



## Winged bean (*Psophocarpus tetragonolobus*) Varieties for Guam

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### Introduction

The winged bean, also known as the Goa bean, Four-angled bean, and Dragon bean, is a legume native to New Guinea. It is a commonly grown bean in Southeast Asia and Papua New Guinea, but is usually cultivated as a small-scale crop (Wikipedia, 2017). Winged bean is a climbing perennial plant that looks and grows similarly to the common pole/string/long bean, *Phaseolus vulgaris* (Fig 1). Pods are distinctly different from those of the common string bean as they resemble a wing/star-like shape. There are many varieties of winged bean varying in length, width, and color (usually green or purple) of pods.



**Figure 1. Winged bean grown on trellis cucumber net.**

Source: Copyright: Arthit Buarapa

In the Mariana Islands, winged bean is a popular crop, locally known as ‘sigidiyas.’ Many parts of the plant are consumed, including immature bean pods, leaves, and tubers. Locally, immature bean pods are consumed the most as they are used as a fresh, or cooked, vegetable in a wide variety of local dishes.

Immature pods for consumption are usually harvested 2-3 weeks after fruit set while they are still tender and not very fibrous.

On Guam, the most popular local winged bean variety is cultivated seasonally or left in the field to grow year-round. Like many winged bean varieties, the popular ‘local green’ variety is a ‘short day’ plant. ‘Short day’ plants usually only produce flowers and fruits when day length (sunlight) periods are less than 12 hours a day (Savonen, 2003). On Guam, ‘short days’ usually occur from October through March (Astronomical Applications Department, 2016). The popular ‘local green’ short day variety can be found in markets November through May (Bamba et al, 2010). Other plants that require longer sunlight in a day (more than 12 hours) to produce flower and fruit are known as ‘long day’ plants (Savonen, 2003). Table 1 displays the average monthly day lengths of Guam.

In recent years, a ‘day neutral’ variety of winged bean has been cultivated on Guam (Quitugua, personal communication, October 21, 2016). ‘Day neutral’ plants can flower and fruit regardless of the length of sunlight throughout the day. Such varieties are virtually unknown to most local producers. Day neutral winged bean varieties will enable local growers to produce winged beans throughout the year.

There are numerous health benefits of winged bean. Fresh, young bean pods contain a good amount of Vitamin C and other minerals and vitamins such as iron, copper, manganese, and calcium. Thiamin pyridoxine (Vitamin B-6), niacin, and riboflavin are

**Table 1. Average monthly day lengths of Guam**

Month	Day Length (Hours/Mins)
January	11 hrs., 25 min.
February	11 hrs., 40 min.
March	12 hrs., 02 min.
April	12 hrs., 25 min.
May	12 hrs., 44 min.
June	12 hrs., 53 min.
July	12 hrs., 49 min.
August	12 hrs., 33 min.
September	12 hrs., 11 min.
October	11 hrs., 48 min.
November	11 hrs., 29 min.
December	11 hrs., 20 min.

Source: <http://www.mariana-islands.climatemps.com/sun-light.php>

also important B-complex vitamins embedded in winged beans (Rudrappa, 2017). Fig 2 shows basic nutrition facts of 1 serving size (44g) of raw, immature winged bean seeds as provided by the United States Department of Agriculture (USDA).

Nutrition Facts	
Serving Size 44 g	
Amount Per Serving	
Calories 22	Calories from Fat 3
% Daily Value*	
Total Fat 0g	1%
Saturated Fat 0g	1%
Trans Fat	
Cholesterol 0mg	0%
Sodium 2mg	0%
Total Carbohydrate 2g	1%
Dietary Fiber	0%
Sugars	
Protein 3g	
Vitamin A 1%	Vitamin C 13%
Calcium 4%	Iron 4%

\*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

NutritionData.com

**Figure 2. Nutrition facts 1 serving size (44g) of raw, immature winged bean seeds.**

Source: USDA.

**Growing winged bean**

Winged beans can be transplanted as a seedling or direct-seeded into the ground. By soaking seeds in water for 1-2 days, germination usually occurs within

1-2 weeks in the nursery or ground. Commercially, winged beans are commonly spaced 1-3 feet between plants and 4-6 feet between rows. These climbing plants are supported by many types of trellis designs.

For plant growth and production, winged beans grow best in the tropics at day temperatures of 77-89°F (25-32°C) and night temperatures above 64°F (18°C). It is known to be cultivated in altitudes of approximately 6,000 ft., but does not tolerate frost (Grubber and Denton, 2015). Winged beans are perennial plants (can grow for more than one season), but because most cultivated varieties are ‘short day’ plants, they are commonly grown as annuals (one season).

A general fertilizer recommendation for one growing season for winged bean is 1,500 lbs of 10:10:10 (N-P2O5-K2O) per acre, or approximately 2.75 lbs. of the same nutrient ratio for every 100 sq. ft. (Guam Cooperative Extension & Outreach, 2017).

Winged beans grow best in fertile, well-drained soils and trellised/staked for supporting the climbing plant (Goebel, 2006). Examples of adequate soils for growing winged beans on Guam include Akina silty clay, Guam-Saipan complex, Guam-Yigo complex, Pulantat clay, and Togcha soils. The plants are not particularly sensitive to soil pH, but best results are obtained when soil is in the 6.0-6.8 range (Ebesu, 2002).

Watering regularly will keep your plants producing fruits, but winged bean plants prefer moist, but not wet soils. Irrigation of winged bean should consist of light, frequent watering. During dry periods, ensure soils are kept moist and not saturated. During extended rainfall events, watering may not be necessary until soils are nearly dried up. Mulching around winged bean plants will conserve moisture.

**Common pests and diseases**

Like many beans, the winged bean is a host for a wide range of pests and diseases. Many of these pests and diseases are found on Guam.

Some common insects of winged bean on Guam include the bean pod borer (*Maruca spp.*), aphids (Family: *Aphididae*), the bean fly (*Ophiomyia phaseoli*), the broad mite (*Polyphagotarsonemus latus*), and lady beetles (*Henosepilachna spp.*). Registered insecticides can help control insect infestations. Insect pests can also be controlled by cultural practices such as monitoring, crop rotation, weeding, and general field sanitations (Appropedia, 2011).

Some common diseases winged bean that occur in nearby regions that may be found on Guam include Root-knot Nematode (*Meloidogyne incognita*, *Meloidogyne javanica*) (nematode), Powdery Mildew (asexual stage *Oidium spp.*) (fungus), Orange Gall (*Synchytrium psophocarpi*) (fungus), Pseudocercospora Leaf Spot (*Pseudocercospora psophocarpi*) (fungus), Psophocarpus Necrotic Mosaic Virus (virus), and Psophocarpus Ringspot Mosaic (virus) (Appropedia, 2011). Some fungal and bacterial diseases can be controlled with registered fungicides and bactericides. Viral diseases may not be controlled, but controlling the insect vector will reduce spread of the virus. Some prevention measures to reduce chances of diseases and avoid pesticide use include growing winged bean in full sunlight, avoid long periods of soil saturation, keep farm tools clean, and choosing disease resistant varieties, if possible.

### Plant care

It is always good practice to consistently monitor plants for pests and diseases. If a pest or disease is unknown, collect samples if possible and submit to CNAS Extension & Outreach program for correct identification and treatment recommendations.

Weeding and mulching around plants will reduce weed competition and conserve soil moisture. It is also advisable to keep good records of all field activities. Good record-keeping will identify good practices and mistakes, along with identifying desired varieties of plants. This will improve decision-making for future crops.

### Harvest

Most winged bean varieties mature approximately 60-90 days after planting. Fruits (pods) are often

harvested when immature and tender within approximately two weeks after flowers begin to fruit. On Guam, ‘Short day’ varieties will only produce fruits approximately between the months of November through May (Bamba et al, 2010). ‘Day neutral’ varieties may be able to produce all year round.

### Post-Harvest Handling

Immediately after harvest, fresh immature winged bean pods should be cooled and stored at 50°F (10°C) at 90 percent relative humidity to slow down water loss and decay (Kitinoja and Kader, 2002).

### 2017 winged bean trial on Guam

There are numerous winged bean varieties available on the internet from seed companies like Baker Creek Heirloom Seed Co. (<http://www.rareseeds.com/>), Kitazawa Seed Co. (<http://www.kitazawaseed.com/>), Asian Vegetable Seeds Evergreen Seeds (<http://www.evergreenseeds.com/index.html>), and Asia Seeds (<http://www.asiaseeds.com/>). Seeds of local varieties can be obtained from local producers. In cooperation with Cooperative Extension & Outreach (CE&O) and the Western Pacific Tropical Research Center (WPTRC) divisions of College of Natural and Applied Sciences (CNAS), University of Guam (UOG), a variety trial was conducted at the Valley of the Latte Farm in Talofofo, Guam (Fig. 3). On March 20, 2017, three varieties of winged bean were transplanted in Inarajan Clay soil, a commonly cultivated soil in southern Guam, after growing in plant trays for 19 days.



**Figure 3. Winged bean variety trial conducted at Valley of the Latte Farms, Talofofo, Guam.**

The three varieties grown for the variety trial included Local Green (‘short day’ variety), Iriarte (‘day neutral’ variety), and Shikaku Mame (‘day neutral’ variety). Growth characteristics were observed and marketable yield data was collected. Harvest data was recorded from May 1 through July 11, 2017 and again from November 20 through December 29, 2017. The first harvest of Shikaku Mame occurred May 1, 2017, while the first harvest from Iriarte occurred on May 29, 2017. The Local Green variety never produced flowers during this period of evaluation and thus proved that it is a ‘short day’ variety. For harvest period May 1 through July 11, 2017, Shikaku Mame and Iriarte started producing harvest-able pods approximately 42 and 69 days after transplant, respectively. Immature green bean pods (fruits) were harvested and measured, and classified as marketable or non-marketable. These two varieties continued to produce fruit until the experiment was terminated, proving that Shikaku Mame and Iriarte are ‘day neutral’ varieties fit for Guam. As expected, the Local Green ‘short day’ variety started to produce flowers in early-October and first fruit set in late-October. During this period of observation, Shikaku Mame and Iriarte continued to produce flowers and fruit. Local Green started to produce harvest-able fruit on October 28, 2017, approximately 213 days after transplanting. For the second harvest period (November 20-December 29, 2017), immature fruits were harvested and measured, and classified as marketable or non-marketable. Average sizes and weights of marketable fruits from the trial are shown in Table 2 with corresponding photos of samples of each variety (Figs 4, 5, and 6). Additional measurements of average number of fruits per plant per harvest, average weights of total harvest per plant per harvest, and average percent of marketable fruits for both harvest periods are displayed in Figs 7, 8, and 9 respectively.

**Table 2. Average sizes and weights of individual marketable fruits (harvested May 1 – August 1, 2017 and November 20 – December 29, 2017). Note that Local Green did not produce fruits from the May – August, 2017 harvest period.**

Cultivar/Variety	Average Length (in)	Average Width (in)	Average Weight (oz)
Shikaku Mame	6.19	0.81	0.49
Iriarte	6.35	0.70	0.45
Local Green	5.25	1.10	0.43



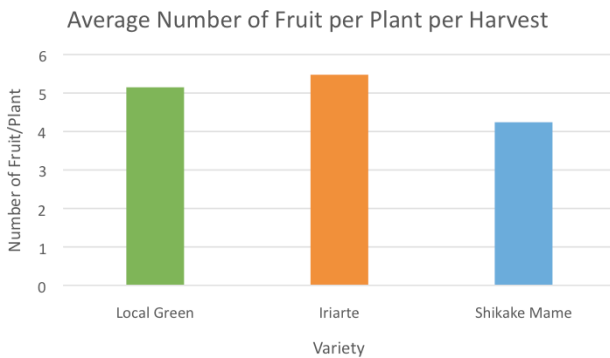
**Figure 4. Winged bean ‘day neutral’ variety ‘Shikaku Mame’ grown in Inarajan Clay in Talofofo, Guam.**



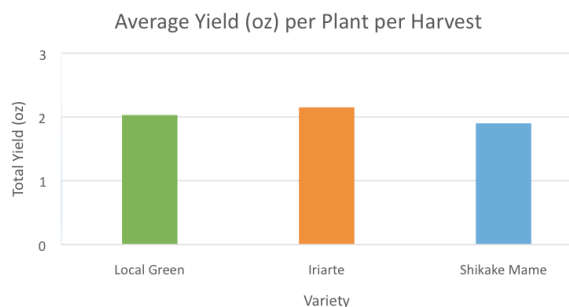
**Figure 5. Winged bean ‘day neutral’ variety ‘Iriarte’ grown in Inarajan Clay in Talofofo, Guam.**



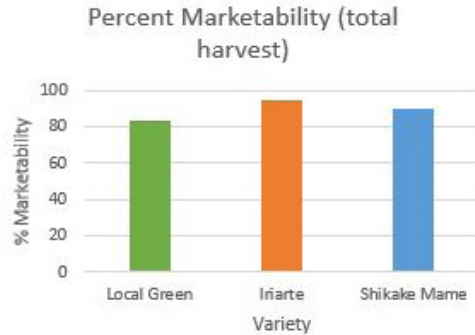
**Figure 6.** Winged bean ‘short day variety ‘Local Green’ grown in Inarajan Clay in Talofofo, Guam.



**Figure 7.** Average number of winged bean fruits harvested per plant per harvest of winged bean varieties, Local Green, Shikaku Mame, and Iriarte. Harvests occurred from May 1 through July 11, 2017 and again from November 20 through December 29, 2017. Note that fruits Local Green, a short day variety, were only harvested from November 20 through December 29, 2017.



**Figure 8.** Average yield (grams) per harvest of winged bean varieties, Local Green, Shikaku Mame and Iriarte. Harvests occurred from May 1 through July 11, 2017 and again from November 20 through December 29, 2017. Note that fruits Local Green, a short day variety, were only harvested from November 20 through December 29, 2017.



**Figure 9.** Percent (%) of marketable fruits of winged bean varieties, Local Green, Shikaku Mame, and Iriarte. Harvests occurred from May 1 through July 11, 2017 and again from November 20 through December 29, 2017. Note that fruits Local Green, a short day variety, were only harvested from November 20 through December 29, 2017.

**Discussion**

It was notable that Shikaku Mame produced harvestable fruit approximately 4 weeks before Iriarte during the May-July harvest period. On Guam, the ‘short day’ Local Green is often harvested 40-75 days after transplanting (Bamba, personal communication). It is advisable to sow Local Green seeds in August-September in order to obtain harvest as soon as Guam short day lengths begin toward October as displayed in Table 1. In comparison, all varieties produced uniformly during harvest periods with very little differences. This experiment proves that winged bean can be grown year-round with ‘day neutral’ varieties, which increases winged bean availability and food security options for Guam.

Winged bean is a nutritious vegetable that is served at gatherings and home prepared meals on Guam. Thus, there is surely a demand for winged bean on Guam. It can be grown in Guam’s climatic conditions, and it is fairly easy to cultivate. It can be grown commercially or as a home garden plant. In recent research, all varieties produced well, but must be watched for infestations.

Historically, winged bean has been commercially cultivated on Guam, but only a very small number of local producers cultivate winged bean commercially. When choosing a variety, it is advisable to choose

those that have resistance to certain diseases, and those that can tolerate high temperatures of 90°F (32°C) and above.

### For support

Contact the College of Natural & Applied Sciences' Extension and Outreach at 735-2080 for help or more information. Additional publications can be found on our website at: [www.cnas-re.uog.edu](http://www.cnas-re.uog.edu) under the Publications tab.

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