

## Severe Weather Events

For shelterbelt information, see section Orchard Shelter on page 9

### FROST

Frost can cause damage to flower buds, flowers, fruit and foliage. Severe frosts and late frosts occurring close to flowering are of the most concern.

There are frost protection methods available, however the effectiveness of these is limited. It is best to plant avocados in locations which do not usually experience severe or late frosts.



### Frost Management Strategies

Plant resistance to Frost	Preventing ice crystal formation	Retaining heat	Adding heat	Removing cold
<ul style="list-style-type: none"> <li>Improve tree health.</li> <li>Use nutrition to promote hardened-off leaves going into winter.</li> </ul>	<ul style="list-style-type: none"> <li>Foliar sprays of copper prior to frost events.</li> <li>Remove deadwood from the canopy.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure adequate shelter.</li> <li>Keep the area beneath the trees free of vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>Frost fans.</li> <li>Irrigation.</li> <li>Overhead irrigation.</li> </ul>	<ul style="list-style-type: none"> <li>Prune shelter and lower branches of trees to allow cold air drainage.</li> </ul>

During clear nights, the air closest to the ground surface cools faster than the air above it, resulting in a heat inversion layer. Frost fans utilize this inversion layer by drawing warmer air down to mix with the cooler air.

Overhead irrigation is the most common form of frost protection in New Zealand avocado orchards. It relies on latent heat being released as water freezes on the outside of plant tissue, protecting it by keeping it above 0°C. Sprinklers will be set to come on when the temperature drops below a certain point, usually 2 or 4°C. The irrigation will stay on until the temperature comes above a certain threshold. They have the potential to use a significant amount of water if temperatures remain low for extended periods of time. This impacts soil moisture levels, which can be a significant issue for tree health, especially in the winter months.

### WIND

Wind can cause damage to both avocado trees and fruit. If trees are blown over during a storm, they can be righted during a window of approximately two days (particularly young trees). If the trees are not able to be righted until after two days, they should be either left as they are and pruned, or removed.

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## FLOODING

Flooding can have severe impacts on avocado trees. Trees should be planted in areas with free-draining soil and low risk of flooding. If a tree's roots are flooded for a period of two days or more, tree death may occur.

Symptoms of flood damage are a sudden wilting of the canopy, with the leaves remaining on the tree. Any fruit on the tree often becomes spongy due to a lack of water being delivered.

Soil moisture levels that are too high reduce the amount of air in the soil, leading to:

- The supply of oxygen to roots being limited, affecting their function.
- A reduction in water and nutrient uptake.
- A reduction in photosynthesis, impacting tree vigor.
- An impact on fruit sizing and maturity.
- Increase the tree's susceptibility to *Phytophthora*. Free water in the soil can also aid the spread of *Phytophthora* throughout the orchard.

Standing or pooled water are the obvious signs of waterlogging but if you have subsoils that are less pervious to water, the soil layer above can become saturated and cause damage to roots. Subsoils may also affect the flow of water, meaning areas of orchards can be affected that may not be intuitively identified by looking at the surface contour of the land.

Removing excess water from the soil as quickly as possible and creating a more aerated soil may help waterlogging. Ripping soil or digging temporary trenches may also help but these methods are often difficult to carry out in an established orchard.

Once a tree begins to wilt, the majority of damage to the root system has likely already occurred. Pruning the canopy back heavily will help reduce the amount of canopy the now limited root system is supporting, speeding the recovery of the tree (if recovery is possible).

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## DROUGHT

Symptoms of drought are a wilting of the canopy, with the leaves remaining on the tree. Fruit on the tree can become spongy due to a lack of water being delivered.

Soil moisture levels that are too low lead to:

- Root dieback, affecting their function and ability to provide sufficient moisture to the canopy.
- A reduction in water and nutrient uptake.
- A reduction in photosynthesis, impacting tree vigour.
- An impact on fruit sizing and maturity.

Watering trees impacted by drought can cause improvement, however it is important not to over-water trees impacted by drought as a compromised root system may not take up water efficiently and excess water applied could result in waterlogging.

Pruning the canopy back heavily can help to reduce the amount of canopy a limited root system is supporting.

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## HAIL

Hail can damage fruit (particularly developing fruitlets) and canopy. Spray copper after hail event to protect fresh wounds on fruit and foliage from infection.