



Growing Roselle (*Hibiscus sabdariffa*) on Guam

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Introduction

Hibiscus sabdariffa, more commonly known as roselle or sorrel is an annual or perennial subshrub that is cultivated in tropical and subtropical regions of the world (Da Costa Rocha et al., 2014). While it is in the same genus as common ornamental hibiscus plants, *Hibiscus syriacus* and *Hibiscus rosa-sinensis*, roselle is cultivated for its mature seed pods, or calyxes (Fig. 1). Roselle leaves and calyxes can be eaten raw, but calyxes are often used for a variety of food products, including herbal drinks, jams, and food additives. In the Caribbean and Central America, the dried calyxes of roselle are boiled to make an antioxidant-rich, tart drink called *Jamaican tea*. Some varieties of roselle can also be used a source of fiber.



Figure 1. Red calyxes of a roselle ready to harvest.

Nutrition Facts	
Serving Size 100 g	
Amount Per Serving, Raw Calyxes	
Minerals	
Calcium, Ca	215 mg
Iron, Fe	1.48 mg
Magnesium, Mg	51 mg
Phosphorus, P	37 mg
Potassium, K	208 mg
Sodium, Na	6 mg
Vitamins	
Vitamin C, total ascorbic acid	12.0 mg
Thiamin	0.011 mg
Riboflavin	0.028 mg
Niacin	0.310 mg
Vitamin B-12	0.00 µg
Vitamin A, RAE	14 µg
Source: United States Department of Agriculture Agricultural Research Service - National Nutrient Database for Standard Reference Legacy Release.	
https://ndb.nal.usda.gov/ndb/foods/show/2380?qlookup=09226&format=Full&max=25&man=&facet=&new=1	

Roselle (particularly, roselle tea) has been used to treat mild hypertension and hyperlipemia (McKay et al., 2010, Mozaffari-Khosravi et al., 2013). Roselle extracts also exhibit potent antioxidant activity (Farombi and Ige, 2007, Mossalam et al., 2011). Roselle is often sold in stores dried, ground calyxes. A report from Agricultural Experiment Station in the U.S. Virgin Islands indicates a market price of \$4.03/lb (Bailey and Ferrarezi, 2016). Roselle can yield 3–16 lbs of calyxes per plant (depending on the variety), and up to 16,800 lbs/acre (Morton, 1987). Although it is not yet an established crop on Guam, its ease of growth and the versatility of the plant as a food product makes it a potential cash crop for local farmers.

Growing Roselle

Roselle grows best in tropical and subtropical areas with rainfall of 72 inches during the growing season (July to December). This makes Guam an ideal place to grow roselle (Fig. 2).



Figure 2. Two roselle varieties growing in Guam Agricultural Experiment Station Yigo Farm.

Roselle plants grow best in moderately fertile, deep, sandy loams, but have also grown well in limestone-rich soils (Morton, 1987).

Roselle plants are usually grown from seed, but can be propagated from cuttings (Morton, 1987). Because roselle is generally a short-day plant (Stephens, 1994), seeds should be planted in June or July in Guam to ensure maturity during the calyx production period later in the year.

Within two to three weeks after germination, seedlings are ready for transplant with spacing of 1-2 feet between plants in a single row and with distance of 5-10 feet between rows (Ayeni, 2018). After transplanting, weed control should be maintained by hand-weeding and using mulch. Once the plants reach a height of 1.5 to 2 feet, plants can suppress some weed growth by shading. It is

important to regularly water the plants. The soil should be kept moist, but not saturated.

Depending on the variety, plants can grow 5 to 8 feet tall. Early pruning will increase branching and produce more flowering shoots (Morton, 1987). Pruning also ensures that plants keep a desirable shape as they grow.

Common Pests and Diseases

Roselle is prone to several pests including: aphids (family Aphididae), whiteflies (*Bemisia* spp.), ground bugs (*Oxycaenus* spp.), and hibiscus mealybug (*Maconellicoccus hirsutus*) (Fig. 3) (Abdel-Moniem & Abd El-Wahab, 2006). The presence of mealybugs and aphids will also attract ants, which cultivate these sucking insects for honeydew. Registered insecticides along with regular monitoring and field sanitation can help control insect pests.

Roselle is also prone to dodder (*Cuscuta* spp.), a parasitic plant (Fig. 4). There is nothing known diseases of resell in Guam, however in world literature, several pathogens are reported to infect roselle plants including: root-knot nematodes (*Rhizoglyphis discopunctulata*) (Morton, 1987), root rot and vascular wilt (*Fusarium* spp.) (Hassan et al., 2014), and bacterial leaf spot (*Coniella musaiaensis*) (Persad & Fortune, 1989). Dodder infestation can be controlled by gently separating dodder plants from the host plant followed by proper disposal of the parasitic plants. Soil saturation and cleaning farm tools can help control pathogens.



Figure 3. Severe mealybug infestation on mature calyxes.



Figure 4. Infestation by dodder (*Cuscuta* spp.), a parasitic plant, girdling stems of a plant.

Harvest

As short-day plants, roselle plants will only flower and fruit during October to February on Guam. If a variety is a day-neutral plant, it will bloom anytime of the year. Most varieties of roselle can be harvested 4 to 5 months after planting. Roselle calyxes first form as white flowers with dark centers. The flowers then fall off and form a fleshy calyx. Their calyxes can be harvested when the seed pod in the center is brown and dry. Mature seed pods contain hard, brown or black seeds and will burst open when squeezed gently. Immature calyxes will have tough, green seed pods that contain white seeds. Depending on the variety, mature calyxes can be green, pink, or red. An annual roselle variety only lives for one harvest. Roselle calyxes progressively ripen from bottom to top. Mature calyxes contain seeds, which can be collected and grown for the next season.

Post-Harvest Handling

After harvest, seed pods should be separated from the fleshy part of the calyx. To prevent decay, calyx flesh can then be dried in the sun or refrigerated at low humidity. After removing seeds from seed pods, seeds should be air-dried for several hours and refrigerated to prevent the development of mold.

2018 Roselle Trial on Guam

A variety trial was conducted at the University of Guam's Yigo Agricultural Experiment Station (**Fig. 5**). The soil on site is characterized as Guam cobbly clay loam soil. On March 27, 2018, ten varieties of roselle were transplanted after 25 days of growing in a nursery. Seeds were obtained from the USDA GRIN seed bank. These included: PI 256039 (Hielo), PI 265319 (Fuego), PI 273389 (Puti'on), PI 275414 (Rouge), PI 291128 (No. 3), PI 500706 (Guaifon), PI 500713 (Tãsi), PI 500724 (Langet), PI 275413 (Isa), and PI 286316 (Tano). Growth characteristics and fruit maturity data were collected. Harvest occurred from October 27, 2018 to December 3, 2018 to determine characteristics of calyxes. The field experiment was terminated as the plants neared the end of production, and because of a heavy infestation of mealybugs. Most varieties produced mature calyxes from late October to early November. The sole exception is 'Tano,' which is day-neutral and produced mature calyxes starting in early July. Maximum production was observed in early December.



Figure 5. Different roselles grown in Guam Cobbly Clay soil in Agricultural Experiment Station Yigo Farm.

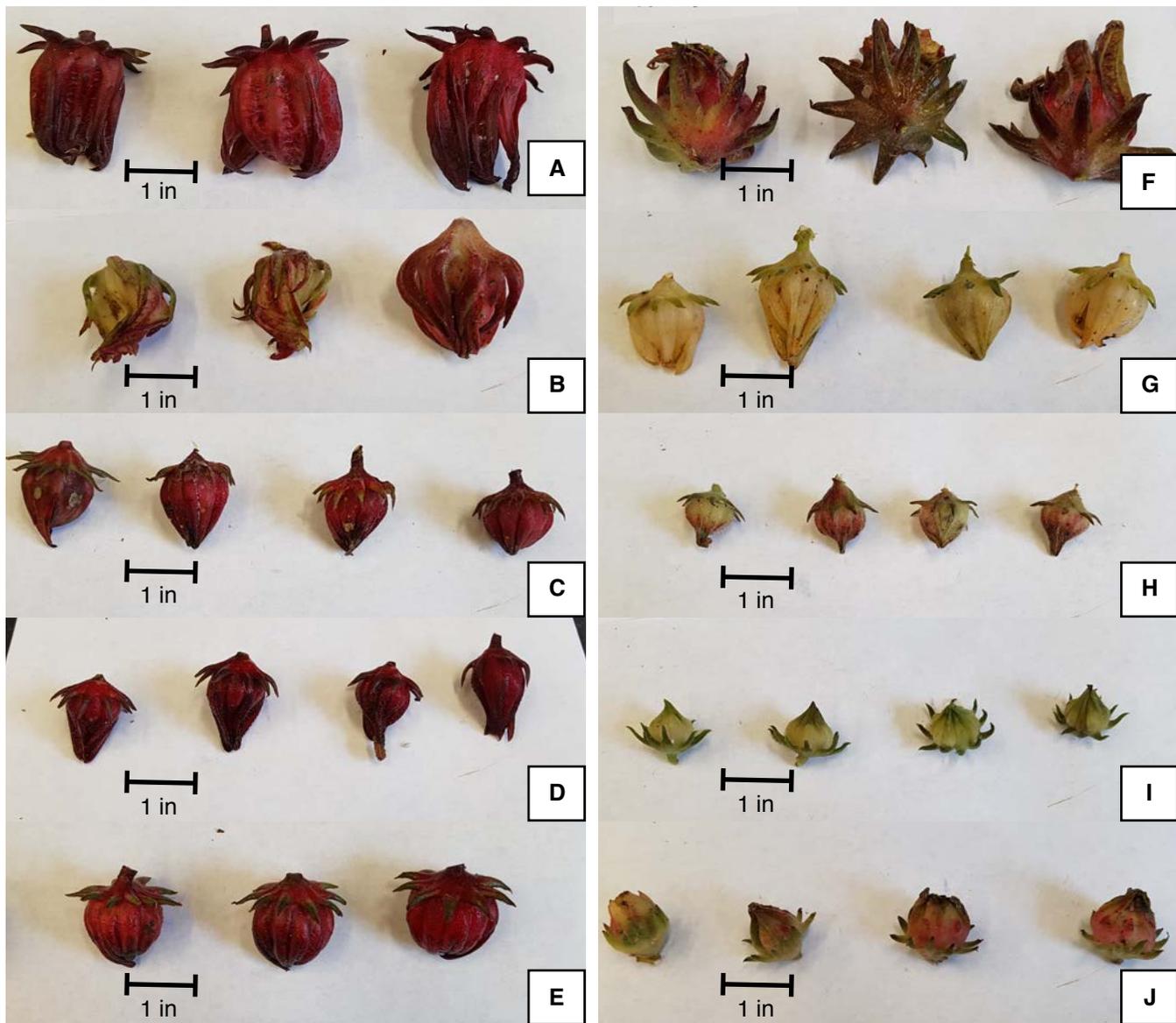


Figure 6. Mature calyxes of roselle varieties grown in the trial. Label indicates name of each variety (accession): A=Puti'on (PI273389); B=No. 3 (PI291128); C=Tâsi (PI500713); D=Tano (PI286316); E=Fuego (PI265319); F=Hielo (PI256039); G=Guaifon (PI500706); H=Isa (PI275413); I=Rouge (PI275414); and J=Langet (PI500724)

Of the ten varieties, eight produced marketable calyxes for food use. Two varieties (Isa and Rouge) were most likely fiber-producing varieties, and produced small, spiny calyxes unfit for use as food (**Fig. 6 - H and I**). Four varieties (Tano, Tâsi, Puti'on and Fuego) (**Fig. 6-D, C, A and E**) produced deep-red calyxes that may be more appealing to consumers, while Guaifon (**Fig. 6 - G**) produced light green-calyxes.

All plants of the Rouge variety may have been too infested by mealy bugs to produce mature calyxes. Of the ten varieties, Fuego was singled out because of its high production of deep red calyxes and resistance to pests (particularly, mealybugs). Guaifon featured a similar produc-

tion rate and pest resistance, but its light green calyx may not be as attractive to consumers. Heavy mealybug infestations began to manifest as plants grew larger, near late October. These infestations resulted in decreased production and often destroyed the quality of already mature fruits (**Fig. 3**). Plants were sprayed bi-weekly with neem oil to control mealybugs early in the season, but damage increased over time.

A shortcoming in this growth trial was transplanting roselle plants too early in the year. We were not aware that most varieties were short-day plants. With the exception of one day-neutral plant, there was a long vegetative growth period when plants were attacked by many pests.

One key consideration for a future trial would be to transplant seedlings late in the year, preferably in July or August. Planting at this time should still result in mature plants at harvest season, but with the added benefit of avoiding unnecessary maintenance (weeding, fertilizing, pest control, pruning, etc.). Later planting may also help to avoid uncontrollable pest infestations before harvest.

Another factor to consider: roselle plants require iron supplements when grown on Guam cobble clay. Roselle grown in iron-deficient soil did display inter-veinal chlorosis, a condition where discoloration appears around the veins of leaves (Fig. 7). If such discoloration occurs, simply applying an iron chelate will result in healthy leaf growth. A phosphorus deficiency symptom was also observed by their development of purplish color on leaves (Fig. 7).

Roselle is a specialty crop that is relatively easy to grow on Guam. Although it is not yet popular on the island, it can be used in many kinds of food products that all have potential for profit. One plant will produce more than enough calyxes for household use. Wide scale cultivation and consumer demand could potentially result in a commercial crop with minimal maintenance. When growing roselle, it is important to select varieties that are pest-resistant/tolerant and produce attractive, fleshy calyxes appealing to consumers. There are no current producers of roselle on Guam. Cultivation of roselle may be potentially profitable for interested growers.



Figure 7. Inter-veinal chlorosis on roselle leaves- an indication of iron (**Fe**) deficiency, and purple leaf caused by phosphorus (**P**) deficiency.

Table 1. Types of calyx and plant height at 3 months.

Accession / Variety	Calyx Description	Average Height (cm)
PI273389 / Puti'on	Large, pinkish-red	38.5
PI291128 / No. 3	Large, green w/ pink spots	48.7
PI500713 / Tãsi	Medium, dark red	41.9
PI286316 / Tano	Medium, dark red	143.0
PI265319 / Fuego	Medium, dark red	60.7
PI273389/ Hielo	Large, pink w/ green spots	49.7
PI500706 / Guaifon	Medium, light green	41.5
PI275413 / Isa	Small, spiny, green + pink	110.9
PI275414 / Rouge	Small, green (immature)	22.1
PI500724 / Langet	Small, spiny, pink	40.6

Seed sources:

Roselle seeds (Fig. 8) are available for purchase online. Suppliers that ship to Guam include Baker Creek Heirloom Seeds Co. (<https://www.rareseeds.com/>), Sheffield's Seed Co. (<https://sheffields.com/>). USDA/GRIN offers limited amount of seeds of *Hibiscus sabdariffa*

<https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?id=19078>



Figure 8. Seeds of *Hibiscus sabdariffa*



Iced Hibiscus Tea Recipe

(10 servings):

Ingredients:

- **Dry/Fresh Hibiscus Calyxes** 3 cups
- **Water** 10 cups
- **Cinnamon Stick*** 3 sticks
- **Star Anise or Ginger*** 4 pieces
- **Orange Peel*** 2 pieces
- **Syrup*** Sugar
sweeten to taste

*Optional

Procedure:

1. Combine all ingredients except sugar in a large pot.
2. Pour boiling water into teapot and remove from heat. Allow mixture to sit for 30 min. (Optional: Leave for 2 hours to infuse for deeper color and flavor.)
3. Strain the mixture into a glass container to remove particles. (Optional: use a cheesecloth to remove fine particles.)
4. Cool tea in the refrigerator.
5. Serve cold tea with sugar to taste.

Hot Hibiscus Tea Recipe

(4 servings):

Ingredients:

- **Dry/Ground Hibiscus Calyxes** 2 tea spoons
- **Boiling water** 1 quart (4 cups)
- **Honey/Sugar** sweeten to taste
- **Black tea bag** 1 bag
- **Cinnamon Stick** 2 pieces
- **Mint Leaves***
- **Lime Wedge*** *Optional

Procedure:

1. Boil a pot of water while putting dried Hibiscus in an empty teapot.
2. Pour boiling water into teapot and then add a tea bag (for caffeine or for taste). Steep for 5 min.
3. Strain tea as you pour it.
4. Add sweetener to taste.
5. Add garnishes if needed. (These include cinnamon, mint, or lime.)

Source: <http://www.cookforyourlife.org/recipes/mint-and-hibiscus-tea> and <https://www.cookforyourlife.org/recipes/ginger-hibiscus-tea/>

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