Atemoya Growing in the Florida Home Landscape[1]

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Common names for atemoya: annon, custard apple

Scientific name for atemoya: *Annona squamosa* x *A. cherimola* and *A. cherimola* x *A. squamosa* hybrids

Family: Annonaceae

Origin: The atemoya is derived from man-made and natural hybrids.

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

Distribution: Atemoyas are grown throughout the subtropics and tropics. In Florida, atemoya 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: Atemoya trees are not common in the home landscape. However, due to their superior cold tolerance and excellent fruit quality atemoya trees should be more widely planted in south Florida.

Figure 1. 'Gefner' atemoya.
Credits: Ian Maguire, UF/IFAS

Description

Tree

Small to medium sized tree, reaching 30 ft (~10 m) in height and spread. Trees may have a rounded or an asymetrical canopy.

Leaves

Leaves are green, hairy when young, smooth when mature, elliptic, ovate, or lanceolate in shape. Leaves are often variable in shape on the same tree. Leaves may be 4 to 8 inches (10–20 cm) long and 1.5 to 3.25 inches (4–8 cm) wide. Trees are semi-deciduous; however, the rate of leaf

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drop depends upon the severity of cool winter temperatures and leaf disease pressure, which is exacerbated by late summer-fall rainfall.

Flowers

Flowers emerge during mid- to late spring as trees flush with new vegetative growth. Flowers are produced singly or in clusters of 2 to 4 from leaf axils on one-year-old shoots or new growth. The flowers are composed of 3 green colored, fleshy petals, 3 small, inconspicuous sepals, and numerous unicarpellate (single ovary) pistils on a common receptacle.

Fruit

The aggregate fruit is conical to ovate shaped, from 3 to 5 inches (7.6–12.7 cm) in diameter, and weighs from 8 to 32 oz (227–908 g). The fruit surface may be smooth, bumpy, or possess pronounced protuberances. As fruit mature, fruit color changes from green to yellowish green, the area between protuberances expands and becomes yellowish, and the fruit becomes covered with a white or bluish-tint bloom. The pulp is white or creamy white, with a custard-like consistency and sweet, pleasant flavor. There may be 10 to 40 small, shiny, dark brown seeds per fruit.

Figure 2. 'Gefner' atemoya.
Credits: Ian Maguire, UF/IFAS

Varieties

There are numerous atemoya varieties; however, few have been critically evaluated for an extended period of time. The most satisfactory variety under Florida conditions has been 'Gefner', which does not require hand pollination and produces fruit of good quality. Fruit production of 'Page' is good but fruit tends to split on the tree at maturity. 'African Pride' ('Kaller') and 'Bradley' usually produce few fruit without hand pollination. 'African Pride' fruit may develop internal disorders upon ripening. Other varieties such as 'Bernitski', 'Caves', 'Chirimoriñon A', 'Chirimoriñon B' and 'Chirimoriñon C', 'Hette', 'Island Gem', 'Lindstrom', 'Kabri', 'Malali', 'Malamud', 'Mammoth' ('Pink Mammoth'), 'Priestly', and 'Stermer' have not proven viable for commercial production. The selection of superior varieties in the future is highly possible due to the numerous seedlings that are under evaluation in public and private collections.

Climate and Environmental Stress Tolerance

The optimum growing conditions for atemoya production appears to be temperatures ranging from 72 to 90°F (22–32°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. Atemoya 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 within the canopy of atemoya trees.

Drought stress: Atemoya trees may withstand prolonged dry soil conditions but does so by reduced growth and shedding leaves to the detriment of fruit development. The drought tolerance of atemoya is less well understood. In general, prolonged drought stress may reduce the percent fruit set, fruit size, and crop yields. Low humidity (<70% RH) during flowering of atemoya may lead to reduce fruit set.

Flood stress: Atemoya trees may be grafted onto various rootstocks and their flood tolerance varies with rootstock. Atemoya grafted on to sugar apple is intolerant of flooded soil conditions. Grafting atemoya on to pond apple, custard apple, and soursop appears to impart flood tolerance to the scion. However, growth of trees grafted onto custard apple and soursop was dramatically reduced compared to trees on pond apple. Soursop is not tolerant of cold temperatures and therefore may not be suitable as a rootstock in sub- tropical areas like Florida. Atemoya is not graft compatible with pond apple and therefore the use of an interstock is required. To produce this three-part tree takes additional time and effort at the nursery and therefore these trees are not commonly found in most nurseries. Finally, field-testing of these atemoya/rootstock combinations needs more investigation in order to determine the effect of flooding on growth and production.

At present, it is recommended atemoya trees grafted onto either sugar apple or seedling atemoya be planted and that planting only in well drained soils be made.

Cold stress: Atemoya trees are adapted to lowland tropical, cool subtropical and Mediterranean-type climates. Trees are more cold tolerant than sugar apple with young trees damaged or killed at 28 to 29°F (~ -2.0°C). Mature trees may tolerate short periods of 24 to 26°F (-3.3 to -4.4°C) however, are damaged or killed at or below 24°F (-4.4°C).

Wind stress: Little research has been conducted on atemoya tree wind tolerance. However, young trees have been observed to 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. Atemoya has been observed to have a relatively shallow and weak root system. Thus tree toppling and uprooting have been observed after tropical storm force winds resulting in loss of tree vigor and unsuccessful recovery.

Dry (low humidity), windy conditions during flowering may reduce fruit set and fruit may be wind-scarred (i.e., fruit rubbing onto branches damages the peel) during strong winds.

Salt stress: Atemoya 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

Atemoya trees grown from seed are extremely variable, grow vigorously and begin to fruit at 3 to 5 years of age. Superior varieties must be vegetatively propagated and are veneer and cleft grafted or shield and patch budded onto suitable rootstocks. Propagation is most successful near the end of the winter (dormant period) when buds are beginning to break.

Atemoya grafted on to seedling atemoya rootstock produces a fast growing, vigorous tree that begins fruit production in 2 to 4 years. However, mature trees on this rootstock are vigorous and may be difficult to control in size. In contrast, atemoya grafted onto sugar apple seedling rootstock tends to be somewhat less vigorous, may take a year or two to reach the production level of atemoya grafted onto atemoya but is generally easier to control in size.

Production (Crop Yields)

The crop yield of atemoya varies from year to year and is influenced by climate, presence or absence of natural pollinators, disease and insect pressures, and cultural practices. Atemoya yields may range from 75 to 200 fruit (35 to 150 lbs; 16 to 68 kg) per tree.

Spacing

Atemoya trees also should be planted in full sun and should be planted at least 25 to 30 ft (6.7–7.6 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

Atemoya 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. Atemoya trees are intolerant of continuously wet or flooded soils.

Planting an Atemoya Tree

Properly planting an atemoya tree 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 atemoya trees are grown in 3-gallon (11 liter) containers and trees stand 2 to 4 ft (0.61–1.2 m) from the soil media. 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, atemoya 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 atemoya trees can grow to about 30 ft 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 rainfall.

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 atemoya tree has come in. Making a large hole loosens the soil adjacent 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 soil excavated from making the hole in no more than a 1:1 ratio.

Backfill the hole with some of the native soil removed to make the hole. Remove the tree from the container and place it in the hole so that the top of the soil media in 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 as 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 (0.9–3.1 m) diameter ring of grass sod. Make a hole 3 to 4 times the diameter and 3 times a deep as the container the atemoya tree has come in. To dig a hole there are several options; 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 rainfall events. To improve plant survival consider planting fruit trees on a 2 to 3 ft 0.6–0.9 m) high by 4 to 10 ft (1.2–3.1 m) diameter mound of native soil.

After the mound is made, dig a hole 3 to 4 times the diameter and 3 times a deep as the container the tree has come 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 Atemoya Trees in the Home Landscape

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

Atemoya Trees and Lawn Care

Atemoya 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 (0.6–1.5 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 the tree to dieback or die.

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

Fertilizer Practices

During the first 2 to 3 years after planting, growing a strong, vigorous tree is the goal (Table 1). It is recommended that any fruit that sets during the first year or so be removed so the tree grows vigorously. After the third year, the emphasis changes to cultural practices that enhance flowering, fruit set, and fruit development (Table 2). These include reduced frequency of N-P_2O_5-K_2O applications and close attention to watering trees 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. 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 element sprays to the foliage should contain magnesium, zinc, and manganese (some also contain boron, molybdenum and iron). 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 (Table 2). 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). Suitable fertilizer formulations for atemoya 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.

During the first year, apply about 1/4 lb (100 g) per tree per application (Table 3). 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.

Application of magnesium and micronutrients such as zinc and manganese may be made to the ground for 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 soils with a high pH (7–8.5). Micronutrient applications should be made 2 to 4 times per year, generally during the growing season. Iron should be applied in a chelated formulation. For the calcareous, rocky soils and 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 climate. 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 shovel 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 mixed with 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 (5–10 cm) thick applied from the tree drip-line to within 6 inches (15 cm) of the trunk is recommended. Keep mulch 6 to 12 inches (15–30 cm) away from the trunk of the tree as this may keep the trunk area in contact with the mulch too moist and lead to bark disease problems.

Irrigation Practices (Watering)

Atemoya 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 has been demonstrated to reduce atemoya fruit size by 10 to 50%. Therefore, periodically watering atemoya trees is recommended from flowering through fruit development to enhance fruit quality and production. Watering of young and mature trees should be reduced during the fall and cease once leaves have mostly dropped. Over watering during the fall and winter may lead to root rot and loss of tree vigor and health.

The length of time of watering atemoya trees that have been mulched should be increased slightly to make sure enough water has been applied to wet the mulch and soil beneath the mulch.

Flowering Behavior, Pollination, and Fruit Set

Atemoya 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. The natural pollinators of atemoya are Nitidulid beetles (Coleoptera: Nitidulidae); sometimes called sap beetles. In some areas and years the population of Nitidulid beetles is absent or low which leads to a lack of sufficient pollination during flowering and poor fruit set. Misshapen fruit is caused by incomplete pollination.

Atemoya have complete flowers, however, the male and female flower parts are functional at different times of the day (called protandry) (Table 3). Atemoya flowers first open in the early morning and the female parts are receptive to pollination, however, by late morning-early afternoon the stigma has dried and is no longer viable. Subsequently, in the late afternoon and/or early evening the male flowering stage occurs and is characterized by the anthers releasing pollen.

Atemoya flowers 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.

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 atemoya 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 transfer 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 (commonly found in water color paint sets) to transfer pollen through the slightly open flower petals to the stigmatic surfaces at the base of the flower.

Pruning

Young nursery trees should be planted and left to grow during their first season so they establish quickly. However, during the early spring of the following year trees should be cut back to either force branching along the main trunk and/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.

Periodic pruning of atemoya trees can easily maintain trees at or below 8 to 12 ft in height. To maintain optimum fruit production trees should be selectively pruned annually just before new growth commences in the spring (i.e., March, April). In general, about one third of the previous year's vegetative growth should be removed during early spring 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 atemoya and sugar apple in Florida. Female ASB lay their eggs into the young seeds of fruits with subsequent larval development inside the fruit and emergence of the adult from the fruit; 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 colored 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 UF/IFAS Extension agricultural agent for further control information.

Plumose scale (*Morganella longispina*). Plumose scale attacks the shoots and stems of atemoya trees. Plumose scales are dark brown to grayish brown in color, circular in shape, and are often found infesting the crotch angle areas of stems and shoots. Damage from heavy infestation result in loss of tree vigor, leaf browning and drop, and stem and shoot dieback. Please contact your local UF/IFAS Extension agricultural 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 underside of leaves. Damage from heavy infestations result in loss of tree vigor, leaf browning and drop, and stem dieback. Please contact your local UF/IFAS Extension agricultural agent for control information.

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

Ambrosia beetles (*Xyleborus* sp.). Ambrosia beetles occasionally attack limbs and the trunk of sugar apple and atemoya 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 dieback. Please contact your local UF/IFAS Extension agricultural 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 in color 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 UF/IFAS Extension agricultural 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 UF/IFAS Extension agricultural agent for control information.

Harvest and Postharvest Handling

Atemoya trees may have multiple blooms, with the main bloom from April through June and a smaller bloom during July. Fruit are harvested from August to October and sometimes during December and January if no frost occurs and leaves remain on the tree.

Harvest of immature fruit should be avoided. Immature fruit will not ripen satisfactorily but remain hard, turn brown, and slowly decay. As atemoya 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. Fruit should be picked at the mature stage and allowed to ripen (soften) at room temperature before being refrigerated. Ripe atemoya may only be stored for 2 to 4 days.

Uses and Nutrition

Atemoya are primarily consumed fresh, as a dessert fruit. The pulp has an excellent flavor and may be incorporated into ice cream and milk shakes. Atemoya trees make beautiful landscape trees that provide a very pleasant fresh fruit.

Table 1. Suggested calendar of cultural practices for mature atemoya trees in the home landscape.

Month	Plant stage of growth[1]	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 ⅓ to ½	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 ready to harvest	Water during dry periods, apply micronutrients	Trees growing vigorously
October	Shoot and leaf growth stops, fruit development, some fruit may 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 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

[1] The dormancy of atemoya is caused by cool temperatures and/or dry soil conditions. Dormancy caused by environmental conditions is technically called quiescence.

Table 2. Suggested fertilizer recommendations for atemoya 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	5–6	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 3. Flowering behavior of atemoya.

Atemoya			
Day	Time of day	Female	Male
1	Early to mid-morning[1]	Receptive	Not functional
2	Afternoon/early evening	Not receptive	Pollen shedding

[1] The best time to hand pollinate atemoya flowers is between sunrise and 11:00 a.m.