

Romeo Bragato Frost Workshop: Wellington 2003

Workshop Convener: Mike Trought, Marlborough Viticulturist, Villa Maria Estate Ltd. Blenheim.

Workshop Panel:

Diane Stewart, National Viticulturist, Nobilos Wines, Blenheim

Bart Arnst, Viticulturist, Seresin Wines, Blenheim

Graham Bartleet, Viticulturist, Montana Wines, Hawkes Bay

Steve McCartney, Scientist, HortResearch, Hawkes Bay

Adam Friend, PhD student, Lincoln University, Canterbury.

The workshop was convened to consider the impact of frost on vine development and to gain from the experiences of those in the industry following the frosts experienced in many parts of the country in the 2002-2003 growing season. Objectives of the workshop were:

- To enable the industry to be better prepared for future frosts, and
- To develop knowledge that will enable growers to ***make better informed decisions following frosts in the future.***

Frost damage can be expected when tissues reach lower than a critical temperature. This temperature depends on a number of factors, including stage of development:

Stage of development	Critical tissue temperature at which damage is observed (°C) in Pinot noir	
	50% tissue death	No damage
Dormant enlarged	-14.0	
Green swollen	-3.4	
Shoot burst	-2.2	-1.0
First leaf	-2.0	-1.0
Second leaf	-1.7	-1.0
Fourth leaf	-1.2	-0.6

From: Gardea 1987

Section 1

Following a frost there is always the question, what now? What are the options for managing a vineyard following a frost?

Factors to consider when responding to a frost include:

- The severity of damage
- The timing of that damage in relation to vine development
- The region in which the vines are growing, in particular the length of the growing season
- The age of the vines and the variety

The first question is "Is it worth trying to salvage a crop in the current season?" To answer this several factors need to be taken into account. They include:

- How fruitful are the secondary buds?
- How productive is the second set?
- What are the disease dangers?
- Can we get fruit to an acceptable level of ripeness in the current season?
- How do we maximize the cropping level?

Management options include:

- Do nothing

- Remove dead material (how should this be done? With secateurs or by rubbing?)
- Remove all shoots including green ones?

Discussion focused on lightly frosted inflorescence:



Browning and death of individual flowers can be observed in the inflorescence. Do I start worrying about this inflorescence?

Comments were:

- Hope for the best but expect the worst
- It is likely to get worse through the season
- A cold snap is often associated with flower and berry abortion and temperatures less than 8 °C can affect pollen tube growth and fruit set.
- Likewise low temperatures, even where there are no visible symptoms of damage, may reduce photosynthesis, which is strongly linked to successful fruit set at flowering.
- However, if the shoots look healthy, there is probably little that can be done to improve matters and probably best to leave it alone. However, if it occurs before thinning, probably would not shoot thin.
- Evaluate vines after a few weeks to see bunch number and potential bunch weight.

To some extent the response depends on the region and the timing of the event. The conclusion was that the greater the length of growing season after the event, the less damage it was likely to do, particularly with regard to problems in the following season. Later events; forget about this years crop and focus on achieving good shoot growth for next season.

Severely damaged shoots



In a severe frost is it better to remove dead material or leave it?

Comments were:

- Dead material is possibly going to cause more of a problem in more humid climates, and be less of a problem in drier climates, where the risk of Botrytis is lower.
- Of the participants that had been frosted approximately 50% removed dead material, and in most cases where comparisons were made between those that had areas of dead material removal and not, Botrytis levels at harvest were lower where dead material had been removed.
- In one case it was observed that the dead material fell out of the vines anyway.
- Most participants indicated that they would remove dead material next time.

Vine following a frost showing excessive lateral development and remnants of dead shoots



Is it better to cut out green shoots or rub them out?

Comments were:

- In Hawkes Bay cutting shoots was useful when some green material was left; reducing the number of lateral shoots developing and resulting in a better canopy for next season.
- Removal of damaged primary shoots encouraged secondary shoots to develop.
- The sooner after the frost the shoots were removed, the better.
- Care needs to be taken when removing damaged shoots as rubbing shoots may also result in damage to secondary shoots. Although others did not notice a differences in the subsequent canopy between rubbed and cut damaged shoots
- An estimate of the cost of cutting was \$600 /Ha compared to \$250 /Ha for breaking shoots off. Additional work, removing laterals also helped.
- Management of vines at this time should be time well spent, as it will reduce the time and cost of pruning during the winter.

What yields were obtained from frosted vines?

Comments were:

- Depends on the variety, Pinot noir, Cabernet Sauvignon and Merlot were less affected than Chardonnay (and probably Sauvignon blanc)
- This probably reflects the overall fruitfulness of the shoots and cropping level expectation of the variety.
- It also depends on the initial percentage bud break. Where vines exhibited poor bud break, the dormant primaries developed after the frost, and produced an acceptable crop.
- This resulted in discussion on the possibility of retaining more buds on the vine as an insurance against frost. A number of vineyards were leaving "Kicker canes", i.e. additional canes left at the head, vertical in the canopy. Shoot development from these was largely restricted to terminal buds. The shoots would be laid down if there was a frost, but removed if no frost eventuated. The shoots were removed post fruit set.
- Others were leaving an additional dropper in Sylvos trained vines as insurance.

One of the consequences of frost is mixed fruit maturity at harvest. What are the consequences of this and how do we deal with it?

Comments were:

- The fruit on frosted vines may arise from:
 - Dormant primaries, which develop following the frost.
 - Secondary shoots
 - Second set on additional lateral shoots
- Depending on the timing of the frost and the variety will largely determine the likelihood of fruit reaching an acceptable ripeness.
- In some cases, the fruit may be diverted to an alternative style (e.g. Pinot noir going to MC base).
- Removal of laterals will reduce excessive second set, and may allow remaining primary fruit to reach an acceptable ripeness.
- Management of fruit may involve several sequential harvests (Selini did three picks on some blocks)
- Some people identified bunches from primary shoots at veraison by tagging them, to enable these bunches to be harvested later.
- Thinning at veraison.

How do you manage young vines that have been frosted?

Comments were:

- Young vines have limited reserves.

- Frost damage to vines can deplete those reserves and limit the capability of the vines to develop shoots.
- Where vines are damaged, it is important to try and generate a good leaf area, to maximize the accumulation of the reserves to enable vines to survive the winter. The management response will depend on the timing of the frost event.
- The long-term management of the vineyard does depend on achieving a good straight trunk. Hence frosted young vines will frequently be pruned to two buds in the winter, to generate a good trunk in the following season.

Adam Friend presented a report on the manipulation of bud break by late pruning vines and alginate gel treatment.

Influence of time of pruning on shoot development in mid-October. Vines were pruned in July, August, September and October from left to right.



Alginate treated buds (left) compared to untreated buds (right), which burst earlier and were damaged by a frost event in October.



Does the later bud break result in later harvest and an increased risk of an autumn frost?

- Late pruned vines ripened more slowly, although this may have in part reflected the higher yields vines were carrying. The higher yields were observed over three year's trials on vines which had not experienced frost.

- The consequence of this on frost vulnerability and the ability of vines to ripen fruit depend to a large extent on the variety.
- Late pruning (undertaken when shoots on terminal buds are approximately 2cm long) is really only effective on spur pruned vines, and is thus restricted to varieties which are compatible with spur pruning i.e. the basal buds are fertile.

How does one apply the alginate gel? How does it slow bud break?

- The gel in the experiments was applied using a paint brush; a calcium salt was then sprayed onto the gel to solidify it.
- It is believed that the gel restricts gas diffusion into the bud, increasing carbon dioxide concentration around the bud.

What causes the higher yield?

- The yield is a reflection of heavier bunches, possibly associated with higher temperatures at flowering.

Section 2:

What are the consequences for the coming season?

Cane pruned vines need to achieve adequate shoot development, what options are there available to ensure this? At the same time, has any damage, which may influence the fruitfulness of vines in the coming season?

Has anyone done any bud dissection?

- One grower who had undertaken bud dissection on Chardonnay in Hawkes Bay indicated 1.7 bunches per shoot. Similar values were suggested by others.
- Sauvignon blanc may be a little lower (10% below average?)
- Buds on thicker canes tend to be more fruitful.
- Others commented that canes were generally looking good, and they were not factoring in any reduction in crop for the coming season.
- The possibility that frosted vines were carbohydrate or nitrogen stressed was raised, and it was suggested that where vines were repeatedly frosted, or damaged relatively late in the season, crops may be lower.
- However, the shoots developed later in the season, at warmer temperatures, which should increase fruitfulness.
- Temperature at flowering is still likely to largely determine crops in the coming season.
- It was commented that crops in the season after the 2000-01 frost in Hawkes Bay did not appear to have been adversely affected by the frost.

It was commented that it has been difficult to find suitable canes at pruning.

- Reflected the need for good canopy management in the previous season.
- Reducing the number of buds remaining on the vine after a frost event may improve the development of those shoots from the vine, e.g. shoots on vines that were reduced from 4-cane to 2-cane after the frost were stronger
- One possibility was to remove the cordon completely, and encourage shoots from the head. Again depends on the timing of the damage.
- Do not be too concerned with what the vine looks like. Use some innovative pruning. If there are decent shoots, use them, cordon cane (using short canes that arise from different parts of the cordon) or fold shoots that back towards the head from the end of the cordon. The better the cane, the more fruitful it is likely to be and the less the reduction in the following seasons crop.

What is the consequence of an autumn frost and is it damaging to leave fruit on vines that have lost their leaves?

Comments were:

- Vines with inadequate over-wintering carbohydrate and nitrogen reserves are likely to exhibit slow and uneven bud break in the following spring.
- There seems to be little benefit to the vine or the fruit by leaving fruit on the vines once the leaves have senesced.

Section 3 **Minimizing damage in the vineyard**

Experience with Vapor Guard

- Experiences were very different. One grower (Burnham), using 4 applications of Vapor Guard said that he had protected his vines to -3°C . This had saved his crop.
- Others had found little benefit and one grower found that applications of Vapor Guard had subsequently limited shoot development.
- It was suggested that where materials like Vapor Guard were being used, untreated vines in the middle of the vineyard should be left (make a note of the row numbers!) to allow treatment comparisons to be recorded. Comparing one treated block with another untreated block was not sufficiently rigorous.
- It was also important to have accurate, calibrated thermometers.

How does one manage the under storey to minimize frost risk?

- Bare soils need to be compacted, and preferably moist. Fluffy soils act as insulation, preventing them from warming up during the day and then reradiating heat at night.
- The alternative is short, closely mown grass, but it is important that the grass is kept short, allowing the soil to heat up. There is little benefit in mowing the grass shortly before a frost event.
- Do not forget the under vine area.
- Talk to someone who knows about good cover crops

Are frost cloths feasible?

- It was pointed out that they need to be out late in the day to keep heat in and it was felt that it was unlikely that they were a practical alternative.

Other alternative methods:

- There was a brief discussion on mobile heater units, and comment that a machine has been compared to an untreated area and one protected by a windmill. A report should be available by the end of September.
- Biodegradable foam has been tried on Strawberries, but there was no experience on grapes.

Appropriate site selection is still considered the best means of frost protection.

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Mike Trought