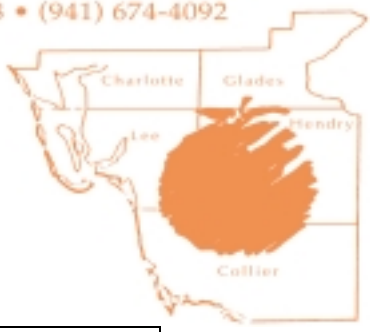
UNIVERSITY OF FLORIDA | EXTENSION
Institute of Food and Agricultural Sciences

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

Flatwoods Citrus



Vol. 4, No. 4 April 2001

Mongi Zekri, Multi-County Citrus Agent, SWF

UPCOMING EVENTS

SOUTHWEST FLORIDA CITRUS SQUEEZER SEMINARS AND WORKSHOPS

*These events will be held at the Hendry County Extension Office in LaBelle or the Southwest Florida Research & Education Center in Immokalee. Location and date may change for some events, but I will keep you posted.

Diaprepes update and control

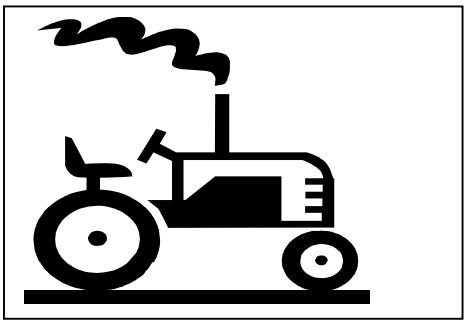
Tuesday, April 17, 2001, 10:00 AM – 12:00 Noon, Hendry County Extension Office
Speaker: Dr. Phil Stansly
1 CEU for Pesticide License Renewal
1 CEU for Certified Crop Advisors
Sponsor: Jay Hallaron, Uniroyal Chemical Company, Inc., Orlando

We are planning a free lunch for all attendees (Compliments of Uniroyal Chemical Company, Inc.) following the seminar. RSVP for lunch by Friday, 13 April to Sheila at 863 674 4092.

Participants with disabilities seeking accommodations, please inform us at least five working days prior to the program

Diaprepes *abbreviatus* is a problem in many areas in Florida including Glades and Hendry counties in SW Florida. Diaprepes is a very destructive and devastating pest. It is very difficult and very expensive to control. **Don't miss the seminar on April 17.**

-Managing resets in Tristeza and Blight infected blocks,
-Citrus psyllid, citrus greening, and canker
Date: Tuesday, May 15, 2001, 8:30 AM –12:00 Noon
Location: Immokalee IFAS Center
Speakers: Jack Neitzke and Drs. Jim Graham, Pam Roberts, Fritz Roka, and Pete Timmer?
3 CEU for Pesticide License Renewal
3 CEU for Certified Crop Advisors
Sponsor: Mark Verbeck, Bayer, Inc., Alva



Farm Safety Day
Date: Saturday, June 2, 2001, 7:45 AM – 2:45 PM
Location: Immokalee IFAS Center
3 CEU for Pesticide License Renewal
Coordinator: Dr. Mongi Zekri

Annual Meeting of the Florida State Horticultural Society

Date: June 10-12, 2001
Location: Hutchinson Island Marriott Resort & Marina

Citrus Expo

Date: August 22-23, 2001
Location: Lee Civic Center, Fort Myers
For more information, call Dr. Bob Rouse at 941 658 3400

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

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

Florida Agricultural Conference & Trade Show (FACTS)

Date: October 1-5, 2001
Location: Lakeland Center, Lakeland
For more information, call Dr. Ed Stover at 561 468 3922

47th Annual Meeting of the Interamerican Society for Tropical Horticulture

Date: October 1-5, 2001
Location: Cuernavaca/Oaxtepec, Morelos, Mexico
For more information, go to www.isth.cjb.net or contact Dr. Richard Campbell, Executive Secretary-Treasurer at Fax: 305 665 8032, E-mail: rcampbell@fairchildgarden.org

Hendry County Extension Ag Tour

Date: December 8, 2001. For more information, call Inez at 863 674 4092

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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Fertigation

It is the application of soluble fertilizers through irrigation systems.

Some advantages of fertigation:

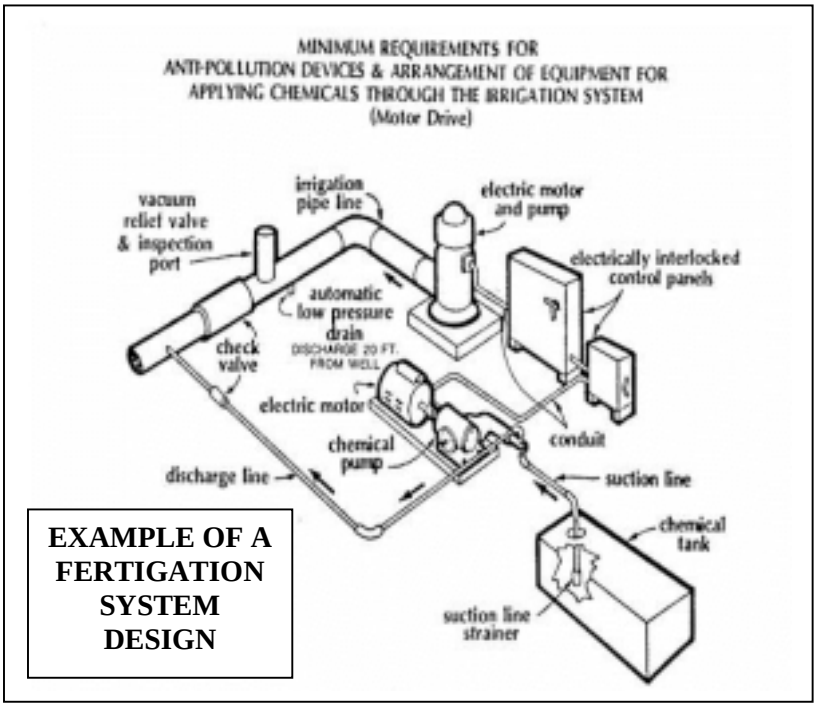
-Fertilizer is placed in the wetted area where feeder roots are extensive,
-Fertilizer may be applied more frequently in small amounts so that it is available when the tree needs it,
-Increased fertilizer application frequency can increase fertilizer efficiency and reduce leaching,
-Application cost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

For microirrigation to be most effective, water and nutrients should be applied simultaneously.
Fertilizer efficiency and fertilizer cost savings of fertigation are greatest for young trees.
Fertigation is not recommended for non-uniform, poorly designed irrigation systems.
It should be kept in mind that fertilizer and water is wasted when fertigating a very wet soil to keep up with a programmed fertigation schedule. Water and nutrient uptake are drastically reduced under waterlogged soil conditions.
It is essential that backflow prevention devices be used to prevent fertilizers from contaminating the water supply.
It is very important to determine how long it takes for the fertilizer to travel to the farthest emitter because the system has to be flushed for at least that length of time.

Some disadvantages of fertigation:

-Extra equipment (filter, injection device, tank, backflow prevention system) must be added to the irrigation system,
-Soluble fertilizers are more expensive than granular fertilizers,
-Fertilizer application uniformity and coverage depend on the proper design and accuracy of the irrigation system,
-Fertilizers injected into an irrigation system may contribute to its plugging.

Caution should be taken when applying solutions containing phosphorus. Phosphorus can combine with dissolved calcium and magnesium in the irrigation water to form insoluble precipitates that clog the irrigation lines.
To avoid emitter plugging, a properly designed microirrigation system should include: -A method of filtering irrigation water, -A means of injecting chemicals into the water,-Equipment for flushing the system,-And in some cases a settling basin to allow aeration and the removal of solids.



EXAMPLE OF A FERTIGATION SYSTEM DESIGN

Special Thanks to the following 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

Importance of Foliar Feeding

Because fertilizer applications to the soil are subject to various factors such as leaching, runoff, and being tied up in the soil in unavailable forms to citrus trees, foliar application of nutrients should be included in the fertilizer program. Foliar application of nutrients is of significant importance when the root system in 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 applications of low-biuret urea or phosphite in late December-early January are known to increase flowering, fruit set, and fruit production. Postbloom foliar applications of potassium nitrate or mono-potassium phosphate in late April have been found to increase fruit size (Read the enclosed sheet entitled "Using foliar potassium applications to enhance fruit size").

Micronutrient applications

Plant nutrients are classified as macronutrients and micronutrients. The term "macronutrient" refers to elements needed in large amounts such as nitrogen, phosphorus, and potassium. The term "micronutrient" is used to signify plant nutrients that are essential to plants but are needed only in small amounts.

Foliar applications of micronutrients (zinc, manganese, boron, copper, molybdenum) are more effective than soil applications with the exception of iron (Fe). Foliar sprays of micronutrients give a more rapid response and are easier to apply, but their effect does not last very long. Soil applications of Fe chelates still offer the most effective means of correcting Fe deficiency. However, Fe chelates are not equally effective. See the Table below.

Iron Chelates	***Effective pH Range***
Fe-EDTA	4 to 6.5
Fe-HEDTA	4 to 6.5
Fe-DTPA	4 to 7.5
Fe-EDDHA (Sequestrene 138 Fe)	4 to 9.0

Zinc (Zn), manganese (Mn), and copper (Cu) should be foliarly applied when the spring or major summer flush leaves are about fully expanded, each at the rate of 2-3 lbs metallic per acre using oxide, sulfate, nitrate or other forms at their recommended rates. The recommended maintenance rate for boron (B) foliar application is 0.25 lb per acre (1.25 lbs of soluble borate containing 20% B). When deficiency symptoms are present, apply up to 0.5 lb per acre. For molybdenum (Mo), the recommended rate also depends on the severity of the deficiency and the size of the trees and is 5-10 ounces of sodium molybdate per acre. Unlike Zn, Mn, Cu, and Fe, Mo deficiency usually occurs under very acid soil conditions. Soil applications of Mo are not satisfactory. Concerning Fe, soil application of Fe sulfate has not given satisfactory results on either acid or alkaline soils. Depending on soil pH (see Table above) and tree size, it is recommended to soil apply 1/4 to 1/2 of an ounce of metallic Fe/tree using a chelated compound. These amounts are equivalent to 4 to 8 ounces of Sequestrene 138 Fe (6% Fe). Chelated materials should be incorporated into the soil because most of them are subject to photo-decomposition. Chelated materials are much less effective when applied in the winter (cool weather) than when applied during the rest of the year.

Diaprepes

Sugarcane rootstalk borer weevil or 'Apopka weevil' (*Diaprepes abbreviatus*) is a problem in many areas in Florida including Glades and Hendry counties in SW Florida. Notching along the margins of the most recent leaf flush is the best way to determine the presence of root weevils. Therefore, it is best to look for a sign, such as the pest doing the damage. Weevils are nocturnal and will be found on the outer portion of the tree in the early morning or late evening hours. Adults generally hide within the tree canopy during the heat of the day. When the adults are disturbed or the tree is shaken, the weevils will fall to the ground faking death. Tedder's Traps placed under the tree canopy have been used to capture adults and determine time and intensity of seasonal adult emergence from the soil. The larvae channel on the outer bark tissue into the cambium layer to the woody portion of the root and often girdle the taproot causing its death and impeding the ability of the tree to take up water and nutrients resulting in plant mortality. In addition, this type of injury provides an avenue for pathogen invasion such as *Phytophthora*. Although adults can emerge year round, their primary emergence period in southwest Florida was found to be mid to late April. Larval entry into the soil begins about 20 days after adult emergence begins. Two applications of parasitic nematodes at 4 and 12 weeks after adult emergence begins may give satisfactory root protection. In southwest Florida, nematode applications are generally recommended with first summer rains. Diaprepes long distance dispersal is through the movement of contaminated soil and nursery plants and trees containing potentially all life stages of the weevil. In addition, soil residues on vehicles and grove equipment may be contaminated with larvae and can move this pest from one grove to another. The use of horticultural oils to separate leaves that have been stuck together to protect eggs may reduce Diaprepes population. When leaves are separated, eggs desiccate or are more subject to parasitism. Oils also prevent females from gluing eggs to leaves. Just after peak trap captures, foliar spays of Guthion, Micromite, or Sevin with one gallon of petroleum oil, or other registered pesticides can effectively control adults. Capture 2EC is also available under Section 18 and can be applied as a soil barrier treatment to control young (neonate) larvae. It should be kept in mind that frequent use of insecticides against adults could affect non-target organisms including biological controls. For more detailed information on this pest and other citrus pests, GET YOUR COPY OF THE 2001 FLORIDA CITRUS PEST MANAGEMENT GUIDE.

ADULTS

EGGS

LARVAE

Melanose

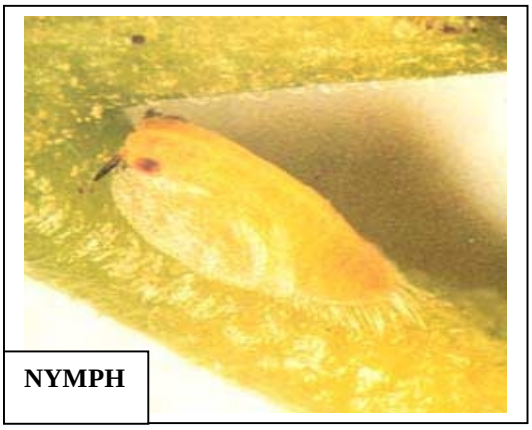
Control of this fungal disease should only be targeted to susceptible cultivars such as grapefruit where the fruit is intended for the fresh fruit market. Grapefruit is susceptible to melanose infection from fruit set until it reaches 3 inches in diameter. Control of melanose should start in April and continue at 2-3-week intervals depending on the rainfall through June until the fruit becomes resistant. Copper fungicides are effective for only short periods when applied to rapidly expanding fruit or leaves. Use 2 lbs/acre of metallic copper for each 3-week period. Benlate spray at petal fall for scab control can reduce the inoculum for melanose infection. The May-June copper spray to control greasy spot is considered to be the last spray for melanose control. If copper fungicides are applied in the summer, they should be applied when temperatures are moderate, at rates no more than 2 lb/acre of metallic copper without petroleum oil, and using spray volumes of at least 125 gal/acre. Abound is also effective for melanose control and can be used at any time for disease control. Copper fungicides are more economical for melanose control until June. Since copper fungicides applied in hot weather can damage fruit, use of Abound at that time will avoid this damage and control greasy spot as well as melanose. Abound appears to have lower residual activity for melanose control than do copper fungicides. Thus, applications may have to be made at shorter intervals especially when rainfall is high.

Citrus Leafminer

DAMAGE ON LEAVES

Citrus leafminer can occur on new flush throughout the growing season, but usually does not affect the first spring flush. Citrus leafminer generally does not significantly affect growth and yield of mature trees. Biological control through natural enemies already present in Florida and the introduced parasitoid wasp makes a significant contribution in suppressing the problem. However, nursery stock, resets, and young trees are very vulnerable to severe leafminer damage because of their frequent flushes. Residual activity of most pesticides is limited by rapid and frequent appearance of new and unprotected flushes so that 2-3 weeks control is the best that can be expected. Therefore, scouting is necessary to determine peak periods of larval activity during flushing periods to increase the efficacy of chemicals. Chemical application should begin when 1/3 of the flush leaves shows active mines. Pesticides should be rotated to reduce selection for resistance. Since citrus leafminer affects only the new flush leaves, coverage of the peripheral leaves in the canopy should be adequate. Petroleum oil at the concentration of 3 to 5% should provide adequate control.

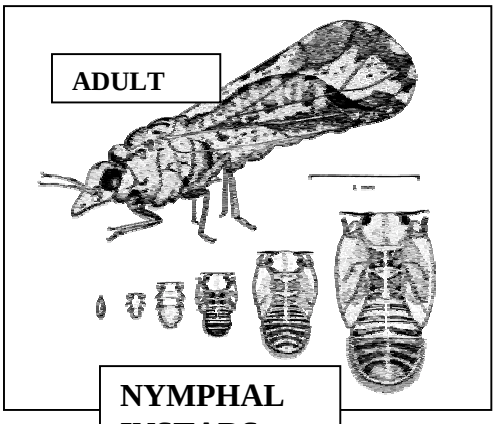
The Citrus Psyllid



In June 1998, the Asian citrus psyllid *Diaphorina citri* was found for the first time in southeastern Florida. It is now very widespread in Florida including the southwest region. The citrus psyllid is a serious pest of citrus. So far, it was confirmed that greening disease was not brought into Florida with the citrus psyllid. *D. citri* can cause two types of damage to citrus: direct feeding damage and transmission of a serious greening disease. It is difficult to separate the effects of feeding from the effects of the disease the psyllids transmit. High populations of *D. citri* cause feeding damage because they attack young tender growth (flush), causing leaf distortion and curling. *D. citri* also produce honeydew, which leads to sooty mold infestations, and badly-damaged leaves will die and fall off. Feeding by citrus psylla *(D. citri)* on the young flush of citrus trees causes damage to leaves and shoots because the psyllid has a toxic saliva.

D. citri breeds exclusively on young flush and has a very high reproductive rate. Multiple, overlapping generations can lead to very high populations. Eggs of *D. citri* are laid in the late winter and spring on very young leaves in the buds or in leaf axils. The egg stalk is forced into the leaf tissue by the ovipositor of the female. Each female may lay up to 800 eggs during her two-month lifespan. The life cycle takes about 20 days and there may be up to 30 overlapping generations per year. Adults of *D. citri* are about the size of aphids (2.5 mm).

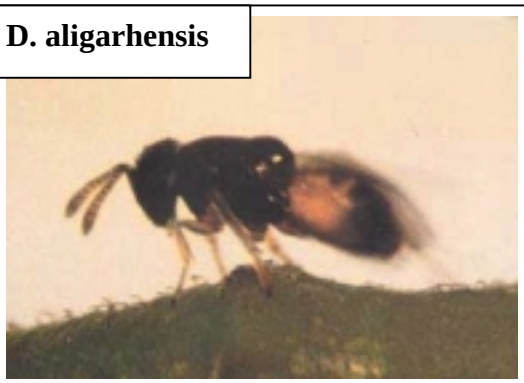
Eradication efforts were not attempted in Florida, because the pest was found to be widely distributed and abundant. Furthermore, the tools available for eradication are very limited for this pest. *D. citri* is an efficient vector of greening disease, which is considered the most serious citrus disease in Asia. If this psyllid species arrived in Florida carrying greening disease with them, the impact on our industry could be very serious. Although the psyllids don't have the disease at this time, a future introduction of the pathogen would result in effective transmission of the disease by the psyllids that are now here. The citrus bacterial disease transmitted by *D. citri* is called various names, including "greening", "leaf mottling", or "die back".



Infected trees or branches suffer heavy leaf drop followed by out-of-season flushing and blossoming, with dieback occurring in severe cases. Infected fruit are small, lopsided, and have a bitter taste and unpleasant flavor in the juice, probably because of higher acidity and lower sugars. Many fruit fall prematurely, while those that remain on the tree do not color properly, remaining green on the shaded side, hence the name of the disease “greening”. Generalist predators such as lacewings, syrphid flies, lady beetles, and spiders attack psyllids. These native natural enemies are not expected to suppress the pest populations to a non-economic level. Two parasitoids, *Diaphorencyrtus aligarhensis* and *Tamarixia radiata* of the pest have been imported in Florida and are being released in a classical biological control program. *T. radiata* was released in SW Florida in June 2000. These two natural enemies are recorded as primary (beneficial) parasitoids. In Thailand and Vietnam, *D. aligarhensis* and *T. radiata* are known to be important parasitoids. These parasitoids can substantially reduce psyllid populations. In northern India one parasitoid is recorded as exerting up to 95% mortality of the pest. Excellent biological control of the Asian citrus psyllid was achieved by the introduction of these two parasitoids into Reunion Island; the vectors were nearly eliminated and the disease was controlled. The parasitoid *Tamarixia radiata* is a eulophid ectoparasitoid (external parasite) that parasitizes the third, fourth, and fifth instars. Females of *T. radiata* lay an egg ventrally on the outside of the psyllid. After the parasitoid larva devours its host, it attaches itself to a leaf or twig and the adult emerges by cutting its way out of the pupal chamber.

Although we had a freeze and very cold weather this winter, the citrus spyllid was able to survive, reproduce and cause noticeable damage to the spring flush in southwest Florida. Many backyard and commercial citrus trees, particularly young trees and resets have been severely damaged by the citrus psyllid. It is recommended for homeowners and growers to use pesticides that can help suppress psyllids, but not disrupt natural enemies of citrus pests in Florida. The use of oil is less disruptive and should be used. Tests with petroleum oil sprays against citrus psylla in China indicated that oil was most toxic to first and second instar nymphs and provided good control if applied frequently during the summer. Based on feedback from citrus growers and production managers in Florida, spray oil is working effectively in knocking down psyllid populations. Oil has a number of advantages over conventional pesticides because oil is less disruptive to natural enemies, insects do not develop resistance to oil, oil has a low toxicity to vertebrates, and oil breaks down readily in the environment.

D. aligarhensis



T. radiata

The Drought Continues

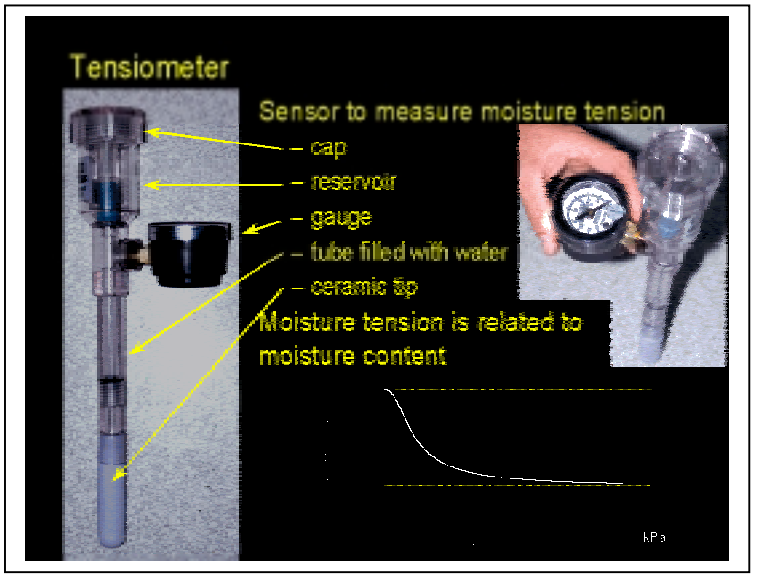
By Dr. Larry Parsons

The drought of 2000-01 continues. Parts of central Florida have had a rainfall deficit of 18 to 24 inches over the past 18 months. The Climate Prediction Center in Maryland has predicted that rainfall through March, 2001 will be below normal. This could mean that our normally dry season could be drier than usual. It is ironic that as recently as February, 1998, parts of Florida had extensive flooding because of El Nino rains. Because of the drought of 2000, much of the fruit is smaller in size and the crop estimate for oranges was lowered in December by 11 million boxes, or 4.6%. This demonstrates that, in spite of all the irrigation that was done, yield and fruit size are strongly influenced by the rainfall Florida receives. As Florida continues its rapid growth, competition for water between urban areas and agriculture will become more intense. Additional water restrictions are likely with more pressure on agriculture to further conserve water. What can you, the grower, do when water supplies are tight? How can you take best advantage of what little rainfall there might be during a drought? Below are listed some things for you to consider that can help stretch your water supplies:

-- Do not overirrigate in the winter or spring. Earlier work showed that irrigation doesn't need to commence in the fall or winter until available water is 50 to 66% depleted. In the spring, irrigate at 25 to 33% depletion.

-- Know the general irrigation requirements for your grove and soil. Table 1 shows that trees use relatively little water during the winter months. Because of shorter days and cooler weather, average daily evapotranspiration (ET) for December and January is 0.07 inch/day. If the grove has 140 trees/acre (e.g. 25 x 12.5 foot spacing), trees use about 14 gallons per tree per day during those months. If the tree density is 200 trees/acre (e.g. a spacing of approximately 20 x 11 feet), those trees would use about 9.5 gallons per tree per day in those months.

-- Use tensiometers or some device that gives an indication of soil or plant water status. Tensiometers measure in units of tension (centibars or kilopascals) that indicate how tightly water is held in the soil. From August through January, you don't need to irrigate with microsprinklers until 50% depletion, which corresponds to a tension of about 15 cbar on the ridge and 30 cbar on the flatwoods. In the spring when irrigation is more critical, irrigation should start at 25 to 33% depletion which corresponds to a tension of around 10 cbar on the ridge and 15 cbar on the flatwoods. Tensiometers should be placed at depths of 6 and 12 inches on the ridge and flatwoods. On the ridge, an occasional tensiometer can be placed at 18 or 24 inches to see if water is getting to roots at that depth. Other devices estimate soil water content instead of tension, and water content levels can be calculated to fit the depletion points indicated above.



-- Have adequate irrigation coverage underneath the tree canopy. If a microsprinkler system has one jet per tree and 140 trees/acre, a system with 10-foot diameter emitters covers only about 25% of the total land area.

Since roots spread throughout much of the entire grove floor in a mature grove, this spray pattern would irrigate only a fraction of the total roots. The majority of the roots are in the top 3 feet of soil on the ridge. In a drought when there is very little contribution of water from the non-irrigated zone, it is tempting to run the system for a long time to make up for the lack of rainfall. This would drive the water deeper into the soil. It may make you feel better, but irrigating for long durations wastes water by moving it below the root zone.

-- Consider partial deficit irrigation in the winter. Mild water stress in the fall and winter can help improve flower induction. Temporary leaf wilt for a short time at midday is acceptable, but irrigate periodically to avoid severe wilt. Do not stress the trees too much because excessive stress can weaken the tree and reduce cold hardiness. If you provide for daily water needs, but do not fill up the entire soil profile, rainfall can be more effective. If irrigation is done just before a rain, that rain can essentially waste the irrigation water by driving some of it below the root zone.

-- Inspect the irrigation system. After harvesting and ground spray operations, emitters can be damaged or lines can be broken. All emitters need to be operating whether they will be used for frost protection or regular irrigation. In freeze-prone areas, elevated microsprinklers are a good idea; but in drought times, it is best to have the microsprinkler near ground level to maximize coverage. In the spring, low hanging branches that distort the spray pattern reduce coverage and cause uneven soil wetting. For reasonable growth and performance, trees need a certain amount of water. Following at least some of these practices can make for more effective use of the limited water you have. And let's hope that the drought ends soon.

Table 1

Month	Ridge Citrus		Flatwoods Citrus	
	Average Daily ET (inches)	Average Daily ET (gal/tree/day)	Average Daily ET (inches)	Average Daily ET (gal/tree/day)
Jan	0.07	14	0.07	14
Feb	0.08	16	0.09	16
Mar	0.10	19	0.12	23
Apr	0.13	25	0.15	29
May	0.16	31	0.17	33
Jun	0.18	35	0.15	29
Jul	0.19	37	0.16	31
Aug	0.18	35	0.15	29
Sep	0.16	31	0.13	25
Oct	0.13	25	0.12	23
Nov	0.09	17	0.09	17
Dec	0.07	14	0.07	14

Table 1. Average daily evapotranspiration for mature citrus trees (from Smajstrla et al. 1987. Trickle Irrigation Scheduling for Florida Citrus. Bulletin 208. UF Coop. Extension Service). The gallons/tree/day column indicates a maximum amount that trees could use. Some of that water can come from rainfall, upwelling in the flatwoods, and/or soil water in the non-irrigated zone. Do not consider this column as an irrigation requirement without considering other water sources to the tree. This assumes 140 trees/acre. In higher density plantings, water use per tree would be less.