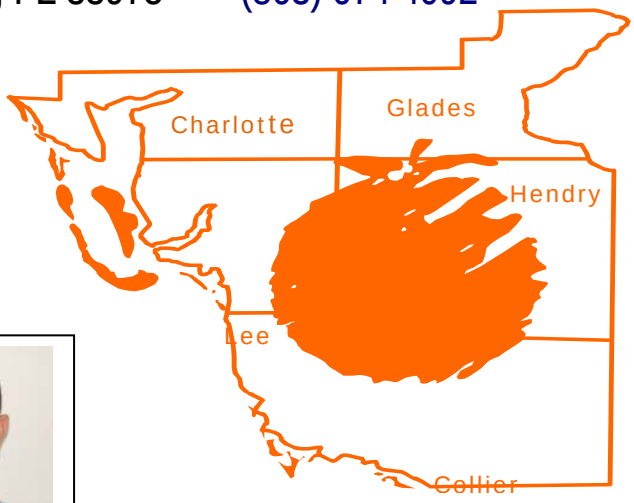
UF UNIVERSITY of FLORIDA
IFAS Extension

EXTENSION

Institute of Food and Agricultural Sciences

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

Flatwoods Citrus



Vol. 20, No. 3 **March 2017**

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/

CRDF Soil Microbial Amendment and Rootstocks Field Day at DUDA, LaBelle Wednesday, March 22, 2017, 9:30 AM

This Soil Amendment experiment, which is replicated in two other sites in Florida, was established in 2014 on 11 year-old Valencia/Swingle trees (maintained by Duda Inc.) to evaluate the ability of 5 soil microbe amendment products to promote tree health in the presence of HLB. The 5 soil amendments:

- Serenade Soil (Bayer CropScience)
- Aliette (Bayer CropScience)
- Quantum product line (AE Microbiology)
- BioFlourish (Triangle Chemical)
- Ecofriendly Products Citrus Soil Amendment

have been applied at recommended rates in replicated plots (by KAC Ag Research) over the past three seasons and data have been collected on tree growth, bacterial titer, and fruit productivity. Horticultural performance will be discussed and maps provided.

The CRDF Rootstock site is a large replicated, 2 year old trial of Valencia on 6 candidate HLB-tolerant rootstocks compared to standard trees on Swingle. Horticultural performance will be discussed and maps provided.

A CRDF sponsored lunch will follow.

RSVP

Please RSVP by Friday 17 March to Mongi Zekri , UF/IFAS Multi-County Extension Agent,
e-mail: maz@ufl.edu
Phone: (863) 674 4092
for a head count.

CRDF Citrus Research and Development Foundation, Inc.

Field Day Site

Duda Grove Entrance
Gate 4 – 12250 SR 29
Felda, FL
13 mi south of Labelle, FL

UF IFAS Extension UNIVERSITY of FLORIDA

Citrus BMPs related to water management

Date: Thursday, **March 23**, 2017, Time: **10:00 AM – 12:10 PM**
Location: Immokalee IFAS Center
Program Coordinators: Dr. Mongi Zekri, UF-IFAS
Dr. Kelly Morgan, UF-IFAS
2 CEUs for Certified Crop Advisors (CCAs), 2 CEUs for pesticide license renewal

Agenda

10:00 Irrigation scheduling, automation and BMPs - Kelly Morgan
Review of equipment and methods of crop irrigation management and their application to citrus BMPs.

10:20 Irrigation Automation - William M. Koos, Jr., President, KTS Wireless
Use of new technology in automation of irrigation systems using wireless technology including remote control from office computers or cell phones.

10:50 break

11:00 Use of Soil Moisture and salinity sensors - Andrew Lewis, High Yield Ag.
Soil moisture and salinity instruments available and use for irrigation and fertilizer management.

11:30 Example of irrigation scheduling and soil moisture sensor use - Timothy Ayankojo
Description of a smart phone ET irrigation scheduling model that uses FAWN weather data with results from a research project.

11:50 Mobile Irrigation lab, Measuring Irrigation System Efficiency - Mark Siverling,
Service available for evaluation of irrigation systems and methods of improving efficiency.

12:10 Lunch provided by KTS Wireless

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

2017 ANNUAL FLORIDA CITRUS GROWERS' INSTITUTE

Date & Time: Tuesday, 4 April 2017, 8:00 AM – 3:35 PM
Location: Avon Park Campus of South Florida Community College
Coordinators: Citrus Extension Agents, UF-IFAS
Agenda and information on registration are below.

The 27th Annual Farm Safety Day

Friday, 12 May 2017
Saturday, 13 May 2017
Immokalee IFAS Center
Information on registration and agenda will be available soon.

Safe and competent equipment operators are important to you as an employer. Our training has been designed to help your employees perform better, operate safely to prevent accidents, fulfill necessary training requirements and build pride in themselves and their farm company. Select the date convenient for you.

Certified pile burners class July 12, 2017

http://www.freshfromflorida.com/content/download/74623/2126893/Certified_Pile_Burner_Hendry_July12-2017.pdf

Pre-registration is required to attend, and class size is limited to the first 50 people.

Registration fee: $50

The $50 fee covers the training sessions, a booklet with all the presentations in color, other handouts, refreshments, and lunch.

PRE-REGISTRATION WILL NOT BE ACCEPTED WITHOUT PAYMENT OF THE REGISTRATION FEE.

Send your registration form and check as soon as possible. This class usually gets full 2-3 weeks before the event.

Location: The Immokalee IFAS Center

The Florida Division of Forestry and University of Florida Cooperative Extension Service will be conducting a Certified Pile Burners Course that will show you how to burn piles ***legally, safely and efficiently***.

Most importantly, it could save a life. If you burn piles regularly, don't put off registering for this training. When the weather is dry, certified pile burners will receive priority for authorization to burn. Also, certified pile burners are allowed to burn up to two hours longer per day and get multiple day authorizations. Don't wait. The number of trainings offered and attendance at each training is LIMITED. This training will be held from 8:00 am till 4:30 pm at the **Southwest Florida Research and Education Center in Immokalee**.

AQUATIC WEED CONTROL SHORT COURSE

MAY 8-11, 2017
Coral Springs, Florida

Hosted by: UF | IFAS Extension UNIVERSITY of FLORIDA

The 2017 Aquatic Weed Control Short Course will be held May 8-11, 2017 at the Coral Springs Marriott.

Certification Exams and CEUs

Just getting started?
Complimentary Commercial, Public, and/or Private pesticide applicator certification testing will be offered on Thursday, May 5th after the course concludes for those looking to become licensed.

Already licensed? Earn up to 22 Florida CEUs and fully re-certify your Aquatic, Natural Areas, Right-of-Way, Forestry, or Private applicator license!

The Short Course is appropriate for new and experienced applicators alike!

Registration opens in December and sponsorship opportunities will be announced soon, so be on the lookout for future announcements! Visit the website for more short course information.

This meeting is organized by the University of Florida | IFAS Office of Conferences & Institutes (OCI).

UF | IFAS UNIVERSITY of FLORIDA

OCI is a full service conference planning division dedicated to assisting groups that support the IFAS mission "to develop knowledge in agriculture, natural resources, and the environment, and to make that knowledge accessible to sustain and enhance the quality of human life." Check out the OCI website to learn more about other events that may interest you.

http://conference.ifas.ufl.edu/aw/ | Registration Questions Call: 352-392-5930
Mandy Stage | Short Course Coordinator | mstage@ufl.edu

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

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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
9 March 2017

ENSO Alert System Status: Not Active

Synopsis: ENSO-neutral conditions are favored to continue through at least the Northern Hemisphere spring 2017, with increasing chances for El Niño development into the fall.

ENSO-neutral conditions continued during February, with near-average sea surface temperatures (SSTs) across the central equatorial Pacific and above-average SSTs in the eastern Pacific (Fig. 1). The latest weekly Niño index values were near zero in the Niño-4 and Niño-3.4 regions, and +0.4 and +2.2°C farther east in the Niño-3 and Niño-1+2 regions, respectively (Fig. 2). The upper-ocean heat content anomaly increased during February and was slightly positive when averaged across the central and eastern Pacific (Fig. 3), a reflection of generally above-average temperatures at depth (Fig. 4). Atmospheric convection remained suppressed over the central tropical Pacific and enhanced over the Maritime Continent (Fig. 5). The low-level easterly winds were slightly enhanced over the western tropical Pacific and were weaker than average over the eastern Pacific. Also, upper-level westerly winds were anomalously easterly over portions of the western and eastern Pacific. Overall, the ocean and atmosphere system is consistent with ENSO-neutral conditions.

Most models predict the continuation of ENSO-neutral (3-month average Niño-3.4 index between -0.5°C and 0.5°C) through the early Northern Hemisphere summer (May-July; Fig. 6). However, some dynamical model forecasts, including the NCEP CFSv2, anticipate an onset of El Niño as soon as the late Northern Hemisphere spring (March-May 2017). Because of typically lower skill in forecasts made at this time of the year, and the lingering La Niña-like tropical convection patterns, the forecaster consensus favors ENSO-neutral during the spring (March-May) with a ~75% chance. Thereafter, there are increasing odds for El Niño toward the second half of 2017 (50-55% chance from approximately July-December). In summary, ENSO-neutral conditions are favored to continue through at least the Northern Hemisphere spring 2017, with increasing chances for El Niño development into the fall (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 13 April 2017. 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

Purpose of the Institute

Citrus Greening or Huanglongbing (HLB) continues to impact all citrus production areas of Florida. The 2017 Florida Citrus Growers' Institute is an opportunity for Florida citrus growers to come together to learn about effective management of HLB and other challenging diseases affecting the industry. Topics this year include citrus tree health, Asian citrus psyllid management, post bloom fruit drop, plant bactericides and food safety.

Continuing Education Units

Continuing Education Units (CEU's) will be offered for holders of restricted use pesticide licenses (RUP) and certified crop advisors (CCA). CEU's have been granted in the following categories: private applicator, agricultural tree crop and demonstration & research for RUP holders. CEU's have been requested for CCA's in the appropriate CEU categories.

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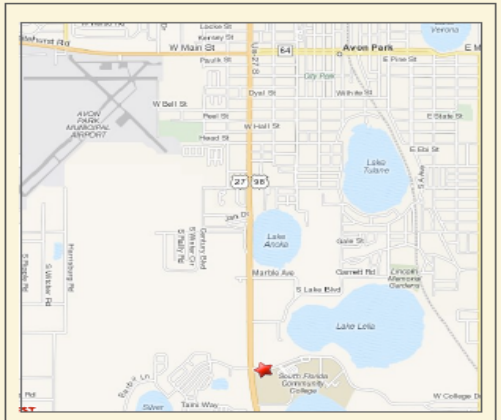


Directions

The South Florida State College is located at 600 West College Drive in Avon Park.

From the South: Take U.S. Hwy. 27/98 north towards Avon Park, turn east onto W. College Drive and follow the signs to the Theatre.

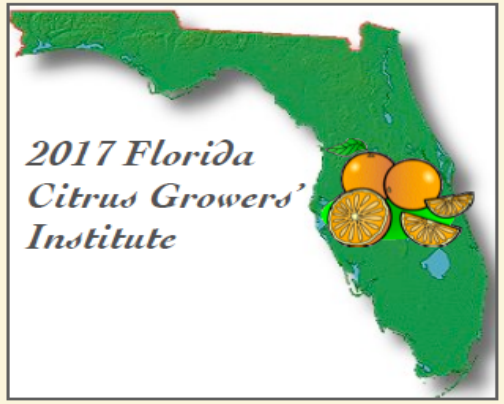
From the North: Take U.S. Hwy. 27/98 south to Avon Park, continue south to W. College Drive, turn east onto W. College Drive and follow the signs to the Theatre.

From the East: Take U.S. Hwy. 98 north to where U.S. Hwy. 27/98 merge south of Sebring. Proceed on U.S. Hwy. 27/98 north towards Avon Park, turn east onto W. College Drive and follow the signs to the Theatre.

From the West: Take S.R. 64 east to Avon Park, turn south on U.S. Highway 27/98 to W. College Drive, turn east onto W. College Drive and follow the signs to the Theatre.

South Florida State College
Alan Jay Wildstein
Center for the Performing Arts
600 W. College Drive
Avon Park, FL

Florida Citrus Growers' Institute



Conducted by

University of Florida, IFAS Extension
Citrus Research and Development Foundation

South Florida State College
Alan Jay Wildstein
Center for Performing Arts
Avon Park, Florida
April 4, 2017

2017 Florida Citrus Growers' Institute

Program Agenda
Tuesday, April 4, 2017

8:00 AM - Registration

8:30 AM - Welcome and Introductions
Mr. Chris Oswalt, CES, Bartow, FL

Entomology and Plant Pathology
Moderators: Ms Laurie Hurner, CES, Sebring, FL,
Dr. Juanita Popenoe, CES Tavares, FL

8:45 AM - The Use of RNAi to Control Psyllids in Citrus - *Dr. Bill Dawson,* UF/IFAS CREC

9:15 AM - Distribution of Psyllids in Citrus Groves - *Dr. Kirsten Pelz-Stelinski,* UF/IFAS CREC

9:45 AM - What Have We Learned about the Bactericides Available for Use in Citrus - *Dr. Stephanie Slinski,* Citrus Research and Development Foundation, Inc., Lake Alfred, FL

10:15 AM - OJ Break - Sponsored by Florida Citrus Mutual

10:30 AM - Postbloom Fruit Drop Management - *Dr. Megan Dewdney,* UF/IFAS CREC

Food Safety Rule

11:00 AM - FSMA's Produce Safety Rule and the Florida Citrus Grower - *Mr. Travis Chapin,* UF/IFAS CREC

Citrus Tree Health
Moderator: Dr. Steve Futch, UF/IFAS CREC
Dr. Mongi Zekri, CES, LaBelle, FL

11:30 AM - Citrus Root Health and HLB Management - *Dr. Evan Johnson,* UF/IFAS CREC

12:00 PM - Lunch

1:00 PM - Nematodes and Citrus Integrated Pest Management - *Dr. Larry Duncan,* UF/IFAS CREC

1:30 PM - Update on Irrigation and Nutrient Management Studies of HLB Affected Trees - *Dr. Davie Kadyampakeni,* UF/IFAS CREC

2:00 PM - Update on Citrus Nutritional Trials - *Dr. Tripti Vashisth,* UF/IFAS CREC

2:30 PM - Genome Editing Technology: What is CRISPR and What Will It will Mean for Florida Citrus - *Dr. Fred Gmitter,* UF/IFAS CREC

3:00 PM - Adjourn

CES: County Extension Service
CREC: Citrus Research & Education Center, Lake Alfred, FL
FSMA: Food Safety and Modernization Act
HLB: Huanglongbing a.k.a Citrus Greening
UF/IFAS: University of Florida, Institute of Food and Agricultural Sciences

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution.

Florida Citrus Growers' Institute
April 4, 2017

Preregistration is required

Name:_____

Company:_____

Address:_____

City/State/Zip:_____

Phone:_____ Email:_____

Please send registration to: Gail Crawford, Polk County Extension Service, P.O. Box 9005, Drawer HS03, Bartow, FL 33831.

By March 31, 2017 By phone: 863-519-1042, Fax: 863-534-0001, email: dorothyc@ufl.edu or online at: https://citrusinstitute2017.eventbrite.com/

NUTRITION OF CITRUS TREES

Fertilizer management should include calibration and adjustment of fertilizer spreaders, booms, pumps, or irrigation systems to accurately deliver fertilizer rates and place fertilizers within the tree rootzone. To increase fertilizer efficiency, soil and leaf analysis data should be studied and taken into consideration when generating a fertilizer program and selecting a fertilizer formulation. Dry fertilizer application should be split into 3 to 4 applications per year with a complete balanced fertilizer. For mature trees, the highest nutrient requirement extends from late winter through early summer. This coincides with flowering, heavy spring flush, fruit set, and fruit development and expansion. For best fresh fruit quality, nutritional requirements, particularly nitrogen (N), should decrease late in the summer and fall. Based on tree demands, 2/3 to 3/4 of the yearly fertilizer amount should be applied between February and June. In warm areas such as southwest Florida where tree growth can continue certain years during the winter, fertilizer applications should also be made in the fall to satisfy vegetative growth demand. However, fall fertilizer applications may sometimes delay fruit color development and fruit maturity for early and mid-season cultivars. For more information, go to **"Nutrition of Florida Citrus Trees, 2nd Edition"** By Thomas A. Obreza and Kelly T. Morgan http://edis.ifas.ufl.edu/pdffiles/SS/SS47800.pdf

IFAS fertilizer guidelines for nonbearing citrus trees

Year in grove	Lb N/tree/year (range)	Lbs Fertilizer/tree/year (range)		Lower limit of application frequency	
		6-6-6	8-8-8	Dry	Fertigation
1	0.15 – 0.30	2.5-5.0	1.9-3.8	6	10
2	0.30 – 0.60	5.0-10.0	3.8-7.5	5	10
3	0.45 – 0.90	7.5-15.0	5.6-11.3	4	10

IFAS fertilizer guidelines for bearing citrus trees (4 years and older)

Oranges	Grapefruit	Other varieties	Lower limit of application frequency	
Lbs N/acre/year (range)			Dry	Fertigation
120 - 200	120 - 160	120 - 200	3	10

Rates up to 220 lbs/acre may be considered for orange groves producing over 500 boxes/acre and up to 170 lbs/acre for grapefruit groves producing over 600 boxes/acre. Young trees planted on previously uncropped soils should receive fertilizer containing the following ratio of elements: nitrogen-1, phosphorus-1, potassium-1, magnesium-1/5, manganese-1/20, copper-1/40, and boron-1/250.

For more information on citrus nutrition, **get to the following EDIS publications:**

Increasing Efficiency and Reducing Costs of Citrus Nutritional Programs
Mongi Zekri, Thomas Obreza and Arnold Schumann
http://edis.ifas.ufl.edu/SS442 [pdf]

Irrigation, Nutrition, and Citrus Fruit Quality
Mongi Zekri, Thomas A. Obreza and Robert Koo
http://edis.ifas.ufl.edu/SS426 [pdf]

Fertigation Nutrient Sources and Application Considerations for Citrus
Brian Boman and Tom Obreza
http://edis.ifas.ufl.edu/CH185 [pdf]

Citrus Fertilizer Management on Calcareous Soils
Thomas A. Obreza, Mongi Zekri, and David V. Calvert
http://edis.ifas.ufl.edu/CH086 [pdf]

Boron and chlorine for citrus trees. UF Coop Ext. Ser.
Zekri, M. and T.A. Obreza.
http://edis.ifas.ufl.edu/pdffiles/SS/SS61900.pdf

Molybdenum and nickel for citrus trees. UF Coop Ext. Ser.
Zekri, M. and T.A. Obreza.
http://edis.ifas.ufl.edu/pdffiles/SS/SS61800.pdf

Iron and copper for citrus trees. UF Coop Ext. Ser. Zekri, M. and T.A. Obreza.
http://edis.ifas.ufl.edu/pdffiles/SS/SS61700.pdf

Manganese and zinc for citrus trees. UF Coop Ext. Ser.
Zekri, M. and T.A. Obreza.
http://edis.ifas.ufl.edu/pdffiles/SS/SS61600.pdf

Nitrogen (N) for citrus trees. UF Coop Ext. Ser.
Zekri, M. and T.A. Obreza.
http://edis.ifas.ufl.edu/pdffiles/SS/SS58000.pdf

Phosphorus (P) for citrus trees. UF Coop Ext. Ser.
Zekri, M. and T.A. Obreza.
http://edis.ifas.ufl.edu/pdffiles/SS/SS58100.pdf

Potassium (K) for citrus trees. UF Coop Ext. Ser.
Zekri, M. and T.A. Obreza.
http://edis.ifas.ufl.edu/pdffiles/SS/SS58300.pdf

Magnesium (Mg) for citrus trees. UF Coop Ext. Ser.
Zekri, M. and T.A. Obreza.
http://edis.ifas.ufl.edu/pdffiles/SS/SS58200.pdf

Calcium (Ca) and sulfur (S) for citrus trees. UF Coop Ext. Ser.
Zekri, M. and T.A. Obreza.
http://edis.ifas.ufl.edu/pdffiles/SS/SS58400.pdf

Pollination of Citrus by Honey Bees

Pollination in most citrus is not really required.

1. Citrus flowers are perfect, having both sexes on the same blossom so that self-pollination takes place regardless of pollinators. But bees (pollinators) are distributed throughout citrus groves in any case.
2. Female-sterile varieties are not benefited by pollinators.
3. Some seedless varieties may benefit, but evidence is lacking.

This by no means indicates pollination is not necessary in citrus.

1. There is a growing number of citrus varieties which require cross pollination because they are self-incompatible.
2. A positive linear relationship between fruit size and number of seeds per fruit exists.
3. Where cross pollination is required, use of honey bees remains the most consistent, effective and economical means of ensuring adequate yields.

Grapefruit: Although consensus suggests pollination is not required, there is evidence that open pollination benefited at least one variety (Marsh) by setting four times the fruit which had twice the number of seeds.

Pummelo: This variety appears to be grown commercially only in the Orient and is self-incompatible. Evidence suggests that pollinating by bees is important whether the plant is self-fertile or self-sterile.

Lemons: Most studies indicated the value to be minimal. However, there is evidence that seedlessness can result from self pollination, and that seedlessness may contribute to a reduction in fruit set.

Limes: Few studies have been done. One suggests limited pollination benefit from bees on Tahiti lime which is strongly parthenocarpic. Another suggested sweet limes would benefit from pollination by setting up to twenty percent more fruit.

Oranges: A large variation between cultivars exists in oranges making any sort of general statement difficult. Studies on certain varieties, however, have been accomplished:

- **Washington Navel**: Although it has been suggested that cross pollination on Washington Navels is not required to increase yield, there is evidence to show that pollination by bees may contribute to less fruit drop.
- **Valencias**: Most investigators contend that this variety benefits little from pollination by bees. One study, however, indicates fruit size was increased as the seed number increased.
- **Other sweet oranges**: Not much study has been done on these, but there is some indication that pollination is beneficial. It has also been suggested that reduced fruit set in so-called "off years" may be offset by honey bee pollination.

Mandarin and Mandarin-Hybrid Complex: Many varieties of this complex are self-incompatible and require pollination.

In summary it may be concluded that honey bees are unquestionably important in the pollination of citrus, though some varieties benefit more than others. In addition, there is the belief that ample quantities of bees are always present in groves because of their rich nectar resources.

Protecting bees from pesticides

Most major bee poisoning incidents occur when plants are in bloom. However, bees can be affected in other circumstances as well. Keep the following suggestions in mind when applying pesticides.

Use pesticides only when needed: Foraging honey bees, other pollinators, and insect predators are a natural resource and their intrinsic value must be taken into consideration. Vegetable, fruit, and seed crop yields in nearby fields can be adversely affected by reducing the population of pollinating insects and beneficial insect predators. It is always a good idea to check the field to be treated for populations of both harmful and beneficial insects.

Do not apply pesticides while crops are in bloom: Insecticide should be applied only while target plants are in the bud stage or just after the petals have dropped.

Apply pesticide when bees are not flying: Bees fly when the air temperature is above 55-60°F and are most active from 8 a.m. to 5 p.m. Always check a field for bee activity immediately before application. Pesticides hazardous to honey bees must be applied to blooming plants when bees are not working, preferably in the early evening. Evening application allows time for these chemicals to partially or totally decompose during the night.

Do not contaminate water: Bees require water to cool the hive and feed the brood. Never contaminate standing water with pesticides or drain spray tank contents onto the ground, creating puddles.

Use less toxic compounds: Some pest control situations allow the grower-applicator a choice of compounds to use. Those hazardous to honey bees must state so on the label. **Use less toxic formulations:** Not all insecticides have the same effects when prepared in different formulations. Research and experience indicate:

- New microencapsulated insecticides are much more toxic to honey bees than any formulation so far developed. Because of their size, these capsules are carried back to the colony. These insecticides should never be used if there is any chance bees might collect the microcapsules. Always consider using another formulation first.
- Dusts are more hazardous than liquid formulations.
- Emulsifiable concentrates are less hazardous than wettable powders.
- Ultra-low-volume (ULV) formulations are usually more hazardous than other liquid formulations.

Identify attractive blooms: Before treating a field with pesticides, it is a good idea to check for the presence of other blooming plants and weeds which might attract bees.

PLANT GROWTH REGULATORS (PGRs)

Plant growth regulator sprays can provide significant economic advantages to citrus growers when used in appropriate situations. Many citrus growers routinely use PGRs to enhance crop profitability. Depending on variety and timing, PGRs may improve fruit set, increase fruit size by reducing cropload, extend the harvest season by delaying rind aging, and reduce preharvest fruit drop. Excessive rates, improper timings, untested surfactants or tank mixes, and inappropriate environmental conditions can result in phytotoxicity, erratic results, and/or greatly reduced cropping. Growers are urged to become familiar with PGRs through application to small plots before treating significant acreage. To avoid drift onto susceptible crops in surrounding areas, products containing 2,4-D (2,4-Dichlorophenoxyacetic acid) have stringent requirements for application conditions. READ THE LABEL. Consult with your County Extension Office.

Since PGRs function by directly influencing plant metabolism, plant response can vary considerably with concentration, making sprayer calibration and accurate material measurement especially important. Studies show that variability in spray deposition increases as spray volume is reduced below 250 gallons/acre in mature citrus groves. At lower water rates, canopy closest to the sprayer manifold tends to retain much more material than other plant surfaces. Because material concentration is especially important in PGR use, water volumes below 125 gallons/acre are not generally recommended.

Unlike most agrichemicals applied to crop, efficacy of PGRs depends on entry of materials into plant tissues. Uptake is influenced by a number of factors: amount of PGR applied, concentration of PGR, presence of surfactants, solution pH, environmental conditions during and after application, foliage condition, and plant stress level. Application of PGRs is recommended only on healthy citrus blocks. Even when properly applied, some PGRs may cause leaf curling, especially when sprayed on young leaves.

GIBBERELLIC ACID (GA_3) is recommended to be used on citrus hybrids that are weakly parthenocarpic and without sufficient cross-pollination to improve fruit set. Applied from full bloom to two-third petal fall, GA can effectively set and produce an excellent crop of seedless Robinson, Nova, Orlando, Minneola, or other self-incompatible mandarin hybrids. Use Gibeerellic acid (GA_3, 4.0% liquid concentrate) at the rate of 10-20 oz/acre. Products marketed include: Pro-Gibb, GibGro, and Gibbex. Because material concentration is important in plant growth regulators, water volumes below 125 gallons/acre are not recommended. Do not use in water above pH 7.5 because uptake will be reduced. Care should also be exercised in not exceeding the recommended GA dosage or concentration because it can cause severe leaf drop.
READ THE LABEL

Chemical thinning of tangerines with NAA to increase fruit size and reduce branch breakage and alternate bearing

NAA (naphthalene acetic acid) encourages greater physiological-drop (usually in May for Florida citrus). Sunburst and Murcott are especially likely to benefit from judicious use of NAA. READ THE LABEL

NAA rate

Since concentration is so important, growth regulator treatments are usually expressed on a concentration basis (part per million or ppm) rather than ounces per acre. Rates of 250-500 ppm NAA have been most effective in thinning citrus varieties. For mature groves of large trees, 125-150 gallons per acre is probably adequate and lower volumes should be used for smaller trees by turning off some sprayer nozzles. Growers uncomfortable with calculations on a ppm basis can use the ounces of NAA/125 gallons, at appropriate ppm, as a rate per acre when applying at 125 gallons/acre. All NAA applications should include a surfactant at 0.05% and should not be tank mixed with other materials, unless you confirm that it is compatible with NAA.

For most healthy, unstressed groves, NAA should be applied at 120 ounces Fruit Fix 200 (or similar product, NOT Citrus Fix, which is 2,4-D rather than NAA plus 6.5 ounces of surfactant per 100 gallons, at 125 gallons per acre. Murcott should receive a lower rate 60-96 oz NAA/100 gallons.
READ THE LABEL

Timing

NAA should be applied near the beginning of physiological drop, when most fruitlets are about 1/2 inch in diameter, which typically occurs 6 to 8 weeks postbloom**. Rain within six hours of treatment, drought stress, or very hot or cool conditions may affect response.**

Environmental conditions can greatly influence uptake and activity of NAA. Higher temperatures and delayed drying of spray solution both contribute to greater thinning action. Best results are likely to occur when applied between 75° and 85° F. Higher temperatures may cause excessive thinning. Since uptake continues for several hours after the spray dries, heavy rain within six hours of application may significantly reduce NAA action.

PLANT GROWTH REGULATORS FOR CITRUS IN CALIFORNIA

The plant growth regulators 2,4-dichlorophenoxyacetic acid (2,4-D), gibberellic acid (GA_3) are registered for preharvest use on California citrus crops. 2,4-D is used mainly to delay and reduce unwanted fruit abscission (fruit drop), GA_3 is used mainly to delay senescence (overripening).

In order to be effective, plant growth regulators must be absorbed by plant tissue. Good spray coverage is essential and climatic conditions that favor absorption are therefore desirable.

Both 2,4-D and GA_3 seem to be compatible with urea, potassium foliar sprays, zinc and manganese micronutrient sprays, and neutral copper sprays, but the timing of growth regulator applications may not coincide with the best time for nutrient sprays.

2,4-dichlorophenoxyacetic acid (2,4-D). 2,4-D is used to control preharvest fruit drop, increase fruit size (oranges, grapefruit, mandarin, and mandarin hybrids), and to control leaf and fruit drop following an oil spray. When you use 2,4-D to reduce drop of mature fruit, apply the compound before (preferably *shortly* before) fruit drop becomes a problem, but far enough ahead of flowering to minimize undesirable effects that 2,4-D would otherwise have on the spring cycle of growth. For navel oranges, October through December sprays are common. October, however, may be too early to effectively reduce fruit drop if conditions favor it (e.g., warm winter, protracted harvest). January sprays may be somewhat risky, especially when environmental factors favor an earlier-than-usual spring flush of growth.

For mature grapefruit and 'Valencia' orange trees, 2,4-D can be applied to control drop of mature fruit or as a dual-purpose spray (to control mature fruit drop and to improve fruit size for the next year's crop). Fruit-sizing sprays require excellent coverage. In general, 'Valencia' orange is more responsive than grapefruit to fruit-sizing sprays. For mandarin and mandarin hybrids, 2,4-D fruit sizing sprays are applied 21 to 35 days after 75% petal fall.

Gibberellic acid (GA_3). The purpose of applying GA_3 to citrus trees in California is to delay fruit senescence. Make applications while the fruit are still physiologically young, but are approaching maturity. GA_3 can have a negative effect on flowering and thus on production for the following year, especially if it is applied much later than specified on the current label or in these guidelines. It delays changes in rind color, an effect that can be considered either desirable or undesirable. For example, if you apply GA_3 to navel orange trees while the fruit still have green rinds, delayed coloring will have a negative effect on your ability to harvest and market the fruit early in the season. In contrast, this effect is desirable for late-harvested fruit because it delays rind senescence, which results in fruit that are paler in color than the deeper-colored fruit from untreated trees. GA_3 applications amplify the re-greening of "Valencia" oranges. This is considered undesirable and can be minimized if you apply the compound no later than the date specified on the label or in these guidelines. GA_3 application may result in leaf drop, which can be severe, especially when it is applied to navel orange trees that are under heat or water stress. When this happens, the tree may also suffer twig dieback. By including 2,4-D in the GA_3 spray, you may be able to reduce this kind of damage.

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PLANT GROWTH REGULATORS IN FLORIDA

By Davies, Ismail, Stover, and Wheaton, UF-IFAS

Plant growth regulator (PGR) sprays can provide significant economic advantages to citrus growers when used in appropriate situations. Many citrus growers routinely use PGRs to enhance crop profitability. Depending on variety and timing, PGRs may improve fruit set, increase fruit size by reducing cropload, extend the harvest season by delaying rind aging, reduce preharvest fruit drop, or reduce hand-suckering by controlling trunk sprout growth in young citrus trees. Excessive rates, improper timings, untested surfactants or tank mixes and inappropriate environmental conditions can result in phytotoxicity, erratic results and/or greatly reduced cropping. Growers are urged to become familiar with PGRs through application to small plots before treating significant acreage. To avoid drift onto susceptible crops in surrounding areas, products containing 2,4-D (2,4-Dichlorophenoxyacetic acid) have stringent requirements for application conditions.

Importance of material concentration and spray volume

Most registered pesticides are effective over a fairly broad concentration range with little likelihood of phytotoxicity. Since PGRs function by directly influencing plant metabolism, plant response can vary considerably with concentration, making sprayer calibration and accurate material measurement especially important. Studies show that variability in spray deposition increases as spray volume is reduced below 250 gallons/acre in mature citrus groves. At lower water rates, canopy surfaces closest to the sprayer manifold tend to retain much more material than other plant surfaces. Because material concentration is especially important in PGR use, water volumes below 250 gallons/acre are not recommended.

PGR uptake

Unlike most agrichemicals applied to crop plants, efficacy of PGRs depends on entry of materials into plant tissues. Uptake is influenced by a number of factors: amount of PGR applied, concentration of PGR, presence of surfactants, after application, and plant stress level.

Effect of surfactants and tank mixes

Surfactants and other spray adjuvants can affect uptake in several ways. Surfactants and oils spread spray materials over leaf surfaces, and increase uptake by enhancing the total area contacted by spray solution. Many surfactants, urea, ammonium salts and oils can also directly enhance uptake by helping materials penetrate the plant cuticle. Organosilicone surfactants and some oils can result in very rapid uptake by carrying material through plant pores known as stomates. Surfactants can significantly enhance entry of PGRs into plant tissues, however, most PGR studies in citrus were conducted without surfactants or with less effective surfactants than many currently available. Use of untested surfactants may significantly enhance uptake, resulting in excessive plant response and/or phytotoxicity. Tank mixing with other spray materials may influence PGR uptake through surfactants or oils in material formulation or may bind PGR molecules rendering them ineffective.

Importance of weather conditions

Studies with other crops have shown that weather conditions greatly influence PGR uptake. Uptake generally increases with both temperature and duration of spray drying. Application at night or in early morning often enhances uptake because greater drying time more than compensates for somewhat lower temperature.

Dew following application is likely to enhance PGR uptake by prolonging drying. Considerable uptake often occurs after spray has dried, therefore, rain within a few hours of application may significantly reduce PGR effectiveness. Many PGRs degrade rapidly in sunlight. Growers should consider the likely influence of environmental factors in timing PGR sprays. It is illegal to apply 2,4-D when wind speed is above 10 miles/hour and distance to susceptible crops downwind is specified at lower wind speeds.

Influence of plant stress

Trees under significant drought, cold, or pest stress may respond excessively to PGR treatments. Therefore, application of PGRs is recommended only to healthy citrus trees.

Leaf curling

Even when properly applied, some PGRs may cause leaf curling, especially when sprayed on young leaves.

Recommended Chemical Controls

READ THE LABEL. See Table 1.

Rates for pesticides are given as the maximum amount required to treat mature citrus trees unless otherwise noted. To treat smaller trees with commercial application equipment including handguns, mix the per acre rate for mature trees in 250 gallons of water. Calibrate and arrange nozzles to deliver thorough distribution and treat as many acres as this volume of spray allows.

Table 1. Recommended Plant Growth Regulators.

Growth Regulator	Rate/Acre[1]	Variety and Activity	Time of Application/Cautions
Fruit Fix K-Salt **200** (Naphthaleneacetic acid, NAA, 200 g/gal liquid formulation)	8-20 pt. Use lower rates on Murcotts.	Tangerines, Murcotts, & Tangelos. Fruit thinning to increase fruit size and reduce alternate bearing.	May/June drop, typically mid-May. Activity is temperature dependent. Severe overthinning may result from applications made to trees of low vigor and/or under stress conditions. Heavy rain within several hours of application may reduce activity.
[1]Rates are based on application in 250 gallons per acre to mature trees. Proportional reduction in water and material rates is desirable for smaller trees. Application of Pro-Gibb at full rate to juice oranges in 125-150 gallons per acre to mature trees has been effective. The effects of applications in concentrate sprays are unknown.			
[2]Greater uptake at lower spray solution pH. Do not use in water above pH 8.			

Table 1. Recommended Plant Growth Regulators.

Growth Regulator	Rate/Acre[1]	Variety and Activity	Time of Application/Cautions
Citrus Fix (2,4-Dichlorophenoxyacetic acid isopropyl ester 3.36 lb/gal)	3.2 oz	Orange, Temple and grapefruit. Reduction of preharvest drop.	Nov-Dec. Do not apply during periods of leaf flush. Observe restrictions to avoid drift.
Citrus Fix (2,4-Dichlorophenoxyacetic acid isopropyl ester 3.36 lb/gal)	2.4 oz	Navel orange. Reduction of summer and fall drop.	6-8 wks after bloom for summer drop or Aug-Sept for fall drop. Do not apply fall spray when fruit is to be harvested early. Do not apply during periods of leaf flush. Observe restrictions to avoid drift.
Pro-Gibb (Gibberellic acid, GA_3, 4.0% liquid concentrate)[2]	20 oz	Seedless grapefruit. Delay of rind aging process and peel color development. Combine with Citrus Fix for fruit drop control.	Nov-Dec. Greater response prior to colorbreak but early harvest is disrupted by delayed coloring and irregular green spotting may develop. Surfactants increase activity but may cause fruit marking, so use is not recommended. Application within 6 weeks of copper or oil may increase rind marking. Application in Dec may reduce subsequent crop and regreen fruit.
Pro-Gibb (Gibberellic acid, GA_3, 4.0% liquid concentrate)[2]	10-20 oz	Tangelo. Improvement of fruit set. Can result in small fruit size from excessive cropping and/or leaf drop.	Full bloom. Surfactants not recommended.
Pro-Gibb (Gibberellic acid, GA_3, 4.0% liquid concentrate)[2]	20 oz	Minneola tangelo. Delay of stem rind deterioration.	Apply 2 weeks before aniticipated colorbreak. Application after or during coloring may cause rind staining or blotchy color development.
Pro-Gibb (Gibberellic acid, GA3, 4.0% liquid concentrate)2	18 oz	Oranges for processing. Delay of rind aging process and peel color development. Delays decline in peel firmness and increases juice extraction weight during processing.	Apply at or near colorbreak. Application may delay bloom the following year. Do not apply after December 1.
Tre-Hold (Naphthaleneacetic acid, NAA, 1.0% liquid concentrate)	Apply undiluted to trunk only as thorough spray or light brush application.	Nonbearing citrus. Inhibition of trunk sprout growth.	Prior to sprout growth. Caution-may inhibit sprouting desired for tree recovery following freeze. Excessive heavy application may result in tree damage. Do not apply after Sept 1.

Flatwoods Citrus

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__Black, non-Hispanic

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__Male