UF UNIVERSITY of FLORIDA | IFAS EXTENSION

Citrus Notes

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Inside this Issue:

Dear Growers,

In order to put together a great program highlighting winter weather and Florida peach production we needed to move our December OJ Break to Wednesday, December 15, 2010. The cold weather experienced back in early November has caused a significant amount of defoliation in some citrus trees, is this stress or greening induced? I have included some of my observations on this subject. Dr. Albrigo has begun his citrus flower bud advisories and I included the first one for this winter. Citrus leaf freezing temperatures for this winter are available on the Florida Automated Weather Network (FAWN) and there is some additional information on how this can be used to improve your cold protection decisions.

Enjoy the issue,

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Polk County OJ Break

Our December Polk County OJ Break meeting will be held at the Stuart Conference Center, 1710 Highway 17 South in Bartow. **The OJ Break will begin at 9:00 a.m. on Wednesday, December 15, 2010.** This month our OJ Break will focus on the following topics: winter weather and peach production practices. The winter weather topics include: this winter's climate forecast, agricultural weather forecasting and fine tuning the forecast for your grove.

The peach production topics will include pruning, fruit thinning, and variety selection for peaches in central Florida.

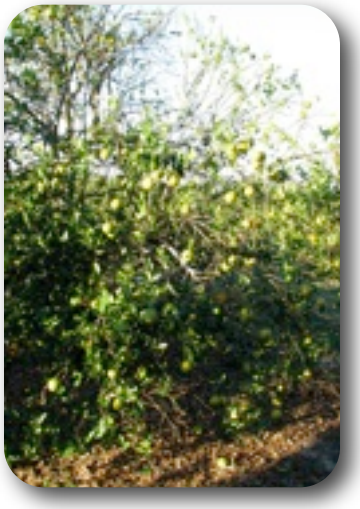
Speakers for the winter weather topics include Fred Crosby, retired NWS meteorologist, Melissa Griffin, Center for Ocean-Atmospheric Prediction Studies, Florida State University and I'll be talking about fine tuning the forecast for your location.

Dr. Jeff Williamson, Extension Specialist, UF Horticultural Sciences Department will be heading down from Gainesville to make the presentation on peach production practices for central Florida.

Lunch will be provided courtesy of Triangle Chemical Company, please pre-register so we can have an accurate head count for lunch. You can register by calling Gail Crawford at 863-519-8677 or you can send me an email: wcoswalt@ufl.edu

Looking forward to seeing you all at the OJ Break on December 15, 2010.

Stress Induced Defoliation and Citrus Greening



Back in the first week of November we experienced our first taste of cooler weather. A week or so later I received a number of calls from growers concerned about sporadic defoliation and some fruit drop. Based on these observations a few growers asked if I could come out and take a closer look at these trees to determine the source of this particular phenomenon. After viewing numerous trees at multiple locations I noticed that in most cases there

were additional symptoms of citrus greening on the trees. I continued to receive calls from numerous growers making this observation from around the area and I currently recommend that growers take a closer look for symptoms of citrus greening on these trees. From my perspective, at least recently, it has been extremely easy to pickup on these types of trees in most groves.

This follows along with the observations we made last year (February 2010 "Citrus Notes"). During freezing weather trees exhibiting symptoms of citrus greening were more susceptible to defoliation than asymptomatic trees in the next row.

Citrus Flower Bud Advisories Now Available

The following information was provided by Dr. Gene Albrigo from the UF/IFAS Citrus Research and Education Center in Lake Alfred. In addition to predicting bloom intensity Dr. Albrigo's model also predicts the date of citrus flowering in the spring. Having this information can greatly help growers in determining the scheduling of their winter and spring psyllid control spray applications to avoid the bloom period.

Overview of flower bud induction in Florida – Citrus flower bud induction starts in the fall and usually is completed by early January. Low temperatures first stop growth and then promote induction of flower buds as more hours of low temperatures accumulate (below 68 degrees F). A period of high temperatures in winter can then initiate bud differentiation which after sufficient days of warm springtime temperatures leads to bloom. The meteorologists predict that this winter in Florida will be an ENSO-La Niña year, above average temperatures and lower than average rainfall. Under these conditions, enough hours of low temperatures below 68 degrees F. usually accumulate to induce an economic level of flower buds. Conditions that can interfere with good flower bud induction include: 1) several warm periods interrupting the induction process or 2) the previous crop was exceptionally high or 3) leaf loss from hurricanes, freezes or other causes (canker) were excessive and tree recovery was not complete. Excessive leaf loss leads to low carbohydrate levels in developing buds which reduces their ability to become flower buds. Except for a few trees with freeze damage, none of these adverse conditions appear to be in play for the coming season's flower bud induction.

Under normal Florida weather conditions but with a moderate to heavy previous crop, sufficient flower bud induction should be achieved when total accumulated hours of low temperatures exceed 800 hours below 68 degrees F. If the crop load is light, sufficient flower bud induction may occur after 700-750 hours of accumulated low temperatures. A warm period of 7 to 12 days, with maximum temperatures > 80 to 85 degrees F., can trigger growth (bud swelling) if a minimum total hours of low temperatures have accumulated (300-400 hours below 68 degrees F). Later in the winter when the accumulated cool temperature induction hours are high, fewer days and lower daytime highs (75 degrees F.) are required in a warm period to stimulate growth of buds. Weather information relative to Florida citrus flower bud development for the current and several previous years (back to 1998) can be obtained from the Florida Automated Weather System (fawn.ifas.ufl.edu) for locations near you. An 8 day forecast from the National Weather Service predicts Florida

weather for several sites around the citrus belt for the next week. Find this information at: http://www.nws.noaa.gov/mdl/forecast/text/state/FL.MRF.htm. This is an easy way to see if a warm period, which could trigger flower bud growth, is predicted for your specific area in Florida.

Some flower buds will be induced in the range of 300 to 450 accumulated hrs < 68 degrees F. Warm events just after these levels of induction result in weak flowering intensity, and therefore many buds remain that can be induced by later cool periods, or these buds may sprout as vegetative shoots if warm weather continues and the trees are well watered. The first situation results in multiple cohorts of flower buds developing to different bloom dates. The second condition leads to low flowering-fruit set and excessive early spring vegetative growth. During the years from 1963 to 2003, multiple blooms occurred in over half of the years. Historically, the time period in which an early warm period (7-12 day) can lead to an initial low number of buds growing and flowering is roughly mid-November to mid-December. Then after more cool temperatures additional flower buds are induced and a later warm period starts their growth and repeats of this process result in multiple blooms. Presently, the only management tool available to eliminate or reduce the chance of multiple blooms is sufficient drought stress to stop growth. This water stress may be provided by stopping irrigation well before these predicted warm periods occur. If the warm periods(s) are of the typical 7 to 10 day duration, a coincident short period of drought stress will have little impact on current crop development or quality. Sufficient drought stress may be interpreted as leaf wilt observed by 10 or 11 am, but leaves recovering by early the next morning. If no rains interrupt a drought stress condition in citrus trees, buds will not grow in response to high temperatures. If a warm period has passed, trees again can be irrigated to minimize current crop stress. Although no weather prediction is guaranteed, rains in the winter usually come on the fronts for cool periods. Sufficiently cool temperatures after a cold front rain will usually prevent growth even though soil moisture is adequate for growth. Since winter rains usually occur just before cool temperatures, the chances that drought stress will prevent an early flower bud differentiation event are reasonably good for many warm periods. Even so, growers in some growing districts have often found it difficult to maintain winter drought stress.

In the shallow soils of bedded groves, it is relatively easy to create sufficient water stress to suppress growth by withholding irrigation for a few days if no rains occur. In deeper, sandy soils, 2 or more weeks without irrigation or rainfall may be required. To minimize the time required for soil to dry sufficiently to initiate water stress, the soil should be allowed to dry out by mid-November so that trees show wilt by mid-day. For bedded groves, minimum irrigation can then be applied at low rates as needed until a weather prediction indicates a warm period is expected. At this time, irrigation should be shut down. For deep sands, the soil needs to be dried out and kept nearly dry below 6 to 8 inches of depth until at least Christmas so that no growth can occur. Minimum irrigations that re-wet perhaps the top 6 to 8 inches of the root zone may minimize excessive drought, while allowing quick return to a water stress condition if a high temperature period is forecast. Soil moisture monitoring can help to achieve these goals. Prolonged late-fall, early-winter drought may be risky for 'Hamlin' or other early maturing cultivars not yet harvested that tend to drop fruit near harvest. In recent studies, Valencia trees in Central Florida have had good flowering and no apparent impact on current crop when irrigation was stopped in early December and

resumed in the Spring. Much of what has been stated above has now been incorporated into a 'Flowering Expert System for Florida Citrus'. Figure 1 represents the different aspects of flower induction as depicted by the software program. The program gives an average bloom situation represented by the shades of green to white, vegetative to heavy flowering, respectively. If the current crop is very heavy, then the greener shaded bands should be broader (require more hours for the same level of flowering). If the current crop is lighter or tree condition better, then the colored bands should be narrower as the level of flowering will be as large with fewer total cool temperature hours. Although this representation does not appear on the working screen, recommendations (bottom text box) do consider the current crop level in assessing when action should be taken to try to prevent or to promote initiation of the flower bud growth process. The system is available online: http://orb.at.ufl.edu/DISC/bloom.

Additional advisories will follow this preliminary one, roughly bi-weekly) and update the reader on accumulating hours of related cool or warm temperatures and other weather effects on flower bud induction. Methods for enhancing (urea or PO3 sprays) or reducing (GA3 sprays) flowering intensity as conditions and cultivars dictate will be discussed in later advisories. Read the archived advisories from previous years (link at top of this page) for more background.

Previous responses – In the winter of 2001-2002 following a good crop, cool temperature accumulation was very slow and few hours accumulated (640 hours), warm temperatures persisted and most buds started to grow by 20 December, particularly in well irrigated blocks, leading to excessive vegetative buds. This resulted in few buds remaining for a second flowering wave and a relatively small crop occurred in the 2002-03 harvest season.

By late December in the winter of 2002-2003, 850 hours of uninterrupted cool inductive temperatures had accumulated with a low current crop on the trees. The subsequent warm period initiated growth of almost all the buds on all of the spring and summer flush with bloom in early March. We had a fairly leafy bloom of very short duration (slightly more than 2 weeks). In spite of the high temperatures during and following bloom, an excellent fruit set occurred in all round oranges resulting in the highest Florida citrus crop forecast by the Florida Agric. Statistical Service (2003-04 crop). In the winter of 2003-2004, there was good flower bud induction and reasonably good fruit setting conditions, although the heavy previous crop probably reduced flowering levels and set. Even though fruit size was small, it looked like we were headed for a 220 million box orange yield before the 2004 hurricanes significantly reduced the 2004-05 crop. Since then, we have had Hurricane Wilma in 2005 and a long period of tree recovery from the 2004 and 2005 hurricanes. Since the hurricanes, flowering levels have been lower and appeared to require more hours to get adequate bloom. This has usually resulted in the main bloom occurring later (late March). There is some indication that tree recovery after the multiple hurricanes took several years. For the 2008-2009 crop season, accumulated hours below 68 degrees F were more than acceptable by the second warm period (over 1000 hours) but flowering and crop per tree was still low resulting in an estimate of only 134 million boxes of oranges. This low yield probably indicates that the trees still were not fully recovered from hurricane effects. Some details of the hurricane effects can be reviewed in the 11/01/2006 summary-introduction for the previous year's flower induction cycle.

Current status for 2010-11 Fall-Winter - The light to medium crops and general tree recovery without a hurricane have finally led

to more typical flowering responses in Florida. This is supposed to be an **ENSO-La Niña** winter with below average cool temperature accumulation and less rainfall. Warm periods can interrupt the accumulation process but lower than average rainfall could make it easier to impose drought stress to prevent an early flowering wave. Currently, citrus locations have accumulated low temperatures < 68 degrees F of 350 to 570 hours from southern to northern areas, respectively. The next 7 days will be moderate for cool temperature accumulation with another 70 to 90 hours. Continued accumulation of cool temperatures and prevention of growth during a winter warm spell are important for good 2010-11 citrus production. Therefore, start to monitor irrigation amounts so drought stress can occur if a warm period occurs between November 20 and Christmas or occurs before reaching an acceptable level of over 750-800 hours of cool temperatures. Prepare to make groves relatively dry by withholding irrigation if a warm period is predicted. Keep track of induction hours in your area and watch for the next advisory after December 3rd.

If you have any questions, please contact me (albrigo@ufl.edu).

Citrus Leaf Freezing Temperatures for the 2010-11 Winter

Citrus leaf freezing temperatures this winter will again be available to citrus growers due to the continuing grant support of the Southwest Water Management District. The information will be available on the Florida Automated Weather Network (FAWN) at the following web address: http://fawn.ifas.ufl.edu/tools/coldp/crit_temp_select_guide_citrus.php . These values will be updated weekly from November 15, 2010 to March 15, 2011 and can be used as a quantified measure of citrus acclimation during the winter.

I have included the following information as background on citrus leaf freezing temperature information.

With the onset of cooler temperatures citrus trees cease active growth and become quiescent. This continued quiescence at lower temperatures results in a subsequent increase in cold hardiness termed acclimation. Citrus trees proceed through many changes during acclimation. These changes include: increases in sugars and amino acids with decreases in starch levels within plant tissues. Tissue moisture decreases along with increases in the stability and binding of cell water. These factors combine to increase the ability of citrus tissues to withstand the formation and presence of ice.

Citrus trees acclimated to cold temperatures have survive temperatures as low as 14°F. Acclimation is affected by exposure temperatures, scion cultivar, rootstock cultivar, rootstock/scion combination, tree nutritional status, crop load and water stress. Acclimation is dynamic and will change during the winter in response to warming exposure temperatures with a possible resumption of growth.

Leaf killing points vary in magnitude in response to the above conditions, although the predominate factor, would be exposure temperatures. Studies of citrus leaf killing point temperatures clearly indicate that citrus trees grown in more northern growing areas acquire greater acclimation than trees grown in growing regions further south. Trees grown in southern regions of the state are also more

susceptible to active growth due to favorable growing conditions during the winter.

Non-acclimated citrus leaves will generally survive to temperatures of 24°F. New spring flush leaves formed in April will rarely survive temperatures of 31°F, by mid May these leaves will have similar leaf killing points to mature leaves. Research studies indicated that citrus leaf killing points can range from 16°F to 24°F during the winter with a Satsuma cultivar reaching 14°F during one year. Field observations indicated that these leaf killing point values hold up in a number of freezes.

Using Leaf Freezing Temperatures Better Manage Cold Protection Practices

(Authors: Chris Oswalt and Dr. Tim Spann, UF/IFAS from Citrus Industry Magazine November 2010)

Determination of the critical temperature at which citrus leaves freeze is an important factor when making cold protection management decisions. The information can be used to measure citrus acclimation, amount of flower bud induction, and the evaluation of cultural practices.

The citrus leaf freezing point can be used to determine the amount of acclimation that has occurred during the winter. This can give growers an idea if or when cold protection practices should be implemented. The change in citrus leaf freezing point temperatures during the winter (figs.1 and 2) can be used to help make these cold protection decisions.

The accumulation of hours below 68 °F, during the fall and winter has a pronounced affect of the induction of citrus flower buds. Currently, citrus leaf freezing point temperatures are being correlated to the amount of bud induction that has occurred during the winter. Citrus trees that have acquired a greater level of acclimation or depression in the leaf freezing temperature have experienced cooler winter temperatures and more quiescence.

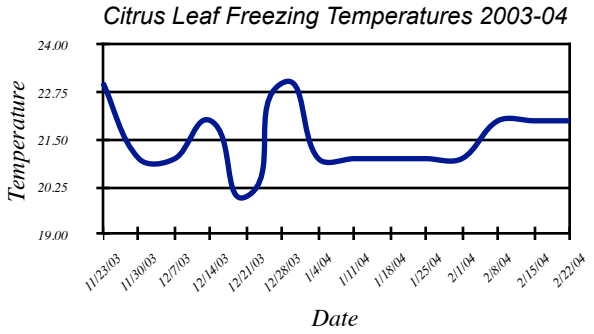


Figure 1. Citrus leaf freezing point temperatures for the 2003-04 winter (Hamlin and Valencia round orange varieties).

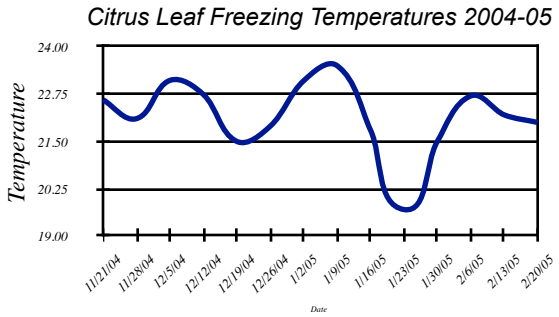


Figure 2. Citrus leaf freezing point temperatures for the 2004-05 winter (Hamlin and Valencia round orange varieties).

Citrus leaf freezing points can be used as a guide for citrus growers in evaluation of winter cultural practices. Reduced irrigation during the fall and winter enhances the formation of citrus flower buds in Florida and increases the cold hardiness of citrus trees. Studies have demonstrated that moderate water stress during the winter has resulted in a decrease in the amount of freeze damage to citrus trees as compared to trees that were well watered or over irrigated. Although studies analyzing the effects of mineral nutrition on the cold hardiness of citrus trees have not demonstrated a direct relationship, citrus leaf freezing point temperatures can provide insight into possible

changes in acclimation brought on by fall and winter fertilization practices.

Irrigation for Cold Protection

Today the preferred method for Florida citrus cold protection is micro-sprinkler irrigation. This methodology uses the heat released from the phase change of water to ice. The release of this heat and the insulating properties of ice protect citrus trees from freeze damage. Micro-sprinklers are very effective on young and moderately sized trees. The effect of micro-sprinklers for cold protection is reduced when used on large mature citrus trees. This is due to the limited amount of water applied and the volume of citrus tree canopy needing protection. Micro-sprinkler irrigation has a very limited effect on protecting citrus fruit up in the tree canopy. The majority of citrus fruit are located on the outer canopy of the citrus tree where micro-sprinkler irrigation will have a limited effect. Citrus leaves on mature citrus trees are also difficult to protect due to their location and small size.

The citrus leaf freezing temperature can be used as a guide for determining the amount of cold hardiness or acclimation that has occurred in a citrus tree. Growers can use this information in making decisions on whether or not to turn on their irrigation system for cold protection when predicted minimum temperatures are not forecast to reach the critical leaf freezing temperature for their particular grove location. Accurate local forecast information is critical in making this determination. Growers should find a source of forecast information that they can have a high level of confidence in and fine-tune this forecast for their specific location. Citrus growers using this information can have a pronounced effect on the amount of water used for cold protection during the winter.

Conversely, knowing the critical temperature at which citrus leaves freeze will provide growers with the minimum temperature that leaves will survive. Once the wet bulb temperature exceeds the leaf freezing point temperature, the irrigation system can be turned off without causing leaf damage. Growers should determine a safety factor of a few degrees to account for variations in the citrus leaf freezing point temperatures due to differences in rootstocks, varieties and cultural practices. This information will allow citrus growers to timely turn off their irrigation systems resulting in an additional water savings.