

Kristi Hammond, L. Robert Barber, Jr., Jian Yang, Rynette Perez, and Mark Acosta

Soursop as a Fast to Fruit Tree

For many new farmers establishing agroforestry or fruit tree plantings, fast to fruit trees provide rapid economic returns and local market impact. *Annona muricata*, commonly known as soursop is a small, tropical fruit tree native to Central America. It was likely distributed throughout the rest of the world and introduced to the island of Guam by Spanish explorers. Known as laguanã in Chamorro, and guayabano in Tagalog. In recent years, chefs on Guam have expressed the desire for more variety in local fruits that convey tropical ambience, during both monthly Micronesian Chefs' Association

Culture at a Glance

Soursop: *Annona muricata*, laguanã (Chamorro), guayabano (Tagalog)

Size: up to 25-30 ft.

Flowering and fruit production: Year-round (with irrigation)

Light: Full sunlight

Soil: Well-drained soil (pH 5 – 6.5), but tolerates higher pH

Propagation: Seeds (most common), cuttings, air-layering, and grafting

Spacing: 8-12 ft. (windbreak), 15-20 ft. (orchard)

Watering: Keep soil moist, but not saturated

Pruning: Trees can be topped as low as 4-6 ft.; on Guam, should be kept between 6-15 feet tall

Common diseases: Anthracnose, fruit rot, diplodia rot, root rot

Common pests: Mealy bugs, aphids

Cautions: Seed toxicity

meetings and in focus groups (L. Barber personal communications, 2013-2018). Soursop offers the potential for production of commercial quantities of fruit in a few years.

In addition to being fast to fruit, the soursop tree has potential use in conservation practices, such as, fruit tree windbreaks. Using soursop as a low in-field windbreak can prevent wind damage to crops and protect livestock. Soursop also makes an excellent barrier plant for property perimeters, both on the farm and in urban settings.

Plant Appearance and Growth

Description of Tree

Soursop (*Annona muricata*) is a low-branching, bushy tree with upturned limbs. It can reach a height of 25-30 feet. Due to Guam's shallow soils, soursop height should be controlled (6 to 15 feet) to prevent tree loss during to high winds. Flowers are borne singly and can emerge anywhere on the trunk, branches, or twigs. In Guam's tropical environment, soursop trees develop quickly and begin to bear fruit in 2-4 years, when planted from seeds.

Description of Fruit

The fruit from the soursop tree is asymmetrical, heart shaped, lopsided, and can weigh up to 5 lbs. However, the seeds and tree bark are toxic and inflammatory and **should not** be consumed. Unripe soursop fruits are dark green and lighten to yellowish-green as it matures. The inedible skin of the soursop fruit is smooth with fleshy spines, which soften and can be broken off upon maturity. The inner flesh is white, fibrous with soft cotton-like strands that contain dark, flattened seeds about ½ to ¾ inches long. Soursop fruits can hold several dozen seeds.



Soursop fruits

Soursop as a Windbreak Material

A windbreak is a row or multiple rows of trees, shrubs, or grass that are strategically planted to shield an area from winds. The windbreak's vegetation filters and slows the wind entering the protected area. With its thick bushy growth habit, soursop is an excellent plant for use as in-field or secondary windbreaks.

Benefits of Using Fruit Trees in Windbreaks

The commonly recognized benefits of windbreaks include improvement of crop quality and appearance, reduction of water stress, and protection from salt spray and dust. Fruit trees as windbreaks provide an economic return the land used for the windbreak. When fruit trees are used as windbreaks, an additional benefit is fruit production.

For more information, see CE&O publication "*Windbreak Benefits, Design, and Management.*"



Soursop Plant

Incentive Programs

On Guam, incentives for farmers are possible through participation in the USDA Natural Resource Conservation Service's (NRCS) Environmental Quality Incentive Program (EQIP). Participating farmers may receive cash reimbursements for establishment costs of recommended conservation practices (i.e. windbreaks, irrigation, and mulch). Planting windbreaks using fruit trees is one of the many sound environmental practices recommended under the EQIP program. Incentives for establishing perennial plantings and implementing conservation plans make this an attractive farm program. Under EQIP, farmers have the ability to both increase the

environmental sustainability of their operations and improve their bottom line.

For participation in government programs, it is important to verify that the program requirements are met, and plans are in place prior to planting. For more information on EQIP program, contact your local NRCS field office on Guam. NRCS offices can be reached at (671) 300-8591. For EQIP on the web visit:

<https://www.nrcs.usda.gov/wps/pertal/nrcs/main/national/programs/financial/eqip/>

Fruit Production

Propagation

There are two ways to propagate soursop plants:

Sexual

Soursop is typically propagated from seed, due to ease and success rate. The seeds should be planted in pots, kept moist, and under shade. It may take between 15-30 days for seeds to sprout (Morton, 1987).

Asexual

To encourage a more uniform and productive orchard, asexual propagation methods can be used. There are many improved varieties of soursop. Superior plants are propagated by cuttings, air-layering, or by grafting. Of these methods, cuttings are the easiest using softwood, treated with rooting hormone, and placed under mist. Softwood cuttings with 2 leaves trimmed to half their size have the best success rate (Santos et al., 2011).

Planting Establishment and Management

Spacing

When used in windbreak plantings, the spacing for soursop is much closer than in orchard plantings. For windbreaks, trees should be spaced 8-12 feet apart. In orchards, soursop plants are spaced 15-20 feet apart. Consider spacing the rows 20-25 feet apart where equipment must pass.

Planting

On Guam, planting is best done at the beginning of the rainy season (July – December). A hole should be dug at least twice the diameter of the root ball and deep enough to accommodate the existing root system. The hole should be large enough to

accommodate the soursop’s first-year root growth. To provide fertile soil, mix amendments such as compost, manure, or fertilizer with the existing soil and refill around the root ball.

An old farmer saying from South Georgia that should be considered when planting a tree:
“It is better to plant a \$1 plant in a \$10 hole than a \$10 plant in a \$1 hole.”

Sheet Mulching

Sheet mulching is a low maintenance practice for weed suppression and erosion control that simultaneously builds soil organic matter. Sheet mulching is a three-layered mulch system used for crops and trees. Waste materials such as cardboard, shredded paper, grass clippings, green waste, etc. can be used. Following planting to reduce weeds, improve soil fertility, and conserve water, sheet mulching around the tree is recommended.

To sheet mulch after planting add compost, manure, or other amendments to the soil around the tree. Next, place a weed barrier (layer of overlapping cardboard or newspaper) around the tree in the shape of a ring. Leave sufficient room (2”- 6”) free of mulch around the tree trunk for good air circulation. The materials used for the weed barrier, such as cardboard, should overlap one another, so weeds will not emerge. Soak this weed barrier layer thoroughly with water. Finally, spread a layer of mulch material over the weed barrier.

Nutrients and Fertilizers

Soursop, like many fruit trees, can survive in Guam’s soil types without additional fertilization. However, supplemental nutrition can improve the health of soursop trees, enhance growth, increase yields, and reduce pest problems.

Application of fertilizer varies with the age and size of the tree and the type and condition of the soil. A “complete” fertilizer is one that has all three primary plant nutrients nitrogen (N), phosphorous (P), and potassium (K). Young non-bearing and fruit-bearing trees respond well to applications of complete fertilizers, such as 16-16-16, 10-20-20, or 10-30-10 on a regular basis.

Do not use a complete fertilizer that has a higher percentage of nitrogen than phosphorous and potassium for fruit trees because nitrogen encourages leaf growth at the expense of fruit and root production.

Fertilizer application

When soil tests and recommendations are not available, Tables 1 and 2 provide general fertilizer recommendations. Table 1 provides recommendations on frequency and fertilizer rates to apply to young, non-bearing soursop trees. Table 2 provides frequency and fertilizers rates of complete to apply to mature fruit-bearing soursop.

Table 1. Fertilizer program for young trees.

Year	Times/Year	Amount per Tree Application (lbs) 10-20-20	Amount per Tree Application (lbs) 16-16-16
1	6	0.50 lbs 3.0 lbs/year	0.25 lbs 1.5 lbs/year
2	6	1.0 lbs 6.0 lbs/year	0.50 lbs 3.0 lbs/year
3	6	1.50 lbs 9.0 lbs/year	0.75 lbs 4.5 lbs/year

Table 2. Fertilizer program for fruit-bearing trees.

Apply ½ pound of (10-20-20) or ¼ pound of (16-16-16) complete fertilizer per foot of the diameter of the tree canopy per year		
Time of application	Amount per 12’ Tree Canopy 10-20-20	Amount per 12’ Tree Canopy 16-16-16
After harvesting all fruit apply ½ the amount of fertilizer for the year	3.0 lbs	1.5 lbs
Apply ¼ of the amount of fertilizer two months later	1.5 lbs	.75 lbs
Apply ¼ of the amount of fertilizer two months later	1.5 lbs	.75 lbs
Total	6.0 lbs yearly	3.0 lbs yearly

Irrigation

Proper irrigation is important especially during the fruit tree's early years. If fruit trees are planted during Guam's dry season (January to June), and for year-round fruiting, irrigation is recommended. Drip irrigation is recommended for water conservation and economic efficiency. Funding assistance is also available for drip irrigation through the EQIP program. For more detailed information on design and installation of drip irrigation systems see Cooperative Extension & Outreach's publication, "Drip Irrigation Basics" (Tuquero, et. al., 2019).

Diseases and Pests

Fungal diseases reported to affect soursop on Guam include: *Botryodiplodia theobromae* (diploia rot), *Colletotrichum gloeosporioides* (anthracnose), *Phomopsis sp.* (fruit rot), and *Phytophthora infestans* (root rot) (Schlub, 2017). The anthracnose fungus can damage seedlings and shoots. Mealybugs are the most common pest. Mealybugs consume sap of young leaves and fruits, causing yellowing and withering of leaves, as well as stunted tree growth (Coronel, 1983).

Harvest and Handling

Maturity & Shelf Life

Fruit maturity and ripeness are essential attributes to make wholesome and good quality products. Soursop has four stages of maturity: fully-developed immature, mature unripe, mature ripe, and fully ripe. On mature fruits, spaces between spikes on the fruit surface are open. The fruit is ready to pick when its color is yellow-green and firm. If the fruit ripens on the tree, it will fall and break. Handle ripe soursop gently and pack in single layers to prevent bruising. Firm fruits may be held at room temperature for a few days. To verify the full ripeness of the fruit, apply slight pressure to the fruit with your thumb; a soft indentation indicates full ripeness. The optimum stage for consumption is about 5-6 days after harvesting a firm fruit. Once the fruit has reached this degree of ripeness, it can be held for another 2-3 days longer. When refrigerated, the skin of the fruit changes color from a yellow-green to black; however, the flesh is still edible.

Packaging Preferences

Soursop is sold on Guam in farmers' markets, roadside stands, and in some grocery stores. To maintain quality, soursop fruits are placed flat, side by side, rather than stacked. Fruits are usually sold unpackaged, although occasionally soft materials are used to prevent bruising and puncturing.

Food Uses and Nutrition

Freezing soursop helps retain its flavor. The juice and pulp can be used in smoothies or the juice used in mixed drinks. Pulp can be used in salad dressings, sauces, soups, sorbets, jams and other value-added products. Soursop leaves are used in teas.



Soursop fruit on tree

Nutritional Value

Soursop is low in calories and fat and is a rich source of Vitamin C, Vitamin B1, and Vitamin B2.

Nutrition Facts

1 servings per container	
Serving size	1 large (625g)
Amount per serving	
Calories	410
% Daily Value*	
Total Fat 2g	3%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 90mg	4%
Total Carbohydrate 105g	38%
Dietary Fiber 21g	75%
Total Sugars 85g	
Includes 0g Added Sugars	0%
Protein 6g	
Vitamin D 0mcg	0%
Calcium 88mg	6%
Iron 4mg	20%
Potassium 1738mg	35%

*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Preservation and Storage from (Yang, 2016)

After harvesting soursop fruit from a tree or obtaining from a market, clean and wash the fruit and sanitize it with 200 ppm chlorine solution (2 teaspoons of regular bleach containing 8.25% sodium hypochlorite in 1 gallon of clean water). The soursop fruit can spoil rapidly, and the seeds contain toxic compounds.



Mature and ripe soursop fruit for consumption

Prepare Soursop Puree

Before making soursop puree, manually remove the peel and core and discard the seeds. The yield of soursop puree is about 62% based on the weight of whole fruit. The peel and core accounts for about 21% and the seeds and fiber for 17% of the total fruit weight. The fresh soursop puree can be stored in a refrigerator at 4°C (40°F) for up to 3 days for fresh consumption or making soursop nectar, smoothie, juice blends, and sorbets.

Process Pasteurized Soursop Puree

To extend the shelf life of fresh soursop puree, the puree should be pasteurized and packed to prevent contamination. The purposes of pasteurizing the soursop pulp are to: (1) kill vegetative spoilage and pathogenic bacteria and (2) inactivate enzymes such as pectinesterase, which degrades the quality of soursop pulp. Pasteurization at 80°C (176°F) for 1.5 min will kill vegetative bacteria as well as inactivate the spoilage enzymes.



Heat resistant vacuum bag

Vacuum sealer

To pasteurize soursop puree, “water-bath pasteurization,” is recommended. The full procedure includes heat treatment, vacuum packaging, cooling,

and refrigeration. For example, put 500 grams soursop puree in a heat resistant plastic bag and use a vacuum sealer to seal the bag opening but leaving a small opening at one side; then immerse the bag in boiling water for 5-6 minutes; letting the air inside of bag leave from the small opening. This heat treatment will increase the internal temperature of soursop puree to 80°C (176°F) that will kill bacteria and inactivate spoilage enzymes. After pasteurization, immediately vacuum-seal the bag to prevent contamination, cool the soursop puree in ice water for 10 minutes, and store the pasteurized soursop puree in the refrigerator. This processed soursop puree will have a shelf-life of up to 3 months at 4°C (40°F) remaining a quality with distinct and pleasant soursop aroma and taste for making variety of soursop products.



Pasteurization of soursop puree Pasteurized and vacuum-sealed soursop puree

Additional Information

For more information on establishment, management, use, pest and diseases, please contact Guam Cooperative Extension & Outreach office at 671-735-2080.

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