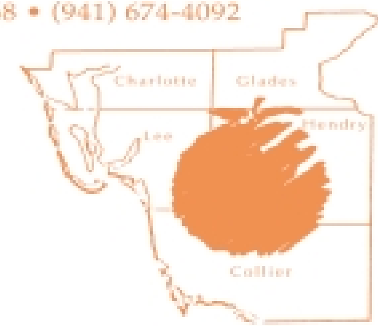
UNIVERSITY OF FLORIDA
EXTENSION
Institute of Food and Agricultural Sciences

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

Flatwoods Citrus



Vol. 4, No. 6 June 2001

Mongi Zekri, Multi-County Citrus Agent, SWF

UPCOMING EVENTS

SOUTHWEST FLORIDA CITRUS SQUEEZER SEMINARS

These events will be held at the SW Florida Research & Education Center in Immokalee.

Special Seminars

*E-Commerce: Agriculture's Newest Tool

Date: Tuesday, June 5, 2001, 10:00 AM - 12:00 Noon, Location: Immokalee IFAS Center
Speaker: Scott Peoples, Director of Marketing of XS Ag., Inc
Free lunch will be provided to all attendees

Following the seminar, we are planning a free lunch (Compliments of XS Ag., Inc.) for only who call Sheila at 863 674 4092 no later than Monday, 4 June.

*The benefits and concerns of using biosolids and poultry manure as nutrient sources for citrus production

Date: June 26, 2001, 10:00 AM - 12:00 Noon, Location: Immokalee IFAS Center
Speakers: Drs. Tom Obreza & Monica Ozores-Hampton
2 CEUs for Certified Crop Advisors
Sponsor: Resource Reclamation Services, Inc.- Bill Townshend, Miami

Following the seminar, we are planning a free lunch (Compliments of Resource Reclamation Services, Inc.) for only who call Sheila at 863 674 4092 no later than Monday, 25 June.

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

Other Meetings & Programs

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)

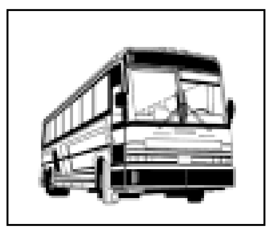
Date: October 1-5, 2001
Location: Lakeland Center, Lakeland
For more information, call Dr. Ed Stover at 561 468 3922

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



Citrus Publications available at the Hendry County Extension Office – The 2001 Florida Citrus Pest Management Guide ($6), Florida Citrus Varieties ($18.00), Your Florida Dooryard Citrus Guide ($7), Florida Citrus Rootstock Selection Guide ($7), Rootstocks for Florida Citrus ($10.00), Citrus Growing in Florida ($35), The Worker Protection Standard for Agricultural Pesticides- How to Comply ($3), and other books...

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

Susan S. Thayer

Maxijet, Inc.

8400 Lake Trask Rd.
P.O. Box 1849, Dundee, FL 33838
Phone: 800 881 6994
Fax: 800 441 6294

Lonnie Pell

SePRO ***Corporation***

600 River Moorings Drive
Merritt Island, FL 32953
Phone: 321 455 9833
Fax: 321 455 1664

Mike Raines

Griffin LLC

13171 Lake Meadow Drive
Fort Myers, FL 33913
Phone: 941 274 3102
Fax: 941 274 6663

Jerry Southwell

Hydro Agri

574 Green Ash Lane
Wauchula, FL 33873
Phone: 941 773 0154
Fax: 941 773 5088

Jack Zorn

Florida Favorite Fertilizer

P.O. Box 1466
Moore Haven, FL 33471

Robert M. Bancroft

Citrus Hedging, Inc.

P.O. Box 1366
LaBelle, FL 33975
Phone: 863 675 2190
Fax: 863 675 2104

FARM CREDIT
SOUTHWEST FLORIDA

330 N. Brevard Ave.
Arcadia, FL 34266
Phone: 800 307 5677
Fax: 941 494 6460

Rachel Martin

AVENTIS **CropScience**

Phone & Fax: 941 415 6987
Mobile: 941 707 1198

E-mail:
rachel.martin@aventis.com

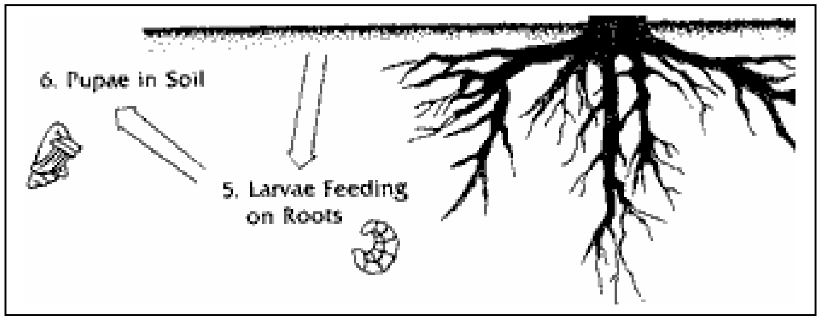
Bobbitt Jenkins

BASF Corporation

11100 Lakeland Circle
Fort Myers, FL 33913
Phone: 941 561 2812
Fax: 941 561 6985
Mobile: 941 707 1603 AGNET #6652

Diaprepes root weevil emergence

The University of Florida and six grower/cooperators are conducting a year-long survey to determine the weekly emergence patterns for Diaprepes root weevils. At each location, 100 Tedder's traps are surveyed weekly to determine the number of weevils collected in the traps. From this data, graphs are being developed to provide growers with average number of weevils per traps as well as total weevils collected during the weekly intervals. From the collected data, growers can get a feel for the emergence patterns over time which have occurred at each of the six locations. With knowledge of emergence patterns, growers can then determine when the best time to apply sprays to reduce Diaprepes injuries. The locations for the surveyed groves are in the following six counties: Lake, Polk, Indian River, Desoto, Hendry and Dade.



In an effort to provide the growers with the data in a timely manner, the information is posted to a web site maintained at the Citrus Research & Education Center in Lake Alfred at:www.lal.ufl.edu
Once at the web site, find the Extension Section and click on "Diaprepes Survey". At this site you can choose the county location, which is closest to your grove to estimate the emergence pattern that represents your area. At this web site you can also find other information related to Diaprepes root weevils and its control.

Get to the New Home of the Florida Citrus Resources Site at http://www.fcprac.ifas.ufl.edu/
There is additional information on Diaprepes and other citrus topics. You can also get access to several newsletters electronically including the Flatwoods Citrus Newsletter. You can find all you need and all links to the University of Florida Citrus Extension and the Florida Citrus Industry.

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

Blight

Citrus blight is a wilt and decline disease of citrus whose cause has not been determined. The first symptoms are usually a mild wilt and grayish cast to the foliage often accompanied by zinc deficiency symptoms. Trees rapidly decline with extensive twig dieback, off-season flowering, and small fruit. Blight trees reach a stage of chronic decline, but seldom die. The disease affects only bearing trees and usually first appears when the grove is 6-8 years old. The first affected trees in a grove are usually randomly distributed, but groups of blighted trees may eventually occur, either as clusters or down the row. The disease has been transmitted by root grafts, but not by limb grafts or with budwood. The means of spread, other than by root grafts, is not known.

Blight symptoms can be confused with other decline diseases and accurate diagnosis is important in order to follow proper practices. Citrus blight is characterized by: 1) high Zn content in trunk bark and wood, 2) presence of amorphous plugs in the xylem, 3) failure to absorb water injected into the trunk, and 4) presence of blight-associated proteins in roots and leaves. The best procedure for diagnosis of individual trees in the field is to test water uptake into the trunk using a battery-powered drill and a plastic syringe without a needle. Healthy trees or trees declining from Phytophthora root rot, nematodes, water damage, or tristeza will usually take up about 10 ml of water in 30 sec. Trees affected by citrus blight take up no water regardless of the amount of pressure applied. A serological test is available which is accurate and, with proper equipment, many samples can be processed in a short time. For confirmation of blight using the serological test, small numbers of samples of mature leaves may be collected and sent to CREC, Lake Alfred or SWFREC, Immokalee.

All scion varieties of citrus, as well as ungrafted seedlings, may be affected by citrus blight. Trees on all rootstocks are susceptible, but significant differences between stocks exist. The rootstocks which are the most severely affected by blight are rough lemon, Rangpur lime, trifoliate orange, Carrizo citrange, and some others. Those most tolerant to blight are sweet orange, sour orange, Cleopatra mandarin, and Swingle citrumelo. Sweet orange and sour orange are not recommended because of problems with Phytophthora root rot and tristeza, respectively.

<u>Recommended Practices</u>

There is no known cure for citrus blight. Once trees begin to decline, they never recover. Severe pruning of blighted trees will result in temporary vegetative recovery, but trees decline again once they come back into production. The only procedures recommended are:

1.Remove trees promptly once yield of affected trees has declined to uneconomic levels.

2.Plant or replace trees with trees on rootstocks such as Cleopatra mandarin or Swingle citrumelo which do not develop blight at an early age.

3.Plant trees on vigorous, productive rootstocks such as Carrizo citrange or rough lemon which develop blight at an early age and replace trees that decline as soon as they become unproductive. Production can be maintained at relatively high levels in spite of blight with these rootstocks.

Observations on Citrus Blight

Dr. Ken Derrick, University of Florida, IFAS, Citrus Research & Education **Center**

1. The cause of citrus blight (CB) is not known. It has been transmitted through root grafting, which suggests an infectious agent

2. How CB is introduced into groves and how it spreads from tree to tree are not known.

3. CB occurs in hot, humid areas, and is more severe in areas of high year around temperatures. In Venezuela and Northern Brazil trees are usually dead within six months of initial symptoms. In more temperate areas, trees with CB seldom die and will survive for many years.

4. CB has not been observed in Mediterranean climates.

5. Symptoms of CB are a general decline that are not diagnostic. Trees with CB have a xylem dysfunction that restricts water flow resulting in drought symptoms.

6. Trees with CB have a significant loss of fibrous roots.

7. Symptoms of CB are not seen on young trees, but are seen on bearing trees approximately four or more years old.

8. The first trees to be seen with CB in a grove are randomly distributed.

9. Trees adjacent to trees with CB are at high risk for getting CB, resulting in clustering of diseased trees, but random single tree infections will continue to be observed throughout the grove, which suggest CB may be moved by an aerial vector.

10. Clonal propagation of scion and rootstock did not reduce the incidence of CB. This contradicts the suggestion of possible seed transmission, which is indicated by the initial random incidence of the disease.

11. Budded trees on all rootstocks are susceptible to CB. Seedling trees are also susceptible to CB.

12. The age at which trees develop CB varies greatly with rootstock: Rangpur lime, lemon types and Carrizo - 5 years; Swingle 5-12 years; Cleopatra - 15 years; sour orange - 25 years; and sweet orange - 30 years.

13. Prior to the 1960s CB was rare in Florida.

14. The increase in the incidence of CB, starting in the 1960s, correlates with the use of clonal budwood in Florida and Brazil. It also correlates with the use of herbicides, which resulted in higher soil temperatures; increases in the use of lime in some groves, and decreases in the use of sulfur.

15. There are blocks on rough lemon that are 50 to 75 years old that have lost very few trees. These trees were propagated using old-line budwood.

16. Any block in Florida that was propagated using clonal budwood on rough lemon will lose up to 10% of the trees per year, starting at an age of about five years.

17. Whenever a grove is essentially lost to CB there will often be a few surviving trees with no symptoms of CB randomly distributed throughout the grove. Are these trees genetically different; do they contain cross-protecting, microorganisms, or did they just escape infection?

18. Trees with CB can be identified by zinc accumulation in the wood, reduced water uptake and serological assays.

19. Trees with CB express several pathogenesis related proteins. Serological detection of one of these, p12, can be used to distinguish trees with CB from those with other declines.

20. The gene for the blight associated protein p12 has been isolated and sequenced. This indicated p12 is a novel protein with some similarities to expansins, which are proteins that have been associated with cell wall expansion. Transgenic expression of the p12 antisense gene in tobacco resulted in stunting and small leaves. This indicates that p12 may be involved in plant growth and could be a response by citrus trees to resist the stunting associated with CB. Production of transgenic citrus with both sense and antisense genes for p12 is in progress. It will be interesting to evaluate these plants for resistance to CB and for any effects on horticultural characteristics. An additional blight associated protein, p35, was shown to be a beta 1-3 glucanase, which are well known pathogenesis related proteins.
21. Leaves from propagations using limbs from trees with blight by rooting or side grafting are p12 negative.
22. In assays of rootsprouts, around and attached to trees with CB, for p12 only about 5% will be positive.
23. Failure to transmit CB using bark patch inoculations or through limbs suggest that the pathogen that causes CB is restricted to the xylem of roots.
24. In some cases, CB appears to be associated with high pH soils.
25. The most vigorous trees in a grove will frequently be the first ones to have CB.
26. Treatment with tetracycline appeared to lesson the symptoms of CB.
27. Frequent spraying with insecticides was reported to decrease the incidence of CB.
28. In a replicated experiment, replacing the soil around healthy trees with soil, taken from under a tree with CB, did not induce CB on the healthy trees.
29. Numerous genera of bacteria were found by analysis of various DNA preparations from the roots of trees with CB by PCR using consensus primers for tRNA, 16s and 5s RNA genes. This work, to associate a specific bacterial gene sequence with CB, is continuing.

Pesticide Resistance Management

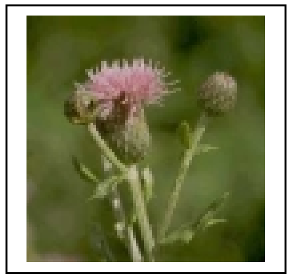
Of the most important factors that affect the development of pesticide resistance is the operational factor, which can be effectively manipulated by the grower. **The key operational factor that will delay the onset of resistance, and therefore prolong the effective life of a compound, is to limit the number of applications of the same or similar materials to one per season.** Rotation of chemicals from different classes within or between years may further reduce the likelihood that resistance to any one material will develop. If resistance to a particular chemical does develop in a pest population, use of that material and materials in the same class, should be discontinued.

To aid in the selection of chemicals by growers wanting to rotate materials within a season or from year to year, the pesticides listed below are grouped by chemical class. Natural products such as sulfur, copper, and oil are not included in this list because the development of resistance to them is not likely.

Carbamates: Carzol SP, Sevin, Temik
Chlorinated Hydrocarbons: Kelthane
Insect Growth Regulators: Micromite
Macrocyclic Lactone: Agri-Mek
Organo-phosphates: Ethion, Guthion, Malathion, Lorsban, Supracide, Cygon, Orthene
Organo-tin: Vendex
Pyridazinone: Nexter
Sulfite Ester: Comite

Weeds

Vegetation species are considered economic pests if they reduce the growth, health and survival of young trees, or the time to come into bearing and ultimately fruit production. The more competitive the vegetation, the more adversely it alters tree physiology, growth, fruit yield and quality. The attainment of early crop production requires controlling the growth of weeds. Weeds alter economic status by competing with trees, particularly young trees, for water, nutrients and even light in the case of climbing vines which can easily cover trees if left uncontrolled.



Weeds also have various effects on tree performance including reduced efficacy of low volume irrigation systems, and interception of soil-applied pesticides.

Management Methods

Cultural & mechanical

Cultural methods include off-target irrigation and fertilizer applications. Mechanical methods include cultivation in row middles. **Constant cultivation also results in the destruction of citrus fibrous roots which normally would grow in the undisturbed portion of the soil.** Mowing is practiced between the tree rows and away from the trees in combination with herbicide applications in the tree row over the major root zone of trees. It is appropriate where a cover crop is desired in bedded groves to prevent soil erosion. Weeds can also be spread by seed and vegetatively during mowing operations, reinfesting tree rows where herbicides have been applied. **Mowing before seedhead formation is necessary to reduce seed dissemination and reinfestation.**

Chemical mowing

Chemical mowing, utilizing Low Rate Technology (LRT) postemergence herbicide spray applications and wiping in combination with mechanical mowing, is used for the suppression of vegetation in row middles. With the high frequency and cost of mechanical mowing required to maintain vegetation control in row middles, chemical mowing and wiping with low rates of glyphosate has increased. Middles management chemical applications result in the elimination of tall growing species and establishment of more manageable sod type species such as bermuda and bahia grasses.

Chemical

Generally speaking, all weed species listed as susceptible on the herbicide product label will be controlled by that herbicide at the appropriate rate, time of application and stage of growth. Environmental and plant conditions before, during and following the application are also important including moisture in the form of rainfall and/or irrigation. **Poor control can sometimes be expected from postemergence applications to weeds under stress conditions due to poor uptake and translocation of applied herbicides**. Assuming that the appropriate herbicide or herbicide mixtures are selected for the weed species present, failures in the program will usually be due to one of the above factors or to the actual application including calibration and/or equipment design and operation.

Herbicides may be classified as foliar or soil-applied. Foliar applied materials may have systemic or contact activity. Soil applied preemergence herbicides are absorbed through weed root systems, being most effective during germination and early seedling growth stages. Systemic herbicides are those that are absorbed by either roots or above-ground plant parts and are translocated throughout the plant. Contact herbicides act as desiccants, damaging or killing all plant parts actually sprayed with little if any translocation.

For the control of well-established perennial weeds, a postemergence herbicide with systemic metabolic activity should be used with preemergence soil residual products.

Timing and frequency of application are the keys to good vegetation management. **Increased application frequency of lower rates of soil residual herbicides is more effective in young groves where vegetation presence is greater due to more exposure of the grove floor to sunlight and where a greater herbicide safety factor is required**.

Application Technology

Rapid advances in herbicide application technology have resulted in the development of sophisticated equipment. Application equipment is now capable of selective delivery of multiple herbicide products, each directly injected into booms. In a single application, tree rows and row middles may be treated with soil residual and postemergence products with selectivity for tree age, soil type and vegetation species. Well-maintained, accurately calibrated equipment with good filtration and agitation systems capable of uniform distribution of prescribed spray volumes and droplet size is essential for efficacious, cost-effective vegetation management. Worn nozzle tips result in increased spray delivery rates and distortion of distribution patterns and should be checked regularly. Improved herbicide boom design to reduce tree skirt contact, spray drift and interference of heavy weed cover with nozzle output will reduce tree damage and fruit drop while improving control of target vegetation. Tree skirt pruning and timing of postemergence applications will also reduce boom and spray contact with low hanging limbs and fruit.

Environmental Considerations

In determining management options, herbicide selection should be based not only on species and stage of vegetation development, but product solubility and leaching potential, soil type and rainfall distribution. Objectives are to reduce weed competition and interference through measured vegetation control/suppression with inputs having reduced potential for leaching through over-irrigation, runoff and erosion, chemical drift, or other off-target impacts.

CAUTION: Herbicides may move through the soil to groundwater. Several factors influence the rate of this movement. Lower rates applied more frequently combined with sound irrigation management practices will reduce herbicide movement.

The use of bromacil-containing herbicides is prohibited on deep, sandy Ridge-type soils.

Here is a list of several herbicides that are registered for citrus.

Preemergence soil residual herbicides: Karmex, Krovar, Princep, Simazine, Solicam,

Non-selective postemergence systemic herbicides: Roudup, Touchdown

Non-selective postemergence contact herbicides: Gramoxone

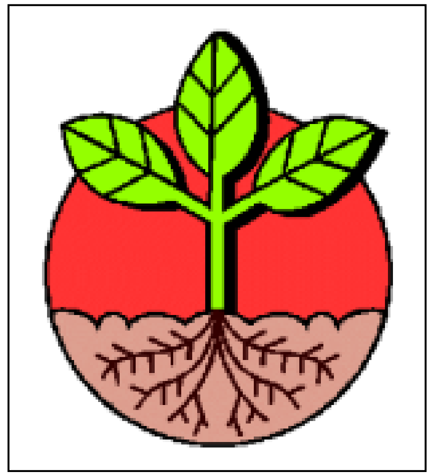
READ THE LABEL. Rates for pesticides are given as the maximum amount required to treat mature citrus trees unless otherwise noted.

For more details, get your copy of the 2001 Florida citrus pest management guide.

Rootstocks

Rootstock selection is of major importance to the success of a citrus planting because the rootstock chosen will become the root system of the budded tree. The root system is responsible for absorption of water and nutrients, adapting the scion to particular soil conditions, and providing tolerance to some diseases and disorders. Many horticultural characteristics are influenced by the rootstock including tree vigor and size, fruit yield, fruit size, maturity date, and fruit quality.

Since there is no perfect rootstock, choice of rootstocks should be mainly based on the most important limiting factor to production in a particular area. Volk is well adapted to a wide range of soil pHs and is tolerant to citrus tristeza, but is sensitive to cold weather, blight and Phytophthora. Since southwest Florida is not considered a cold-winter area, probably soil conditions is the first consideration in rootstock selection.



Cultivar and intended use of the crop (fresh or processing) are also important for rootstock selection. Cleopatra mandarin is well suited for use with tangerines, Temple, and tangerine hybrids. Cleo is not widely used for grapefruit and sweet oranges, particularly Valencia. Sweet orange and grapefruit cultivars on Cleo generally produce small fruit and are not precocious. Low yield results from poor fruit set and size and fruit splitting. After 15 years of age, trees on Cleo can decline significantly due to citrus blight. Scions on Cleo are as cold hardy as those on sour orange or Swingle citrumelo and are most productive on heavier soils. Cleo is relatively tolerant to salinity and moderately tolerant to high pH or calcareous soils. Sun Chu Sha mandarin seems to be better than Cleo. It appears to be tolerant to citrus tristeza, Phytophthora, blight, and calcareous soils. Smooth Flat Seville has some degree of citrus tristeza tolerance. Trees on Smooth Flat Seville are moderately tolerant to calcareous soils, but their yield and juice quality are lower than trees on sour orange.

Rootstocks that are drought tolerant such as rough lemon and Volk and planted on deep sandy soils impart high vigor to the scion, induce high yield, but produce fruit relatively poor in total soluble solids and acids. Tangerine fruit from trees grown on vigorous rootstocks tends to be puffy, hold poorly on the tree, and have high incidence of granulation. However, grapefruit and sweet orange on Carrizo citrange and Swingle citrumelo rootstocks typically produce high quality fruit. Trees on Carrizo grow well on sandy and sandy-loam soils, but grow poorly on calcareous or high pH soils. Carrizo is moderately sensitive to Phytophthora and tree losses due to blight have been high in Flatwoods areas. However, sweet oranges budded on Carrizo have been among the most profitable combinations over the long term in Florida. Swingle citrumelo is the most widely propagated rootstock in Florida. Scion cultivars budded on Swingle grow well on sandy and loamy soils, but grow poorly on clays, high pH or calcareous soils and in poorly drained areas. Trees on Swingle are very productive at high densities. Swingle is tolerant to Phytophthora and blight. Swingle is potentially one of the good all-purpose rootstocks for grapefruit and sweet oranges. However, it is advisable not to bud ‘Roble’ and ‘Murcott’ on Swingle.

Ranking of Citrus Rootstocks

Rootstock	***Vigor***	***Yield***	***Juice quality***	***Phytophthora***	***Calcareous soil***	***Blight***	***Tristeza***
Volk	*1	1	3	2.5	1	3	1
Swingle	2	2	1.5	1	4	1	1
Benton	1	1	1.5	2	3	2	1
Carrizo	1	1	1.5	2	3	2.5	1
Cleo	1	2	1.5	3	2	2.5	1
Sun C Sha	1	2	1.5	2.5	2	2	1
S F Seville	2	2	2	1	2.5	1	1-2
Gou Tou	2	2.5?	2.5	1	2.5	1?	1
Kinkoji	2	2?	2	1	2.5	1?	1

***The smaller the number, the better is the ranking.**

Tree Spacing

Tree spacing is an important consideration in citrus grove management. The move toward higher density planting is driven by the desire to obtain greater and earlier returns on investment, reduced availability of suitable land, increased land values and taxes, increased expenditures for equipment, irrigation systems, and labor. In Florida, the average spacing between rows of about 25 ft has remained relatively constant. However, spacing in the row, has been drastically reduced over the last decade. Many experiments on tree spacing have shown that hedgerow is a satisfactory system and that creating a space between trees in the row failed to improve yield. Furthermore, continuous hedgerows have been found not to affect fruit color and juice quality. A disadvantage of higher density plantings is yield reduction due to overcrowding or shading after the planting has reached containment size. Such yield reduction is a result from delays in hedging and topping for tree size control until trees are well beyond containment size. It is possible to maintain satisfactory yield in higher density plantings with timely pruning practices and efficient fertilizer management. Many variables must be included in making a decision about spacing. Tree vigor and habit as influenced by cultivar and rootstock and soil characteristics including depth to the water table are important. In general, a spacing of 20 to 25 ft between rows and 10 to 15 in the row is considered suitable for citrus plantings. Within this range, more vigorous trees such as grapefruit, lemons, Orlando and Minneola tangelos, and other cultivars with more spreading growth habits should be planted at wider spacing than sweet oranges. A middle width of 7 to 8 ft should be maintained to provide adequate access for current production and harvesting operations. Do not plant Valencia on Volk at spacings less than 12 ft in the row and 24 ft between rows. On the other hand, Valencia on Swingle should not be planted further apart than 12 by 22 ft.

Rootstock Selection

By Dr. Bill Castle

Choosing a rootstock is an important decision. It should be carefully considered because such decisions are relatively permanent in their effect and, thus, in their long-term significance. The steps involved in choosing a rootstock may not always be obvious, but there are factors that traditionally have been important. Among these are the experiences and opinions of friends, neighbors, nurserymen, and the grower himself. The information can be conflicting and confusing, making the choice of a rootstock unnecessarily difficult. What follows is just one approach that may be helpful in selecting the best rootstock for your conditions.

GATHER THE FACTS ABOUT YOUR SITE

There is no substitute for having available as much factual information as possible. Information should be obtained regarding:

1. Soil - Texture, depth, hardpan, pH, chemical characteristics, water holding capacity, drainage, nutrient status, etc.
2. Elevation and air drainage - These factors are strongly related to the potential for cold damage.
3. Nematodes - The presence of the parasitic citrus and burrowing nematodes has the potential for simplifying a rootstock decision because of the ease with which many choices can be eliminated. Even if this information is not used in the decision-making process, it is still useful.
4. Historical - If a new site is being planted, learn about the successes and failures of your neighbors. If an area is being replanted, consider the reason for replanting.

KNOW YOUR OBJECTIVE

Many decisions are made within the framework of a well-defined goal. Therefore, it is important to consider:

1. Scion cultivar - Like choosing a rootstock, the cultivar selected represents a choice not often or easily changed after planting.
2. Market - Juice quality may be less important than yield if the fruit is for processing, and this would affect the choice of rootstock. If the fruit is for the fresh market, the influence of the rootstock on external quality may become more important.
3. Time - If you have a short-range goal, a tree on a vigorous, productive rootstock might be appropriate. For long-range objectives, another rootstock with different characteristics may be more suitable.

KNOW THE ROOTSTOCKS

There are two readily available sources of information on rootstocks. Each provides a different perspective. They are:

1. Experience - Few growers have hesitated to plant trees on rootstocks such as Carrizo citrange because this stock and its characteristics are well known. The boundaries of its performance have been established from years of commercial use. Practical experience has also shown that it has limitations; nevertheless, this rootstock is generally more

acceptable than others that are untried. Confidence (and less risk) is derived from knowledge.

2. Field experiments and research data - A major function of rootstock research is to determine the commercial potential of new rootstocks and also to ensure that the capabilities of currently used rootstocks are completely and clearly understood. The various field experiments established for this purpose, including those in commercial groves, represent essentially the only source of data regarding new rootstocks. As a result, they are likely to provide answers for today's important issues, such as the incidence of blight among trees on Carrizo citrange. It wasn't too many years ago that Volkamer lemon and Swingle citrumelo rootstocks were unknown in Florida. Now, one of these, Swingle, is of considerable commercial interest.

CHOOSING THE ROOTSTOCK

The first three steps are the relatively simple information gathering process, which provides a sound foundation for the final step - selecting a rootstock.

There are several factors that combine to make the final step more difficult than the preceding ones. These include the lack of complete information about any rootstock as well as recognizing that no rootstock is perfect. Unfortunately, all the desirable attributes for a citrus rootstock have never been combined in one rootstock. Every rootstock has certain weaknesses as well as advantages. Perhaps more importantly, though, is that all rootstocks do not have the same disadvantages or strengths.

Another consideration affecting the choice of a rootstock is the relative importance given to individual rootstock effects. To illustrate this point and those mentioned above, consider, for example, trees on *Citrus macrophylla*. They are precocious, bear well, and are highly resistant to foot rot; however, they are also very easily cold damaged and the fruit have a poor quality juice. Which of these traits is of greatest concern under your grove site conditions and with your objectives?

In Florida, the choice of a rootstock is generally based on a combination of concern for productivity and tree survival. The fundamental question with fruit produced for processing is how to produce the maximum quantity of soluble solids with the minimum number of risks. Therefore, priority is normally given to rootstock effects on yield, but sometimes other factors become limiting. Examples in Florida are the potential for cold damage and susceptibility to foot rot or root rot, tristeza and blight. In contrast, some rootstock characteristics are essentially non-limiting or can be controlled and are, therefore, less important. If trees on a cold tolerant, productive rootstock are susceptible to drought, they can be irrigated.

The final step in selecting a rootstock essentially involves developing a composite assessment of a rootstock based on its individual characteristics and then choosing the rootstock that best matches your interests and goals. As no one rootstock is likely to be entirely satisfactory in any set of circumstances, it is often wise to consider using two or three. If two or more are selected, setting a grove so that trees are planted on alternating rootstocks is not recommended. Rootstocks should be selected to match specific, local conditions especially when planting the highly variable soils found in the Flatwoods. Soil and drainage are critical factors and are often the basis for rootstock decisions. It is the author's opinion that soil and yield are priority determinants. Differences in juice quality usually do not exceed the larger differences in yield among rootstocks.