Sugar Apple Growing in the Florida Home Landscape[1]

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Scientific Name: *Annona squamosa* L.

Common Names: annon, custard apple, sweetsop

Family: Annonaceae

Origin: The sugar apple is indigenous to tropical America.

Relatives: cherimoya (*A. cherimola*), soursop (*A. muricata*), custard apple (*A. reticulata*), pond apple (*A. glabra*), ilama (*A. diversifolia*), atemoya (*A. cherimola x A. squamosa*)

Distribution: Sugar apples are mainly grown in the tropics. In Florida, sugar apple production is restricted to warm locations along the lower southeast and southwest coasts. However, home landscape trees may be found along the southeastern shore of Lake Okeechobee and in warm, protected locations along the lower east and west coasts.

Importance: Sugar apples are a common fruit tree in the home landscape throughout the tropics and have been widely planted in south Florida.

Description

Tree

Small, open, spreading to upright tree with long, slender branches; trees rarely exceed 15 to 20 ft (4.6-6.1 m) in height and spread.

Figure 1. Red and green sugar apples.
Credits: Ian Maguire, UF/IFAS

Leaves

Leaves are dull, pale green, and hairy when young but smooth at maturity, thin, lanceolate to oblong lanceolate, and 2.5 to 4 inches long (6.4-10.2 cm). Trees are deciduous; however, the rate of leaf drop depends upon the severity of cool winter temperatures and leaf disease pressure, which is aggravated by late summer–fall rainfall.

Flowers

Flowers emerge during mid- to late spring as trees flush in new vegetative growth. Flowers are small, about 1 inch long

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(2.54 cm), produced singly or in clusters of 2 to 4 from the leaf axils on year-old shoots or new growth. The flowers are composed of 3 green, fleshy petals, 3 small, inconspicuous sepals, and numerous pistils on a common receptacle.

Fruit

The aggregate fruit is heart-shaped, round, ovate, or conical, from 2 to 5 inches (5.1-12.7 cm) in diameter and weighs from 4 to 24 oz (113-682 g). The fruit is composed of loosely cohering segments, which project as rounded protuberances and are easily separated when the fruit is ripe. The pulp of green and purplish-red sugar apples is white or creamy white, with a custard-like consistency and sweet, pleasant flavor. There are numerous, small, shiny, dark brown seeds embedded in the pulp.

Varieties

Most sugar apple trees are grown from seed and within a particular selection (e.g., 'Thai Lessard', 'Kampong Mauve') there appears to be little variability among seedlings. Several selections have been introduced including 'Thai Lessard' (a green type), 'Purple' or 'Red', 'Kampong Mauve' (purplish-red types), and a seedless type known under various names, 'Cuban Seedless' and 'Brazilian Seedless' (Table 1). However, the seedless fruit split when nearing maturity, and the fruit quality and yield is reported to be inferior to seedy types. Green or red type sugar apples are recommended for the home landscape.

Climate and Environmental Stress Tolerance

The optimum growing conditions for sugar apple production appear to be temperatures ranging from 73 to 94°F (23-34°C), 70% or higher relative humidity (RH) during flowering and fruit set, non-limiting soil moisture from flowering to harvest, and an extended dry period several months prior to the spring flowering period. Sugar apple trees and fruit production may benefit from wind protection. Properly placed and managed wind-breaks may enhance tree growth, decrease the drying effect of winds, and increase the relative humidity around sugar apple trees.

Drought Stress: Sugar apple trees may withstand prolonged dry soil conditions, but do so by reduced growth and shedding leaves to the detriment of fruit development. In general, prolonged drought stress may reduce the percent fruit set, fruit size, and crop yields. Low humidity (<70% RH) during flowering of sugar apple may lead to reduce fruit set.

Flood Stress: Sugar apple trees are mostly grown as seedlings, and they are not tolerant of excessively wet or flooded soil conditions. Flooding for as little as 7 to 10 days may result in root rot and plant death. Symptoms of flooding stress include leaf chlorosis (yellowing), stunted leaf and shoot growth, leaf wilting and browning, leaf drop, stem dieback, and tree death.

Cold Stress: Sugar apple trees are best adapted to warm to hot, frost-free climates. Unprotected young trees are severely damaged or killed at temperatures of 30 to 32°F (0 to –1.0°C). Mature trees may tolerate short periods of 28 to 29°F (~ -2.0°C) without substantial injury but be damaged or killed at temperatures of 26 to 28°C (-2.2 to –3.3°C).

Wind Stress: Little research has been conducted on sugar apple tree wind tolerance. However, young trees establish more satisfactorily in wind-protected areas. Constant winds may distort the tree canopy, making tree training and pruning more difficult. Strong winds along with heavy crop loads may result in limb breakage. Sugar apple trees have a relatively shallow and weak root system. Thus, tree toppling and uprooting have been observed after hurricane-force winds. Even trees not toppled or uprooted appear to be damaged by very strong winds, resulting in loss of tree vigor and unsuccessful recovery.

Dry, windy conditions during flowering may reduce fruit set and fruit may be wind-scarred (i.e., stems rubbing against the peel) by strong winds during fruit development.

Salt Stress: Sugar apple is not tolerant of saline soil and water conditions. Symptoms of salt stress include marginal and tip necrosis (death) of leaves, leaf browning and drop, stem dieback, and tree death.

Propagation

Sugar apples are generally propagated by seed since there is little variability among seedlings. However, improved selections may be veneer- and cleft-grafted or shield-budded onto suitable rootstocks (e.g., sugar apple, atemoya, custard apple).

Production (Crop Yields)

Sugar apple trees may bloom from March through June, and fruit are harvested from mid-summer through fall. Fruit may be available through midwinter if no frost occurs and leaves remain on the trees. The crop yield of sugar apple varies from year to year and is influenced by climate, presence or absence of natural pollinators, disease and insect pressures, and cultural practices. Sugar apple yields

may range from 20 to 50 fruit (10 to 50 lbs; 4.5 to23 kg) per tree.

Spacing

Sugar apple trees make an attractive tree in the home landscape. Sugar apple trees should be planted in full sun and at least 15 to 20 ft (4.6-6.1 m) from adjacent trees and structures and power lines. Trees planted too close to other trees or structures may not grow normally or produce much fruit due to shading.

Soils

Sugar apple trees are well-adapted to most well-drained soil types, including the sands and limestone based soils of south Florida. Trees in muck soils may tend to grow more vigorously but produce less fruit due to the high native nitrogen content. Sugar apple trees are intolerant of continuously wet or flooded soils.

Planting a Sugar Apple 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 sugar apple 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, sugar apple 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, sugar apple trees can grow to about 20 ft (6.1 m) high if not pruned to contain their size. Select the warmest area of the landscape that 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 (0.9- to 3.1-m) ring of grass sod. Dig a hole 3 to 4 times the diameter and 3 times as deep as the container the sugar apple 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 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 hard, calcareous bedrock. Remove a 3- to 10-ft-diameter (0.9- to 3.1-m) 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 as directed in the proceeding section for sandy soil.

Planting on a Mound

Many areas in Florida are within 7 ft (2.1 m) or so of the water table and experience occasional flooding after heavy rains. To improve plant survival, consider planting fruit trees on a 2- to 3-ft-high by 4- to 10-ft-diameter (0.6- to 0.9-m by 1.2- to 3.1-m) 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 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 Sugar Apple Trees in the Home Landscape

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

Sugar Apple Trees and Lawn Care

Sugar apple 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 sugar apple trees spread beyond the dripline of the tree canopy, and heavy fertilization of the lawn adjacent to sugar apple 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 sugar apple trees to decline. This is because too much water too often applied causes root rot.

Fertilizer Practices

During the first 2 to 3 years after planting, growing a strong, vigorous tree is the goal (Table 3). It is recommended that any fruit that sets during the first year or so be removed so that the tree will grow vigorously. After the third year, the emphasis changes to cultural practices that enhance flowering, fruit set, and fruit development. These include reduced frequency of N-P_2O_5-K_2O (NPK) applications and close attention to irrigation from flowering to harvest during prolonged dry periods.

Fertilizer recommendations are based on experience and observation. Frequent applications of small amounts of nitrogen-containing fertilizer and watering during the growing season when there are prolonged dry periods is recommended (Table 2). After the third year, trees will begin to bear fruit and the strategy is to reduce the number of applications of nitrogen-containing fertilizer. Minor and secondary element sprays to the foliage should contain magnesium, zinc, and manganese (some also contain boron, molybdenum, iron, and boron). Foliar sprays are most efficient from April to September.

Young trees should be fertilized with a complete fertilizer every six to eight weeks during the growing season. A complete fertilizer is a fertilizer containing a source of nitrogen (N), phosphate (P), and potassium (K) (many also contain a source of magnesium, Mg). By convention, fertilizer formulas are written as the percentage of nitrogen (N), phosphate (P_2O_5), and potassium oxide (K_2O) (e.g., 6-8-9, 6% nitrogen, 8% phosphate and 9% potassium oxide). Acceptable mixtures include 6-6-6 or 8-3-9 or some similar material. Suitable fertilizer formulations for sugar apple include 2-8-8, 4-8-8, 6-6-6-3, or 8-3-9-5, or similar materials. Frequent applications at low rates will provide a more constant nutrient supply and reduce the potential for leaching of nutrients beyond the roots due to heavy rainfall.

Apply about ¼ lb (100 g) per tree per application (Table 1). The rate may gradually be increased as trees grow. For mature trees, increase the NPK rates from 1.5 to 4 lbs per tree per application as trees become older. Make 2 to 4 applications per year.

Applications of magnesium and micronutrients such as zinc and manganese may be made in ground applications to trees growing in sandy soil with a low-pH (4–7). However, foliar applications of zinc, manganese, and magnesium are more efficacious for trees growing in highly calcareous with a high-pH (7–8.5). Micronutrient applications should be made 2 to 4 times per year, generally during the growing season. For trees growing in calcareous, rocky soils, and for sandy soils with a high-pH, use a chelated iron specifically formulated for high-pH soils. For sandy soils with a low-pH, use either a chelated iron specifically formulated for low-pH soils or iron sulfate, or similar materials. Iron should be mixed with water and applied as a soil drench under the tree canopy.

Compost and Mulch

Compost is composed of completely degraded (weathered) organic matter such as leaves, stems, wood chips, and other organic materials. Compost has a dark color, is friable, and usually has an earthy, pleasant odor. It is usually impossible to determine what the original plant material was. However, some compost, such as composted sewage sludge, may have a strong odor when first applied that dissipates with exposure to the weather. Compost has a high nutrient- and water-holding capacity and may be used as a very slow-release fertilizer material; although typically use of conventional fertilizer materials is recommended in conjunction with the compost. Compost may be used sparingly (in small amounts, 1–3 shovels full) as an addition to the native soil when planting landscape trees and added to the topsoil under the tree canopy.

In contrast, mulch is incompletely degraded organic matter such as straw, hay, wood chips, and bark chips. Generally,

mulch does not have a strong odor, and one can usually determine whether the mulch is made up of dead leaves, stems, wood chips, or wood bark. Mulch generally does not have a high nutrient-holding capacity because the microbes that degrade mulch into compost require most of the nutrients contained within the dead plant material. Mulch should never be added to the soil used to plant trees because the non-degraded plant material may be toxic to the tree roots. Instead, mulch is most useful when applied to the soil surface under the tree canopy. Mulching around trees reduces evaporation of soil moisture from the soil surface, thus reducing the need to water as often compared to bare soil. Mulch also has a moderating effect on the upper soil temperatures and eventually degrades into compost. Eventually mulch breaks down into compost, improving the soil structure and nutrient- and water-holding capacity. A thin layer of mulch 2 to 4 inches thick applied from the tree drip-line to within 6 inches of the trunk is recommended. Keep mulch away from the trunk of the tree to prevent the trunk area from becoming too moist, which can lead to bark disease problems.

Irrigation Practices (Watering)

Sugar apple trees are tolerant of drought conditions, however, fruit set and fruit size may be reduced and defoliation may occur due to drought stress. Mild to severe drought stress may reduce atemoya (a relative of sugar apple) fruit size by 10 to 50%. Therefore, periodic watering of sugar apple trees is recommended from flowering through fruit development to enhance fruit quality and production. Watering is important from flowering through the fall until harvest. Watering of young and mature trees should be reduced during the fall and cease once leaves have mostly dropped. Watering a mostly leafless tree during the fall and winter may lead to root rot and loss of tree vigor and health.

Water sugar apple trees that have been mulched for a slightly longer time to make sure enough water has been applied to wet the mulch and soil beneath the mulch.

Flowering Behavior, Pollination, and Fruit Set

Sugar apple trees produce flowers on 1- to 2-year-old wood and newly emerging shoots. Natural fruit set ranges from near zero to about 3%, and fruit production may be severely limited by poor fruit set and fruit shape. This is due in part to the absence of their natural nitidulid beetle pollinators in some areas and/or a lack of sufficient pollination during flowering. Misshapen fruit is caused by incomplete pollination.

Sugar apple have complete flowers; however, the male and female flower parts are functional at different times of the day (called protandry) (Table 4). Sugar apple flowers first open during the day and the female parts are receptive to pollen (female stage); early the next morning the flowers open wider and shed pollen (male stage). Subsequently, in the late afternoon and early evening, the male flowering stage occurs and the anthers release pollen.

Flowers of sugar apple in the female stage are characterized by only a slight opening of the petals and a glistening appearance to the stigmatic surfaces. Flowers in the male stage are characterized by flower petals being wide open, petals may easily fall when touched and stamens may have a brownish color. This arrangement of having male and female flower parts functional at different times during the day makes cross pollination among different flowers necessary.

The natural pollinators of sugar apple and atemoya are nitidulid beetles (*Coleoptera: Nitidulidae*); sometimes called sap beetles. Nitidulid beetles are commonly found feeding and breeding on decomposing fruits and vegetables and are attracted to the strong, sweet odor of *annona* flowers during bloom. They feed on the nectar and pollen of the *annona* flowers and effect pollination by transferring pollen from functional male flowers to other flowers in the female stage.

Flowers that open under conditions of high humidity and warm temperatures are more likely to set fruit than those flowers opening during low humidity and/or cool temperatures. This is because a dry atmosphere more rapidly desiccates the female flower parts than a humid atmosphere.

Hand pollination of sugar apple is possible and may be very effective in improving fruit set (up to nearly 100%) and fruit shape. In general, pollen is collected from stamens of flowers in the male stage, which may be late afternoon, early evening, and early morning. The collected flower may be placed on paper where the anthers (male flower parts) are allowed to dehisce (release pollen). The next morning the pollen may be mixed with talcum powder to improve handling and transferred to flowers in the female stage of development. Hand pollination is usually most successful in the early to mid-morning hours (sunrise to about 11:00 am) and is done by using a thin paint brush (like the brush found in water color paint set) to transfer pollen through the slightly open flower petals of the female stage flowers to the stigmatic surfaces at the base of the flower.

Pruning

Periodic pruning of sugar apple trees can easily maintain trees at or below 8 to 12 ft (2.4-3.7 m) in height. Young nursery trees should be planted and left to grow during their first season so that they will establish quickly. However, during the early spring of the following year either trees should be cut back to force branching along the main trunk, or selective branches should be headed back and others cut out completely to encourage the formation of evenly spaced branches with wide branch to trunk crotch angles.

To maintain optimum fruit production, trees should be selectively pruned annually (Table 2). In general, about one third of the previous year's vegetative growth should be removed during early spring (February/March) as trees commence bud break. The goal is to maintain fruit production in the lower tree canopy, improve light penetration into the canopy, and limit tree size.

Insect Pests

Annona Seed Borer (*Braephratiloides cubense*). The annona seed borer (ASB) is the most important insect pest of sugar apple in Florida. Female ASB lay their eggs in the young seeds of small fruits. The larva develops inside and the adult emerges, ruining the fruit in the process. ASB populations increase during the summer and peak during August–September. Symptoms of insect damage include small, black holes on the fruit surface and brown to black decay of the fruit. Bagging individual fruit in small paper lunch bags or paint strainer bags will prevent the ASB from infesting fruit. Please contact your local County Agricultural Cooperative Extension Agent for further control information.

Plumose Scale (*Morganella longispina*). Plumose scale attacks the shoots and stems of sugar apple and atemoya trees. Plumose scales are dark brown to grayish brown, circular, and often found infesting the crotch angle areas of stems and shoots. Damage from heavy infestation results in loss of tree vigor, leaf browning and drop, and stem and shoot dieback. Please contact your local County Agricultural Cooperative Extension Agent for control information.

Philephedra Scale (*Philephedra* n.sp.). Philephedra scale attacks mature and immature leaves, leaf petioles, young stems, and fruit. Most commonly, these scales are found on the undersides of leaves. Damage from heavy infestation results in loss of tree vigor, leaf browning and drop, and stem dieback. Please contact your local County Agricultural Cooperative Extension Agent for control information.

Mealy Bugs (*Pseudococcus* sp.). Mealy bugs are generally found at the stem-end of the fruit and the shady side of the fruit. Mealy bugs are small, white, scale insects with wispy protuberances along their surfaces. They exude a sticky, sugary substance, which becomes colonized by fungi, giving the fruit surface (and sometimes adjacent leaves) a sooty appearance. This is referred to as sooty mold. Please contact your local County Agricultural Cooperative Extension Agent for control information.

Ambrosia Beetles (*Xyleborus* sp.). Ambrosia beetles occasionally attack limbs and the trunk of sugar apple trees. They bore into the bark and outer wood and inoculate the tree with a fungus they subsequently feed on. This boring causes the infested limb or tree to decline rapidly and die back. Please contact your local County Agricultural Cooperative Extension Agent for control information.

Diseases

Dry Fruit Rot. Dry fruit rot or mummification of the fruit is caused by several fungi. Fruit appear purplish-black to black and may remain on the tree for some time. Usually fruit are colonized by these fungi after emergence of the adult annona seed borer from the fruit. Please contact your local County Agricultural Cooperative Extension Agent for control information.

Fruit Rot. Fruit may be attacked by fungi which cause the fruit to rot before or after harvest. Fruit symptoms are very similar to dry fruit rot. Please contact your local County Agricultural Cooperative Extension Agent for control information.

Harvest and Postharvest Handling

Harvest of immature fruit should be avoided. Immature fruit will not ripen satisfactorily but will remain hard, turn brown, and slowly decay. As green type sugar apple fruit mature, fruit color changes from green to yellowish green, the area between protuberances swells and becomes yellowish, and the fruit becomes covered with a white or bluish bloom. As purplish-red colored sugar apples mature they take on a darker purple color and at maturity the color between protuberances becomes bright pink. Fruit should be picked at the mature stage and allowed to ripen (soften) at room temperature before being refrigerated. Ripe sugar apple may only be stored for 2 to 4 days.

Uses and Nutritional Value

Sugar apple is primarily consumed fresh, as a dessert fruit. The pulp has an excellent flavor and may be incorporated into ice cream and milk shakes. The fruit contains some vitamin C and A (Table 5). Sugar apple trees make beautiful small landscape trees that provide a very pleasant-tasting fresh fruit.

Table 1. Characteristics of selected sugar apple cultivars or selections in south Florida.

Cultivar or selection	Peel color	Fruit weight (g/oz)[1]	Quality Rating[2]	Recom. [3]
Lessard Thai	Green	227–454/8–16	EX	H, C
Kampong Mauve	Reddish purple	136–398/5–14	G–VG	H, C
Purple or Red	Dark reddish purple	136–398/5–14	G–VG	H
Cuban Seedless	Green	<340/12	F–P	N
Brazilian Seedless	Green	<340/12	F–P	N

[1] Data estimated.
[2] EX, excellent; VG, very good; G, good; F, fair; P, poor.
[3] Recommended planting for the landscape (H), commercial (C), and not recommended (N).

Table 2. Suggested calendar of cultural practices for 4-year-old or older sugar apple trees in the home landscape.

Month	Plant stage of growth	Cultural practices	Comments
January	Dormant	None required	Trees will be losing their leaves
February	Dormant	None required	Trees will continue to lose their leaves or have essentially lost their leaves
March	Bud break, new shoot and leaf growth, flowering begins	Remove dead wood, reduce long shoots by 1/3 to 1/2	New shoot and leaf growth may begin to appear
April	Continued bud break, new shoot and leaf growth, flowering continues	Apply NPK fertilizer, begin watering during dry periods	New shoots and leaves begin to appear and/or are actively growing
May	Continued bud break, new shoot and leaf growth, flowering continues, fruit set	Water during dry periods, apply micronutrients	New shoots and leaves growing
June	Shoots and leaves continue to grow, fruit set and fruit development	Water during dry periods, apply micronutrients	Trees growing vigorously
July	Shoots and leaves continue to grow, fruit set and fruit development	Apply fertilizer, water during dry periods	Trees growing vigorously
August	Shoots and leaves continue to grow, fruit development, some fruit may be ready to harvest	Water during dry periods, apply micronutrients	Trees growing vigorously
September	Shoots and leaves continue to grow, fruit development, some fruit may be ready to harvest	Water during dry periods, apply micronutrients	Trees growing vigorously
October	Shoot and leaf growth stops, fruit development, some fruit may be ready to harvest	Water during dry periods	Tree growth is slowing
November	Shoot and leaf growth stops, trees are dormant, fruit development, some fruit may be ready to harvest	Reduce or stop watering	Tree growth has stopped, leaves begin to drop
December	Shoot and leaf growth stops, trees are dormant	Reduce or stop watering	Tree growth has stopped, leaves begin to drop

Table 3. Suggested fertilizer recommendations for sugar apple in Florida.

Year	Times per year	Amount/tree/ application (lbs)[1]	Total amount/tree/ year (lbs)	Minor element sprays (times /year)[2]	Iron chelate drenches (oz/tree/year) [3]
1	5–6	0.25–0.5	1.25–3.0	2–4	0.5–0.75
2	3–6	0.5–1.0	2.5–6.0	2–4	0.75–1.0
3	3–6	1.0–1.5	3.0–9.0	2–4	1.0–1.5
4	2–4	1.5–2.5	3.0–10.0	2–4	1.5–2
5	2–4	2.5–3.5	5.0–14.0	2–4	2–4
6	2–4	3.5–4.0	7.0–16.0	2–4	2–4
7	2–4	4.0	8.0–16.0	2–4	2–4
8	2–4	4.0	8.0–16.0	2–4	2–4

[1] Use 6-6-6, 8-3-9, young tree, or slow-release fertilizer.
[2] Spray should contain zinc, manganese, boron, molybdenum, and may also contain iron. Foliar sprays are most efficient from April to September.
[3] Iron chelate drenches will avoid iron deficiency, not the sprays. Apply from June to September.

Table 4. Flowering behavior of sugar apple flowers.

		Stage of flowering	
Day	Time of day	Female	Male
1	Early morning to mid-day	Receptive	Not functional
2	Morning to late-afternoon	Receptive	Pollen shedding

Table 5. Sugar apple pulp composition per 100 grams (3.5 oz).[z]

Water	69–75%	Vit. C	34–42 mg
Energy	88–114 cal	Thiamine	0.10 mg
Protein	1.2–2.4 g	Riboflavin	0.06–0.17 mg
Lipids	0.1–1.1 g	Niacin	0.65–1.3 mg
Carbohydrates	18–26 g	Vit. A	0.004–0.007 mg

[z] Leal, F. 1990. "Sugar apple". In: *Fruits of tropical and subtropical origin: composition, properties, and uses.* FSS, Lake Alfred, Fla. P. 149–158.