

Chinese Kale (*Brassica oleracea*), Cultivar Group *alboglabra* A Potential Commercial Crop for Guam

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Introduction

Chinese kale is a vegetable crop that originated from China. It is also known as Chinese broccoli, Kailan, or Gai-lan (Anonymous, 1993). Chinese kale belongs to the same species as common kale, common broccoli, cauliflower, and head cabbage, *Brassica oleracea*, but is in the cultivar group *alboglabra* (Fig. 1).

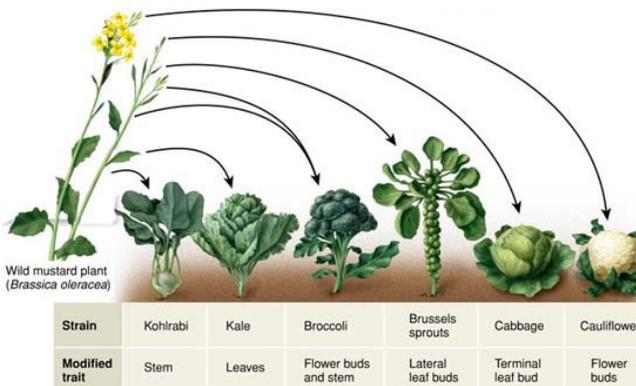


Fig. 1. *Brassica oleracea* from its uncultivated form to several examples of cultivated forms. Source: <https://www.geneticliteracyproject.org/wp-content/uploads/2015/10/V8XnPeQ.jpg>

Chinese kale is a popular vegetable in Asia and now is being sold fresh and cooked in restaurants on Guam. This green vegetable is sold in bunches consisting of bolts/shoots with flower buds and young leaves. Chinese kale sells for about \$2.65/lb at stores (Bamba, personal communication). Young leaves, stems and flower head bolts are widely used in Chinese cuisines, usually as a stir-fry dish. It is also cooked in soups, steamed, or eaten as fresh greens. Chinese kale can be slightly bitter, but generally has a sweeter and nuttier taste than common broccoli.

Chinese kale is rich in Vitamin A, Vitamin C, Vitamin K, Folic Acid, Calcium, and Dietary Fiber (Healthiest-Foods.com, 2015). Fig. 2 shows basic nutrition facts of cooked Chinese kale as provided by the United States Department of Agriculture (USDA).

Nutrition Facts	
Serving Size: 1 cup	
Amount Per Serving	
Calories 19	Calories from Fat 6
% Daily Values*	
Total Fat 0.63g	1%
Saturated Fat 0.097g	0%
Polyunsaturated Fat 0.29g	
Monounsaturated Fat 0.044g	
Cholesterol 0mg	0%
Sodium 6mg	0%
Potassium 230mg	
Total Carbohydrate 3.35g	1%
Dietary Fiber 2.2g	9%
Sugars 0.74g	
Protein 1g	
Vitamin A 29%	Vitamin C 41%
Calcium 9%	Iron 3%

* Percent Daily Values are based on a 2000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Fig. 2. Nutrition facts of cooked Chinese kale. Source: USDA

Growing Chinese Kale

Chinese kale can be transplanted from a seedling or direct-seeded into the ground (Choo and Kee, 1974). Seeds germinate in 5-15 days in the nursery or ground. Commercially, seedlings can be spaced 6 inches apart initially and thinned to 1-2 feet apart in about three weeks. Thinned plants are harvested for fresh young leaves, while remaining plants are mainly harvested for bolt/shoot harvest (Anonymous, 1993).

Plants grow to about 1-2 feet tall. Chinese kale is a perennial plant (can grow for more than one season), but is often grown commercially as an annual crop (one season) (Kopta and Pokluda, 2009).

A general fertilizer recommendation for one growing season for Chinese kale is 500 lbs. of 8:11:10 (N-P2O5-K2O) per acre, or approximately 1 lb. of the same nutrient ratio for every 100 sq. ft. (Department of Agriculture and Fisheries, Queensland Government, 2010).

Irrigation of Chinese kale 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.

Chinese kale grows best in temperatures of 64-82°F (18-28°C) (Department of Agriculture and Fisheries, Queensland Government, 2010), but can tolerate Guam's hotter temperatures, and can be cultivated year round on the island. Preferably, Chinese kale should be grown in fertile soils that consist of good drainage such as Akina silty clay, Guam-Saipan complex, Guam-Yigo complex, Pulantat clay, and Togcha soils. Guam cobbly clay loam is a shallow limestone soil that is not very fertile, but with proper management, Chinese kale can be productive in this soil.

Common Pests and Diseases

Aphids (Family: Aphididae), butterfly caterpillars (Order: Lepidoptera), and whiteflies (Family: Aleyrodidae) are commonly observed insects on almost all Brassica species, but the one of the most damaging insects is the diamondback moth (*Plutella xylostella*) (Ekman et al, 2014). Larvae of the diamondback moth feed on all parts of the plant. Registered insecticides can help control insect infestations. The use of or-

ganic pesticides like Dipel is also an option to control Diamondback moth larvae. Planting trap crops like mustard and collards on the perimeter of fields may reduce diamondback moth larvae infestations on Chinese kale (Bamba, personal communication).

Common diseases that are problematic for Chinese kale and other *Brassica* include fungi, particularly Black leaf rot (*Alternaria spp.*) and Black rot (*Xanthomonas campestris*). Registered fungicides can control the spread of such fungal problems associated with Chinese kale. Some prevention measures to reduce chances of diseases and avoid pesticide use include growing Chinese kale in full sunlight, avoid long periods of soil saturation, keep farm tools clean, and choose 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 your local extension service 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

Young leaves can be harvested approximately 50-70 days after germination. Initial bolts (shoots with young leaves and flower buds) generally are ready to harvest 80-95 days after germination to the heaviest harvest time. Bolts should be harvested when flower buds are unopened or slightly opened (Fig. 3). Bolts average 6-10 inches in height. Some varieties of Chinese kale can be harvested earlier.

Following first harvest of initial bolts, new bolts will arise and harvesting can continue about one week after first harvest. These bolts average 5-10 inches in height, and are usually lighter in weight than initial harvested bolts.

Plants can produce a quality harvest for at least 2 months. Chinese kale is a perennial plant, but commercially grown as an annual crop (one growing season).



Fig. 3. Bolts/Shoots with young leaves and flower buds.

Post-Harvest Handling

Like most cabbage (*Brassica*) family crops, Chinese kale should be cooled immediately after harvest and stored at 33-39°F (1-4°C) at 90-95 percent relative humidity to slow down water loss and decay (ZongQi, 2007). Avoid losing moisture in storage rooms. This will provide a longer shelf life in stores.

2016 Chinese Kale Variety Trial on Guam

There are numerous varieties of Chinese kale available on the internet from seed companies such as Baker Creek Heirloom Seed Co. (<http://www.rareseeds.com/>), Kitazawa Seed Co. (<http://www.kitazawaseed.com/>), and Asian Vegetable Seeds-Evergreen Seeds (<http://www.evergreenseeds.com/index.html>).

A variety trial was conducted at the Western Pacific Tropic Research Center, Yigo Agricultural Experiment Station, College of Natural & Applied Sciences, University of Guam (Fig. 4). On March 24, 2016, four varieties of Chinese kale were transplanted in Guam Cobby Clay Loam soil, a commonly cultivated soil in northern Guam, after growing in plant trays for 18 days. The four varieties were Peth Nam Eak, Yhod Fa, Emperor, and Green Leaf. Growth characteristics were observed and marketable yield data from harvested bolts was collected.



Fig 4. Chinese kale varieties grown in Guam Cobby Clay Loam in Yigo, Guam.

Two insect pests, an unidentified whitefly species (Family: Aleyrodidae) and the diamondback moth (*Plutella xylostella*) were observed and controlled until the last harvest. One fungal disease, either Black leaf rot (*Alternaria spp.*) or Black rot (*Xanthomonas campestris*) was observed and also controlled until last harvest.

All four varieties, except Green Leaf, grew to their potential with similar marketable yields. Green Leaf produced early quality harvest of young leaves and bolts, but were clearly lower in yield weight than the other three varieties. Fig. 5 and Fig. 6 show harvested bolts/shoots from two varieties from the Chinese kale variety trial.

Green Leaf produced early ready-to-harvest bolts starting on April 21, 2016, about 35 days after transplanting. Green Leaf harvests were quite short in size and light in weight compared to the other varieties, averaging 14 cm (5 in) in height and 51 g (0.1 lbs) in



Fig 5. Peth Nam Eak, 1st shoot harvest (left), 2nd shoot harvest (right).



Fig 6. Emperor (1st shoot harvest).

weight. The average size and weight of Green Leaf were clearly lower than the average size and weight Chinese kale bolts generally sold in markets on Guam. Green Leaf may not be suitable for commercial production, but may be suitable for home gardens. Yhod Fa, Emperor, and Peth Nam Eak produced ready-to-harvest bolts on May 16-19, 2016, about 54-57 days after transplanting. Average size and weights of these harvests (approximately 25 cm (9-10 in) in height and 150 g (0.33 lbs) in weight) were consistent with average size and weight Chinese kale bolts generally sold in markets on Guam (Bamba, personal communication). Yhod Fa, Emperor, and Peth Nam Eak are potential varieties that can be locally grown commercially and/or subsistence. Fig. 7 consists of bar graphs depicting results from yield data measured from the variety trial.

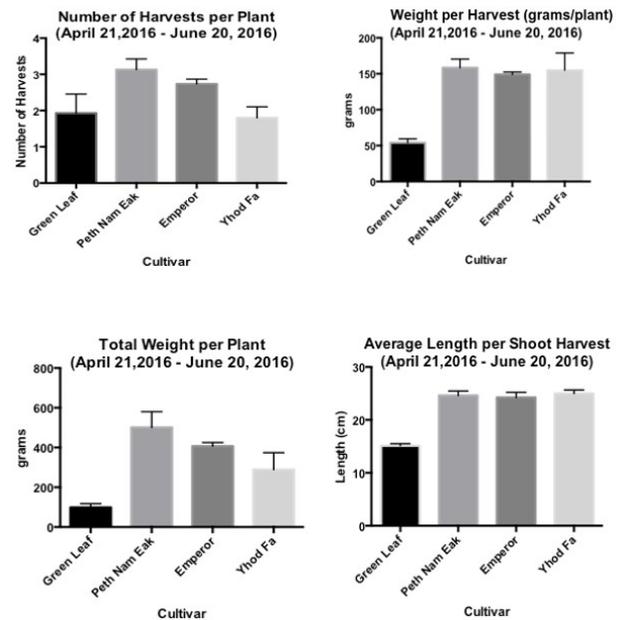


Fig 7. Bar graphs depicting results of harvest data recorded from Chinese kale variety trial. Harvest data was collected from April 21-June 20, 2016.

Discussion

Chinese kale is a nutritious vegetable that is served in several restaurants on Guam. Because it is primarily used in Chinese cuisines, there is a market for this vegetable as there are many Chinese restaurants on island. It can be grown in Guam's climatic conditions, and it is fairly easy to cultivate. It can be grown as a home garden plant and commercially. Chinese kale may be a potential commercial crop for Guam growers.

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