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Preparing for Cold Winter Conditions

(Author's Note: Please read the disclaimer at the end of the article.)

Winter is here and cold mornings may threaten freeze damage – but proactive management can safeguard an avocado orchard.

Avocados are frost-sensitive, so a hard frost can have a multi-year impact on yields. This is because cold temperatures can directly damage fruit on the tree, as well as damage exposed budwood, limiting future fruit set. Maintaining an overall healthy orchard is a preventative measure that can help avocado trees withstand the impacts of extreme temperatures, including freeze damage. In addition, to prepare for low temperatures in the orchard and minimize damage, growers can adopt four strategies: use wind machines, run irrigation, apply biostimulants/leaf coatings, and/or generate heat.

Monitoring

The first step to minimize cold damage is to monitor the orchard for frost. Numerous companies provide weather stations with frost alarm features that can be sent directly to a phone, or any other network-connected device. Another option is a high-accuracy digital thermometer, which can be installed on a vehicle, allowing growers to monitor orchard temperatures from the comfort of their truck. In the event of a frost, growers can then implement the appropriate tactics to try to raise temperatures in the orchard.

Graphic courtesy of FrostBoss®

Strategy #1: Use Wind Machines

In California's avocado growing regions, a common phenomenon occurs called an inversion layer[1] – when a layer of warmer air sits on top of a layer or pocket of cold air. This occurs because warm air is less dense than cool air, so the warmer air floats above cooler air. When this happens, growers can use wind machines to mix the cool air from within the orchard canopy with the warm air floating on top (Figure 1),[4] which in many cases is around 20-40 feet above the orchard floor. By using wind machines, researchers have observed approximately a 2-4°F increase in orchard temperature when inversion layers are present.

Please note wind machines are only effective when inversion layers are present and there hasn't been enough natural turbulence to mix the cool and warm air together. If no warm air exists to pull down into the orchard, then wind machines can worsen freezing conditions!

Strategy #2: Run Irrigation

Running irrigation can be an effective tactic to help maintain higher temperatures in the orchard.[1] Irrigation water temperatures vary depending on the source, but they are generally well above freezing. Therefore, irrigating during the day can increase the amount of heat stored in the soil and the stored heat can continue radiating throughout the night. Additionally, if temperatures drop below critical levels, turning on the irrigation system can introduce more heat into the orchard.

If ice forms on a tree, the ice will act as an insulation layer that maintains a 32°F temperature, protecting the tree from even colder air temperatures. However, when the ice starts to melt, it is important to run irrigation water until *all* the ice has melted, even after the sun comes up. If water is not run until all the ice melts, sublimation can occur — super-cooling the ice and further damaging the crop. This is because as ice melts into liquid water,

the remaining ice and the underlying leaves and stems can actually become colder than 32°F (this is similar to how sweating makes our skin cooler in the summer).

Strategy #3: Apply Biostimulants and/or Leaf Coatings

A tree's natural ability to manage cool temperatures can be enhanced through the application of frost-protective biostimulants and/or leaf coatings.[5,6] Products such as Anti-Stress 550, Parka®, or diKaP™, to name a few, can help a tree cope with cold weather. Application methods and the duration of their effectiveness may vary depending on the product. Consult your ag chem provider to determine the best options for your orchard.

Strategy #4: Generate Heat

Generating heat within the orchard can increase average canopy temperatures. Historically, burning oil with the classic smudge pot was used for this purpose, but this is no longer as common due to clean air regulations and fire hazards. Newer smudge pot models on the market offer cleaner burning fuels and new engineering. Other technologies that use propane burners also are available. Heat generation can be a tool in concentrated cold spots or other areas where frost may settle, and a few degrees can make a difference.

Orchard Health

Tree health plays an important role in frost resistance. Nutrients in a tree's leaves can act as an "antifreeze," decreasing the freezing point of leaf tissue.[2] When trees are nutrient-deficient, they are more susceptible to frost damage.[2] Nutrient-deficient trees also have a harder time physiologically responding to cool temperatures.[2] In addition, healthy fuller canopies can limit freeze damage to the outer edges of the canopy and protect the internal canopy where fruit is held.

Growing a healthy orchard with consistent yields is essential to maintaining farm sustainability. These tactics can help to preserve orchard viability during a cold event. Please reach out to your Mission Field Representative for more information or to schedule a consultation with our agronomy team.

References

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About the Author

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