

# **Frost management**

## What is frost damage?

Frost occurs when the temperature at ground level falls below 0°C. Most temperate plant species, including vines, tolerate this temperature even though surface ice may have formed. At about –2°C water from within the cells in leaves, buds or flowers begins to move out into the ice layer that has been forming on the surface, resulting in death of the exposed tissue.

## **Management options**

#### Irrigation protection

Applying irrigation is effective to -5°C. The application rate is critical, and the rule of thumb is that systems that apply less than about 3.5 mm/hr are ineffective. For best results, the irrigation event needs to be continuous over the whole protected area from when air temperature is above 0°C in the evening until it has risen well above freezing the next morning. Water availability, pumping capacity and soil drainage may all limit the use of irrigation as the primary protection system.

#### Fire pots

lighting a fire near the vineyard can supply direct heat that can mitigate frost damage, though used alone are surprisingly inefficient with most of the heat lost directly upwards.

#### Fan systems or helicopters

There is usually a layer of warmer air above the coldest air near the ground and mixing of the atmosphere results in a small increase in temperature in the lowest and coldest layer. Air can be mixed by fans or helicopters, and the effectiveness is critically dependent on being able to access warm air from higher levels. For growers planning to use such systems, measurement of a vertical temperature profile during a frost is essential.

## Vineyard floor management

Bare, compact, dark coloured and moist soil works best to mitigate frost damage as heat is stored in the soil and released into the lower atmosphere at night. Do not cultivate soil if a frost is expected, as this reduces the heat holding capacity of the soil. Any mulch or mid-row vegetation lowers air temperature because the ground cover insulates the soil from the sun during the day and slows the release of heat at night.

## Airflow management

On a frost prone site any barrier to airflow down the slope (eg. shelterbelt etc) will cause cold air to pool. Opening up suitable air flow channels will reduce the risk of damaging frosts.

## Vine height

Pruning so that the head of the vine is as high as is practicable, to place the sensitive buds higher in the inversion, captures the natural increase in temperature with height above the ground.

#### Variety selection and delayed pruning

In frost prone sites, select varieties that have a late budburst to avoid frost. Delaying pruning can also avoid frost damage.

#### **Chemical protection options**

Products contain active ingredients including seaweed extracts, natural and synthetic glycols, oils, resins, sugars, mineral salts and even a common fungicide. Some products can influence the water balance of stressed cells and should therefore offer a few degrees of frost protection. To date, there is little evidence that these laboratory results have been translated into practical and reliable protection from field frosts. Spray on controls usually need to be applied a day or two before a frost.



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## Dealing with damage

If protection fails and damage occurs, it can severely reduce the current crop, as well as reduce the crop of following seasons. Direct impacts on flowering and vegetative growth in both the current and subsequent year may influence longer-term vine balance, with the indirect effects of a single frost damage event potentially continuing into a third year. Although -2°C is generally taken as the critical temperature for damage to non-dormant tissue across a wide range of temperate crop species, tissues vary in susceptibility and the potential damage in any season depends on the time of the frost and the phenological stage.

There are three management strategies for reducing the damage;

- Taking no action
- · Removing only the visibly frost damaged material and
- Removing all green shoots (effectively re-pruning)

Post-frost pruning results in an open and more manageable canopy, which allows for more efficient pruning the following winter. Pruning decreases bunch number in the frost year, but can increase bunch number in the following year. Post frost management does not affect ripening or fruit quality other than reducing the amount of fruit. From a practical point of view and considering the labour costs, doing nothing may be the best option. However, as frost damaged material rots over time, in years when disease pressure is high, removing the damaged tissue may be warranted. If growers do decide to prune after a damaging frost, severity needs to be matched against the amount of damage on each vine rather than a prescribed pruning guideline. With variable damage across a block, there is a risk that a prescribed pruning may limit both quantity and quality of an otherwise salvageable crop.



Frost damage can vary in severity, and management options need to be decided for individual scenarios

Sources: Jones, J. & Wilson S. (2010) Arming Against Frost, GWRDC Factsheet, September 2010 Chalmers, Y (2009) Frost Management in vineyards - what are the options? Scholefield Robinson Horticultural Services, June 2009 The advice provided within this publication is intended for source information only. The organisations involved disclaim all liability for any error, loss or other consequence which may arise from any information in this publication.