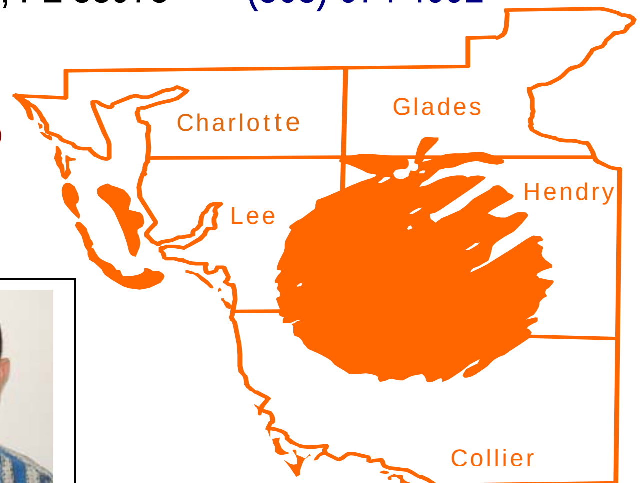
UNIVERSITY of FLORIDA
IFAS Extension

EXTENSION

Institute of Food and Agricultural Sciences

Hendry County Extension, P.O. Box 68, LaBelle, FL 33975 (863) 674 4092

Flatwoods Citrus



Vol. 16, No. 6 **June 2013**

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

Table of Contents

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/

I M P O R T A N T   E V E N T S

SEMINAR

Leafminer, Psyllid, and Weed, Phytophthora, and canker managements

Program Coordinator: Dr. Mongi Zekri, UF-IFAS Extension
Program Sponsor: Stacey Howell with Bayer
Date: Tuesday, June 25th, 2013, Time: **10:00 AM** – 12:00 Noon
Location: UF-IFAS Southwest Florida Research and Education Center, 2685 SR 29, Immokalee, FL 34142, See **http://www.imok.ufl.edu/** for directions

Agenda

1. Summer and fall management of leafminer and psyllid in mature citrus groves **- Dr. Phil Stansly, UF-IFAS**
2. Weed control programs for citrus groves **- Dr. Megh Singh, UF-IFAS**
3. Phytophthora and canker management **- Dr. Jim Graham, UF-IFAS**

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

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

SEMINAR

Brown rot, citrus black spot, and breeding for HLB resistance

Date: Tuesday, August 6th, 2013, Time: **10:00 AM** – 12:00 Noon
Location: Southwest Florida REC (Immokalee)

1. Brown rot and citrus black spot (CBS) management **- Dr. Megan Dewdney, UF-IFAS**
2. Practical control strategies for CBS **– Paul Meador, Everglades Harvesting**
3. Breeding citrus for HLB resistance **- Dr. Jude Grosser, UF-IFAS**

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

Presentations from 2013 Florida Citrus Growers' Institute

The 2013 Institute held on April 2 in Avon Park drew over 300 growers to the South Florida State College campus. For those of you who attended and those who could not make it, video recordings were made of the presentations and most of them are posted on the Citrus Agents Website.
http://citrusagents.ifas.ufl.edu/events/GrowersInstitute2013/GrowersInstitute2013.htm

Special Thanks to sponsors of the "Flatwoods Citrus" newsletter for their generous contribution and support. If you would like to be among them, please contact me at 863 674 4092 or maz@ufl.edu

Jack Kilgore, II
Regional Representative
Florida and South Georgia

Natural Industries, Inc.

Cell	239-707-7677
Nextel	158*17*24422
Fax	239-481-3498

g8trmanjek@comcast.net

www.naturalindustries.com
Natural Industries, Inc.
6223 Theall Rd
Houston TX 77066
Tel 888-261-4731
Fax 281-580-4163

Office Address:
7150 E. Brentwood Road
Ft. Meyers, FL 33919

Donald Allen
AGLIME SALES, INC.
1375 Thornburg Road
Babson Park, FL 33827-9549
Mobile: 863 287 2925
Agnet # 52925
donald.allen@aglimesales.com

Nufarm Agriculture USA
Craig Noll
Office-239 549 2494
Mobile-239 691 8060
craig.noll@us.nufarm.com
Gary Simmons
Phone: 772 260 1058

MONSANTO
Jack Conroy
Phone: 863 318 1486
Fax: 886 318 8617
Mobile: 863 559 4468
Andrew.j.conroy@monsanto.com

Jeff Summersill
THOMAS R. SUMMERSILL, INC.
Custom Aerial
Ground Application
Mobile 561-722-4502, Agnet # 33169
trsummersill@msn.com

Chemtura AgroSolutions
Jay Hallaron
Phone: 407 256 4667
Fax: 407 523 1097
Cell: 321 231 2277
jay.hallaron@chemtura.com

Stacey Howell
***BAYER* CropScience**
239-272-8575 (mobile)
239-353-6491 (office/fax)

stacey.howell@bayercropscience.com

FMC
FMC Corporation APG
Ronald Palumbo
Cell: 305 304-7491
Nextel Agnet: 14772
ronald.palumbo@fmc.com
fmccrop.com

Special Thanks to sponsors of the "Flatwoods Citrus" newsletter for their generous contribution and support. If you would like to be among them, please contact me at 863 674 4092 or maz@ufl.edu

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).

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.

Post-Hurricane Recovery Checklist

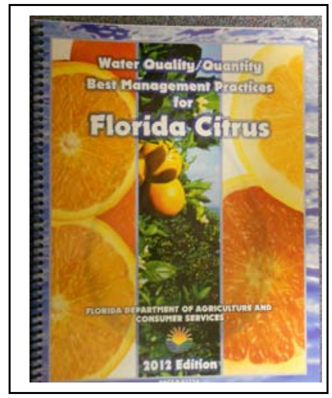
Damage inspection:
Make a visual assessment of the damage and determine priorities and equipment needed.
Prioritize Damage:
A priority plan can quickly determine where and how to begin recovery operations.
Employee call-in:
When safe, call in those needed for damage inspection and grove recovery work.
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.

HLB ESCAPE TREES

To accelerate citrus gene discovery for HLB tolerance/resistance, UF-IFAS Citrus Researchers and Extension Agents are working closely with the citrus industry. They would like to know about trees that appear to be doing better than their cohorts in groves declining from HLB. We need your help in reporting to us about escape trees or potential survivor trees in your groves. Please contact Mongi Zekri (maz@ufl.edu or 863 674 4092) or any other citrus extension agent to determine if your trees meet this research criterion.



Department adopts new statewide citrus manual

The Florida Department of Agriculture and Consumer services (FDOACS) adopted a new statewide citrus BMP manual, *Water Quality/Quantity Best Management Practices for Florida Citrus*, on Jan. 9. This new manual incorporates the four region-based citrus programs: Ridge Citrus, Indian River Citrus, Gulf Citrus and the Peace River/Manasota basins. All citrus operations that enroll in department BMPs as of Jan. 9 must submit a Notice of Intent (NOI) under the new statewide manual.

Over the past month, growers representing about 10,000 acres have enrolled or re-enrolled under the new statewide citrus manual. Benefits of participation include a presumption of compliance with state water quality standards, a release from fines or damages related to pollutants addressed by BMPs, and eligibility for BMP implementation cost-share funds.

Ridge Citrus Growers

Growers now participating in the Ridge Citrus BMP have until Jan. 8, 2015, to enroll in the statewide manual and implement applicable BMPs, in order to maintain their presumption of compliance with state water quality standards. Notices of Intent to implement BMPs submitted under the previous Ridge Citrus rule will be invalid after this 2-year period.

David “Bo” Griffin is leading the effort to reenroll Ridge Citrus growers in the new statewide manual, and can be contacted at (863) 402-7020 or David.Griffin@FreshFromFlorida.com. Growers also may contact Susie Bishop at sbishop@highlandsswcd.org. Please contact Bo or Susie for Ridge Citrus reenrollment or first-time enrollment soon to take advantage of cost-share opportunities.

Flatwoods Citrus Growers

Growers currently enrolled under one of the three region-based Flatwoods Citrus Manuals (Indian River, Gulf and Peace River/Manasota) are grandfathered under the new rule.

However, growers must continue to implement the applicable BMPs and must follow guidelines in Nutrition of Florida Citrus Trees, Second Edition, UF/IFAS Publication SL253 from January 2008, that are relevant to their operations.
Flatwoods Citrus growers who are re-establishing or renovating groves already enrolled under a region-based manual must contact the department for assistance in submitting an NOI under the new statewide manual at (850) 617-1727 or AgBMPHelp@FreshFromFlorida.com.

In the Gulf region, to get more information, to enroll, and/or to get a hard copy of the citrus BMP manual, contact Callie Walker, Office of Agricultural Water Policy, Florida Department of Agriculture & Consumer Services, 483 E. Cowboy Way, LaBelle, FL 33935, Phone: 863-674-4160, Fax: 863-674-4161, Callie.Walker@FreshFromFlorida.com or Mongi Zekri at 863 674 4092, maz@ufl.edu

MOBILE IRRIGATION LAB

The Agricultural MIL is a FREE service that serves Florida. For an Agricultural MIL evaluation in Southwest Florida call (239) 455-4100

Assisting the agricultural community by improving irrigation efficiency and conserving water.

The Mobile Irrigation Lab program is an ongoing joint effort between the District, the U.S. Department of Agriculture–Natural Resources Conservation Service (USDA–NRCS) and the agricultural community. The program began in 1987 to assist the District in meeting its statutory responsibilities and to assist growers with water conservation.

The Mobile Irrigation Lab is a free volunteer service to the agricultural community. Any grower can contact the District to arrange a free evaluation. It was expanded to help growers meet water use permit conditions. District staff has used high pumpage reports to identify users who might wish to voluntarily reduce water use before a resource problem or permit violation occurs.

A trained technician is invited to a grower's field and collects irrigation system and specific field data. System pressure and irrigation uniformity data are then reviewed and computer-analyzed. A report provides recommendations for improvements and irrigation schedules. If needed, the technician assists the local NRCS office in the redesign of the system.

An irrigation schedule offers a general guide to determine when and how much to irrigate based on system efficiency, crop requirements and soil characteristics.

In addition to the benefits of free irrigation evaluations, water conservation and water quality improvements, the program shares valuable technology and information with growers.

Mobile Irrigation Lab data suggests that most evaluated systems are already at or above permitted efficiency standards. With only minor improvements, about half the sites below these standards could easily meet them. Typically, if all recommendations are implemented, overall system irrigation efficiency can improve by an estimated 17 percent — helpful to any grower's bottom line, as well as the region's water resources.

ACIDIFICATION TO REMOVE MINERAL DEPOSITS IN IRRIGATION SYSTEMS

Acid Injection

Mineral precipitates can form deposits (scale) that clog emitters. The most common deposits are calcium or magnesium carbonates and iron oxides. Since precipitation occurs more readily in water with a high pH (above 7.0), precipitation of these compounds can be prevented by continuous injection (whenever the system is operating) of a small amount of acid to maintain water pH just below 7.0. A more popular control method is to remove deposits as they are formed by periodic injection of a greater volume of acid. Enough acid should be injected continuously for 45 to 60 minutes to reduce the water pH to 4.0 or 5.0.

Phosphoric acid (which also supplies phosphate to the root zone), sulfuric acid, or hydrochloric acids are commonly used. The selection of a specific acid depends on cost and availability, water quality, the severity of clogging, and nutrient needs of the crop. The amount of acid required to treat a system depends on (1) the strength of the acid being used, (2) the buffering capacity of the irrigation water and (3) the pH (of the irrigation water) needed to dissolve mineral precipitates in lines and emitters. The required pH of the irrigation water (target pH) depends on the severity of mineral deposits. Experience is helpful when estimating target pH.

To determine the volume of a selected acid needed at a specific site, estimate the target pH and run a "titration" test (as described below) using the selected acid and irrigation water from the site. This test will indicate the volume of acid required to lower the pH of a selected volume of water to the target pH. Titration provides an acid volume:water volume ratio that can be used in conjunction with the system flow rate to determine the appropriate acid injection rate. The acid injection rate is determined by dividing the volume of water by the flow rate of the irrigation system and multiplying the result by the volume of acid added to reach the target pH.

Titration

A water container, a non-corrosive measuring cup, beaker or pipette calibrated in small increments such as milliliters, and a portable pH meter are needed to run the titration test. The volume of the container may be as small as 10 liters (about 3 gallons) or as large as 55 gallons. In general, the smaller the increments used when measuring and dispensing the acid into water, the smaller the required container.

To run the titration test, put a known volume of water (from the site) into the container and check the pH. Add a small amount of acid (1-3 ml for 3 gallons, 4-8 ml for 30 or more gallons) to the water, stir and re-check the pH. Continue this process until the target pH is attained. As the acidity of the water gets near to the target pH, add acid in very small increments (1 ml) so that the pH does not quickly drop below the target pH and necessitate repeating the test. **Always add acid to water.**

Caution: Never add water to acid.

The following example illustrates how to determine the required volume of acid and the appropriate acid injection rate.

Example: For a system with a flow rate of 200 gal/min.
Based on the severity of mineral deposits in the system, a target pH of 4.5 and an injection period of one hour are selected.
--Put 50 gallons of water into a 55-gal drum. Check the pH. Meter indicates pH of 7.4.
--Add 8 ml phosphoric acid. Check the pH. Meter indicates pH of 6.9.
--Add 7 more ml phosphoric acid. Check the pH. Meter indicates pH of 6.0.
--Add 4 more ml phosphoric acid. Check the pH. Meter indicates pH of 5.3.
--Add 1 more ml phosphoric acid. Check the pH. Meter indicates target pH of 4.5.
20 ml (8+7+4+1) of phosphoric acid were required to lower the pH of 50 gal of water to the target pH of 4.5.
--Divide 50 gal by the system flow rate of 200 gal/minute and multiply the result by the ml of phosphoric acid required to reach the target pH. 200 gal divided by 50 gal = 4 x 20 ml = 80 ml phosphoric acid. Therefore, the required acid injection rate is 80 ml per minute.
--Multiply 80 ml per minute by the injection time to determine the required volume of acid needed during the 1-hour injection period. 80 ml x 60 min = 4,800 ml (approximately 1.3 gal/hr, since there are 3785 ml in 1 gallon)

Note: Acid injection rates are usually very low (ml/hour or oz/hour). Although injection pumps with low flow rates may be suitable for acid injection, they may not have enough capacity for injecting fertilizers.

After the desired amount of acid has been injected and distributed throughout the irrigation system, turn the system off and let the low pH water remain in the lines for several hours, preferably overnight. This allows sufficient reaction time for the acidified water to dissolve mineral precipitates. After the setting period, flush the lines to remove dislodged and solubilized materials. To flush the lines, bring the system to full charge by running the irrigation pump (injection pump off) until the system reaches normal operating pressure. With the irrigation pump running, begin sequentially opening the ends of the PVC lines and emitter lines to flush the system. To ensure proper flushing, do not open so many lines at one time that system pressure drops below normal levels. If too many lines are opened at one time, the pressure drops too low and the system will not flush adequately. Improperly flushed lines after acidification will likely result in severe clogging problems. Keep in mind that routinely flushing lines with non-acidified irrigation water will also help remove mineral precipitates from the system.

CHLORINATION TO CONTROL ALGAE AND BACTERIA IN IRRIGATION SYSTEMS

Chlorine Injection Interval

Chlorine injection will prevent clogging of lines and emitters by algae and bacterial slime. Continuous injection of small amounts of chlorine can keep algae and bacterial slime under control. However, periodic injection of larger amounts of chlorine is the preferred treatment for controlling algae and bacteria in microirrigation systems. You do not need to inject chlorine if you are using municipal water that is already chlorinated. However, if your irrigation water has not been chlorinated, you should be prepared to inject chlorine as needed. If water quality is extremely poor, it may be necessary to chlorinate at the end of each irrigation cycle. Experience is helpful when determining the appropriate intervals between chlorine injections.

Recommended Chlorine Formulations

Liquid sodium hypochlorite (NaOCl) is the easiest form of chlorine to handle and is the type most often used for treatment of microirrigation systems. It is readily available in supermarkets and other stores as common household bleach (5.25% chlorine). Liquid chlorine is also available from some swimming pool companies as a 10% chlorine solution. Caution: Powdered calcium hypochlorite $Ca(OCl_2)$, also called High Test Hypochlorite (H.T.H.) is a dry powder commonly used in swimming pools. This material is not recommended for injection into microirrigation systems. When mixed with water (especially at high pH), the calcium contained in H.T.H. can form precipitates.

Initial Chlorine Injection Rate

As chlorine is injected, some of it reacts with bacteria (as it destroys the bacteria) and other forms of organic matter in the irrigation lines. This "reacted" chlorine is chemically bound or "tied up" and is no longer antibacterial. Chlorine that has not reacted remains as "free residual chlorine." Only this free chlorine is available to destroy bacteria and to continue treatment of the system. For chlorination to be effective, you should maintain 1 to 2 ppm free chlorine in the system for 30 to 60 minutes. Usually, an initial concentration of 5 to 6 ppm is required in order to maintain 1 to 2 ppm free chlorine. Samples for determining the initial chlorine concentration should be taken near the point of injection. However, samples should be taken far enough past the point of injection that the chlorine is uniformly mixed in the irrigation water.

The following equation can be used to calculate the injection rate.

Injection rate (gal/hr) = 0.03 x GPM divided by % chlorine.

Example: The desired initial chlorine concentration in irrigation water just past the point of injection is 5 ppm. Assume a drip irrigation system with a total flow rate of 100 gallons per minute (gpm) and that common chlorine bleach (5.25% chlorine) will be injected.

Injection rate (gal/hr) = 0.03 x GPM divided by %chlorine
= 0.03 x 100 divided by 5.25
= 0.57 gal/hr

The chlorine solution must be in contact with algae and bacteria for at least 30 minutes to successfully treat the drip irrigation system. To ensure that all parts of the system receive a minimum of 30 minutes' contact time, inject chlorine for one hour.

For convenience, the injection rates (gal/hr and oz/hr) required to give an initial concentration of 5 ppm chlorine have been calculated for selected flow rates in the following Table.

	5.25% Chlorine Solution		10% Chlorine Solution	
Water Flow (gpm)	gal/hr	oz/hr	gal/hr	oz/hr
10	0.06	7.7	0.03	3.8
20	0.11	14.1	0.06	7.7
30	0.17	21.8	0.09	11.5
40	0.23	29.4	0.12	15.4
50	0.29	37.1	0.15	19.2
75	0.43	55.0	0.22	28.2
100	0.57	73.0	0.30	38.4
150	0.86	110.1	0.45	57.6
200	1.14	145.9	0.60	76.8
250	1.43	183.0	0.75	96.0
300	1.71	218.9	0.90	115.2
350	2.00	256.0	1.05	134.4
400	2.29	293.0	1.20	153.6

Maintaining Free Residual Chlorine Concentration

During chlorination, maintain 1 to 2 ppm free chlorine at the point in the system where the concentration is lowest (usually at the point farthest from injection). If the irrigation water has a pH of 7.5 or less, 1 ppm free chlorine may be sufficient. However, for alkaline water with a pH above 7.5, maintain 2 ppm. Chlorination for bacterial control may be ineffective above pH 7.5. Therefore, it is recommended to inject acid to lower the pH to increase the efficacy of chlorine. The free chlorine concentration drops as the chlorine reacts with organic matter in the lines. Therefore, to maintain 1 to 2 ppm free chlorine in the lines farthest from injection, it is often necessary to maintain a concentration of 5 to 6 ppm free chlorine near the point of injection. The specific concentration necessary (near the point of injection in a given zone) depends on water quality and the quantity of bacteria, algae and other organic matter in the lines. Maintain the recommended free chlorine concentration at the most distant emitter for 60 minutes. This requires frequent testing of the free chlorine concentration and subsequent adjusting of the chlorine injection rate if needed.

To ensure that the free chlorine concentration is maintained at 1 to 2 ppm, measure free chlorine concentration at the emitter most distant from the injection point 10 to 20 minutes after injection is initiated. This can be done by using a D.P.D. (N,N Diethyl-P-Phenylenediamine) test kit, which measures only free residual chlorine. These test kits are available from chemical suppliers and from most irrigation dealers. Caution: The orthotolidine type test kit, often used for swimming pools, measures total chlorine content (not free residual chlorine) and, therefore, cannot be used satisfactorily for microirrigation systems.

In cases where the injection pump cannot be calibrated low enough to inject 5.25 percent or 10 percent liquid chlorine at the desired rate, dilute the chlorine solution prior to injection. This permits the use of a higher injection rate within the capacity of the injector pump.

Example: Assume you need to inject 1 gallon of 5.25 percent chlorine into your drip system during a one-hour injection period. If your injection pump can inject no less than 2 gallons per hour, add 1 gallons of water to the 5.25 percent chlorine to give a total chlorine solution of 2 gallons. Then set the injector pump to inject 2 gallons per hour.

HEDGING AND TOPPING CITRUS TREES

Hedging and topping is an 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, 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 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 to 14 ft at the shoulder and 15 to 16 ft 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 results 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 and Murcott 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 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 to severe pruning should not continue into the winter 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 information on pruning, go to http://edis.ifas.ufl.edu/HS290

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.

WATER TABLE MEASUREMENT AND MONITORING

Most flatwoods citrus soils have a restrictive layer that can perch the water table and significantly affect tree water relations. To optimize production and tree health, the level of this water table should be monitored and maintained within an optimal zone. Simple and practical observation wells can normally produce adequate information.

Water Table Behavior. The water table under flatwoods citrus may rise rapidly in response to either rainfall or irrigation because sandy soils are highly conductive to water flow. A general rule of thumb is that 1 inch of rain will cause the water table to rise about 10 inches in fine textured soils, 6 inches in most of the flatwoods sandy soils, and 4 inches in coarse sands. It may take 4 to 6 days for the water table to return to its desired levels following rains of 1 inch or more.

Observation Wells. A water table observation well is made with a porous casing buried vertically in the ground. It permits the groundwater level to rise and fall inside it as the water level in the adjacent soils. Observation wells with a simple float indicator can provide rapid evaluation of shallow water table depths. The float and indicator level move with the water table, allowing an above-ground indication of the water level. Water table observation wells installed in flatwoods soils usually penetrate only to the depth of the restrictive (argillic or spodic) layer. Typically this layer is within 30 to 48 inches of the soil surface.

Well Construction. The basic components of the well itself include a short section of 3-inch perforated PVC pipe (3-5 ft long), 3-inch PVC cap, screening material, a float, indicator rod, and small stopper.

The indicator rod can be a dowel, ½ -inch PVC pipe (thin wall) or microsprinkler extension stake. Dowels are a poor choice since they require painting and will rot out near the float within a few years. The float is typically a 2½- inch fishing net float or a 500 ml (approximately 2½ in. diameter x 6 in. high) polyethylene bottle with a 28-mm (1.1 in.) screw cap size. The float assembly can be constructed by inserting the microsprinkler extension stake into the fishing float or ½-inch pipe into the polyethylene bottle.

The bottle neck provides a snug fit for the stake and no sealant is required. The hole in the cap should be drilled slightly larger than the indicator stake to serve as a guide for the float assembly. Fittings should not be glued so that components can be easily disassembled for cleaning or replacement.

Observation well casings are constructed from 3-in. diameter PVC pipe (Class 160). A circular saw or drill can be used to perforate the pipe prior to installation. Perforations should be staggered in rows around the pipe to allow flow into the well from the sides in addition to the bottom. Perforations totaling about 5% of the well's surface area are adequate for sandy soils encountered in the flatwoods. No perforations should be made within 12 inches of the surface in order to minimize the chances of ponded water from high intensity storms creating flow channels into perforations near the soil surface.

The pipe should be wrapped (sides and bottom) with a screening material to prevent soil particles from moving into the well. Materials such as cheesecloth, polyester drain fabric, and fiberglass screen have been used successfully as filters. The filter material should be taped in place with duct tape. A 3-inch soil auger can be used to bore holes for the wells. When possible, the observation wells should be installed when no water table is present in order to minimize chances of the well sides sloughing into the bore as it is dug.

When a water table is present, it is easiest to install the well by starting off with a larger diameter pipe. For a 3-inch observation well, a 4-inch installation pipe (Sch 40 preferred) will be needed. The installation pipe should be cut at least 6 inches longer than the intended depth of well. Holes (½-inch diameter) should be drilled in the sides of the pipe opposite each other about 1½ inches from the top of the pipe. These will be used to aid in removing the pipe from the soil after the observation well is installed. Auger a hole in the soil until it begins to slough in (when the water table is reached). The 4-inch pipe should then be forced into the hole. A 3-inch auger can then be used to remove soil from within the 4-inch casing. As soil is removed, the casing needs to be forced downward to keep the hole from sloughing. Continue to remove soil from inside the casing until the appropriate depth is achieved (typically when hardpan material begins to be excavated).

The well casing pipe should be cut to length and installed in the hole so that it extends 2 to 6 inches above the soil surface. Care should be taken to ensure that the casing is installed plumb to minimize binding of the float assembly. If a 4-inch installation pipe was used to excavate the hole, it needs to be removed. A ½-inch rod can be inserted through the holes that were drilled in the top of the 4-inch pipe. If the pipe cannot be removed easily by hand, a chain can be attached to the rod and attached to a high-lift jack. Usually, after jacking the installation pipe up about a foot, the pipe can be easily removed by hand. The soil should be backfilled around the observation well casing and tamped to compact the soil and get a tight fit between the soil and the sides of the pipe.

A measurement should be taken of the distance from the bottom of the well to the soil surface. The float assembly can then be lowered into the well. Make sure that the indicator rod and float do not bind against the sides of the observation well. The well is now ready for calibration.

Calibration. A mark on the indicator stake or rod should be made at the top of the well when the float is at the bottom of the well. This level is the reference mark for the well depth. The indicator stake or rod can then be marked with major divisions (feet) and minor divisions (inches) for easy reading of the water table depth. These rings can be painted at appropriate intervals using different colors for major and minor divisions. Marks painted at 2-inch increments provide enough accuracy for most users.

The mark at the upper level is dependent on the depth of the water furrow and root depth. The upper depth should be selected so that water does not pond in water furrows and it should be at least 6 inches below the bottom of the root zone to prevent root pruning. Observations over time will help to determine the water table level depth that will prevent root damage or excessive wetness in the root zone.

Flatwoods Citrus

☐ If you did not receive the ***Flatwoods Citrus*** newsletter and would like to be on our mailing list, please check this box and complete the information requested below.

☐ If you wish to be removed from our mailing list, please check this box and complete the information requested below.

Please send: Dr. Mongi Zekri
Multi-County Citrus Agent
Hendry County Extension Office
P.O. Box 68
LaBelle, FL 33975

Subscriber's Name:____

Company:____

Address:____

City:______________________State:___________Zip:__________

Phone:__________________________

Fax:____________________________

E-mail:____

Racial-Ethnic Background

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

Gender

__Female

__Male