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Freeze Factors

Since this winter is neither in an El Niño nor La Niña situation, it is considered to be in a "neutral" phase. Research has shown that nearly all of the severely damaging freezes that hit Florida over the past 110 years came during neutral winters. During the past century, temperatures in central Florida have usually dropped below 20°F at least once every 20 years. Even southwest Florida can get surprisingly cold more frequently than one might expect. The last major freeze we had in Florida was in 1989. Because neutral conditions are predicted to persist through the spring of 2006, the risk of having a freeze with temperatures of 20°F or less is three times greater than normal.

Top: Ice on trees actually helps them maintain higher canopy temperatures. Right: Young trees can break if the microsprinklers are elevated too high.

Preparation Is Key

While no one can control the severity or frequency of freezes, a grower can prepare by inspecting his irrigation system and making sure it is in optimum condition. Research between 1981 and 1989 — when we had five major freezes — showed that microsprinklers, when properly managed, could provide partial protection of mature trees and nearly complete protection of young trees.

In 1989, Nick Faryna showed that 360° flat-fan microsprinklers that were elevated 2 or 3 feet above the ground protected more of the canopy. Raising the microsprinklers inside the canopy improved their effectiveness by encasing more of the canopy in ice. When liquid water freezes to ice, it releases the heat of fusion, which is 1200 btu per gallon or 80 calories per gram of water frozen. As long as the application rate is sufficient, application of new water will keep the wetted areas at or near 32°F.

In one study, after the tree-killing 1989 freeze, 9-foot tall Hamlin trees with microsprinklers elevated to a 2-foot height had a much better survival rate than those with microsprinklers at the more conventional 6-inch height. Because more of the tree survived, recovery in the following years occurred much faster. Two years after the freeze, trees in a grove with elevated jets were significantly taller and produced 2.6 times more fruit than an adjacent grove with jets operating at a 6-inch height. If jets had been raised in this 41-acre grove, it could have theoretically produced 5842 more boxes than it did just two years after this major freeze.

Weighing The Options

One problem with raising jets in the canopy is that the weight of the ice can break down young trees. Jets that are raised above a 3-foot tall tree can build up ice in the upper canopy and break the thin trunk. With large, mature trees, jets that were raised to a 3-foot height gave good protection. When trees are less than 6-feet tall, it is best to raise the jet to no more than half the height of the tree. For trees less than 4-feet tall, a jet with a half-circle spray pattern aimed upward into the canopy builds self-supporting icicles that provide good protection and do not break the tree down.

Evaporative cooling is a major risk when using water for cold protection. In dry, windy freezes, evaporation can remove up to 8950 btu per gallon of water evaporated from the grove. This is about 7½ times the amount of heat gained by the heat of fusion. If the system fails during the night, evaporation can continue to chill the wetted branches and cause more damage than applying no water at all. Generally speaking, higher water application rates provide more warming and reduce the risk of evaporative cooling.

While not as effective as grove heaters, microsprinklers are much more affordable than heaters and provide the dual benefit of normal irrigation as well as some freeze protection. For more information, see "Microsprinkler Irrigation for Cold Protection of Florida Citrus" at **http://edis.ifas.ufl.edu/CH182**. FC