Sweetsop Tree Care Guide for Guam

UNIVERSITY OF GUAM
COOPERATIVE EXTENSION
& OUTREACH

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PREFACE

This sweetsop tree care guide is a compilation of local growing experience and the following publications:

- "Useful Plants of Guam" (1905)
- "The Flora of Guam" (1970)
- "Promising Fruits of the Philippines" (1983)
- "Fruits of Warm Climates" (1987)
- "Mango" (1997)
- "Compendium of Tropical Fruit Diseases" (1998)
- "Annona Species" (2005)
- "Florida's Best Fruiting Plants" (2006)
- "ANNONA (Annona cherimoya, A. muricata, A. reticulata, A. senegalensis and A. squamosa)" (2006)
- "Tropical Fruits, Vol. 1" (2011)
- "Tropical Fruits, Vol. 2" (2012)
- "Sugar Apple Growing in the Florida Home Landscape" (2016)
- "Custard Apples, Sugar Apples, Cherimoya, and Sour Sop" (2019)

This guide is tailored for Guam's climate and offers suggestions on choosing what type of sweetsop to grow, the right location to plant the tree, preparing the site for planting, managing the sweetsop tree for excellent fruit production, and much more.

INTRODUCTION

Sweetsop, known scientifically as *Annona squamosa L.*, is the most widely grown fruit from the Annonaceae family and is native to tropical America. It is now widely cultivated in the tropical regions of the Americas, Africa, Asia, and the Pacific. The Spanish probably introduced sweetsop from the New World to Guam during the Spanish galleon trade route from Mexico to Guam to the Philippines. The Spanish occupation of Guam lasted 300 years; therefore, the vast majority of introduced plants came from the ports in Mexico and the Philippines.

There are three species from the Annonaceae family that are commonly found on Guam. *A. squamosa L.* (sweetsop) and *A. muricate L.* (soursop) are the two most popular species cultivated in home gardens. The third species -- *A. reticulata L.* (custard apple) -- is the least preferred and is usually found growing wild in the jungle and along roadsides around the island.

A. squamosa has many regional names, such as sweetsop and sugar apple (English); *anon*, *rinon* (Spanish); *noina* (Thai); *nona seri kaya* (Malay);

custard apple (India); *annona blanca* (Mexico), and *ata* (Hindu). In Guam and the Philippines, it is known as *åtes*.

In 1899, William E. Safford reported that "the sweetsop was favored by the natives of Guam, and it was found planted by nearly every house." Safford was a botanist for the U.S. Department of Agriculture and served as the assistant governor of Guam from 1899 to 1900. Safford wrote the book "Useful Plants of Guam" that was published in 1905 and re-published in 2009. The sweetsop fruit is still highly prized today in modern Guam, and the tree is found in many home gardens and farms on the island.

This guide provides information and steps on how to grow and maintain a healthy, fruit-producing tree. The first and most crucial step is planning before planting. The planning stage involves determining what type of sweetsop to grow, choosing the right location to plant the tree, preparing the site for planting, and most importantly, managing the sweetsop tree after planting. The tree will require proper watering, fertilizing, pruning, and pest management. All of these practices are essential for the success of the tree over its lifetime.

QUICK FACTS

Common name: Sweetsop, Sugar Apple
CHamoru name: Åtes
Scientific name: *Annona squamosa L.*
Height: 9 to 21 feet (2.7 to 6.4 meters)
Peak harvest: July to September
Light: Full sunlight year-round
Soil: Well-drained
Spacing: 15 to 20 feet (4.6 to 6.0 meters)
Watering: Soil around the tree should be moist but not wet
Mulching: Maintain 2 to 4 inches (5 to 10 centimeters) of organic mulch placed 6 inches (15.2 centimeters) away from the trunk extending to the edge of the leaf canopy
Pruning: Ideal height and width is 8 to 10 feet (2.4 to 3.0 meters)
Fertilizing: Trees may require applications of complete fertilizer
Plant diseases: Anthracnose and fruit rot
Most common pests: Mites, thrips, whiteflies, mealybugs, and scales

DESCRIPTION

Tree

Sweetsop trees are small, deciduous, tropical, and perennial fruit trees with broad open crowns and many lateral branches. They are cultivated in tropical areas of the world. The trees can grow to 9-21 feet (3.0 - 7.0 meters) under ideal conditions. In Guam, however, they rarely reach this size because of typhoons and tropical storms (Fig. 1).

Figure 1. Sweetsop tree

Figure 2. Sweetsop leaves

Leaves

Åtes has deciduous leaves that are a brilliant green above and bluish green below, hairy when young becoming smooth when mature. The leaves are simple, alternate, elliptical and 2-4 inches (6-10 centimeters) long, oblong in shape and have a slight fragrance when crushed (Fig. 2).

Flowers

Sweetsop flowers are fragrant and produced on one- to two-year-old wood. The flowers emerge in groups of two to four along the branches (Fig. 3). They produce complete flowers that are made up of functional male and female parts in the one flower but are functional at different times of the day (Fig. 4).

Figure 3. Newly emerged sweetsop flower

Figure 4. Sweetsop flower

Figure 5. Purplish-red sweetsop fruits

Figure 6. Sweetsop fruits

The sweetsop flower alternates the opening and closing of female and male flower parts during pollination. A single flower takes two days to complete its cycle. On the first day (early morning to mid-day) of flowering, the female parts are receptive to pollen. The next day (morning to late afternoon), the same flower opens wider as a male and sheds pollen. This behavior allows for cross-pollination from different flowers on the tree.

Fruit

A sweetsop is a compound fruit that is generally conical, or roundish, or heart-shaped and can grow from 2-5 inches (5-12 centimeters) in diameter and weigh between 4-24 ounces, or 113-682 grams. There is a purplish-red skin variety (Fig. 5) available, but the exterior of most of the popular sweetsop fruit grown is usually dark green when young turning greenish yellow — even reddish — when ripe (Fig. 6).

When mature, the fruit is soft with white, juicy segmented pieces of flesh that have a custard-like texture with a sweet, pleasant flavor. There are varieties that are seedless, but the more commonly grown sweetsop contains sometimes few or numerous hard brown or black bean-like seeds within the pieces of flesh (Fig. 7).

Figure 7. Mature sweetsop fruit with seeds

SOIL

Sweetsop plants tolerate and produce satisfactory yields in a variety of well-drained soils. Healthy roots require good aeration and do not like flooding or poorly drained soils. Trees growing in soils that are wet and soggy for long periods of time often have decreased growth and production, nutrient deficiencies, dieback, root rot, and even tree death.

SPACING

In a home landscape, plants should be spaced at least 15-20 feet (4.6-6.1 meters) away from buildings, concrete sidewalks, power lines, overhead or underground utilities, and other trees. Commercially, tree spacing may be 12x12 feet (3x3 meters) or 16x16 feet (5x5 meters) between trees depending on variety, management, and soil conditions.

WATERING

Newly planted sweetsop trees should be watered at planting and then every other day for the first week, and two times per week until rainfall is sufficient. Small trees need about 0.5 inches (1.2 centimeters) of rain every three to four days. If no rain has fallen during that period, the tree will need to be watered. Established juvenile plants need infrequent deep watering during dry periods. For established mature trees, supplemental irrigation is recommended from the flowering period throughout fruit development and during extended dry periods.

FLOWER AND FRUIT PRODUCTION

Sweetsop generally can bloom year-round, although in Guam, the main flowering season is from January to June, which is generally the driest and coolest time of the year. It can take up to one to two months after flowering for fruit set and fruit development to begin. Depending on the variety, it takes three to four months for the fruit to mature after fruit set. Dry cool weather helps with good flower and fruit set and decreases the possibilities of fungal disease during fruit development.

The fruit yield of a sweetsop tree depends on its variety, spacing, the age of tree, soil fertility, and weather. In some parts of the world, sweetsop can produce up to 50 fruits/tree. However, during a good year in Guam, each sweetsop tree bears an average of 20-30 fruits.

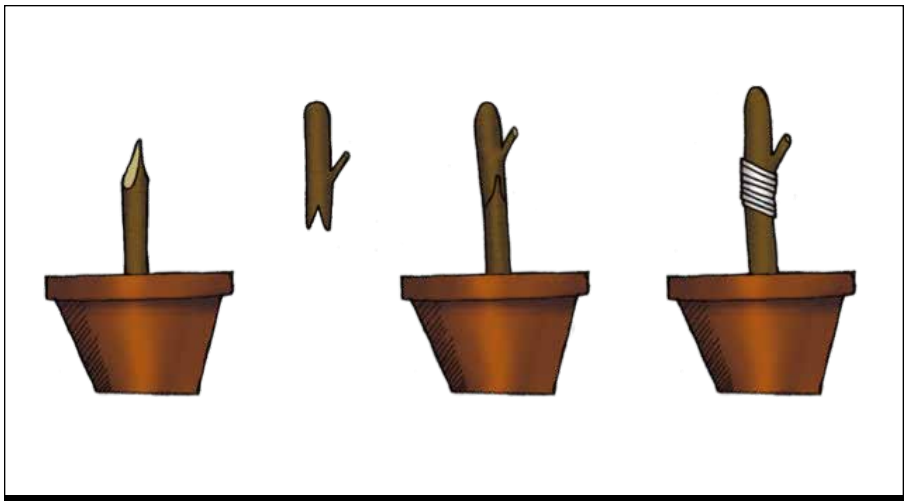

Figure 8. Wedge graft

Figure 9. Side approach graft

PROPAGATING SWEETSOP

Propagation

Planting sweetsop from seed is easy and very common in Guam. If seeds are to be used, be sure to collect them from a healthy, high-yielding, and excellent fruit quality sweetsop tree. The disadvantage, however, is the new plant produced from seed may show some fruit variability from the mother plant. To establish a genetically identical offspring, asexual propagation (grafting) is recommended.

Planting a Seed

After eating the flesh of the sweetsop, remove and rinse the exposed seed. A sweetsop seed should be planted soon after removing it from the fruit. Plant seeds in a 2x2x6 inch (5x5x15 centimeter) pot for germination. Plant two to three seeds per pot to ensure germination, then thin to one seedling per pot leaving the strongest seedling. Seeds should be planted in a potting mix with good drainage at a depth of 0.5-0.7 inches (1-2 centimeters) below the soil line, then cover with potting mix gently and water to saturation. Fresh sweetsop seeds usually take 30-45 days to germinate.

Asexual Propagation

When propagating sweetsop asexually, a variety identical to the mother plant will be produced. The most common way to asexually propagate sweetsop is grafting. Grafting involves the union of a healthy detached bud or shoot (scion) from the branch of a desired healthy mature (mother) plant to a healthy seedling (rootstock) or a healthy trunk of a mature tree (top working). Generally, the upper portion of the rootstock is removed completely and is replaced with the scion. Seedlings that are grafted can produce sweetsop fruits in as little as one to three years, compared to two to five years from seed. Two of the easiest ways to graft sweetsop are wedge grafting (Fig. 8) and side approach grafting (Fig. 9).

PLANTING A TREE

Planting a young, vigorous sweetsop tree properly will provide the tree with what it needs to grow rapidly and establish a strong canopy. It is highly recommended that sweetsop seeds be first planted in a pot rather than directly in soil.

Seedlings should be grown in at least 2-3 gallon (7.5-11.3 liter) pots so that the plant does not become root-bound. After the plant has reached a height of 2-4 feet (0.6-1.2 meters), it should be transplanted into the ground. The planting hole should be at least twice the diameter of the pot. The depth of the hole should be no deeper than the depth of the root ball.

It is not necessary to add fertilizer before the plant is placed in the hole. After transplanting, fill the hole with excavated soil until the top of the root ball is level with the existing soil line (Fig. 10). Water the plant thoroughly after transplanting. Preferably, the seedling should be planted at the beginning or during the rainy season (July through November) to take advantage of the free water.

If there is potential for excessively wet or flooded soil conditions, plant the tree on a large hill or mound made up of native soil, 1-2 feet (0.3-0.6 meters) high by 4-10 feet (1.2-3.0 meters) in diameter. Follow

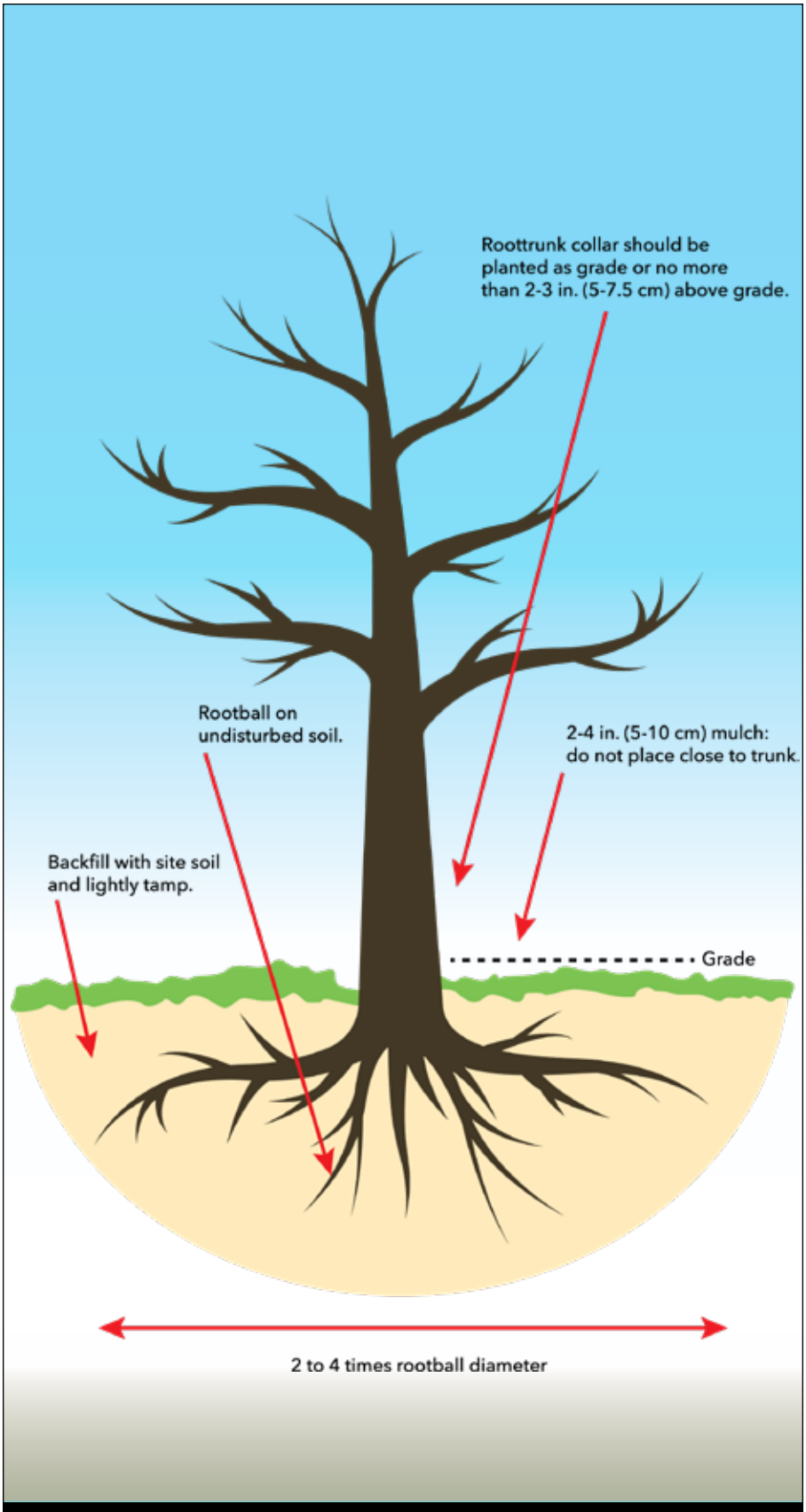

Figure 10. How to plant a sweetsop tree

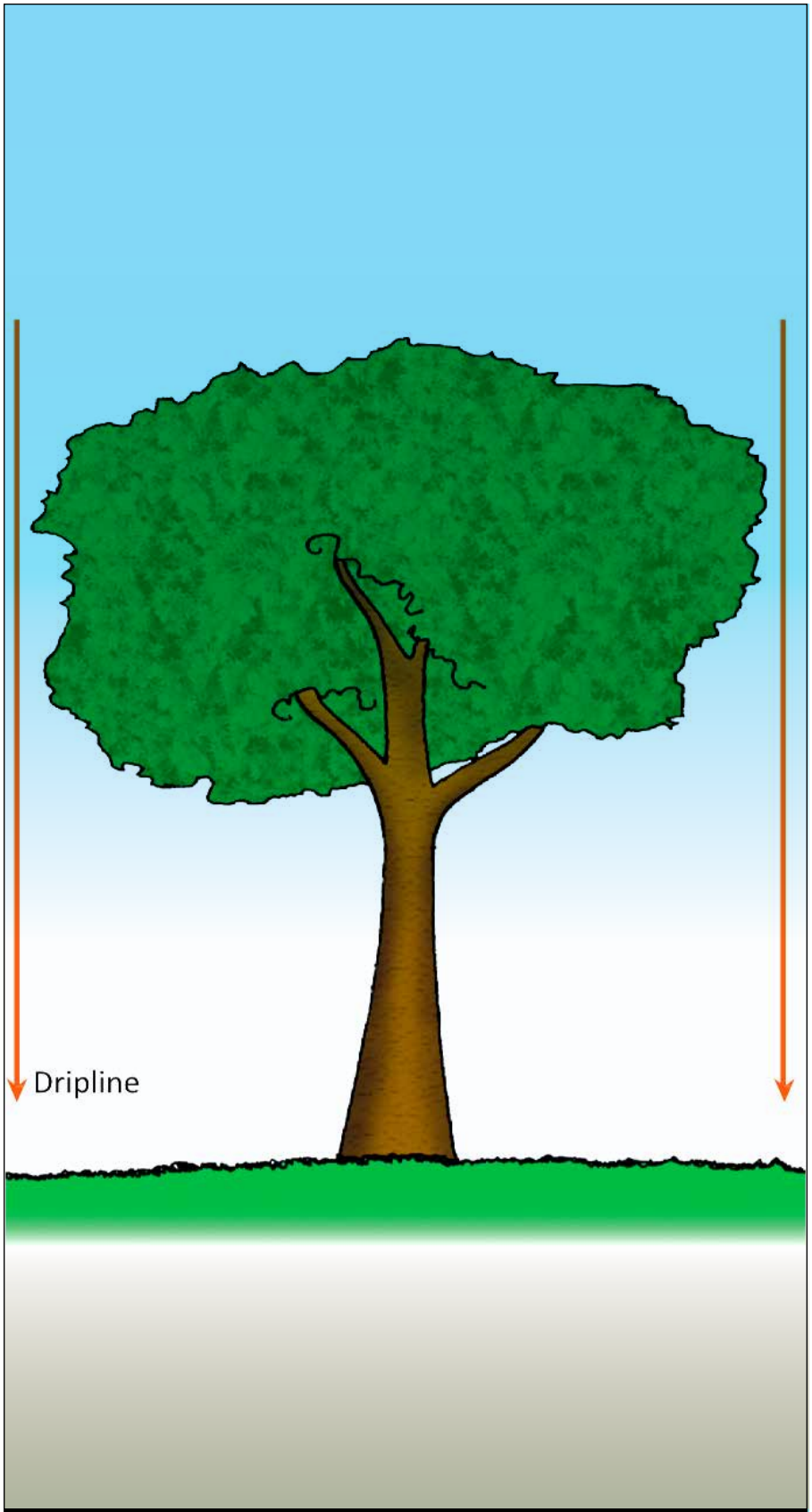

Figure 11. Tree dripline

the same directions above for planting in a mound.

ORGANIC MULCH

Sweetsop trees are shallow-rooting plants, so maintaining organic mulch around the trees is beneficial. Organic mulch is fresh and decaying material that is applied to the surface of the soil. This process takes place naturally in undisturbed jungles and forests. Organic mulch consists of plant residue such as leaves, twigs, and branches or paper and cardboard (torn or shredded). Organic mulch provides a moist environment for healthy root growth, suppresses weed growth, helps with beneficial soil micro-organism interaction, improves the physical characteristics of the soil, prevents soil-borne pathogens from splashing up on the leaves, and slowly releases nutrients as it decomposes.

Roots function and develop best when protected by 2-4 inches (5-10 centimeters) of heavy, undisturbed mulch (Fig. 10) that extends beyond the circumference of the edge of the leaf canopy or "dripline" (Fig. 11). Organic material like shredded paper, grass clippings, and small leaves should be replenished every few months while wood chips, palm fronds, and cardboard can last up to one year. The mulch should be placed 6 inches (15.2 centimeters) away from the tree trunk to ensure that it does not accumulate and possibly cause the base of the tree to rot.

PRUNING

On Guam, sweetsop trees are not pruned when growing. However, selective pruning or training of limbs at a young age will help develop a strong, manageable canopy height and width for sweetsop trees grown in a home landscape or an orchard.

Initial pruning starts with a single stem up to 2.6 feet (80 centimeters) in height from the soil level and then induce scaffold branching in all directions. The second pruning should be done after the tree is two years old. The secondary branches should be cut back to a length of 1.5 feet (40 centimeters). Maintaining proper spacing between branches and removing overlapping and crisscrossing branches will eventually form a well-balanced canopy.

Yearly pruning maintenance after fruit harvest will also improve sweetsop tree health by allowing air and sunlight to penetrate the canopy, reduce pest and disease problems, and allow for easier fruit harvesting.

In most cases, it is best to keep trees low and compact to reduce wind damage since their branches are easily broken by strong winds or heavy fruit loads. Severe pruning is sometimes necessary to maintain the ideal tree height and width of 8-10 feet (2.4-3.0 meters). Sweetsop trees usually respond well to the canopy reduction.

Figure 12. A bag of a complete fertilizer

COMMON PESTS OF SWEETSOP

There are numerous pests of the sweetsop, but only a few of them cause significant damage. Pests, such as insects and diseases that cause significant damage are called "economic" pests. If the damage caused by a pest reduces a plant's potential production by an amount greater than the cost of treatment, it is considered an "economic" pest. In this section, only those diseases and insect pests of sweetsop having economic significance are discussed.

Disease Pests

Plant pathologists at the University of Guam College of Natural & Applied Sciences have reported many different diseases of sweetsop on island. The fungal disease called Anthracnose, known scientifically as Colletotrichum gloeosporioides, is by far the most economically important disease affecting sweetsop leaves, young stems, and fruits in Guam. Anthracnose thrives in areas of poor sunlight penetration, excess soil moisture, and poor drainage. It can easily be spread by wet and windy conditions, contaminated plant parts, and equipment.

Insects and Insect-like Pests

Most insects and insect-like pests cause relatively minor damage to sweetsop, whereas others can severely reduce yield. The pests that attack sweetsop include aphids, mealybugs, mites, scales, thrips, and whiteflies.

FERTILIZER

Most fruit trees can survive in the natural environment without additional fertilization. However, sweetsop trees, as well as other plants grown commercially, generally need a complete fertilizer (Fig. 12) to maintain or improve the health of the tree, enhance growth, increase yields, and reduce pest problems.

The application of fertilizer varies with the age of the tree and the type and condition of the soil. Young non-bearing and fruit-bearing

trees require some type of complete fertilizer, such as 16-16-16, 10-20-20, or 10-30-10 on a regular basis. The numbers on the fertilizer bag represent the percentage of three primary elements: nitrogen (N), P2O5 (available phosphate), and K2O (soluble potash/potassium), respectively. All are needed for healthy, productive sweetsop trees.

For example, a 30-pound bag of a 10-20-20 complete fertilizer contains 3 lbs of N (10% x 30 lbs), 6 lbs of P2O5 (20% x 30 lbs), and 6 lbs of K2O (20% x 30 lbs). The remaining contents are generally inert materials and sometimes include other secondary and trace elements used by plants. Do not use a complete fertilizer that has a higher percentage of nitrogen than phosphorus and potassium, for example 30-10-10, for fruit trees because nitrogen encourages leaf growth at the expense of fruit and root production. Fertilizers high in N are generally recommended for use on leafy crops, such as leafy greens and green herbs.

Application of fertilizer for sweetsop trees may be done either topically or as in-ground spot applications (Table 1). Topical (broadcast) applications involve the even distribution of fertilizer on the soil surface under the tree and away from the main tree trunk. Preferably, concentrate the application of fertilizer within the circumference of the edge of the leaf canopy, or "dripline" (Fig. 11). It is advisable to water fertilizer thoroughly after it is applied to get the nutrients into the soil as soon as possible, so they are not lost into the atmosphere. For medium to large sweetsop trees, apply the fertilizer 1 foot toward the tree trunk from the dripline in a circular (band) fashion. Consider fertilizing your tree before adding new mulch.

In-ground spot application of fertilizer involves digging numerous holes 2-3 feet apart along the dripline. Deposit fertilizer, about 1-2 Tablespoons per hole, cover with soil, and water moderately. Spot application, while it requires more work, makes more efficient use of the fertilizer. In-ground spot applications have less chance of fertilizer loss, especially nitrogen. The fertilizer should be covered with soil promptly and watered in.

Fertilizer Application

Table 1. How much complete fertilizer to apply to sweetsop trees

Year	Times/ Year	Amount per Tree Application (lbs) 10-20-20[1]	Amount per Tree Application (lbs) 16-16-16[1]
1	4	0.5 lbs 2 lbs/year	0.25 lbs 1 lbs/year
2	4	1 lbs 4 lbs/year	0.5 lbs 2 lbs/year
3	4	1.5 lbs 6 lbs/year	0.75 lbs 3 lbs/year
4	4	2 lbs 8 lbs/year	1 lbs 4 lbs/year
5	4	2.5 lbs 10 lbs/year	1.25 lbs 5 lbs/year
6	4	3 lbs 12 lbs/year	1.5 lbs 6 lbs/year
7	4	3.5 lbs 14 lbs/year	1.75 lbs 7 lbs/year

[1]Total amount of a complete fertilizer to be applied for the year.

Figure 13. Harvested sweetsop fruit

FLOWER AND FRUIT PROBLEMS

The production of flowers on a sweetsop tree is necessary for consistent fruit production and is the main objective for homeowners and commercial producers.

REASONS FOR POOR FLOWERING

- The tree may be too young to flower. Trees grown from seed may take 2-5 years before they can flower, whereas grafted trees usually take 1-3 years.
- The tree may be out of season. Sweetsop trees generally flower from January to June on Guam.
- The variety may be poorly adapted to Guam. Some sweetsop varieties may have specific requirements for good flowering naturally.
- The tree may have had excessive vegetative growth prior to the flowering season. This can be caused by too much nitrogen from fertilizing, new organic matter that was added to the soil, typhoon damage, or severe pruning of the tree canopy.

REASONS FOR POOR FRUIT PRODUCTION

- Poor flowering
- Poor fruit set from poor pollination
- Disease or insect damage
- Poor nutrition of the tree
- Drought stress
- Unfavorable weather, such as heavy rain, high winds, or a typhoon at the time of flowering and when the fruits are small
- Too much shade. Sweetsop trees require full sun for optimum fruit production.

HARVEST, RIPENING, AND STORAGE

Depending on the variety, it takes three to four months for the fruit to mature after fruit set. The main harvesting season can span three to four months. The fruit should be harvested while they are still firm on the tree. As the fruit matures, the color changes from dark green to a yellowish green and even reddish. The segments on the fruit exterior will start to spread apart and the areas between the segments will develop a greenish to creamy yellow color (Fig. 13). After picking the mature fruit, place it on your kitchen counter-top or in a paper bag or box. The fruit will begin to soften and ripen in two to five days. The fruit should be eaten as soon as it softens. When ripe they may be stored in the refrigerator for two to four days before eating.

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