pesticide application methods and equipment, a quick summary on new Worker Protection Standard regulations, and more. This will also be the final appearance at this event by Andrew Landers and Wayne Wilcox (at least in their role as faculty at Cornell), who have helped growers to make great strides in improving their pest management programs, not just in the Finger Lakes, but throughout the country.

There is no charge for FLGP-enrolled growers, and a $15 registration fee for those not enrolled in the Grape Program (if you aren't sure of your enrollment status for 2017, please call our office). We do ask everyone to register for the meeting ahead of time, however, so that we have a head-count for dinner. Walk-in registration will cost $25 per person regardless of enrollment status, and only a limited number of walk-ins will be allowed.

Sponsors: We are also accepting sponsorships for this year's meeting to help defray our costs. If you are interested in being a sponsor for this year's meeting, please go to https://flgp.cce.cornell.edu/sponsor_event.php?event_id=292 or contact Brittany Griffin at (315) 536-5134.

Become a fan of the Finger Lakes Grape Program on Facebook, or follow us on Twitter (@cceflgp).

Visit our website, http://flgp.cce.cornell.edu, for more information on grape growing, pest management, educational events and more.

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FINGER LAKES VINEYARD NOTES

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