IRRIGATION FOR COLD PROTECTION DURING THE DECEMBER 1989 FREEZE

LARRY R. PARSONS AND T. ADAIR WHEATON
University of Florida, IFAS
Citrus Research and Education Center
700 Experiment Station Road
Lake Alfred, FL 33850

The Florida freeze of December, 1989 will be remembered in some parts of the state as the worst freeze of the decade. Severe tree damage occurred to areas south of Lake Wales and fruit damage was noticeable near Vero Beach. Minimum temperatures in Tavares and Lake Alfred were 19°F. In much of the citrus growing region, durations below 32°F were longer in this freeze than any other recent freeze. Orange production dropped by 15% from an estimated 130 million boxes to 110.1 million boxes. While fruit and tree loss was significant in this freeze, protection measures when used properly benefitted some groves.

Microsprinkler irrigation became the most commonly used form of cold protection in Florida citrus in less than 5 years. Of the 697,929 acres of citrus in 1988, it has been estimated that over 100,000 acres use microsprinkler irrigation for cold protection. Microsprinkler irrigation proved effective in this freeze, particularly with young trees. Previous research has shown that a microsprinkler can keep the portion of the tree that is in the direct spray zone at temperatures near 32°F. Hence, as long as the irrigation system reliably and continuously supplies water, portions of the tree in the main spray area will usually survive. Young trees were protected this way in Gainesville during the freeze with temperatures down to 14°F.

A major problem in this freeze was frequent power blackouts. Because of the extensiveness of the arctic air mass, heating demands were high, and local power companies were unable to purchase power from neighboring states where demand was also quite high. Many growers relied on electric pumps only to find that when the power went out, their irrigation systems failed. The systems then rapidly froze up and it was virtually impossible to thaw and restart them. Temperatures of the wetted plants could then drop to the wet bulb temperature which was several degrees colder than the air temperature. Wet bulb temperature is the lowest temperature to which air or a wetted surface can be cooled solely by the addition of water. A number of growers learned the hard lesson that one must have a reliable power supply if water is to be used for freeze protection. Several growers who had reliable diesel systems were able to protect the lower portion of young trees completely.

Another reason for damage was that some caretakers did not get to the field soon enough to turn on their microsprinkler systems. Although there was adequate warning that this freeze was coming, very few people expected the temperature to drop below freezing as early in the day as it did. Most growers are accustomed to turning on their pumps in the late afternoon or after sundown. In this freeze, temperatures were already dropping by 10:00 a.m. Saturday morning. By 2 p.m., temperatures in some areas of the central citrus belt were below 32° and continuing downward. If caretakers turned their pumps on then, the irrigation emitters were probably already frozen up.

When microsprinklers were used with tree wraps or covers, freeze protection was usually good. With a reliable source of water, covers and sleeves gave virtually complete protection up to the top of the cover. While the cover reduced the wind speed around the young tree, the microsprinkler was able to warm the air inside the cover sufficiently to keep the plant above the critical temperature.

In several high density groves, some growers used one microsprinkler to irrigate 2 adjacent trees. While this method is effective for normal irrigation, it is not effective for protecting young trees in windy freezes. If the emitter were north or northwest (upwind) of the tree, that tree would usually be protected. However, if the emitter were south or east (downwind) from the tree, the variable wind would cause the water spray to be erratic on the trunk. Without a continuous spray, evaporative cooling would predominate and could cool the trunk to the wet bulb temperature. Similar results were seen in the 1983 windy freeze in which trees that were upwind from the spray emitter were damaged by cooling from the erratic spray.

Dewpoint temperature is the temperature at which dew or condensation first begins to form. Dewpoints were as low as 13°F in Orlando and Sarasota on the morning of December 24, 1989. If one assumes that this dewpoint were common in central Florida, that means that wetted surfaces which had erratic or no spray could reach wet bulb temperatures of 18°F when the minimum temperature was 19°F.

While microsprinklers can be quite effective in protecting young trees, it has generally been assumed that microsprinklers provide limited or no benefit to mature trees in a windy freeze. While this is generally true, there were a few examples where microsprinklers at higher volumes (23 to 37 gal/hr/tree) apparently provided a small amount of benefit to mature trees. This was observed in the Haines City and Lake Wales area, particularly where trees were in a lower or more wind protected area.

Due to reliability problems, undertree high volume systems with rotating impact sprinkler heads generally performed poorly in this freeze. During a milder freeze in February, 1989, with warmer minimum temperatures (around 23-25°F) and less wind, these undertree systems benefitted some groves. However, in this very cold and windy December, 1989 freeze, impact sprinkler heads froze up and stopped rotating. Evaporative cooling continued, and these systems gave no benefit to the trees.

Heaters were also effective but only when used in high enough concentration. One grower successfully protected Sunburst tangerines in Lake County but used nearly 100 heaters per acre. Considering that most of the unprotected trees in the vicinity were dead, this kind of expense which saved the trees was indeed justified.

In Umatilla, one grower successfully protected the lower part of trees by elevating the microsprinkler in the canopy. With young trees having trunk diameters of 2 inches or less, spray jets elevated to a 2 foot height gave protection that allowed trees to regrow to a height of 4 feet by April, 1990. With older trees (4 inch diameter trunks), jets elevated to a 3 foot height allowed trees to regrow to an 8 foot height by June. This elevated jet inside the canopy protected the lower

portion of the tree and appears to be a potentially promising method for partial tree protection in windy freezes.

In summary, microsprinkler irrigation was reliable as a means of freeze protection in two kinds of situations. First, it provided a noticeable benefit to young trees. Second, if water was used at higher volumes, irrigation sometimes provided a small amount of benefit under mature trees. Growers fortunate enough not to lose power and those with added means of protection such as covers or wraps benefitted most from the use of their irrigation systems. Nevertheless, even though water provided some benefit, there was no guaranteed panacea for tree survival in a freeze this severe and extensive.

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