Lake Erie Regional Grape Program

Vineyard Notes-April 2018

The Lake Erie Regional Grape Program

PENNSTATE

Cornell University
Cooperative Extension

Building Strong and Vibrant New York Communities

Business Management

Kevin Martin, Penn State University, LERGP, Business Management Educator

Enterprise Analysis: Avoiding the Pitfalls of Change and Investment

The struggles of the Concord grape market have attracted the attention of NYS. One of the things this might mean for some NYS growers is the ability to increase their flexibility and diversify the agricultural operation. At the moment, we aren't exactly sure what the details of proposed programs will mean for grape growers. The summit was a big picture event with discussion, ideas and possible solutions. On the supply side of things, proposed solutions included product development research, state contract and school lunch purchases and product development or value added grants. One of the largest programs announced specifically targeted the demand side. It appears there will be a program to help growers diversify, renovate existing vineyards and to provide assistance in replanting to in-demand cultivars.

While the details of this program have yet to be established, it might be a good time to start thinking about the conditions that justify participation in this type of program. Historically, assistance for removal or establishment have come from the private sector. The Niagara planting program was the most recent large scale example of assistance on the east coast. Performance of those vineyards varied considerably as some growers realized significant and convenient profits in a cultivar that was compatible with their business operation. Others were not so successful. Incentives led to rapid plantings without adequate analysis of site location. Even with subsidized plantings, regular winter injury lead to financial loss and decreased the overall profitability of the farm.

Current market trends complicate matters further. I anticipate the market for cultivars, other than Concord, to grow slowly. If this market were to triple in acreage, it would increase the acreage demand back to 2009 levels, with significantly more hybrids and obscure natives in the market place. Rather than demand for that market tripling it looks like it could grow by 10% - 30%. Therefore, finding a market will be the first hurdle. Given there is a market hurdle, assumptions about prices should be conservative (unless guaranteed by a long-term contract). The most obvious example is Marquette. If speculative plantings continue, the price of Marquette could fall by hundreds of dollars per ton. Price risk, particularly for high priced hybrids and natives, should be anticipated.

Despite obstacles, it's important to remember that the Niagara planting program was a great benefit that actually continues to benefit certain growers despite changes in the Niagara market. The best practice before changing the direction of a vineyard operation is to develop an enterprise budget. Enterprise budgets estimate profitability for the activity based on estimated production costs and management practices. One of the key benefits to an enterprise budget is a list of assumptions that are used to calculate profitability. These assumptions highlight key variables and allow for an open and frank discussion with other growers, industry and extension to get feedback on how realistic a plan is.

LERGP has the research based information as well as the resources to help growers think critically about the most important assumptions that relate to an enterprise budget. For a vineyard, these assumptions include labor costs, average yield, distribution of yield, and price. Other costs will factor into profitability but tend to be less variable from farm to farm and year to year. Even when a cost like fuel gets expensive, it tends not to be the driver of profit vs. loss.

A brief business plan helps to articulate how the enterprise fits into the existing business. It provides information like the size of the farm and the current state of profitability on the farm. What is the mission of the farm?

Description of Farm:

- _____ consists of 205 acres of wholly owned grape acres, primarily Concord.
- Diversified agricultural investments value added products and field crops provide some diversification in income sources.

Statement of Purpose:

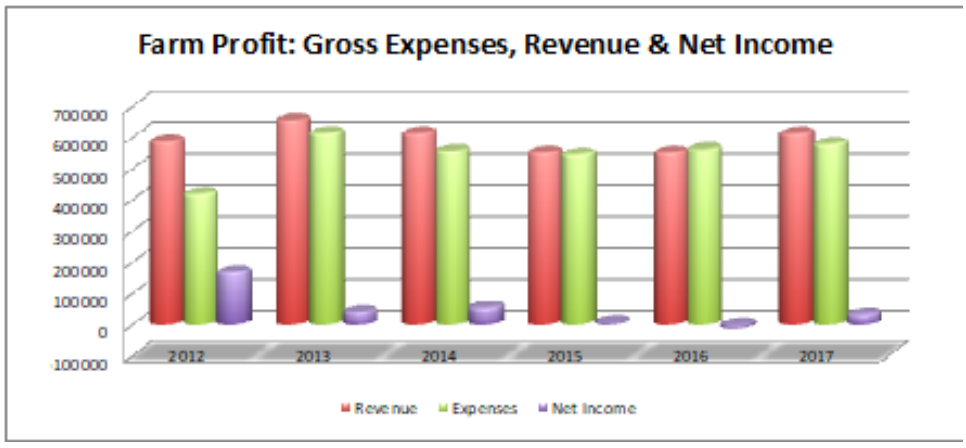
- The fundamental purpose of _____ Farms is to:
  - 1. Supply local processors with high quality grapes and enhance the value of the business for future sale.
  - 2. To ensure economic and environmental sustainability of production through constant and conservative investment and innovation.

This particular farm exists only to produce grapes for processing. Any business plan that involves interaction with retail, creation of value added products, processing or custom hire will potentially change (perhaps dramatically) the scope of business. A more detailed plan would be prudent in that situation. If this farm already has 5 acres of Riesling and 100 acres of Concord an additional 3 acres of Ives would be well within the current operational expertise of the business. The analysis can be much more brief when the scope of the project is so narrow.

Interestingly, this farm has already diversified into field crops and value added crops sold at a local stand. While there is no retail experience the farm has a more diverse set of equipment and experience growing crops other than grapes. There are possibilities that other crops might be efficiently managed on this farm. With the Concord acreage being so sizable, it is also possible that retooling to different cultivars, expanding Concords, or reducing Concords to increase other products are all reasonable possibilities for this farm.

A review of profits and loss is a straightforward indicator of farm strength. Of course, we expect thin margins and low profits for many vineyard operations. Along with a debt:profit ratio these two indicators provide a window into the capacity of the farm to change direction. Any potential subsidy would reduce the intensive capital investment generally associated with strategic change. It is fairly likely, though, that there will still be short-term cash flow burdens associated with larger projects.

This actual chart of revenue, expenses and net income shows a dramatic decrease in profitability. In 2015 this farm sustained losses, which were followed in 2016 by profits near $0. Despite these challenges, debt remains at $0 and expenses remain flexible as the farmer has the ability to reduce depreciation expenses to fund projects that increase profitability. Paid labor expenses, for this farm, reduce flexibility. Long-term profitability and sustainability is a risk for this operation because of paid labor expenses.



Next, a grower identifies strategies to improve profitability. Those strategies are then linked to a project. As the farm identifies strategies to improve profitability, paid labor would typically be one area to target. In previous grants, the reduction of paid labor did not align with the goals for the farmer. Decreasing unpaid labor was highly desirable, even at the expense of profitability. For this grower, different Concord

markets, different varieties and efficiencies in the operation are all possible projects that would improve sustainability and profitability.

The key element of the business plan is a five to ten year forecast. Defining assumptions that forecast an improvement to profitability are key to the success of communicating plans with external people. A vineyard improvement cost will vary considerably based on techniques and timing. On the revenue side, the type of grape and the market the grape is sold will be the most significant factors to consider. If land is planted to other crops, more detail might be required. Rather than just adding to marginal costs capital cost in the equipment side could be necessary. Justifying equipment cost with conservative product pricing forecasts will be key to success and sustainability.

For growers that want assistance with this process, LERGP can help. Whether the enterprise analysis is for a grant, loan or just a strategic shift the grower wants to undertake, just contact me. In the context of a complex and lengthy downward trend in Concord pricing; support for research, extension and industry is a key element to long-term sustainability. As other Concord regions have dramatically shifted away from grapes we may be in a position to improve our relative efficiency and capitalize on the next cycle.

IPM

Tim Weigle, NYSIPM, Cornell University, LERGP Team Leader

eNEWA for Grapes – a Daily Reminder of Pest Potential in Your Vineyard Operation

With the cost of inputs continuing to rise, wouldn't it be nice if you could get a daily reminder of the current weather and grape disease and insect model information found on NEWA (Network for Environment and Weather Applications) http://newa.cornell.edu? If so, then eNEWA is for you. eNEWA is a daily email that contains current weather and grape pest model information from a station, or stations, near you. The email will contain; 1) high, low and average temperature, rainfall, wind speed and relative humidity 2) the 5-day forecast for these weather parameters, 3) GDD totals (Base 50F), 4) 5-day GDD (Base 50F) forecast and 5) model results for powdery mildew, black rot, Phomopsis and grape berry moth. The weather information is provided for not only the current day but for the past two days as well. eNEWA is a great way to get an idea of pest potentials for your vineyard operation without having to click around the NEWA website. eNEWA is not meant to be a replacement for the website, rather it is a quick and easy way to determine if a visit to the website is warranted to provide information specific to your site to increase the accuracy of the output of the disease and grape berry moth models.

NEWA station

When you sign up for eNEWA, you can choose from any number of stations located near you for delivery of this information via email each day at a time specified by you. Please keep in mind that you will receive a separate email (approximately 3 pages in length) for each station you choose. Once during the growing season and again after harvest, you will be asked to complete a short survey to assist us in improving the eNEWA for grapes email system. If you would like to be a part of this project just fill out the form found in this newsletter and return to: thw4@cornell.edu or send to me at Tim Weigle CLEREL 6592 West Main Road Portland, NY 14769.

In a survey conducted after the 2017 growing season, grape growers across NYS were asked if they used NEWA resources in their vineyard operations. Of the 88 responses, 68% indicated they used weather and pest model information found on NEWA. Of those who used NEWA, 60% of participants reported that they improved profitability by implementing the information found on the NEWA website.

One of the comments that is heard often at grower meetings and personal conversations is that there is not a NEWA station close enough to be of use in a particular vineyard site. That can be alleviated by purchasing a station and siting it wherever you would like in your vineyard operation and then sharing it through the NEWA website. We have also been working to increase the scope of the weather station network in the Lake Erie region through the inclusion of NYS Mesonet stations and more Rainwise units.

If you remember back to 2014, there was much written about the NYS Mesonet that was part of the Early Warning Weather Detection System. The NYS Mesonet consists of 125 stations across the state and delivers weather data from a host of sensors to a central facility located at the University of Albany. You can access graphs representing many of the weather parameters at http://www.nysmesonet.org/data/meteogram#?stid=FRED. This link is for the station in Fredonia but you can choose any of the 125 stations in the Mesonet. So what does this have to do with NEWA? Part of the excitement back in 2014 was that these machines were going to have the ability to provide weather data to NEWA. This would allow the data to be used by the various weather and pest models NEWA provides. Unfortunately, this took a bit longer to happen than expected.

Flash forward 4 years and NEWA is happy to announce that a number of the NYS Mesonet stations are now available on their website. In the Lake Erie region you will find Fredonia (Chautauqua) and Burt (Niagara) added to the list of available stations. A Mesonet station in a Brant, NY vineyard is currently not on NEWA but we are making effort to get it included in the coming years.

Keep checking the NEWA website http://newa.cornell.edu as there will be a number of new Rainwise stations being set up across the Lake Erie region. If you have not checked NEWA lately, you may have missed two new stations being set up after harvest. **Lake City (Erie, PA)** and **East Westfield (Chautauqua)** were to the site since the end of the 2017 harvest. Coming soon are two more stations have recently been added with **East Fredonia (Chautauqua)** and **Hanover (Chautauqua)** joining the Lake Erie network of stations. These improvements are possible through a grant from National Grape Cooperative, Constellation Brands, Walker's Fruit Basket and the NY Wine & Grape Foundation.

2018 eNEWA Grape Subscription Testing Sign-Up

Subscriber information

Name_____

Email address _____

City_____

Select Location(s) (circle as many as you like, or write in below)

_____

Lake Erie	**Lake Erie**
Appleton, North	**Ransomville**
Burt	**Ripley**
Corwin	**Sheridan**
Dunkirk	**Silver Creek**
East Fredonia	**Somerset**
East Westfield	**Versailles**
Erie	**Westfield**
Fredonia	
Hanover	**Other: Please fill in**
Harborcreek	
Lake City	
North East Escarpment	
North East Lab	
Portland	
Portland Escarpment	

Select eNEWA Delivery Times (write in times below) Delivery requests should be on the hour.

_____

Credits, Coffee and Calories – Coffee Pot Meetings Coming Soon

The Lake Erie Regional Grape Program (LERGP) will be starting their series of weekly Coffee Pot Meetings on May 2 at Clover Hill Farms, 10401 Sidehill Road, North East, PA 16428. These meetings are held each Wednesday throughout the growing season at 10 AM at a different venue each week. In June we follow up the morning Coffee Pot meeting with a second one at 3 PM. This allows the LERGP team to visit a larger area during some of the most crucial times of the growing season. Coffee Pot Meetings are a great way to not only find out what is going on in the industry, but this year you will also have the opportunity to meet and interact with our new Viticulture Extension Support Specialist, Jackie Dresser.

Coffee Pot meetings have no set agenda, other than Kevin paying for the coffee and donuts by providing a weekly crop insurance update, and are a great way to find out what is happening in vineyards in your neighborhood and across the Lake Erie grape belt. The discussion usually varies greatly from week to week and location to location, so there is always the opportunity to learn from other growers and the LERGP team about implementing the latest in research-based knowledge. Coffee Pot meetings are also a great way to educate the LERGP team. With the large geographical area of the Lake Erie Grape Belt, Coffee Pot meetings are a great way for the team to learn from growers what the concerns are from one end of the belt to the other. And, of course, the ever popular pesticide recertification credits are available with participants earning 1.0 NY Pesticide Recertification category credits and 2.0 PA Pesticide Recertification category credits for each meeting.

Viticulture

Jacqueline Dresser, Viticulture Extension Support Specialist, LERGP

Considerations for Soil Health and Nutrient Management in No-Till Systems

Introduction

In the Lake Erie region, frequent tillage of the row middle throughout the growing season used to be the industry standard for weed control. With the introduction of affordable herbicides to the market in the late 1970s, chemical control became a viable means of knocking down weeds in the vineyard. Introduction of cover crop rotations have provided an additional tool in the weed management toolbox while providing other benefits. Management decisions related to tillage, addition of soil ammendments and cover cropping have implications for soil health. Typically, fertilization and liming recommendations are made holding things like tillage depth constant and are not tailored to the variables present in soil and in management practices. Most growers in the Lake Erie region are working in no-till systems and some are introducing cover crops in their vineyards. This article will provide some background on soil composition and soil health, compare no-till and conventional systems with respect to soil health and discuss considerations that should be considered when interpreting nutrient and liming recommendations in no-till systems with or without cover cropping.

Soil as a Habitat

Soil is made up of solids (minerals, organic matter), liquids (water and dissolved salts), and gases (air, water vapor and other gases) (Havlin et al. 1999). Each of these components of soil plays an important role in the growth and development of grapevines and the potential yields they will carry. Mineral solids provide a soil's structure and aggregate with organic matter to create pores for air and water to infiltrate. Water, or the soil solution, is the medium that holds nutrients in a form where vines may take them up and use them. The air in soil provides a channel where oxygen from the atmosphere is exchanged with carbon dioxide through respiration of vine roots and soil organisms (Magdoff and Van Es 2009).
It should go without saying that growing healthy and productive vines begins with building soils that are well suited to this task. So, what makes a soil conducive to growing grapevines? Biologically, a healthy soil hosts a diverse population of beneficial organisms and a low proportion of harmful ones. Chemically, healthy soil has pH between 5.5 and 6.5 (for grapevines), contains an appropriate balance of nutrients (Table 1) in forms that feed vines and the organisms their roots share the soil with, is free of toxic chemicals and has low salt content. Physically, healthy soil has low compaction both in surface layers and in subsoil layers, a stable and porous surface structure and good air flow and drainage (Magdoff and Van Es 2009).

Grapevine roots need to be able to develop enough surface area using as little energy as possible to take in the water and nutrients the vines require. Secondly, the water and nutrients need to be available to the vines at the frequency and in the quantity that they are needed for vegetative and reproductive growth. The conditions of a growing season can affect a soil's performance. In a dry season, heavier clay soil may be able to retain precious water for vines to use (Figure 1); while, in a wet season, well-drained deep gravels may be more conducive to vine growth as their roots avoid water-logging. Soil variation also poses a challenge. Across a vineyard, soils may offer a drastically variable environment for grapevine roots to explore and may cycle nutrients differently. Even holding all other factors constant, the soil is an ecosystem and there are dynamics constantly working to challenge the one stewarding the soil with the goal of maximizing yield of ripe fruit.

Table 1. Nutrient concentration requirements for normal grapevine growth and development					
Nutrient	Chemical symbol	Form used in plant uptake	Target Values		
			Soil	**Bloom petiole**	**70 – 100 DAB petiole**
Hydrogen	H	H_2O, HCO_3^-	NM	NM	NM
Carbon	C	CO_2	NM	NM	NM
Oxygen	O	CO_2, H_2O, oxyanions	NM	NM	NM
Total Nitrogen	N	NH_4^+, NO_3^-	NM	1.2% - 2.2%	0.8% - 1.2%
Phosphorous	P	$H_2PO_4^-$, HPO_4^{2-}	20 – 50 ppm	0.17% - 0.30%	0.14% - 0.30%
Potassium	K	K^+	75 – 100 ppm	1.5% - 2.5%	1.2% - 2.0%
Calcium	Ca	Ca^{2+}	500 – 2000 ppm	1.0% - 3.0%	1.0% - 2.0%
Magnesium	Mg	Mg^{2+}	100 – 250 ppm	0.3% - 0.5%	0.35% - 0.75%
Boron	B	H_3BO_3	0.3 – 2.0 ppm	25 – 50 ppm	25 – 50 ppm
Iron	Fe	Fe cations or chelates	20 ppm	30 – 100 ppm	30 – 100 ppm
Manganese	Mn	Mn^{2+}	20 ppm	25 – 1,000 ppm	100 – 1500 ppm
Copper	Cu	Cu^{2+}	0.5 ppm	5 – 15 ppm	5 – 15 ppm
Zinc	Zn	Zn^{2+} or chelates	2 ppm	30 – 60 ppm	30 – 60 ppm
Molybdenum	Mo	MoO_4^{2-}	Uncertain	0.5 ppm	0.5 ppm
Sulfur	S	SO_4^{2-}	NM	NM	NM
Chlorine	Cl	Cl^-	NM	NM	NM
Aluminum	Al	May inhibit root growth	< 100 ppm	NM	NM
Organic Matter			3 – 5%		
pH			5.5 – 6.5		
Modified from Bates and Wolf 2008, NM = not routinely measured					

The living soil is home to earthworms, insects, fungi, bacteria, viruses, protozoa and algae. There are a multitude of organisms that will share space with grapevine roots, some of them are beneficial to vine growth and others are detrimental. Some benefits that may be offered from beneficial organisms are transportation of and conversion of nutrients to forms available to vines, consumption of or competition with organisms that are parasitic to grapevines, aggregation and channeling of soil for improved structure, and mixing of organic matter into the soil. Detrimental organisms may release toxic chemicals into the grapevine rooting zone or directly feed on living tissues of the vine. Promoting conditions, not just for grapevines, but for the organisms that share the soil with their roots, is crucial to establishing and maintaining a healthy and productive vineyard.

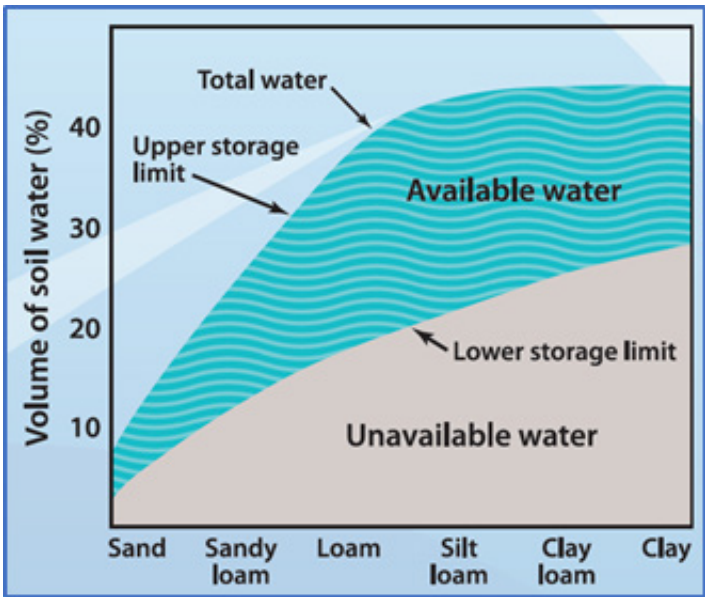


Figure 1. Water Availability to Plants by Soil Type, From Kramer 1983.

Soil Health Implications of Tillage or No-Till

The transition in weed management in vineyards from intensive tillage to no-till has implications for soil characteristics. In tillage systems, though fertilizers and amendments are easily incorporated into the soil, surface weed seeds are buried, the soil is able to dry quickly and topsoil compaction is temporarily reduced, there are trade-offs. The aggregate forming, burrowing, and mixing activities of organisms in the soil are reversed and many organisms are killed in the process (Kladivko 2001). The resulting soil has poor structure, is more susceptible to erosion and temperature swings, tends to facilitate runoff of rain water, has

an unstable soil ecosystem, and may contain a subsurface compaction layer that is impenetrable to water and roots (Figure 2).

Continuous no-till offers better soil structure, erosion control, increased quality and/or level of organic matter, preservation of biodiversity, improved availability of many nutrients, higher cation exchange capacity and improved water-holding capacity (Havlin et al 1999). However, no-till cannot alleviate soil compaction where heavy equipment contacts the soil (Figure 3) and it is more difficult to incorporate fertilizers and amendments into the soil. Compaction from traffic does not necessarily worsen with each pass of heavy equipment, though. Rather, most of the compaction is a result of the heaviest loading (Magdoff and Van Es 2009).

Figure 2. Soil Compaction Layer Illustrating Water Runoff. Photo by Jason Haines.

Figure 3. Grapevine Rooting Zone and Compaction from Traffic Lane. Photo by Terry Bates.

Nutrient Dynamics in No-Till

Most nutrient and lime recommendations are based on a 6 inch tillage depth (read the fine print!). Soil amendments behave differently in no-till systems than they do when they are incorporated with tilling. Fertilization and liming decisions for no-till systems should consider nutrient mobility and cycling, variation in soil fertility and pH with increasing depth, dynamics of organic matter decomposition and fertilizer efficiency and the effects of other management practices like cover cropping or mulching.

The mobility of K^+, Ca_2^+, and Mg_2^+ in the soil is dependent on cation exchange capacity and pH. With pH in the range of 5.5 -6.5 and high CEC, these cations are stable in the soil. As pH and/or CEC decreases, K^+, Ca_2^+, and Mg_2^+ are more susceptible to leaching. Lime is considered immobile in the soil and surface application will only neutralize the first couple of inches of the soil in the short-term. The pH in this shallow layer of soil is affected most by addition of acidifying fertilizers and breakdown of organic material. So, if lime is applied regularly, its shallow neutralization should not be a drawback to soil health. Over the long-term, surface liming can raise soil pH at depths up to 12in (Grove et al. 2009). Phosphorous is considered immobile in the soil unless it is present at unusually high levels where the soil has maximized its potential to bind it. Nitrogen mobility in the soil is dependent on the form that it is in. NO_3^- (nitrate) is highly mobile in the soil and leaches easily in the soil solution. NH_4^+ (ammonium) can be held on cation exchange sites and is less mobile in the soil (Ketterings et al. 2016). The contrast in mobility of constituents of surface applied fertilizers, organic material and lime without incorporation

creates uneven distribution of nutrients and pH (Figure 4) with depth in the soil profile. Soil mobility is also an important consideration when deciding whether to band-apply or broadcast fertilizers.

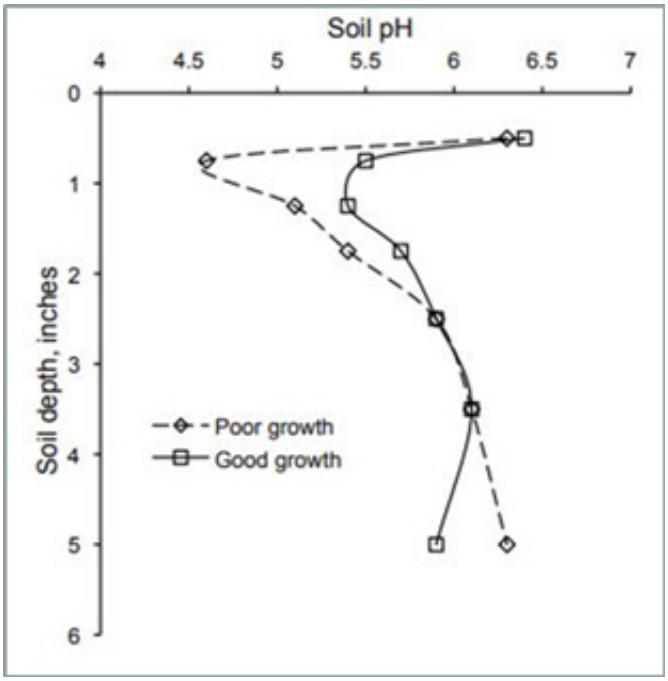


Figure 4. Soil pH Variation with Soil Depth. Taken from Anderson et al. 2010.

Nutrient cycling is another important consideration for nutrient management in no-till systems, especially with respect to nitrogen and phosphorous. The forms of nitrogen used for plant uptake, NH_4^+ and NO_3^-, are gained and lost in the soil through several processes. Either may be added to the soil through fertilization. NH_4^+ may also arrive through mineralization: the breakdown of organic matter by microorganisms in the soil. If not taken up by roots or bound to cation exchange sites, NH_4^+ may be converted to NO_3^- through nitrification by bacteria. In no-till systems, the slow breakdown of organic matter provides NH_4^+ in a low and slow fashion. For surface applied nitrogen in no-till systems, there is a higher risk of loss from volatilization, immobilization or denitrification before nutrients can be utilized by the vines. It is important to remember that just adding nutrients does not guarantee they are going the make it into the tissues they are designated for. Considering the type of nitrogen fertilizer (ammonium has low mobility and nitrate will more readily leach), splitting its application and utilizing precipitation to help the material penetrate the soil can help ensure that efficiency is maximized in no-till systems.

Phosphorous can originate from fertilizers or organic matter. $H_2PO_4^-$ and HPO_4^{2-} are the forms taken up by grapevines from the soil solution. As roots take up P, the soil solution may be replenished from desorption from mineral and clay surfaces or mineralization by microorganisms. Just as with nitrogen, phosphorous may be immobilized in the soil. It may also leave the soil solution by adsorption to clay and other minerals or precipitation. pH plays a major role in P cycling, with lower pH soil resulting in higher immobilization of P. In no-till systems where pH is higher in the shallow soil, P availability in the soil solution will decrease with depth in the soil. High organic matter also increases P availability, so no-till systems will see a higher concentration of available P in the soil solution in surface soils, where OM is highest.
The rooting structure of own-rooted Concord tends to proliferate underneath the vine in the first 12 inches of soil, but this will depend on the characteristics and fertility of the soil in its rooting zone (Figure 3). The soil horizon where roots develop may exhibit stratification in nutrients, pH and other characteristics. Thus, sampling in no-till systems should be modified to provide a better idea of how surface soils are behaving in comparison to deeper soils.

Soil and Tissue Sampling
An effective nutrient management plan should be informed by regular soil and petiole samples. The soil samples illustrate the nutrient balance in the soil, while the petiole samples illustrate how those nutrients are taken up (or not taken up) by the vines. Soil samples should be collected every three years while tissue samples should be collected and analyzed annually or bi-annually. While tissue sampling protocols do not warrant modification due to the absence of tillage in modern viticulture, soil sampling protocols should be adjusted to no-till.

Collecting soil samples to a depth of 6-8 inches has been common practice in the Lake Erie region, even

since the widespread transition to no-till vineyards. This sampling depth would be adequate if lime, nutrients and surface residue were being incorporated into the soil through tilling. However, in no-till systems, soil sampling should be undertaken in a way that will allow the shallow soil horizon, where effects from surface application of fertilizers and breakdown of organic matter will be most prominent, to be characterized independently of the deeper soils.

Soil samples in no-till vineyards should be separated by depth, with the top two inches of the soil probe separated from the rest of the sample (Figure 5). In established vineyards, where tillage has not taken place for many years, it is possible that mixing soil from the surface two inches and soil from two to six or eight inches is resulting in tests that show nutrient deficiency in the soil when the surface soil may exceed recommended levels. As fertilizers continue to be surface applied, nutrient stratification becomes more pronounced, only to be masked in mixed soil samples. Stratification of soil pH may also be masked in mixed soil samples, which may result in excessive liming of the surface and subsequent K^+ deficiency as excess Ca_2^+, and/or Mg_2^+ are added to the soil.

Figure 5. Illustration of Separation of Top Two Inches from Soil Probe. Taken from Anderson et al. 2010.

Variation in soil characteristics and fertility are not limited to the vertical plane; they occur horizontally as well. If a detailed survey of soil texture cannot be done using soil sensors that measure electrical conductivity, a county soil map may offer a sensible guideline for setting out soil samples. At a minimum, soil samples should be taken once every ten acres, but this number should increase if there is a large amount of variability in the field. It is tempting to try to take as few samples as possible, as their collection and analysis does not come free, but the benefits in growth and yield potential as well as efficient use of fertilization and liming materials should greatly exceed the costs associated with sampling.

Once soil samples are analyzed, and an accurate picture of the soil in the rooting zone across a vineyard is painted, tissue samples can illustrate the nutrient status of vines. Regular sampling and thoughtful interpretation creates a feedback loop where the effects of nutrient management decisions can be evaluated, and the results can be used to continue to refine a management plan. Visual observation is a key component of this cycle and can signal if there is a breakdown in the nutrient status of vines.

NPK Fertilization in No-Till

It is important to remember that just adding nutrients does not guarantee they are going the make it into the tissues they are designated for. For nitrogen, considering the type of fertilizer (ammonium has low mobility and nitrate will more readily leach), splitting its application and utilizing precipitation to help the material penetrate the soil can help ensure that efficiency is maximized in no-till systems. Deciding how much supplemental N to apply depends on several factors. Vines need varying amounts of nitrogen throughout the growing season, reaching a peak of 40g/vine or about 53 pounds/acre at 60 days after bloom (Bates et al. 2013). The size of the vegetative and reproductive sink will dictate the amount of nitrogen vines need. The quantity of fertilizer that needs to be added to provide adequate nitrogen depends on soil organic matter (1% OM ≈ 20 lbs/acre N), soil moisture, soil temperature, the presence of competitive vegetation, the type of fertilizer, and cation exchange capacity for ammonium fertilizers. Foliar applications are another option for short-term N supplementation.

Phosphorous is typically added using monoammonium phosphate (MAP) or diammonium phosphate (DAP), containing 11% and 18% nitrogen respectively. This should be considered when deciding how much nitrogen fertilizer to add. Superphosphates are an option if supplemental nitrogen is not needed. One advantage to no-till for phosphorous fertilization is that decreasing the soil-fertilizer contact for water soluble phosphate fertilizers tends to lengthen the amount of time that phosphorous stays available in the soil solution. Band application of phosphorous fertilizer may offer advantages in soils that have a higher risk of phosphorous immobilization.

Potassium is of special importance to grape production, as ripening fruit is a strong sink for K. The availability of K to vines is closely tied to the CEC and pH of the soil. Soils with low pH have an increased concentration of Al_3^+, which can outcompete the weak charge of K^+ for cation exchange sites. High levels of Ca_2^+ and Mg_2^+ often contributed from liming materials can also outcompete K^+ for cation exchange sites. Without being able to bind to clay surfaces, K^+ will easily leach from the rooting zone and not be available for the vine. For this reason, it is a good idea to supplement lime applications with potash.

The method (banding, broadcasting, foliar application), frequency, and type of fertilization is ultimately up to the vineyard manager but should consider the nutrient dynamics in a no-till system. Foliar nutrient applications tend to have an abbreviated effect but can be advantageous when nutrients are in high demand for a short period of time (ex. peak of N demand at 60 days post bloom). Broadcasting may work well for mobile nutrients and if nutrients need to be directed to a cover crop in the row middle, while banding increases the probability that immobile or less mobile nutrients are available in the rooting zone.

Cover Crops

Cover crops are well suited to no-till vineyards for their ability to break up compaction, add organic matter to the soil, increase activity of organisms living in the soil, fix nitrogen, and reduce soil erosion. Whether present in the row middle or the inter-vine space, it is important to consider the contributions or demand of nutrients by cover crops. The most popular cover crops used in vineyards will be discussed in terms of their nutrient contribution and demand.

Annual ryegrass is an annual bunch grass capable of 3ft of growth above ground and up to 6ft below ground. With respect to nutrients, annual ryegrass is highly demanding of water and nitrogen. It can compete with grapevines for water and nutrients during the spring and early summer. If terminated early, it will return over two-thirds of the nitrogen it removed from the soil back to the soil (Ingles et al. 1998).

The most popular clover for vineyard cover cropping is crimson clover. It is a legume that can be used as a winter or summer annual and may provide 70 – 150 lbs of nitrogen per acre through nitrogen fixation (Bowman et al. 2012). It provides dense cover and is effective in weed suppression. Crimson clover may be terminated by mowing after early bud stage, or earlier if nitrogen losses are tolerable.

Buckwheat (Figure 6) is one of the fastest growing cover crops used in vineyards and offers the advantages of, attracting beneficial insects, loosening topsoil and rejuvenating low fertility soils. It can become a weed itself if left unchecked but is not frost tolerant. With respect to nutrients, buckwheat is excellent at scavenging phosphorous. It can take in phosphorous and other nutrients that are in unavailable forms to plants and release them for plant use as it breaks down (Bowman et al. 2012).

Figure 6. Buckwheat for Weed Suppression. Photo from lergp.com.

Figure 7. Twelve Inch Forage Radish in Row Middle. Photo from lergp.com

Forage radish (Figure 7) is untouchable when it comes to compaction relief. Its taproot penetrates hard pan with ease and it creates large holes in the soil which fill in as it decomposes, essentially tilling the soil over time. They help retain soil moisture and reduce erosion during the season and decompose to release nutrients deep into the soil profile after winter kill. The nutrients are available in the early spring when vines need them most for exponential shoot and canopy development. Generally, radishes do not require supplemental fertilization, but they can produce biomass up to 5 tons/acre (Steve Groff, pers. comm.).

With the integration of cover crops into a vineyard management plan, their contributions to the soil nutrient equation should be considered as well as any competition they may present for water and nutrients during the growing season. Regular soil sampling, petiole sampling and visual scouting for nutrient or water deficiencies in the vineyard are useful tools to make sure the benefits of using cover crops outweigh the risks.

Liming

In no till systems, applying lime does not provide instant gratification. Several studies reported that 10 to 14 years were required for surface applied lime to raise soil pH at a depth 15 cm (6 in) without incorporation (Havlin et al. 1998). Many variables exist that contribute to how quickly a desired pH may be achieved in vineyard soils. Initial pH, organic matter content, texture, moisture, cation exchange capacity, and compaction of a soil can all influence how effective broadcasting lime may be in increasing soil pH and the time required to reach the desired pH. The presence of cover crops, weeds, and the specifications of the lime used also play a role.

It is also important to consider that soil pH changes with increasing depth in the soil. Acidifying fertilizers will have the most pronounced effect on pH in the first few inches of soil. Ruling out deep cultivation to incorporate lime and considering poor infiltration of liming materials into the soil profile, maintaining surface soil pH near 7.0 consistently across several growing seasons is the most practical way to reduce acidity deeper in the root zone (Ketterings et al. 2006).

Soil texture, water holding capacity and compaction vary across vineyards as well, which means that the soil pH (which varies spatially as well) may not respond uniformly to lime application at the same rate. Some growers in the region are using variable rate lime application to make sure lime additions are well matched to the soil conditions in the targeted area.

Broadcasting dry lime (Figure 8) either after harvest or before budbreak is the most typical practice in vineyards, though more expensive fluid lime may offer an increased reaction rate and other advantages. For lime additions exceeding 2 tons per acre, it is advisable to split the addition over successive seasons.

Figure 8. Lime Application with Stolzfus Lime Spreader. Taken from Liming the Vineyards. 2012. Missouri State University.

Conclusion

The soil sampling and nutrient management protocols developed for vineyards were created at a time where row middles were tilled several times during the growing season as a weed management strategy. This resulted in erosion of topsoil on knolls and deposits in swales, creating variation in vine growth that often still exists today. Liming and nutrient recommendations made from soil samples taken at a 6-8 in depth fail to consider nutrient and pH stratification in the soil with depth. Other considerations, like the utilization of cover crops, also fail to weigh in to many nutrient recommendations. Splitting soil samples to isolate the top two inches from the deeper soil will provide better information on soil fertility in no-till systems. With soil and petiole analyses in hand, considering the behavior of surface applied nutrients as well as the nutrient demand and contributions from cover crops throughout the season will facilitate better nutrient management decisions in no-till systems.

References

Anderson et al. (2010). Evaluating soil nutrients and pH by depth. Oregon State University EM 9014.
Bates, T.R., Martinson, T., Cheng, L., Lakso, A. (2013). Lessons from the big dig: dry matter, nitrogen uptake and fertilizer efficiency. Grapes 101 Issue 14, May 2013.

Bates, T.R. and Wolf, T.K. (2008). Nutrient Management. In: Wolf, T.K. (ed.) Wine Grape Production Guide for Eastern North America. Ithaca, PALS Publishing, pp. 141-168.

Bowman, G., Cramer, C. and Shirley, C. (2012). Managing Cover Crops Profitably, 3rd Edition. Sustainable Agriculture Research and Education (SARE) program. Brentwood, Maryland.

Grove, J.H., Ward, R.C. and Weil, R.R. (2007). Nutrient stratification in no-till soils. Agron. J, 65, pp.781-783.
Havlin, J.L., Beaton, J.D., Tisdale, S.L. and Nelson, W.L. (2005). Soil Fertility and Fertilizers: An Introduction to Nutrient Management 6th edition. Upper Saddle River, Pearson Prentice Hall.

Ingels, C.A., Bugg, R.L., McGourty, G.T., Christensen, L.P. (1998). Cover Cropping in Vineyards: A Grower's Handbook. University of California Division of Agriculture. Oakland, California.

Ketterings, Q., Czymmek, K., Beegle, D., Lawrence, J. (2016). Soil fertility and nutrient management. NRCCA Study Guide.

Ketterings, Q.M., Shaw Ried, W., Czymmek, K.J. (2006). Lime Guidelines for Field Crops in New York. Department of Crop and Soil Sciences Extension Series E06-2 Cornell Univeristy.

Kramer, P.J. and Boyer, J.S., 1995. Water relations of plants and soils. Academic press.

Magdoff, F. and Van Es, H. (2009). Building Soils for Better Crops: Sustainable Soil Management. Third Edition. Sustainable Agriculture Research and Education (SARE) program. Brentwood, Maryland.

In Case You Missed it:
The First NYS Concord Summit at the Grape Discovery Center

Introduction:
Though the Concord Summit held at the Grape Discover Center in Westfield on Thursday was not the first summit held for Agriculture , joining the ranks of industrial hemp, dairy and a new farm-to-school program in summit topics, it was the first dedicated to the Concord grape. Elected officials, industry representatives, growers, researchers and administrators came together in a public forum to converse about ways to revitalize the Concord grape industry, whose heritage dates back to the 1800s in the Lake Erie region. In addition to integrating the Concord industry into the New York Grown and Certified program and adding Concord products to the list of ten core products featured at Taste NY welcome centers across the state, New York State's Agriculture Commissioner, Richard Ball, wrapped up the summit by announcing several ways that NYS will do their part to help support the Concord grape industry.

Key Points from the Head Table:
Richard Ball, New York State's Agriculture Commissioner, facilitated the discussion and asked questions of the panel. Lieutenant Governor Kathy Hochul welcomed guests with the affirmation that summits help to bolster interest in industries and pledged the support of Governor Andrew Cuomo in following through on the actions announced at the Summit. A longtime supporter of the region and its many agricultural industries, Senator Cathy Young addressed the audience with gratitude for their hard work and devotion to the "grape capital of America," adding that she would do her part to help secure a strong future for the industry. Other elected officials who addressed the public were Assemblymen Andy Goodell and County Executive George Borrello. Institutions of higher education were well represented at the summit. Dr. Virginia Horvath, President of SUNY Fredonia and Co-chair of the WNY Regional Economic Development Council gave her encouragement to the industry and asked for its members to consider ways that SUNY Fredonia could continue to collaborate on internships or other programs that could help bolster the Concord grape industry. Julie Suarez, Associate Dean of the College of Agriculture and Life Sciences at Cornell University, announced the release of a new table grape with Concord parentage (NY-98) as a product of Cornell's grape breeding program under the leadership of Dr. Bruce Reisch. Dr. Terry Bates, Director of the Cornell Lake Erie Research and Extension Laboratory, noted "the innovation of the growers here is farther along than other places" when describing the role of local growers in a national research project on Precision Viticulture. Dr. Gavin Sacks, Associate Professor in Food Science at Cornell University, has worked with colleagues in product development research involving Concord grapes and/or juice and described some of the innovative processes he and his team are using to facilitate of new opportunities for Concord as an ingredient.

Representatives from the industry on both a farm and processing level weighed in on the past, present and future of Concord. Tim Bigham, Field Supervisor with the New York Farm Bureau, expressed that the Farm Beurau would take ideas from the summit to pursue new policy development to help the Concord industry. Steve Cockram, General Manager of Grower's Coop, pointed out that juice consumption is declining in more than the grape juice sector and that legislators should consider this when developing solutions. Dennis Rak, Director on Boards of Welch's and National Grape, Owner of AA Vineyards, a commercial production facility and nursery that provides clean planting material all over the U.S., showed his support for the NYS Department of Ag And Markets grapevine certification program to certify planting stock and said that he hoped that NYS could model some programs on the successes seen in Niagara-on-the-Lake and Tobacco programs in other states. Alan Rassie, president of Westfield Maid, urged elected officials to consider the need of growers "with no growers, there is no point in having a Concord grape summit", noting that growers had been "in survival mode" for the past several years due to low prices and often bear the brunt of the consequences when industry conditions decline. Nova Cadamatre, Director of Winemaking at Constellation Brands and a Master of Wine, voiced her concern for the "sustainability of our growers, many of whom have been with the company

Figure 1. Head table at the NYS Concord Summit on Thrusday, April 12, 2018

for three generations." Dawn Betts, Co-owner of Betts Farms in Westfield, NY, described the successes of active collaboration with researchers on the farm and urged elected officials and the industry to continue to support research. Brent Roggie, general manager of National Grape Cooperative, brought the dichotomy of "absence claims" in advertising attention, exclaiming, "exactly what is in there anyway?!" He voiced that Concord should market "take the health and nutrition that we have and advertise what we are."

Other speakers came from associations and foundations with ties to the Concord industry. Patty Hathaway, President of the Concord Grape Belt Heritage Association, gave the opening remarks and hosted the event. Mark Bordeaux, Vice President of the NYS School Nutrition Association, pledged his support for integrating Concord grape juice in school lunches as part of the Farm-to-School program, the product of a summit last year. Sam Filler, Director of the New York Wine and Grape Foundation, said "everyone is a believer is Concord grapes, supports the effort that is happening [at the Concord grape summit]." He gave a short presentation about the history of Concord, current market conditions and the future of the industry as they see it. NYWGF invests funding into promotion marketing and research to support the grape and wine industry.

Key Outcomes:
After about two hours of discussion from the panel of speakers, Commissioner Ball cautioned the audience that "summits are not the end of anything, they are the beginning of a lot of work." He then outlined some things that NYS plans to do immediately and also some things that "are going to take some time to develop." There was not a clear differentiation between the action items in terms of their rate of completion, but they are listed below in the order they were announced:

- Continued support for advanced viticulture and enology sciences, specifically Dr. Sacks' denaturing work to remove Concord character from juice and create a neutral blending resource for wine production
- Re-invest in the vine certification program with Cornell University to ensure disease-free planting stock available in April of 2019
- Continue to support Cornell's breeding program to develop new varieties
- Facilitate development of new products and new markets by providing funding to food and beverage manufacturers to develop new product lines using Concord. – "Grape State of New York Competition"
- Fund market development matching grants

- Senator Young founded Wine and Grape Caucus to help funnel funds to NYS wine and grape industry and secured $300,000 for the Food Venture Center at Cornell.
- Potential for tax breaks from NYS to growers looking to plant new cultivars.
- Focus on institutional purchasing of grape juice
- Host workshops to help facilitate new product development and connection with new markets and export opportunities
- Increase representation of Concord industry at domestic and international trade shows (May 2018 American Food Pavilion at the National Restaurant Show, October 2018 PMA Produce Marketing Show, December 2018 New York Produce Show and Conference)
- Start discussion with Commissioner of Health to look at incorporating Concord grape products in the WIC program
- $1.2M investment in a "Vineyard Improvement Program" for renovation, planting of new vines, or diversification. This will be a cost sharing program for growers to remove "poorly performing or underutilized vineyards, help growers with the cost of new planting stock…"
- Add Concord products as one of ten core products featured at Taste NY welcome centers statewide
- Concord grapes will be featured at the "Grape New York State Fair" with a day designated for grapes.
- Add a category at the Governor's Cup craft beverage competition for Concord based signature brandy.
- Open New York State Grown and Certified program up to Concord processors (already an option for Concord growers) to communicate to consumer that a product is a New York product, it has food safety embedded in the process of its production, and there is an environmental stewardship aspect to the growing and production of that product

Conclusion:
Though stakeholders in the audience did not get a chance to ask questions or add to the discussion, there was a lengthy reception that followed the summit. This provided the opportunity for more candid discussion on the summit and its announced outcomes. It seemed that the summit generated an abundance of questions which will hopefully be answered in short order, especially with respect to the Vineyard Improvement Program. LERGP will do our best to provide a clear channel of communication between NY Ag and Markets and our members and keep you informed as the actions announced at the summit develop.

PA Update

Andy Muza, LERGP Extension Team, Penn State Extension- Erie County

Early Warning for Phomopsis Cane, Leaf Spot and Fruit Rot in 2018

A new season will be starting soon and growers should be prepared for the first fungicide application of the season to protect against phomopsis infections.

A Reminder about last season

A review of what occurred last season during the first week of May shows that NEWA recorded an infection period (16 hours wetting, 56 degrees F) from May 1-2, 2017, with heavy rainfall when Concord shoots were about 1" - 3" in length. This was followed by another extended wetting period from May 4-7, during which time zero growing degree days were accumulated. This resulted in extensive shoot infections throughout vineyards because few, if any, fungicide applications were applied during this period in the Lake Erie Region.

About Phomopsis

"Research from Ohio suggests that when inoculum is present, moderate-severe infection can develop after about 26 hr. of wetness at an average temperature of 48 degrees F, 16 hr. at 54 degrees F, and 12 hr. at 60 – 68 degrees F (shorter or longer periods of wetness at any given temperature should reduce or increase disease severity, respectively)" (1).

Spores of the phomopsis fungus are produced in overwintering fruiting structures called pycnidia which develop in diseased woody tissue in the trellis. In the spring, spores will ooze from pycnidia during wet weather and are then rain splashed onto green tissue. Frequent and extended periods of rainy weather during the early season provide ideal conditions for infections to occur. Vines are susceptible to these infections **as soon as buds break** in the spring and green tissue is exposed. The majority of spores are released from bud break through bloom (2).

Infected shoots develop black lesions which are usually located on the first few basal internodes. These lesions can elongate and split resulting in a blackened, scabby appearance (Figure 1). Numerous lesions on internodes can weaken shoots enough to cause breakage.

Leaves which become infected exhibit small spots with dark centers surrounded by yellow, margins (Figure 2). Crop loss can occur if rachis lesions girdle cluster stems or pedicel infections cause shelling of berries (Figures 3 & 4).

Figure 1. Black, scabby lesions on Concord shoot due to phomopsis infection. Photo: Andy Muza, Penn State.

Management of Phomopsis

Phomopsis inoculum levels are moderate-high throughout vineyards in the Lake Erie Region. Therefore, diligent management of phomopsis requires both sanitation and protectant fungicide applications.

Figure 2. Phomopsis lesions on Concord leaf. Photo: Andy Muza, Penn State.

Reduce Inoculum Levels – remove as many diseased canes (particularly canes exhibiting an extensive amount of lesions) as possible during pruning. Also, remove any dead wood (i.e., dead arms, canes and old pruning stubs) from the trellis during the pruning operation. Pruned wood should be chopped up or removed from the vineyard and burned.

Protect against new infections - early season fungicide applications are critical to protect against phomopsis infections. NEWA contains a Phomopsis infection model that calculates when weather conditions may allow spores to infect susceptible tissue. Using this model, growers can insert the phenological (growth) stage and monitor Forecast Details.

- Growers should be prepared to apply a mancozeb spray as early as 1" shoot growth if rainfall is predicted during this stage.
- Regardless of the weather conditions, a mancozeb application should be applied no later than 3" growth stage.
- Additional fungicide protection against Phomopsis infections should continue through at least the FIRST POSTBLOOM SPRAY.

Figure 3. Severe rachis infection on Niagara cluster caused by Phomopsis. Photo: Andy Muza, Penn State.

Figure 4. Pedicel (berry stem) infections caused by Phomopsis resulting in Niagara berry infections. Photo: Andy Muza, Penn State.

Consider Every-Row Spraying – This season, taking into account the amount of inoculum present in vineyards, consider every-row spraying during early season applications instead of the common practice of alternate-row spraying. Research by Wilcox and Landers has shown the benefits of every-row spraying early in the season during this critical time for phomopsis management.

References

(1) 2018 New York and Pennsylvania Pest Management Guidelines for Grapes.
Timothy H. Weigle and Andrew J. Muza, *et. al*. Cornell and Penn State Universities. 154 pages.

(2) Grape Disease Control, 2017. Wayne F. Wilcox, Department of Plant Pathology
Cornell University, NY State Agricultural Experiment Station, Geneva NY 14456
Lake Erie Regional Grape Program Vineyard Notes- June 2017
https://nygpadmin.cce.cornell.edu/pdf/newsletter_notes/pdf83_pdf.pdf

---

LERGP
2018 COFFEE POT MEETING SCHEDULE

Date	Time	Location	Address
May 2, 2018	10:00am	Clover Hill Farm	10401 Sidehill Rd. North East PA 16428
May 9, 2018	10:00am	Ann & Martin Schulze Winery	2090 Coomer Rd. Burt NY 14028
May 16, 2018	10:00am	Sprague Farms	12435 Versailles Rd. Irving NY 14081
May 23, 2018	10:00am	NE Fruit Growers	2297 Klomp Rd. North East PA 16428
May 30, 2018	10:00am	Double A Vineyards	10277 Christy Rd. Fredonia NY 14063
June 6, 2018	10:00am	Fred Luke Farm	1755 Cemetery Rd. North East PA 16428
June 6, 2018	3:00pm	Thompson Ag	Corner of Hanover and Dennison, Silver Creek NY 14136
June 13, 2018	10:00am	Jim Vetter Farm	12566 Versailles Rd. Irving NY 14081
June 13, 2018	3:00pm	Jerry Chessman Farm	11725 Middle Rd. North East PA 16428
June 20, 2018	10:00am	Duane Schultz	3692 Wilson Cambria Rd. Wilson NY 14172
June 20, 2018	3:00pm	Brant Town Hall	1272 Brant Rd. Brant NY 14027
June 27, 2018	10:00am	Betts Farm	7365 East Route 20 Westfield NY 14787
June 27, 2018	3:00pm	Beckman Farms	2386 Avis Dr. Harborcreek PA 16421
July 11, 2018	10:00am	CLEREL	6592 W. Main Rd. Portland NY 14769
July 18, 2018	10:00am	Tom Tower Farm	759 Lockport St. Youngstown NY 14174
July 25, 2018	10:00am	Ziesenheim	8760 W. Lake Rd. Lake City PA 16423

INSURING GRAPES

NY, 2017

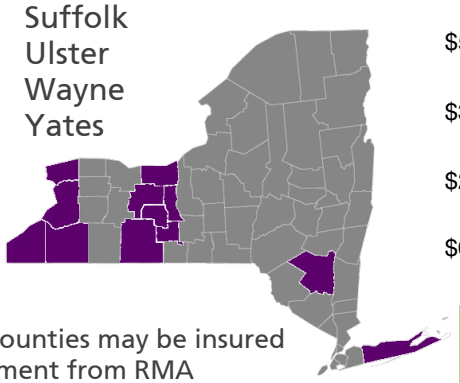
Crop insurance is a safety net for farmers that helps you **manage risk**. If you have a crop failure, crop insurance can help you farm again next year.

Important Insurance Deadlines

- **Aug. 15, 2017:** Premium Billing Date
- **Nov. 20, 2017:** Sales Closing, Policy Change, Cancellation, Termination Date
- **Nov. 20, 2017:** End of Insurance Period
- **Jan. 15, 2018:** Acreage / Production Report Date

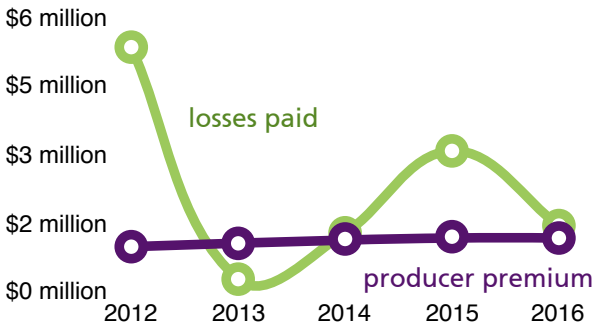
Over 40 grape varieties are insurable in these counties:

Cattaraugus
Chautauqua
Erie
Niagara
Ontario
Schuyler
Seneca
Steuben
Suffolk
Ulster
Wayne
Yates



Grapes in other counties may be insured by written agreement from RMA

NYS Grape Crop Insurance Performance



for every $1 grape producers spent on crop insurance premiums from 2012 to 2016, **they received $2.07** in losses paid, on average

Learn more & sign up:

Explore your personalized crop insurance costs and loss payments under different yield outcomes at ag-analytics.org. To sign up, contact a crop insurance agent. Find an agent using the Agent Locator tool at rma.usda.gov/tools/agent.html

Ag-Analytics.org
@aganalytics

USDA

6592 W. Main Rd.
Portland NY 14769

Lake Erie Regional Grape Program Team Members:
Andy Muza, (ajm4@psu.edu)Extension Educator, Erie County, PA Extension, 814.825.0900
Tim Weigle,(thw4@cornell.edu) Grape IPM Extension Associate, NYSIPM, 716.792.2800 ext. 203
Kevin Martin, (kmm52@psu.edu) Business Management Educator, 716. 792.2800 ext. 202

THE LAKE ERIE REGIONAL GRAPE PROGRAM at CLEREL
6592 West Main Road
Portland, NY 14769
716-792-2800

Cornell University
Cooperative Extension

PENNSTATE
College of Agricultural Sciences