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Institute of Food and Agricultural Sciences

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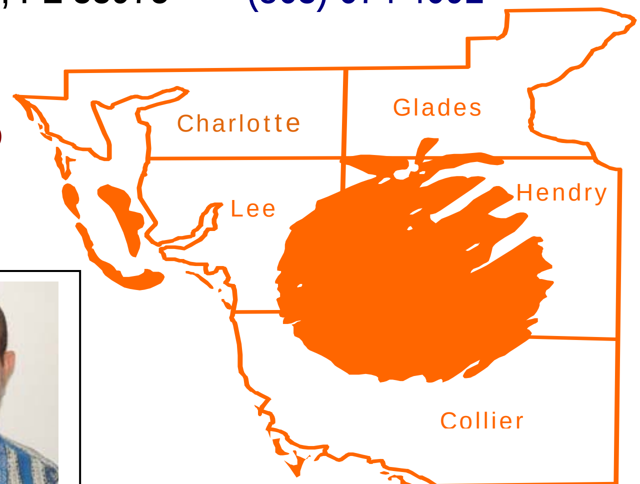
Flatwoods Citrus



Vol. 19, No. 6 **June 2016**

Dr. Mongi Zekri
Multi-County Citrus Agent, SW Florida

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Previous issues of the Flatwoods Citrus newsletter can be found at:
http://citrusagents.ifas.ufl.edu/agents/zekri/index.htm
http://irrec.ifas.ufl.edu/flcitrus/

Seminars

Adjuvants & agrochemicals in citrus production and reduction of bicarbonate and Phytophthora stresses to sustain performance of HLB-infected trees

Date: Tuesday, June 7th, 2016
Time: **10:00 AM – 12:00 Noon**
Location: Immokalee IFAS Center
Program Coordinator: Dr. Mongi Zekri, UF-IFAS

Topics

Adjuvants & agrochemicals in citrus production, **Dr. Megh Singh**, UF-IFAS, Lake Alfred CREC

1. Weed management in citrus.
2. Chemical weed control is still the most effective and economical method
3. Use of adjuvants to enhance efficacy of herbicides
4. What are the adjuvants?
5. Types of adjuvants and how they work
6. Use and benefits of adjuvants

Why bicarbonates matter for management of HLB-affected trees, **Dr. Jim Graham**, UF-IFAS, Lake Alfred CREC

To sustain productivity of HLB-affected trees with root damage by Candidatus Liberibacter asiaticus and deterioration of root functioning in water and nutrient uptake, growers must comprehensively manage root health by minimizing abiotic (bicarbonates) and biotic (Phytophthora) stresses.

2 CEUs for Certified Crop Advisors (CCAs)
2 CEUs for Pesticide License Renewal

12:10 PM, Sponsored Lunch

Pre-registration is required. No registration fee and lunch is free Thanks to Frank Miele with Magna-Bon**.** To reserve a seat, call 863 674 4092, or send an e-mail to Dr. Mongi Zekri at: maz@ufl.edu

Citrus breeding for HLB resistance/tolerance

Date: Thursday, June 23rd, 2016
Time: **10:00 AM – 12:00 Noon**
Location: Immokalee IFAS Center
Program Coordinator: Dr. Mongi Zekri, UF-IFAS

Topics

1. Scion Resistance and Tolerance to Citrus Greening Disease AKA Huanglongbing or HLB, **Dr. Ed Stover**, USDA Fort Pierce
2. The best USDA rootstocks available now and in the near future, **Dr. Kim Boman**, USDA Fort Pierce
3. Rootstock effects on tolerance to HLB, **Dr. Ute Albrecht**, UF-IFAS Immokalee

We will cover:

HLB bacterium,
HLB tolerance/resistance solutions,
overview of US citrus,
tolerance to HLB in existing cultivars,
do new citrus selections hold up to HLB?
trifoliate genes for HLB resistance,
transgenics for HLB-resistant citrus,
antimicrobial peptides,
Defensins for HLB resistance,
rootstock trials,
comparison of rootstocks,
tolerance/resistance to HLB,
best rootstock available now
best rootstocks available in the near future
identifying tolerance to HLB under greenhouse and field conditions
rootstock effects on commercial citrus production
mechanisms of rootstock tolerance to HLB
current and planned rootstock-related projects

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EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

issued by

CLIMATE PREDICTION CENTER/NCEP/NWS
and the International Research Institute for Climate and Society

12 May 2016

ENSO Alert System Status: El Niño Advisory/ La Niña Watch

Synopsis: La Niña is favored to develop during the Northern Hemisphere summer 2016, with about a 75% chance of La Nina during the fall and winter 2016-17.

During the past month, sea surface temperature (SST) anomalies decreased across the equatorial Pacific Ocean, with near-to-below average SSTs recently emerging in the eastern Pacific (Fig. 1). The latest Niño region indices also reflect this decline, with the steepest decreases occurring in the Niño-3 and Niño-1+2 regions (Fig. 2). The surface cooling was largely driven by the expansion of below-average subsurface temperatures, which extended to the surface in the eastern Pacific (Figs. 3 and 4). While oceanic anomalies are clearly trending toward ENSO-neutral, many atmospheric anomalies were still consistent with El Niño, such as the negative equatorial and traditional Southern Oscillation indices. Upper-level easterly winds persisted over the central and eastern Pacific, while low-level winds were near average. Enhanced convection continued over the central tropical Pacific and was suppressed north of Indonesia (Fig. 5). Collectively, these anomalies reflect a weakening El Niño and a trend toward ENSO-neutral conditons.

Most models predict the end of El Niño and a brief period of ENSO-neutral by early Northern Hemisphere summer (Fig. 6). The model consensus then calls for increasingly negative SST anomalies in the Niño 3.4 region as the summer and fall progress. However, there is clear uncertainty over the timing and intensity of a potential La Niña (3-month Niño-3.4 SST less than or equal to -0.5°C). The forecaster consensus favors La Niña onset during the summer, mainly weighting the dynamical models (such as NCEP CFSv2) and observed trends toward cooler-than-average conditions. Overall, La Niña is favored to develop during the Northern Hemisphere summer 2016, with about a 75% chance of La Nina during the fall and winter 2016-17 (click CPC/IRI consensus forecast for the chance of each outcome for each 3-month period).

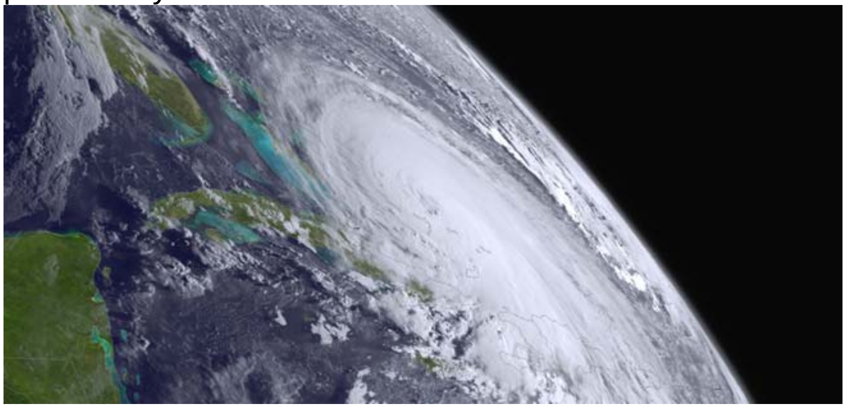
This discussion is a consolidated effort of the National Oceanic and Atmospheric Administration (NOAA), NOAA's National Weather Service, and their funded institutions. Oceanic and atmospheric conditions are updated weekly on the Climate Prediction Center web site (El Niño/La Niña Current Conditions and Expert Discussions). Forecasts are also updated monthly in the Forecast Forum of CPC's Climate Diagnostics Bulletin. Additional perspectives and analysis are also available in an ENSO blog. The next ENSO Diagnostics Discussion is scheduled for 9 June 2016. To receive an e-mail notification when the monthly ENSO Diagnostic Discussions are released, please send an e-mail message to: ncep.list.enso-update@noaa.gov.

Climate Prediction Center
National Centers for Environmental Prediction
NOAA/National Weather Service
College Park, MD 20740

Near-normal Atlantic hurricane season is most likely this year

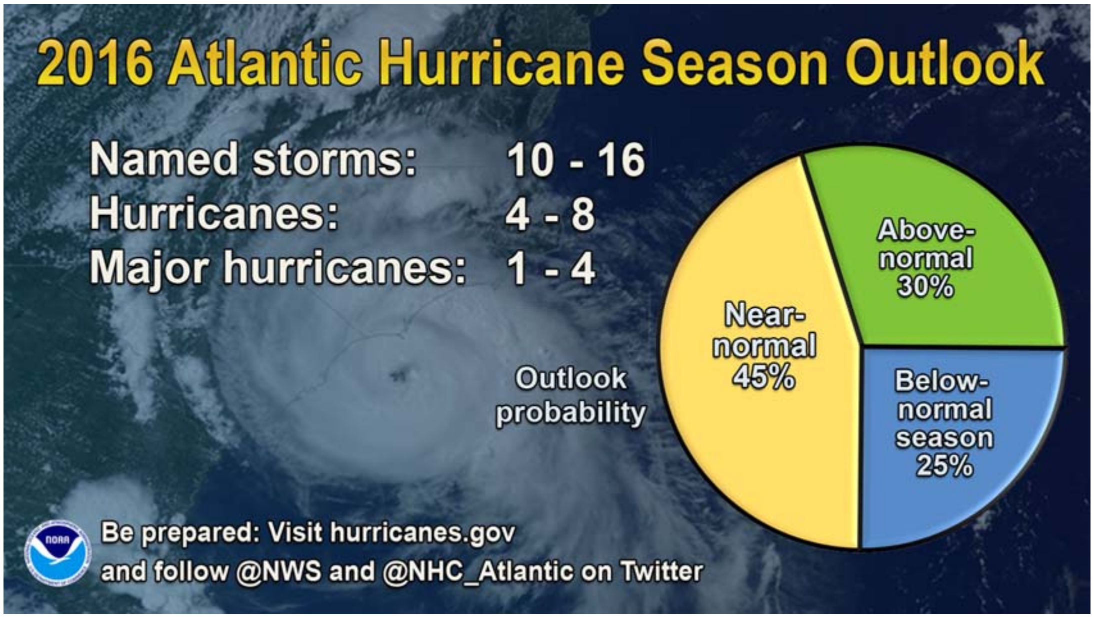
70 percent likelihood of 10 to 16 named storms

NOAA's Climate Prediction Center says the 2016 Atlantic hurricane season, which runs from June 1 through November 30, will most likely be near-normal, but forecast uncertainty in the climate signals that influence the formation of Atlantic storms make predicting this season particularly difficult.



NOAA predicts a 70 percent likelihood of 10 to 16 named storms (winds of 39 mph or higher), of which 4 to 8 could become hurricanes (winds of 74 mph or higher), including 1 to 4 major hurricanes (Category 3, 4 or 5; winds of 111 mph or higher). While a near-normal season is most likely with a 45 percent chance, there is also a 30 percent chance of an above-normal season and a 25 percent chance of a below-normal season. Included in today's outlook is Hurricane Alex, a pre-season storm that formed over the far eastern Atlantic in January.

"This is a more challenging hurricane season outlook than most because it's difficult to determine whether there will be reinforcing or competing climate influences on tropical storm development," said Gerry Bell, Ph.D., lead seasonal hurricane forecaster with NOAA's Climate Prediction Center. "However, a near-normal prediction for this season suggests we could see more hurricane activity than we've seen in the last three years, which were below normal."



The Time to Prepare is NOW!

What should you do to prepare for a hurricane?

Get a plan. The most important step is to identify your hurricane risk. Do you live in an evacuation zone? If so, you need to plan on where you and your family would ride out the storm if you are told to evacuate. Most people only need to evacuate a few miles from the coast to avoid the dangers of storm surge. Find a friend or relative that lives outside the storm surge evacuation zone and have a plan to ride out the storm with them. You should also establish a family communications plan in case you are not together when you need to evacuate.

Once a person understands their risk for hurricane impacts, an appropriate disaster safety plan should be developed to help ensure an individual's and a family's safety. A disaster safety plan is a comprehensive plan that identifies all of the steps a family needs to take before, during, and after a disaster to ensure maximum personal safety and property protection. For a step-by-step guide on creating a family disaster plan please see Florida's "Get a Plan" guide. Citizens should also visit their State Emergency Management Agency websites for family disaster plan templates that may be more suited to a local area.

How to prepare

Dr. Corene Matyas, a professor at UF who specializes in severe weather, advises people to have copies of important documents, extra medications, plenty of drinking water and nonperishable foods. Flashlights, batteries and a first-aid kit are also good ideas. A National Oceanic and Atmospheric Administration (NOAA) weather radio can be set to alert you of any watches or warnings and also provide weather forecasts.
When going to the shelter, bring:
Sufficient nonperishable food for 72 hours, medicine and baby needs, games for children, bedding and a change of clothes for the entire family, flashlight with extra batteries.
If you are unable to evacuate during a hurricane, go to your wind-safe room. If you do not have one, follow these guidelines:
Stay indoors during the hurricane and away from windows and glass doors.
Close all interior doors — secure and brace external doors.
Keep curtains and blinds closed. Do not be fooled if there is a lull; it could be the eye of the storm — winds will pick up again.
Take refuge in a small interior room, closet or hallway on the lowest level.
Lie on the floor under a table or another sturdy object.
Avoid elevators.
What to do with your pet during a hurricane:
Keep it inside with you unless you must evacuate your home.
If you have to evacuate, there are shelters that can care for your pet until the storm passes.
Have pictures of your pets in case they get lost during a storm.
Keep your pets up-to-date on their vaccinations. Many shelters require proof of vaccination.
Have a pet emergency kit with identification, immunization records, medication, supply of food and water, a muzzle, collar and leash.

Hurricane Preparedness

Citrus Growers Must Prepare for Hurricanes Every Year

By **Bob Rouse** and **Mongi Zekri**

Hurricane preparation for citrus growers in 2013 is the same drill as every year. Each year growers look forward to the rainy season to help grow their fruit to maturity. This year, we will be praying for good rains following a dry year and a long drought. Along with the anticipation of the rainy season is the reality that hurricanes may bring too much water in August and September at the end of the rainy season.

Every year, there are predictions of what the hurricane season (June 1 through November 30) will bring. Sometimes it may seem like hocus-pocus when the prognostications are made. Each year, highly popular and widely publicized prognostications for the Atlantic basin come from the Colorado State University's (CSU) and NOAA forecasters. The group at CSU will release their prediction on April 10, and state that we have been in an active era for the Atlantic basin since 1995 and expect positive Atlantic Multi-Decadal Oscillation and strong thermohaline circulations to continue. One of the big challenges for 2013 will be whether or not El Nino will develop this year. Since El Nino didn't fully develop in 2012, and we have returned to neutral conditions, there is the possibility that El Nino will develop for the 2013 hurricane season. The team has defined the average number of storms per season (1981 to 2010) as 12.1 tropical storms, 6.4 hurricanes, 2.7 major hurricanes (storms of category 3 in the Saffir-Simpson Hurricane Scale).

For more information on Preparing for and Recovering from Hurricane and Tropical Storm Damage, go to "Preparing for and Recovering from Hurricane and Tropical Storm Damage to Tropical Fruit Groves in Florida"
http://edis.ifas.ufl.edu/pdffiles/HS/HS28700.pdf
By Jonathan Crane and Carlos Balerdi

Saffir-Simpson hurricane storm rating scale

Storm category	Wind speed (mph)	Expected Damage to Citrus
1	74-95	Some loss of leaves and fruit, heaviest in exposed areas
2	96-110	Considerable loss of leaves and fruit with some trees blown over
3	111-130	Heavy loss of foliage and fruit, many trees blown over
4	131-155	Trees stripped of all foliage and fruit, many trees blown over and away from property
5	over 155	Damage would be almost indescribable, groves and orchards completely destroyed

In 2011, the CSU scientists expected the cycle to continue for another 10 to 15 years before switching back to a less active phase. The pre-season numbers prior to April 10, 2013 are for 15 to 18 named storms, 8 to 11 hurricanes, and 3 to 6 major hurricanes.

The coastal area of Florida where citrus is grown has been extraordinarily lucky in recent years, except for the destructive hurricane seasons of 2004 and 2005. The three hurricanes that impacted citrus in 2004 were Charley (August), ripping the Gulf Coast up through central Florida, and Frances and Jeanne (September), which devastated east coast groves. In 2005, Wilma (October) caused fruit loss and some tree loss in south Florida.

The bottom line is predictions are dubious and a curiosity, and shouldn't affect what we must do. We must prepare every year, regardless of weather predictions. Little can be done to protect trees and fruit from hurricane velocity wind, but we can take steps to protect the people, equipment and supplies that will be needed for the recovery. Below is a checklist for citrus grove managers.

Pre-Hurricane Preparation Checklist

Personnel assignments:

1. Make a list of all tasks and make assignments.
2. Update the names on the damage inspection team.
3. Update worker contact list and means for them to call in after the storm.

Safety training:

Train workers in the safe operation of unfamiliar equipment they may have to use. Example: Drivers may have to use chain saws to remove downed trees blocking roads.

Insurance:

Buildings, equipment including tractors, irrigation parts, and supplies may be damaged.

Buildings:

1. Close storm shutters or board up windows.
2. Store loose, light-weight objects such as garbage cans and tools.

Liquid tanks:

1. Keep fuel, fertilizer and other tanks full so they don't move in the wind.
2. Ensure sufficient fuel is available.

Roads and Ditches:

1. Clear, grade, and keep roads well maintained and keep ditches clean and pumped down.
2. Arrange with a flying service for grove manager to survey grove damage.

Emergency equipment:

1. Test-run generators, chain saws, torches, air compressors, and other equipment.
2. Have shovels, slings, fuel, paint, and equipment parts available in good repair.
3. Know where to obtain backhoes, front-end loaders, and other heavy equipment.

Communications equipment:

1. Ensure that radios are in good working order.
2. Have hand-held portable radios with extra charged battery packs available.
3. Direct truck-to-truck radio and cellular phones save valuable time during recovery.

Hazardous materials:

1. Secure hazardous materials prior to a storm.
2. Shut down gasoline pumps.

Emergency contacts:

1. Have a list of emergency phone numbers, including electric companies, sheriff, and medical.

Cultural Practices:

1. Regular pruning can reduce broken limbs and minimize toppled or uprooted trees.
2. Windbreaks reduce tree damage and spread of citrus canker bacterium.

<u>Post-Hurricane Recovery Checklist</u>

Damage inspection:

Make a visual assessment of the damage and determine priorities and equipment needed.

Prioritize Damage:

A priority plan can quickly determine where and how to begin recovery operations.

Employee call-in:

When safe, call in those needed for damage inspection and grove recovery work.

Clear road access:

Clear roads to where trees must be reset or recovery activities must be conducted.

Water removal:

Remove excess water from tree root zones within 72 hours to avoid root damage.

Tree rehabilitation:

1. Resetting trees to an upright position should be accomplished as soon as possible.
2. Toppled trees should be pruned back to sound wood.
3. Painting exposed trunks and branches with white latex paint helps prevent sunburn.

Irrigation:

Check the irrigation system as rehabilitation is a long process and water is critical.

Fertilizer:

1. Plant nutrients should be applied when new growth begins.
2. Toppled trees will require less fertilizer due to reduced root system and tree canopy.
3. Reduce N fertilizer proportionally to canopy or leaf loss.
4. The following year, trees may require more-than-normal rates to re-establish canopy.
5. Micronutrients should be applied in nutritional sprays to the leaves.

Weeds:

Resume row middles mowing and herbicide applications on a normal schedule.

FLOODING INJURY

Almost all citrus trees grown in southwest Florida are located on high water table, poorly drained soils. Water management on poorly drained soils is difficult and expensive because during heavy rains in the summer, excess water must be removed from the rootzone and in periods of limited rainfall, irrigation is needed. On these soils, drainage is as important as irrigation. The concept of total water management must be practiced. If either system—irrigation or drainage—is not designed, operated, and maintained properly, then the maximum profit potential of a grove cannot be achieved. Both surface and subsoil drainage is necessary to obtain adequate root systems for the trees.

Roots, like the rest of the tree, require oxygen for respiration and growth. Soils in Florida typically contain 20-21 % oxygen. When flooding occurs, the soil oxygen is replaced by water. This condition causes tremendous changes in the types of organisms present in the soil and in the soil chemistry.

Flooding injury would be expected if the root zone were saturated for 3 days or more during extended summer rains at relatively high soil temperatures (86-95° F). Flooding during the cooler December-March period can be tolerated for several weeks at low soil temperatures (< 60° F). The rate of oxygen loss from the soil is much greater at high than at low temperatures. The potential for damage to roots is less obvious but equally serious when the water table is just below the surface. Flooding stress is much less when water is moving than when water is stagnant. The use of observation wells is a very reliable method for evaluating water-saturated zones in sites subject to chronic flooding injury.

Short-term estimates of flooding stress can be obtained by digging into the soil and smelling soil and root samples. Sour odors indicate an oxygen deficient environment. The presence of hydrogen sulfide (a disagreeable rotten egg odor) and sloughing roots indicate that feeder roots are dying. Under flooded conditions, root death is not exclusively associated with oxygen deficiency. Anaerobic bacteria (the kind that can grow only in the absence of oxygen) develop rapidly in flooded soils and contribute to the destruction of citrus roots. Toxic sulfides and nitrites formed by anaerobic sulfate- and nitrate-reducing bacteria are found in poorly drained groves. Sulfate-reducing bacteria require both energy and sulfates in order to change sulfates to sulfides. The best sources of energy have been found to be certain organic acids contained in citrus roots, grass roots, and buried pieces of palmetto. Thus, citrus roots can contribute to their own destruction by being an energy source for these bacteria.

Symptoms of flooding injury may occur within a few days or weeks, but usually show up after the water table has dropped and the roots become stranded in dry soils. Leaf wilting, leaf drop, dieback, and chlorosis patterns may develop and tree death may occur. Trees subjected to chronic flooding damage are stunted with sparse canopies, dull colored, small leaves and produce low yields of small fruit. New flushes of growth will have small, pale leaves due to poor nitrogen uptake by restricted root systems. Usually, the entire grove is not affected, but most likely smaller more defined areas will exhibit the symptoms. Striking differences in tree condition can appear within short distances associated with only slight changes in rooting depths. Water damage may also be recognized by a marked absence of feeder roots and root bark, which is soft and easily sloughed.

With acute water damage, foliage wilts suddenly followed by heavy leaf drop. Trees may totally defoliate and actually die, but more frequently partial defoliation is followed by some recovery. However, such trees remain in a state of decline and are very susceptible to drought when the dry season arrives because of the shallow, restricted, root systems. Moreover, waterlogged soil conditions, besides debilitating the tree, are conducive to the proliferation of soil-borne fungi such as Phytophthora root and foot rot. These organisms cause extensive tree death especially in poorly drained soils.

Water damage may usually be distinguished from other types of decline by a study of the history of soil water conditions in the affected areas. Areas showing water damage are usually localized and do not increase in size progressively as do areas of spreading decline. Foot or root rot symptoms include a pronounced chlorosis of the leaf veins caused by root damage and girdling of the trunk. Lesions also appear on the trunk usually near the soil level (foot rot) or roots die and slough-off (root rot). Flood damage does not produce lesions. Trees with blight or CTV are usually randomly distributed within the grove and diagnostic tests are available to distinguish them from water-damaged trees.

Citrus trees respond physiologically to flooding long before morphological symptoms or yield reductions appear. Photosynthesis and transpiration decrease within 24 hours of flooding and remain low as flooding persists. Water uptake is also reduced which eventually translates to decreased shoot growth and yields.

It is both difficult and costly to improve drainage in existing groves, so drainage problems should be eliminated when the grove area is prepared for planting by including a system of ditches, beds and/or tiling. Growers should not depend on the slight and often unpredictable differences in rootstock tolerance to waterlogging to enable trees to perform satisfactorily under such conditions. Trees, irrespective of scion and rootstock cultivars, should be planted under the best drainage conditions possible. Drainage ditches should be kept free of obstruction through a good maintenance program including chemical weed control. Tree recovery from temporary flooding is more likely to occur under good drainage structure maintenance conditions.

Do not disk a grove if trees were injured by flooding. Irrigation amounts should be reduced, but frequencies should be increased to adequately provide water to the depleted, shallow root systems. Soil and root conditions should be evaluated after the flooding has subsided. Potential for fungal invasion should be determined through soil sampling and propagule counts. If there is a Phytophthora problem, the use of certain fungicides can improve the situation.

HEDGING AND TOPPING CITRUS TREES

The interception and utilization of sunlight should be an important consideration in citrus grove design. The effect of insufficient light is frequently observed in mature citrus groves that are not pruned (hedged, topped) regularly. Shading reduces yield and foliage on the lower parts of the trees. Sunlight not only influences flowering and fruit set but also enhances fruit quality and color development. Increased sunlight penetration within the tree canopy might also allow foliage to dry quicker after a rain shower and could help reduce establishment of fungal pathogens. Therefore, adjustments must be made in tree height and hedging angle to maximize sunlight interception.

Hedging and topping are important cultural grove practices. 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 susceptible to cold injury.

In general, tree response to hedging and topping depends on several factors including variety, rootstock, tree age, growing conditions, time of pruning, 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. As a general rule of thumb, pruning of branches greater than 0.13”- 0.25” in diameter should be avoided. Developing a pro-active pruning program should assist managers in removing the right-sized 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 skirts of the tree. Hedging angles being commonly used vary from 10 to 15 degrees from vertical.

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 increase the cost of the operation due to heavy cutting and more brush disposal. Furthermore, excessively tall trees are more difficult and expensive to harvest and spray. Topping trees will improve fruit quality and increase size. Some common topping heights are 10 to 12 ft at the shoulder and 13 to 14 ft at the peak (Figure 2). As a general rule, topping heights should be two times the row middle width.

After severe hedging or topping, heavy nitrogen applications will produce vigorous vegetative regrowth at the expense of fruit production. Therefore, nitrogen applications should be adjusted to the severity of hedging and/or topping. Reducing or omitting a nitrogen application before and possibly after heavy hedging will reduce both costs and excessive vegetative regrowth. Light maintenance hedging should not affect fertilizer requirements.

Large crops tend to deplete carbohydrates and results in a reduced fruit yield 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 and Murcott production.

Severe hedging may create problems of brush disposal and 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 canopy area. The larger the wood that is cut, the 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 late maturing varieties. Most growers prefer to hedge before bloom, but trees will get more vegetative regrowth, which may not be desirable. Pruning could begin as early as November prior to harvesting in warmer areas. During this period, conducted pruning operations should only cut minimal foliage and fruit from the trees.

Valencia trees may be hedged in 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 to severe pruning should not continue into the winter in freeze-prone areas, as trees with tender regrowth are susceptible to cold injury.

With citrus canker and greening diseases, 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 leafminers and psyllids and aggravate the spread of citrus canker and greening. Declining trees with defoliated tops, dieback, reduced cropping, and severe root loss due to citrus greening are being hedged and topped to help balance the shoot to root ratio to improve tree performance and extend tree longevity.

WEED MANAGEMENT

Weeds can reduce the growth, health and survival of young trees, or the time to come into bearing and ultimately fruit production. The more competitive the weeds, the more adversely they alter tree physiology, growth, fruit yield and quality. The attainment of early crop production requires controlling the growth of weeds. Weeds alter economic status by competing with trees, particularly young trees, for water, nutrients and even light in the case of climbing vines, which can easily cover trees if left uncontrolled.

Weeds also have various effects on tree performance including reduced efficacy of low volume irrigation systems, and interception of soil-applied pesticides.

Management Methods

Cultural & mechanical

Cultural methods include off-target irrigation and fertilizer applications. Mechanical methods include cultivation in row middles. However, **constant cultivation results in the destruction of citrus fibrous roots, which normally would grow in the undisturbed portion of the soil.**

Mowing is practiced between the tree rows and away from the trees in combination with herbicide applications in the tree row over the major root zone of trees. It is appropriate where a cover crop is desired in bedded groves to prevent soil erosion. Weeds can also be spread by seed and vegetatively during mowing operations, reinfesting tree rows where herbicides have been applied. **Mowing before seedhead formation is necessary to reduce seed dissemination and reinfestation.**

Chemical mowing

Chemical mowing, utilizing Low Rate Technology (LRT) postemergence herbicide spray applications and wiping in combination with mechanical mowing, is used for the suppression of vegetation in row middles. With the high frequency and cost of mechanical mowing required to maintain vegetation control in row middles, chemical mowing and wiping with low rates of glyphosate has increased. Weed management in Middles by chemical applications results in the elimination of tall growing species and establishment of more manageable sod type species such as Bermuda and Bahia grasses.

Chemical

Generally speaking, all weed species listed as susceptible on the herbicide product label will be controlled by that herbicide at the appropriate rate, time of application and stage of growth. Environmental and plant conditions before, during and following the application are also important including moisture in the form of rainfall and/or irrigation.

Poor control can sometimes be expected from postemergence applications to weeds under stress conditions due to poor uptake and translocation of applied herbicides. Assuming that the appropriate herbicide or herbicide mixtures are selected for the weed species present, failures in the program will usually be due to one of the above factors or to the actual application including calibration and/or equipment design and operation.

Herbicides may be classified as foliar or soil-applied. Foliar applied materials may have systemic or contact activity. Soil applied preemergence herbicides are absorbed through weed root systems, being most effective during germination and early seedling growth stages. Systemic herbicides are those that are absorbed by either roots or aboveground plant parts and are translocated throughout the plant. Contact herbicides act as desiccants, damaging or killing all plant parts actually sprayed with little if any translocation.

For the control of well-established perennial weeds, a postemergence herbicide with systemic metabolic activity should be used with preemergence soil residual products.

Timing and frequency of application are the keys to good vegetation management. **Increased application frequency of lower rates of soil residual herbicides is more effective in young groves where vegetation presence is greater due to more exposure of the grove floor to sunlight and where a greater herbicide safety factor is required**.

Application Technology

Rapid advances in herbicide application technology have resulted in the development of sophisticated equipment. Application equipment is now capable of selective delivery of multiple herbicide products, each directly injected into booms. In a single application, tree rows and row middles may be treated with soil residual and postemergence products with selectivity for tree age, soil type and vegetation species.

Well-maintained, accurately calibrated equipment with good filtration and agitation systems capable of uniform distribution of prescribed spray volumes and droplet size is essential for efficiency, cost-effective vegetation management. Worn nozzle tips result in increased spray delivery rates and distortion of distribution patterns and should be checked regularly. Improved herbicide boom design to reduce tree skirt contact, spray drift and interference of heavy weed cover with nozzle output will reduce tree damage and fruit drop while improving control of target vegetation. Tree skirt pruning and timing of postemergence applications will also reduce boom and spray contact with low hanging limbs and fruit.

Environmental Considerations

In determining management options, herbicide selection should be based not only on species and stage of vegetation development, but product solubility and leaching potential, soil type and rainfall distribution. Objectives are to reduce weed competition and interference through measured vegetation control/suppression with inputs having reduced potential for leaching through over-irrigation, runoff and erosion, chemical drift, or other off-target impacts. CAUTION: Herbicides may move through the soil to groundwater. Several factors influence the rate of this movement. Lower rates applied more frequently combined with sound irrigation management practices will reduce herbicide movement. **The use of bromacil-containing herbicides is prohibited on deep, sandy Ridge-type soils**. For more information and for the list of herbicides registered for citrus in Florida, go to:
http://www.crec.ifas.ufl.edu/extension/pest/PDF/2016/Weeds.pdf

High Bicarbonates in Irrigation Waters

Bicarbonate (HCO_3) hazard of irrigation water (meq/L)			
	None	Slight to Moderate	Severe
(meq/L)	<1.5	1.5-7.5	>7.5

Some practices to solve problem of carbonates and bicarbonates in irrigation water
- Injection of sulfuric acid to dissociate the bicarbonate ions (pH around 6.2) giving off carbon dioxide. It allows the calcium and magnesium to stay in solution in relation with the sodium content.
- Add gypsum when soils have low free calcium plus leaching
- Add sulfur to soils with high lime content plus leaching

Potential Bicarbonate Hazard (ppm HCO_3)

None/slight	Moderate	Severe	Very Severe
0-120	121-180	181-600	>600

What can I do to minimize the adverse effects of high-bicarbonate water?
Apply acids or acid-forming materials to the soil to counteract the bases applied in the water. Neutralize the liming effect of the water by adding acid to the water before it is applied to the crop.

What are the dangers of using acids for water neutralization?
Hydrochloric, sulfuric and phosphoric acids are highly toxic materials irritating to the skin, eyes, nose, throat, lungs, and digestive tract. Always wear goggles and chemical resistant (rubber, neoprene, vinyl, etc.) gloves, apron and boots whenever handling these acids. Acid must be poured into water, never vice versa, and should be done in a well-ventilated area.
--Determine the proper amount of acid to apply.
--Monitor the irrigation system to ensure that the correct amount is applied.

How can I assure that I'm adding the correct amount of acid to my water?
Monitoring the pH of the acid-treated water is one way of checking on a daily operational basis. You can do this with a pH meter or with pH papers (both methods require some experience to give reliable results). Add acid to bring the water pH to 5.0. Because the neutralization reaction continues slowly over a period of a day or two, the measured pH of the water immediately after acid addition will usually be lower than that measured once the reaction is complete. (**See previous issue of this Flatwoods Citrus newsletter**)

Lake Okeechobee Operations
Goals, roles and responsibilities

The U.S. Army Corps of Engineers manages Lake Okeechobee water levels with the goal of balancing flood control, public safety, navigation, water supply and ecological health. The Corps bases operational decisions — whether to retain or release water in the 730-square-mile lake — on its regulation schedule and the best available science and data provided by its staff and a variety of partners, including the South Florida Water Management District (SFWMD).

Goals for Lake Management

- Providing public safety through flood protection for 8.1 million residents — including safeguarding the Herbert Hoover Dike during its rehabilitation.
- Maintaining water supply for residents, businesses, agriculture and the environment.
- Sustaining seagrasses and aquatic vegetation that serve as critical habitat for a variety of fish, shellfish, birds and mammals, including those that drive Florida's tourism industry.
- Achieving salinity levels in the St. Lucie and Caloosahatchee estuaries that provide a healthy ecosystem for spawning fish and invertebrates.
- Fostering foraging and nesting success for wading birds and protecting endangered, threatened and native species such as the Everglade snail kite and the wood stork.
- Managing the lake level to best balance all of these goals.

U.S. Army Corps of Engineers Responsibilities

- Making ultimate decision to retain or release water.
- Managing the lake between 12.5 and 15.5 feet throughout the year.
- Adhering to the Lake Okeechobee regulation schedule, which was re-evaluated and updated in 2008.
    - This guidance prescribes low-volume releases to the St. Lucie and Caloosahatchee estuaries to keep lake levels within the desired range.
    - The 2008 update reduces the frequency of larger releases that have greater impact on receiving water bodies.
- Monitoring the upper basin north of Lake Okeechobee, lake inflows and the integrity of the Herbert Hoover Dike to protect local communities.
- Participating in weekly conference calls with partners — such as the SFWMD and local governments — to collect information and discuss variables such as rainfall, health of aquatic vegetation and wildlife and a variety of related data.

SFWMD Science and Engineering Role

- Providing unique expertise and data for assessing ecological health of lake, St. Lucie and Caloosahatchee estuaries and surrounding ecosystems.
- Supplying rainfall forecasts and climate outlooks from staff meteorologists and a staff climatologist, along with analysis of rainfall data from an expansive rain gauge network.
- Providing knowledge exchange between SFWMD scientists and water managers at the Corps.
- Assuring water supply to legal, permitted users from Lake Okeechobee under the authority of the State of Florida, through the SFWMD.

Flatwoods Citrus

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Racial-Ethnic Background

__American Indian or native Alaskan
__Asian American
__Hispanic
__White, non-Hispanic
__Black, non-Hispanic

Gender

__Female __Male