

Sapodilla Growing in the Florida Home Landscape¹

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Scientific name: *Manilkara zapota*

Common names: English - naseberry, chikoo, chiku, dilly. Spanish - chicle, chicozapote, níspero, zapote, zapotillo.

Scientific name synonyms: *Manilkara achras*, *Achras sapota*, *A. zapota*, *Sapota achras*

Family: Sapotaceae

Relatives in same family: mamey sapote, canistel, caimito, lucumo, green sapote, abiu, satin leaf.

Origin: Mexico (Yucatan Peninsula) and Central America

Distribution: The United States, Caribbean, Central and South America, Asia, India, Sri Lanka, The Philippines, Australia, New Zealand, and South Africa.

Importance: Sapodillas are extensively planted and consumed locally in Mexico, Central America, the Caribbean, India and some Asiatic countries.

Invasive potential: Sapodilla has been assessed by the IFAS Invasive Plants Working Group as invasive in south and central Florida and is not recommended by IFAS for planting. For more information see: Fox, A.M., D.R. Gordon, J.A. Dusky, L. Tyson, and R.K. Stocker (2005) IFAS Assessment of the Status of Non-Native Plants in Florida's Natural Areas [Cited from the internet (6 Jan., 2006) at <http://plants.ifas.ufl.edu/assessment.html>].

Description

Tree

Sapodilla trees are medium to large trees with a pyramidal to rounded canopy. These long-lived trees grow slowly, but after many years may reach 60 to 100 feet in height. Sapodilla trees are well adapted to subtropical and tropical climates. The tree has ornamental value and may be used for landscaping. Branches are horizontal or drooping. A milky latex exudes from all tree parts. This latex is known as chicle and was used to make chewing gum.

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1. This document is Fact Sheet HS-1, one of a series of the Horticultural Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Publication date, May 1973; minor revision, April 1994 and; major revisions November 2000, October 2005, and October 2008. Please visit the EDIS web site at <http://edis.ifas.ufl.edu>
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Leaves

The foliage is evergreen. Leaves are 2 to 5 inches (5-20 cm) long, stiff, pointed and clustered at the ends of shoots. The leaves are pinkish when newly emerged and light green to dark green at maturity.

Inflorescence (Flowers)

Flowers are borne singly or in clusters in leaf axils near the tips of branches. Flowers are small, bisexual, off-white, bell-shaped, and measure about 3/8-inch (9.5 mm) in diameter.

Fruit

The fruit is a berry with a scurfy brown peel. Fruit may be round to oval-shaped or conical, and 2 to 4 inches (5-10 cm) in diameter. They weigh 2.6 oz to 2.2 lbs (75 to 1000 g). The pulp is light brown, brownish yellow to reddish brown, with a texture varying from gritty to smooth. The pulp has a sweet to very sweet (19-24°Brix), pleasant flavor. Seed number varies from 0 to 12. Seeds are dark brown to black, smooth, flattened, shiny, and 3/4 inch (1.9 cm) long.

When fruit reaches maximum size, it may be picked and allowed to ripen off the tree. From experience, one can judge maturity of fruit of a particular variety or selection by its size and appearance.

Season of Bearing

In Florida, trees mainly bear from May to September, but fruit may mature throughout the year.

Varieties

Seeds should not be used for producing new trees because it takes a long time for trees to begin production and there is also a lot of variability among seedling trees. There have been a number of new cultivars developed in Florida, India, the Philippines, Mexico and Venezuela. Table 1 shows a list of varieties and some of their characteristics. Varieties with good horticultural characteristics should have high yield, moderately large to large fruit, and a

smooth, sweet and aromatic pulp with little or no grittiness.

Climate

Sapodillas are adapted to tropical and warm sub-tropical climates. Trees are well adapted to south Florida and to the coastal areas of Florida as far north as Tampa and Merritt Island.

Environmental Stress Tolerance

Drought Stress

Young sapodilla trees have been observed to defoliate or decline due to lack of water; therefore young trees should be watered periodically during dry periods. Mature sapodilla trees are tolerant of dry soil conditions. However, for optimum fruit production and quality, periodic irrigation during long dry periods is recommended from flowering through harvest. In the home landscape, well established sapodilla trees generally do not require regular watering to produce satisfactorily.

Flood Stress

Sapodilla has been observed to be moderately tolerant of excessively wet or flooded soil conditions. However, prolonged excessively wet or flooded soil conditions may reduce tree growth and crop yields.

Cold Stress

Young sapodilla trees may be severely damaged or killed at 30 to 32°F (-1 to 0°C) or below but mature trees may withstand down to about 26°F (-3°C) for a few hours without major damage.

Wind Stress

Sapodilla trees are tolerant of windy conditions and young trees generally do not have a problem with establishment on windy sites. Mature trees should be limited to 12 to 15 feet (3.7-4.6 m) in height to help reduce the chances of toppling due to hurricane-force winds.

Salt Stress

Sapodillas grow well near the seashore, indicating a good tolerance to sea salt spray. Their tolerance to saline soils and irrigation water is not known. Typical symptoms of salt stress include marginal and tip necrosis of leaves, leaf browning and drop, stem dieback, and tree death.

Propagation

Although seeds can be used for propagation and are used for selection of superior types, they should not be used for home plantings. Marcottage (air layering) has not been an effective propagation method. Side veneer and cleft grafting on to seedling sapodilla rootstock are the most common grafting methods. Chip budding can also be used. Scions or bud sticks are chosen from young terminal shoots. Cover the grafted scions completely with grafting tape. The best time to graft is late summer and early fall.

Top working undesirable mature sapodilla trees may be accomplished by cutting trees back to a 3-ft-height (1-m) stump, white washing the entire stump and then veneer-grafting several new shoots when they reach 1/2 inch (13 mm) in diameter or larger.

Production

Seedling trees usually begin bearing in 6 to 7 years or more. Grafted trees may begin to bear in the second to fourth year after planting. After 10 years, a good cultivar may bear 150 to 400 pounds (45-180 kg) of fruit per year. This yield may keep increasing until about the twelfth to fifteenth year after planting depending on plant size and cultural practices.

Isolated sapodilla trees may not be productive because some sapodilla cultivars are self-incompatible. In self-incompatible cultivars, the flowers require cross-pollination by another sapodilla seedling or variety in order to produce fruit. Other varieties may not require cross-pollination but produce more fruit when cross-pollinated.

Spacing

Although sapodillas grow slowly, trees that are not pruned eventually need a lot of space because they will develop a large canopy. Sapodilla trees in the home landscape should be planted 25 feet (7.6 m) or more feet away from the nearest tree and/or structure. Trees planted too close to other trees or structures may not grow normally or produce much fruit due to shading.

Soils

Sapodillas are well adapted to a wide range of soils but grow best in well-drained, light soils. Trees are especially well adapted to the rocky, highly calcareous soils of south Florida. Although sapodilla trees are moderately tolerant of occasional flooding or excessively wet soil conditions, they will not perform well in poorly drained soils.

Planting a Sapodilla Tree

Proper planting is one of the most important steps in successfully establishing and growing a strong, productive sapodilla tree. The first step is to choose a healthy nursery tree. Commonly, nursery sapodilla trees are grown in 3-gallon (11-liter) containers, and trees stand 2 to 4 feet (0.9-1.2 m) 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, sapodilla 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 sapodilla trees can become very large if not pruned to contain

their size. Select the warmest area of the landscape that does not flood (or remain wet) after typical summer rainfall events.

Planting in Sandy Soil

Many areas in Florida have sandy soil. Remove a 3- to 10-foot-diameter ring of grass sod (0.9- to 3.1-m). Dig a hole 3 to 4 times the diameter and 3 times as deep as the container the sapodilla 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 50-50 ratio.

Backfill the hole with some of the excavated native 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. Several inches below the soil surface is a hard, calcareous bedrock. Remove a 3- to 10-foot-diameter ring of grass sod (0.9- to 3.1-m). Make a hole 3 to 4 times the diameter and 3 times as deep as the container the sapodilla 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 described in the previous section.

Planting on a Mound

Many areas in Florida are within 7 feet (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-foot-high by 4- to 10-foot-diameter mound of native soil (0.6- to 0.9-m by 1.2- to 3.1-m) .

After the mound is made, dig a hole 3 to 4 times the diameter and 3 times as deep as the container the sapodilla 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.

If there is a potential for flooding, plant the tree on a large hill or mound made up of native soil, 2 to 3 feet high by 4 to 6 feet in diameter (0.6 to 0.9 m by 1.2 to 1.8 m).

Care of Sapodilla Trees in the Home Landscape

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

Fertilizer

Sapodilla is not demanding in its fertilizer requirements (Table 3). After planting, when new growth begins, apply 1/4 lb (113 g) of a young tree fertilizer such as a 6-6-6-2 (% nitrogen-% phosphate-% potash-% magnesium) with minor elements with 20 to 30% of the nitrogen from organic sources. Repeat this every 6 to 8 weeks for the first year, then gradually increase the amount of fertilizer to 0.5, 0.75, 1.0 lb (227 g, 341 g, 454 g) as the tree grows. Use 4 to 6 minor element (nutritional) foliar sprays per year from April to September.

Sapodilla trees generally do not develop iron deficiency, even when grown in the rocky, calcareous, high-pH soils of Miami-Dade County. If iron deficiency symptoms appear (chlorotic leaves with green veins), apply iron. For trees in acid to neutral soils, apply dry iron sulfate at 0.25 to 1 oz per tree to the soil 2 to 4 times per year; water the iron into the ground. In alkaline soils with a high pH, drench the soil next to the tree trunk with iron chelate 1 to 2 times per year from June through September. Table 2 summarizes the fertilizer recommendations for sapodillas.

For mature trees, 2.5 to 5.0 lbs of fertilizer per application 2 to 3 times per year is recommended. The fertilizer mix (NPK) should also include phosphate (P_2O_5) and potash (K_2O); use a 6-6-6, 8-3-9 or similar material. Use 2 to 3 minor element (nutritional) foliar sprays per year from April to September.

Irrigation (Watering)

Newly planted sapodilla trees should be watered at planting and every other day for the first week or so and then 1 to 2 times a week for the first couple of months. During prolonged dry periods (e.g., 5 or more days of little to no rainfall) newly planted and young sapodilla trees (first 3 years) should be watered once a week. Once the rainy season arrives, irrigation frequency may be reduced or stopped.

Once sapodilla trees are 4 or more years old, watering will be beneficial to plant growth and crop yields only during very prolonged dry periods during the year. Mature sapodilla trees do not need frequent watering, and over-watering may cause trees to decline or be unthrifty.

Insect Pests

Sapodilla has relatively few insect pests. Occasionally, a moth (*Barnisia myrsusalis*) causes extensive damage to blooms in some years in Florida. The fruit of some cultivars is susceptible to the Caribbean fruit fly (*Anastrepha suspensa*). Periodically, other pests attack sapodilla, including the Cuban may beetle (*Phyllophaga bruneri*), mining scale (*Howardia biclavis*), green shield scale (*Pulvinaria psidii*), pustule scale (*Asterolecanium pustulans*), leafminer (*Eucosmophora* sp.), and *Conotrachelus* sp. beetle. Please contact your local County Cooperative Extension Service for current control recommendations.

Diseases

There are no major diseases of sapodillas in Florida. A leaf rust (*Uredo sapotae*) causes minor leaf damage. Other diseases of minor importance include dry rot (*Fusarium solani*), septoria leaf spot (*Septoria* sp.), fruit rot (*Phytophthora palmivora*), phyllosticta leaf spot (*Phyllosticta sapoticola*),

pestalotia leaf spot (*Pestalotia scirrofaciens*), anthracnose (*Colletotrichum gloeosporioides*), scab (*Elsinoe lepagei*), and phomopsis leaf spot (*Phomopsis* sp.). Please contact your local County Cooperative Extension Service for current control recommendations.

Weeds

Weeds compete for water and nutrients. Weeds may be controlled by herbicide applications of registered materials, by hand weeding, and/or by mulching.

Sapodilla Trees and Lawn Care

Sapodilla 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 (0.6 to 1.5 m) 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 sapodilla trees spread beyond the drip-line of the tree canopy, and heavy fertilization of the lawn next to sapodilla trees is not recommended because it may reduce fruiting and fruit quality. The use of lawn sprinkler systems on a timer may result in over-watering and cause sapodilla trees to decline. This is because too much water too often applied causes root rot.

Mulch

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

Tree training and pruning

Young Trees

The development of a strong limb framework is important to allow sapodilla trees to carry large crops of fruit without limb breakage. If the tree is leggy and lacks lower branches, remove part of the top to induce lateral bud break on the lower trunk. In addition, shoot tip removal (1 to 2 inches) of new shoots of about 3 feet in length, once or twice between spring and summer will force more branching and make the tree more compact. Remove any limbs that have a narrow crotch angle because these may break under heavy fruit loads.

Mature Trees

As trees mature, most of the pruning is done to control tree height and width and to remove damaged or dead wood. Trees should be kept at a maximum of about 12 to 15 feet (3.7 to 4.6 m). If the canopy becomes too dense, removing some inner branches will help in air circulation and light penetration. Another pruning objective is to remove dead, damaged, or diseased branches. Low branches should not be cut, however, unless they touch the soil. Cultural practices e.g., picking, spraying, and pruning are easier on small trees.

For mature, very large sapodilla trees in the home landscape that may pose a risk of damaging adjacent buildings or trees, we recommend a professional arborist provide the pruning services. Make sure the arborist is licensed, has insurance, and knows the local ordinances pertaining to fruit tree pruning in your area.

Harvest, Fruit Maturity, Ripening, and Storage

For the beginner, fruit maturity is difficult to judge. Immature fruit may not soften for many days, may not develop optimum sweetness and flavor, and may contain pockets of coagulated latex within the flesh. Fruit picked at optimum maturity usually ripen in 4 to 10 days. If you don't know the time of fruit maturity, you may wait until some fruit drop and then begin to harvest those of similar size. Other indicators of maturity are fruit size, loss of peel

scurfiness, and a change in skin color from brown to amber. Another test is to lightly scratch the skin; if it is tan it can be picked, but if it is green or oozes latex, the fruit is not fully mature.

Sapodilla trees may have harvestable fruit year round, though there is a main season for each cultivar (Table 1). As the season for each cultivar advances, the ripening time decreases. Ripe fruit may be stored in the refrigerator.

Uses and Nutritional Value

Sapodillas are nutritious and mostly eaten as fresh fruit (Table 4). Sherbets, milk shakes and ice cream can be made from fresh pulp. Chicle, the latex obtained from the bark of the tree, was for many years the principal ingredient of chewing gum. Because of their beauty and tolerance to neglect, sapodilla trees may also be used as an ornamental for landscaping in south Florida.

Table 1. Sapodilla cultivars in Florida.

Cultivar name	Country of origin	Fruit shape and skin color	Fruit size ¹	Pulp color and texture	Quality	CFF rating ²	Yield ³	Season
Alano	United States (Hawaii)	conical to round, skin light brown, smooth	S to M, 115-250 g (4-9 oz)	smooth to slightly granular	very good to excellent	U	G	Nov.-June
Betawi	Indonesia	conical	ML, 140-315 g (5-11 oz)	light amber - yellow, slightly granular	very good, juicy	U	G	late Dec.
Brown Sugar	United States	round to ovate, skin light brown, moderately scurfy	S to M, 133-170 g (4.6-6.0 oz)	brown, slightly granular	very good	M	G to VG	May-Sept.
Gonzalez	Philippines	round to oval, skin very light brown, slightly scurfy	M, 90-260 g (3.1-9.2 oz)	light brown to brown, smooth	very good to excellent	U	VG	Nov.-April
Hasyá	Mexico	oval to slightly conical, skin light brown, moderately scurfy	ML, 150-365 g (5-13 oz)	brownish red	excellent	U	G	Nov.-June
Makok (dwarf) tree	Thailand	conical, skin light brown, slightly scurfy	S, 30-140 g (1-5 oz)	light brown to slightly greenish-red, smooth	very good	U	VG	May-Nov.
Modello	United States	elliptic to ovate, skin light brown, moderately scurfy	M to ML, 227-340 g (8-12 oz)	whitish to tan, smooth	good	L	F	Feb.-May
Molix	Mexico	oval	M to M-L, 150-360 g (5-13 oz)	brownish red, smooth	very good to excellent	U	VG	Feb.-April
Morena	Mexico	oval	M to ML, 170-345 g (6-12 oz)	brownish red, smooth	very good to excellent	U	G to VG	Feb.-April
Oxkutzcab (Ox)	Mexico	roundish	L to very L, up to 800 g (1 lb, 12 oz)	reddish brown	very good	U	VG	May-Sept.

Table 1. Sapodilla cultivars in Florida.

Cultivar name	Country of origin	Fruit shape and skin color	Fruit size ¹	Pulp color and texture	Quality	CFF rating ²	Yield ³	Season
Prolific	United States	round to conical, ovate, skin light brown, slightly scurfy	M, 170-225 g (6.0-7.9 oz)	light tan to reddish tan and smooth	very good	H	VG	May-Sept
Russell	United States	round to conical to ovate, skin brown with grayish-brown patches, scurfy	L, 284--454 g (10-16 oz)	pinkish tan, granular	good, mildly fragrant	H	P	May-Sept.
Tikal	United States	ellipsoid to conical, skin light brown, slightly scurfy	S to ML 80-323 g (3-11 oz)	light brown, smooth	very good, fragrant	L	VG	Main, Dec. - March; minor, May-Sept.

1, S=small; M=medium; ML=medium-large; L=large.
2, CFF, Caribbean fruit fly rating; L=low potential for infestation; M=moderate potential for infestation; H=high potential for infestation; U=unknown potential for infestation not known.
3, Yield rating; P, poor; F, fair; G, good; VG, very good.

Table 2. Cultural calendar for sapodilla production of mature (bearing) trees in the home landscape.

Operation	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
General fertilizer ¹								Apply 2-3 dry applications of a nitrogen-phosphate-potash-magnesium material during this time. Do not apply any nitrogen-containing fertilizer after August because this may induce the tree to continue to grow during the winter and therefore reduce flowering in the spring.				
Nutritional sprays ²								Apply 2-3 foliar nutritional sprays containing magnesium, manganese, zinc, molybdenum, and boron. Applications are most effective during the warm part of the year.				
Iron applications ³								Apply 1-2 iron applications to the soil around the base of the tree. Iron applications are most effective during the warm part of the year.				
Watering	Do not water the tree unless a severe and prolonged drought occurs.											
Insect control	Monitor for the moth larvae. Control only if a large infestation occurs. Monitor trees for scale insects and treat only if a large infestation occurs.											
Disease control	In general, diseases are not a problem with sapodilla trees											
Pruning	Selectively prune the tree after harvest to control tree height and spread.											
	1, Use a 6-6-6-3, 8-3-9-3, 4-2-12-2 or similar material.											
	2, Follow label directions for dilution of dry and liquid micronutrient formulations.											
	3. In low pH, acid sandy soils apply iron sulfate; in high pH, rockland soils apply chelated iron.											

Table 3. Suggested fertilizer recommendations for sapodillas for 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	4-6	0.25-0.5	1.5-3.0	4-6	0.5-0.75
2	4-6	0.5-1.0	3.0-6.0	4-6	0.75-1.0
3	4-6	1.0-1.5	6.0-9.0	4-6	1.0-1.5
4	2-3	1.5-2.5	9.0-10.0	2-3	1.5-2
5	2-3	2.5-3.5	10.0-14.0	2-3	2-4
6	2-3	3.5-4.0	14.0-16.0	2-3	2-4
7+	2-3	4.0-4.5	16.0-18.0	2-3	2-4

1, Use 6-6-6, 8-3-9, or a young-tree or slow release fertilizer.
 2. The spray should contain zinc, manganese, boron, molybdenum; it may also contain iron. Foliar sprays are most effecient from April to September.
 3, Iron chelate soil drenches (iron plus water) will prevent iron deficiency; foliar sprays are generally not effective. Apply soil drenches from June to September.

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

Constituent	Approximate value	Constituent	Approximate value	Constituent	Approximate value
Water content	78%	Carbohydrate	20.0 g	Phosphorus	12.0 mg
Calories	83 kcal	Total dietary fiber	5.3 g	Potassium	193.0 mg
Protein	0.4 g	Calcium	210 mg	Sodium	12.0 mg
Fat	1.1 g	Iron	0.8 mg	Vitamin C	14.7 mg
Cholesterol	0 mg	Magnesium	12.0 mg	Vitamin A	60 IU

z, Data source, USDA-ARS, Nutrient Data Laboratroy, Database for Standard Reference, Release 18 [website: <http://www.nal.usda.gov/fnic/foodcomp/>].