

Cold Weather Protection for Vegetables and Tropical Fruits in South Florida

By: David D. Sui¹, Jonathan H. Crane², Alan L. Wright³, and Ronald. W. Rice¹

¹ Palm Beach County Extension, West Palm Beach, FL

² Tropical Research and Education Center, Homestead, FL

³ Everglades Research and Education Center, Belle Glade, FL

Winters in south Florida (the part of the state extending south from West Palm Beach) are generally mild and pleasant with day/night temperatures typically in the 70s°F/50s°F. While many other states are contending with snow and ice during this time of the year, south Florida agriculture is in full swing with winter vegetable production, as well as some tropical fruits, and winter market prices are generally favorable. However, south Florida is not free from frosts and freezes, thus vegetable and tropical fruit growers should have a cold protection plan in place to deal with the sporadic arrival of cold fronts. For two years in a row, January 21-22 in 2009 and January 4-13 in 2010, vegetable and tropical fruit growers in south Florida have confronted severe cold weather and suffered substantial crop losses. With cold protection strategies in place, crop losses can often be minimized.



Figure 1. Unprotected Tomato: Total Loss from freeze events in January 2010. Photo by David Sui.



Figure 2. Bell Peppers Protected by Freeze Cloth during several freeze events in January 2010. The Foam Cups Provided Non-Abrasive Support of Freeze Cloth. Photo by David Sui.

Many different cold protection methods have been used by vegetable and tropical fruit growers in south Florida. Every cold front is different and each has specific weather characteristics that work together to cause cold damage. Furthermore, each cold protection method has its own strengths and weaknesses. Farms should be prepared to have multiple cold protection methods in place and be able to choose the proper approaches according to each unique cold situation. Adverse weather is forecast by many sources. For south Florida, National Weather Service-Miami, which provides forecasts for a week ahead (<http://www.srh.noaa.gov/mia>), and the University of Florida's Florida Automated Weather Network (FAWN), which provides instant temperature recordings at various sites throughout the state of Florida (<http://fawn.ifas.ufl.edu>), are two most reliable free-of-charge sources on the Internet. Growers should regularly check the websites for weather updates.

Once a cold freeze or near freeze weather is in the forecast, growers should plan well ahead in order to avoid frantic last-minute decision-making as temperatures start dropping. According to the crops a farmer grows, farms usually have a predetermined threshold temperature upon which action must be immediately taken.

Water has the highest thermal capacity amongst all materials that nature provides. Thus, the most widely used cold protection method by growers by far is water application. Elevating the water table is the first line of defense when dealing with freezing weather. Most vegetable and tropical fruit farms in south Florida are connected to irrigation/drainage systems that use farm canals and field ditches to regulate seepage irrigation, often with the help of pumps. Manipulating water table levels is the least expensive but most effective way to battle the cold. It is important to raise the water level several days before the freeze since it takes time for the sun

to heat up the extra volume of water in the soil profile and for thorough capillary seepage to occur. Water-filled soil-pore space buffers against cold temperatures much more effectively than air-filled soil-pore spaces. Once the ground is moistened, it radiates heat and keeps the near ground temperature warm, thus protecting vegetable and tree roots from freeze damage. For near freezing temperatures in the lower 30s°F, elevating water tables alone may be sufficient for protection. One weakness of this method is that cold-stressed plants may suffer a higher probability of plant disease development due to prolonged wet soil conditions. It is advisable to drain the fields and return to a normal water table level once the freeze danger has passed.

Freezing and subfreezing weather in the forecast calls for additional cold protections, such as freeze cloth, air mixing, microjets, in-tree sprinklers, and soil banking.

Freeze cloth is another effective method that can be used in addition to an elevated water table. Use PVC pipes, aluminum pipes, or any smooth arches to support the freeze cloth above the crop for low tunnels. For plants that are already fairly tall-statured and staked, pipe extensions on the stakes can be arranged to create high tunnels. To prevent “tip burns”, make sure the freeze cloth is supported so that it does not come in contact with foliage, otherwise plant tissues and freeze cloth can actually get frozen together, causing crop damage.



Figure 3. Basil Difference: Protected (two beds in the middle) vs. Unprotected (beds on the left and right) following the freeze events in January 2010. A prior freeze has also killed plants and left large skips from the unprotected bed (left). Photo by David Sui.

Air mixing is effective to prevent radiation frost, which tends to form when a clear sky and calm

winds (less than 5 mph) allow an inversion to develop, and temperatures near the ground drop below freezing. Wind machines that used to be used in citrus groves are less used these days due to their high fuel cost and initial investment. Helicopter flight has become more popular recently for large acreage operations, but this is an expensive option, and pilots are generally paid a fee to simply be on call for possible night-time flights. The weakness of air mixing is its ineffectiveness against advective freezing, which happens under cold air and windy conditions.

Microjets are popular cold protection strategies for tropical fruit trees, and are used to protect root systems and lower trunks. In-tree sprinklers are installed to protect limbs and canopy. Care must be taken to make sure that the system is operational and spraying water through the night until just past dawn or when ice/frost has melted away. Unintentional stoppage (pump runs out of fuel, intake pond dries up, etc.) may quickly result in evaporative cooling, and subsequent freeze damage could be more severe than the scenario where no cold protection measure had been implemented. Before the freezing weather comes, check that the equipment is working, the water supply (pond) is at least sufficient to last well into next morning, the in-tree sprinkler system is on in all zones and not on zoned rotation, and to use diesel pumps (rather than electric) for better dependability in case electrical problems develop during severe weather or power rotation between municipalities.

Similar to trunk wrapping, soil banking of fruit trees can protect the basal trunk from freeze damage and this has been applied to early stage sweet corn, in some cases, where cultivation hilling buries the growth point of young seedlings below the soil surface.

Finally, all of these practices involve careful planning and timing. There is no one-size-fits-all method in cold protection against freeze damage. Attention to preparation, designing sensible cold protection protocols, and having all materials in inventory long before cold weather approaches should help farms escape the brunt of many cold-weather systems, ensuring a more stable supply of fresh produce for a demanding market once the cold weather has passed.

References

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