Winter production practices

COLD PROTECTION • HEDGING • TOPPING

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COLD HARDINESS AND COLD PROTECTION

ENVIRONMENTAL CONDITIONS

Certain environmental conditions will initiate the winter acclimation process. These environmental cues will cause physiological changes to occur within the plant, reducing the critical temperature at which plant damage will occur. Two major environmental factors in Florida citrus that regulate cold hardiness are temperature and water.

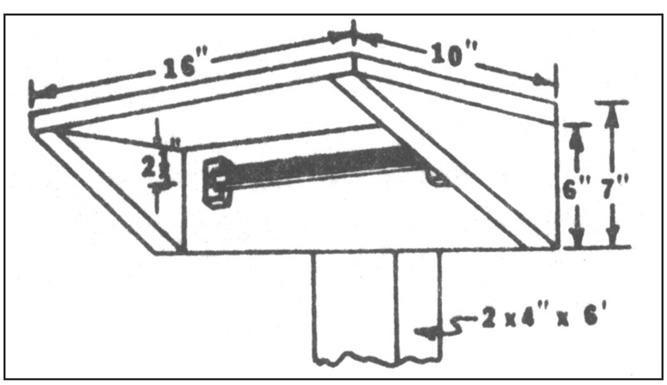
At 55° F, citrus plant growth slows. As temperatures remain below 55° F, citrus trees will continue to acquire acclimation to these cooler temperatures. This process is reversible during warm winter periods, and de-acclimation (loss of acclimation) can occur. The greatest amount of citrus acclimation occurs during consistently cool falls and winters. Once de-acclimation occurs, citrus trees will generally not re-acclimate to the same level prior to the onset of de-acclimation.

Irrigation and fall/winter rainfall can have a pronounced effect on the citrus acclimation process. Drought-induced stress has been shown to increase the tolerance of citrus trees to freezing temperatures when compared to well-watered or over-watered citrus trees in Florida. However, excessively drought-stressed trees are more susceptible to freeze damage.

CRITICAL TEMPERATURES FOR FLORIDA CITRUS

It is very important to know the critical temperature at which freezing temperatures can damage citrus. Minimum temperature indicating thermometers are a wise investment for any grower concerned with freeze/frost protection. Thermometers should be installed in the coldest grove locations. They should be placed at a height of 42 inches (4.5 ft) on a stand, sheltered at the top and facing north.

In citrus trees, there can be a great deal of variation in the minimum temperature at which plant damage will occur. These variations can be examined by the different plant structures that are exposed to critical temperatures. Citrus sensitivity to freeze damage is dependent not only on the actual minimum temperature, but also on the duration at or below critical temperatures. In looking at citrus plant structure, critical temperatures can be related to mass of the structure, citrus fruit and leaves.



Grove thermometer shelter

Plant mass plays an important role in the rate at which temperatures fall within given plant structures. Generally the structures with the greatest mass lose heat at a slower rate. This can be best illustrated by comparing the difference between a young and mature citrus tree. If both the young and mature citrus trees are exposed to the identical minimum temperature and duration, the young citrus tree may receive extensive damage while the mature tree receives less damage other than loss of a few exposed leaves. This result is directly related to the rate of heat loss of a young tree (less mass) as compared to a mature tree (greater mass).

Freeze damage in citrus fruit is also related to the rate of heat loss within the fruit. Larger fruit lose heat more slowly than smaller thin-skinned fruit. Small fruit reach the critical temperature quicker, resulting in greater freeze damage. Citrus varieties can be ranked in the following order from most cold tolerant to least: grapefruit, oranges, tangerines, lemons and limes.

The reference temperature and duration for the initiation of the freezing process in round oranges is 28° F for four hours. Tangerines and fruit with smaller mass would receive freeze damage after shorter durations, while grapefruit would require longer durations.

Minimum temperatures of 26° F will damage fully mature, harden-off leaves that have not received any acclimation. Minimum temperatures of 30° F can significantly damage unhardened new flush leaves. Leaves that have received extensive acclimation have been shown to survive temperatures as low as 20° F in Florida.

PROTECTING TREES FROM COLD DAMAGE

Cultural practices can have a major influence on the cold hardiness of citrus trees. A clean, hard-packed soil surface intercepts and stores more solar radiation during the day and releases more heat at night than a surface covered with vegetation or a newly tilled area.

Irrigation should be applied minimally during the fall and winter. Reducing irrigation results in an increase in the cold tolerance of citrus trees and enhances tree stress, resulting in an increase in the formation of flower buds.

Excessive application of nutrients should be avoided late in the fall, especially with young citrus trees. Luxurious consumption of nutrients by citrus trees in late fall may cause a delay in the acclimation process.

Heavy hedging or topping during the winter can reduce citrus cold hardiness by reducing canopy integrity that would trap heat released by the soil. This should be avoided.

Water from microsprinkler irrigation protects young trees by transferring heat to the tree and the environment. The heat provided is from two sources — sensible heat and the latent heat of fusion. Most irrigation water comes out of the ground at 68º to 72º F, depending on the depth of the well. The major source of heat from irrigation is provided when the water in the liquid form changes to ice (latent heat of fusion). As long as water is constantly changing to ice, the temperature of the ice-water mixture will remain at 32º F. The higher the rate of water application to a given area, the greater the amount of heat energy that is applied.

The major problem in the use of irrigation for cold protection occurs when inadequate amounts of water are applied or when windy (advective) conditions occur. Evaporative cooling, which removes 7.5 times the energy added by heat of fusion, may cause severe reductions in temperature under windy conditions, particularly when inadequate amounts of water are used. It is generally advisable to place the emitter northwest of the tree, about 1 to 2 feet away from the trunk for young trees.

A 90º to 180º spray pattern, which is angled upward into the lower branches, will concentrate the water on the trunk and lower limbs, providing greater protection than a 360º pattern. For mature trees, the irrigation pattern is not as critical as it is with young trees.

When expecting a freeze, turn on the water early before the air temperature reaches 32º F. Remember that in cold pockets, the ground surface can be colder than the air temperature reading in a thermometer shelter. Once irrigation has begun, the system must run for the duration of the time plant temperatures are below the critical temperature. For more details, go to http://edis.ifas.ufl.edu/CH182 <http://edis.ifas.ufl.edu/CH182> http://edis.ifas.ufl.edu/CH054 <http://edis.ifas.ufl.edu/CH054>

In bedded groves to provide additional cold protection, water should also be pumped high in the ditches the day before and during the time of freezing weather. This water should be removed within two to three days after the freeze to avoid root damage.

SOURCES OF WEATHER INFORMATION

WINTER WEATHER WATCH

A decision by the NWS administrators in 1996 eliminated the agricultural weather program, which has forced the Extension Service to move to private weather forecasting sources for information on freeze forecasts for rural agricultural areas. Since the 1996-97 winter, the Extension Service has utilized several private agricultural meteorologists to obtain accurate and reliable weather data. For more information, call Chris Oswalt (863-519-8677 ext. 108) in Polk County. The Winter Weather Watch starts in mid-November and continues through mid-March. There is a subscription fee to get telephone access to the daily weather recordings. This service provides timely information to help growers and farmers minimize their damage from frosts and freezes. An unlisted telephone number is available to subscribers to obtain recorded weather forecasts.

THE FLORIDA AUTOMATED WEATHER NETWORK (FAWN)

FAWN is another tool to provide a reliable source of real-time agricultural weather information from more than 30 automated weather stations in the state. Data are collected every 15 minutes and available through the Internet (http://fawn.ifas.ufl.edu; <http://fawn.ifas.ufl.edu/>) or toll free by calling (866) 754-5732.

FAWN has three management tools to assist growers that utilize cold protection methods. The first is the Brunt Minimum Temperature <http://fawn.ifas.ufl.edu/scripts/brunt.asp> guide that can be helpful in determining if critical temperatures could be reached on a given night. The Brunt minimum temperature calculator uses the temperatures at sunset to estimate the lowest temperature for any given night. The "tool" should be used by every grower using water for cold protection.

FAWN also provides a safe cut-off temperature tool based on the moisture content of the air. This tool can save growers millions of dollars and reduce water demand by billions of gallons.

For citrus growers, an additional tool provides growers with the citrus leaf freezing temperature during the winter. The leaf freezing temperatures are determined weekly from a variety of locations throughout the state. Growers use this information to determine when it would be safe to turn their micro-sprinkler irrigation systems off or on.

For more details, go to http://edis.ifas.ufl.edu/HS179

HEDGING AND TOPPING

Hedging and topping is another important cultural grove practice during late fall and winter. Severe hedging or topping of citrus trees during the winter can reduce cold hardiness. Trees with exposed internal scaffold wood and new tender growth are more susceptible to cold injury.

In general, tree response to hedging and topping depends on several factors including variety, tree age, vigor, growing conditions and production practices. No one system or set of rules is adequate for the numerous situations encountered in the field. Growers are encouraged to gain a clear understanding of the principles involved in hedging and topping, and to take advantage of research results as well as consulting knowledgeable colleagues and custom operators for their observations.

Hedging should be started before canopy crowding becomes a problem that would cause cutting of small branches. Removal of a significant portion of the tree will result in excessive vegetative growth and a drastic reduction in subsequent yield.

Hedging is usually done at an angle, with the boom tilted inward toward the treetops so that the hedged row middles are wider at the top than at the bottom. This angled hedging allows more light to reach the lower

larger is the subsequent shoot growth. Severe pruning reduces fruiting and increases fruit size.

The best time of year to hedge and/or top depends on variety, location, severity of pruning and availability of equipment. Since pruning is usually done after removal of the crop, early maturing varieties are generally hedged before later maturing varieties. Many prefer to hedge early before bloom, but they may also get more vegetative regrowth, which may not be desirable. Pruning could begin as early as November in warmer areas.

Valencia trees may be hedged in the late fall with only minimal crop reduction when the hedging process removes only a small amount of vegetative growth. In cases where excessive growth is to be removed, the trees are usually harvested before hedging is conducted.

Light maintenance pruning can be done throughout the summer and until early fall with little or no loss in fruit production. Moderate pruning should not continue late into the fall in freeze-prone areas, as trees with tender regrowth are more susceptible to cold injury.

With the finding of citrus greening disease, selecting the best time for hedging and topping is becoming more complicated. New growth flushes promoted by hedging and topping in late spring, during the summer and early fall can increase the population of psyllids and aggravate the spread of citrus greening. For more details, go to http://edis.ifas.ufl.edu/HS290

skirts of the tree. Hedging angles being used vary from 0 to 25 degrees from vertical, with 10 to 15 degrees being more commonly used.

Topping should be done before trees have become excessively tall and should be an integral part of a tree size maintenance program. Long intervals between toppings increases the cost of the operation due to heavy cutting and more brush disposal. Excessively tall trees are more difficult and expensive to harvest and spray. Topping trees will increase fruit quality and size. Some common topping heights are 12 feet to 14 feet at the shoulder and 15 feet to 16 feet at the peak.

Excessive nitrogen after severe hedging or topping will produce vigorous vegetative growth at the expense of fruit production. Therefore, nitrogen applications should be adjusted to the severity of hedging and/or topping. Reducing nitrogen applications avoids an imbalance when heavy pruning is done. Reducing or omitting a nitrogen application before and possibly after heavy hedging will reduce both costs and excessive vegetative growth. However, light maintenance hedging should not affect fertilizer requirements.

Large crops tend to deplete carbohydrates and result in a reduced crop and increased vegetative growth the following year. Pruning after a heavy crop additionally stimulates vegetative growth and reduces fruit yield the following year. Pruning after a light crop and before an expected heavy crop is recommended because it can help reduce alternate bearing, which can be a significant problem in Valencia production.

Severe hedging stimulates vigorous new vegetative growth, especially when done before a major growth flush. This happens because an undisturbed root system is providing water and nutrients to a reduced leaf area. The larger the wood that is cut, the

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