

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

Flatwoods Citrus



Vol. 23, No. 2

February 2020

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



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Seminar—Food safety and regulatory requirements related to citrus

Pre-registration is required. No registration fee and lunch is free Thanks to **Ed Early** with **FMC Corporation**.

To reserve a seat, call 863 674 4092 or send an e-mail to Dr. Mongi Zekri at maz@ufl.edu

Approved CEUs:

- 2 CEUs for certified crop advisors (CCAs)
- 2 CEUs for pesticide license renewal

Location: Southwest Florida Research & Education Center, Immokalee

Date & time: Wednesday, February 19, 2020, 10:00 AM – 12:00 Noon.

Speakers: Matt Krug, Callie Walker, and Dr. Mark Ritenour

Program Coordinator: Dr. Mongi Zekri, UF-IFAS

Program Sponsor: Ed Early with FMC Corporation

Agenda

10:00 AM - 10:50 AM

Matt Krug, UF-IFAS

An Introduction to Produce Safety for Citrus Growers

- overview of produce safety rule implementation
- foodborne pathogens of concern
- routes of contamination (workers, soil amendments, wildlife, equipment/tools, water)
- Potential Exemptions and Recordkeeping

10:50 AM - 11:40 AM

Dr. Mark Ritenour, UF-IFAS

Agricultural Water

- Risks that impact microbial safety of water
- Risks associated with different water application methods
- Water testing and criteria
- Water treatment options and monitoring
- Postharvest water (very brief mention of the most important key points)
- Postharvest handling (very brief mention of the most important key points)

11:40 AM - 12:00 Noon

Callie Walker, FDACS, DPI

Regulatory Requirements for EU Shipment

- Grower Requirements: Surveying and Harvesting Permits
- Harvester/Hauler Requirements: Field Ticket Requirements
- Quarantine Area

In-Service Training/Workshop

Beneath the Citrus Canopy – Weeds, Roots, and Microbes.



Purpose and Objectives: This training will provide county extension faculty with science-based information on weed management and identification in citrus groves, history and importance of rootstocks for Florida citrus production, rootstock propagation, and the benefits of a healthy soil environment for crop production.

Description and agenda for In-service Training:

This IST addresses the Extension Roadmap High Priority Initiatives #1 (Increasing the sustainability, profitability, and competitiveness of agricultural and horticultural enterprises).

Date and timeline: 18 March 2020, 8:30 AM – 1:30 PM

Location: Southwest Florida Research and Education Center (SWFREC), Immokalee and Zoom

Speakers)/Instructors)
Dr. Ute Albrecht (UF), Dr. Ramdas Kanissery (UF), Dr. Sarah Strauss (UF)

For more information and for registration, please contact Dr. Ute Albrecht at ualbrecht@ufl.edu

2020 ANNUAL FLORIDA CITRUS GROWERS' INSTITUTE

Date & Time: Tuesday, 14 April 2020, 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 will be available in March.

The 30th Annual Farm Safety Day

Friday, 1 May 2020
Saturday, 2 May 2020

AN IMPORTANT MESSAGE TO EMPLOYERS

Safe and competent equipment operators are important to you as an employer. Accidents, which cause damage, injury or death to employees, equipment and crops, are costly. We believe all types of accidents can be reduced with proper employee training. 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.

Certificates

The 2020 Southwest Florida Farm Safety Day is almost here. Farm Safety Day is an educational event designed to emphasize the importance of farm/equipment safety. Each participant is presented with a certificate of attendance and **the employer will be provided with a certificate of training that can be placed into the employee's file.**

Registration Info

The deadline for registration is Friday, April 17, 2020. It is the employer's responsibility to assure that the employee is present at 7:30 AM on Friday, May 1 or on Saturday, May 2 at the Immokalee IFAS Center, 2685 State Rd. 29 North, Immokalee, FL 34142 to receive their nametag. Upon arrival each participant will check in at the registration table and receive a packet containing their nametag, instructions (in both English and Spanish) session handouts, an evaluation form, rodeo cap and pencil. They will be directed to their respective course sessions.

Please give us the names of those who will be attending our 30th Farm Safety Day on **Friday, 1 May or Saturday, 2 May 2020 (please select the date)**. The cost is **\$25.00** per person, which will include educational sessions, handouts, pencils, refreshments, lunch, and a cap.

Make checks payable to: SW Florida Citrus Advisory Committee

Mail registration and checks to:
University of Florida, IFAS, SWFREC
Attention: Barbara Hyman
2685 State Rd. 29 North
Immokalee, FL 34142

Or fax registration to: 239 658 3403
Deadline is Friday, April 17, 2020

Don't wait. The number of trainings offered and attendance at each training is LIMITED. For each day, class size is limited to the first 80 Spanish-speaking and 20 English-speaking people.

30th ANNUAL SAFETY DAY

Friday, 1 May 2020
Saturday, 2 May 2020

Location: University of Florida, IFAS, SWFREC
2685 State Rd. 29 North
Immokalee, FL 34142

SCHEDULE:

7:30-8:10	Check In, Coffee, Juice, Refreshments, Door Prizes
8:10-9:00	Session 1 (Begin sessions)
9:00-9:10	Break (change session, door prizes)
9:10-10:00	Session 2
10:00-10:10	Break (change session, door prizes)
10:10-11:00	Session 3
11:00-11:10	Break (change session, door prizes)
11:10-12:00	Session 4
12:00-1:30	Lunch and Adjourn

The 2020 FARM SAFETY DAY REGISTRATION FORM

Please give us the names of those who will be attending our 30th Farm Safety Day on **Friday, 1 May or Saturday, 2 May 2020** at the Immokalee IFAS Center, 2685 State Rd. 29 North, Immokalee, FL 34142. The cost is **\$25.00** per person, which will include educational sessions, handouts, refreshments, lunch, and a cap.

Make checks payable to:
Citrus Advisory Committee

Mail registration and checks to:
University of Florida, IFAS, SWFREC
Attention: Barbara Hyman
2685 State Rd. 29 North
Immokalee, FL 34142

Or fax registration to: 239 658 3403
Deadline is Friday, April 17, 2020

Company Name:

Administrative Contact Person:

E-mail address:

Mailing Address:

Telephone: _____ Fax: _____ County: _____

Please list the employees who will be attending our safety training and please check their language preference*. If there is not enough space to fill in all attendants, please attach an additional sheet with the necessary information.

<u>Name</u>	<u>Friday or Saturday</u>	<u>English</u>	<u>Spanish</u>	<u>Name</u>	<u>Friday or Saturday</u>	<u>English</u>	<u>Spanish</u>
	
	
	
	
	
	
	
	
	

***Please Note: It is very important that we know the date (Friday, 1 May or Saturday, 2 May 2020) and the language capabilities for each attendee.**
Next to each attendee's name please mark in which language they are more fluent.
 If there are any questions, please contact **Barbara Hyman (hymanb@ufl.edu) at 239 658 3400.**
Don't wait. The number of trainings offered and attendance at each training is LIMITED.
Don't wait. For each day, class size is limited to the first 80 Spanish-speaking and 20 English-speaking people.

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

13 February 2020

ENSO Alert System Status: Not Active

Synopsis: ENSO-neutral is favored through Northern Hemisphere spring 2020 (~60% chance), continuing through summer 2020 (~50% chance).

During January 2020, near- to above-average sea surface temperatures (SSTs) were evident across most of the equatorial Pacific Ocean (Fig. 1). The latest weekly Niño-3.4 and Niño-3 indices were near average (+0.2°C to 0.0°C), while the Niño-4 and Niño-1+2 indices were warmer at +1.2°C and +0.8°C, respectively (Fig. 2). After decreasing in early to mid January, positive equatorial subsurface temperature anomalies (averaged across 180°-100°W) slightly increased during the latter part of the month (Fig. 3). Temperatures remained above average across most of the subsurface ocean, reaching ~150m depth in the central Pacific (Fig. 4). During the month, westerly wind anomalies persisted over the western equatorial Pacific Ocean, while upper-level winds were mostly westerly over the east-central and eastern equatorial Pacific. Tropical convection remained suppressed over Indonesia and was enhanced around the Date Line (Fig. 5). The traditional and equatorial Southern Oscillation indices were near zero. Overall, the combined oceanic and atmospheric system remained consistent with ENSO-neutral.

The majority of models in the IRI/CPC plume (Fig. 6) continue to mostly favor ENSO-neutral (Niño-3.4 index between -0.5°C and +0.5°C) through the Northern Hemisphere summer. The forecaster consensus predicts the Niño-3.4 index will be at or slightly above +0.5°C for the January – March 2020 season, but then slightly favors ENSO-neutral for the February – April 2020 season. While it is expected that oceanic temperatures will remain elevated in the near term, particularly in the western and central equatorial Pacific Ocean, most models predict a gradual decrease in Niño-3.4 SST anomalies into the spring and summer. In summary, ENSO-neutral is favored through Northern Hemisphere spring 2020 (~60% chance), continuing through summer 2020 (~50% chance; 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 12 March 2020. 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

POSTBLOOM FRUIT DROP

(PFD) has been most severe on Navel and Valencia oranges.



Most spores of this fungus are produced directly on the surface of infected petals. Spores are splash-dispersed by rain to healthy flowers where they infect within 24 hours and produce symptoms in 4-5 days. The fungus survives between bloom periods as resistant structures on the surface of leaves, buttons, and twigs. Groves with persistent calyxes (buttons) from the previous year should be closely examined once the bloom begins. Groves with a history of PFD should be checked twice weekly during the bloom period. Ground and aerial applications are

Table 1. Recommended Chemical Controls for Postbloom Fruit Drop

Pesticide	FRAC MOA ²	Mature Trees Rate/Acre ¹
Ferbam Granuflo	M3	5-6 lb. Maximum 3 ferbam applications a year and do not apply more than 6 lb ai/acre in a single application.
Abound ³	11	12.0-15.5 fl oz. Do not apply more than 92.3 fl oz/acre/season for all uses.
Abound ³ + Ferbam	11, M3	12.0 fl oz + 5 lb. Maximum 3 ferbam applications a year and do not apply more than 6 lb ai/acre in a single application.
Gem 500 SC ³	11	1.9-3.8 fl oz. Do not apply more than 15.2 fl oz/acre/season for all uses. Do not apply within 7 days of harvest.
Gem ³ + Ferbam	11, M3	1.9 fl oz + 5 lb. Maximum 3 applications a year and do not apply more than 6 lb ai/acre in a single application.
Headline SC ³	11	12-15 fl oz. Do not apply more than 54 fl oz/acre/season for all uses.
Headline ³ + Ferbam	11, M3	12fl oz + 5 lb. Maximum 3 applications a year and do not apply more than 6 lb ai/acre in a single application.
Pristine ^{3,4}	11 + 7	16-18.5 oz. Do not apply more than 74 oz/acre/season for all uses.
Amistar Top ^{3,4}	11 + 3	15.4 fl oz. Do not apply more than 61.5 fl oz/acre/year
Priaxor ^{3,4}	11 + 7	9-11 fl oz. Do not apply more than 44 fl oz/acre/year
https://crec.ifas.ufl.edu/extension/pest/PDF/Postbloom%20Fruit%20Drop.pdf		

effective for control of PFD. The removal of declining trees, where off-season blooms may provide a site for fungal spore buildup should reduce disease severity.

Of the products recommended for control of PFD, Abound, Gem, and Headline are effective but do not have a long residual effect. Ferbam is less effective and should not be used alone, but it can be combined with low rates of other products to maximize protection and reduce the risk of resistance development. No resistance has been detected to date. Neither Abound, Gem, nor Headline should be used alone more than once per season, but can be used more than once if combined with Ferbam.

For more information go to:

<https://crec.ifas.ufl.edu/extension/pest/PDF/Postbloom%20Fruit%20Drop.pdf>

Recommended Chemical Controls

READ THE LABEL.

Rates for pesticides in Table 1 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 125 gallons of water. Calibrate and arrange nozzles to deliver thorough distribution and treat as many acres as this volume of spray allows.

CITRUS BLACK SPOT fungal disease causes fruit blemishes and fruit drop especially on sweet oranges.



Lemons are the most susceptible, but sweet oranges, especially mid to late maturing types such as Valencia, are highly susceptible to this disease. Hamlin sweet oranges and tangerine/mandarin types are moderately susceptible. Grapefruit is thought to be moderately susceptible and symptoms have been seen in Florida.

Black spot fruit symptoms are wide ranging and have many different names. Hard spot is the most diagnostic symptom of black spot. Lesions are nearly circular, depressed, with gray necrotic tissue at the middle, and a brick-red to black margin that can be cracked around the

edges. Significant fruit drop is a common symptom in heavily infected groves. Airborne ascospores produced in decomposing leaf litter on the grove floor are the source of the primary inoculum for black spot. They are blown into the canopy by wind. These spores germinate and directly infect the leaves and fruit. Major ascospore release usually occurs from April to early September, with favorable infection conditions from May through September. Fruit remains susceptible most of the growing season. Monthly fungicide applications of copper and/or strobilurins (Abound, Gem, or Headline) will be needed from early May to mid-September to control black spot. If there is substantial rain in April, starting fungicide applications in April is advised. Since only four strobilurin fungicides can be used in a season for any purpose, it is recommended for fresh fruit to reserve strobilurin fungicides for times when phytotoxicity from copper applications is a concern (temperatures >90°F). For processing fruit, strobilurins can be used earlier in the season, and applications for greasy spot and melanose can be combined. It is recommended that strobilurin fungicides not be applied in two consecutive sprays to manage pathogen resistance. Currently, we do not have any other rotational fungicides for resistance management.

In addition to chemical control measures, practices to accelerate leaf litter decomposition beneath the trees to reduce the ascospore inoculum may be beneficial. Enhancing leaf litter degradation should commence in mid-March. There are three methods that have reduced the ascospore inoculum of *Mycosphaerella citri*, the fungus that causes greasy spot. The first is to increase the microsprinkler irrigations to at least 5 times a week for approximately a ½ hour per irrigation period for 1.5 months. The leaf litter decomposition will

be greater compared to that with the traditional irrigation frequency. A drawback is that leaf litter reduction will be confined to the areas where the microsprinklers reach. A second method is to apply urea (187 lb/treated acre) or ammonium sulfate (561 lb/acre) to the leaf litter. The final method is to apply dolomitic lime or calcium carbonate (2226 lb/treated acre) to the leaf litter. The decay rate is greater for litter treated with lime and inoculum production is reduced. All treatments worked equally well with *M. citri* and there is no indication that one method is better than another. Lime or irrigation methods should not be used in conjunction with the high N treatments, since they have opposite methods of action.

Care must be exercised in handling and moving citrus fruit, leaves, twigs and debris from citrus black spot (CBS) Quarantined Areas, since the disease

may be easily and unwittingly spread to other citrus trees, nurseries or groves. There are many rules and regulations that **Growers, Harvesters, Haulers, Processing, Packing Facilities and Haulers have to be aware of with relation to the black spot disease in Florida. For more information, go to: <https://crec.ifas.ufl.edu/extension/pest/PDF/Citrus%20Black%20Spot.pdf>**

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 Chemical Controls for Citrus Black Spot

Pesticide	FRAC MOA²	Mature Trees Rate/Acre¹
copper fungicide	M1	Use label rate.
Enable 2F4	3	8.0 fl/oz. Do not apply more than 24 oz/acre/season
Abound ³	11	9.0-15.5 fl oz. Do not apply more than 92.3 fl oz/acre/season for all uses. Best applied with petroleum oil.
Gem 500 SC ³	11	1.9-3.8 fl oz. Do not apply more than 15.2 fl oz/acre/season for all uses. Best applied with petroleum oil. Do not apply within 7 days of harvest.
Headline SC ³	11	12-15 fl oz. Do not apply more than 54 fl oz/acre/season for all uses. Best applied with petroleum oil.
Pristine ^{3,4}	11 + 7	16-18.5 oz. No more than 74 oz/acre/season
Amistar Top ^{3,4}	11 + 3	15.4 fl oz. Do not apply more than 61.5 fl oz/acre/year
https://crec.ifas.ufl.edu/extension/pest/PDF/Citrus%20Black%20Spot.pdf		

IMPORTANCE OF SPRAYER CALIBRATION

Sprayers must be checked to ensure all nozzles are applying pesticides uniformly and at the correct rate. Make sure your equipment is working properly and calibrated to ensure the correct amount of pesticide is delivered to the target area.

Pesticide application, greater than the label rate, is illegal and can result in needless risk to groundwater, increased production costs, and crop damage. Under-application might be costly by not properly controlling the target pest. Although you can sometimes repeat the application, doing so is time-consuming, costs more, increases the risk of applying too much and increases the risk in pesticide resistance.

Regular sprayer calibration includes measuring the output of each nozzle to ensure all nozzles are functioning properly. Specific calibration guides are available from a number of sources. Sprayer calibration should be done every time a different pesticide is applied or at least once each season.

The rate of application depends partly on the particle or droplet size, texture, and other properties of the pesticide being applied. Use only water during the test if the pesticide is a liquid. Contact the manufacturer to get reliable information regarding carrier material to perform the tests if the pesticide is a dust, granule, or fumigant, or a liquid diluted with a liquid other than water.

Follow calibration and mixing instructions carefully. Mixing, loading, and calibration

methods must also conform to the speed of the application machinery. Moving too fast or too slow changes the rate of application.

Minimizing spray drift

Spray drift, movement of a pesticide through air during or after application to a site other than the intended site of application is a challenging issue facing pesticide applicators. Complete elimination of spray drift is impossible. However, drift can be minimized by following these control measures:

1. Read and follow the pesticide label.
2. Select low or nonvolatile pesticides.
3. Use spray additives following label guidelines.
4. Use large orifice sizes for spray nozzles.
5. Avoid high sprayer pressures, which create finer droplets.
6. Use drift reduction nozzles.
7. Use wide-angle nozzles, lower spray boom heights, and keep spray boom stable.
8. Do not spray when wind speeds exceed 10 mph and when wind direction is directed toward sensitive vegetation.
9. Use a shielded spray boom when wind conditions exceed preferred conditions.
10. Avoid spraying on extremely hot and dry days, especially if sensitive vegetation is nearby.
11. Keep good records and evaluate the results.



IMPORTANCE OF FERTILIZER SPREADER CALIBRATION AND MAINTENANCE

Properly calibrated and maintained equipment ensures a more uniform distribution of nutrients. This, combined with other conservation practices, reduces production costs, soil surface runoff, and nutrient movement to nearby surface waters. Spreaders that have not been properly maintained and calibrated will have problems delivering accurate rates and evenly distributed fertilizer amounts to the grown crop.

Calibration

Calibration is the process used to help ensure that the equipment applies proper rates of the selected product. Proper calibration is the key to successful fertilizer use efficiency. Failure to calibrate equipment can result in ineffective applications. Applying too much is costly, unlawful and may cause crop injury. Applying too little can result in poor crop growth and production. It is important to calibrate equipment on a regular basis to compensate for variations. The equipment will become worn or damaged with use and result in inaccurate output and spread pattern.

Two items must be considered when calibrating a spreader. The first is the distribution pattern of the spreader. The second is the product application rate, which is the amount of product applied per acre. There are many factors that affect the distribution pattern of a rotary spreader and some of them relate directly to the product. For this reason, it is recommended that the spreader be calibrated separately for every product to be applied. Spreader calibration should be checked more often when the spreader is used frequently.

Product & application

Choose a product according to the need of the crop. Before applying the product, read the spreader manual. The spreader manual will usually indicate proper settings for various application rates. However, calibration still needs to be performed to ensure the settings are accurate and to compensate for wear and variations in equipment. Be sure that the proper procedures and application rates are followed. Check the 'spread pattern' and amount being applied. The physical properties of dry fertilizer can vary widely. Since larger particles are thrown further than small particles, a product of uniform size should be used to achieve a consistent application pattern. It is essential to maintain a constant speed when using a rotary spreader to obtain uniform and accurate distribution.

Maintenance and Cleaning

Proper care and maintenance will help retain precise applications and prolong the life of spreaders. Manufacturer's directions on cleaning and lubricating should be followed. With the shutter or gate wide open, remove all granules from the spreader at the end of each application. Then, the spreader should be thoroughly washed and allowed to dry. Hot water may help break loose fertilizer which is caked on. Finally, lubricate the spreader according to instructions. Spreaders should be stored in a clean, dry place out of direct sunlight.



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. For citrus trees in the citrus greening (HLB) era, soluble fertilizer should be split into 6-10 applications per year with a complete balanced fertilizer. Besides nitrogen, phosphorus, and potassium, be sure that the fertilizer has magnesium, and micronutrients such as manganese, zinc, iron, and boron. The use of controlled release fertilizer or frequent fertigation is preferred. 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. Foliar applications of micronutrients should be applied at least 3 times a year on the major spring, summer, and fall flushes when the new leaves are about fully expanded. Foliar spray applications of 3-5 lbs/acre of magnesium, manganese, zinc, and copper, and 0.25-0.50 lb/acre of boron and molybdenum are also recommended on each of the three major flushes of citrus trees to prevent nutrient deficiencies, cope with HLB, and improve production. Sulfate forms are less expensive and nitrate forms appear to facilitate the uptake of micronutrients.

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	6	10
3	0.45 – 0.90	7.5-15.0	5.6-11.3	6	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	6	10

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>

FOLIAR FEEDING

Foliar feeding is not intended to completely replace soil-applied fertilization of the macronutrients (nitrogen, potassium, and phosphorous). However, macronutrients can be foliarly applied in sufficient quantities to influence both fruit yield and quality. Citrus trees can have a large part of the nitrogen, potassium, and phosphorous requirements met through foliar applications.

Foliar applications of other plant nutrients (calcium, magnesium, and sulfur) and micronutrients (zinc, manganese, copper, boron, and molybdenum) have proven to be an excellent means for supplying the plants' requirements. Soil application of manganese, zinc, boron, and molybdenum is not as economical and not as effective as foliar application to supply those nutrients to citrus trees. Applications made to the soil can be subject to leaching, volatilization, and/or being tied up by soil particles in unavailable forms to plants.

Foliar feeding should be used as an integral part of the annual nutritional program. It can be used in other situations to help plants through short, but critical periods of nutrient demand, such as fruit set and bud differentiation. Foliar nutrition may also prove to be useful at times of soil or environmentally induced nutritional shortages. Foliar application of nutrients is of significant importance when the root system is unable to keep up with crop demand or when the soil has a history of problems that inhibit normal growth.

Foliar feeding is proven to be useful under prolonged spells of wet soil conditions, dry soil conditions, calcareous soil, cold weather, or any other condition that decreases the tree's ability to take up nutrients when there is a demand. Foliar feeding may be utilized effectively when a nutritional deficiency is diagnosed. A foliar application is the quickest method of getting the most nutrients into plants. However, if the deficiency can be seen, the crop might have already lost some potential yield.

Several Florida citrus growers and production managers are using foliar nutritional sprays, mainly micronutrients, to slow down tree decline and maintain adequate fruit productivity of citrus greening-infected trees. Supplemental, balanced foliar nutrition has positive effects on plant diseases by inducing naturally occurring plant resistance mechanisms. It is always important to maintain the balance between nutrients because having one nutrient significantly out of balance can be as bad as a deficiency.

While foliar feeding has many advantages, it can burn plants at certain rates under certain environmental conditions. It is important, therefore, to foliar feed within the established guidelines. There are a number of conditions that can increase the chances of causing foliar burn. A plant under stress is more susceptible to damage. Stressful conditions include drying winds, disease infestations, and poor soil conditions. The environmental conditions at the time of application are also important factors. Applications when the weather is warm (above 80°F) should be avoided. This means that during warm seasons, applications should be made in the morning or evening. Additionally, applications should not be at less than two-week intervals to give the plant sufficient time to metabolize the nutrients and deal with the added osmotic stress.

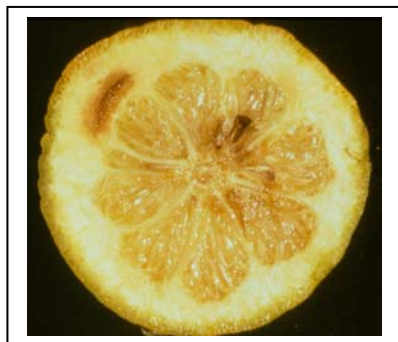
Another important factor when applying nutrient foliarly is to ensure that the pH of the material is in the proper range. The pH range of the spray solution should be between 6 and 7. This is significant in areas where water quality is poor.



Boron (B)

Boron is particularly necessary where active cell division is taking place. Boron plays an important role in flowering, pollen-tube growth, fruiting processes, nitrogen (N) metabolism, and hormone activity. Florida sandy soils are low in B, and a deficiency of this element in citrus occasionally occurs under field conditions. The deficiency may be aggravated by severe drought conditions, heavy lime applications, or irrigation with alkaline water. Boron is very mobile in the soil profile of sandy soils and readily leaches by rainfall or excess irrigation.

Boron deficiency is known as “hard fruit” because the fruit is hard and dry due to lumps in the rind caused by gum impregnation. The chief fruit symptoms include premature shedding of young fruits. Such fruit have brownish discoloration in the white portion of the rind (albedo), described as gum pockets or impregnations of the tissue with gum and unusually thick albedo. Older fruit are undersized, lumpy, misshaped with an unusually thick albedo containing gum deposits. Seed fails to develop and gum deposits are common around the axis of the fruit.



The first visual symptoms of B deficiency are generally the death of the terminal growing point of the main stem. Further symptoms are a slight thickening of the leaves, a tendency for the leaves to curl downward at right angles to the midrib, and sometimes chlorosis.



Young leaves show small water soaked spots or flecks becoming translucent as the leaves mature. Associated with this is a premature shedding of leaves starting in the tops of the trees and soon leaving the tops almost completely defoliated. Fruit symptoms appear to be the most constant and reliable tool for diagnostic purposes.

To treat citrus affected with B deficiency, B compounds can be applied either foliarly or in the fertilizer. As a maintenance program, apply B in the fertilizer at an annual rate equivalent to 1/200 of the N rate. In Florida, foliar spray applications have been found much safer and more efficient than soil application. Soil applications frequently fail to give satisfactory results during dry falls and springs and may result in toxicity problems if made during the summer rainy season. Boron solubility in the soil is reduced at soil pHs below 5 and above 7. Foliar spray may be applied during the dormant period through post bloom, but preferably during early flower development. Treating at this growth stage is important because boron does not move very readily from other parts of the tree to the buds. Applying boron at this time will assist in flower initiation and pollen production, satisfy the needs for pollen tube growth, and enhance fruit set. Boron levels in the leaf tissue should not drop below 40 ppm or exceed 120 ppm (dry wt basis). Where deficiency symptoms are present, double the amount suggested. Use care not to apply more than the recommended amount because it is easy to go from deficiency to excess.

MICROSPRINKLER IRRIGATION & FERTIGATION

Microsprinkler irrigation is an important component of citrus production systems in Florida. Microirrigation is more desirable than other irrigation methods for several reasons. Three important advantages are: water conservation, the potential for significantly improving fertilizer management and for cold protection.

Research has shown that when properly managed (no overirrigation), water savings with microirrigation systems can amount to as much as 80% compared with subirrigation and 50% compared with overhead sprinkler irrigation.



Microirrigation provides for precise timing and application of fertilizer nutrients in citrus production. Fertilizer can be prescription-applied during the season in amounts that the tree needs and at particular times when those nutrients are needed. This capability helps growers increase the efficiency of fertilizer application and should result in reduced fertilizer applications for citrus production. Research has also shown the important advantage of microsprinklers for freeze protection of citrus.

Fertigation is the timely application of small amounts of fertilizer through irrigation systems directly to the root zone.

Some advantages of fertigation:

- ◆ Fertilizer is placed in the wetted area where feeder roots are extensive,
- ◆ Fertilizer may be applied more frequently in small amounts so that it is available when the tree needs it,
- ◆ Increased fertilizer application frequency can increase fertilizer efficiency and reduce leaching,
- ◆ Application cost is much lower than that of dry or foliar fertilizer application.

Through fertigation, comparable or better yields and quality can be produced with less fertilizer. Microirrigation systems must properly maintain to apply water and fertilizer uniformly. Growers must determine:

- (1) which fertilizer formulations are most suitable for injection,
- (2) the most appropriate fertilizer analysis for different age trees and specific stages of growth,
- (3) the amount to apply during a given fertigation event, and
- (4) the timing and frequency of applications.

Properly managed applications of plant nutrients through irrigation systems significantly enhance fertilizer efficiency while maintaining or increasing yield. On the other hand, poorly managed fertigation may result in substantial yield losses. Fertigation involves deciding which and how much nutrients to apply, selecting the most effective formulations and scheduling injections to ensure that essential nutrients are available as needed.

Injection Duration

A minimum injection time of 45 to 60 minutes is recommended. This time is sufficient for uniform distribution of nutrients throughout the fertigation zone. Limit injection time to prevent the application of too much water, because excessive water leaches plant nutrients below the root zone.

MOBILE IRRIGATION LAB

The Agricultural MIL is a FREE service that serves Florida. For an Agricultural MIL evaluation in Southwest Florida, call
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Assisting the agricultural community by improving irrigation efficiency and conserving water.



The Lower West Coast Mobile Irrigation Lab (MIL) is a cooperative project of the Collier Soil & Water Conservation District, the Natural Resources Conservation Service, and the Florida Department of Agriculture and Consumer Services. 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.



Flatwoods Citrus

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