

2007 Easter Freeze Muscadine Damage Report

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During the three weeks following the Easter weekend freeze (April 8-9, 2007), we have been involved in assessing cold injury in muscadine vineyards across the state, with most of our time spent in the severely hit southeastern North Carolina counties of Bladen (177 A), Duplin (140 A), Pender (97 A), Sampson (17 A), Jones (19 A), and Scotland (65 A). ‘Carlos’ broke bud in mid-March in these southeastern counties, and had reached first- to fourth-leaf developmental stages (with visible clusters), depending on vineyard location, by April 8th. Further inland, in production areas in Johnston County (60 A), as well as most of the piedmont and foothills, muscadine vines were not as far along developmentally and sustained only moderate bud/shoot injury by comparison to the southeastern counties in the state.

Main variety ‘Carlos’ hit hardest. In Duplin County, the minimums recorded early Easter morning were in the range of 24-25°F, and Figure 1 shows the extensive shoot injury in a new ‘Carlos’ vineyard near Rose Hill. No other cultivar was as severely affected as Carlos, which has a known problem with early bud break (see *Muscadine Grape Production Guide for NC*, p.1).



Fig. 1. Cold injury to shoots at various stages of development on 1-year vines



Fig. 2. In this shallow cut you can see brownish streaks in vascular tissues (xylem)

One-year-old wood damage. There was also cold damage to one year old “fruiting” wood as shown in Figure 2. There should be a very fine bright green ring of vascular cambium around the edge of a shallow, oval shaped cut into the spur/cane wood. The wood tissue just beneath this outer thin “green layer” of vascular cambium should be whitish-green, but in this cut made by Whit Jones you can see brown streaks, indicating injury to the water conducting tissue known as the xylem. The xylem wood tissue should be whitish-green if it is healthy.

Two-year-old wood damage. On two year old ‘Carlos’ vines in southeastern NC, we are often seeing wood such that as shown in Figures 3 and 4 (page 2).



Figure 3. Cordon on 2-year-old 'Carlos' vine showing cracking or splitting at junction with 1-year spur



Figure 4. Brown areas on damaged cordon that indicate serious injury to water conducting tissue (xylem)

In vineyard visits following the Easter freeze in Bladen, Duplin, Sampson, Jones, and Pender Counties, wood from the 2005 season (2-year wood), was also observed to be seriously damaged. The outer layers of tissue, including the phloem, vascular meristem and possibly the new xylem, was splitting and separating from the older xylem tissue. (Phloem provides the “food pipes” and xylem the “water pipes” for plants. The vascular meristem is the tissue that generates new xylem and phloem tissues.) The wood underneath appeared water-soaked or was already dried out. Healthy tissue in this outer layer would be bright green without any brown flecks. Even if new buds have broken or break on this damaged wood, they may collapse within the next few weeks as the limited reserves in the tissue are depleted.

Younger vines affected most severely. On 2-year 'Carlos' vines we are seeing widespread incidence of cordon splitting, but the damage on most 3-year vines, or older, does not extend to the cordon. On one-year vines in some vineyards, the trunks have large splits or cracks. Older vines seem okay at this point. Also, vines sheltered by woods appear to have less damage (Figure 5).



Figure 5. In this vineyard corner that was protected by woods, a number of 1-year-old 'Carlos' vines had new shoots that survived the Easter Freeze

Grower Meeting at Duplin 3 weeks after Easter Freeze. By May 1st (the date of the grower meeting held at Duplin Winery's Cape Fear Vineyard), it was possible to see cracks from ½ inch to as much as 12 inches long on the cordons of damaged muscadine vines. At this meeting it was recommended that now is the time (early May) to remove any section of the cordon showing splits or cracks. If the cracks from cold injury are confined to the ends of the cordon (away from the head of the vine), then it may be

satisfactory to remove just these affected areas. Growers should also inspect just beneath the bark for evidence of injury to the vascular tissues (refer to Figures 3 and 4). At this time (early May), it is possible to determine the extent of cordon injury in two-year vines by inspecting the condition of the outer layers of tissue – if you see splitting and separating from the older xylem tissue, then this wood should be removed to prevent the potential for disease infection (especially *Botryosphaeria*) at a later time, according to Bill Cline.

Removing severely damaged cordons may be more practical. It may prove more practical to simply remove most of the cordon on vines with splits or cracks, than to try to remove smaller sections near the terminal end of the vine. It is hard to determine how extensive the cordons are damaged without checking the condition of the wood beneath the bark (Figure 4). According to Clay Parker, a muscadine grower in Orange County who has had considerable experience in dealing with cold-injured ‘Carlos’ vines in his piedmont location, growers should cut the cordons back several inches beyond the cracks and splits they observe. Growers who elect to replace injured cordons can follow the same recommendations given in the extension bulletin, *Muscadine Grape Production Guide for NC*; directions on p. 18 for re-establishing the arms of neglected vines can be followed for developing replacement cordons on freeze-injured vines. Basically, the existing cordon is cut off about 6-8 inches from the “V” junction at the head of the vine, and then the grower must select and train out a replacement shoot over the course of the 2007 growing season.

For vines with trunk damage or damage to the head of the vine, growers should cut back to healthy wood and wait for latent buds to break to re-train the head and cordons of the vine. If suckers emerge at the base of the vine it may be more practical to cut the trunk off near the ground and train one of the suckers up to the wire. This is probably the best course of action for damaged one-year-old vines. That way a healthy framework is ensured for the many future years of harvest.

3-year vines and older – crop loss and vine injury assessment. The new shoots that have emerged from injured vines, regardless of vine age, are coming from what are often called “base buds”. “Base buds”, in contrast to the more fruitful “count buds” that were killed in the freeze, may not have fruit clusters, or if they’re present, they may only be weakly developed in muscadines. At this point, it is fair to state that with virtually all the potential ‘Carlos’ production in 2007 coming on base buds of vines in Duplin, Bladen, Sampson, Jones, and Pender Counties, it is possible that growers in these counties may expect as much as an 80% crop yield reduction. Currently we are still in the process of trying to assess the possible extent of cold injury to the wood of older vines. In Bladen, Sampson, and Scotland Counties, we will be visiting vineyards in the weeks of May 7th and 14th, where temperatures dropped to as low as 15°F on Easter in some locations, and there is the potential for extensive wood injury in older vines (3-years and older), as well as severe damage to 1- and 2-year-old vines of ‘Carlos’.

Many of the fruitful count buds escaped injury further inland. Though temperatures were just as cold on Easter morning in areas of the central coastal plain as well as transition areas from the coastal plain into the piedmont (e.g. Johnston County), growers in these areas were considerably more fortunate that their vines were not as far along and many of the fruitful count buds on ‘Carlos’ vines in these regions of the state did escape cold injury because the buds were still in a dormant swollen stage. However, count buds that were in the early shoot burst stage (less than 1/2 inch) were damaged.

Further west, in Cleveland (50 A), Rowan (15 A), and Stanly (10 A) Counties, damage was quite minimal in comparison to southeastern NC, as buds were still relatively dormant at the time of the Easter freeze (dormant emerged and dormant swollen stages).

Final Action Steps Recommended:

- Prune back to healthy wood
 - Allows the vine to put all its resources into developing new spurs or cordons
 - Minimizes colonization by *Botryosphaeria* and crown gall
- Do not apply any more fertilizer at this point
 - Take a leaf tissue sample in late May and submit to NCDA&CS for analysis - if N is low, fertilizer can be applied in mid-June
 - It is important to not exceed 2.75% N, otherwise vines will not harden off properly in the fall
- Minimize vine stress
- Don't expect normal yields - if vines are damaged or struggling it will be better in the long run to cut off flower clusters this year
- Irrigate as necessary to avoid drought stress
 - Irrigation will encourage replacement shoots to develop on 1- and 2-year-old vines
 - Irrigation will facilitate shoot growth on mature vines during the Grand Period of Growth (Ch. 6, *Muscadine Grapes*) – we only have one month left
- Continue to monitor and document the damage - it may not appear for weeks, months, or even years (vines in Clay Parker's vineyard in Orange County began to die 2 years after the initial damage)
 - Dates, temperatures, pictures of damage, records of your cultural activities and spray applications
- There is nothing to spray for *Botryosphaeria*, but the usual foliar diseases and insects need to be controlled as usual