21 Pruning strategies following a freeze event

By Imed Dam, Said Ennahli, and Yi Zhang
Am. J. Enol. Vit. 63(1): 106-111, 2012
Summarized by Bibiana Guerra. April, 2013

• Winter's extreme low temperatures may cause significant economic losses to the industry because of the reduced yield and fruit quality, and the need to retrain and replace dead vines. *Climate* –including continentality, latitude, and altitude- has the greatest impact on winter injury. *Genotype* is also important, with *Vinifera* cultivars being generally more sensitive than hybrids. Of the various *vine structures* – buds, canes, cordons, trunks-, bud tissues are the most sensitive to freezing.

• After a freezing event, the grower can feel powerless against the forces of nature. Faced with extensive bud damage, they tend to react by bypassing winter pruning altogether. However, pruning adjustment is likely the only tool the grower has to successfully restore the vineyard to full production. The goals of this study were: 1) to assess the extent of winter injury after a freeze event in various cultivars and in two locations; and 2) to identify the best pruning method to optimize vine recovery.

• For the first goal – assessing winter injury- the authors collected dormant canes in two locations that had experienced different degrees of cold temperatures. After dissecting their buds up to the 12th position on the cane, they recorded "green color" as live tissue, and "brown or black color" as dead. They did this for more than 30 varieties.

• For the second goal – identifying the best pruning method- the authors setup a Pinot gris trial taking advantage of the fact that the trial location had suffered extreme low temperatures (-26^{o}C) on January 15, 2009. The vines in this experimental vineyard (Wooster, Ohio) were trained to a bilateral cordon and spaced 1.5 x 3 meters (5 x 10 ft). The authors already knew that cane pruning performs poorly after a freezing event. Therefore, they compared the following pruning systems:

- **Spur prune to 2-bud spurs retaining 12 spurs = Standard pruning (16 buds/meter of cordon)**
- **Hedge-prune to 2-bud spurs retaining all spurs**
- **Hedge-prune to 5-bud spurs retaining all spurs**
- **No pruning**

Results:

• **Extent of bud injury.**

- *Location*: the Cabernet sauvignon on the first site (Wooster), which had experienced -26^{o}C, sustained twice the amount of damage than that in the second location (Kingsville), which experienced -24^{o}C. For Pinot gris, this 2^{o}C difference had even more dramatic consequences, with the vines in Wooster showing ten-fold more damage than those in Kingsville.
- *Variety*: Within the viniferas, the most affected varieties, in this order, were: Cabernet franc (98% damage at Wooster), Chardonnay (93%), Pinot gris (87%), and Traminette (40%). (The percentages at Kingsville were 54%, 25%, 9%, and 11%, respectively). Within the "old hybrids", the variety with the most damage was Chambourcin (93%), followed by Vidal and Seyval. The advanced selections from the breeding programs at Cornell and Minnesota ("new cold hardy hybrids") faired very well, with an encouraging 8 to 14% damage. Finally, *Vitis labrusca* Concord sustained the least damage (<3%).

- *Preconditioning*: The vines at Wooster experienced minimal trunk damage or dieback compared with the same temperatures experienced in other locations. The many days of below-freezing temperatures before the "big freeze" are thought to have preconditioned the vines to better resist the cold event.
- *Short cycle*: At the Kingsville location, both Pinot noir and Pinot gris, which ripened early in the season, were the varieties that best resisted the cold event. The authors believe that the active postharvest leaves of these varieties may have contributed reserves that helped these vines get better acclimated, something that gave them a "leg up" on confronting the freeze event.

• **Best pruning practices after freeze event.** 1) There were no statistical differences in bud injury among the various pruning systems. The authors attribute this to the very erratic pattern of the winter injury. 2) In midsummer, the vines experienced what is known as "vine collapse", a result of vascular damage to phloem, xylem, and cambium tissues. This damage was the same for all pruning systems. 3) At harvest, non-pruned vines had the highest number of clusters, and spur-pruned and 2-node hedge-pruned the lowest. That is, the higher the pruning severity, the lower the yield. 4) All pruning systems were within the optimal range of pruning weights (**0.3 to 0.6 kg/m of cordon**) except for non-pruned vines which, due to their small size, were below the optimal range. 5) It is accepted that well balanced vines have pruning:fruit ratios (Ravaz index) between 5 and 10 for vinifera varieties. When both pruning weights and fruit weights were considered, non-pruned vines were "overcropped"; spur-pruned vines and 2-node hedge-pruned vines were "undercropped; and 5-node hedge-pruned vines were "balanced".

• **Vine shape restoration and bud fruitfulness the following year.** In Year 2, the authors tried to restore the vines to the standard spur-pruning system. Due to the extent of dead wood, it was not always possible to have 2-node spurs evenly spaced along the cordon, resulting in lower total count buds after pruning. Count buds were the lowest in non-pruned vines and the highest in the 2-node hedge treatment. Bud fruitfulness (% of those buds left at pruning that carried clusters) in year 2 was not affected by pruning treatment the previous year. That is, there was no carryover effect of pruning method on fruitfulness the following year.

In summary,
- The extent of winter injury is driven not only by the lowest minimal temperature experienced in the location, but as well by the temperatures preceding the freezing (preconditioning), and the growing conditions the previous year (acclimation);
- The various pruning strategies did not affect the recovery of a Pinot gris that had sustained up to 90% bud damage after experiencing -26^{o}C freeze, in terms of amount of bud injury or amount of vascular damage;
- The 5-node hedge-pruning was the treatment that produced the highest yield in the current year. This treatment also allowed the highest number of "count buds" the following year, when efforts were made to retrain the vines to their original 2-node spur pruning.

With no pruning system giving any advantage in terms of reduced bud injury, the authors recommend the practice of 5-node spur pruning over a non-pruning or the standard spur pruning on cultivars that sustain extensive damage after a freezing event, because of its ability to a) allow the harvest of a moderate harvest the same year, and b) provide a rapid retraining of the vines the following year.

Author: Bibiana Guerra, PhD, Viticulture & Enology Technical Writer, guerra.wineink@gmail.com