Young tree care in the canker and greening era

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The care given to young citrus trees during the first three years after planting can have a tremendous influence on future tree health, vigor and productivity. A tree that gets off to a poor start will take years to catch up to one that is well attended at the outset, if it ever does.

The primary goal during the first three years after planting is to grow the largest, sturdiest tree possible to bring trees into early fruit production and maximize productivity. This point has become more important since the discovery of greening (*huang-longbing*) in Florida because grove lifespan will likely be significantly shorter (some IFAS researchers and industry leaders estimate as little as 10 to 12 years) than it has been historically. However, growing young trees quickly encourages frequent flushing which makes them highly susceptible to both the Asian citrus psyllid and citrus leafminer and possible greening and/or canker infection. Successfully growing young trees under these conditions will be challenging.

This article primarily focuses on young tree care for new, solid-set plantings, but the recommendations are applicable to resets as well. However, remember that resets face formidable challenges for water, nutrients and even sunlight when planted among older and larger trees. Proper management of irrigation, nutrition, and perhaps most importantly psyllids, on resets takes considerable planning and effort.

Table 1. Citrus microsprinkler irrigation schedule for young (age = 1-3 years) trees under average conditions.

Month	Allowable soil water depletion (%)	Duration (Hours)	Interval (Days)
January	50	3-4	7-8
February	25	2-3	3-4
March	25	2-3	3
April	25	2-3	2-3
May	25	2-3	2
June	25	2-3	2
July	25	2-3	2
August	25	2-3	2
September	25	2-3	2-3
October	25	2-3	3
November	50	3-4	5-6
December	50	3-4	7-8

Irrigation efficiency was set at 75%.
Irrigation frequency and duration depend on soil type, root depth, climate, spray volume and diameter.

From: Management of Microsprinkler Systems for Florida Citrus, http://edis.ifas.ufl.edu/HS204.

IRRIGATION

Water management for young trees is critical. Water stress reduces vegetative growth before almost any other plant process is affected. Thus, young trees, with their rapid growth and frequent flushes, are highly sensitive to water stress. During the first few weeks after planting, trees must be supplied with water frequently to ensure their survival.

When using drip irrigation, position the dripper close to (but not touching) the trunk of the tree to ensure that adequate water reaches the root zone. Keep the dripper there until new growth commences, at which time the dripper can be moved away from the tree to promote lateral root development. Drip irrigation on newly-planted trees may require short cycles (30-45 minutes) applied several times per day (irrigation pulsing) in order to be effective on our sandy soils; however, there are no current IFAS recommendations for drip irrigation.

Current IFAS recommendations for microsprinkler irrigation scheduling during the first three years are shown in Table 1.

FERTILIZATION

Second only to irrigation, fertilization, especially N (nitrogen), is an important factor affecting the growth of young trees. Nitrogen recommendations for young trees based on numerous

Table 2. Recommended N rates and minimum number of applications for non-bearing citrus trees

Year in grove	lbs N/tree/year (range)	Lower limit of annual application frequency: Controlled-release fertilizer	Dry soluble fertilizer	Fertigation
1	0.15 - 0.30	1	6	10
2	0.30 - 0.60	1	5	10
3	0.45 - 0.90	1	4	10

From: Nutrition of Florida Citrus Trees, UF-IFAS Bulletin SP-169.

Florida fertilization studies are shown in Table 2. Factors such as soil type and land history will influence fertilizer needs and should be considered.

Young tree P (potassium) needs should be based on soil test results. Soils testing high or very high in P do not require additional applications. Medium, low, and very low soil P levels should have P fertilizer applied at a P_2O5 rate equal to 50 percent, 75 percent, and 100 percent of the N rate, respectively.

Potassium fertilizer should be applied to young trees at a K_2O rate equal to the N rate.

Because of the calcareous nature of some citrus soils in Florida, Ca (calcium) availability is based on soil pH. A soil with a pH greater than 5.5 will not require any additional Ca; soil with a pH below 5.5 should be limed to pH 6.5, which will make Ca available. Magnesium (Mg) should be applied at a rate equal to 20 percent of the N rate if soil test Mg levels are medium or lower. Soil tests should be repeated at least annually and P and Mg fertilization adjusted as needed.

Micronutrients will likely not be needed if the trees are planted on previously cultivated soil (e.g., previous citrus grove or other agricultural use) unless leaf analysis or visual deficiency symptoms indicate otherwise. For trees planted on previously uncultivated land, Mn (manganese), Cu, and B should be applied at 5 percent, 2.5 percent, and 0.33 percent of the N rate, respectively. Continued application of these nutrients should be based on soil and leaf (preferred) analyses. Zn (zinc), Fe (iron) and Mo (molybdenum) do not need to be applied routinely unless visual symptoms indicate deficiencies.

Fertilizer for young trees should be applied in frequent light applications as opposed to fewer heavy applications to promote uptake efficiency and minimize losses. Dry fertilizer should be split into a minimum of four applications per year and follow guidelines for best management practices.

PRUNING

Citrus trees generally do not require pruning since the trees are not trained in any particular form. However, checking for and removing rootstock and low trunk sprouts several times during the season is desirable so they do not compete with canopy growth and development.

Future harvesting plans should be considered early in the life of the young tree. Mechanical harvesting equipment requires a relatively high skirt height, so major scaffold limbs should not be allowed to develop below 24 to 30 inches from the soil surface.

In the third or fourth year of growth, prior to the onset of bearing, trees should be examined and crossing limbs, weak limbs or other limbs with undesirable characteristics should be removed to strengthen the bearing framework.

Young trees may produce some fruit during the first two years after planting. If excessive, these fruit can be removed so they do not compete with and restrict vegetative growth.

INSECT PEST MANAGEMENT

The Asian citrus psyllid and citrus leafminer are the two main insect pests of concern for citrus growers, especially on young citrus trees. Both of these pests must have new flush for egg laying and development of the immature stages to adult. Since young trees continually produce new flushes throughout the year, if left uncontrolled in blocks of young trees, populations of psyllids and leafminer can build to very high levels. Additionally, resets within groves of mature trees can serve as a breeding ground for these pests in the off-season when mature trees are not flushing. Extra protection must be given to young trees in both situations for successful management of citrus greening and canker.

The most effective approach for controlling psyllids and leafminer on young trees is the use of soil-applied imidacloprid. Imidacloprid soil applications are most effective when applied as a drench using a specialized applicator to deliver a metered amount of solution directly to the soil/rootstock interface. The purpose of drench applications is to get as much of this material as possible into the root zone for uptake by the plant. Injection of imidacloprid through the irrigation system is not as effective as soil drench applications, since a large portion of the material is applied outside the root zone.

Since these soil applications are made to the plant's root system, a period of two to three weeks may elapse before enough imidacloprid is absorbed by the plant roots and moved up into the canopy to provide control of pest insects feeding on new flush. Thus, soil applications of imidacloprid are best applied preventively (before pests are observed) instead of curatively (in reaction to severe pest infestations). The best timing for soil applications of imidacloprid would be approximately two to three weeks prior to the anticipation of budbreak. Attempts should be made to avoid soil imidacloprid applications 24 hours prior to significant rainfall events since this can result in movement of the product below the root zone before absorption by the plant.

There are restrictions on the amount of imidacloprid that can be applied to citrus per growing season. Regardless of imidacloprid product (brand name) or application method used (soil vs. foliar), growers are limited to a maximum imidacloprid use rate of 0.5 lbs active ingredient per acre each crop season.

In terms of amount of product applied per acre, the 0.5 lbs a.i./A limit is equivalent to 32 fluid ounces of imidacloprid 2F applied to the soil per season, or 14 fluid ounces of imidacloprid 4.6F (Admire Pro) applied to the soil per season, or 40 fluid ounces of imidacloprid 1.6F applied as a foliar spray to the canopy of the trees per season. Thus, if you use or plan to use 32 fluid ounces of imidacloprid 2F per acre in one growing season, label restrictions prevent the use of additional foliar applications of imidacloprid to that acreage which would exceed the 0.5 lbs a.i./A rate limit.

The effectiveness of soil imidacloprid applications is dependent on the rate used and tree height. The larger the tree, the

higher the rate of imidacloprid needed to provide effective control of insects feeding on the new flush. See Table 3 for soil-applied imidacloprid use rates based on tree height.

In blocks of young trees, imidacloprid use rates can be adjusted based on tree height to allow multiple applications within a year without exceeding the maximum allowable seasonal limit. Between imidacloprid applications, foliar sprays with products other than imidacloprid can be used to help maintain pests at low levels. (See the 2007 Florida Citrus Pest Management Guide for a list of recommended products.)

In the case of resets within blocks of mature trees, if the maximum allowable use rate of imidacloprid has not been met due to use of foliar applications of imidacloprid, these resets can be treated repeatedly throughout the season with soil-applied imidacloprid as needed as long as the maximum use rate per acre is not exceeded.

DISEASES

CITRUS CANKER: Citrus canker, caused by the bacterium *Xanthomonas axonopodis* pv. *citri*, is a leaf, fruit and stem-spotting disease that affects numerous species, cultivars and hybrids of citrus and citrus relatives. Young lesions are raised on both surfaces of the leaf, but particularly on the lower leaf surface. The pustules later become corky and crater-like with a raised margin, sunken center and are surrounded by a yellow halo. Stem lesions can support long-term survival of the bacterium. Older lesions can become colonized by saprophytic fungi such as *Colletotrichum spp*.

Frequent rainfall in warm weather, especially during storms, contributes to disease development. Citrus canker is mostly a leaf-spotting and fruit rind-blemishing disease, but when conditions are highly favorable for infection, it causes defoliation, shoot die-back and fruit drop. When feeding galleries of leafminer on leaves, stems and fruit become contaminated with the bacterium, the number and size of individual lesions greatly increase and result in tremendous inoculum production.

As of September 2006, 75 percent of the citrus acreage in Florida was within 5 miles of a canker find. Thus, newly planted trees, whether resets or solid-set plantings, are likely to face disease pressure.

Windbreaks are highly effective in reducing the spread of canker, but more importantly, they reduce the severity of the infection in endemic situations. When canker lesions are wetted, millions of bacteria ooze onto the leaf surface. While bacteria can swim very short distances, they have no active means to penetrate the fruit, leaves or twigs. The vast majority of the infection occurs by wind-blown rains. Winds of 18 to 20 mph (typically associated with thunderstorms) are needed to actually force bacteria into the stomates on leaves and fruit.

Table 3. Soil-applied imidacloprid drench rates for young trees

Tree height	Ounces product per tree*	Trees per ounce
Imidacloprid 2F		
2 ft to 4 ft	0.0625 fl oz	16 trees
4 ft to 6 ft	0.125 fl oz	8 trees
Imidacloprid 4.6F (Admire Pro)		
2 ft to 4 ft	0.025 fl oz	40 trees
4 ft to 6 ft	0.05 fl oz	20 trees

**Product should be delivered in a sufficient volume of water to the base of tree to thoroughly wet the root zone as per label instructions.*

Windbreaks are the single most effective means of dealing with canker. In tests in nursery situations, artificial windbreaks greatly diminished the distance of canker spread down the nursery row and reduced disease to only a few scattered lesions.

For effective canker control, windbreaks need not be dense. All that is required is to reduce wind speed to less than 20 mph. The need for and the distance required between windbreak rows will depend on the destination of the fruit, fresh or processed, and the susceptibility of the variety. In the case of highly susceptible grapefruit for the fresh market, each 5- to 10-acre block will likely need to be surrounded by a windbreak. In many groves of less susceptible varieties, a windbreak down the row about every 300 feet may be sufficient. In some situations where some protection exists and tolerant varieties are grown for processing, additional windbreaks may be unnecessary. Further information on windbreaks is available at http://www.crec.ifas.ufl.edu/extension/windbreaks/index.htm.

Over the last 30 years, IFAS has evaluated dozens of products for canker control, but no material has proven more effective than copper products. Application of copper to young leaves protects against infection, but protection is soon lost due to rapid expansion of the leaf surface area. Nevertheless, for young trees in areas where canker infestations are present or nearby, a copper spray program will reduce canker-induced defoliation at a stage when vegetative flushes are frequent and abundant.

Windbreaks will be critical for canker control on young grapefruit and certain tangerine and tangelo (e.g. Minneola) varieties of highest canker susceptibility destined for fresh market. For best results, the windbreak should be established in advance so that the height of the windbreak exceeds that of the newly planted citrus trees. For processed orange varieties, windbreak installation may not be in the immediate plans, but with young trees, all varieties are highly susceptible due to flushing activity.

Promotion of excessive vigor by overfertilization will further increase susceptibility of young trees. A stringent leafminer control program to protect the spring flush and subsequent flushes combined with sprays of copper products at 1-2 lbs metallic Cu per acre applied every 21 to 28 days, will reduce the risk of canker-induced defoliation and loss of tree productivity.

WEED CONTROL

Weed control is much more important in young trees than in older trees. Because of the smaller and shallower root systems of young trees, weeds will compete for water and nutrients, significantly reducing young tree growth. Young trees can also be quickly overgrown by vigorous weed species.

Weeds should be controlled from the trunk to approximately one foot beyond the edge of the canopy. The most effective and cost efficient method of weed control in young trees is through the use of pre- and post-emergent chemical herbicides. However, for these treatments to be effective, the nuisance weeds need to be identified so that the appropriate chemical(s) are selected. Identified weed species should have their location and prevalence within the grove recorded, so that any population changes over time can be determined.

Effective weed management programs begin during site development and continue for the life of a grove. In addition to their direct effects on tree health, weeds may harbor insect and disease pests. Weed surveys should be conducted two to three times a year along with other scouting activities.

Care and establishment of young trees requires attentive management. Those who are most successful take the time to plan. The Extension page of the CREC Web site (http://www.crec.ifas. ufl.edu/extension) has links to the "Florida Citrus Pest Management Guide," and the "Windbreaks for Citrus" pages which provide an abundance of data on pest, disease and weed management. Other information and recommendations on fertilization can be found in "Nutrition of Florida Citrus Trees" (UF-IFAS Bulletin SP-169).