UNIVERSITY OF GUAM
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Chaya

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Agriculture & Natural Resources

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Introduction

Cnidoscolus aconitifolius, commonly known as chaya and sometimes called the spinach tree, is a fast-growing perennial plant native to Mexico. It was distributed throughout the rest of the world and introduced to the island of Guam by Spanish explorers. For many new farmers establishing agroforestry or fast-growing perennial plantings, these plants provide rapid economic returns and local market impact. In recent years, chefs in Guam have expressed the desire for more variety in local vegetables that convey tropical ambiance, during both monthly Micronesian Chefs' Association meetings and in focus groups (L. Barber personal communications, 2013-2018). Chaya offers the potential for the production of commercial quantities of perennial plants in a few years.

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

Figure 1. Chaya produces lots of large, attractive dark green leaves.

CULTURE AT A GLANCE

Scientific Name: *Cnidoscolus aconitifolius*
Common Name: Cabbage Star or Tree Spinach (English), Katagan (Chamorro), Chaya (Tagalog)
Size: Up to 13-16 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: Cuttings
Spacing: 8-12 ft. (windbreak), 15-20 ft. (orchard)
Watering: Keep soil moist, but not saturated
Pruning: Plants can be topped as low as 3 ft.; maintenance at 5-7 ft. tall is recommended for ease of harvest.
Common diseases: Many studies show no signs of common diseases.
Common pests: No common pests, but it can be affected by aphids, bugs, spider mites, and broad mites.
Cautions: Leaves contain high content of hydrocyanic acid. Boil the leaves and tips for at least five minutes to remove/volatilize the hydrocyanic acid.

Plant characteristics

Chaya is a fast-growing perennial plant that produces lots of large, attractive dark green leaves (Fig. 1). It can reach a size of 13-16 ft. in height and 7 ft. in width. Chaya height should be controlled to 5-7 ft. to prevent tree loss during high winds. Chaya blooms frequently, and both female and male flowers are born together at the end of long flower stems. In

Figure 2. After its first year, chaya plants can be pruned, resulting in rapid new growth.

Guam's tropical environment, chaya plants develop quickly and begin producing edible leaves within 3-5 months of being transplanted as a seedling. The early growth of young chaya plants is slow, but after the first year, the plants can be pruned, resulting in rapid new growth.

Propagation and planting

Chaya plants rarely produce seeds. Thus, the most common way to propagate chaya plants is by asexual propagation methods.

Asexual propagation

To encourage a more uniform and productive perennial plant, asexual propagation methods, such as cuttings, air-layering, and grafting are used. Of these, cuttings are the easiest and most common propagation method. Cut woody sections of chaya stems of about 20-30 cm. long that contain two to three nodes. These cuttings can be taken from the top or bottom portion of the stem, although cuttings from the top portion tend to have fewer problems with rotting during the rooting process. Remove the leaves and air dry the cuttings in the shade for three to four days. This will allow the cut ends to seal and make them less susceptible to rotting (USAID, 2013). Cuttings should be treated with a rooting hormone and placed under mist.

Two cultivars are grown here in Guam: the wild chaya, known as *kadagan* in CHamoru, and chaya. The kadagan variety has stinging hairs and is rarely used for consumption, while chaya does not have stinging hairs, is eaten regularly, and has been grown at the University of Guam in the past few years. Chaya leaves must be boiled or cooked for five minutes or more prior to consumption because of the presence of hydrocyanic glycosides. Dr. Frank Martin, co-founder of ECHO and former head of ECHO's Agricultural Resources Department, stated that cooking the leaves quickly removes the cyanide.

Spacing

When used in windbreak plantings, the spacing for chaya is closer than orchard plantings. For windbreaks, chaya plants should be spaced 2 ft. apart. In commercial production, rows of chaya should be planted 3-7 ft. apart, with 2 ft. between each row.

Planting

Cuttings are ready to be transplanted when mature leaves are produced. In Guam, planting is best done at the beginning of the rainy season (July to December) to promote high survival and good growth. 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 chaya'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.

Chaya as 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 vegetation of the windbreak filters and slows the wind entering the protected area. With its fast-growing growth habit, chaya is an excellent plant for use as in-field or secondary windbreaks.

Benefits of using fast-growing perennial plants 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. Food trees as windbreaks provide an economic return for the land used for the windbreak. When fruit trees are used as

Figure 3. Chaya plants should be pruned to 5 to 7 ft. and as low as 3 ft. for ease of harvesting the leaves and young shoots.

windbreaks, an additional benefit is fruit production. For more information, see the UOG Land Grant publication "Windbreak Benefits, Design, and Management."

Plant care and maintenance

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. It is recommended to do sheet mulching after planting to reduce weeds, improve soil fertility, and conserve water.

To do this, add compost, manure, or other amendments to the soil around the base of 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 in. - 6 in.) free of mulch around the tree trunk for good air circulation. The materials used for the weed barrier, such as cardboard, should overlap with 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

Chaya can survive in Guam's soil types without additional fertilization. However, supplemental nutrition can improve the health of chaya plants, enhance growth, increase yields (leaf foliage), and reduce pest problems.

Application of fertilizer varies with the age and size of the plant 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). Since chaya plants are grown mainly for their edible leaves, a complete fertilizer that has a higher percentage of nitrogen than phosphorus and potassium is an ideal fertilizer for application because nitrogen encourages leaf growth at the expense of root production. Nonetheless, chaya has little need for additional care or extra fertilizer.

Irrigation

Proper irrigation is important especially during the perennial plant's early years and when planted during Guam's dry season (January to June). Drip irrigation is recommended for water conservation and economic efficiency. However, chaya's need for water is moderate. Once established, the plant can stand a great deal of drought or months of excess water, as long as there is good drainage and the roots are not in water-logged soil. Moreover, chaya plants have the ability to thrive well in both arid and rainy regions.

For more detailed information on the design and installation of drip irrigation systems, see the UOG Land Grant publication "Drip Irrigation Basics" (Tuquero, et. al., 2019). Funding assistance is available for drip irrigation through the EQIP program.

Diseases and pests

Current studies have shown little to no sign of pests and diseases associated with chaya plants. Although chaya is resistant to most insects and plant diseases, it can be affected by bugs, broad mites, spider mites, and aphids. It is also a host of CCMV (Cassava Common Mosaic Virus).

Harvesting and handling

Harvesting stage preferences

Since chaya is a perennial plant, harvesting of its edible leaves is year-round. The first harvest often occurs on the third month after planting. It is recommended to avoid harvesting more than 50% of the total leaves to ensure continuous vigorous plant growth. Leaves, even petioles and stems, can be dried and ground to make a storable product. When refrigerated, the leaves of chaya change color from light green to darker green or black but are still edible.

Packaging preferences

It is recommended to boil chaya leaves in water for at least 5 minutes before packaging. The leaves can be packed in Ziplock plastic bags or other secure plastic bags for marketing.

Food uses and nutrition

Chaya has been used for food since pre-Columbian times and is still eaten regularly, especially in Central America, southern Mexico, the Micronesian Islands, and throughout the Pacific region. Leaves should be cut into pieces and boiled or fried for at least five minutes before they are eaten because of the presence of hydrocyanic glycosides. (Hepler, 2018). Brief stir-frying is not adequate cooking.

Additionally, chaya has also been used as a medicinal plant. Typically, cooked leaves are consumed, or the leaves are used to make teas or infusions. Although many medicinal claims have been made for chaya, it is most commonly used to treat diabetes and kidney problems. In a 1991 survey conducted in the Mexican state of Morelos, 85 individuals were interviewed. A total of 60 individuals used chaya for kidney trouble (e.g., leaves blended into a shake), 21 for diabetes (to lower blood sugar), 10 for ulcers, blood pressure, and scorpion bites, and 4 for other purposes (Berkelaar, 2006).

Table 1. Range of nutritional values found in a 100g serving of chaya and percentages of recommended daily intakes of key nutrients.

Key Nutrient	Actual Quantities	% Daily Value	Why Eat Chaya?
Protein	6.2 - 7.4 g	12-15%	Protein builds muscles. One serving of chaya has the same amount of protein as an egg.
Calcium	200 - 330 mg	20-33%	Calcium builds strong bones. Chaya has more calcium than any other vegetable.
Iron	9.3 - 11.4 mg	42-52%	Iron is good for healthy blood and more energy. Chaya has two times as much iron as spinach.
Vitamin A	1,357 IU	27%	Vitamin A prevents night blindness and protects the body against infections.
Vitamin C	165 - 205 mg	275-342%	Vitamin C builds strong bones, protects against infections, and helps the body absorb iron.

Sources: Nature's Solution to Malnutrition, www.MiraclesInAction.org (accessed 13 May 2013), Pacific Islands Farm Manual, and Tropical Perennial Vegetable Leaflet No. 4, August 1994.

Figure 4. Chaya with coconut milk. *Photo sourced from the Northern Marianas College Cooperative Research, Extension & Education Services*

Nutritional value

Chaya leaves are very high in protein, calcium, iron, carotene, and vitamins A, B, and C. Table 1 summarizes the range of nutrients found in a 100g serving of chaya and percentages of recommended daily intake of key nutrients (USAID, pg. 1). Moreover, the amino acids in chaya are well-balanced,

Table 2: Comparison of nutrient composition of chaya (*Cnidoscolus aconitifolius*) and spinach (*Spinacia oleraceae L.*) leaves per 100 g edible portion

Component	Chaya	Spinach[c]
Energy (kcal)	64.0[a]	28.0
Protein (g)	6.2[a]	2.9
Fat (g)	1.3[a]	0.6
Total Fiber (g)	2.0[a]	1.6
Total CHO (g)	10.7[a]	2.6
Ash (g)	2.0[a]	1.4
Calcium (mg)	234.0[a]	67.0
Phosphorus (mg)	76.0[a]	41.0
Potassium (mg)	244.0[b]	460.0
Iron (mg)	2.8[a]	1.0
Magnesium (mg)	98.0[b]	93.0
Vitamin C, total ascorbic acid (mg)	194.0[a]	30.3
Vitamin A (µg)	2,370.0[a]	306.0

[a]Leung & Flores (1961)
[b]Kuti & Kuti (1999)
[c]U.S. Department of Agriculture, FoodData Central (2025)

which is important for those who have a low-protein diet, children, women who are pregnant, and nursing mothers.

Chaya is superior to many leafy green vegetables, such as Chinese cabbage and spinach. Table 2 provides a comparison of nutritional composition of chaya and spinach leaves (Berkelaar, pg. 4).

"A typical daily serving of approximately 1/2 cup (100 ml) of chaya leaves, in a soup boiled with other ingredients such as onion, garlic, tomato, and meat or chicken, may provide an individual with sufficient quantities of required vitamins A and C and mineral nutrients such as calcium, potassium, and iron" (Kuti & Kuti, 1999).

Instructions for processing chaya

1) After picking chaya leaves, wash them thoroughly under running water.
2) Bring water to a boil in a large pot.
3) Blanch chaya leaves in boiling water for 15 to 20 minutes.
Safety warning: The vapors from boiling the leaves are dangerous if inhaled. Be sure to boil the leaves in an uncovered pot in a well-ventilated room, using either oven vents or open windows.
4) Drain the leaves. Use them immediately in a recipe or store in freezer for future use.

Recipes

Green Goddess Chaya Dip

Nutrition Facts

servings per container
Serving size (113g)

Amount per serving
Calories 80

	% Daily Value*
Total Fat 2g	3%
Saturated Fat 1g	5%
Trans Fat 0g	
Cholesterol 10mg	3%
Sodium 280mg	12%
Total Carbohydrate 7g	3%
Dietary Fiber 0g	0%
Total Sugars 3g	
Includes 0g Added Sugars	0%
Protein 10g	
Vitamin D 0mcg	0%
Calcium 150mg	10%
Iron 1.1mg	6%
Potassium 210mg	4%

*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.

Serving size: ½ cup
Servings per recipe: 5

Ingredients

1 cup (~134g) chaya leaves, boiled and chopped
1 cup cottage cheese
4 Tbsp. lemon juice
½ cup plain lowfat Greek yogurt
¼ cup chives
¼ cup parsley
¼ cup dill
1 clove garlic
2 tsp. parmesan cheese
Salt and pepper to taste

Instructions

1) Add all ingredients into a food processor. Blend until smooth.
2) Serve with crackers, toast, or chips.

Note: Be sure to use boiled chaya leaves for this recipe. (See "Instructions for processing chaya" section above.)

Gollai Hågon Kadagan

Nutrition Facts

servings per container
Serving size (105g)

Amount per serving
Calories 80

	% Daily Value*
Total Fat 6g	8%
Saturated Fat 2g	10%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 105mg	5%
Total Carbohydrate 7g	3%
Dietary Fiber 1g	4%
Total Sugars 3g	
Includes 0g Added Sugars	0%
Protein 2g	
Vitamin D 0mcg	0%
Calcium 40mg	4%
Iron 0.7mg	4%
Potassium 120mg	2%

*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.

Serving size: ½ cup
Servings per recipe: 6

Ingredients

½ cup (~67g) chaya, boiled and chopped
1½ Tbsp. vegetable oil

1½ cup of onion, chopped
2 tsp. garlic, minced (about 2 cloves)
1 Tbsp. ginger, minced (about 1 piece)
4 Tbsp. lemon juice (from about 1½ lemons)
½ can lite coconut milk
2 Tbsp. water
2 pieces of hot pepper, chopped
Salt and pepperto taste

Instructions

1) Heat vegetable oil in a pot on medium-high heat.
2) Add onion, garlic, and ginger. Cook until translucent (about 2–3 minutes).
3) Add chopped chaya leaves. Continue to cook until softened (about 2 minutes).
4) Add juice from 3 lemons. Continue to cook for an additional 5 minutes.
5) Add coconut milk, water, and chopped hot peppers.
6) Season with salt and pepper to taste.
7) Cook mixture for an additional 10 minutes on medium-low heat, stirring occasionally.
8) After 10 minutes, turn off heat and cover pot. Serve warm and refrigerate leftovers.

Note: Be sure to use boiled chaya leaves for this recipe. (See "Instructions for processing chaya" section above.)

Chaya Titiyas

Nutrition Facts

servings per container
Serving size (113g)

Amount per serving
Calories 80

	% Daily Value*
Total Fat 2g	3%
Saturated Fat 1g	5%
Trans Fat 0g	
Cholesterol 10mg	3%
Sodium 280mg	12%
Total Carbohydrate 7g	3%
Dietary Fiber 0g	0%
Total Sugars 3g	
Includes 0g Added Sugars	0%
Protein 10g	
Vitamin D 0mcg	0%
Calcium 150mg	10%
Iron 1.1mg	6%
Potassium 210mg	4%

*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.

Serving size: 1 titiya
Servings per recipe: 7

Ingredients

½ cup (~67g) chaya, boiled and chopped
1 cup all-purpose flour
1 cup whole wheat flour
1 Tbsp. sugar
1 Tbsp. canola oil
¼ tsp. salt
½ tsp. baking powder
¾ cup 2% milk

Instructions

1) Mix all ingredients in a bowl.
2) Knead dough on lightly floured surface. If too dry, add more cold milk; if too wet, add more flour.
3) Form dough into 2-inch balls. Use rolling pin or hands to flatten dough into round titiyas (about 6-inch wide, 1/8-inch thick).
4) Heat a large skillet over medium-low heat. Place titiyas one at a time onto the heated skillet. Cook until golden brown on both sides (about 3–4 minutes).
5) Serve whole or sliced into triangles. Pair with kelaguen, dip, or *tinala' katne*.

Note: Be sure to use boiled chaya leaves for this recipe. (See "Instructions for processing chaya" section above.)

Conservation incentive programs

In 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 fast-growing perennial plants 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 could 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 the EQIP program, contact the local NRCS field office in Guam. NRCS offices can be reached at (671) 300-8591. Or visit https://www.nrcs.usda.gov/wps/pertal/nrcs/main/national/programs/financial/eqip.

Additional information

For more information on the establishment, management, use, and pests and diseases of chaya, contact the Agriculture & Natural Resources office of the UOG Extension Service at (671) 735-2080.

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