FINGER LAKES
Vineyard Notes
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SOUR ROT RECAP

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SOUR ROT is often used as an imprecise catch-all term to describe the "snork" that can take over injured clusters near harvest if the weather becomes wet. Unfortunately, this means that different people (and fungicide labels) can use one name to refer to a general condition that might have multiple causes. However, for the rest of this discussion, I'll be referring to what I call "true" sour rot--a syndrome that involves pre-harvest cluster decay accompanied by the smell of vinegar (hence the name, duh). Note that whereas decaying clusters can harbor various fungi that are happy to help "eat" the broken-down berries, fungi that form typical mold spores are usually secondary colonizers of sour-rotted berries rather than primary causes of the syndrome, at least in our part of the world. Indeed, we often see sour rotted fruit that shows no sign of mold growth, at least not until they start breaking down, as per the photo below.

Winemakers often refer to and measure the cause of the vinegar smell in sour-rotted fruit (acetic acid) as volatile acidity, or VA. Dr. Wendy McFadden-Smith at OMAFRA on Ontario's Niagara peninsula, who has been in the forefront of sour rot research for over 5 years now, has documented that the measure of VA in grapes harvested from different vineyards is strongly associated with their pre-harvest levels of sour rot. It's generally accepted that the vinegar in such clusters is produced by certain acetic acid-forming bacteria (species of *Acetobacter* and *Gluconobacter*), and that wounds (birds, rain cracking, berry moth, compression in tight bunches, powdery mildew damage, etc.) are necessary to get the whole process started. Sometimes these bacterial infections are accompanied or followed by infections by several wild "bad" yeasts, which can produce ethyl acetate

Figure 1. Symptoms of sour rot on a cluster of cv. Vignoles. Decayed berries in the foreground show subtle signs of secondary fungal growth beginning to develop, whereas tan berries in the lower right already have the characteristic smell of vinegar but are not moldy. (Photo courtesy of Megan Hall).

(smells like nail polish remover or varnish), although this symptom does not seem to be typical in our region. Rather, there appears to be a

progression of steps involved in the development of sour rot, which begins with the production of ethanol by "good" yeasts as the injured berries start leaking grape juice, since ethanol is the substrate that the abovementioned bacteria convert to acetic acid. (And we've found a lot of *Saccharomyces* yeasts associated with sour-rotted berries in the field.) Consistent with such a scenario, Megan Hall, a graduate student now working on this disease in Geneva, measured both ethanol and acetic acid in every one of a large sample of sour-rotted clusters, and found their relative concentrations to be inversely proportional (as ethanol concentrations went down, acetic acid concentrations went up and *vice versa*). A lot of the details are still rather murky, but we know a lot more than we did when Wendy started delving into this in earnest a few years back.

To my mind, two of the more important findings that Wendy and her group have contributed towards understanding sour rot development are: (1) Berries of Pinot Noir and Riesling (the primary cultivars they've worked with) do not become worrisomely susceptible to infection until they mature to a point of about 15°Brix (minor levels of disease developed from inoculations at 13°Brix in their tests, nothing at 10°); and (2) The disease develops rapidly and severely at temperatures between 68 and 77°F; much more moderately at 59 to 68°F; and just barely chugs along at temperatures in the 50's. These data probably make sense to Finger Lakes Pinot Noir growers who remember September 2013—very warm and wet after Labor Day as clusters of this cultivar were nearing harvest and accumulating sugars rapidly, with nasty sour rot ensuing soon thereafter.

Wendy's contingent has also done a nice job of documenting that sour rot doesn't get started in the vineyards until rain occurs after berries have reached 15°Brix and temperatures are at least in the 60's. Rain probably plays a few different roles in disease development, but two of the more important are that (i) it moves the causal microorganisms around and into open wounds where they can do their dirty work, and (ii) it can help cause the injuries necessary for infection to occur in the first place (e.g., cracking that results as berries swell rapidly and/or become excessively compacted in tight clusters).

Another piece of the puzzle that we're beginning to understand is the increasingly apparent role that fruit flies (*Drosophila* spp.) play in the cause and spread of this disease. Clusters with sour rot are typically swarming with fruit flies. A prominent line of thinking over the years has been that these insects are opportunists coming to feed on a convenient food source; indeed, they are attracted to the smell of both acetic acid and ethanol. However, a study from Portugal published in 2012, while far from conclusive, suggested that the flies may actually play a direct role in the initiation and/or spread of the disease. Which caught our interest, as discussed a bit below.

All of this being said, it seems that the basic strategies for managing sour rot are: (1) Provide a microclimate around the cluster zone that's less conducive to pathogen growth; (2) Minimize berry injuries that allow infections to occur; (3) Minimize populations of the responsible microbial pathogens; and (4) Control the fruit flies if they are, indeed, a factor.

In 2013, we (graduate student Megan Hall, entomologist Greg Loeb and his technician Steve Hessler, along with yours truly and technician Dave Combs) began a multi-year project to better understand sour rot and how we might improve our management of it. We're still in the relatively early stages, but here's what we've found so far:

Canopy microclimate. Prior to starting our new sour rot study, there was an opportunity in 2011 to measure the effect on this disease of different viticultural factors, as part of a broader study conducted in a commercial Vignoles vineyard where different canopy management techniques were applied across two different training systems (VSP and Top Wire). The effects of both canopy management treatment and training system were pretty dramatic, as shown in Figure 2 below.

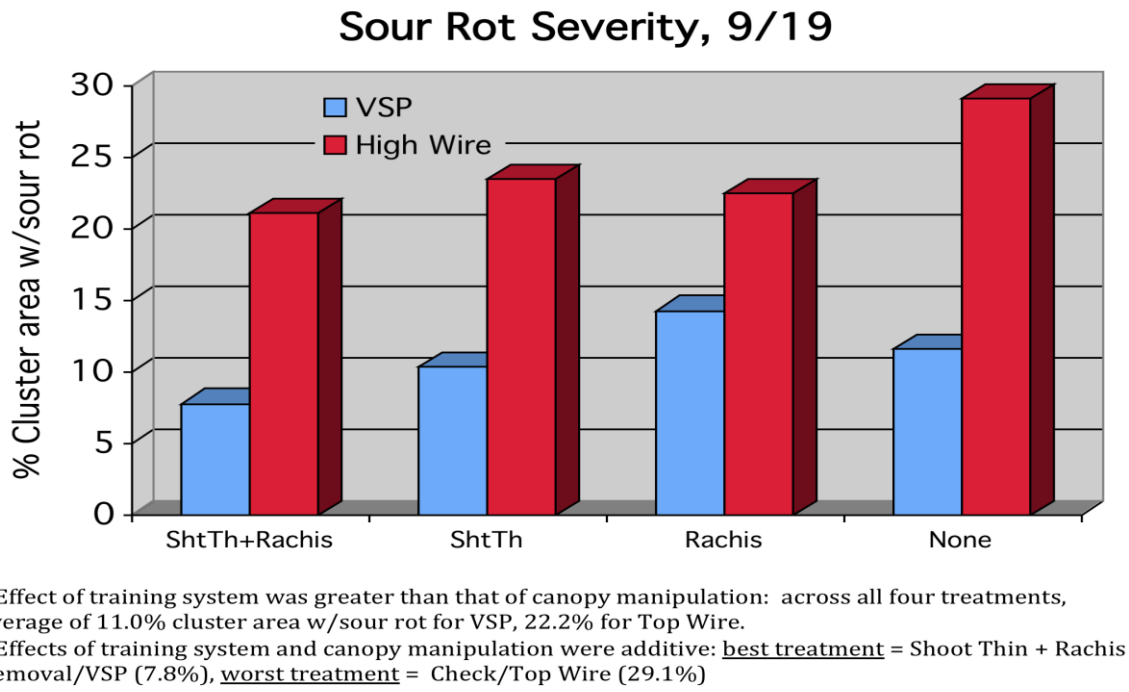

Figure 2. Effects of canopy-management treatment and training system on the degree of sour rot development in a commercial vineyard of cv. Vignoles, as assessed on the day of harvest in 2011.

In September 2014, Megan returned to this vineyard to assess sour severity in a different season. No variable canopy management treatments had been imposed, but the effect of training system was pronounced once again, with twice as much disease with Top Wire training versus VSP. The data are presented in Figure 3 on page 4.

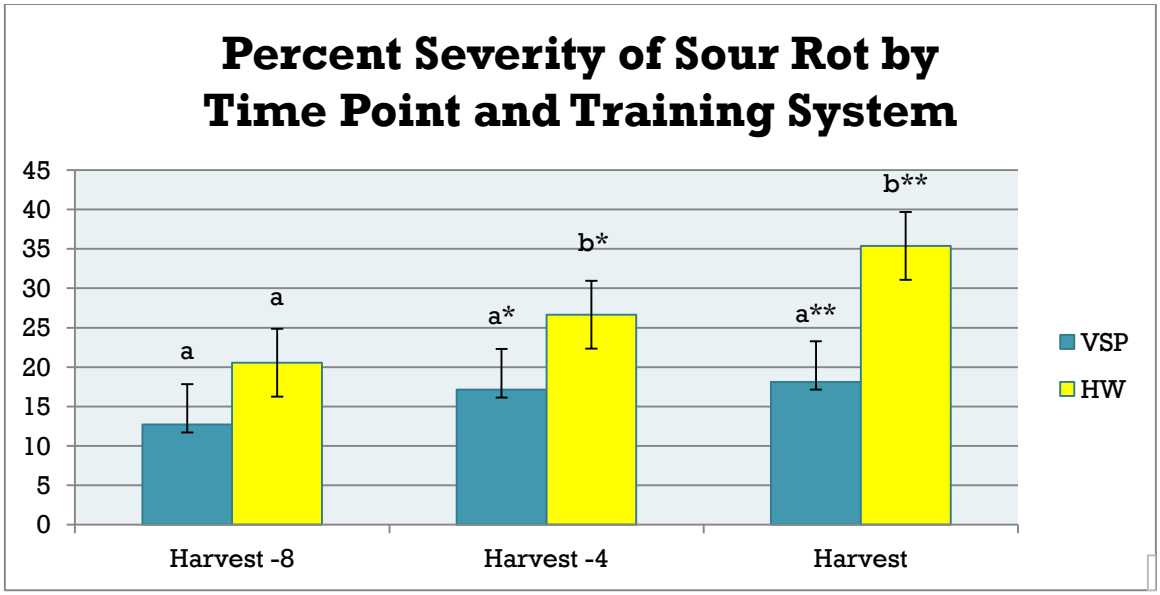

Figure 3. Effect of training system (VSP and Top Wire [HW]) on the development of sour rot in a commercial vineyard of cv. Vignoles, Finger Lakes NY, 2014. Disease severity represents the average percent of the cluster area affected with sour rot, assessed on the day of harvest plus 4 and 8 days before.

Minimize injury. Beyond the obvious (do what you can to reduce damage from birds, berry moth, powdery mildew, etc.), loosening clusters is likely to reduce the mechanical injuries that occur due to compaction, and this will also go a long way toward reducing sour rot, just as cluster loosening does for Botrytis. This is a whole other topic, which we've discussed in some detail before and will save for another time to do so again. Calcium sprays to "toughen" the grape skins haven't reduced sour rot development when tried by Wendy et al., nor have Raingard or calcium chloride sprays applied as anti-cracking treatments.

Minimize the pathogen population. A number of antimicrobial sprays tried in Ontario did not have any effect on sour rot development: Serenade, Pristine, vermicompost, potassium bicarbonate (e.g., Milstop, Armicarb). But what did reduce sour rot was potassium metabisulfite ("KMS", in shorthand), applied weekly at a rate of either 0.5 or 1.0% (4 or 8 lb per 100 gallons of water, respectively). It must be noted that whereas KMS is used widely in wineries both to sanitize equipment and as an additive to musts and wines to kill wild microorganisms and prevent oxidation, it is NOT registered for spraying onto vines to control diseases, either in the US or Canada. Also, it is nasty stuff if you get it in your eyes or breathe in the dust. Oxidate is legal and should act similarly (sterilize berry surfaces), and although it didn't provide control in Wendy's trials, we had some grower testimonials about its benefits in 2013. We're taking a closer look at Oxidate in our own replicated trial this year.

Control fruit flies. Although some growers have tried this approach, I'm not aware of any experimental data evaluating its efficacy prior to our trials the past 2 years. Our 2014 trial was snakebit (most clusters were destroyed by hail, then very little rain the last few weeks before harvest at the experimental site) and we didn't learn much from it, but the 2013 trial was a doozy.

2013 trial results. To look at a combination of insecticide and antimicrobial sprays, alternate rows in a 'Vignoles' vineyard were sprayed with the insecticide Delegate (weekly, beginning at 15° Brix), with the adjacent row receiving no insecticide. Then, within these insecticide-plus or -minus rows,

we applied various antimicrobial treatments, also on a weekly schedule: (i) 0.5% KMS, beginning at 15° Brix; (ii) 1.0% KMS, beginning at 15° Brix; (iii) Kocide at 2 lb/A (registered!), beginning at 15° Brix; (iv) 1.0% KMS, beginning at first appearance of disease symptoms; (v) none (check). The results are presented in Figure 4 below.

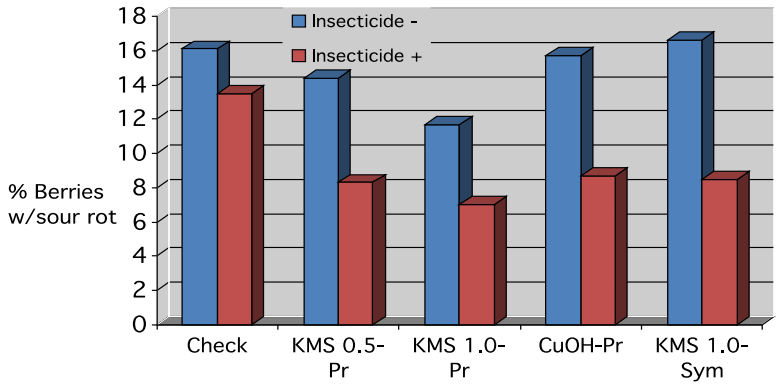

Figure 4. The effect of antimicrobial and insecticide (Delegate) sprays on sour rot control in an experimental 'Vignoles' vineyard; Geneva, NY 2013. Kocide (CuOH) at 2 lb/A or potassium metabilsulfite (KMS) in 0.5% or 1.0% solutions were applied at weekly intervals either preventatively (Pr) beginning at 15° Brix or after symptoms first appeared (Sym) = 1 week after 15° Brix. Delegate was applied at weekly intervals beginning at 15° Brix.

Bottom line: Antimicrobials **with** insecticide provided an average of 50% control (vs. check); antimicrobials **without** insecticide provided an average of 9% control (vs. check); and insecticide without antimicrobials provided 15% control.

A few comments:

- These are data from a single experiment and I'll feel more confident about them once we're able to repeat the results in another bad sour rot year. However, both our results and those from Ontario indicate that some antimicrobial sprays can reduce sour rot. Because bacteria are a critical part of the complex and we haven't seen any consistent association with "filamentous" (non-yeast) fungi, I wouldn't expect fungicides to provide much benefit in our region or those with similar climates, other than perhaps reducing the number of certain injury sites (e.g., pre-harvest Botrytis infections). In warmer climates such as California, Texas, and South Australia, species of the *Aspergillus* fungus often are associated with sour rot; what causal role they may or may not play in the whole complex is not clear, although they may help to "liquify" infected berries and thereby provide more juice to eventually become vinegar.

- We have many other reasons beyond this one trial to believe that fruit flies are important players in the sour rot complex. For example, when Megan tries to reproduce sour rot symptoms on berries in the lab, the only combination of factors that gives her symptoms consistent with what we see in the field is wounding followed by inoculation with both *Saccharomyces* yeast (to produce ethanol from the juice) and acetic acid bacteria (to oxidize the ethanol to acetic acid) **plus fruit flies** (symptoms are atypical without fruit flies). We have a couple of ideas about why this might be so and are working to see if they're correct or not—stay tuned. Also, it should be noted that whereas the spotted wing Drosophila is getting a lot of attention these

days and may be a component in the mix, it doesn't seem to be a major player, as grapes are not a preferred host; rather, the "garden variety" species—*D. melanogaster*, which has always been around—seems to be far more important from what we can tell so far.

- This trial was designed as a "proof of concept" experiment—we nuked the hell out some vines in order to see whether insecticide plus antimicrobial sprays can have an effect. Once we're convinced that they can, we'll start working on finding out how much less we can spray to still get an economically acceptable result.

- **KMS is not a legal treatment** and Kocide has potential copper residue issues that, although legal, might cause problems with fermentation in the winery. As noted above, we're also looking at Oxidate, which is expensive but legal and without potential fermentation issues. There's another new product out there with purported efficacy, which we're also taking a look at right now but have zero experience with otherwise. Finally, we'll also be using Mustang Maxx as our insecticide in future trials, as Greg thinks it will have more residual efficacy than Delegate. (Note that it is labeled for use on grapes with a 1-day PHI, although fruit flies are not a listed target pest). Again, stay tuned.

What does this all mean for now? Sour rot occurs sporadically, and the "state of the art" with respect to understanding and controlling it is still a lot more sketchy than for nearly all of our other important diseases. Individual growers will approach managing it differently depending on their own risk as they perceive it and their philosophy for addressing it.

For now, I'd keep these concepts in mind: (i) Disease can be initiated once rains occur after berries reach approximately 15° Brix; (ii) warm temperatures (extended periods in the upper 60's and above) are much more problematic than cooler temperatures; (iii) good canopy management will keep things from getting worse than they would otherwise; and (iv) it's much easier to keep things down to a dull roar if you address a disease outbreak early than if you wait until things start blowing up in your face. But just how to do this economically and practically is the $64,000 question (a term that was coined in 1950's currency!).

Knowing what we do at this point, if it was my vineyard and I had a few thousand dollars per acre of crop threatening to go south in a hurry, I'd put something on to help control the fruit flies and responsible microbes. If I wanted to go cheap, I might concentrate on the fruit flies. If it was consistently warm and wet, particularly if I'd had a problem in that block before, I might start antimicrobials (Oxidate is probably the best legal bet) at 15° Brix before seeing symptoms and back off if the weather turned more favorable and/or disease development stayed in check.

Otherwise, I'd probably keep a very close eye on my vineyards and the weather, and be ready to jump in with both insecticide and antimicrobial if I saw the disease starting and the weather looked conducive for its spread.

A Detailed Cash Flow Model

Kevin Martin, Business Management Educator
Lake Erie Regional Grape Program

While this article was written primarily for Concord growers in the Lake Erie Region, I think many of the basic points in it are probably applicable to growers in general. It was originally published in the July 2015 issue of the Lake Erie Vineyard Notes, and I appreciate Kevin's permission to reproduce it here. - HCW

Cash Flow Issues

When surveyed, 160 of 600 Lake Erie Growers indicated that they've already had to take steps to modify their business or production practices in order to have adequate cash flow to operate through harvest. Keep in mind - this does not indicate growers that have decided to reduce production investments because of price. These growers report that the cash flow is here, now, even before low prices have really taken hold. I do take a portion of these results with a degree of skepticism. On average, most growers are fairly pessimistic. However, the majority of growers are solving cash flow problems by acquiring and refinancing debt. To me this indicates a grower has an awareness of his financial situation. To me, this indicates that at least 25% of our growers were unable to adequately prepare for multiple years of low prices and potential disasters.

Cash flow challenges already hitting growers may be the result of 2012 frost damage and mostly moderate grape prices throughout the high bulk price period. Whatever the cause of early cash flow challenges, if 2013 did not allow an operation to build significant equity or cash reserves that operation may not be sustainable.

Crop Insurance

I know growers are tired of hearing about crop insurance. I actually assumed growers that did not carry crop insurance owned mature businesses and decided to self-insure with equity in their farm.

To the contrary, the same survey indicates that growers without high levels of crop insurance actually have less equity in their farm. Over 50% of surveyed growers carry high levels of crop insurance. Growers that report cash flow concerns are much more likely to be carrying no crop insurance.

The silver lining on crop insurance is that more growers have obtained policies over the years. Further, growers who get crop insurance are getting fairly robust polices. These policies will prevent cash flow problems for most growers.

Unusual Challenges for Mature Businesses

Businesses can be challenged by a lack of cash flow for various reasons. New businesses, regardless of competitive advantage and profit margins, can be challenged by cash flow. Historically, Lake Erie vineyard operations do not typically face issues relating to cash flow. The businesses tend to be mature, conservatively investing capital and usually not growing.

The previous period of high prices was quite long. For most growers, prices never did exceed $300 per ton. Reaching that threshold allows most growers to quickly build equity and cash reserves. Other

challenges, like the 2012 frost, provided additional setbacks. As a result, we are likely seeing something unusual - cash flow challenges for mature businesses.

It is important to look at your individual financial situation and not rely on the advice of other growers. The collective knowledge of the industry can be overwhelmingly helpful. In this situation, however, individual variables dramatically change the cash flow picture from operation to operation.

How to React

It is hard to provide general advice on the best way to react to cash flow problems. Some general guidelines follow, but ultimately this is a personal decision based on personal circumstances.

Exiting via Business Transfer

If a grower has the means to avoid bankruptcy and put food on the table but is already seeing significant cash flow challenges, an exit plan should be crafted. For Welch growers, this may be easier. There are growers that do not have cash flow problems; they also don't have a market. The sale of a contract is a critical part of an exit strategy.

Bankruptcy

Lots of famous businesses emerge from bankruptcy and realize success. With that in mind, as painful as the process is, it does work for some. The time it takes to build equity in farming is extremely long. This avenue would be more appropriate for growers that simply do not have a sustainable exit strategy other than bankruptcy. With some hard work, you might emerge with a higher standard of living. However, it is fairly likely you will no longer be growing grapes.

Low Cost Production

Growers do have flexibility in reducing business costs. Operating costs, excluding debt service, represent between 20% and 50% of total cost. Growers that operate between 30% and 40% are the most sustainable. It does take planning and innovative production practices to obtain those benchmarks. If you've put yourself in a position to maximize flexibility, you may be in a position to survive. A low-cost producer needs to have the reliable equipment necessary to operate efficiently with low labor and debt service costs.

Over-Estimating Costs

Before you go sell the farm and move your family to New York City, I would really make sure the vineyard operations were not sustainable. In particular, if I didn't have a highly motivated buyer, I would make sure I actually had a cash flow problem.

Revenue

Between 15% and 20% of all acreage will receive no revenue payments between now and their scheduled 2015 harvest advance. Most growers will have at least some revenue between now and harvest advance. As current payments by most cooperatives indicate, these payments will not be in line with long-term historical performance. As a general rule, monthly and quarterly payments are about 50% of recent years. These growers market grapes to the cash market and Westfield Maid Cooperative. Other Cooperative members will continue to receive payments quarterly or monthly. Some growers may have meaningful custom service fees for taking care of neighboring farms. If these fees happen to be significant, most are not until harvest, make sure billing is timely.

Expense

If you have made it this far with your checking account, you do not have far to go. Most growers have already applied the immediate post-bloom spray. For a nimble and conservative operation this leaves berry moth as the primary remaining expense. High-risk sites may need to budget $60 per acre. Moderate risk sites should budget at least $20 per

acre. If you've already done an excellent job, another $20 - $40 should be adequate to cover all other insect and diseases.

Post emergent weed spray programs should be used when cash flow is a concern. However, part of the challenge this year is renewing with suckers. If a pre-emergent program was used, hopefully most of the costs have already been realized. Growers should target less than $15 per acre when applying post-emergent programs. Overuse of more expensive post-emergent materials undermines the economic advantage of roundup and gramoxone.

The cost of renewal work for the grower with cash flow problems presents an issue. Growers should expect to spend between $1.50 and $2.00 per vine. TAP is a wildcard that will take a couple of years before a payment is made, if a payment is ever made. Growers with more than 35% trunk death should consider vineyard removal to minimize the impact renewals have on cash flow. When considering which strategy to take, budget at least $100 per acre for renewals this year when trunks are dead.

Leveraged and Salary Expenditures

Debt and salary draw really limit the financial flexibility of an operation. Many growers that do not have a need for debt service payments or a salary draw really should be able to avoid cash flow issues as long as they concentrate on investments that sustain long-term average yields.

As mentioned in an article in 2012 a salary draw may not be avoidable for some farm businesses. We see a decreasing number of growers relying on salary draw to maintain their lifestyle. Unfortunately, the business typically needs more flexibility than a rigid monthly draw allows. It can be possible for larger growers, when debt service is minimal.

Even a highly leveraged grower of one hundred acres probably does not have more than $500,000 in debt. Interest payments for the year should total between twenty and thirty thousand. Principle payments may be adjusted, depending on the lender. Total loan expenses should not exceed $35,000 on this type of farm. This kind of leveraging allows a younger grower to enter the business. The cash flow budget reveals the additional risk realized with higher debt levels. Again, this is a reason to consider high levels of crop insurance. Without it, the typical grower would have to increase debt (if possible) to make it through the year.

Other cash flow variations

While a great number of variables can slightly change cash flow, the previously considered capture most variation. Of an important note, of course is the baseline. The purpose of a cash flow budget is not to determine profitability. It does not determine the long-term sustainability of your operation.

The largest variability that cannot be assessed across the industry, only on individual farms, is the amount of cash on hand prior to the beginning of 2015 crop payments and 2015 crop expenses. If one had a crop loan larger than the value of the crop, it is entirely possible a farm entered the 2015 crop year with negative cash.

Outlook

The last cash flow oriented newsletter was written in 2012. At the time, the industry had a lot to be optimistic about. 2012 actually turned out better than forecast. 2013 was an excellent year. For growers that had a market, 2014 was still an above average year. For this reason, the self-reported cash flow problem has me concerned. There are fewer reasons to have short-term optimism going into 2015 and 2016 harvest. It is particularly challenging to be optimistic if cash reserves on your operation were not built up in 2013 and even 2014.

In 2012, I thought, optimistically, that most growers would be able to easily withstand the frost. With so many growers diversifying household income across multiple income streams, the necessity of grapes to hit every year has passed. For growers that struggled through 2013 and 2014, it may make more sense to keep those other sources of income for yourself, rather than funding a grape operation. If low prices continue into 2017, cash flow challenges may justify increasing debt load. If declining equity and increasing debt load is already a significant challenge in 2015, an exit strategy should be part of your plan - it just may not be sustainable to continue until a time when prices recover.

Fact-Checking Some Viticulture Myths

Hans Walter-Peterson, Finger Lakes Grape Program

One of the things that science does is force us to rethink commonly held notions, assumed truths, or what appears to be common sense. In viticulture, we have our own set of myths and beliefs about growing grapes that have survived for decades, or more, in the absence of good field research. But while many of them have some basis in fact, they are not necessarily the absolute truths that they are sometime touted as being. Here are a few 'myths' that we have in viticulture, and what researchers have found out about them.

Myth #1: Planting vines closer together on a vigorous site will keep them from growing too much.
The idea behind this would seem to make some sense at first glance – if you plant vines close enough, their roots will have to compete for water and nutrients and therefore reduce vine growth, which we are often trying to do in many grape growing regions in the U.S. Research back as early as the 1960s has shown, however, that this strategy rarely accomplishes that goal on moderately to highly vigorous sites. Grapevines generally do not create large enough root systems that they will effectively compete with each other for water and nutrients. By planting vines closer together, you create more competition in the above-ground portion of the vine (the leaves) than below-ground. In this case, the vines will usually require more canopy manipulation, and therefore more costs and labor, because tightly-spaced vines will often have too many leaves and shoots for the small amount of trellis space that they are given to fill. This results in excessive shading of clusters, leaves and buds, all of which have negative consequences with regard to promoting disease and reducing yield and fruit quality.

Myth #2: Cluster thinning after veraison will result in fruit that is more ripe at harvest.
Again, this one seems to be a bit of a no-brainer at first. If you reduce the number of clusters that the vine needs to ripen, then more of the good stuff that we want in the fruit – sugar, color, flavor and aroma compounds, etc. – will go into each berry and cluster. While this can be true if a vine is significantly overcropped, it is more often the case that the fruit that is remaining after thinning does not get significantly riper than if there was no thinning.

There have been several studies that have looked at the how cluster thinning at different points in the season impacts the fruit. While there are some fairly consistent effects that are found in these studies when thinning is done before veraison – larger berries, heavier clusters (both due to yield

compensation by the vines), improved color or sugar accumulation in some cases – the evidence of any significant impacts to the fruit from thinning after veraison is, well – thin.

Myth #3: Lower yields equal better quality
This is probably one of the most widely repeated, and yet misunderstood, ideas in all of viticulture. It is not uncommon to hear wine writers and bloggers talk about certain wineries producing high quality wines because they keep yields low, and often times it's winemakers and grape growers themselves who are promoting this idea. That's not to say that it is untrue in every situation – smaller crops are appropriate for low vigor sites - but it is not the universal truth that it is sometimes stated to be.

One of the essential tenets of grape growing is that there is a balance between the amount of exposed leaf area and the crop level that the vine produces. When clusters are removed from the vine, there is less fruit to balance out the growth of the shoots and leaves, which results in larger canopies that need more management and cause excess shading of the fruit. If a site has relatively deep and fertile soils, the vines will want to grow a lot of leaves and shoots, and the best and easiest way to balance that high growth potential is to hang a *larger* crop on it, which will still have the same or even better quality than a smaller crop.

A recent project at Cornell looked at whether or not trained wine professionals could tell the difference between several Riesling wines produced from vines that had various levels of cluster thinning, ranging from 1 cluster/shoot to no cluster removal at all. These trained individuals were unable to tell the difference between any of the treatments, leading to the conclusion, in this case, that cluster thinning in Riesling doesn't pay because there was no impact on final wine quality.

Science is the best tool we have to understand how things work in our vineyards. This is not meant to discount growers' experiences on their own farms, which are extremely important. But to really understand how best to farm a piece of land, whether the crop is grapes, tomatoes or corn, we should lean on science rather than stories.

This article originally appeared in the November 2014 issue of American Fruit Grower magazine.

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Petiole Testing at Veraison

Now that we have entered the ripening phase of the season, between the botrytis sprays and the final preparations before harvest, it's also time to think about taking petiole samples. Petiole sampling has traditionally been done in eastern viticulture at approximately 70-100 days after bloom, which just happens to coincide nicely with veraison for many varieties, and therefore the standards that have been used to determine nutrient status are based on samples being taken at this point of the season.

Samples taken at veraison are best taken as part of a vineyard's regular nutrition management regimen, as any deficiencies that are noted at this point in the season will be difficult to alleviate before harvest. This is one advantage that taking petiole samples at bloom can have over those taken at veraison. However, samples taken at veraison are considered to be better indicators of vine nutrient status for some nutrients, such as potassium.

When collecting samples at this point in the season, there are several key things to remember in order to make sure you are getting as accurate of a representation of nutrient status as possible:

- *Take petioles from the "most recently mature leaf" on the shoot*. What does that mean? Starting at the shoot tip, work back down the shoot until you reach the first leaf that appears to be about full size. This is usually somewhere around 4-6 leaves back from the shoot tip. At this point in the season, basal leaves will usually be mobilizing some elements to new leaves, so petioles from these leaves will not be representative of the true nutrient status of the vine.

- *Try to only take petioles from shoots that are bearing fruit.* Non-bearing shoots don't have fruit to balance the nutrient demand of the shoot. Including more than a few of these petioles in a sample may mask a deficiency.
- *Take separate samples for each variety/rootstock combination. Also separate by major soil types if possible*. Each of these factors will have an impact on the nutrient status of your vines. If you lump them all into one sample, you may again be masking possible deficiencies that are developing in a certain portion of the sampling area.
- *Each sample should contain about 50-75 petioles per sample.* Varieties with larger petioles, like Concord, can have fewer petioles per sample, while those with smaller petioles, like some hybrid and *vinifera* varieties, should lean towards the higher end of the range. Take no more than two petioles from any single vine.

- *Each sample should represent no more than about 5 acres.* This is true even if the vineyard is very uniform.
- *Wash samples before submitting them.* Dust and traces of chemical or foliar nutrient sprays used during the season can impact the results of the tests, particularly for some of the micronutrients. Make sure to wash petioles in warm water with a couple of drops of detergent (less than one minute) and rinse them in order to remove as much of these elements as possible. Allow the petioles to dry for a couple of days before submitting them.

Got some grapes to sell? Looking to buy some equipment or bulk wine? List your ad on the NY Grape & Wine Classifieds website today!

Become a fan of the Finger Lakes Grape Program on Facebook, or follow us on Twitter (@cceflgp). Also check out our website, at http://flg.cce.cornell.edu.

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