

Papaya Growing in the Florida Home Landscape¹

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Scientific name: *Carica papaya* L.

Common names: Papaya and pawpaw (English and Spanish), malakor, loko, ma kuai thet (Thai), and du du (Vietnamese).

Family: Caricaceae

Origin: Lowlands of Central America and southern Mexico, possibly West Indies (Caribbean). Center of diversification southern Mexico to Nicaragua.

Relatives: Mountain papaya (*Carica candamarcensis* Hook.f.).

Distribution: Throughout the tropical and subtropical world; in protected culture in cool subtropical regions.

History: Papaya was taken to the Caribbean and Southeast Asia first and then spread to India, Oceania, and Africa.

Importance: Papaya is a major commercial crop throughout the tropical and subtropical world and exported widely to areas where production is not possible. Florida has a small commercial industry.

Invasive potential: *Carica papaya* has not been evaluated using the IFAS Assessment of Non-Native Plants in Floridas Natural Areas (IFAS Invasive Plant Working Group 2008).

Description

Tree and tree types

Giant arborescent plant to 33 ft (10 m)tall; generally short-lived although may live up to 20 years; usually single trunked, no secondary growth.

Leaves

Leaves are palmately-lobed and short-lived, 6-8 months.

Flowers

There are 3 basic tree types, male plants, female plants, and hermaphroditic (bisexual) plants. Fruit is normally only produced from female and bisexual plants.

The inflorescence is a an elongated (25-100 cm long), branched cyme in male plants and a much reduced cyme for bisexual and female plants. Papaya is a polygamous species with 3 basic plant types. Male (staminate) plants, in which small, tubular,

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yellow flowers possessing only 10 anthers are held in cymes at the ends of long peduncles. Female (pistillate) plants with large yellow to whitish flowers which possess a large, superior ovary which is held on a much reduced cyme in the leaf axils along the trunk. Bisexual (hermaphroditic) plants possess perfect flowers held on a much reduced cyme in the leaf axils along the trunk.

Fruit

Papaya fruit is a berry with a thin, smooth exocarp (peel) and thick, fleshy mesocarp surrounding an open cavity containing many small seeds. Fruit may be globose, ovoid, obovoid, and pyriform, 7-35 cm long, and 0.250-10 kg in weight.

In addition, some plants may produce more than one type of flower and exhibit different degrees of male or femaleness. This may be triggered by temperature, changing day length, and soil moisture availability. Female plants produce medium to large round-shaped fruit of good quality and a large seed cavity. Bisexual plants produce small to medium elongated fruit of good quality and a smaller seed cavity. Male plants with bisexual flowers may produce a few, elongated, poor quality fruit.

Pollination

Papaya plants may be self-pollinating (bisexual plants) or cross pollinated by insects or wind. Pollinators include honey bees, wasps, midges, thrips, surphid flies, and butterflies.

Varieties

There are numerous varieties of papaya. However, very few are available to most urban residents because of the seeds are not commonly for sale in small amounts. Important varieties in the U.S. include 'Red Lady', 'Maradol', and various Solo-types.

Climate

Any climatic factor such as cool or cold temperatures, lack of water (drought), high constant winds, or shade will reduce papaya growth and production. Papaya plants grow and fruit best in areas where temperatures remain warm to hot

(70°F-90°F; 21-32°C). Root growth is best if soil temperatures remain above 60°F (15.5°C) and slow or decline below that temperature. Papaya plants are not tolerant of freezing temperatures and are damaged or killed below 31°F (-0.6°C). High temperatures above 90°F (32°C) may cause flowers to drop, and low temperatures below 59°F (15°C) may inhibit flowering or cause misshapen fruit. Well distributed rainfall is required for best plant growth and fruit production. Any non-favorable weather conditions may lead to a reduction of plant growth and fruit production.

Papaya plants are susceptible to wind damage and will not establish or grow well in continuously windy areas. Papaya plants with a large amount of developing fruit are very susceptible to toppling due to high winds. Therefore plants should be planted in wind-protected areas of the landscape.

Propagation

Papaya is mainly propagated by seed, but tissue culture and rooted cuttings are practiced to a limited extent. The sex of the plant is determined by its parents.

To propagate by seed, remove the seeds from an elongated ripe fruit and place in a colander. Press the seeds against the side of the colander to break the sarcotesta (sac) surrounding the seed (this sac inhibits seed germination). Rinse seeds thoroughly and place on a paper towel to dry (not in the sunlight). Once seeds are dry they may be placed in a plastic bag and stored in the refrigerator for several years for later use.

In general, propagating and planting 2 to 3 plants is best to insure fruit production from at least 1 plant. This is because depending upon the source of seeds, they may produce female, bisexual, or male plants. Plant 2 to 4 seeds in each 1-gallon (3.8-liter) container in a clean, sterile artificial media. Water thoroughly, and place the containers in a warm sunny location. Germination may take 2 to 3 weeks. Once seedlings have emerged, select the most vigorous one and snip the others off at the soil line with clippers. Fertilize the seedlings with a dilute complete fertilizer solution every 10 to 14 days. Once plants have

reached 6 to 12 inches (15-30 cm) tall, plant in a sunny location.

Production (Crop Yields)

Well-cared-for plants may begin to produce flowers 4 months after planting and fruit 7 to 11 months after planting. The amount of fruit produced by a papaya plant varies with the general climate, weather conditions during the year, and plant care. Yields vary from 60 to 80 lbs per tree over a 12 month period.

Spacing and Pruning

Papaya plants should be planted in full sun and at least 10 to 20 ft (3.1-6.1 m) away from other plants, buildings, and power lines. In general, planting 2 to 3 papaya plants 7 to 12 ft (2.1-3.7 m) away from each other will insure that at least one will be fruitful, and it will also facilitate fertilizing and watering.

Papaya plants are not pruned because their main growing point is terminal, and branched trees generally do not produce as well. If the main growing point is damaged or killed, side sprouts may grow. Selecting 1 or 2 of the most vigorous shoots and removing the others will facilitate growth and fruiting of the remaining shoots. Tying these side shoots to a stake will reduce the chance they may break off due to a heavy fruit load or high winds.

Removal of dead leaves is a good practice and results in less scarring of the fruit from the base of the leaf petiole. It also reduces disease and insect problems.

Soils

Papaya plants grow and fruit well in many well drained soil types. Plants will do well with care in sands, loams, and rocky soils with a pH of 4.5 to 8.0.

Planting Papaya Plants

Properly planting a papaya tree is one of the most important steps in successfully establishing and growing a strong, productive tree. Some nurseries offer papaya plants and the first step is to choose a healthy nursery tree. Commonly, nursery papaya

trees are grown in 1- to 3-gallon containers and trees stand 6 inches to 2 ft tall. Large trees in smaller containers should be avoided as 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, papaya 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. Select the warmest area of the landscape that does not flood (or remain wet) after typical summer rainfall.

Planting in Sandy Soil

Many areas in Florida have sandy soil. Remove a 3- to 5-ft-diameter ring of grass sod (0.9- to 1.5-m). Dig a hole 3 to 4 times the diameter and 3 times as deep as the container the papaya 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 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 5-ft-diameter ring of grass sod (0.9- to 1.5-m). 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 trees 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 2- to 3-ft-high by 4- to 10-ft-diameter mound of native soil (0.3- to 0.9-m x 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 papaya 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 Papaya Plants in the Home Landscape

A calendar outlining the month-to-month cultural practices for papaya is shown in Table 1.

Fertilizer

Frequent applications of small amounts of fertilizer are best for continuous papaya growth and fruit production (Table 2). Young plants should be fertilized every 14 days with 1/4 lb of a complete fertilizer with the amounts increasing as trees become larger. Complete fertilizers include nitrogen (N), phosphate (P_2O_5), potash (K_2O), and a source of magnesium (Mg). Once trees become about 7 to 8 months old they should be fertilized with 1 to 2 lbs

every other month. Minor elements may be applied up to 1 time per month. Minor elements including manganese and zinc may be applied to the ground in soils with a low pH (7 or less) and foliarly applied for plants growing in high pH soils. Similarly, iron sulfate may be applied to the ground for plants growing in low pH soils. However, for plants growing in high pH soils, chelated iron should be mixed in water and applied as a soil drench.

Irrigation (Watering)

Watering is essential for best papaya plant growth and fruit production. Papaya plants that lack water (drought stress) may drop flowers, leaves, and young fruit and produce small fruit of low sugar content.

Plants growing in sandy or rocky soils that are well drained and do not hold much water should be watered every other day or every day during hot, dry conditions and less often during cool parts of the year (late fall, winter). Plants growing in soil with a capacity to hold water (loams, sandy loams) should not be overwatered and therefore should be watered at 3- to 4-day intervals, especially during hot weather.

Mulch

Mulching papaya trees in the home landscape helps retain soil moisture, reduces weed problems adjacent 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.

Insect Pests and Nematodes

Papaya plants are attacked by a number of insect pests including:

The papaya fruit fly (*Toxotrypana curvicauda*), which lays eggs through the papaya fruit peel into the fruit cavity where the larvae feed and eventually emerge from the ruined fruit. This fly is commonly mistaken for a wasp due to its long abdomen and yellow and black markings. Fruit infested with papaya fruit fly may show yellow areas and may drop from the tree prematurely. The easiest control for this

pest is to place a paper bag over individual fruit when they are small and leave the bag on until harvest.

The papaya webworm (*Homolalpia dalera*) is mainly a pest of the developing fruit peel and papaya stem and is usually found in, on, or near the stem amongst the flowers and fruit. Control includes hand removal and hosing off the plant with a strong stream of water from a garden hose.

The papaya whitefly (*Trialeuroides variabilis*) is generally only a pest of the leaves causing, leaves to drop and reducing fruit production. Control includes removing infested leaves and applying appropriate pest control products.

The two-spotted mite (*Tetranychus urticae*) is a major pest of papaya leaves and may cause defoliation and early leaf drop. Symptoms include a browning of the leaf surface and eventually upper leaf surfaces and skeletonizing of the leaf. For current control measures please contact your local County Extension Agent.

A number of nematode species (*Meloidogyne incognita*, *Rotylenchulus reniformis*). Nematodes are small, microscopic, worm-like organisms that feed on papaya plant roots, causing plants to decline in vigor and making more plants more susceptible to toppling over because of the loss of roots. Papaya plants should be planted in areas with clean soil, avoiding areas of the landscape with known nematode problems.

Diseases

Papaya plants in Florida are susceptible to a number of diseases:

Papaya ringspot virus is the most important disease of papaya in Florida. The earliest symptoms are a yellow mottling of leaves and vein-clearing of leaves. As the disease progresses, the lobes of the leaves become distorted and leaf size is greatly reduced. Dark green streaks may develop on leaf petioles and the main stem. Fruit symptoms consist of dark circles or C-shaped markings on the fruit peel. Homeowners wishing to grow papaya in their home landscapes should avoid using seed from small, pear-shaped Solo-type fruit which, tend to be more

susceptible to this virus than the larger, elongated, oval-shaped fruit found in many local markets. All papaya plants showing symptoms of the virus should be removed so as not to be a source of infection for new plants. Due to the problems with this virus, we recommend replanting papaya plants every 18 to 24 months.

Anthracnose (*Colletotrichum gloeosporiodes*) primarily attacks the maturing fruit. Symptoms include small water-soaked spots that enlarge, turn brown or black and become sunken. Eventually the fungus grows into the fruit tissue, ruining it for consumption. Please contact your local County Extension Agent for current control recommendations.

Powdery mildew (*Oidium caricae*) is primarily a disease of the leaves in Florida. A superficial white growth on the leaf surfaces leads to small, light yellow spots on the lower surfaces of the leaves. Next, pale yellow spots appear on the upper leaf surfaces. Eventually, dead leaf areas fall out of the leaves, giving them a shot-hole effect. Control includes removing infested leaves and removing them from near the plants.

Phytophthora blight (*Phytophthora* spp.) includes a number of diseases including damping-off, root rot, stem rot, and fruit rot. These diseases decrease plant vigor and may result in plant death.

Corynespora leaf spot (*Corynespora cassiicola*) is a disease of the leaves and begins as small, yellow areas which expand into larger (0.2-0.4 inches) circular brown spots.

Papaya apical necrosis is a relatively new virus in Florida. Symptoms include a drooping and downward cupping of the leaves, reduced leaf size, and browning of the leaf margins. At present there is no control for this disease.

Papaya Trees and Lawn Care

Papaya 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 (0.9-1.5 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 result in weakening the tree and if severe enough can cause dieback or kill the tree.

Roots of mature papaya trees spread beyond the drip-line of the tree canopy and heavy fertilization of the lawn adjacent to papaya 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 papaya trees to decline. This is because too much water too often applied causes root rot.

Harvest, Ripening, and Storage

Papaya fruit may be harvested green for use as a vegetable and ripe when full yellow to orange color develops on the peel. Generally, fruit may be picked when yellow color covers 1/5 to 1/3 of the surface peel, however, greater color development of the fruit while on the tree increases fruit sugar content. After picking fruit, should be placed at room temperature to fully ripen before being stored in the refrigerator. Ripe fruit will keep up to 4 to 7 days.

Uses and Nutritional Value

Papaya fruit are commonly used as a ripe fresh fruit alone, in fruit salads, drinks, and desserts. Non-ripe fruit may be used as a vegetable or used in green salads. Fruit is also dried, candied, and made into pastes, jellies, and jams. Papaya fruit is low in calories and high in potassium and vitamin A (Table 3).

Table 1. Cultural practices for fruiting papaya plants in the home landscape.

Operation	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Disease control ¹	Monitor plants for diseases year round. Treat plants showing signs of leaf diseases promptly.											
Insect control ²	Monitor plants for insect pests, inspecting the lower surface of leaves for mites, whitefly, and webworms. Paper bag young fruit to prevent papaya fruit fly attack.											
Fertilizer	Throughout the year apply small amounts of fertilizer frequently.											
General ³	Apply NPK		Apply NPK		Apply NPK		Apply NPK		Apply NPK		Apply NPK	
Nutritional ⁴			Apply micro-nutrients	Apply micro-nutrients	Apply micro-nutrients		Apply micro-nutrients		Apply micro-nutrients		Apply micro-nutrients	
Iron ⁵				Apply iron		Apply iron		Apply iron		Apply iron		
Watering ⁶	Water trees more frequently as temperatures increase. Trees grown in well drained soil that does not hold much water (sands, rock) may be watered at a shorter interval than trees growing in a soil that holds water (sandy loams, loams, muck).											
<p>1, Contact your local County Extension Agent for current control measures. Remove all virus-infected plants from your landscape prior to planting new plants.</p> <p>2, Contact your local County Extension Agent for current control measures.</p> <p>3, NPK, nitrogen-phosphate-potash.</p> <p>4, Nutritional, micronutrients including manganese, zinc, and boron.</p> <p>5, Iron, iron sulfate in acid pH soils and chelated iron materials in high or low pH soils.</p> <p>6, Avoid getting fruit and foliage wet when watering.</p>												

Table 2. Fertilizer recommendations for papaya production in the home landscape.

Month	Times per month	Amount per tree per application (lbs)	Number of nutritional sprays per month	Number of iron applications per month	Iron chelate drenches (oz/tree/application)
1	2	1/4	1	1	1/4
2	2	1/4-1/2	1	1	1/4
3	2	1/4-1/2	1	1	1/4
4-7	2	1/2-3/4	1	1	1/2
8	1	3/4-1	1-2	1	1/2
9	1	1	1-2	1	1/2
10	1	1	1	1	1
12+	1	1-2	1	1	1

Table 3. Nutrient content of ripe papaya (100 g or 3.5 oz).^z

Constituent	Approximate value	Constituent	Approximate value	Constituent	Approximate value
Water	89%	Calcium	24 mg	Sodium	3 mg
Calories	39 kcal	Iron	0.1 mg	Niacin	0.34 mg
Protein	0.61 g	Phosphorus	5 mg	Pantothenic acid	0.22 mg
Fat	0.14 g	Potassium	257 mg	Vitamin A	1094 IU
Carbohydrate	9.8 g	Magnesium	10 mg	Vitamin E	0.73

^z, USDA National Nutrient Database for Standard Reference, Release 18 (2005) [website: <http://www.nal.usda.gov/fnic/foodcomp/search/>] [Accessed 10-20-2005].