

Carambola Growing in the Florida Home Landscape¹

Jonathan H. Crane²



Figure 1. Selected carambola cultivars.

Credit: Ian Maguire, UF/IFAS

Scientific Name: *Averrhoa carambola* L.

Common Names: carambola, star fruit (starfruit), bilimbi, and five-finger

Family: Oxalidaceae

Relatives: bilimbi, oxalis

Origin: Southeast Asia

Distribution: Carambolas are cultivated throughout many tropical and warm subtropical areas of the world. In the US, carambolas are grown commercially in southern Florida and Hawaii. In Florida, carambolas are grown commercially in Dade, Lee, Broward, and Palm Beach counties.

History: Carambolas have been cultivated in southeast Asia (e.g., Malaysia, India, Sri Lanka) for centuries, and trees were introduced in Florida over 100 years ago. Fruit from the first introductions into Florida were tart. More recently, seeds and vegetative material from Thailand, Taiwan, and Malaysia have been introduced and sweet cultivars have been selected.

Importance: As consumers become more familiar with carambola (also called star fruit), commercial acreage and production will increase throughout the tropical and subtropical world. Currently, the major producers include Taiwan, Malaysia, Guyana, India, Philippines, Australia, Israel, and the United States (Florida and Hawaii).

Warning: People who have been diagnosed with kidney disease should not eat carambola (star fruit) unless their doctor says that it is safe for them to eat. This fruit may contain enough oxalic acid to cause a rapid decline in renal function.

Description

Tree

The carambola tree is small to medium in height (22 to 33 ft; 7 to 10 m) and spreading (20 to 25 ft in diameter; 6 to 7.6 m), and single or multi-trunked. Carambola trees are evergreen, although when grown in cooler locations, they lose some or all their leaves during the late winter and early spring. Trees grow rapidly in locations protected from strong winds. The mid-canopy area (3 to 7 ft high; 0.9 to 2.1 m) is the major fruit-producing area of mature trees.

Leaves

Carambolas have compound leaves 6 to 12 inches long (15 to 30 cm) that are arranged alternately on branches. Each leaf has 5 to 12 green leaflets 0.5 to 3.5 inches long (1.5 to 9 cm) and 0.4 to 1.8 inches wide (1 to 4.5 cm).

Inflorescence (Flowers)

Carambola flowers are borne on panicles on twigs, or small-diameter branches, and occasionally on larger wood. The flowers are perfect, small (3/8 inch or 1 cm in diameter) and pink to lavender in color. They have 5 petals and sepals. Depending upon the cultivar, carambola flowers have either long or short styles.

Fruit

The fruit is a fleshy, 4- to 5-celled berry with a waxy surface. Fruit are 2 to 6 inches (5–15 cm) in length, with 5 (rarely 4–8) prominent longitudinal ribs. They are star-shaped in cross section. The fruit skin is thin, light to dark yellow, and smooth, with a waxy cuticle. The pulp is light to dark yellow in color, translucent, crisp, very juicy, and without fiber. Desirable varieties have an agreeable, subacid to sweet flavor. Fruit are sweetest when allowed to ripen on the tree. It takes about 60 to 75 days from fruit set to maturity depending upon variety, cultural practices, and weather.

Seeds

There are usually no more than 10–12 seeds per fruit and sometimes none. Seeds are edible, ¼ to ½ inch (0.6–1.3 cm) long, thin, light brown, and enclosed by a gelatinous

aril. Seeds lose viability in a few days after removal from fruit.

Pollination

All the flowers on a given carambola variety have either long or short styles; this condition is called heterostyly. Some carambola cultivars may require cross pollination (short-styled by long-styled cultivar or vice versa) for good fruit set and yields. However, varieties such as 'Fwang Tung', 'Golden Star' and 'Arkin' produce abundant crops when planted in solid blocks, indicating that the need for cross pollination by opposing stilar types is not always necessary. Other varieties such as 'B-10' and 'B-17' produce more fruit when cross pollinated with another variety.

Varieties

There are many cultivars; however, some may be unavailable for purchase from nurseries due to a limited amount of plant-propagation material or undesirable fruit characteristics. There are two main types of carambolas, sweet and tart. Sweet types are recommended for fresh fruit while both sweet and tart types are useful for processing and home recipes. Some tart cultivars, such as 'Golden Star' attain a sweet flavor if they are allowed to ripen on the tree (i.e., become golden yellow).

Environmental Conditions

In Florida, carambola may be grown in warm locations along the southeastern (e.g., Merritt Island) and southwestern (e.g., Tampa Bay area) coasts, Miami-Dade, Lee, Broward, Palm Beach, Monroe, and Collier Counties, and in protected areas in Brevard, Pinellas, Highlands, and Polk Counties.

The optimum environmental conditions for carambola production include warm to hot temperatures, well-drained soil, continuous access to soil moisture, and protection from wind.

Temperatures

Carambola trees grow best in warm to hot areas, although they also do well in warm subtropical areas that experience only occasional freezing temperatures. The range of temperatures for best growth and fruiting are 68° to 95°F; trees generally stop growing at temperatures below 65°F. Air temperatures of 30° to 32°F may kill young leaves; young trees, twigs, and mature leaves may be killed at 27° to 29°F. Small branches may be damaged at 25° to 29°F, and large branches and mature trees may

be killed at temperatures of 20° to 24°F. Symptoms of freezing damage include leaf wilting, water soaking, desiccation, and drop; stem and limb dieback; fruit drop; and tree death.

Drought

Carambola trees have only limited tolerance to drought. Symptoms of excessively dry soil conditions (drought) include leaf folding, leaf wilting, yellowing and browning of leaves, leaf drop, reduced flowering and fruit size, stem and limb dieback, and in severe drought, tree death.

Flooding

Carambola trees are moderately tolerant of excessively wet or flooded soil conditions for about 2 to 10 days depending upon tree health, air temperatures (less time when it is hot), and presence of root diseases. However, during flooding time the tree stops growing, and if wet conditions persist, symptoms of flooding develop. Symptoms of excessively wet soil conditions include leaf wilting, yellowing and browning of leaves, leaf and fruit drop, stem and limb dieback, and, if wet conditions persist, tree death. In addition, root rotting fungi may attack the root system, causing trees to decline, die back, or die.

Wind

Carambola trees are intolerant of constantly windy conditions. Symptoms of wind damage include browning of leaflet margins, distorted leaflet shape, leaf drop, stem dieback, fruit scarring, stunted tree growth, reduced fruit size and fruit yields. Carambola trees that are annually pruned to limit their tree size to 12 ft or less generally will survive hurricane force winds without toppling.

Salinity

Carambola trees are intolerant of saline soil and water. Symptoms include browning of leaflet margins, leaf drop, stem and limb dieback, reduced fruit size, and in severe conditions tree death.

High-pH Soils

Carambola trees generally develop iron, magnesium, and manganese deficiencies when grown in soils with a pH above 7. Symptoms of iron deficiency are interveinal chlorosis (green veins with yellowing in between), reduced leaflet size, and, with severe deficiency, leaflets may become almost white. Symptoms of magnesium deficiency include a mottling of green and yellow areas. Symptoms of manganese deficiency include reduced leaf size and yellowing.

Propagation

Carambola cultivars are generally grafted on seedling rootstocks. Seedlings of 'Golden Star' appear to be better adapted to high-pH soils than are seedling rootstocks of 'Arkin'. Veneer grafting and chip budding during the time of most active growth have given good results. Actively growing, healthy carambola seedlings of ¼ inch in diameter (7 mm) are best for rootstocks. Graftwood should be taken from mature twigs on which leaves are still present and, if possible, when the buds are just beginning to grow. Alternatively, graftwood can be prepared 3 to 4 days ahead of grafting by removing the leaves. This will stimulate the buds to begin growing. Air-layering (marcottage) has not proved successful due to poor root development.

Production (Crop Yields)

The carambola has two major blooms in south Florida, April through May and September through October. However, some bloom may be found throughout the year. The harvest season is generally from June through February with peaks in fruit production during August through September and December through February. Usually there are a few fruits available throughout the year.

Carambola trees grown in wind-protected areas may begin to produce fruit within 10 to 14 months after planting. Generally, 10 to 40 lbs (4.5 to 18 kg) of fruit per year per tree can be expected during the first two to three years. As trees mature, fruit production will increase rapidly so that by years 5 and 6, 100 to 150 lbs (45 to 68 kg) of fruit per tree can be expected. Mature trees 7 to 12 years old may produce 250 to 350 lbs (112 to 160 kg) of fruit or more per year.

Spacing

Carambola trees in the home landscape should be planted 20 to 30 feet or more (7.6 to 9.1 m) away from buildings and other trees. Trees planted too close to other trees or structures may not grow normally or produce much fruit due to shading.

Soils

Carambola trees are well-adapted to many types of well-drained soils. Trees grow best where the soil reaction is moderately acid to neutral in pH (4.5 to 7). In calcareous and high-pH soils (above 7), special care is required to

prevent minor element deficiencies, particularly iron, manganese, and zinc (see Fertilizer section).

Planting a Carambola Tree

Proper planting is one of the most important steps in successfully establishing and growing a strong, productive tree. The first step is to choose a healthy nursery tree. Commonly, nursery carambola trees are grown in 3-gallon containers and trees stand 2 to 4 ft from the soil media. Large trees in smaller containers should be avoided because the root system may be "root bound." This means all the available space in the container has been filled with roots to the point that the tap root is growing along the edge of the container in a circular fashion. Root bound root systems may not grow properly once planted in the ground.

Inspect the tree for insect pests and diseases, and inspect the trunk of the tree for wounds and constrictions. Select a healthy tree and water it regularly in preparation for planting in the ground.

Site Selection

In general, carambola trees should be planted in full sun for best growth and fruit production. Select a part of the landscape away from other trees, buildings and structures, and power lines. Remember, carambola trees may become moderately large if not pruned to contain their size. Select the warmest area of the landscape that is protected from constant winds and does not flood (or remain wet) after typical summer rains.

Planting in Sandy Soil

Many areas in Florida have sandy soil. Remove a 3- to 10-ft-diameter ring of grass sod. Dig a hole 3 to 4 times the diameter and 3 times as deep as the container the carambola tree came in. Making a large hole loosens the soil next to the new tree making it easy for the roots to expand into the adjacent soil. It is not necessary to apply fertilizer, topsoil, or compost to the hole. In fact, placing topsoil or compost in the hole first and then planting on top of it is not desirable. If you wish to add topsoil or compost to the native soil, mix it with the excavated soil from making the hole in no more than a 1:1 ratio.

Backfill the hole with some of the excavated soil. Remove the tree from the container and place it in the hole so that the top of the soil media from the container is level with or slightly above the surrounding soil level. Fill soil in around the tree roots and tamp slightly to remove air pockets. Immediately water the soil around the tree and tree roots.

Staking the tree with a wooden or bamboo stake is optional. However, do not use wire or nylon rope to tie the tree to the stake because they may eventually damage the tree trunk as it grows. Use a cotton or natural fiber string that will degrade slowly.

Planting in Rockland Soil

Many areas in Miami-Dade County have a very shallow soil, and several inches below the soil surface is a hard, calcareous bedrock. Remove a 3- to 10-ft-diameter ring of grass sod. Make a hole 3 to 4 times the diameter and 3 times as deep as the container the tree came in. To dig a hole, use a pick and digging bar to break up the rock or contract with a company that has augering equipment or a backhoe. Plant the tree as described in the previous section.

Planting on a Mound

Many areas in Florida are within 7 ft or so of the water table and experience occasional flooding after heavy rains. To improve plant survival, consider planting fruit trees on a 3- to 4-ft-high by 4- to 10-ft-diameter mound of native soil.

After the mound is made, dig a hole 3 to 4 times the diameter and 3 times as deep as the container the carambola tree came in. In areas where the bedrock nearly comes to the surface (rockland soil), follow the recommendations for the previous section. In areas with sandy soil, follow the recommendations from the section on planting in sandy soil.

Care of Carambola Trees in the Home Landscape

A calendar outlining the month-to-month cultural practices for carambola is shown in Table 2.

Fertilizer

Young trees should receive $\frac{1}{4}$ to $\frac{1}{2}$ pound (113 to 226 g) of a mixed fertilizer containing nitrogen (N), phosphorus (P), potassium (K), and magnesium (Mg) every 30 to 60 days. As trees mature, the fertilizer rate should increase (1 to 5 lbs; 0.45 to 2.3 kg) with an application frequency of 4 to 6 times per year. Fertilizer mixtures containing 6–8% nitrogen, 2–4% available phosphoric acid, 6–8% potash and 3–4% magnesium are satisfactory.

In acid to neutral-pH soils, micronutrients such as manganese, zinc, and iron may be applied in dry applications to the soil or in a liquid form and sprayed onto the leaves. Three to 6 applications should be made per year. Trees

growing in high-pH or calcareous soils should receive 4 to 6 foliar applications per year of a micronutrient mix which includes zinc and manganese. Iron deficiency may be corrected by 1 to 2 yearly soil applications of iron sulfate for trees growing in neutral or low-pH soils and 4 to 6 soil drench applications of chelated iron (specifically formulated for calcareous soils) to high-pH soils (pH above 7).

Irrigation (Watering)

Young trees should be irrigated regularly to facilitate tree establishment and growth. Once trees begin to bear (1 to 2 years after planting), trees should be irrigated regularly from flowering through harvest.

Carambola Trees and Lawn Care

Carambola trees in the home landscape are susceptible to trunk injury caused by lawn mowers and weed eaters. Maintain a grass-free area 2 to 5 or more feet away from the trunk of the tree. Never hit the tree trunk with lawn mowing equipment and never use a weed eater near the tree trunk. Mechanical damage to the trunk of the tree will weaken the tree and, if severe enough, can cause dieback or kill the tree.

Roots of mature carambola trees spread beyond the drip-line of the tree canopy and heavy fertilization of the lawn next to carambola trees is not recommended because it may reduce fruiting and or fruit quality. The use of lawn sprinkler systems on a timer may result in over watering and cause carambola trees to decline. This is because too much water too often applied causes root rot.

Mulch

Mulching carambola trees in the home landscape helps retain soil moisture, reduces weed problems next to the tree trunk, helps to prolong warm soil conditions (beneficial to carambola trees) and improves the soil near the surface. Mulch with a 2- to 6-inch (5–15 cm) layer of bark, wood chips, or similar mulch material. Keep mulch 8 to 12 inches (20–30 cm) from the trunk

Insect Pests

Carambola trees are attacked by a number of scale insects including plumose (*Morganella longispina*) and philephedra (*Philephedra tuberculosa*) scales, which attack leaves and twigs, causing defoliation and stem dieback. The diaprepes weevil (*Diaprepes abbreviatus*) causes damage to the roots, which may lead to root and shoot dieback.

Fruit damage caused by stink bugs (*Nezara* sp.) and squash bugs (*Acanthocephala* sp.) results in pinhole-sized markings on the fruit surface and dry areas of the flesh under the puncture wounds. This may lead to infection by fungi which cause soft rot of the fruit. Fruit blotch miner (*Lepidoptera: Gracillariidae*) causes a superficial damage to the waxy cuticle and can be identified by meandering brownish colored trails on the fruit surface. Brown scales (*Coccus hesperidum*), red-banded thrips (*Selenothrips rubrocinctus*) and a weevil (*Myctides imberbis*) have also been observed feeding on carambola fruit. Birds, opossums, and raccoons may attack fruit especially early in the season. Their damage can be identified by the V-shaped marks left on the ribs of the fruit. For more information and control measures, consult your local UF/IFAS Extension agricultural agent.

Diseases

Reddish colored leaf spot diseases are caused by various fungi (*Cercospora averrhoa*, *Corynespora cassicola*, *Phomopsis* sp., *Gloeosporium* sp. and *Phyllosticta* sp.). Observations indicate that these leaf spot fungi are more common on environmentally stressed or nutritionally deficient trees and occur on older leaves that normally abscise (drop) during the winter and early spring. No control is necessary for these leaf spotting fungi. Twigs and limbs may be attacked by red alga (*Cephaleuros virescens*). Symptoms include rough, circular, greenish-grey or rusty-red areas and shoot dieback. Contact your local UF/IFAS Extension agent for current control of red alga.

Ripe fruit that is injured may be attacked by the fruit-rotting fungus (*Colletotrichum gloeosporioides*), which causes anthracnose. A superficial blackish discoloration on fruit (sometimes called "sooty mold" or "sooty blotch") caused by *Gloeodes pomigena* may be found on fruit surfaces. Generally, no control is warranted for these fruit diseases.

The fungus *Pythium splendens* has been identified as the cause of root rot and a general tree decline syndrome. Decline symptoms include loss of tree vigor, leaf drop, twig, shoot, and root dieback, and reduced fruit size and production. For more information and control measures, consult your local UF/IFAS Extension agricultural agent.

Pruning

Tree Training and Maintenance

During the first 1 to 2 years after planting, young trees should be pruned by tipping shoots in excess of 2 to 3 ft to increase branching. If desired, trees may be trained to a modified central leader or open center configuration. Mature trees may be selectively pruned to maintain trees at 6 to 12 ft (1.8 to 3.6 m) in height. Selectively removing a few upper limbs back to their origins (crotches) each year will help prevent the loss of the lower tree canopy due to shading by the upper canopy. In addition, maintaining a smaller tree facilitates tree care and fruit harvest, makes it easier to spray the tree, and greatly reduces possible storm damage. Do not remove lower tree branches.

Pruning to Produce Off-Season Fruit

Carambola trees are unique in that once a shoot and limb develop the ability to flower, they can flower repeatedly. Shoots gain the ability to flower after about 3 months of age. Pruning the willow-like long shoots ("whips") or selecting a small diameter limb and removing all the lateral shoots from this limb to their branch collars will induce flowering in about 21 days and fruit approximately 70–80 days later. Pruning during August may result in fruit during October. Pruning during November–December may result in fruit during February–April or June. This delay in fruit production is because cool temperatures during the fall and winter may prevent fruit set during January to March; however, generally the shoots will continue to flower until fruit is set.

Flowering and fruiting may also be induced on whips by bending them from an upright position to a lateral position, clipping off the last 12 to 18 inches of growth, and clipping the leaves off but leaving a small (1/3 inch) piece of the petiole (leaf stem).

Removing Fruit to Produce Off-Season Fruit

Removing young fruit from trees during November–December will help to retain carambola leaves on the tree and may result in early spring flowering and fruit in June. Removing young fruit along with selective pruning described previously may induce flowering and off-season fruit production.

Harvest, Ripening, and Storage

Carambola fruit do not increase in sugar content after picking and so for optimum sweetness and flavor should be picked when fruit turn from green to a yellow color in the furrow between the ribs while the tips of the ribs (fins) remain green. Fruit may be stored in plastic bags for up to about 21 days in the refrigerator.

Uses and Nutritional Value

Carambolas are primarily consumed as a fresh fruit. They may be used in fruit salads, as a garnish for meat, salad, and casserole dishes or they may be processed into pickles, sauces, wines, and jellies. The fruit may also be canned, preserved, and dried. The fruit is a good source of potassium (Table 4).

Carambola trees are an excellent tree for the home landscape. The foliage is green and attractive, and flowers and fruit are beautiful. The fruit is valued for its appearance and unusual shape.

Table 1. Carambola varieties under south Florida conditions.

Variety	Origin	Size ¹	Sweetness ²	Color ³	Comments	Rec. ⁴
Arkin	Florida	M–L	S	Y-DY-O	Good quality and flavor.	Y
B-2	Malaysia	M–L	S	W-LY	Fair quality and flavor.	N
B-10	Malaysia	M–L	S	Y-DY-O	Good quality and flavor. Needs cross pollination.	N
B-16	Malaysia	M–L	S	Y	Fair quality and flavor.	N
B-17	Malaysia	M–L	S	Y-DY-O	Good quality and flavor. Needs cross pollination.	N
Cheng Chui	Taiwan	S–M	I	W-LY	Poor quality and flavor.	N
Dah Pon	Taiwan	M–L	I	W-LY	Poor quality and flavor.	N
Demak	Indonesia	M–L	S	Y	Poor quality and bitter aftertaste.	N
Erlin	Taiwan	S–M	I	W-LY	Poor quality and flavor.	N
Fwang Tung	Thailand	M–L	S	W-LY	Very good flavor.	Y
Golden Star	Florida	M–L	T	Y-DY-O	Tart unless picked fully ripe.	N
Hew-1	Malaysia	M–L	S	Y	Whitish spots on fruit, good flavor.	N
Kajang	Hawaii	M–L	S	Y-DY-O	Good quality and flavor.	Y
Kary	Hawaii	M–L	S	Y-DY-O	Very good quality and flavor.	Y
Lara	Florida	M–L	S	Y-DY-O	Good quality and flavor.	Y
Maha	Malaysia	M–L	I	W-LY	Poor quality and flavor.	N
Miss	Taiwan	S–M	I	W-LY	Poor quality and flavor.	N
Newcomb	Florida	M–L	T	Y-DY	Tart	
Pasi	Taiwan	S–M	I	W-LY	Poor quality and flavor.	N
Sri Kembangan	Malaysia	L	S	Y-DY-O	Good quality and flavor.	Y
Star King	Florida	M–L	T	Y-DY	Tart	N
Tean Ma	Taiwan	M–L	I	Y	Poor quality and flavor.	N
Thayer	Florida	M–L	T	Y-DY	Poor quality and flavor.	N
Waiwei	Taiwan	S–M	I	W-LY	Poor quality and flavor	N
Wubentou	Taiwan	S–M	I	W-LY	Poor quality and flavor.	N

¹ S, small; M, medium; L, large

² S, sweet; I, insipid; T, tart

³ Y, yellow; LY, light yellow; DY, dark yellow; O, orange; W, white

⁴ Rec., recommendation for planting in the home landscape; Y, yes; N, no

Table 2. Carambola cultural practices for mature trees.

Operation	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
General ¹			Apply NPK		Apply NPK		Apply NPK		Apply NPK		Apply NPK	
Micronutrient applications ²				Apply		Apply		Apply		Apply		
Iron applications ³			Iron applications are most effective during the warmer parts of the year.									
Watering	Water trees during dry periods. Trees should be watered 1 to 2 times per week if no rainfall occurs. Less frequent watering may be made during the cool winter months.											
Insect control	Monitor trees for scales and other insects throughout the year. Monitor for stink bugs especially when fruit is present.											
Disease control	Monitor for signs of root rot. Trees exposed to excessively wet or flooded conditions may be attacked by root rot fungi. Typically, these trees do not regrow rapidly or respond to iron applications during the late spring and summer.											
Pruning									Prune to control tree size.			
Pruning for off-season fruit								Prune or bend and clip whips to produce fruit in October.			Prune or bend and clip whips to produce fruit in June. Remove young fruit to enhance early fruit production.	

¹ NPK, nitrogen-phosphate-potash. Purchase a complete fertilizer which may also include magnesium and other elements.

² Trees growing in acid soils may be fertilized with dry or liquid micronutrient formulations. Trees growing in high-pH soils should be fertilized with a foliar mix of micronutrients.

³ Trees growing in acid soils may be fertilized with iron sulfate; trees in high-pH soils should be fertilized with a chelated iron material mixed in water and drenched from the drip-line in toward the tree trunk.

Table 3. Fertilizer recommendations for carambola trees in the home landscape.¹

Year	Times per year	Amount/tree/application (lbs)	Minor element sprays (times /year)	Iron chelate drenches (oz/tree/year) ²
1	5–6	0.25–0.5	4–6	0.5–0.75
2	5–6	0.5–1.0	4–6	0.75–1.0
3	5–6	1.0–1.5	4–6	1.0–1.5
4	4–6	1.5–2.5	4–6	1.5–2
5	4–5	2.5–3.0	4–6	2–4
6	3–4	3.0–3.5	4–6	2–4
7	2–4	3.5–4.0	4–6	2–4
8	2–4	4.0–4.5	4–6	2–4

¹ Lower fertilizer rates for trees 4 or more years old may be appropriate if trees are kept relatively small (10 ft or less).

² Rates for chelated iron soil drenches for trees growing in high-pH soils.

Table 4. Nutrient value of carambola fruit (3.5 oz or 100 g of fruit).^z

Constituent	Approximate value	Constituent	Approximate value	Constituent	Approximate value
Water content	92%	Carbohydrate	6.7 g	Phosphorus	12 mg
Calories	31 kcal	Total dietary fiber	2.8 g	Potassium	133 mg
Protein	1 g	Calcium	3 mg	Sodium	2 g
Fat	0.3 g	Iron	0.08 mg	Vitamin C	34 mg
Cholesterol	0 mg	Magnesium	10 mg	Vitamin A	61 IU

^z USDA National Nutrient Database for Standard Reference, Release 18 (2005). [website: <https://fdc.nal.usda.gov/>] [Accessed, Feb. 17, 2022].

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² Jonathan H. Crane, professor emeritus, tropical fruit crop specialist, Department of Horticultural Sciences, UF/IFAS Tropical Research and Education Center, Homestead, FL; UF/IFAS Extension, Gainesville, FL 32611.

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