



Artocarpus camansi (breadnut)

Moraceae (mulberry family)

breadnut (English), *castaña* (Spanish), *chataignier* (French), *kapiak* (New Guinea), *dulugian*, *kamansi*, *kolo*, *pakau*, *ugod* (Philippines), *kelur*, *kulor*, *kulur*, *kuror* (Malaya, Java), *mei kakano* (Marquesas), *pana de pepitas* (Puerto Rico)

Diane Ragone

IN BRIEF

Distribution Currently found throughout the tropics, including some Pacific islands.

Size Medium tree 15 m (50 ft) or more in height at maturity.

Habitat Grows best in equatorial lowlands below 600–650 m (1970–2130 ft) and rainfall of 1300–3800 mm (50–150 in) but is widely adaptable.

Vegetation In native range, an important component of the vegetation associated with lowland mixed alluvial forests; in cultivation, associated with a wide variety of domesticated plants.

Soils Deep, fertile, well drained soils are preferred.

Growth rate Moderately fast growing in favorable conditions, growing 0.5–1.5 m (1.5–5 ft) per year.

Main agroforestry uses Overstory, home-gardens.

Main products Staple food, wood for crafts.

Yields Mature trees can yield 600–800 fruits per season.

Intercropping Interplanted with small fruit trees or short-term fruit and vegetable crops.

Invasive potential It has little potential for invasiveness.



PHOTO: D. RAGONE

Young breadnut tree.

INTRODUCTION

Breadnut (*Artocarpus camansi*) is native to New Guinea and possibly the Moluccas (Indonesia) and the Philippines. In New Guinea, it is a dominant member of alluvial forests in lowland areas and is one of the first species to appear on the tops of frequently flooded banks of rivers. The trees grow widely scattered in the forest and are dispersed by birds, flying foxes, and arboreal mammals that feed on the flesh and drop the large seeds. *Artocarpus camansi* has often been considered to be a form of seeded breadfruit, *A. altilis*. Breadfruit, however, is a separate species that originated from its wild seeded ancestor, breadnut. Pacific islanders did not distribute it through the region, probably because the seeds are short-lived and would be difficult to transport long distances. A few trees, all fairly recent introductions, can be found in New Caledonia, Pohnpei, the Marquesas, Tahiti, Palau, and Hawai'i. While breadnut is uncommon in the Pacific islands, it has long been cultivated and used in other tropical regions. Beginning in the late 1700s the British and French spread breadnut throughout the tropics. The oblong, spiny fruits have little pulp and are primarily grown for their large, nutritious seeds, although immature fruits, seeds and all, are thinly sliced and cooked as a vegetable, especially in the Philippines. The seeds are high in

protein and relatively low in fat. They are boiled or roasted and are similar to chestnuts in texture and flavor.

DISTRIBUTION

Native range

This wild seeded ancestor of breadfruit (*Artocarpus altilis*) is native to New Guinea and possibly the Moluccas (Indonesia) and the Philippines. It is distributed throughout its natural range by flying foxes (fruit bats) and arboreal mammals.

Current distribution

Breadnut is widespread throughout the lowlands of New Guinea where it occurs naturally, and it is also found in cultivation in homegardens. It is now found only in cultivation in the Philippines, where it is typically grown as a backyard tree. It is infrequently grown in the Pacific islands outside of its native range. A few trees can be found in New Caledonia, Pohnpei, the Marquesas, Tahiti, Palau, and Hawai'i, mainly introduced by immigrants from the Philippines in recent years. It is currently not found on any of the Pacific atolls. While breadnut is still underutilized



A mature breadnut tree can produce as many as 600–800 fruits per year. PHOTO: D. RAGONE

in Oceania it has long been grown and used in other tropical regions. Beginning in the late 1700s the British and French spread breadnut throughout the tropics, and it is now widespread in the Caribbean—where it is especially popular in Trinidad, Tobago, and Guyana—Central and South America, Southeast Asia, and parts of Africa, especially coastal West Africa.

BOTANICAL DESCRIPTION

Preferred scientific name and author

Artocarpus camansi Blanco

Family

Moraceae (mulberry family)

Non-preferred scientific names

These names for other *Artocarpus* species have been used incorrectly for *A. camansi*:

Artocarpus altilis

A. communis

A. incisa

Common names

breadnut (English)

castaña (Spanish)

chataignier (French)

kapiak (New Guinea)

kamansi, *dulugian*, *pakau*, *kolo*, *ugod* (Philippines)

kulur, *kelur*, *kulor*, *kuror* (Malaya, Java)

mei kakano (Marquesas)

pana de pepitas (Puerto Rico)

Size

Trees grow to heights of 10–15 m (33–50 ft) or taller with a trunk 1 m (3.3 ft) or larger in diameter, often growing to a height of 5 m (16 ft) before branching. A sticky, white, milky latex is present in all parts of the tree. Canopy diameter generally measures about half of the tree height.

Form

It is a single-trunked tree with a spreading evergreen canopy. The tree typically forms buttresses at the base of the trunk. It has a more open branching structure than breadfruit (*A. altilis*) or dugdug (*A. mariannensis*).

Flowering

Flowering is monoecious with male and female flowers on the same tree at the ends of branches, with the male inflorescence appearing first. Male flowers are club-shaped, up to 3 cm (1.2 in) in diameter and 25–35 cm (10–14 in) long



Buttress roots and trunk of breadnut. PHOTO: D. RAGONE

or longer. Thousands of tiny flowers with two anthers are attached to a central spongy core. Female inflorescences consist of 1500–2000 reduced flowers attached to a spongy core. Unlike breadfruit, the individual flowers do not fuse together along their length.

Leaves

Leaves are alternate, large, 40–60 cm (16–24 in) long, moderately dissected with 4–6 pairs of lobes and sinuses cut half way to the midrib. New leaves on young trees can be 76 or more cm (30 in) long. They are densely pubescent, with many white or reddish-white hairs on upper and lower veins, lower leaf surface, and petiole. Blade is dull green with green veins. Two large green stipules enclose the bud, turning yellow before dehiscing.

Fruit

The fruit is a large fleshy syncarp, oval or ovoid, 13–20 cm (5–8 in) long and 7–12 cm (2.6–4.8 in) in diameter, weighing approximately 800 g (1.8 lb). The skin is dull green to green-yellow when ripe with a spiny texture from the

pointed, flexible, 5–12 mm (0.2–0.5 in) long tips of individual flowers. The scanty pulp is yellow-whitish when ripe with a sweet aroma and taste. The fruit is not as solid or dense as breadfruit because the individual flowers forming the fruit are fused together only at their bases.

Seeds

This species is grown for its seeds, and there is much variation in seed number, size, and nutritional composition. The fruit contains numerous seeds, from 12 to as many as 150, each weighing an average of 7–10 g (0.25–0.36 oz), comprising 30–50% or more of the total fruit weight. The seeds are rounded or flattened by compression and about 2.5 cm (1 in) long. They have a thin, light-brown outer seed coat that is patterned with darker veins. In contrast, the seeds of breadfruit and dugdug usually have a dark-brown, shiny seed coat. The seeds have little to no endosperm, no period of dormancy, germinate immediately, and are unable to withstand desiccation. Typically spread by flying foxes and arboreal mammals. Seeds are harvested from soft, ripe fruits.

Rooting habit

The roots are spreading and grow on or slightly below the surface. Extensive buttresses develop when mature.

How to distinguish from similar species/look-a-likes

Breadnut can be readily distinguished from its close relative, breadfruit (*A. altilis*), by its very spiny fruits with little pulp and numerous large, light-brown seeds. Dugdug (*A. mariannensis*) has small, dark-green, cylindrical or kidney-shaped fruits with dark yellow flesh, dark brown seeds, and small, entire to shallowly 1–3-lobed leaves.

GENETICS

Variability of species

Breadnut is genetically variable, diploid, and produces abundant fertile pollen. Most of the trees in cultivation throughout the tropics originated from a few early introductions, and little work has been done to evaluate and select superior seedlings.



Top: Variation in seeded and seedless varieties of breadfruit (*A. altilis*) and seeds of breadnut (upper right corner). Bottom: Breadnut fruits are readily identified by their spiny skin. PHOTOS: D. RAGONE

Known varieties

There are no varieties of breadnut.

ASSOCIATED PLANT SPECIES

General flora of native habitat

Breadnut is an important component of the vegetation as-

sociated with lowland mixed alluvial forests of New Guinea (Papua New Guinea and Irian Jaya) below 1000 m (3300 ft) elevation. This tall forest (canopy of 30 m (100 ft) or greater) is floristically and structurally very rich. The forest is rather open and the upper story is characterized by *Pometia pinnata*, *Ficus* spp., *Alstonia scholaris*, and *Terminalia* spp. Typical lower-story trees are *Garcinia*, *Diospyros*, *Myristica*, *Maniltoa*, and *Microcos*. Palm species, such as rattans and *Licuala* spp., gingers, and members of the Marantaceae family abound in the understory and shrub layer. Drainage affects forest height and composition. In regularly inundated areas, *Planchonia papuana*, *Bischofia javanica*, *Terminalia complanata*, *Cananga odorata*, *Teysmanniodendron bogoriense*, *Intsia bijuga*, *Nauclea coadunata*, *Alstonia scholaris*, *Vitex cofassus*, and *Anthocephalus chinensis* are locally abundant in the riverside forest, and the shrub and herb layer are typically sparse. The wild breadnut tree is one of the first trees to appear on the tops of frequently flooded, low levee banks. In areas where the banks are higher and less frequently flooded, it is joined by *Octomeles sumatrana*, and a young forest dominated by one or both species develops. *Ficus*, *Dendrocnide*, *Nauclea*, *Kleinhovia hospita*, and *Terminalia* eventually invade the young forest. On the inner curves of larger river banks of oxbows, sinuous low ridges separated by swampy swales are built up. Trees of *Timonius* spp., *Althoffia* spp., *Artocarpus camansi*, and *Octomeles sumatrana* form narrow, even-aged, and increasingly higher stands on successively older ridges. During the clearing of the lowland forest for plantations and tree gardens, wild breadnut trees and other species such as *Canarium indicum*, *Terminalia kaernbackii*, *Dracontomelon puberulum*, *Pangium edule*, *Gnetum gnemon*, *Areca betel*, and *Ceiba bombax* are left standing or planted.

Associated introduced species in Pacific islands

Breadnut is a modern introduction in only a few Pacific islands, where it is usually grown as a backyard tree around homes. It is associated with banana (*Musa* spp.), coconut (*Cocos nucifera*), Indian mulberry (*Morinda citrifolia*, noni), sugarcane, ornamental plants, and other common homegarden species.

ENVIRONMENTAL PREFERENCES AND TOLERANCES

Climate

Breadnut, like breadfruit, has a wide range of adaptability to ecological conditions. It requires a tropical climate and will not grow where the temperatures go below 5°C (41°F). It grows best in equatorial lowlands below 600–650

m (1970–2130 ft) but is found at elevations up to 1550 m (4950 ft). The latitudinal limits are approximately 17° N and S; maritime climates extend that range to the Tropics of Cancer and Capricorn. It should do well wherever breadfruit is grown.

Elevation range

0–1550 m (0–4950 ft)

Mean annual rainfall

1300–3800 mm (50–150 in)

Rainfall pattern

Prefers climates with summer rains.

Dry season duration (consecutive months with <40 mm [1.6 in] rainfall)

0–3 months

Mean annual temperature

15–40°C (50–104°F), does best at 21–32°C (70–90°F)

Mean maximum temperature of hottest month

32–38°C (90–100°F)

Mean minimum temperature of coldest month

16–18°C (61–64°F)

Minimum temperature tolerated

5–10°C (41–50°F)

Soils

Deep, fertile, well drained soils are preferred.

Soil texture

The tree prefers light, well drained soils (sands, sandy loams, loams, and sandy clay loams).

Soil drainage

It requires freely draining soils.

Soil acidity

Neutral to alkaline soils (pH 6.1–7.4+)

Tolerances

Drought

Can withstand drought for a few months but will prematurely drop fruits.

Full sun

Does best in full sun.

Shade

Seedlings do best in 20–50% shade but prefer full sun conditions once established.

Frost

It is damaged by frost, which causes it to lose all fruits and leaves, and branch dieback will occur.

Waterlogging

It can tolerate waterlogged soils and periodic flooding for brief periods, and is the first species to colonize riverbanks in its native habitat.

Wind

It can withstand strong winds and will resprout after sustaining wind damage.

Abilities

It produces new shoots and branches after wind damage.

GROWTH AND DEVELOPMENT

Growth rate

This species is fast growing in favorable conditions, growing 0.5–1.5 m (1.5–5 ft) in height per year for the first 10–12 years. The canopy diameter keeps pace at approximately one-half the height of the tree. Branches are widely spaced. Small branches often die back at the tip after fruiting, but new shoots and branches continue to develop throughout the life of the tree.

Flowering and fruiting

Fruiting season is October to May, with some fruits available into July in Hawai'i. It begins in April or May in the Philippines. Trees begin producing at 8–10 years of age.

Yields

Mature breadnut trees in the Philippines have been reported to produce 600–800 fruits per season. The average number of seeds per fruit is variable, ranging from 32 to 94 per fruit, each seed weighing an average of 7.7–10 g (0.25–0.33 oz). Based on 100 trees/ha (40 trees/ac) producing 200 fruits per tree, an average yield of 11 mt/ha (4.9 t/ac) of fresh seeds has been estimated.

Reaction to competition

As evidenced by its widespread distribution in the native lowland forest, this species is able to withstand competition from other forest trees.

PROPAGATION

Breadnut is easily propagated by seeds. The trees do not produce root shoots and cannot be grown from root cuttings as can breadfruit. It has been successfully grafted in the Philippines using inarching (where one branch is grafted to another plant without first separating it from its parent) and budding. Seeds are typically gathered from soft, ripe fruits.

Propagation by seeds

Seeds quickly germinate and will often sprout inside the fallen fruits. Collect seeds from soft, ripe fruits and wash to remove all pulp. Select firm, shiny, uniform seeds that do not yield to the touch when squeezed. Discard any sprouted or aborted seeds. The latter are typically misshapen, flat, and contain little or no endosperm. Surface-clean in a 2% bleach solution for 5–10 minutes or treat with a fungicide according to the manufacturer's recommendation. Plant immediately, as seeds are recalcitrant and cannot be dried or chilled. Germination rates are high, close to 100%.

Place seeds in seedling flats in a loose, well drained medium. Plant at a depth twice the width of the seed. Keep moist, but not wet. Seeds germinate within 10–14 days. Transplant into 1–2 gallon (4–8 liter) pots once the true leaves have hardened. If adding fertilizer (such as balanced 8-8-8 slow-release), use only sparingly, less than half the manufacturer's recommendations. Keep plants in partial shade and weed-free. Seedlings grow quickly, reaching 1 m (3.3 ft) in approximately 6 months and are ready to plant into the field in less than a year.

Establishment in the Nursery

Young plants prefer partial shade. If they are to be planted in full sun, gradually move them to full-sun conditions in the nursery for 1–2 months to harden them to the site conditions. Young plants should never be allowed to dry out or be exposed to strong wind.

Outplanting

Outplant when the plants have reached the desired size of about 1.25 m (4 ft) tall and 2 cm (0.8 in) in diameter. Because of their large surface area, it is best to reduce the size of the leaves to reduce transpiration. Carefully remove 1/2 to 2/3 of the lower leaves by trimming the blade and leaving only a small section attached to the petiole. Do not remove or damage the growing point of the plant where new leaves develop. Protect from wind and excessive heat during transport. Dig a hole the same depth as the container and twice as wide. Add a small amount of slow-release fertilizer, such as 8-8-8, to the bottom of the hole and cover with soil. To prevent injury to the brittle root system,



Breadnut seeds readily germinate and should be gathered from soft, ripe fruits before they fall to the ground. PHOTO: D. RAGONE

carefully cut off the container rather than pulling the plant out. Place the tree in the hole, add soil no higher than the level of the plant in the pot, topdress with compost, and water well.

The young plants prefer partial shade. It is best to plant at the onset of the rainy season, but if the weather is dry, irrigate for the first 1–3 months of establishment. Once established, breadnut trees can withstand a dry season of 3–4 months, although they prefer moist conditions. Mulching young plants is beneficial by helping keep the soil moist and adding a steady supply of nutrients. It also helps control weeds around the root system. Use of herbicide to control weeds around the base of the tree can damage the tree if it comes in contact with the surface roots or young trunk. Young trees need to be protected from cattle, goats, horses, and pigs, which will eat the bark and tender shoots. Close to 100% success rate can be expected if the above precautions are taken.

DISADVANTAGES

Potential for invasiveness

This species has little potential for invasiveness because the large, fleshy seeds quickly lose viability and are not readily spread except by flying foxes.

Susceptibility to pests/pathogens

It has few serious diseases or pests and is relatively trouble-free, with disease and pest problems localized. Breadnut does not appear to be as susceptible as breadfruit to fruit rots caused by *Phytophthora*, *Colletotrichum* (anthracnose), and *Rhizopus*.

Host to crop pests/pathogens

Fruit flies are attracted to ripe fruits on the trees and ground and infest many fruit and vegetable crops.

Other disadvantages or design considerations

The spreading surface roots can interfere with other plants and are easily hit by mowers or other equipment.

AGROFORESTRY/ENVIRONMENTAL PRACTICES

Mulch/organic matter

The large leaves of this evergreen species provide abundant mulch for the tree and other plants growing beneath the canopy.

Soil stabilization

Breadnut naturally occurs on frequently flooded river banks.

Crop shade/overstory

Can be interplanted with a wide range of crops and plants, such as yam, banana, medicinal plants, aroids, ginger, Indian mulberry, small fruit trees, and field and vegetable crops such as corn, beans, peanut, tomato, and eggplant.

Homegardens

Breadnut is ideal for homegardens, producing nutritious, high-protein seeds and providing beneficial shade.

Animal fodder

All parts—flesh, peel, core, and seeds—of both mature and ripe fruits are edible and are fed to pigs and other livestock.

Native animal/bird food

Breadnut is an important food source for flying foxes and

arboreal mammals in its native range.

Host plant trellising

Could be used as a trellis tree for yam (*Dioscorea* species).

Bee forage

Honeybees visit male inflorescences and collect pollen and also collect latex that oozes from the fruit surface.

USES AND PRODUCTS

Staple food

The nutritious fruits are usually consumed when immature, thinly sliced and boiled as a vegetable in soups or stews.

Nut/seed

Breadnut is primarily grown for its nutritious seeds; it is a good source of protein and low in fat compared to nuts such as almond, brazil nut, and macadamia nut. The fat extracted from the seed is a light yellow, viscous liquid at room temperature with a characteristic odor similar to that of peanuts. It has a chemical number and physical properties similar to those of olive oil. Its seeds are a good source of minerals and contain more niacin than most other nuts. In 100 g edible portion, four amino acids, methionine (3.2 g), leucine (2.6 g), isoleucine (2.4 g), and serine (2.1 g) comprised 50% of 14 amino acids analyzed.

Nutritional composition of breadnut seeds per 100 grams edible portion (dry weight basis)

| | |
|------------------|-----------|
| Water (%) | 56.0–66.2 |
| Protein (g) | 13.3–19.9 |
| Carbohydrate (g) | 76.2 |
| Fat (g) | 6.2–29.0 |
| Calcium (mg) | 66–70 |
| Potassium (mg) | 380–1620 |
| Phosphorus (mg) | 320–360 |
| Iron (mg) | 8.7 |
| Magnesium (mg) | 10.0 |
| Niacin (mg) | 8.3 |
| Sodium (mg) | 1.6 |

From Ragone (2003) based on McIntoch & Manchew (1993), Negron de Bravo et al. (1983), and Quijano & Arango (1981).



Seeds comprise 30–50 percent or more of the weight of breadnut fruit. PHOTO: J. WISEMAN

Medicinal

No specific medicinal uses are reported, but the breadnut tree probably has medicinal properties similar to breadfruit.

Timber

The wood is lightweight, flexible, and easy to work.

Fuelwood

The wood is fast burning, but generally only older, less productive trees are used for fuel.

Craft wood/tools

The wood is easy to work and carve into statues, bowls, fishing floats, and other objects.

Toxin/insecticide/fish poison

Dried male flowers can be burned to repel mosquitoes and other flying insects.

Other uses

The breadnut tree is not as extensively used as breadfruit, but its timber, latex, and inner bark can be utilized in the same fashion.

COMMERCIAL PRODUCTS

Breadnut is a natural component of the forests of New Guinea and is an important part of the subsistence econ-

omy in lowland areas. The seeds are a valued food and are widely collected. Gathered seeds are sold in village markets, providing an important source of income for women in some areas. In the Caribbean and parts of Central and South America, the seeds are locally consumed and available in markets and restaurants. Since breadnut seeds are so similar in taste and texture to chestnuts, they could have commercial possibilities roasted, canned in brine, or processed into nut butter or nut paste, flour, or oil.

INTERPLANTING/FARM APPLICATIONS

Breadnut trees provide shade, mulch, and a beneficial microclimate. It is generally planted as part of a homestead or mixed agroforestry system with a wide array of useful plants. Widely spaced trees in an orchard can be interplanted with small fruit trees such as citrus and a leguminous cover crop. Short-term fruit crops such as pineapple, banana, and papaya, or field and vegetable crops including taro, tomato, and eggplant can also be grown between breadfruit trees. A leguminous cover crop should replace these intercrops when they begin to interfere with orchard operations. Interplanting systems include:

Example system 1

In the Philippines the center of the square formed by four breadnut trees is planted with small fruit trees such as guayabano or soursop (*Annona muricata*), citrus, chico or sapodilla (*Manilkara zapota*), and atis or sugar apple (*Annona squamosa*).

Example system 2

Gnetum gnemon is grown for its edible leaf in *Artocarpus camansi* and *Pandanus* orchards in the Jimi Valley, Papua New Guinea.

PUBLIC ASSISTANCE AND AGROFORESTRY EXTENSION

Extension offices for agroforestry and forestry in the Pacific: <http://www.traditionaltree.org/extension.html>

GERMPLASM RESOURCES

A germplasm collection at the National Tropical Botanical Garden in Hawai'i has 24 accessions of *A. camansi* from Papua New Guinea, Indonesia, Hawai'i, Pohnpei, Palau, and Tahiti.

INTERNET

The Breadfruit Institute: <<http://www.breadfruit.org>>.

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Species Profiles for Pacific Island Agroforestry (www.traditionaltree.org)

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