CROWN GALL REARS UP IN 2003
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Crown gall results in the development of fleshy galls that typically appear at wounds on the trunks and canes of vines and at graft unions. It is caused by the bacterium, Agrobacterium vitis which can survive within the vascular system of healthy-appearing vines and is spread in cane cuttings. Agrobacterium causes crown gall by transferring a part of its DNA into the plant. The transferred DNA (crown gall genes) is expressed in the plant resulting to the development of galls. Such DNA transfer leading to disease is unique for Agrobacterium, and represents the only known example of natural DNA transfer from a bacterium to a plant.

Crown gall in vineyards develops most often at wounds that are caused by cold winter temperatures. Although injury may occur over a long period in the winter, fresh crown galls are usually first apparent from mid June to mid July. It is this period when it is thought that auxin is transported from growing shoots to the wounds, leading to the initiation of wound-healing. Research being done by a graduate student, Jodi Creasap, at Geneva has shown that Agrobacterium takes advantage of the wound-healing process in grapevines by infecting those grape cells that are associated with the vascular cambium and that are generated during wound-healing. It has been determined that it is these undifferentiated callus cells that are generated in the presence of auxin that become infected by Agrobacterium. Thus instead of regenerating functional vascular tissue at wounds, crown gall infections lead to the growth of disorganized gall tissue. In addition to producing cells that are crown gall-susceptible, the wounds also release compounds that are sensed by Agrobacterium and that stimulate the bacterium to begin the process of DNA transfer.
In 2003 we are seeing crown gall developing on susceptible cultivars including major vinifera cultivars and non-vinifera such as Niagara. Rootstocks also differ in their susceptibility with 110R and Teleki 5C being relatively susceptible as compared to more resistant 3309C and Mgt101-14. In established vineyards, the bacterium has most likely been residing in the vines for years, however infections have generally not been observed because of moderate winters and little injury. The resulting effect on vine growth and longevity will depend on the severity of injury and subsequent i.e. the area of vascular cambium that is infected. I would not advise removing crown gall-infected vines until they die or until it is apparent (next year) that the vine is injured to a point where it will not recover. If possible, bring up new trunks that will over time replace those that are infected. Although galls may be unsightly, if they only affect a relatively small region of the cambium, it is likely that the vine will recover. This, of course depends on conditions that occur the following winter. Repeated injuries and crown gall on young vines can be devastating.

Because crown gall is carried in vines and *A. vitis* is not known to infect other types of plants, the development of *A. vitis*-free propagation material is being done. Through research that is supported by USDA/CREES Viticulture Consortium-East and the NYS Wine and Grape Foundation, we have been working with Dennis Rak (Double A Vineyards) and Tom Zabadal (Michigan State University) to establish *A. vitis*-free Niagara propagation material. Cuttings from the established “mother blocks” have been indexed at Geneva for the past three years and thus far, they remain free of the pathogen. We are also indexing cuttings of other grape cultivars that Tom Zabadal has established in an additional crown gall mother block at MSU.

Clean vines should be particularly effective for preventing crown gall when planting in new vineyard sites. In other planting sites however, where diseased vines have been removed, it is likely that the pathogen will be present in residues of roots and canes that are left in the soil. Therefore a means of protecting the vines against infection from this source of pathogen is being sought. Most promising at this time is to treat vines with a non-pathogenic strain of *A. vitis* (strain F2/5) that inhibits the development of grape crown gall. Part of our research is aimed at determining how the biological control is able to control the disease. We know that the biological control is specific to grape and that it must come into contact with susceptible plant cells in the wound before the pathogen comes into contacts them. Thus to be most effective, the biological control will have to establish systemically in vines and be present as the wounding occurs. Previous field experiments in the U.S. and in other countries indicate that the biological control can significantly reduce crown gall under field conditions. Field experiments that have been established in NY and Ohio will be evaluated this year.

The use of genetic engineering to produce crown gall-resistant vines is also being pursued. Because the mechanism by which *Agrobacterium* infects plants has been studied extensively for more than 30 years, strategies for producing transgenic plants that can block infection are possible. For example, it is possible to genetically engineer plants so that they are able to silence the expression of the pathogenicity genes of *Agrobacterium*. It is likely that in the future, crown gall resistant selections of major rootstocks and scions will be available.

**DISEASE CONTROL UPDATE,**
**AUGUST 2003**

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It’s certainly been a “challenging” season. The good news is that, as wet as it’s been, the standard “wet weather” diseases--Phomopsis,
black rot, downy mildew—have been held at bay, although Botrytis is still a potential threat. In contrast, there’s far more powdery mildew to be found on highly susceptible cultivars (Chardonnay and Riesling, in particular) than we had hoped for or expected, especially since most growers have increased their efforts to manage this disease after the problems last year. A brief rundown on where we stand and what to be considering for the remainder of the season.

**Phomopsis.** Inoculum should be depleted by now, no longer a threat.

**Black rot.** Berries are immune or nearly so. New infections are no longer a threat in clean vineyards, although disease spread is theoretically an outside possibility on *vinifera* cultivars if more than a few infected berries are present in the clusters (a rare scenario this year). Be aware that infections that may have occurred in mid- to late July can take up to 4 weeks to become visible.

**Downy mildew.** There’s a bit of it around here and there, and our current weather pattern is very conducive to further spread. Berries are no longer susceptible, although new leaves are. Captan and copper will do a good job of keeping things clean. There has been a lot of use of phosphite (phosphorous acid) products, and these seem to be doing a good job also. Experiments that we’ve conducted this summer indicate significant protective and postinfection activity against foliar infections. Under extreme experimental pressure (applying 50,000 spores per leaf!), the protective activity starts breaking down on older leaves by 7 days, although it is still very good on younger leaves. I suspect that it will still be adequate even on older leaves under more real-world conditions, where you’re merely trying to keep things clean. Postinfection activity shouldn’t be pushed past more than 2 or 3 days.

**Powdery mildew.** With a couple of notable exceptions, we haven’t seen the devastating losses that occurred last season, but there’s a lot more of it around than we’d like to see. The likely culprits include: (i) Warm, humid conditions in the early postbloom period; (ii) continued erosion of the activities of the strobie and SI fungicides; (iii) wash-off of sulfur; and (iv) compromised spray coverage.

After last season, we wondered if the strobie problem was indicative of a ‘worst-case scenario’ or the ‘tip of an iceberg’. Unfortunately, it appears to be the latter. Control trials that we’re running in a Chardonnay vineyard that had problems last year are showing poor control by any of the strobies when used alone. I wish it weren’t so, but there you have it.

**Coverage.** It’s too easy for people in my position to blame any problems with recommended control programs on application deficiencies, but that doesn’t mean it can’t be true. I’ve seen a number of vineyards where there’s more than a little mildew on clusters and nearly all of it can be found by pawing through the foliage or moving back leaves to find these clusters. And we know that we don’t have resistance to sulfur. Nobody gets perfect spray coverage, but this is an issue that deserves a lot more attention before we start the next season. Training systems that provide excellent exposure of the fruit throughout their development appear to have fewer problems in general.

A number of growers have resorted to “eradicant” sprays of Stylet Oil and the potassium salt products, with levels of success ranging from moderate to slim. It’s much easier to keep mildew off the clusters than it is to remove it once a problem has occurred. Growers who get into trouble based on spray coverage issues are unlikely to get out of it with materials that are 100% dependent on complete coverage a few weeks later.

There should be no additional cluster infections occurring, although those that are present will continue to turn ugly. Best bet at this point is to keep the foliage clean with something cheap and not prone to resistance.
Concord growers can use copper and lime as an alternative if they want to maintain additional protection into what looks like a late season with challenging ripening conditions.

**Botrytis.** We’ve had excellent conditions for bloom and postbloom latent infections to become established. It won’t matter if a few of these become active preharvest and things are dry, but there’s potential for considerable spread if the weather is wet preharvest when berries are highly susceptible to new infections. The safe option for growers of valuable and highly susceptible varieties is to apply a Botrytis fungicide at veraison and continue to monitor the vineyard and the weather preharvest (a second preharvest application is also an option if the disease becomes established and it’s wet). Alternate between Vangard and Elevate, the best of these is the one that you haven’t used recently.

ESTIMATING CROP YIELDS

*Timothy E. Martinson*

Obtaining accurate crop estimates is becoming more important in the Finger Lakes. Those who sell smaller quantities of grapes to several buyers need to be able to plan for harvest to know how many tons they will have to sell to each buyer. For premium varieties, particularly those that ripen late (Cabernet Franc, Cabernet Sauvignon, Riesling, Chambourcin), or are sensitive to cropping level (Pinot noir), estimates are important tools for deciding whether crop thinning is necessary, and how much to reduce crop through thinning. If you are aiming for a yield target for quality reasons, its important to know how much is there, so you will know how much to remove, if necessary.

**Yield Components.** Yield is determined by three factors – the number of vines per acre, the number of clusters per vine, and cluster weight. In our climate, all three can vary as a result of winter injury, pruning severity, cropping history, water stress, and environmental conditions during bloom, which influence both fruit set and bud initiation that can influence fruitfulness of next year’s canes. Estimating these three factors is the key to obtaining accurate crop estimates.

**Vines per acre.** This is the factor that probably varies the least- Everyone knows their row and vine spacing, and therefore the number of vines per acre, right? What’s important is the number of bearing vines per acre, so don’t forget to subtract skips and replants that won’t produce any fruit, particularly if you have had recent winter injury.

**Clusters per vine.** For most varieties, the number of clusters per vine is determined by pruning severity (nodes per vine) and bud fruitfulness (clusters per shoot). However, some of the hybrids can produce fruitful shoots out of basal buds and non-count shoots (those arising from latent buds). With these varieties (e.g. Seyval blanc, Dechaunac) it is more difficult to control crop (or predict cluster number) through pruning alone.

Cluster counts can be made at any time after developing clusters are visible on shoots. In general it’s less time consuming to count clusters as early as possible, before vine growth obscures them. In small (<5 acres), uniform blocks, counting clusters on 10 – 15 vines is sufficient to obtain accurate estimates. In larger blocks, or non-uniform areas, take separate samples in different areas, and sample more vines (again- at least 10-15 for every 5 acres, where growth and pruning severity is uniform). Count vines may be randomly selected, but it will probably work better to establish a grid to ensure that the entire block is represented. For example, in a block with 20 rows of 50 vines each, you may want to count clusters on every 10th vine in every 5th row to obtain counts from 20 vines.

**Cluster Weight.** Cluster number is set early in the season, but cluster weight can vary greatly from season to season due to environmental factors and cropping history.
Heavy crops the previous year or poor acclimation can reduce the number of florets per cluster before bloom. Poor fruit set can reduce the number of berries per cluster. Finally, berry weight can vary due to moisture differences among seasons and other sources of vine stress. The number of berries per cluster is the most important variable influencing cluster weight. For example, in a vineyard with 800 vines per acre, 60 clusters per vine and 1.5 gram berries at harvest, each additional berry per cluster accounts for 160 lb of grapes per acre.

**Lag phase cluster sampling.** Historical cluster weights can be used with cluster counts to obtain rough crop estimates – if you have the records. Lag phase cluster sampling, however, can greatly improve the accuracy of these estimates. The lag phase is a period of 1-2 weeks when there is a pause in fruit growth. This pause occurs between the first phase (cell division) of berry growth after fruit set and the second phase (cell enlargement). Cluster weights obtained at this time correlate well with final cluster weights. For Concord grapes, the lag phase occurs about 30 days after bloom, at around 1200 growing degree days (Base 50 F). At this time, Concord clusters reach about half their final weight, so final cluster weight can be calculated by multiplying by two. For other grape varieties, timing of the lag phase and the ‘multiplier’ are probably similar, but this needs verification through further study. Sample at least 100 clusters, selected randomly from throughout the vineyard, weigh, and divide by the number of clusters sampled.

**Harvest cluster sampling.** Developing historical records for your block is important to refining your crop estimation program over the years. Collecting an additional cluster sample near harvest won’t help you predict yield or make management decisions about thinning for the current season, but it will help you improve the accuracy of your predictions for coming years. Records of average cluster weights can be used in future years with early cluster counts to make more accurate early crop estimates. By dividing cluster weight at harvest by the lag phase estimate, you can determine the appropriate multiplication factor to use in mid-season crop estimates.

**Putting it all together.** A seasonal program using the steps outlined above would be:

1. **First estimate** – A week or two before bloom, count clusters. Use historical cluster weights and multiply by cluster counts to estimate crop weight (lb.) per vine. Multiply crop per vine by the number of vines per acre and divide by 2000 to obtain tons per acre. Use this first estimate to guide early flower and shoot thinning, if necessary. [Note – if you don’t have historical cluster weight data, most Vinifera in the Finger Lakes have average cluster weights between 0.2 – 0.3 lb. Use the smaller figure for small-clustered varieties; larger end of the range for large-clustered varieties]

2. **Second estimate** – At 1200 growing degree days, or about 30 days after bloom, collect and weigh lag phase cluster sample. Multiply cluster weight by appropriate factor to estimate cluster weight at harvest. Use this estimate to make decisions about pre or post-veraison thinning. [The factor may vary from 1.8 to 2.9. For Concords, 2 works well, and some area growers have had good success using it with some vinifera as well. The Oregon Grape Growers Guide suggests that 2.2 is a good starting point for Pinot Noir]

3. **Harvest estimate** – Collect and weigh cluster sample before harvest, check against earlier estimate to refine estimates for next season, compare estimates with actual tonnage.

The needs of your operation will determine how much time you want to put into crop estimation, and how accurate your estimate needs to be. Some growers have had success using the eyeball method and their own
experience, without counting or weighing clusters. For premium grape growers, my guess is that accurate crop estimates will become increasingly important to managing crop load and maintaining quality. Whether you use a simple system or the full program I have just outlined, the important thing is to maintain accurate records from year to year, so that you have a better basis for making improved estimates the following year.

References:

Oregon Winegrape Growers Guide, Oregon Winegrowers Assn, Portland OR 503-228-8403


UPCOMING EVENTS

August 5-7, 2003. Empire Farm Days, Seneca Falls, NY. This year EFD is featuring Grape Center 903 emphasizing the grape industry. IPM specialists will offer methods for keeping vines healthy and talk about changing pest problems. Companies will also be showing specialized grape equipment including tractors and sprayers. For more information: www.empirefarmdays.com

August 11, 2003. AgriLogic, Inc. Risk Management Meeting, Glenora Wine Cellars, Dundee, NY. AgriLogic, Inc. has been contracted through the USDA’s Risk Management Agency to determine if a grape vine replacement insurance program should be developed to cover lost vines and possibly lost revenue.

The objective is to obtain producer feedback on AgriLogic’s proposed recommendations for a grape vine replacement insurance program for the New York Wine Grape Industry. This feedback will assist in the analysis and evaluation of the possible program. This is an opportunity for the members of the Grape Industry to have direct input in the development of an insurance program to cover grape vine loss. Time: 11:00 a.m. -1:00 p.m (lunch provided) at The Inn at Glenora Wine Cellars, 5435 Route 14 Dundee, NY 14837. For information about the meeting or to RSVP, please call Brandi toll-free at (877) 245-6442 ext. 8116.

To learn more about AgriLogic, and this project visit www.agrilogic.com
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