Subject: New England Grape Notes - May 15 Freeze Injury Information
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UMass Grape Notes - May 17, 2013

Frost/Freeze Injury Recommendations

UMass Extension
CENTER FOR AGRICULTURE

On the morning of May 15, some New England grape growers awoke to find frost or freeze injury on their grape vines. Low temperatures ranged from mid 30's to mid 20's in the region.
See an article by Dr. Paul Demoto from Iowa State University at http://www.ipm.iastate.edu/ipm/hortnews/2012/4-18/grapes.html about frost/freeze damage last year on cold hardy hybrid vines.

Below is an article by Dr. Tony Wolf from Virginia Tech responding to a question about *V. vinifera* vines that have been damaged by a spring frost or freeze event.

Question: Following a frost/freeze event in the vineyard, what can be expected in terms of crop yield and crop maturation? And, should the damaged shoots be rubbed off?

Dr. Wolf: To answer the second question first, No, I don't believe that you should have rubbed off injured shoots, although there could be a justification for this under specific conditions. Vineyardists have dealt with the consequences of frost since weather and vineyards have existed, so it's not surprising that someone took a methodical approach to looking at various vine management strategies following a frost event. Frost is rarely even-handed in the injury it causes, especially when air temperatures are at, or just below, the critical temperature required to initiate freeze events. Some shoots are totally scorched. Others are unscathed. Still other shoots may have their tips or only a portion of leaf area frosted, with the basal portions of the shoot, including inflorescences escaping injury. To simplify the response discussion here, let's just consider these three scenarios:
A) totally destroyed shoots
B) healthy shoots
C) shoots with injury to the tips and/or some degree of leaf area, but with apparently unaffected flower clusters

As I discussed at the vineyard meeting on 19 May (see additional Upcoming Meetings at

end of this newsletter), a first course of action would be to survey the frosted vineyard and determine the classification of injury and the pattern of injury within the vineyard. As you illustrated in your question, topography would obviously affect the pattern or incidence of injury within the vineyard, but also the severity of injury on a given vine.

In areas where a significant portion of the shoots are “A” (totally destroyed), most (possibly 75% or more, but varies by variety) of the current season’s crop potential of these vines will have been lost. New shoots will emerge in time from base buds on cordons or from secondary buds in the compound bud of cane-pruned vines. Some of these new shoots will bear some crop. The amount of crop will depend on (i) variety, (ii) training system, (iii), exposure of the buds during their development, and (iv) general management of the vines in the previous year. Certain hybrid varieties, for example, can have very fruitful base buds. High training systems (such as GDC) tend to have somewhat more fruitful base buds than do low-trained (such as VSP) vines owing to the greater sunlight exposure of buds on high training systems. Canopies that were relatively thin and well exposed to sunlight in 2009 will likely have more fruitful base buds in 2010 than would canopies that were heavily shaded in 2009. Growers understandably feel a compelling need to do something, anything, to help vines that are totally scorched (“A”). Would the stripping of damaged shoots benefit the vine? With vines that have total loss of shoots (“A”), there would likely be no benefit to this strategy. Work in California (Winkler, 1933; Lider, 1965; Kasimatis and Kissler, 1974) suggests that while a positive response (slight crop increase) to stripping damaged shoots might occasionally be observed with some varieties (such as ‘Tokay’ in the Winkler study), the overriding result was no significant increase in yields. Furthermore, if the shoots were partially lignified at their point of attachment to older wood when the stripping was done (18- to 24-inch shoots), the manual breaking out of damaged shoots often damaged the base buds.

What about vines that have long shoots (24 inches or longer) that had their tops/tips frosted, but which appear to have unaffected flower clusters (what I called scenario “C”, above). The consequence of this damage is difficult to accurately predict, but let’s try. A damaged shoot will initiate one or more lateral shoots at nodes proximal (below) to the point of frost injury. We’ve all seen this response with shoots that were decapitated from grape cane girdlers, periodical cicada egg-laying, hedging, wind damage, or from a host of other reasons. The new leaf area of the lateral shoot(s) will compensate in time for the primary shoot leaf area lost to frost. However, the lateral leaf area may not develop rapidly enough to ensure good fruit set on the subtending clusters. We know from leaf pulling research that pulling leaves prior to bloom can cause small reductions in fruit set by depriving the vine of a source of carbohydrates at a critical time (bloom and fruit set). This can be good if we’re simply trying to reduce cluster compactness. If the leaf area to flower ratio is greatly depressed, however, the reductions in set may be much greater than desired. There’s not a lot you can do here – it simply takes time for the vine to re-foliate after a frost. But don’t expect full set on shoots that are damaged in this (“C”)

fashion.

Vines that bear largely unaffected shoots (“B”) will generally set and mature a normal crop. One could do some shoot-thinning (or cluster thinning) of these vines if/as fruitful secondary shoots appear in order to standardize the crop to primary crop only (see following discussion).
The above discussion focuses primarily on the yield response of frosted vines. What can you expect in regards to fruit ripening? It’s easier to predict the ripening pattern of vines that have completely destroyed shoots (“A”) than it is for vines that have partially destroyed shoots (“C”), or those that have a mix of healthy (“B”) and damaged shoots. The clock is reset for vines that have lost all shoots to frost. Base and secondary buds will eventually produce a full canopy of leaf area, assuming that temperatures were not so cold as to cause vascular injury (they were not so cold on 10 May). This “second” flush of canopy will have some crop, depending on variety, etc., and this crop will ripen in a generally predictable fashion. It will, however, reach commercial maturity somewhat later than a normal crop owing to the fact that budbreak of the second canopy was more than a month later than the original budbreak. On the positive side, it will be a lighter than normal crop and this will accelerate ripening to a point.

The picture is muddied for vines that bear a mix of destroyed (“A”), damaged (“C”) and perfectly healthy shoots (“B”). Here we have two or more discrete populations of fruit that differ in the onset of ripening, if not the rate of ripening. The populations may be mixed on the same vine, and will very likely differ within sections of the vineyard due to topographic impacts of the vineyard on frost incidence. What is the predicted outcome for such vines? Mardi Longbottom described such a situation that occurred in Coonawarra Australia following a frost in 1998. Her description can be read in the July/August 2007 Viticulture Notes (http://sites.ext.vt.edu/newsletter- archive/viticulture/07julyaugust /07julyaugust. html). In sum, Mardi found that the two populations of fruit (primary shoots vs. secondary shoots) did indeed have large differences in Brix at veraison. Those differences tended to converge with ripening, however, and the crops were ultimately picked at the same point in time. They had decided not to drop one or the other crop in advance, which was a gamble, but it paid off for them (quantity-wise, anyway) to harvest the sum of the two crops. Lider (1965) reported a similar pattern of Cabernet Sauvignon maturation in the Napa Valley, with the crop on primary shoots running about 3.0°Brix greater than that of the secondary crop in the week prior to harvest on differentially frosted vines. Lider’s advice to differentially sample affected portions of the vineyard makes as much sense today as it did 45 years ago. Seasoned growers know that vineyard topography, variation in vine capacity, and soil characteristics can affect the rate of crop maturation and will stratify their vineyard sampling (and harvest) accordingly. Variable frost damage adds another layer of complexity to this sampling approach. What are your options? One potentially compelling reason to strip off both uninjured and partially injured shoots on frosted vines is that it resets the vine to a common crop ripening sequence, and avoids the asynchrony described above. The negatives are three-fold: (i) you will further reduce yield potential; (ii) you might push the ripening end-point beyond what your site/variety/season mix can adequately ripen; (iii) and it incurs a labor expense. In the case described with the leading question, you are starting with a very late-ripening variety (Norton) in a site that has shown its potential for frost damage. If,

on the other hand, you had a variety such as Seyval, that has very fruitful base buds, and which ripens early, completely shoot-thinning a partially frosted vine would make more sense (if done immediately after the frost, not a month later!).

Some other general considerations of frosted vines: First, never give up. Even heavily frosted vines may bear a nominal – even "adequate" crop. Here again, go back and look at the yields that we harvested from our Blackstone research vineyard following the Easter freeze of 2007 when vineyard temperatures dipped to 18°F (http://sites.ext.vt.edu/newsletter- archive/viticulture/07novdec/07novdec.html#I I). Secondly, fungal pest management and canopy management should be prudently applied to avoid defoliating disease or shaded canopy interiors, respectively. Remember, we are, in part, farming this season to provide optimal vine conditions for next year's crop. Light crops on otherwise high-capacity vines can lead to overly vigorous growth, necessitating perhaps some added labor in shoot hedging. Go easy on the fertilizer if the crop is dramatically reduced.

We've (Virginia) not experienced widespread frost since 2007, and northern Virginia has escaped frost, for the most part, even longer. I tell beginning grape producers that the best of growers in the best of sites should expect a weather- or disease-related loss of crop once in 10 years (drought, hail, excess rain, frost, winter injury, disease). If you beat those odds, consider yourself lucky. A final recommendation would be to reflect on this frost event and consider options for future episodes. If this is a once in a decade event for you, you're still doing well. Perhaps some revision of the vineyard layout should be part of the future strategy if portions of the vineyard are being routinely frosted (spring or early fall frost). Previous issues of VN and many other references discuss the various strategies and tactics for avoiding frost.

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