



UNIVERSITY OF  
FLORIDA

EXTENSION

Institute of Food and Agricultural Sciences

Hendry County Extension • P.O. Box 68 • LaBelle, Florida 33975-0068 • (941) 674-4092

# Flatwoods Citrus



Vol. 4, No. 8 August 2001	Dr. Mongi Zekri, Multi-County Citrus Agent
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## UPCOMING EVENTS

### Citrus Expo

**Date:** August 22-23, 2001, **Location:** Lee Civic Center, Fort Myers

For more information, call Dr. Bob Rouse at 941 658 3400

### Citrus Packinghouse Day

**Date:** August 30, 2001, **Location:** Citrus Research & Education Center, Lake Alfred

For more information, call Dr. Mark Ritenour at 561 468 3922

### Annual meeting of the Florida Associations of Extension Professionals (FAEP)

**Date:** September 10-14, 2001, **Location:** West Palm Beach

For more information, go to <http://extension.ifas.ufl.edu/FAEPMain01.htm>

### Florida Agricultural Conference & Trade Show (FACTS)

**Date:** October 1-3, 2001, **Location:** Lakeland Center, Lakeland

For more information, call Dr. Ed Stover at 561 468 3922

### Annual Meeting of the Interamerican Society for Tropical Horticulture

**Date:** October 1-5, 2001, **Location:** Cuernavaca/Oaxtepec, Morelos, Mexico

For more information, contact Dr. Richard Campbell at Fax: 305 665 8032, E-mail:

[rcampbell@fairchildgarden.org](mailto:rcampbell@fairchildgarden.org)

### Hendry County Extension Ag Tour

**Date:** December 8, 2001

For more information, call Inez at 863 674 4092



**The Citrus Canker Eradication Program will be conducting presentations pertaining to Quarantine and Statewide compliance. For more information, read the last attached sheet or call Deborah Smith at 941 658 3684.**

## *Drainage and 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. Flooding injury would be expected if water stands on the surface for 4 days or more during extended summer rains.

Flooding during the cooler December-March period can be tolerated for several weeks. The potential for damage to roots is less obvious but equally serious when the water table is just below the surface. Flooding stress is usually 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 during 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 were 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 soil. Wilting, leaf drop, dieback, and leaf chlorosis patterns may develop and tree death may occur.

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 and the potential for fungal invasion determined. If there is

a *Phytophthora* problem, the use of certain fungicides can improve the situation. The nature of the soil, the rootstock, root condition and stagnation of the standing water, soil pH, and the presence of sulfur and organic matter in the soil are all factors that need to be considered when trying to evaluate flooding injury and manage tree recovery.



Special Thanks to the following sponsors of the Faltwoods Citrus Newsletter for their generous contribution and support. If you would like to be among them, please contact me at 863 674 4092.

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# CITRUS EXPO

The 2001 Citrus Expo will be held on August 22 & 23 at Fort Myers Lee Civic Center. The Citrus Expo has become an outstanding agricultural event for the Florida citrus industry because of its trade show, seminar program, and banquet. The success of the program has been the three-way partnership of the Florida citrus growers through the Gulf Citrus Growers Association, the University of Florida Extension Service, and the trade show organized by the Citrus Industry Magazine. The Expo is the largest seminar and trade show event dedicated exclusively to citrus. *Enclosed you will find a brochure for the Citrus Expo including a pre-registration form which can be xeroxed if needed and mailed or faxed.* Pre-register before August 10 and receive a free gift when you pick up your registration packet at Lee Civic Center. There is no registration fee. Admission and parking are free. The theme of this year's Expo seminar program is "Progress through technology." Genome technology and citrus will be addressed on Wednesday, Aug. 22<sup>nd</sup>. Thursday morning program is heavy on marketing, harvesting, and protecting Florida citrus. Thursday afternoon will focus on the weather, water, and environmental and governmental concerns. The trade show opens early at 7:30 AM on Wednesday and 8:00 AM on Thursday with a free continental breakfast and drawings for great prizes (\$1,000 cash on Wednesday and a grand prize on Thursday). The Gulf Citrus Growers Association Reception and Banquet will be held on Wednesday evening at Harborside Convention Hall in downtown Ft. Myers. Call the association for reservations. The program is approved for CEUs for Certified Public Accountant, Certified Crop Advisors, and pesticide license renewal.

## *Courses offered at the Immokalee IFAS Center*

Citrus Culture I (HOS1541) is offered next fall semester starting Tuesday, August 28, 2001 at the Southwest Florida Research and Education Center (SWFREC), Immokalee. For more information, call or write to Dr. Bob Rouse, Teaching Coordinator, WSFREC, 2686 S.R. 29 North, Immokalee, FL 34142-9515, Phone: (941) 658 3400.

### **ADVANCED CITRICULTURE I - HOS 6545 - Fall 2001 CREC and Distance Education Locations of Immokalee, Gainesville, and Fort Pierce.**

A course on regulation of vegetative growth of citrus will be offered this Fall semester from Aug 27<sup>th</sup> through Dec 3<sup>rd</sup> 2001 from Lake Alfred CREC. This graduate level course will meet Mondays from 4 to 7 pm. Students will meet at the nearest location listed and participate in class by interactive Internet Video-Audio Conferencing. The in-person site will be Lake Alfred. Students will come to Lake Alfred once or twice during the semester, when they lead the discussion session. Students will review literature on climatic, physiological, production practices and other factors as they influence vegetative development of citrus. Each week a student will lead the discussion of the assigned literature that has been selected by the student with guidance of the instructor. This is a 3 unit course that will cost approximately \$450 for in-state students. The course is available in Continuing Education or as a regular Graduate School offering. Interested students should have taken basic plant physiology or citrus production courses. The limit is 12 students; please contact Dr. L. Gene Albrigo at (863) 956-1151 or [albrigo@lal.ifas.ufl.edu](mailto:albrigo@lal.ifas.ufl.edu) for further information and class enrollment.



Special Thanks to these sponsors of the Flatwoods Citrus Newsletter for their generous contribution and support. If you would like to be among them, please contact me at Phone 863 674 4092, Fax: 863 674 4636, or [maz@gnv.ifas.ufl.edu](mailto:maz@gnv.ifas.ufl.edu)

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# NEUTRALIZING EXCESS BICARBONATES FROM IRRIGATION WATER

Many sources of irrigation water in Florida contain dissolved bicarbonates, which are bases and are thus liming materials. Irrigation with such water can decrease the lime requirement for plant production and can cause adverse plant growth by excessively raising the soil pH. The magnitude of the effect depends on the concentration of the bicarbonates in the water, the amount of the water applied, the buffering capacity of the soil, and the sensitivity of the varieties and rootstocks being grown.



A water test is the surest means of determining if a problem exists. If the pH of the irrigation water is below 7.0, then it will not be a significant source of liming materials. However, if the pH is above 7.0, it means that the water contains bases. Multiplication of parts per million (ppm) Ca by 0.05 and ppm Mg by 0.083, and summing the two products, will give the milliequivalents of those cations per liter (me/liter) of water.

## SOIL TREATMENT

It is important to note that the acid-producing effect of sulfur comes from the formation of sulfuric acid when soil bacteria act on the elemental sulfur. The sulfate form of sulfur applied in fertilizers such as potassium sulfate, magnesium sulfate, or gypsum (calcium sulfate) does not have the acid-producing effect of elemental sulfur.



Sulfur application rates of 300 to 500 pounds per acre should not be exceeded. This rate is equivalent to between 0.7 and 1.1 lbs/100 square feet of treated surface area. Over-application of sulfur or acid can cause damage to trees. Remember the pH will increase again as irrigation with high bicarbonate water continues. Water or soil acidification will therefore be a continuing effort or battle.

Under most circumstances, the quantity of bases that is being supplied in the irrigation water far exceeds the quantity of acid formed by addition of fertilizer. Under these conditions, acid-forming fertilizers will not control the problem of increasing soil pH.

## WATER TREATMENT

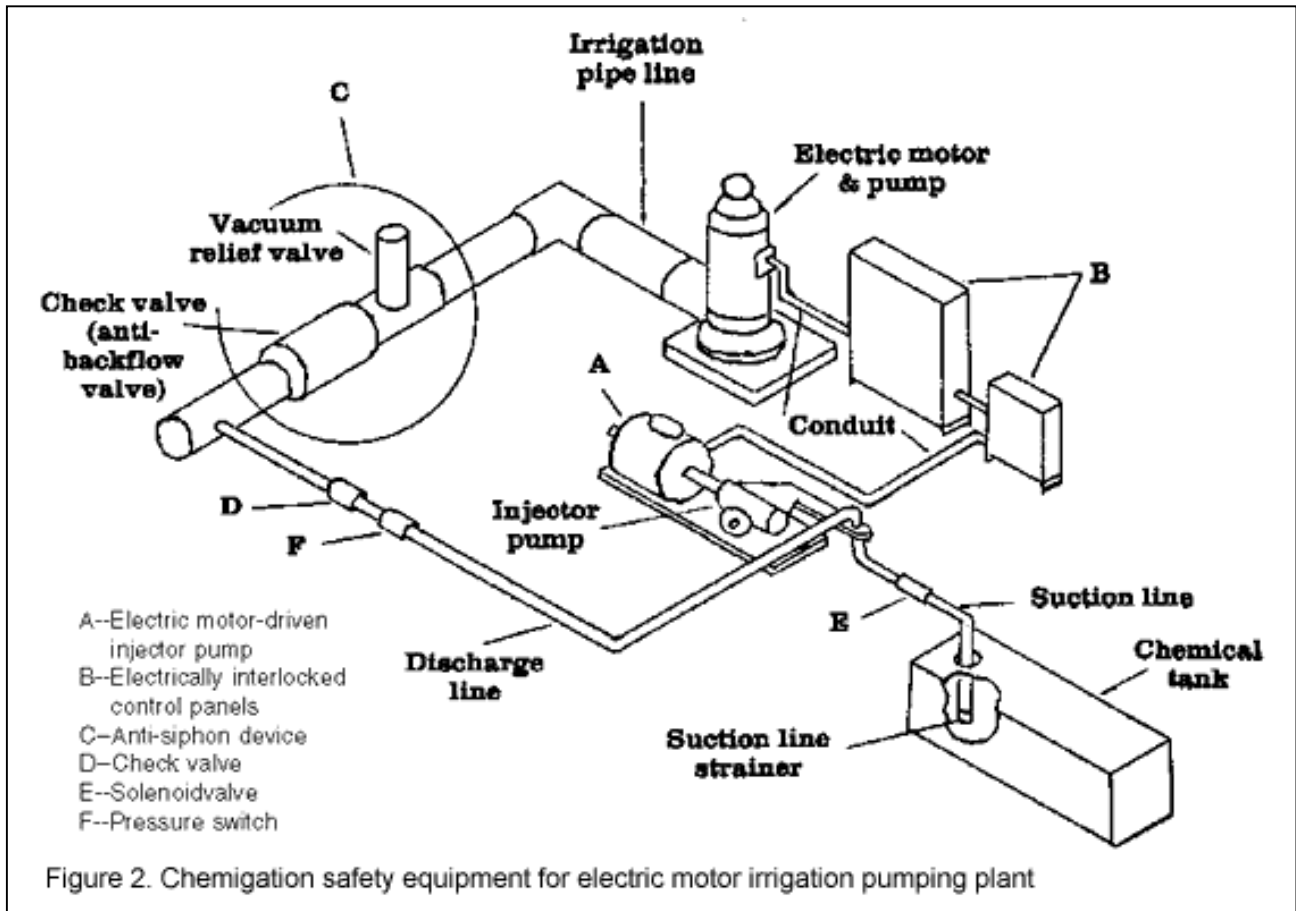
Injection of acid into the irrigation water is a direct way of neutralizing the bases present. Acid may be injected in much the same way as fertilizer. However, precautions should be taken to avoid injuries to personnel, equipment, and trees.

The amount of acid that needs to be mixed with the irrigation water will depend on the quantity of bases the irrigation water contains and on the strength of the acid that will be used. The base content of the water is determined in the water test and the strength of the acid is given on the container.

One milliequivalent (me) of acid neutralizes one milliequivalent of base. For example, if irrigation water contains 5 me of bases per liter, it would take 5 me of acid to completely neutralize a liter of water. Neutralization of 80-90% of the bases in water should be a reasonable goal for most situations.

The most commonly used acids are sulfuric, hydrochloric, and phosphoric acid. Other acids could be used but cost and availability usually limit the choices to these three. Phosphoric and sulfuric acids may have some nutritional value but this should be a minor consideration in choosing an acid for neutralization of irrigation water. Hydrochloric, sulfuric and phosphoric acids are highly toxic materials irritating to the skin, throat, lungs, and digestive tract. Always wear goggles and chemical resistant (rubber, neoprene, vinyl, etc.) gloves, apron and boots whenever handling these acids. Acid must be poured into water, never vice versa, and should be done in a well-ventilated area.

**NOTE:** It is illegal to inject any chemicals into irrigation systems without appropriate safety devices, which will automatically prevent the backflow of water and chemicals to the water supply.



It is generally advisable to dilute concentrated acid in a nonmetal mixing tank prior to injection into the irrigation system, rather than injecting concentrated acid directly. Most metal fittings, tanks, and other parts of the irrigation system will be damaged by acid, even diluted acid, so proper precautions must be taken. The system has to be flushed after application to avoid significant damage.

In addition to the dangers involved with handling strong acids, there is also the danger of over-application of acid. Excess acid addition could result in injury to trees, which come in direct contact with the water. Also, an excessive acidification of the soil could result in tree injury or death. These problems can be avoided by:

1. determining the proper amount of acid to apply and
2. monitoring the irrigation system to ensure that the correct amount is applied.

Monitoring the pH of the acid-treated water is one way of checking on a daily operational basis. It can be done with a pH meter or with pH papers. Acid needs to be added to bring the water pH between 4.5 and 5.0. Because the neutralization reaction continues slowly over a period of a day or two, the measured pH of the water immediately after acid addition will usually be lower than that measured once the reaction is complete. For monitoring purposes during acid additions, use the pH measured immediately after acid addition as a guide to avoid over-acidifying.

### **Summary**

1. Have your irrigation water tested.
2. Select an acid producing material.
3. Add the calculated amount of acid producing material.
4. Measure the pH of the water as it comes out of the irrigation line.
5. If the pH is not between 4.5 and 5.0, increase or decrease the amount of acid.

Water quality (me base/Liter)	Approximate amount of pure calcium carbonate added per acre by 20 inches of water	Approximate amount of acid-producing materials per acre to neutralize 100% of the bases from the water	
		93% Sulfuric acid (gal)	Elemental sulfur (lbs)
1	225	15	75
2	450	30	150
3	675	46	225
4	900	62	300
5	1125	77	375
6	1350	92	450
7	1575	108	525
8	1800	123	600
9	2025	138	675
10	2250	154	750

**1 gallon = 3.785 liters**

**1 acre inch = 3,630 cubic feet = 27,154 gal.**



# *Phytophthora Foot Rot and Root Rot*

Foot rot results from infection of the scion near the ground level, producing bark lesions, which extend down to the budunion on resistant rootstocks.

Crown rot results from infection of the bark below the soil line when susceptible rootstocks are used. Root rot occurs when the cortex of fibrous roots is infected, turns soft and appears water-soaked. Fibrous roots slough their cortex leaving only white thread-like stele. When managing *Phytophthora*-induced diseases, consider integration of cultural practices (e.g., disease exclusion through use of *Phytophthora*-free planting stock, resistant rootstocks, proper irrigation practices) and chemical control methods.

Cultural practices. Field locations not previously planted with citrus are free of citrus-specific *P. nicotianae*. Planting stock should be tested free of *Phytophthora* in the nursery and inspected for fibrous root rot in the nursery or grove before planting. In groves with a previous history of foot rot, consider use of Swingle citrumelo for replanting. Swingle citrumelo is resistant to foot rot and roots do not support damaging populations once trees are established.

Cleopatra mandarin should be avoided because it is prone to develop foot rot when roots are infected in the nursery or when trees are planted in flatwoods situations with high

or fluctuating water tables and fine-textured soils. Trees should be planted with the budunion well-above the soil line and provided with adequate soil drainage. Overwatering, especially of young trees, promotes buildup of populations in the soil and increases risk of foot rot infection. Prolonged wetting of the trunk, especially if tree wraps are used on young trees, should be avoided by using early to midday irrigation schedules. Control of fire ants prevents their nesting under wraps and causing damage to tender bark.



Sampling for *P. nicotianae*. Population densities of the fungus in grove soils should be determined to assist in decisions to treat with fungicides. Soil samples containing fibrous roots should be collected during the spring through fall (March to November) from under-canopy within the tree dripline. Individual small amounts of soil from 20 to 40 locations within a 10-acre area are composited into one resealable plastic bag to retain soil moisture. Samples must be kept cool but not refrigerated for transport to the analytical laboratory. Currently, populations in excess of 10 to 15 propagules per cm<sup>3</sup> soil are considered damaging.



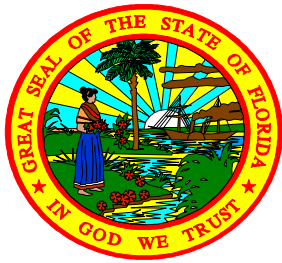
The same soil sample could be tested for populations of nematodes, to assess whether they occur at damaging levels.

#### Chemical control.

Use of fungicides in young groves should be based on rootstock susceptibility, likelihood of Phytophthora infestation in the nursery, and history of Phytophthora disease problems in the grove. For susceptible rootstocks, such as Cleopatra mandarin and sweet orange, fungicides may be applied to young trees on a preventive basis for foot rot. For other rootstocks, fungicide treatments should commence when foot rot lesions develop. The fungicide program for foot rot should be continued for at least one year for tolerant rootstocks, but may continue beyond for susceptible stocks.

In mature groves, the decision to apply fungicides for root rot control is based on yearly soil sampling to indicate whether damaging populations of *P. nicotianae* occur in successive growing seasons. Time applications to coincide with periods of susceptible root flushes in late spring and late summer or early fall. Soil application methods with fungicides should be targeted to under canopy areas of highest fibrous root density. To avoid leaching from the root zone, soil-applied fungicides should not be followed by excessive irrigation. Aliette and Ridomil are both effective, but alternation of the materials should be practiced to minimize the risk of the development of fungicide resistance. Foliar spray with Aliette: It is recommended to buffer the spray solution to pH 6 or higher to avoid phytotoxicity when copper has been used prior to or with Aliette. For nonbearing trees, use 5 lb/100 gal. For bearing trees, use 5 lb in 100-150 gal/acre. Soil application with Ridomil Gold 4EC: Apply 1 quart/treated acre or soil drench by applying 5 gallons of solution (1 quart/100 gal) in water ring.

For more details and product selection and rates, get your copy of the 2001 Florida Citrus Pest Management Guide. In SW Florida, it is available at the LaBelle Hendry County Extension Office and the Immokalee IFAS Center.



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Florida Department of Agriculture and Consumer Services  
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**Date 7-16-01**

To: The Commercial Citrus Industry Of SW Florida

The Citrus Canker Eradication Program (CCEP) will be conducting presentations at the Immokalee location pertaining to Quarantine and Statewide compliance.

It is necessary to sign a new 2001 Compliance Agreement due to new revisions. It is also necessary to complete these agreements prior to the fall harvest of 2001.

These presentations will be held on September 6<sup>th</sup>, 7<sup>th</sup>, 11<sup>th</sup>, 12<sup>th</sup>, 13<sup>th</sup>, 18<sup>th</sup>, 19<sup>th</sup>, 20<sup>th</sup>, 2001 at 10:00am. The presentation will last approximately 2 hours, and you will have the opportunity to sign an agreement at that time. Please R.S.V.P by August 30<sup>th</sup> 2001

If you need an agreement prior to these dates listed or are unable to attend, please contact us to make arrangements to get your agreement signed.

Sincerely,  
Deborah Smith  
Regulatory Supervisor

WE CAN ALSO CONDUCT THESE PRESENTATIONS IN SPANISH FOR YOU, PLEASE CONTACT US TO MAKE THESE ARRANGMENTS.