

# Potentially Important Food Plants of Timor Leste



**FOOD PLANT  
SOLUTIONS  
ROTARIAN ACTION GROUP**

*Solutions to Malnutrition  
and Food Security*



A Project of the Rotary Club of Devonport North,  
District 9830 & Food Plants International

[www.foodplantsolutions.org](http://www.foodplantsolutions.org)



**World Vision**



**Australian  
Aid** 

World Vision's Better Food, Better Health project in Timor-Leste, supported by the Australian Government – Department of Foreign Affairs and Trade, (DFAT), aims to address high anaemia and under-nutrition rates among children under five and their mothers through food based approaches and improving health seeking behaviour. Food Plant Solutions publications provide educational resources to East Timorese, particularly women, with the aim of creating awareness and enabling a better understanding of the nutritional value of their local food plants.



# Potentially Important Food Plants of Timor Leste

## **Dedication**

This book is dedicated to the 3 billion hard working farmers and families around the world who cultivate these, and other, food plants for their own subsistence, and who help conserve them in their rich diversity for other people to enjoy.

## **Preface**

This guide is based on information from the Food Plants International (FPI) database developed by Tasmanian agricultural scientist Bruce French. The source material and guidance for the preparation of the book has been made possible through the support of Food Plants International, the Rotary Clubs of District 9830, particularly the Rotary Club of Devonport North who founded Food Plant Solutions, (previously the Learn◊Grow project), and many volunteers who have assisted in various ways.

The selection of plants included in this guide has been developed by Rick Campbell and John McPhee working in a voluntary capacity using the selection criteria developed by Food Plant Solutions. These selection criteria focus on the local plants from each of the main food groups with the highest levels of nutrients important to human nutrition and alleviation of malnutrition. Other important nutritious plants may be equally useful, and it is recommended that the FPI database be used to source information on the full range of plants known to occur in Timor Leste. This guide has been developed with the best intention to create interest and improve understanding of the important local food plants of Timor Leste, and on

Food Plant Solutions was initiated by the Rotary Club of Devonport North to assist in creating awareness of the edible plant database developed by Food Plants International, and its potential in addressing malnutrition and food security in any country of the world. In June 2007, Food Plant Solutions was established as a project of Rotary District 9830, the Rotary Club of Devonport North and Food Plants International. The primary objective of the project is to increase awareness and understanding of the vast food resource that exists in the form of local plants, well adapted to the prevailing conditions where they naturally occur, and how this resource may be used to address hunger, malnutrition and food security. For more information, visit the website [www.foodplantsolutions.org](http://www.foodplantsolutions.org). More detailed or specific information on plants, including references to material by other authors, is available on DVD on request.

**Disclaimer:** This Field Guide has been produced using information from the “Edible Plants of the World” database compiled by Bruce French of Food Plants International. Although great care has been taken by Food Plants International and Food Plant Solutions, neither organisation, or the people involved in the compilation of the database or this Field Guide:

- makes any expressed or implied representation as to the accuracy of the information contained in the database or the Field Guide, and cannot be held legally responsible or accept liability for any errors or omissions
- can be held responsible for claims arising from the mistaken identity of plants or their inappropriate use
- assume responsibility for sickness, death or other harmful effects resulting from eating or using any plant described in the database or this Field Guide

Always be sure you have the correct plant, and undertake proper preparation methods, by consulting with specialist scientists or local users of the plant. The Food Plants International database, from which the information in this Field Guide is drawn, is a work in progress and is regularly being amended and updated.

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## ***Introduction***

This book is designed as a simple introduction to the more common food plants of Timor Leste. It is hoped people will take greater pride and interest in these plants and become confident and informed about how to grow and use them. Many of the local food plants that occur in every country are very good quality foods. Unfortunately, people often reject traditional food plants and grow more of the introduced vegetables, such as ballhead cabbage. These do not have the same food value as many traditional, tropical, dark green, leafy vegetables.

### **Growing food**

Growing food to feed a family is, without doubt, one of the most important things anyone can do. The more interest you take in your garden and the more you learn about plants and how to grow them well, the more interesting and fun food gardening becomes.

### **A country with very special plants**

The local food plants of most countries have not been promoted and highlighted in the way they deserve. Visiting a local food market will quickly show what a rich variety of food plants can be grown in this country. Good information about these plants is often still in the minds and experience of local farmers, and has not been written down in books. This can make it hard for the next generation of young people to find out how to grow them.

In many countries, some of the traditional food plants are only harvested from the wild and others are only known in small areas. Others have hundreds of varieties and are the main food for people in different regions. Information on all these plants, their food value and the pest and diseases that damage them is available in the Food Plants International database.

### **Getting to know plants**

People who spend time in gardens and with their food plants get to know them very well. It is a good idea to learn from someone who grows plants well. Each plant grows best in certain conditions and there are often special techniques in getting it to grow well. For example, sweet potato will not form tubers if the soil is too wet, but it may still grow lots of green leaves. Taro will grow in light shade, but sweet potato will not. Ginger can grow in fairly heavy shade. Pruning the tips of betel leaf or pepper vines will cause more side branches to grow and therefore, produce more fruit. Stored yam tubers need special treatment if you want them to put out shoots early. There are lots of unique things about every plant and learning about these helps a good gardener produce more food.

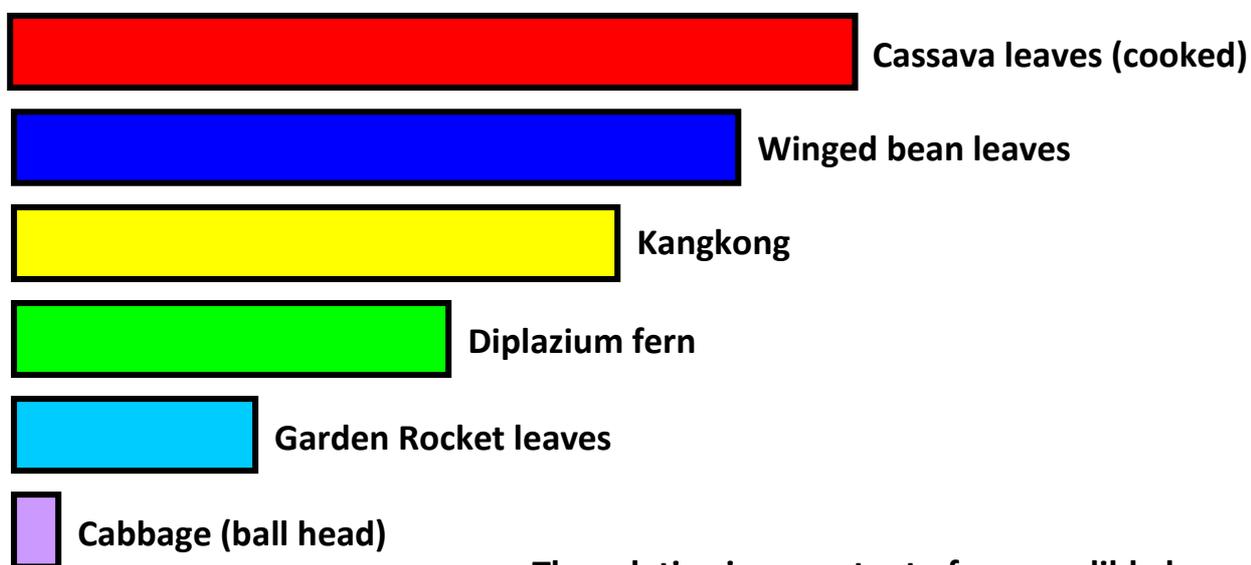
### **Naming of plants**

Many food plants have local names, as well as a common English name. Every type of plant also has its own scientific name. Although the scientific name might not be widely recognised, this is the link by which people in different countries and with different languages can recognise the same plant. We know that many plants are grown in many different countries, but relying on local or common names, we might not recognise the same plant grown in different places. By using scientific names to accurately identify plants, we can get useful information from people in other countries. Wherever possible, plants in this book are named by their common English name and their scientific name.

### Local food plants are often very good

People sometimes think that local food plants are not very special and that any food plant that is new or comes from another country must be a lot better. This is often not true. Many of the newer or introduced food plants, such as the round or ballhead cabbages, have very little food value. Many traditional tropical green, leafy vegetables and ferns have 10 times or more food value as ballhead cabbage or lettuce. It is important to find out more information about the food value of different foods if we want to eat well. Citrus fruit, such as lemons and oranges, are often grown for vitamin C that helps keep people healthy. These fruits do not grow well in the tropics - the common guava fruit has three times as much vitamin C and is loved by children. This is just one example that there are often much better choices of local foods with higher levels of important nutrients.

Our bodies need a variety of food plants to enable us to grow, stay healthy and have enough energy to work. Different foods are needed to provide energy, protein, vitamins and minerals. The following diagram highlights the iron content value of some traditional edible, tropical plant leaves, compared with cabbage. Iron is a nutrient that is very important for our bodies and especially our blood. People who are short of iron become anaemic and lack energy.



The relative iron content of some edible leaves

### A healthy balanced diet

Good nutrition, or eating a healthy balanced diet, is really very simple. If people eat a wide range of food plants, their bodies will normally get a balanced amount of all the different nutrients they require. If a nutrient is lacking in one food plant, then they are likely to get it from another plant if they are eating a range of food plants. For this reason, everybody should eat a range of different food plants every day. The food group that is especially important for young people is the dark green leaves. Everyone should eat a good serving of dark green leaves every day. They have many vitamins and minerals, as well as protein. There are many spices or flavouring plants that can improve the taste of foods, but taste should be considered separately from food value.

### **Learning to cook well**

Even though some nutrients in food can lose some of their value during cooking, it is normally much safer to cook all food plants, at least for a short time. Bacteria, which cause diarrhoea, can occur in gardens and on food plants. These are killed during cooking. Many plants in the tropics develop cyanide, a chemical that makes them bitter and poisonous. This happens often with cassava (tapioca, manioc) and beans, but can also occur in many other plants. Boiling the food for two minutes normally destroys cyanide and makes the food safe to eat. Some of the nutrients our bodies need (such as vitamin A for good eyesight) only become available when food is cooked in oil.

### **Learning to grow “wild” food plants**

Many plants grow wild in the bush and are not cultivated by people. We can normally find someone who has taken an interest in them and has learned to grow them. This may be people from a different language group. It may be that in their area they have found better types than the ones that simply grow wild.

### **Saving better types of plants**

If we simply allow plants to grow from seed, the improvements that have been made in finding sweeter or better types may get lost. Some fruit trees are like this and the fruit produced may not be sweet at all. It is often necessary to take cuttings from a tree to be sure the new plant is exactly the same as the old one. If the plants won't easily grow from cuttings simply by sticking a piece of the branch in the ground, there are other ways of helping these plants to form roots and start to grow. One good way is to make a small cut in the bark of a young branch and then wrap soil around the cut and cover it with plastic. With plants like guava, new roots will start to grow from this cut and grow into the soil wrapped around the branch. It can then be cut off and planted. This is called air-layering. A similar method is used with the roots of breadfruit. A shallow root is uncovered and a small cut made from which a new sucker will start to grow. This can be cut off and replanted.

### **Growing from cuttings and suckers**

Many food plants are grown from cuttings and suckers. This is very important, as it allows all the different kinds of yams, taros, bananas, sweet potato and sugarcane to be continually grown and ensures the varieties are preserved. Each plant has its own special propagation method. It is important to use healthy planting material, as diseases can be spread in planting material.

### **Saving seed**

Some food plants are grown from seed. Sometimes this is very easy as the seeds are large, store well, grow easily and grow the same as the original plant. It is more difficult with other plants. Many large fleshy seeds, such as breadfruit, need to be planted while still fresh as they do not store easily. Other seeds do not “breed true” or do not grow into new plants that are the same as the original plants. For example, the fruit may not be as large or sweet or have the same colour or taste. With many of these plants, it may be necessary to find ways of growing them from cuttings or other methods such as grafting. Some plants “inbreed” and get smaller or poorer. This happens when a plant self-pollinates or receives pollen from a close relative. Corn grown in small plots normally does this and the plants grown from seed grown in this situation get smaller and smaller each year. The seed needs to be saved from several different plants with different history and then mixed together before sowing. All the seeds on one cob are related and will inbreed. Some seeds develop a hard seed coat and need to be scratched, soaked in water, or even put into hot water, before they will start to grow. Saving local seeds is often a good idea as they are already adapted to local conditions. For example, seed saved from pumpkins grown locally will produce plants with less pest

and disease damage than those grown from imported seed. *If you can't get seeds or planting material from local gardens – it is probably not a suitable local plant!*

### **Growing a garden of mixed plants**

In nature, one variety of one plant never grows alone. There are always lots of different plants of different kinds and sizes, all growing together. Anyone who has ever walked into a tropical jungle will know this very well. The reason people all over the world want to save the rainforest is because it has so many different kinds of plants all growing together. Growing plants in a food garden in a way similar to how they grow in nature, as a mixed group of plants, is very good agriculture. Mixing plants in a garden usually gives more reliable food production, as any disease from one plant will wash off in the rain onto a different plant, where it cannot survive. Small plants fill the gaps and reduce the need for weeding.

### **Different types of plants for food security**

There is another reason for growing a range of food plants in a local garden or around a village. If something goes wrong, like extreme insect damage to plants, some disease occurring in the garden, or a poor growing season, some plants will be more damaged than others. With a variety of plants, there will still be some food to eat until the other plants recover and grow again. Also, a wide variety of plants will mean that different ones will be maturing at different times, which helps ensure a continuous supply of food. There are shrubs that can be planted as edible hedges around houses, and fruit and nut trees that need to be planted as a gift for your children, several years before they will be able to enjoy them. Some nuts can be stored and eaten when other foods are not available. Most yams will store well for a few months.

### **Looking after the soil**

Gardeners in traditional tropical agriculture usually move their gardens often by shifting to a new piece of land. There are usually three reasons for this:

- In the tropical lowlands, weeds can become a very big problem. There are usually a lot fewer weeds in the first year or two after clearing and burning the land, but weeds increase in the following years.
- Some of the nutrients in the soil are used each year and the soil becomes poorer and plants do not grow as well. There are ways of reducing this loss of nutrients.
- Very small worms called nematodes build up in the soil after a few years and get into the roots, especially of annual vegetable plants, and stop their roots working properly. For example, root knot nematode will cause the roots of plants like tomatoes and beans to become twisted resulting in poor growth of the plant.

### **Building up the soil**

When a new garden has been cleared, it has lots of leaf mulch and other old plant material. This provides plant nutrients for new plants to grow. There is a simple rule for growing plants and improving the soil - "If it has lived once, it can live again." Any old plant material can provide nutrients for new plants to grow, but it must be allowed to rot into mulch or compost for this to happen. If this plant material is burnt, some nutrients, especially phosphorus and potassium ("potash"), get left behind in the ashes for new plants to use, although it also allows these important nutrients to be lost by being washed away by rain. But with burning other important nutrients, such as nitrogen and sulphur, get lost in the smoke and disappear from the garden and soil. These last two plant nutrients are especially important for growing green leaves and when their levels are low, plants grow small or pale green. When nitrogen is lacking, the old leaves of the plant go pale and fall off early, and when sulphur is lacking, the young leaves go pale. Wherever possible, old plant

material should be covered with some soil to allow it to rot down and not simply dry out or get burnt.

### **Poor soils where crops won't grow**

When soils are very acid (or sour), plants cannot get the necessary nutrients. Natural chemicals in the soil that are toxic to plants when present at higher levels become soluble, get into plants, and stop them growing. Adding limestone to these soils can improve them. Using compost will not make them less acid, but will keep the plant nutrients in the soil in a more readily available form that plants can use.

### **Soil nutrients**

Plants need 16 different kinds of plant food or nutrients in different amounts to grow properly. A plant that has already been growing will have these nutrients in them and probably even have them in a balanced amount. That is why composting old plant material is so important. Plants usually show some signs or symptoms if any of these nutrients is running out.

One of the most common and important nutrients for plant growth is nitrogen, which actually comes from the air, but gets into plants through the soil. When plants are short of nitrogen, their older leaves often become yellow or pale. When grass family plants, like sugarcane and corn, are short of nitrogen, the centre of the oldest (lowest) leaves starts to develop a dry or dead V-shape. The plant cannot find enough nitrogen in the soil so it gets it from an old leaf to grow a new leaf. This causes the old leaf to die, forming a characteristic V-shape in the centre of the leaf. The plant does not get any bigger as an old leaf dies each time a new leaf is produced. Village farmers often walk through grassland before they clear it for gardens, looking to see if the grass leaves are dry and dead, because they know gardens on this soil won't grow well. It is necessary to use compost or legumes (such as beans) to put nitrogen back into the soil. Growing plants from the bean family (legumes) is the most efficient way to increase the level of nitrogen in the soil.

Corn is a good plant for indicating which nutrients are running short in the soil. If the older leaves go dry along the edges, the soil is running out of potash. If leaves that are normally green develop a bluish colour, the soil is short of phosphorus. Generally, leafy crops need lots of nitrogen, and root crops need lots of potash.

### **Making compost**

Compost is old plant material that has been allowed to rot down into a fine, sweet smelling mulch that is full of nutrients that can be put back on the soil to grow new plants. Making good compost is very simple. A simple heap of plant material can be made in the corner of a garden or near a house. The composting process is carried out by small bacteria that live in the soil and feed on decaying plants. They break down old plant material into compost. These bacteria are living, so they need air, water and food. A good compost heap must have air, so don't cover it with plastic or put it in a container. This makes a foul smelling compost, as different bacteria that don't need air turn it into an acid mixture that preserves it. Good compost must have moisture, so keep the heap damp, but not too wet. The compost bacteria like a balanced diet, which means that both green material and dried material is needed to balance the carbon and nitrogen in the compost pile. If the compost material gets too dry and brown, it will not break down, and if it gets too green, it will go slimy. Using a little bit of compost from an old heap will make sure the right bacteria are there to start the whole process off. As soon as the plant material is broken down to a fine mulch it can be put onto the garden. It is best if it is dug in, but if it is regularly put onto the surface of the garden, worms will mix it into the soil.

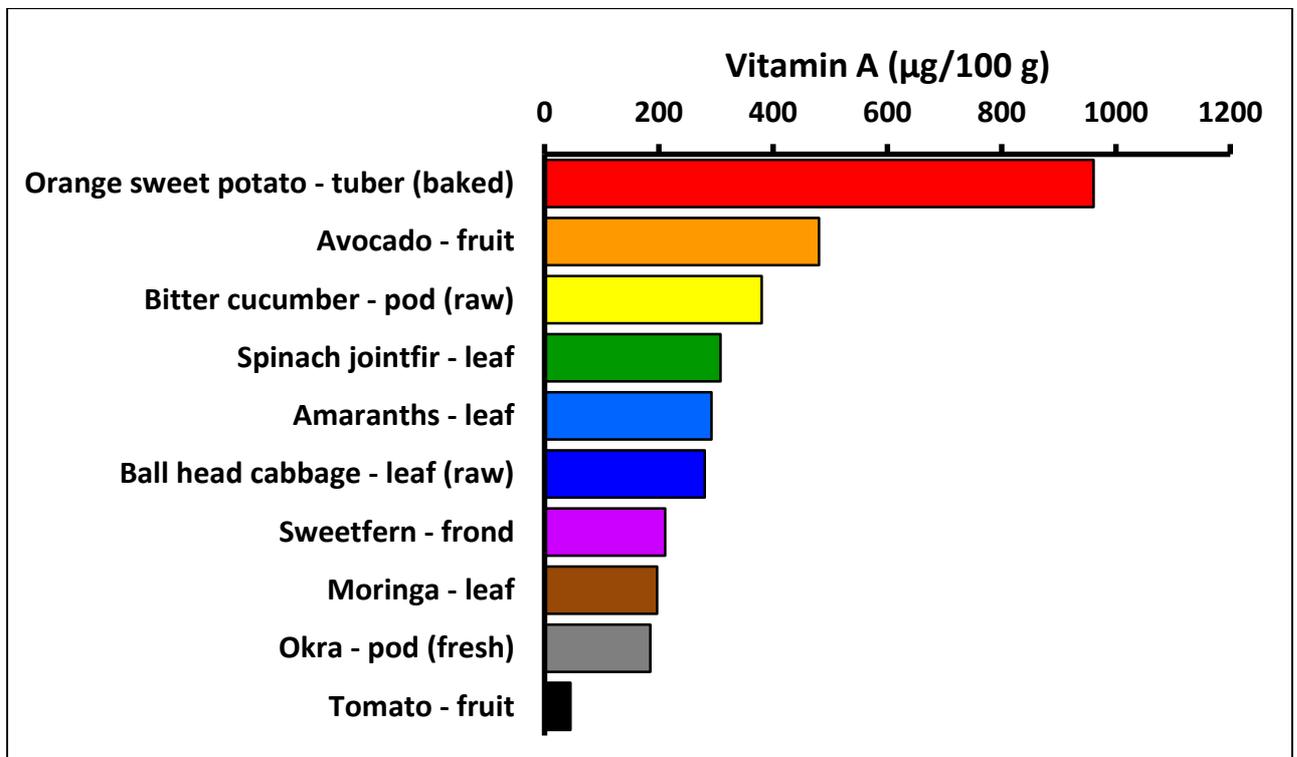
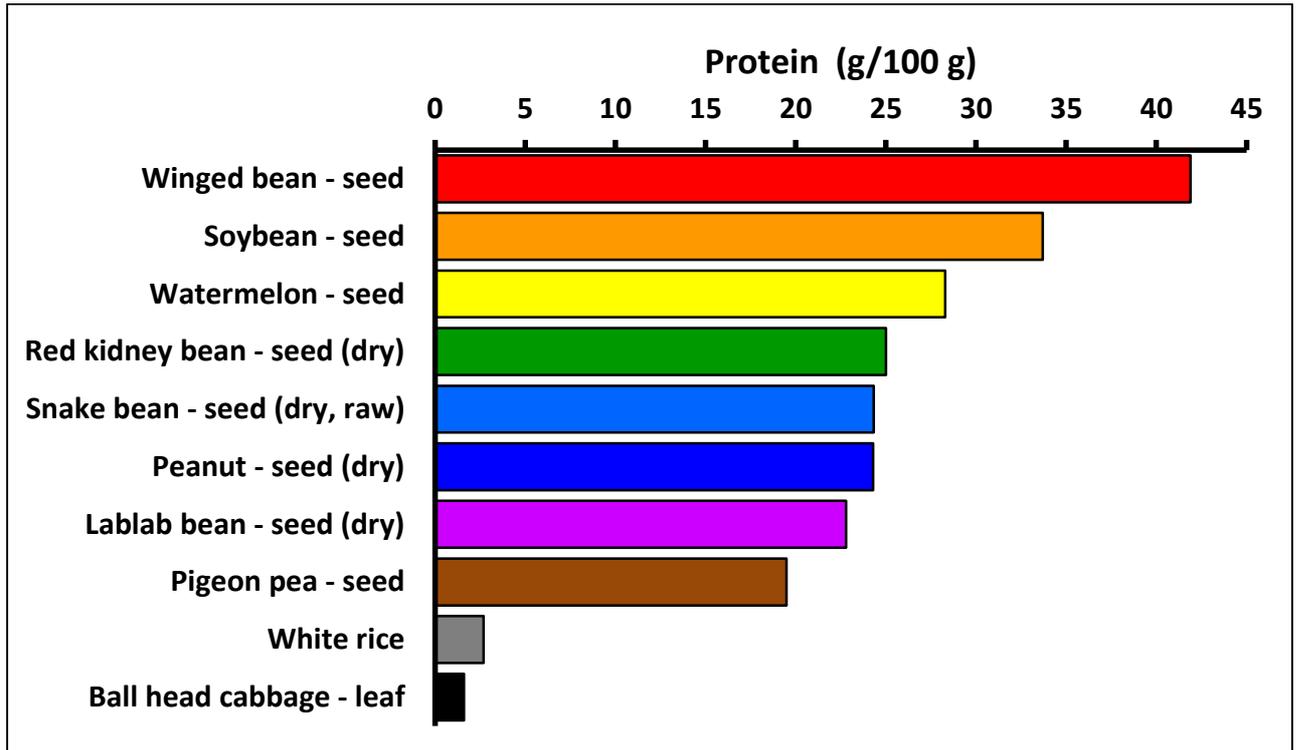
## **Pests**

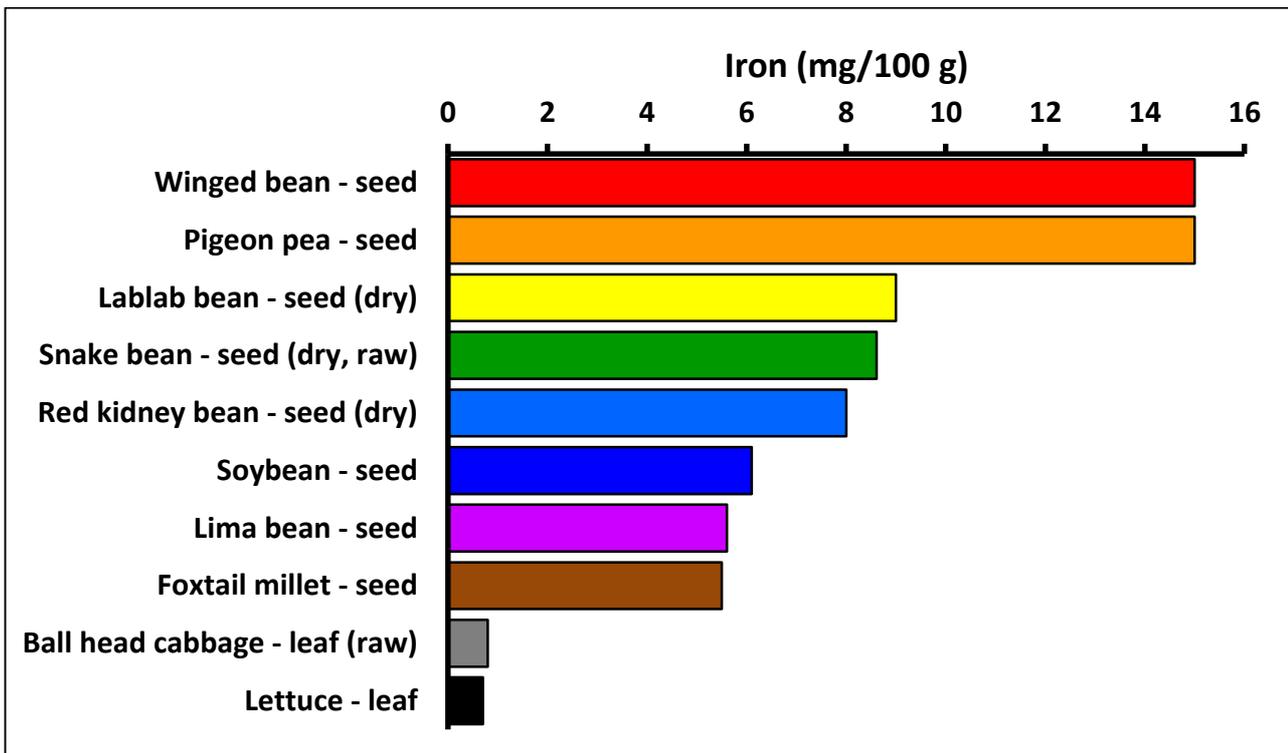
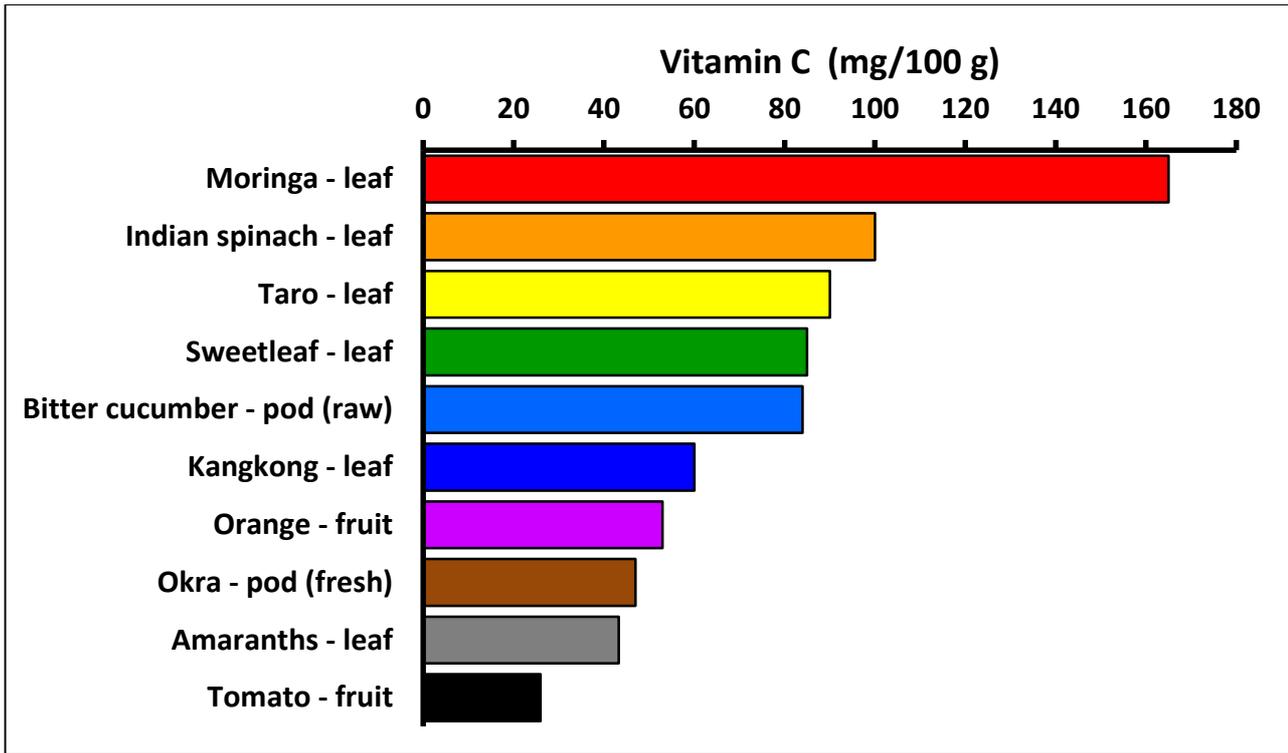
There are a large number of insects that enjoy sharing our food with us! We should not try to kill all these insects as they have an important role to play in keeping everything in nature in balance. What we need to do is to learn to manage these insects so we can all get some food to eat! Some insects are attracted to lights, and if the garden is near village lights some insects can cause a lot of damage. If large areas of one particular crop are planted, insects can breed more quickly and cause a lot of damage. As an example, insects called armyworms can breed up in large numbers on the shade trees of cacao and then move “like an army” into gardens. Some insects are large and breed slowly and can be picked off and removed. The large, green grubs with pointy tips that hide under taro leaves are best controlled by simply picking them off. Some insects, like taro beetles, can be a serious problem, but the young curl grubs of this insect are tasty if you catch and cook them. Some insects do not like sunlight. The very small moth that damages banana fruit is like this. Simply pulling off the leafy bracts over the banana fruit reduces the damage, as this lets sunlight in and the insect flies away. The best rule for reducing pest damage is to grow healthy plants, as they suffer less damage.

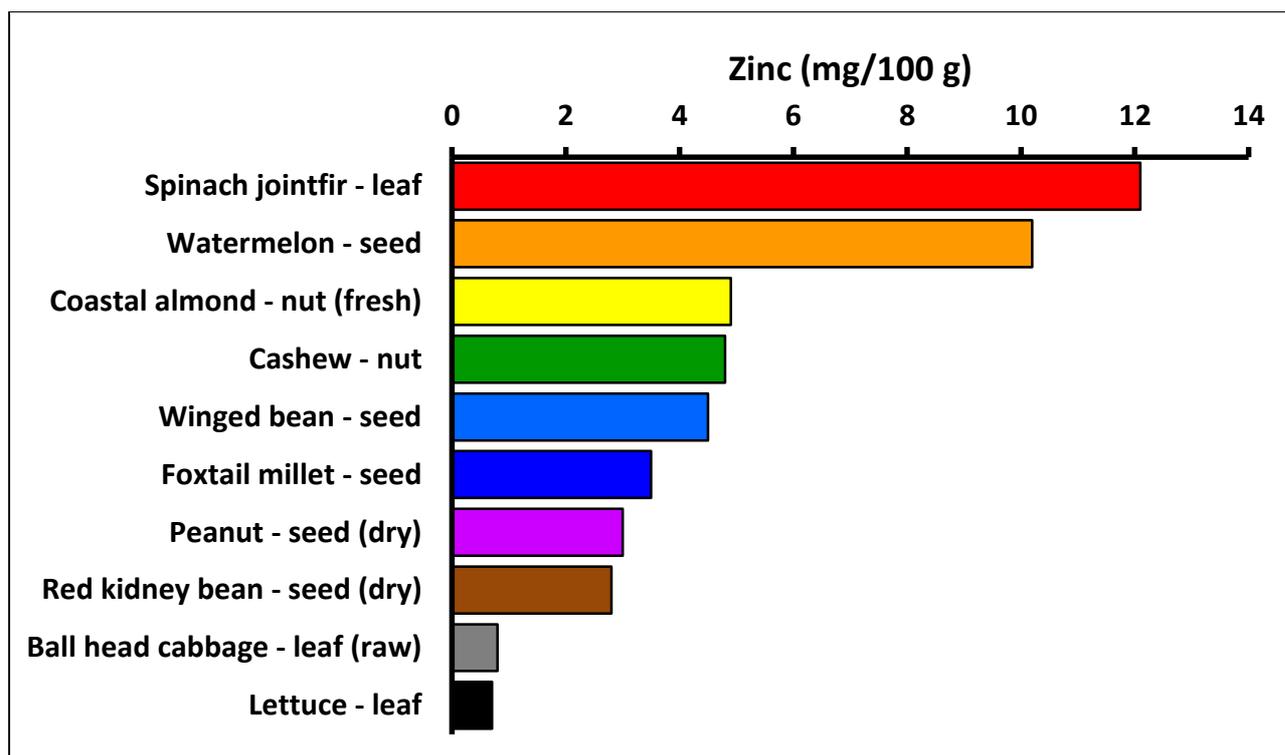
## **Diseases**

The living organisms that cause disease are much smaller than insects. These disease organisms can often only be seen with a microscope. There are three main kinds of disease organisms - fungi, bacteria and viruses. Fungi are like the mushrooms we eat, only very much smaller. They usually make distinct dry spots on leaves and other plant parts. Fungi have spores that often blow in the wind. Bacteria are often smaller and live in damp places. They usually make plants go soft and squashy, and they may cause a smell. Bacteria are mostly spread with rain and in water. Viruses are very, very small and usually make irregular stripes and patterns on leaves and other plant parts. Viruses usually spread in planting material or in the mouths of small sucking insects. One common fungus disease on sweet potato causes the leaves to become wrinkled and twisted. It usually gets worse in old gardens and where soils are running out of nutrients. It doesn't affect all kinds of sweet potato to the same extent. The answer is not to stop the disease, but to improve the soil. The general rule is that healthy plants that are growing well will suffer less damage from disease.

## Food value charts for a selection of plants from Timor Leste







**Note regarding plant selection:** In compiling these field guides, we acknowledge that some staple foods and commercial crops which are grown widely in the target country may be omitted. Such foods are often in the starchy staple category (e.g. rice, corn). This does not mean that they are not useful, but merely reflects a desire for the Food Plant Solutions project to concentrate on plants that are less well known and/or underutilised.

## ***Starchy staples***

**English:** Orange Sweet potato

**Tetun:** Fehuk midar

**Scientific name:** *Ipomoea batatas*

**Plant family:** CONVULVULACEAE

**Description:** This is a root crop which produces long creeping vines. The leaves are carried singly along the vine. Leaves can vary considerably from divided like fingers on a hand, to being entire and rounded or heart shaped. Purple trumpet shaped flowers grow at the end of the vine. Fattened tubers are produced under the ground. There are a large number of varieties which vary in leaf shape and colour, tuber shape, colour, texture and in several other ways.



**Distribution:** A tropical and subtropical plant. They grow from sea level up to about 2,700 m altitude in the tropics. Plants can grow with a wide range of rainfall patterns and in different soils. Plants are killed by frost and can't stand water-logging. Plants grow well with temperatures between 21 - 26°C. It can grow with a pH between 5.2 - 6.8. It suits hardiness zones 9 - 12.

**Use:** Tubers are boiled or baked. They can be steamed, fried, mashed or dried. They can be fermented into alcoholic drinks. They can also be used in pies, cakes, puddings and candies and jams. They can be used in noodles. The chopped and dried tubers can be boiled with rice or ground into flour and mixed with wheat flour to make cakes or bread. The young leaves are edible.

**Cultivation:** Vine cuttings are used for planting. In grassland soils it is grown in mounds, ridges or other raised beds. In bush fallow, it is mostly planted in undug loose soils. It needs a sunny position. Tubers won't form if the ground is waterlogged when tubers start to develop. Sweet potato is grown by cuttings of the vine. About 33,000 cuttings are required per hectare. These weigh about 500 kg. Vine lengths of about 30 cm are optimum. As long as the vine is adequately inserted in the soil, the length of vine inserted does not significantly affect yield. Excess nitrogen restricts storage root initiation and therefore excess leaves are produced without significant tuber yield. Dry matter percentage increases with increasing age of the crop. Higher dry matter tubers are normally preferred.

Sweet potato are not tolerant to shading. Under shaded conditions, both foliage growth and storage root production are decreased. Some cultivars can be selected for increased production under mild shade but not heavy shade. The survival of cuttings at planting is also reduced under shaded conditions. Under shaded conditions, plant become more climbing and with fewer, larger leaves. With increasing shade, fewer tubers are produced and these grow more slowly. Sweet potato tends to be responsive to potassium fertiliser. Cultivars are often selected for yield under low fertility conditions.

Under lowland conditions in the tropics sweet potato tubers undergo active tuber enlargement from 6 - 16 weeks. Weed control is essential especially during early stages of growth. The rate of ground coverage by foliage varies greatly with growing conditions and cultivar, but once ground coverage has occurred, weed control is less of a problem. Sweet potato tuber initiation is subject to aeration in the soil. Either heavy clay soils, waterlogged conditions or other factors reducing aeration can result in poor tuber production. For this reason, sweet potatoes are often grown on mounded beds. In well drained or high organic matter soils, digging or mounding is not as essential.

Leaf scab (*Elsinoe batatas*) can significantly reduce yield especially in sites where leaf production is low due to low soil fertility. To reduce sweet potato weevil damage, plants need to be hilled or have the tubers well covered with soil. Cracking soils can allow the weevil access to tubers.

**Production:** The time to maturity ranges from 5 months to 12 months depending on the variety planted and the altitude at which it is being grown. Yields range from 6 - 23 t/ha.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
tuber (baked)	72.9	431	1.7	961	24.6	2.4	1.3
tuber (raw)	70.0	387	1.2	709	25	0.7	0.4
tuber (boiled)	72.0	363	1.1	787	15	0.6	0.3
leaf	86.3	168	3.9	105	58	2.9	-

Tumwegamire S., Genetic Variation, Diversity and Genotype by Environment Interactions of Nutritional Quality Traits in East African Sweetpotato. 2011 Ph.D. Thesis Makerere Univ. Kampala Uganda p28.

## Starchy staples

**English:** Taro

**Tetun:** Talas

**Scientific name:** *Colocasia esculenta*

**Plant family:** ARACEAE

**Description:** This plant has large flat leaves on the end of upright leaf stalks. It grows up to 1 m high. The leaf stalk or petiole joins the leaf towards the centre of the leaf. The leaves are 20 - 50 cm long. Near the ground a thickened rounded corm is produced. Around this plant there is normally a ring of small plants called suckers. Many different varieties occur. If left to maturity, a lily type flower is produced in the centre of the plant. It has a spathe 15 - 30 cm long which is rolled inwards. The flowers are yellow and fused along the stalk. There are many named cultivated varieties. Taro comes in two basic forms. The Dasheen type *Colocasia esculenta* var. *esculenta* and *Colocasia esculenta* var. *antiquorum* or the Eddoe type. The basic difference is the adaptation of the Eddoe type to storage and survival in seasonally dry places, while the dasheen type needs to be maintained in a more or less continuously growing vegetative stage.



**Distribution:** It is a tropical plant. Taro grows from sea level up to about 2,300 m altitude in the tropics. It grows well in humid places. It can stand damp soil and grow under light shade. It suits hardiness zones 9 - 12.

**Use:** The corms, petioles and leaves are all edible after cooking. The leaves are also dried and stored. Fresh leaves can be stored for 4 - 5 days. **Caution:** Some varieties burn the throat due to oxalate crystals.

**Cultivation:** Taro can be planted from cormels or from the top of the central corm. Other sections of the corm could also be used but this is not commonly done. Flowering of taro and seed production can lead to new cultivars. Flowering can be promoted by the use of gibberellic acid. The general growth pattern is for an increase in top growth, in terms of leaf number, leaf area and petiole length, to continue for about 6 months under tropical lowland conditions then for each of these to decrease and tuber storage to continue to increase. Corm weight increases significantly from 5 - 11 months. Starch content also increases with time but protein content declines over the corm development period.

Taro can be grown under flooded conditions but root rots develop if the water becomes stagnant. For flooded cultivation, the land is cleared, ploughed, cultivated and puddled. The aim is to get a field that is flat with embankments allowing the impounding of water. Planting is done into 2 - 5 cm of standing water.

For dryland taro, the soil is prepared by digging, unless a fresh bush fallow is used where the natural friability of the soil allows plants to be put into the undug soil in a small hole that is prepared. Plants are put into a hole 5 - 7 cm deep or deeper. Mulching to conserve moisture and reduce weed growth is beneficial. Setts from corms normally give higher yield than that from cormels. The greater leaf area and root production may be responsible for this. Setts of about 150 g are optimum.

The time of planting is primarily determined by the availability of moisture. Planting is done shortly after the rainfall has become regular, if seasonally distinct wet and dry occur. Higher rainfall, higher

temperatures, and higher hours of sunlight, enhance production and determine seasonality of production.

Evapotranspiration for flooded taro averages about 4 mm per day, ranging from 1.5 - 7.2 mm, with a total of about 1,200 mm for the crop. Intermittent moisture can result in irregular shaped corms. Flooding has been found to be more effective than sprinkler irrigation, or furrow irrigation. Increased suckering, giving greater leaf area, seems to be the reason for this.

Taro is sensitive to weed competition throughout most of its growth, but it is more critical during early growth up to 3 - 4 months. About 7 - 9 weedings are required, to keep the crop clean under tropical lowland conditions, where flooding is not used. Due to the decrease in height and leaf area towards the end of the growth cycle when starch accumulation in the corms is maximum, weed competition and weed control are again significant. Mechanical weeding needs to be shallow to avoid damaging the superficial taro roots. A range of herbicides have been recommended in various situations.

Taro produces the highest dry matter yield under full sunlight, but it can still grow under moderate shade. Under shaded conditions it grows more slowly and develops fewer cormels. They require good moisture conditions and have little tolerance for drought. Taro residue has an allelopathic factor which can reduce the germination and growth of other plants, for example, beans.

Taro tends to demand high fertility, and is responsive to additional NPK fertiliser. Higher doses of K increases starch content and higher doses of N increases protein content. Both N and K applications increase oxalic acid content of the tubers.

Spacing affects total yield, and marketable, harvestable yield, of corms. Close spacing increases the corm yield per area, and the shoot yield per area, but decreases the corm yield per plant, and the contribution of sucker corms, to the yield. Where spacings of 30 cm x 30 cm are used, giving about 110,000 plants per hectare, a very large amount of planting material is required, which reduces the net return per unit of planting material. A spacing of 60 cm x 60 cm is more common. Wider spacings of 90 cm x 90 cm reduces overall yield.

**Production:** Crops mature in 6 - 18 months. Yields of 5 - 15 tonnes per hectare are probably average.

**Food Value:** Per 100 g edible portion

Edible part	2	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
root	66.8	1231	1.96	3	5	0.68	3.2
leaf	85.0	210	5.0	57	90	0.62	0.7
leaf stalk	93.0	101	0.5	180	13	0.9	-
leaf (cooked)	92.2	100	2.7	424	35.5	1.2	0.2

## Starchy staples

**English:** Cassava  
**Tetun:** Ai-Farina

**Scientific name:** *Manihot esculenta*  
**Plant family:** EUPHORBIACEAE

**Description:** A plant which can re-grow year after year from the thickened roots. It has several stems. The stems are woody and have some branches. Plants grow up to 3 metres tall. Stalks have distinct scars where leaves have fallen. The leaves tend to be near the ends of branches. The leaves are divided like the fingers on a hand. The leaves have long leaf stalks. The leaves have 3 - 7 long lobes which can be 20 cm long. These are widest about 1/3 of the distance from the tip and taper towards the base. The colour varies. It produces several long tubers. These can be 50 cm long by 10 cm across. The flowers are on short stalks around a central stalk. They are produced near the ends of branches. The female flowers are near the base of the flower stalk and the male flowers higher up.



**Distribution:** A tropical plant. Plants grow from sea level up to about 1,650 m. In Fiji they grow to 900 m. They can grow in poor soil and can survive drought. It is native to tropical America. It grows between 25°N and 25°S and needs a rainfall above 750 mm. It suits hardiness zones 10 - 12.

**Use:** The tubers are eaten after thorough cooking. They are boiled, roasted or made into flour. The starch is used in puddings, soups and dumplings. Young leaves are edible after cooking. They are also sometimes dried and stored. Seeds are also eaten. **Caution:** Bitter kinds of cassava contain poison but this is destroyed on heating. This kind of cassava should be cooked, sun dried, soaked and cooked again.

**Cultivation:** Cassava is planted from sections of the stalk. Sections about 15 - 20 cm long of the more mature woody stem are cut and stuck into the ground. They can be completely buried or put at almost any angle and it affects the growth little. Soon roots form and leaves start to sprout from the stalk. Cassava seeds need a soil temperature of 30°C for their germination. Flower and fruit production is more common under lower temperatures such as in highland or less equatorial conditions.

It is not necessary to dig a hole to plant cassava and on many soils where the soil is loose it can be planted without digging the soil first. Cassava does not suit waterlogged soils and preferably they should not be too shallow or stony.

Cassava can be planted at any time of the year but to get started it needs moisture so is often planted near the beginning of the wet season. The crop once established can survive for several months without rain. The ability to tolerate drought varies significantly with cultivar. During drought less and smaller leaves are produced and leaves die off more quickly but storage roots can be increased in the short term.

Because cassava can still grow satisfactorily in poorer soils it is often put last in a rotation after others crops have already been grown on the piece of land. Cassava is more responsive to nitrogen and potassium than phosphorus under many field situations. Nitrogen can increase cyanide levels. Under very acid conditions with high soluble aluminium levels, cassava has been able to achieve and maintain top growth but with significantly reduce root yields. When drainage is good and soil

moisture is adequate, cassava stalks can be planted at any orientation from horizontal to vertical, but in very sandy soils horizontal planting is best and in heavy clay soils vertical planting is best.

Because of the slow growth in early establishment stages, soil loss from erosion with heavy rains can be significant. To avoid this planting should be timed so that the maximum vegetative growth is occurring during the heaviest rains. A leaf area index between 2.5 - 3.5 is optimal for cassava yield. The critical period for weed control is the time from 2 - 8 weeks after planting. Cassava tuber bulking is delayed under shaded conditions. Yields are also reduced. In mixed cropping situations using crops which mature early, allowing the cassava time to recover, is one possible strategy. For optimum production shading should be avoided.

Cassava takes about 10 - 12 months to produce mature tubers in the lowlands tropics although some varieties produce a smaller yield earlier. Yields in the range of 20 - 45 t/ha have been recorded for 12 - 14 month crops. The plants can be left growing and the tubers stored in the soil for considerable time. Crops of 24 months duration occur. Once the tubers have been dug they do not keep for more than a few days. Pre-harvest pruning of plants increases the storage time of tubers after harvest.

Spacing and plant density varies with soil climatic conditions and variety. Plant densities from 10,000 to 30,000 plants per hectare are used. Plants from the higher density crops have been shown to have quick post-harvest deterioration. Mulching has given significant yield increases in some conditions. It also reduces the incidence and damage of some root boring insects.

**Production:** Plants can be harvested after 10 months in the lowlands. There are some faster growing varieties. Yields in the range of 20 - 45 t/ha have been recorded for 12 - 14 month crops.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
tuber	62.8	625	1.4	30	15	0.23	0.48
leaf	82.0	382	7.1	57	275	7.6	-

## Starchy staples

**English:** Lesser yam

**Tetun:** Fehuk midar kor kinur

**Scientific name:** *Dioscorea esculenta*

**Plant family:** DIOSCOREACEAE

**Description:** A prickly, climbing yam with a spiny vine. It can climb 1.2 - 2.4m high and spread 1.8m across. The vine twines to the left. The leaves are round with a gap where the leaf stalk joins. They are almost heart-shaped. The leaf is about 12cm long. This yam produces a cluster (5 - 20) of tubers under the ground. The tubers are often sticky when cut. In many varieties, there are sharp thorns just under the ground. The flowers are green, 4mm across and borne on long slender spikes. These are singly in the axils of leaves. There are many different varieties.



**Distribution:** It grows in many tropical countries, from sea level up to about 1500 m, but mostly below 800 m. It cannot tolerate water-logging and needs a reasonably long rainy season and a loose, fertile soil. It does poorly on sandy soils and becomes mis-shapen in heavy clay soils. High levels of organic matter promote growth. It suits hardiness zones 9 - 12. Lesser yam is an important root crop for the tropical humid lowlands.

**Use:** The tubers are cooked and eaten.

**Cultivation:** Normally, small tubers (50 - 75 g) are planted, but cut portions of a tuber can be used. Using either the top or the bottom section of a tuber gives better establishment and yield than middle portions. Using larger tubers gives larger individual tubers and higher yields for individual plants. With a spacing of 30 cm between plants and 100 cm between rows, about 2,000 kg of planting material are used if 70 g tubers are used. Tubers are planted 8 - 12 cm below the ground. Plants can be grown from stem cuttings where a leaf and node are propagated under mist. This method is normally only used for increasing the amount of planting material of a selected variety. Planting in mounds assists drainage, improves aeration and makes harvesting easier. A spacing of 80 - 100 cm between plants is suitable. Planting is normally adjusted to fit in with the beginning of the rainy season. The growing season of 9 - 10 months is long and an extended wet season is therefore desirable. Stakes 2 m long are required. Lesser yams compete poorly in shade. Weed control is most critical during the first 3 months. As early growth of the plant is sustained from the tuber, fertilisers can be applied after planting. Added nitrogen fertiliser is more effectively used when plants are staked. Nitrogen is of more benefit for leaf growth in the early stages of plant development. Potassium is beneficial, although phosphorus applications often do not give significant responses, as lesser yams are efficient at extracting it from the soil.

**Production:** High yields can be obtained. Plants take about 9 months to reach maturity. In some varieties and under some conditions, leaves do not die-off and tubers must be harvested to avoid tubers rotting as new growth commences. Tubers need to be harvested and handled carefully. They must often be cut from the vine and can be washed and dried. Tubers will store for about 3 months under ventilated conditions above 15°C. Fungal growth and rots easily occur on cut or damaged surfaces under damp conditions. Tubers need to be peeled either before or after cooking.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
tuber	74.2	470	2.1	84	20	0.75	0.5

## Starchy staples

**English:** Foxtail millet  
**Tetun:** Batar talin naruk

**Scientific name:** *Setaria italica*  
**Plant family:** POACEAE

**Description:** An annual grass. It grows 1 - 1.5 m tall. It can be tinged with purple colour. The stalks are upright and the section between the nodes is hollow. It develops tillers from the base. It has long leaf sheath. The leaf blade is 30 - 45 cm long by 1.2 - 2.5 cm wide. It has a prominent midrib and tapers towards the tip. The flower is a spike-like branching flower 7.5 - 25 cm long by 1.2 - 5 cm wide. The side branches carry 6 - 12 small spikes each with 1 - 3 bristles. The mature grain is 2 mm long. There are many named cultivated varieties.



**Distribution:** A warm temperate plant. It suits regions of low rainfall. It is grown from sea level to 2,000 m altitude. It can tolerate a wide range of soil conditions. It cannot tolerate waterlogging or long periods of drought. It can grow in arid places.

**Use:** It can be cooked and eaten like rice. The seeds can be parched, popped, added to soups and sauces or made into porridge, cakes, puddings, and dumplings. The sprouted seeds can be used as a vegetable. The seeds can be used for making beer. The seeds can also be made into syrup.

**Cultivation:** Plants are grown by seed. Seed can be broadcast or drilled. Pure stands require 8-10 kg/ha of seed. Plants are harvested by cutting off the ears.

**Production:** It grows quickly. Plants mature in 80 - 120 days. Flowering occurs over 10 - 15 days. Plants can be self or cross pollinated. Yields of 800 - 900 kg/ha are common and straw yields for livestock feed can be up to 2,500 kg/ha.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	13.5	1425	9.5	-	-	5.5	3.5

## Starchy staples

**English:** Breadfruit

**Tetun:** Kulu

**Scientific name:** *Artocarpus altilis*

**Plant family:** MORACEAE

**Description:** A large tree that grows 20 - 26 m in height. The trunk can be 6 m tall before branching, and up to 1 m across. It is an evergreen tree, but can lose its leaves in dry weather. The leaves are large and vary from rough to smooth and shiny, and from entire to deeply lobed. They can be entire or divided into 5 to 11 lobes. The leaves are bright green on the upper surface with yellow veins and are pale and dull on the under surface. They have very small stiff hairs underneath. Male and female flowers grow separately on the same tree and normally appear at the same time. The flowers are in the axils of leaves. Male flowers form a drooping, oblong catkin 12 - 30 cm long. Female flowers form a globular head. The flower head develops into the compound fruit. The fruit are large and green and vary from round to oblong. They can be 12 - 22 cm long and 9 - 17 cm wide. Seeded fruit have projecting tubercles on the surface of the fruit. Seedless kinds are smoother with rounded or 5 to 6 sided processes on the surface. Seeded, small-seeded, and non-seeded types occur. There are a number of cultivars of each. Seeded fruit have 30 - 90 seeds per fruit. Seed can be 2 cm across and with darker lines.



**Distribution:** A tropical plant that grows in the hot, humid, tropical lowlands. The plant is purely tropical and normally grows below about 650m altitude, but they can grow from sea level up to about 1,150 m. Seeded types are more dominant in the west of Papua New Guinea. Trees are killed by temperatures below 5°C. It tends to grow in the temperature range 16°C to 38°C and probably requires an average temperature over 22°C to grow well. It grows on a range of soils providing they are well drained. There is some cultivar difference in drought and salt tolerance. Uniformly warm humid climates suit it best. An annual rainfall of 200 - 250 cm and a relative humidity of 70 - 80% suits. It suits hardiness zone 11 - 12.

**Use:** The large seeds are boiled in salted water or roasted before eating. The flesh of the fruit is eaten cooked. It can be boiled, baked, steamed, mashed, or turned into soups, puddings, cakes and pies. Dried fruit are made into flour. Young leaves and flowers are edible. The central core and the skin are not eaten.

**Cultivation:** Seeded forms are self-sown by birds or bats. The presence or absence of seeds significantly affects the production. Seeded trees are mostly propagated by seed which needs to be sown fresh, without seed drying out. Seedless trees are propagated by root cuttings. Cuttings of roots 1.5 - 4 cm across and 25 cm long are suitable. Cuttings can be rooted in sand during the wet season. They should be placed horizontally and kept moist and shaded. Using intermittent mist improves root formation and cutting establishment. Rooting hormones also assist. This process takes 10 weeks or more and then rooted cuttings should be hardened off in a sunny position for up to 3 more months before planting out into the field. Young plants do best with adequate sun and no shade. Root suckers produced naturally, or by damaging the roots, are a common method of production of new material. Marcottage or budding can also be used for propagation. The vegetatively propagated trees are therefore clones and the variation is presumably therefore somatic.

Fruit set can be improved by dusting male flowers onto female flowers 3 days after they emerge. Artificial pollination has resulted in increased yields in some places. This is both an increase in fruit size and more fruit retained on the tree to maturity. The pollen in the male flower is available 10 - 15 days after emergence. It is about 3 months from flowering to fruit maturity.

Because trees often occur from natural seed dispersal by fruit bats and marsupials, trees are often randomly spaced and common in secondary forest. A spacing of 10 - 13m is suitable between cultivated trees.

Trees rarely receive much attention after establishment but pruning of branches to allow easier access to fruit is sometimes undertaken. Seedless fruit are picked before maturity when the fruit is eaten by boiling. Mature fruit can be sweeter but they need to be cooked by baking or roasting. Seeded fruit are normally allowed to drop and are then harvested. The seeds are about 20 % dry matter as protein with a good nutritional balance. The essential amino acid levels are high for vegetable protein. Fresh fruit are highly perishable and need to be handled carefully.

Pit preservation of breadfruit involves lactic acid fermentation. The fermentation needs to be last for 2 - 3 months to produce a palatable product. Breadfruit slices can be stored under refrigeration in a fresh marketable state at 14°C for up to 10 days. Segments can be boiled for 2 - 5 minutes then frozen at minus 15°C for at least 11 weeks.

**Production:** Trees begin to bear after 3 - 6 years. Growth of the trees is vigorous, with fruiting starting after about 3 years. Trees grow to 10 - 15 m in 10 - 12 years. Fruiting can occur over 5 - 8 months in some locations and this is partly due to varieties with overlapping fruiting seasons. A tree can produce 50 - 150 fruit, weighing 1 - 1.6 kg each, per year. Large trees can give 700 fruit per year of 1 - 4 kg each. An average seed weighs 5 g. Fruit are harvested 65 - 95 days after flowering.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	74.4	506	1.5	4	25	0.4	0.2
leaf	75.5	314	5.0	-	-	17.5	-
fruit & seed	87.1	192	2.0	-	-	-	-

## Starchy staples

**English:** Chinese taro

**Tetun:** Talas

**Scientific name:** *Xanthosoma sagittifolium*

**Plant family:** ARACEAE

**Description:** A herb that grows up to 2 m tall. It has a short stem with large leaves at the top. A corm grows at the base of the plant, and produces about 10 flask-shaped cormels, each about 15 - 25 cm long. They get wider towards the tip. The oval leaf blade is 50 - 75 cm long with a vein around the edge. The leaf has triangular lobes at the bottom. The flower is produced below the leaves. The large bract around the flower is pale green and about 20 cm long. The bases of the bract overlap. The closely arranged spike of flowers is about 15 cm long. The smaller female part is at the bottom of the spike and the larger male part towards the top.



**Distribution:** It grows in many tropical countries and suits tropical rainforest regions. It can tolerate high rainfall and light shade. It does well in regions with an annual average temperature of 26°C and a well distributed rainfall of 1,400 - 2,100 mm during the growing season. It grows from sea level up to about 2,000 m. Soils need to be well-drained, but moist with a pH of 5.5 - 6.8.

**Use:** Cormels, or small corms, are eaten roasted or boiled. Main corms are often fed to pigs. Young leaves can be eaten after cooking.

**Cultivation:** The top piece of the main central corm or stem is normally planted. Pieces weighing 1.5 kg are often used. It can also be grown by using the small side corms which may weigh 0.3 kg, or pieces of the corm can be used as long as they have some buds on them. These are often pre-sprouted before planting. To multiply large amounts of planting material and still achieve acceptable yields, the latter method of using sections of the main corm works well. In crop growth, an axillary bud is produced in the axil of each leaf but only some of these develop into cormels. Often 10 or more cormels develop per plant into cormels 15 - 25 cm long.

**Production:** The crop grows for about 9 months, although may be left for 12 months before harvest. Crops can be planted at any time of the year, but are often planted to make best use of natural rainfall. The middle of the dry season should be avoided. Naturally loose or well cultivated soils are needed. The water table must be at least 45 cm below the soil surface. *Xanthosoma taro* grows better in good soils with plenty of nitrogen. It can be grown in poorer soils and still give satisfactory yield. It can grow in shade and is inter-cropped under cacao and coconuts. Yield is reduced, but it is still worth doing if no other land is available. Weed control is important. The corms can be harvested without digging out the whole plant by carefully digging soil away from the plant and breaking off small corms. The main stem is then covered to produce a new crop. The corms store well under dry, cool, well-ventilated conditions. The corms will also remain in good condition if they are left growing in the ground and just harvested when needed.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
root	67.1	559	1.6	5	13.6	0.4	0.5
leaf	90.6	143	2.5	160	37	2.0	-
shoot	89.0	139	3.1	-	82	0.3	-

## Legumes

**English:** Winged bean  
**Tetun:** Duhaen

**Scientific name:** *Psophocarpus tetragonolobus*  
**Plant family:** FABACEAE

**Description:** A climbing perennial bean up to 4 m tall. It can re-grow each year from the fattened roots. Stems twine around supports or trail over the ground. Leaves have 3 leaflets 8 - 15 cm long with long leaf stalks. Flowers are blue or white and occur on the ends of branches from within the axils of leaves. Pods have wavy wings and are roughly square in cross section. They are 6 - 36 cm long with 5 - 30 seeds. Seeds can be white, yellow, brown or black and are bedded in the solid tissues of the pod. The seeds are round and smooth with a small hilum. The root has large nodules.



**Distribution:** A tropical plant that grows from sea level up to about 1,850 m altitude in the tropics. It normally only produces tubers at 1,200 - 1,850 m altitude. It is a short day plant and needs a day length less than 12 hours. It will not produce flowers or pods at places far from the equator. The main areas of production are between 20°N and 10°S latitudes. It is ideally suited to the tropics including the hot humid lowlands. For maximum seed production, temperatures of 23 - 27°C are needed, and for tubers the temperatures should be 18 - 22°C. Winged beans can grow on a wide variety of soils and have been grown on soils with pH from 3.6 - 8.0. Very acid soils have soluble aluminium to which winged beans are sensitive. Soils should not be waterlogged.

**Use:** Young leaves, flowers, young pods, ripe seeds and root tubers are edible. The seeds can be used to extract an edible oil.

**Cultivation:** Seeds are sown at the beginning of the rainy season. Seeds germinate and grow slowly for the first 3 - 5 weeks. For tubers, vines are pruned off at about 1 m high (or left unstaked) and some flowers are removed. Cultivation procedures vary slightly depending on which part of the plant is to be eaten. Short podded winged bean is used for tubers and long podded ones have poor tubers. Tuber production is not as efficient in tropical lowland conditions.

**Production:** The first green pods are ready about 10 weeks after sowing. Tubers are ready after 4 - 8 months. Seed yields of 1.2 tons/ha and tuber yields of 4 tons/ha are possible. A single plant can produce up to 75 pods. Dry bean yields of 45 - 330 g per plant can be produced depending on variety. Tuber yields of 5,500 - 12,000 kg per hectare have been produced. Seeds can contain a trypsin inhibitor which reduces protein digestibility. This inhibitor is destroyed by soaking seeds then boiling them well. Tubers can also contain this chemical and need to be well cooked.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	8.5	1764	41.9	-	-	15.0	4.5
pod (fresh)	92.0	105	2.1	-	-	-	-
leaf	95.0	197	5.0	809	30	6.2	1.3
seed (young)	87.0	205	7.0	13.0	18.3	1.5	0.4
root	57.4	619	11.6	-	-	2.0	1.4

## Legumes

**English:** Peanut

**Tetun:** Forae

**Scientific name:** *Arachis hypogea*

**Plant family:** FABACEAE

**Description:** Peanuts grow on spreading bushy plants up to about 40 cm high. The leaves are made up of 2 pairs of oppositely arranged leaflets. Flowers are produced in the axils of the leaves. Two main kinds of peanuts occur. The runner kind (Virginia peanut) has a vegetative or leafy branch between each fruiting branch and therefore produces a spreading bush. The bunch type (Spanish-Valencia peanuts) produces fruiting branches in a sequence one after the other along the branches. They grow as a more upright plant and grow more quickly. Pods



are produced on long stalks which extend under the ground and they contain between 2 - 6 seeds. The stalk or peg from the flower grows down into the soil and then produces the pod and seed under the ground. The flowers need to be no more than 18 cm from the soil surface for the seed pod to develop underground.

**Distribution:** Peanuts grow in tropical and subtropical areas. They grow well from sea level up to about 1,650 metres in the equatorial tropics. They require temperatures of 24 - 33°C. Plants are killed by frost. They need a well-drained soil and cannot stand water-logging and often require raised garden beds. Peanuts need 300 - 500 mm of rain during the growing season. Dry weather is needed near harvest.

**Use:** The seeds can be eaten raw, cooked or sprouted. They are boiled, steamed, roasted, salted or made into peanut butter or flour. The young leaves and unripe pods are edible after cooking. An edible oil is extracted from the seeds. The remaining meal can also be eaten.

**Cultivation:** Peanuts require soil with good levels of calcium and boron or they produce empty pods. Peanuts have nitrogen fixing root nodule bacteria and therefore can give good yields in soils where nitrogen is low. The nuts are normally removed from the shell before planting and are sown 2 - 3 cm deep, with 10 cm between plants and 60 - 80 cm between rows. The soil needs to be weeded and loose by the time the flowers are produced to allow the peg for the seed pods to penetrate the soil.

**Production:** Flowering can commence in 30 days and it takes 3.5 - 5 months until maturity. Peanuts are harvested by pulling out the plant when the top of the plants die down. After harvesting, they should be left to dry in the sun for 3 - 4 days. Virginia peanuts have a longer growing season and the seeds need to be stored for 30 days before they will start to re-grow.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	4.5	2364	24.3	-	-	2.0	3.0
seed (fresh)	45	1394	15	-	10	1.5	-
leaf	78.5	228	4.4	-	-	4.2	-

## Legumes

**English:** Snake bean

**Scientific name:** *Vigna unguiculata* subsp. *sesquipedalis*

**Tetun:** Fore talin naruk

**Plant family:** FABACEAE

**Description:** A climbing bean with long pods. The vines can be 3 m long. They normally twine around stakes. Dwarf kinds also occur. Leaves have 3 leaflets. The leaflets are oval and side leaflets are at an angle. Leaflets can be 2 - 16 cm long by 1 - 12 cm wide. The centre leaflet can have lobes near the base and the side leaflets can have lobes on the outer edge. The leaf stalks can be 2 - 13 cm long. The flowering stalks are in the axils of leaves. There can be few or several flowers. The flowers can be white, yellow or blue. Flowers are 1 - 3 cm long by 1 - 3 cm wide.



Pods are long (up to 90 cm) and flexible. The seeds can vary between white to dark brown. They are oblong or kidney-shaped. Seeds are 4 - 12 mm long by 2 - 6 mm wide.

**Distribution:** It is grown in many tropical countries in Africa, Asia, the Americas and in Australia, Papua New Guinea and Solomon Islands. Plants grow in coastal areas in the tropics from sea level up to about 300 m in equatorial regions. Seeds shoot in moist soil over 22°C. For growth, day temperatures between 25 - 35°C and night temperatures not below 15°C are required. It suits wet areas and cannot tolerate drought. It is a day-length neutral plant that performs best under full sunlight, but can tolerate some shade. It has a high water requirement when fully grown (6 - 8 mm/day). It can tolerate a wide range of soils with pH of 5.5 - 7.5. Seeds show no dormancy or inactivity. This is a very important bean for the hot, humid tropics, including Solomon Islands.

**Use:** The young pods and leaves are eaten. The ripe seeds can also be eaten.

**Cultivation:** Plants are grown from seed. Seeds germinate quickly (2 - 3 days) and plants grow rapidly. Flowering occurs after 5 weeks and harvesting of young pods can start 2 weeks later. Plants die after about 3 - 4 months. A spacing of 60 cm is suitable. Plants need sticks to climb up. Sticks about 2 - 2.5 m long are suitable. Often 5 - 6 seeds are sown around the one stick. Plants are often topped when growing too vigorously. It only grows as an annual bean, so seeds need to be replanted each year. The pods need to be harvested every 2 - 3 days. It suffers more from diseases if the bean does not have sticks to climb. Damage by bean pod borer is less if snake beans are grown intercropped with maize.

**Production:**

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
pod (fresh)		197	2.8	43	18.8	0.47	0.37
seed (boiled)	87.5	197	2.5	20	16.2	0.98	0.36
seed (dry, raw)	8.43	1453	24.33	0.16	1.6	8.61	3.5

Food values obtained from: U.S. Department of Agriculture, Agricultural Research Service. 2011. USDA National Nutrient Database for Standard Reference, Release 24. Nutrient Data Laboratory Home Page, <http://www.ars.usda.gov/ba/bhnrc/ndl>

## Legumes

**English:** Pigeon pea

**Tetun:** Tunis

**Scientific name:** *Cajanus cajan*

**Plant family:** FABACEAE

**Description:** An upright perennial shrubby legume that can live for 3 - 4 years. They can grow up to 4 m tall and spread to 1.5 m wide. It has a bushy appearance and a strong deep taproot. The root nodules are round and sometimes lobed. The leaf consists of 3 narrow, green leaflets which are silvery-green underneath. The end leaflet is larger with a longer leaf stalk. The pea shaped flowers are red and yellow and occur on branched flower stalks which stick upwards in the axils of leaves. Pods are long, straight and narrow, often with 4 - 8 seeds. Seeds vary in shape, size and colour. The pods are slightly hairy. Pods are often 4 - 8 cm long and have a beak at the end. Pods are constricted between the seeds. Many varieties of pigeon pea occur. Some are dwarf and day length neutral.



**Distribution:** A tropical plant that requires a tropical or subtropical climate. Plants grow from sea level up to about 1,800 m in the tropics. They can tolerate drought and are suited to a drier climate. They can grow in places with less than 600 mm rainfall per year. They do less well in the wet tropics. They suffer in waterlogged soils and are damaged by frost. It can also tolerate heat. It will grow on poor soils cannot grow on salty soils. It can grow in arid places and suits hardiness zones 10 - 12.

**Use:** Young leaves, shoots and pods are eaten. The pods can be used in curries. The leaves and shoots as potherbs. Young seeds are cooked and eaten like peas. Ripe seeds are also cooked and eaten in soups and curries. Bean sprouts can be produced and eaten. Preparation of the seeds for dahl is somewhat complicated.

**Cultivation:** They are grown from seeds. It is best to sow seeds where the plants are to grow. Seeds normally germinate easily and well. Before sowing seed it helps to soak them in cold water for one day. Seeds store well if kept cool and dry. A spacing of 1.5 m x 1.5 m is suitable. Plants can be cut back and allowed to re-grow. Plants can also be grown from cuttings.

**Production:** Plants are fast growing. Pods are ready after 5 months. Mature seeds take about 8 months. Plants will often live for 3 - 4 years. Plants are cross pollinated by insects, or self pollinated.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	10.0	1449	19.5	55	-	15.0	-
pod (young)	64.4	477	8.7	-	-	2.0	-
seed (young, boiled)	71.8	464	6.0	2	28.1	1.6	0.8

## Legumes

**English:** Lablab bean

**Tetun:** Ervilla

**Scientific name:** *Lablab purpureus*

**Plant family:** FABACEAE

**Description:** A climbing bean which can have vines 1 - 5 m long. It keeps growing from year to year. The stems can be smooth or hairy. Leaves are made up of 3 almost triangular leaflets. The leaflets are 5 - 15 cm long and 3 - 14 cm wide. The side leaflets are somewhat asymmetrical. Often the plants are flushed purple. The flowering clusters are 5 - 20 cm long. Flowers are often white but can vary from red to blue. The pods are flattened, pointed and up to 12 cm long and 2 cm wide. They can be green, purple or white. Inside there are 3 - 5 white or dark seeds. Seed pods have a wavy margin. The seeds are 0.5 - 1.5 cm long. (This bean is similar to Lima bean but the keel of the flower is not spirally twisted, the pod ends more bluntly with a long thin style at the end and the hilum on the seed is longer.)



**Distribution:** It is a tropical and subtropical plant. It mostly grows between 750 and 2175 m altitude in the tropics. It is drought resistant and can grow in quite low rainfall areas. Some varieties are short day and some are long day kinds. It suits hardiness zones 9 - 12.

**Use:** The young pods, ripe seeds and young leaves are edible, cooked. Flowers can be eaten raw, steamed or added to soups and stews. Dried seeds can be cooked as a vegetable. The seeds can also be sprouted then crushed and cooked. The large starchy root is edible. **Caution:** Many types can be poisonous. They should be boiled and the cooking water thrown away.

**Cultivation:** Seeds are sown at 30 x 60 cm spacing near stakes or trees. About 20 kg of seed per hectare are required. Fertilising with nitrogen and potash until flowering is recommended.

**Production:** Young pods are ready 4 - 6 months after planting and seeds 6 - 8 months. Pods are often harvested over 2 or 3 years. Pollination and seed setting are reduced in cold weather.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	10.0	1428	22.8	-	-	9.0	-
seed (young)	86.9	209	3.0	14	5.1	0.8	0.4
pod (fresh)	86.7	203	3.9	-	1.0	2.4	-

## Legumes

**English:** Red kidney bean

**Tetun:** Fore/Koto

**Scientific name:** *Phaseolus vulgaris*

**Plant family:** FABACEAE

**Description:** There are many bush and climbing varieties of this bean. Climbing forms can be 2 - 3 m tall. Bush types are 20 - 60 cm tall. The leaves have three leaflets, one after another along the stem. The leaf stalk has a groove on the top. The side leaflets are unequal in shape, and can be 8 - 15 cm by 5 - 10 cm. The flowers are in the axils of leaves (where the leaves join the stem) and occur in a loose form. Flowers are white to purple. Pods are smooth, slender and 8 - 20 cm long by 1 - 1.5 cm wide. They are straight or slightly curved with a beak at the end and often have 10 - 12 coloured, kidney-shaped and seeds.



**Distribution:** It is a temperate plant that grows in many temperate and subtropical countries, including Solomon Islands. It mostly grows from 700 - 2,000 m altitude in the tropics. It suffers from pest and disease damage in the lowlands, but can be grown to sea level. It is not suited to the wet tropics. It is shallow-rooted and damaged by excess moisture near the roots. A crop lifecycle needs about 350 mm of water. It is sensitive to frost and high temperatures. Flowers will not form below 9.5°C. Night temperatures above 37°C cause flowers to drop. The best temperature range is 15 - 21°C. It does not suit very acid soils. It suits hardiness zones 8 - 11.

**Use:** The young pods, leaves and mature seeds are edible. Dry seeds are soaked in water and boiled until soft.

**Cultivation:** Plants are grown from seed, preferably sown in raised beds. Seeds remain viable for 2 years. Germination is normally good if seed has been well stored. Climbing types need stakes. Plants are self-fertilised. These beans are intercropped with other plants in many places. If grown on their own, bush types can be spaced at 25 cm x 25 cm. They can be sown closer together in rows wider apart to make weeding and harvesting easier. For dried beans, once the pods are mature and turning yellow, the whole plants are pulled, then dried and threshed. About 50 - 75 kg of seed will sow a hectare. Flowering in most French bean varieties is not affected by day length.

### Production:

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	10.0	1386	25.0	10	1	8.0	2.8
seed (young)	92.0	142	3.0	-	20	0.8	0.2
pod	88.0	151	2.5	750	27	1.4	0.2
sprout	90.7	121	4.2	-	38.7	0.8	0.4

## Legumes

**English:** Lima bean  
**Tetun:** Ervilla nurak

**Scientific name:** *Phaseolus lunatus*  
**Plant family:** FABACEAE

**Description:** A perennial climbing bean. It is often a tall, vigorously climbing plant which can keep growing for some years. The leaves are slightly rounded at the base and pointed at the tip. The flower is white or yellow. The keel of the flower is twisted which helps tell the difference between this bean and Lablab bean. The pods are long (10 cm), flattened and curved and have 3 - 4 seeds which are highly variable in colour. The seeds are large. The seeds have a short round hilum where the seed is attached to the pod. The seeds also have lines going out from this point across the bean seed.



**Distribution:** It suits warm and subtropical areas. In the tropics it is common from 500 - 2,100 m altitude but grows to the limit of cultivation (2,700 m). For germination it must have a soil temperature above 15.5°C and cannot withstand frost. In very hot weather seeds often do not set. It does best in a temperature range 14 - 21°C. It is sensitive to a pH less than 6. It can grow in arid places.

**Use:** The leaves, young pods and seeds are all eaten. The seeds are eaten fresh or after drying. They are also fried in oil. Dried beans are boiled or baked. They can be used in soups and stews. The seeds are sometimes grown as bean sprouts then cooked and eaten. **Caution:** Some kinds have poison (hydrocyanic acid). This is destroyed by thorough cooking. The beans contain a protein inhibitor but this is also destroyed by cooking.

**Cultivation:** It is grown from seed. Coloured seeds are often hard to get to grow but white seeded kinds start growing easily. Sow 3 - 4 seeds in a hill and put a stick 2 - 3 m tall in the middle. Hills should be about 1 m apart. Seeds should be 2 - 4 cm deep.

**Production:** Harvesting can begin after about 100 days. Dried beans can be stored for several months. Yields of 0.12kg of seed per square metre have been obtained. The yield of pods can be 1kg per square metre.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	12.0	1407	19.8	-	-	5.6	-
seed (young, cooked)	67.2	515	6.8	37	10.1	2.5	0.8
seed (young, raw)	70.2	473	6.8	30	23.4	3.1	0.8

## Legumes

**English:** Soybean

**Tetun:** Fore keli

**Scientific name:** *Glycine max*

**Plant family:** FABACEAE

**Description:** A small erect bean growing up to 60 cm tall. It grows each year from seed. Straggling kinds can occur. Stems, leaves and pods are softly hairy. The leaves have 3 leaflets. The leaflets have stalks. Flowers are small and white or blue. They occur in groups in the axils of leaves. The pods are broad, flat and hairy. Pods have 2 - 4 seeds. The seeds can be yellow to black.



**Distribution:** It is a temperate plant that suits lowland areas. It can be grown from sea level to 2,000 m altitude. Many varieties will not flower in the tropics (short days). It needs fertile soil. The best soil acidity is pH 5.5 - 7.0. It is damaged by frost.

**Use:** The young pods and ripe seeds are eaten. They are used for flour. The dried seeds are boiled or baked and used in soups, stews and casseroles. The seeds are used for oil. Toasted seeds are eaten like a snack. Strongly roasted seeds are used for coffee. Soy flour is used for noodles, and confectionary. The beans are fermented and used in a range of foods. Sometimes the young leaves are eaten. The seeds are also used for sprouts and for making cooking oil and soya sauce etc. Because soybean contains a trypsin inhibitor they should be cooked and even the sprouts should be lightly cooked.

**Cultivation:** It is grown from seed. Seeds need to be inoculated with bacteria before planting. Plants need to be about 20 cm apart.

**Production:** Plants flower about 8 weeks after sowing and pods mature about 16 weeks after sowing. Often plants are pulled up and hung up before threshing out the seed.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	9.0	1701	33.7	55	-	6.1	-
seed (immature)	68.0	584	13.0	16	27	3.8	0.9
sprout	79.5	339	8.5	1.0	8.3	1.3	1.0

## Leafy greens

**English:** Amaranths  
**Tetun:** Modo bayam

**Scientific name:** *Amaranthus tricolor*  
**Plant family:** AMARANTHACEAE

**Description:** A small, annual, leafy green herb about 1 m high, spreading to 45 cm wide. An upright, much-branched annual with a thin membrane covering the stems. Sometimes the plant lies over. The stems are angular. The plant branches in the upper part of the plant. It does not have thorns and grows from seed each year. Leaves have long leaf stalks which can be 5 - 10 cm long. Leaves vary in shape, size and colour. The leaf blade can be 5 - 25 cm long by 2 - 6 cm wide. Leaves are dull-purplish and the top leaves can be yellow or red. Some types have coloured leaves or patterns on the leaves. It has a clumpy seed head at the top. The flower spike at the top can be 30 cm long. The seeds are 1 - 1.2 mm across and black.



**Distribution:** It grows in most tropical countries, including the Pacific and Solomon Islands. It will grow in warm, temperate places. Plants grow wild in waste places. Amaranths grow from sea level to 2,400 m altitude in the equatorial tropics. Amaranth seeds need a temperature above 15 - 17°C to germinate. In areas of the equatorial highlands above 1,800 m, average temperatures are probably below this during the cooler months. It may be more difficult to get Amaranths started during these months. It suits hardiness zones 8 - 11.

**Use:** The young leaves and stems are cooked and eaten as a vegetable. The seeds can be eaten. It is a very important tropical vegetable. It grows quickly, produces well and is nutritious.

**Cultivation:** The very small seeds of this plant are scattered over ashes or fine soil in fertile ground. The seeds are normally spread by rubbing the dry seed heads between the hands. Some types are self-sown. These plants grow in most tropical countries. The soil must be fertile. If they are put in an old garden, they will grow very poorly. They should either be put in a new garden site, when it is cleared from bush, or in old ground that is had compost added. Small gardens close to a house can often be built up to a good fertility by using food scraps and ashes that are left over near houses. Amaranths need high amounts of two nutrients, nitrogen and potash. The ashes from fires are high in potash, so farmers scatter seeds of Amaranth over areas they have burnt. Normally, the hotter it is, the better they grow. They also like plenty of sunlight and do not suit shaded places. They need to have water most of the time they are growing. This is mostly not an issue in areas with high rainfall.

**Production:** Plants can be harvested when small by thinning out closely-spaced plants. These can be either transplanted or eaten cooked. Plants can be harvested whole or have top leaves harvested several times. Harvesting begins after 4 - 7 weeks and can continue over the next 2 months.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	91.7	96	2.5	292	43.3	2.3	0.9

## Leafy greens

**English:** Slippery cabbage

**Tetun:** Aidila fuik

**Scientific name:** *Abelmoschus manihot*

**Plant family:** MALVACEAE

**Description:** A branched shrub up to 2 m or more high. It has smooth, green, rounded twigs. The large leaves are simple and smooth, can vary in shape and have 3 - 5 lobes. They are normally very dark green, but pale green types can occur. The leaf stalks are 6 - 13 cm long and stalks can be green or have red colours on them. The hibiscus-like flowers are borne singly and are yellow with dark purple centres. They are produced on mature bushes. The fruit pods are a dry capsule with many small seeds, and are rather stiff or have bristly hairs. Plants can last for several years.



**Distribution:** It is grown in many Asian and Pacific countries. It is well-suited to the tropical lowlands, but grows only poorly at an altitude of 1,800 m. It needs fertile soil. Plants will withstand occasional short periods of temperatures, down to about -5°C, so long as they are in a very well-drained soil. It suits areas with high humidity. It suits hardiness zones 10 - 12.

**Use:** Young leaves are cooked and eaten. They are slimy unless steamed or fried. It is a very nutritious plant.

**Cultivation:** It is normally grown from cuttings. Lengths of about 25 cm (2 or 3 leaf joints or "nodes") of fresh, green, stem cuttings are used. These are stuck in the ground. It can be grown from seeds. The narrow-leafed types tend to compete less well with weeds. In some areas, people tend to put the narrow-leafed types in the middle of the garden cropped amongst sweet potato, and the broad-leafed types near stumps or logs and around the edges of gardens. The pale, green-leafed types grow slowly. A fertile soil is needed. It can be planted in good soil in a newly cleared garden site or near houses where the soil fertility can be built up by adding food scraps, compost and ashes. The growth and colour of the leaves can be improved greatly by spraying the leaves each 2 - 3 weeks with a very small amount of nitrogen fertiliser (urea), dissolved in water (0.5% solution). This uses less fertiliser than putting it on the ground where it can wash away in the rain. Picking the tips off branches of the plants encourages the plant to produce more branches and leaves. If too many leaves are picked off the one bush at the one time when harvesting, it slows down the growth of more leaves. If the soil is very fertile, older bushes, which are only growing a few leaves, can be chopped off and the stump will regrow into a new bush. It is a very fast growing and productive food plant in the hot, humid tropics.

**Production:** Leaves are ready to harvest after about 80 days. Yields of 6.7 - 7.3 t/ha/crop have been recorded.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	88	120	3.4	1.0	7.0	1.5	1.2

## Leafy greens

**English:** Kangkong

**Tetun:** Kanko

**Scientific name:** *Ipomoea aquatica*

**Plant family:** CONVOLVULACEAE

**Description:** Kangkong is a creeping sweet potato-like plant. It has hollow stems and can float on water. The leaves are green and are normally not divided like some sweet potato leaves, but the shape and size varies a little between different kinds. The trumpet shaped flower looks like a sweet potato flower and is normally white. The runners develop roots at the nodes and also branch. This branching increases when tips are picked off. Some variation in leaf shape can be observed. Leaf shape is less variable than in the related sweet potato, but narrow and broad leafed kinds occur. White and green stemmed kinds occur. Green stemmed kinds have more cold tolerance than white stemmed.



**Distribution:** Kangkong is a tropical plant. It grows best in short day, stable high temperature, moist conditions. Temperatures need to be above 25°C for satisfactory growth. In equatorial regions plants probably grow up to 1,000 m altitude. Below 23°C the growth rate is too slow for economic production, so production is mainly in the lowland tropics. Optimum soil pH is between 5.3 - 6.0. It suits damp places and grows well in swamps. It can grow as a partly floating plant in swamps and lagoons behind the beach along the coast. In some countries they grow the dry land form in gardens.

**Use:** The young tips of shoots are cooked and eaten. They can be boiled, steamed, stir-fried, or added to soups, stews or curries. The young stems can be used in pickles. The young tips can be eaten raw in salads and the roots are occasionally cooked and eaten.

**Cultivation:** Dryland kangkong is normally grown from seed. Sometimes seed are pre-soaked for 12 - 24 hours prior to sowing. Plants can also be grown from cuttings and establishment is rapid. Top cuttings 25 - 40 cm long can be planted beside a pond.

**Production:** Young tips can be harvested 30 days after planting, and subsequent harvests every 7 - 10 days. Production of new shoots probably declines at flowering. Yields up to 60,000 kg/ha have been recorded.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	90.3	126	3.9	40	60	4.5	-
leaf (boiled)	92.9	84	2.1	520	16	1.3	0.2

## Leafy greens

**English:** Sweetfern  
**Tetun:** Modo kabura

**Scientific name:** *Diplazium esculentum*  
**Plant family:** ATHYRIACEAE

**Description:** A large fern with an upright stem. It forms tufts. It can be 1 m high and 1 m wide. It usually grows as a large clump. It spreads by underground runners. It has feather-like fronds that are 50 - 80 cm long and divided 2 or 3 times. The leaf stalks are black near the bottom. The secondary leaflets are pointed at the tip and about 8 cm long and 1 cm wide. The leaflets have teeth and are about 2 - 5 cm long.



**Distribution:** It grows in Asia and the Pacific including Solomon Islands. It grows in moist tropical places and mostly occurs in coastal areas. It is common in wet areas. It also occurs in Malaysia, Indonesia, Philippines and Fiji where it is used as food. It is widely distributed in the Philippines on areas of gravel and the banks of streams. It is frost sensitive. It is an important vegetable fern throughout Asia and the Pacific.

**Use:** The fronds are cooked and eaten as a vegetable. They are also used in stews.

**Cultivation:** Plants can be grown from spores. They need to be in a well-drained potting medium and kept in a high humidity environment. The spores need a temperature of 21°C to grow and should be sown as soon as ripe. Plants should be transplanted into a moist, well-drained soil with partial shade. Plants can also be grown by separating the underground runners.

**Production:**

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
frond	94	81	2.4	211	2.0	2.4	1.8

## Leafy greens

**English:** Sweetleaf

**Tetun:**

**Scientific name:** *Sauropus androgynus*

**Plant family:** EUPHORBIACEAE

**Description:** A low-growing shrub with small red flowers. It continues to grow from year to year. It grows 0.8 - 2 m tall. It can grow 6 m tall. It tends to grow upright, then falls over due to its weight. It branches little. Compound leaves on the sides of the stems bear flowers along their underside. The fruit are purple and about 1 cm across. They open and drop their seed at maturity.



**Distribution:** An Asian vegetable now grown in Australia, Papua New Guinea and Solomon Islands. It occurs commonly in South East Asia. It can grow in partial shade or full sun. It suits the hot, humid lowlands. It will grow in heavy clay soils and acid soils.

**Use:** The young tips, young leaves, flowers and small fruit are eaten raw. Older leaves are cooked. Leaves are often singed before being added to soups. The fruit can be used to make jam.

**Cultivation:** It is easily grown from cuttings. Pruning encourages more upright shoots. It can also be grown from seed. Seed only remain viable, or usable, for a few months. It is often grown as a hedge. Cuttings for this are placed 10 cm apart. Adding shade (shade cloth) and fertiliser can be used to force the leaf tips to grow rapidly. , Bushes are normally planted about 60 cm apart.

**Production:** Young leaves can be harvested 4 months after planting. The top 15 cm of young leaf tips are picked. It gives a high yield of leaves and production continues year round. Shrubs last a long time.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	81	244	4.8	133	85	2.7	-

## Leafy greens

**English:** Spinach jointfir

**Tetun:**

**Scientific name:** *Gnetum gnemon*

**Plant family:** GNETACEAE

**Description:** A shrub or small tree about 10 m high. It can grow to 20 m high. It normally has a cone-shaped crown. The bark is greyish-brown. The small branches are slender and like a vine. The leaves are produced in pairs opposite each other. They are dark green and shiny, oval and pointed at both ends. The leaves are 7.5 - 12.5 cm long by 2.5 - 7.5 cm wide. Trees are either male or female. Male spikes are 3 - 6 cm long. They consist of 50 - 80 very small flowers in rings along the stalk. Flowers are produced as cones made up of rings of scales along stalks that can be up to 12 cm long. There are 5 - 8 flowers at each node. Fruits are oval and green when young, but red when ripe. Fruit are 2 - 3 cm long and contain one seed.



**Distribution:** It grows in Asia in Burma, Cambodia, China, India, Indochina, Indonesia, Malaysia, Myanmar, Thailand, and Vietnam, and in the Pacific in Fiji, Palau, Papua New Guinea, Philippines, Solomon Islands and Vanuatu. Trees occur in tropical rainforest from sea level to about 1,200 metres altitude. It can grow on a range of soils but does best on deep well-drained soils. It suits hardiness zones 10 - 12.

**Use:** Young leaf tips, young flowers, and young fruit are eaten cooked. Ripe fruit are eaten raw or cooked. Fruit should be crushed before cooking or they can explode. Young flowers and fruit need cooking to get rid of irritating substances. The seeds are dried and flattened and then deep fried in hot oil and salt added. It is a popular snack food and an important vegetable.

**Cultivation:** Trees are grown from seed. A fully-ripe, red fruit is needed. Seeds exhibit a natural dormancy due to a very hard (impermeable) seed coat. Breaking this seed coat can normally hasten germination. This is done by boring a hole into the seed. Propagation, or starting new plants, can occur naturally from seeds distributed by birds, or by planting seeds or by cuttings. A spacing of 6 m is suitable, although in rows, they are often sown closer together. Trees appear to establish in the forest understorey, indicating some shade tolerance. Trees recover readily from pruning. Coppicing, or chopping back and letting the plant regrow, can produce a rapid flush of new leaves. Flushes of new leaves tend to occur seasonally. Trees can be topped to keep them shorter. If plants are grown by air-layering, they are shorter and more compact.

**Production:** Trees produce flushes of young, reddish leaves. Flowers are produced throughout the year. Trees grown from seed fruit in 5 - 8 years. Air-layered trees produce fruit in 2 - 3 years. Leaves are harvested when fully expanded, but still soft and succulent. The fruit are harvested when the skin turns red. Trees can produce 20,000 pieces of fruit per year, each weighing 6 - 7 g.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	66.0	378	5.9	308	1.5	2.7	12.1
seed	13.0	1442	12.0	-	-	5.0	-
fruit	72.6	385	5.2	-	2.9	15.6	11.8

## Leafy greens

**English:** Indian spinach  
**Tetun:** Modo mean (dollar ai leten)

**Scientific name:** *Basella alba*  
**Plant family:** BASELLACEAE

**Description:** An annual or perennial climbing herb with thick fleshy leaves. The vine is smooth and juicy and can be 10 m long. It branches freely. The vine and leaves can be red or green. The leaves are fleshy and pointed at the tip. They can be 8 - 18 cm long and 8 - 10 cm across. They are carried alternately along the vine. Leaves can be heart shaped or oval. It has white, pink or red flowers in short spikes which are in the axils of the leaves. The fruit are round and soft. They can be red, white or black and are 6 - 8 mm across. The seeds are round and black. They are 3 mm across. (Often the ones with heart shaped leaves are called *Basella cordifolia*, the ones with a red stem *Basella rubra* and the short day flowering dark green kind *Basella alba*.)



**Distribution:** A tropical plant. It occurs mostly in the tropical lowlands and is best below 500 m but will grow up to about 1,600 m. in the equatorial tropics. It will grow quite well in the temperature range 15 - 35°C. It does not like water-logging but can survive 4 - 12 weeks drought once well established. It requires adequate water during the growing season. The best pH is 5.5 - 7.0. It cannot tolerate salty conditions. Flowering does not occur when day lengths are over 13 hours.

**Use:** The young shoots and leaves are eaten cooked. They are somewhat slimy. In soups and stews the mucilage can be used as thickening. The purple colour of fruit is harmless and is used to colour vegetables and agar-agar. Some lemon juice added to the dye enhances the colour. The leaves can be eaten raw in salads or cooked like a vegetable. The leaves are used to make tea and can also be dried and stored. The seeds can be crushed to use as an edible dye for jellies.

**Cultivation:** It can be sown from seeds or cuttings. Seeds germinate in a few days. Sticks can be provided for support, or it can grow over fences and stumps. If seeds are used, 3 kg of seed will sow one hectare. They are best sown in a nursery and transplanted. A spacing of 1 m is suitable. Plants grown from seed are more productive than those grown from cuttings. When cuttings are used, 20 - 25 cm long cuttings are suitable. Where the plant grows over light soil it can root at the nodes and continue growing. Partial shade, rich fertile soil and adequate moisture favour abundant leaf production. It is responsive to nitrogen fertiliser. Light shade gives bigger leaves. It requires a trellis to climb over. Frequently picking of the bud encourages branching.

**Production:** It is 4 - 6 weeks until the first harvest. It grows reasonably well on poor soils and is fairly resistant to pest and disease. Leaves will only store for one day at 20 - 30°C. Yields of 40 kg of leaves from a 10 metre square bed is possible over 75 days.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	85.0	202	5.0	56	100	4.0	-

## Fruit

**English:** Banana  
**Tetun:** Hudi

**Scientific name:** *Musa sp (A &/or B genome) cv.*  
**Plant family:** MUSACEAE

**Description:** These are the main group of cultivated bananas. They can be classed into diploid, triploid and tetraploid kinds with various amounts of the A or B parents. They grow 2 - 9 m high. They are large non woody herbs with broad long leaves. Most kinds have several suckers. Bananas grow a soft firm false stem from an underground corm. The fruiting stalk eventually emerges from the top of this false stem and normally curves over pointing towards the ground. Fruit occur in clumps or hands along this stem. The male flowers are in a red bud at the end of the flower stalk. The colour of the stem, bracts, bud and fruit varies considerably depending on the variety. The fruit can be 6 - 35 cm long depending on variety. They can also be 2.5 - 6 cm across.



**Distribution:** A tropical and subtropical plant. They grow from sea level up to about 2,000 m altitude in the tropics. They are rarely an important food above about 1,600 m. In Nepal they grow to about 1,800 m altitude. They do best in warm and humid tropical climates. Temperatures need to be above 15°C. The best temperature is 27°C. The maximum temperature is 38°C. Bananas grow best in full sun. For best growth, a rainfall of 200 - 220 mm per month is needed. A deep friable soil is best. They can tolerate a pH between 4.5 - 7.5. It suits hardiness zones 10 - 12. It is widely grown in many countries.

**Use:** Fruit are eaten raw or cooked depending on variety. Male buds and flowers are eaten on some varieties. They are cooked as a vegetable. The central pith of the false stem and the underground rhizome are also sometimes eaten.

**Cultivation:** They are planted from sword suckers. Diploids need re-planting annually but many triploids can be re-suckered from the base on the same site. Spacing depends on variety. A spacing of 1,000 - 3,000 plants per hectare is used depending on variety. Suckers are usually put 30 cm deep.

**Production:** Time to maturity varies from 6 - 18 months depending on variety and altitude. Triploids have larger bunches than diploids. Tetraploids are very large plants.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit (cooking)	65.3	510	2.0	113	18.4	0.6	0.1
fruit (sweet)	70.7	365	1.7	-	2	0.9	0.4
flower buds	91.3	109	1.6	-	-	1.0	-

## Fruit

**English:** Soursop  
**Tetun:** Ai-ata boot

**Scientific name:** *Annona muricata*  
**Plant family:** ANNONACEAE

**Description:** A low, bushy tree, that grows 8 - 10 m tall. The leaves are long (14 cm) and narrow (4 cm) and are thick and slightly shiny on top. The flowers are large (2 - 3 cm), rounded and produced on short stems on the branches. They occur singly or in groups of three. The flowers have two layers of thick, fleshy petals. The fruit are 10 - 30 cm long. The fruit is spiny and the flesh is juicy. Many black seeds are embedded in the white flesh. Fruit are often mis-shaped, due to only some of the ovules, or young undeveloped seeds, being fertilised. Beetles are normally thought to do the pollinating. This means fruit end up heart-shaped when unevenly pollinated. Several types occur with different sweetness, shape and juiciness.



**Distribution:** A tropical plant that has been taken to most tropical countries. It grows in tropical lowland areas below 1,200 m altitude. It can tolerate quite poor soils and a humid climate, but not frost. The trees can withstand temperatures down to freezing (0°C) for a short time but salt-laden winds from the sea can kill the trees. It needs a well-drained soil and cannot tolerate waterlogging. Trees continue to grow and produce satisfactorily in fairly poor, compacted soil, but improving the fertility increases the amount of fruit. It can grow well in hot humid areas, but a fungus disease called Blossom blight can cause flowers to fall off. It suits hardiness zones 10 - 12.

**Use:** Fruit can be eaten fresh, or used in ice-cream and for drinks. Young fruit can be cooked as a vegetable. Leaves are edible when cooked. The trees are fairly common, but the fruit may not be widely used. **Caution:** The seeds are toxic, so should be removed before processing.

**Cultivation:** Trees are grown either as seedling trees or grafted plants. They can be grown from cuttings or air-layering (part of the plant cut and wrapped in dirt so it produces new shoots). Trees are easy to grow and maintain. Plants can easily be grown from seeds. Seeds can be planted fresh or stored. Seeds grow in about 15 - 20 days. Trees grown from seeds vary in the quality of the fruit. Seedlings are transferred to plastic bags when 15 cm tall. Trees can also be grown from cuttings or by grafting. This allows better trees to be selected and produced. Seedlings are suitable for grafting after 6 months. Trees need to be about 5 m apart. Flowers are pollinated by insects. Hand-pollination of flowers can increase the number of fruit that are produced. Fruit are soft and fleshy, and difficult to transport.

**Production:** Trees grow quickly and commence bearing by the third year. It bears fruit almost continually throughout the year, but there is normally one season when more fruit are getting ripe. A tree can produce 12 - 24 fruit in a year, weighing up to 4 - 5 kg each. The fruit contain 11 - 14% sugars.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	82.4	294	0.88		16	0.3	0.1

## Fruit

**English:** Pomelo  
**Tetun:** Jambua

**Scientific name:** *Citrus maxima*  
**Plant family:** RUTACEAE

**Description:** A dome-shaped, spreading, spiny tree that grows up to 15 m tall. The glossy, oval leaves are very large. And are downy underneath. The leaf stalks have broad wings. Young shoots and stems have fine hairs on them. Flowers are large (2 cm) and creamy white. The flowers are produced in bunches from woody shoots. The flowers have a sweet scent. The fruit are oval or pear shaped. The fruit is very large (20 cm) with a thick skin. The skin is dotted with oil glands. The fruit are green but become yellow when ripe. They contain 11 - 14 segments.



The flesh can be pale yellow or pink. Each segment of the fruit is covered by a strong membrane. Some kinds have many seeds, while others are almost seedless. There are several named cultivated varieties.

**Distribution:** A tropical plant that thrives in warm lowland areas. It can grow from sea level up to 900 m. It is tolerant of brackish and salty conditions. It suits humid climates in tropical and subtropical locations.

**Use:** The fruit can be eaten fresh. It is used for desserts, jams and marmalades. The fruit pulp can be dried and candied. The skin can be eaten as a vegetable. The leaves are used to flavour meat and fish during cooking.

**Cultivation:** It is mostly grown from seed, and does not breed true. The seed only produce one seedling unlike many citrus. Trees are often produced by aerial layering, but budding or grafting can be used. Air-layered trees give sweeter fruit. Trees start producing after about 9 years. Trees need to be about 9 m apart. Trees grown away from other trees often produce almost seedless fruit.

**Production:** Fruit is produced almost all the year round. The time from flowering to ripe fruit is about 6 months. Fruit can be stored quite well.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit (raw)	90.3	175	0.6	20	37	0.4	-

## Fruit

**English:** Pacific lychee

**Tetun:** Ai-maras

**Scientific name:** *Pometia pinnata*

**Plant family:** SAPINDACEAE

**Description:** An evergreen large tree, 40 - 50 m tall. There are often large buttresses at the base, and the rough, scaly bark is a bright, orange-brown colour. The hard timber is widely used. The young leaves and twigs are bright red. The lowest pair of leaflets are small and clasp the stem-like stipules. There are 5 - 11 pairs of leaflets along a stalk and the leaflets at the centre are often the largest. The leaflets droop from long stalks. The flowers are produced in clusters on stalks up to 50 cm long that grow near the ends of the branches. The flowers are small and yellowish-green. They have no scent. The skin of the ripe fruit peels off like a mandarin. The edible part is a clear layer around the seed, like in a rambutan. An inedible type also occurs. The fruit is about 6 cm across and the seed about 3 cm across.



**Distribution:** It grows in Asia, Australia, Papua New Guinea, Solomon Islands and other Pacific countries. It is native from Malaysia to Polynesia. It occurs in lowland and lower, mountainous forest, from sea level to 700 m altitude, and along riverbanks and near swamps. The inedible type occurs on the ridges and is the more useful timber tree. In Samoa, it grows from sea level to 500 m altitude.

**Use:** The fleshy layer (aril) around the seed is eaten raw. The seeds are roasted and eaten in parts of the Solomons and other countries. **Caution:** The edible form must be chosen. The seeds have been reported to be poisonous.

**Cultivation:** Dispersal of self-sown trees is probably by bats or fresh water. Trees are produced from seeds. Seedlings are transplanted from a nursery site. Self-sown seedlings are also transplanted and some trees occur wild in the bush. It probably takes about 5 years from planting until the tree bears fruit.

**Production:** Plants grow quickly. There is a short and clearly defined fruiting season early in the year. There also appears to be significant variation between years on the amount of fruit set. This does not follow a clear biennial pattern (grows in the first year, flowers in the second year, then dies). In Santa Cruz, it has been observed that fruit set does not always follow flowering. The cause is not known. The season is very short and is between November and March.

**Food Value:** Per 100 g edible portion

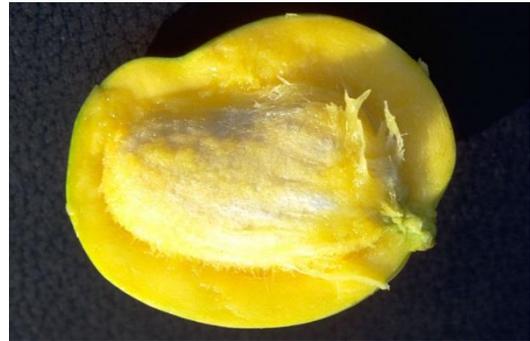
Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	87	211	1.1	3	5	0.5	0.3

## Fruit

**English:** Mango  
**Tetun:** Has timor

**Scientific name:** *Mangifera indica*  
**Plant family:** ANACARDIACEAE

**Description:** An erect, branched evergreen tree. It can grow to 10 - 40 m high and is long lived. (Trees grown by vegetative means are smaller and more compact.) Trees spread to 15 m across. It has strong deep roots. The trunk is thick. The bark is greyish-brown. The leaves are simple and shaped like a spear. Some kinds of mangoes have leaves with a wavy edge. They can be 10 - 30 cm long and 2 - 10 cm wide. They are arranged in spirals. The leaf stalk is 1 - 10 cm long and flattened. Leaves are often brightly coloured and brownish-red when young. These tender leaves which are produced in flushes become stiff and dark-green when mature. The flower stalks are at the ends of branches. They are 10 - 50 cm long and branching. Up to 6,000 flowers can occur on a stalk. Most of these are male and up to 35% have both male and female flower parts. Fruit are green, yellow or red and 2.5 - 30 cm long. The fruit hang down on long stalks. The outside layer of the seed is hard and fibrous and there is one seed inside. Several embryos can develop from one seed by asexual reproduction. The fruit shape and colour vary as well as the amount of fibre and the flavour. India has many varieties and they cannot tolerate humidity.



**Distribution:** A tropical and subtropical plant. It grows in the lowlands. It grows from sea level up to 1300 m altitude in the tropics. It does best in areas below 700 m and with a dry season. Rain and high humidity at flowering reduces fruit set. It thrives best where temperatures are about 25°C but will grow with temperatures from 10 - 42°C. Temperatures of 0°C will damage young trees and flowers. Low temperatures (10 - 20°C) at flowering time will reduce fruiting. As temperatures get lower due to latitude or altitude, fruit maturity is later and trees become more likely to only have good crops every second year. Mangoes can grow on a range of soils. In wetter areas soils with less clay are better. They can withstand occasional flooding. A soil pH of 5.5 - 6.5 is best. Soils with pH above 7.5 cause plants to develop iron deficiency. It grows in the Sahel. It can grow in arid places. It suits hardiness zones 11 - 12.

**Use:** Ripe fruit are eaten raw. Unripe fruit is pickled. Seeds can be eaten cooked. They are boiled or roasted. They are made into meal by powdering. Young leaves can be eaten raw or cooked. Amchur is made from the dried unripe fruit. This is used in curries, and pickles and chutneys. The seed kernels are used for famine food in India. They are boiled, roasted or soaked to remove the bitterness. **Caution:** The sap from the tree or fruit can cause skin problems with some people.

**Cultivation:** Trees are grown by planting fresh seed and they can be transplanted. Mangoes vary in their ability to breed true from seed. When more than one seedling emerges from the seed some of these are asexual and breed true. Clean seed germinate best if they are treated at 50°C for 20 minutes, then planted on their edge with the round bulge upwards and near the soil surface. The husk around the seed should be removed. Seeds germinate in 3 - 6 weeks. The strongest growing seedlings from this seed are used and the others thrown away. The seedlings from the folds of the seed are vegetative while the seedling from the centre of the seedling near the stalk end may be sexual and show variation from type. Other seeds only produce one seedling and these normally vary and can be different from the parent tree. Plants can be propagated by budding, or by grafting using in-arching. This is not easy and care is required. In wetter places, flowers need to be protected with fungicides to enable fruit to form. If organic manure is used this should not be directly in the

planting hole nor immediately against the new plant. Young transplanted seedlings need regular watering. A spacing of 6 - 12 m between plants is used. Wind protection is advisable to prevent fruit rubbing and getting damaged. Trees should only ever be lightly pruned as fruit develop on new growth and heavy pruning can reduce flowering. Flowering can be brought about by foliar sprays of potassium nitrate.

**Production:** Seeds germinate after about 20 days. Seedling trees produce after 4 - 6 years and increase in production up to 20 years. Trees often bear better each second year. Rain at flowering reduces fruit setting. Fruiting is at the end of the year. Fruit take 4 - 5 months to mature. Fruit vary in weight from 200 - 1,000 g. Trees can produce one million flowers but only 500 fruit. Trees last for many years.

**Food Value:** Per 100 g edible portion

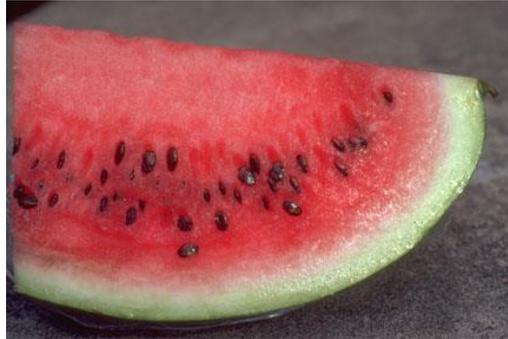
Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	83.0	253	0.5	54	30	0.5	0.04
leaf	82.1	226	3.9	-	60	2.8	-

## Fruit

**English:** Watermelon  
**Tetun:** Pateka

**Scientific name:** *Citrullus lanatus*  
**Plant family:** CUCURBITACEAE

**Description:** An annual climber, with deeply divided leaves and tendrils along the vine. It trails over the ground and has hairy, angular stems. The leaves are on long leaf stalks. The leaves are deeply divided along their length. These leaf lobes are rounded and can themselves be divided. The leaves are 5 - 20 cm long by 2 - 12 cm across. The tendrils are divided. The plant has separate male and female flowers on the same plant. The flowers are pale yellow and smaller than pumpkin flowers. The flowers occur in the axils of leaves. The male flowers appear first. Fruit are large and round or oval. They can be 60 cm long. Fruit have a hard smooth skin. Several fruit colours and shapes occur. They often have a dark green mottle, or blotches. The fruit has reddish, juicy flesh and black or red seeds. The seeds are oval-shaped and smooth.



**Distribution:** It grows in most tropical and subtropical countries. It grows best on the coast in the tropics, but will grow up to about 1000 m altitude. It will not stand water-logging and does well on sandy soils. Plants are frost-sensitive. Seed will not germinate below 21°C. Temperatures between 24 - 30°C are suitable. Fruit are sweeter in arid warm areas. It suits hardiness zones 10 - 12.

**Use:** The fruit is eaten raw when ripe. Small, unripe fruit can be cooked as a vegetable. The skin is sometimes candied in vinegar and eaten with fish. Seeds are also eaten. They are dried, soaked in salt water, then roasted. Oil is extracted from the seeds. Very young leaves are occasionally eaten. It is a popular fruit.

**Cultivation:** They are suitable mainly for the dry season. A spacing of 1.5 - 2 m is suitable. They grow easily from seed. They do best when fully exposed to the sun. Seed can be dried and stored. If too much vegetative growth occurs, picking out the tip to produce side branches will produce more fruit.

**Production:** Harvesting commences after 4 - 5 months. The main fruit season is November to January. The ripeness can be determined by tapping the fruit to get a dull sound. The part of the fruit on the ground changes from green to light yellow and the tendril near the base of the fruit becomes dry when ripe. Fruit yield can be 45 - 60 t/ha.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	94.0	92	0.4	20	5	0.3	0.1
seed	5.1	2330	28.3	0	0	7.3	10.2

## Fruit

**English:** Malay-apple

**Tetun:** Jambu air

**Scientific name:** *Syzygium malaccense*

**Plant family:** MYRTACEAE

**Description:** An evergreen tree that grows 5 - 25 m tall and spreads to 4 m across. Trees tend to branch near the base. Leaves are simple, thick and leathery and shiny on both surfaces. They are large and oval. Leaves can be 25 - 30 cm long and 12 cm wide. The leaves have a vein around the edge. Flowers are produced on old wood and on the trunk, as well as in the angles where leaves join and at the ends of branches. Flowers are purple, crimson or white and 2.5 cm across. They mostly occur in dense clusters, giving a brilliant display. The red stamens often fall under the tree. The fruit is rounded or oblong and 5 - 6 cm across by 6 - 8 cm long. The fruit has white flesh around a large, brown seed. The seed is about 1.3 cm by 1.7 cm. Some kinds are seedless. The skin of the fruit is red or pink with darker stripes. The fruit are edible.



**Distribution:** It is grown in many tropical countries in Africa, Asia, the Pacific and the Americas. It grows in coastal areas in the tropics and up to 1,000 m altitude. It is a rainforest species that needs fertile soil, plenty of moisture, and good drainage. They are sensitive to frost. It does best in an open sunny position. It can tolerate drought but does best where there is an absence of drought. It suits hardiness zones 10 - 12.

**Use:** The fruit can be eaten fresh or cooked. They are also used in jam and pickles. The young leaves are eaten. The flowers have also been recorded as being eaten.

**Cultivation:** Trees are normally grown from seed. Seeds need to be fresh. Growing plants in light shade reduces problems related to termites. Plants can be grown by budding, grafting, layering or cuttings. Aerial-layering (part of the plant cut and wrapped in dirt so it produces new shoots) is probably the most common method for vegetative propagation. Budding onto rootstocks of the same species has proven successful, but it is rarely successful if rootstocks of related species are used. A spacing of 10 m between trees is suitable.

**Production:** Flowering and fruiting is seasonal. In the southern hemisphere, flowering occurs October to November. Fruit ripen in 2 - 3 months. The fruit ripen from January to February.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	91.1	105	0.4	-	15	0.4	0.1

## Fruit

**English:** Avocado

**Tetun:** Abokat

**Scientific name:** *Persea americana*

**Plant family:** LAURACEAE

**Description:** A small to medium sized tree that normally grows 8 - 10 m tall, but can reach 25 m. The leaf stalk is 1.5 - 5 cm long. Leaves are entire, oval and 5 - 40 cm long. Flowers are greenish, small and on the ends of branches. Clusters of flowers may contain 200 - 300 flowers. Normally only 1 - 3 fruit develop from each cluster. The fruit is round or pear shaped, and 7 - 20 cm long. The fruit are greenish-yellow with some red coloration. The fruit has greenish-yellow flesh and a large round seed. There are 3 named races - West Indian, Guatemalan and Mexican.



**Distribution:** A subtropical plant that grows from sea level up to 2,250 m in the tropics. It cannot stand water-logging. Branches are easily damaged by wind. It needs a frost free location or where frosts are rare. West Indian varieties thrive in humid, tropical climates, freeze at or near 0°C and can stand some salinity. Mexican types come from dry subtropical plateaus and thrive in a Mediterranean climate. They are hardy to -7° C. They are salt sensitive, have the smallest fruits and the thinnest skin. The best daytime temperature is 25 - 33°C. Guatemalan types come from cool, high-altitude tropics and are hardy to -3° C. It does best with neutral or slightly acid and well aerated soil. Growth is disrupted when soil temperature is below 13°C. It needs high humidity at flowering and fruit set. It can grow in arid places.

**Use:** The fruit pulp is eaten raw or cooked. It is used in salads, soups, sandwiches, spreads, ice cream, and also in tortillas and wine. The fruit is mixed with sugar and water to make a drink. Oil is extracted from the flesh and is used in salad dressing. The leaves can be used for tea sweetened with sugarcane juice. Toasted leaves are used to season stews and bean dishes. **Caution:** Some people are allergic to avocado.

**Cultivation:** Plants are often grown from seed. Seeds remain viable for 2 - 3 weeks. Fresh seed held at 25°C day to 15°C night will germinate in 3 weeks. It is best to propagate vegetatively. Tip cuttings, layers and grafts can be used. Because different types have pollen at different times of day, a mixture of trees which have pollen and flowers receptive at different times gives best fruit set. Although trees will grow in shade, they need sun for fruiting. The leaves do not rot easily and can accumulate under trees. Other plants cannot be grown under avocado trees.

**Production:** Seedlings grow quickly and continuously in warm, moist conditions. Seedlings bear after 5 - 8 years. Grafted trees can fruit in 1 - 2 years. A good tree produces 400 - 600 fruit each year. A fruit can weigh 50 g - 1 kg. In the subtropics, trees often produce 2 main flushes of fruit per year. From fruit set to maturity can take 6 - 12 months. Fruit ripen off the tree in 4 - 14 days. For the Mexican types, the fruit weigh less than 250 g and they ripen 6 - 8 months after flowering.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	74.4	805	1.8	480	11	0.7	0.4

## Vegetables

**English:** Bulb onion  
**Tetun:** Lis mean

**Scientific name:** *Allium cepa var cepa*  
**Plant family:** AMARYLLIDACEAE

**Description:** An onion family plant with a two year life cycle. Normally it develops fattened bulbs at the base. It has a shallow fibrous root system. The actual stem is very short and condensed. Leaves are produced in an alternate fashion one after the other from the top of this stem. Successive leaves grow up inside, then burst through the leaf sheath of the previous leaf. Leaves are thin and long. They are slightly to markedly flattened on the upper surface. Long day lengths and warm temperatures help the leaf bases become swollen and store food reserves. Flowers are greenish white in colour. Flowers develop on a rounded head with stalks all coming from the centre. Flowers in the rounded head open irregularly. There are no bulbils on the flower-head. There are short day cultivars that will form bulbs in the tropics.



**Distribution:** A temperate plant. It is easier to get onions to grow and form bulbs in the highlands in the tropics but they can be grown from sea level to 2,600 m altitude in Papua New Guinea. In Nepal they grow to 3,000 m altitude. They do not suit the wet humid tropics. Because the day lengths are short near the equator, onions often do not produce a bulb. Some newer varieties will yield in the tropics. The plant grows best at 12 - 21°C and the bulb forms best at 15 - 25°C. It grows best with a pH 5.7 - 6.6. It suits hardiness zones 5 - 10.

**Use:** The bulbs and leaves are used as flavouring raw or cooked.

**Cultivation:** They are grown from imported seed. For bulbs, a tropical cultivar is needed and bulbing is normally better at higher altitudes. Cultivars which form flowers early need to be avoided. Seedlings can be transplanted.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
bulb (boiled)	96.6	53	0.6	-	6	0.3	0.1
bulb (raw)	92.8	99	0.9	-	10	0.3	0.1
leaf	90	-	1.4	49	-	0.5	0.5

## Vegetables

**English:** Tomato

**Tetun:** Tomati

**Scientific name:** *Lycopersicon esculentum*

**Plant family:** SOLANACEAE

**Description:** A short-lived, perennial plant. It is upright, but has weak stems. It can grow to 2 m tall with support for the stems. The stems have long hairs. It has a strong smell. The leaves are deeply lobed with an odd number of leaflets. They have irregular teeth around the edge. There are up to 12, star-shaped flowers on each raceme (flower cluster). Flowers are yellow. The fruit are round and red when ripe. Yellow coloured fruit also occur. There are many varieties.



**Distribution:** It is grown in most warm, temperate countries and most tropical countries. It grows from sea level to 2,400 m altitude in the tropics. It needs to be grown in fertile soil. A soil pH of 6.0 - 7.9 is best. For best production, it requires much water, plenty of sunshine and low night temperatures. For germination, it does best between 20 - 30°C. It is frost-susceptible and suits hardiness zones 9 - 12.

**Use:** The fruit are eaten raw or cooked. **Caution:** Leaves and green fruit are poisonous.

**Cultivation:** Plants are sown from seeds. These are normally sown in a nursery and transplanted. They are transplanted when 40 - 45 days old or 15 cm high. They are spaced about 60 - 90 cm apart. Seeds can also be sown directly in the field. They can also be grown from cuttings. The side branches of upright types are removed to give fewer and larger fruit. Upright plant types need to be tied to stakes. Plants are often grafted into stronger rootstocks.

**Production:** Harvesting commences after about 14 weeks. Yields can be 3 - 4 kg of fruit per plant.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	93.0	88	1.2	45	26	0.6	0.1

## Vegetables

**English:** Okra

**Tetn:** Okra

**Scientific name:** *Abelmoschus esculentus*

**Plant family:** MALVACEAE

**Description:** A tropical annual herb that grows erect, often with hairy stems. It mostly grows about 1 m tall but can be 3.5 m tall. It becomes woody at the base. The leaves have long stalks up to 30 cm long. Leaves vary in shape but are roughly heart shaped with lobes and teeth along the edge. Upper leaves are more deeply divided than lower ones. The flowers are yellow with red hearts. The fruits are green, long and ribbed. The seeds are 4 - 5 mm across. They are round and dark green.



**Distribution:** A tropical plant that suits the hot humid tropical lowlands but is unsuited to the highlands. It is very sensitive to frost. It can grow in salty soils. It grows best where temperatures are 20 - 36°C. It can grow well in dry climates with irrigation. It suits hot humid environments. It does best on well drained well manured soils but will grow on many soils. A soil pH of 5.5 - 7.0 is best.

**Use:** Pods are eaten cooked. They are slimy, but less so if fried. Dried powdered seeds can be used in soups as a thickener. They can also be pickled. Young leaves can be eaten cooked. They can be dried and stored. Flowers can also be eaten. Okra is frozen and canned. The seeds are roasted and used as a coffee substitute.

**Cultivation:** They are grown from seeds, which are easy to collect. They need high temperatures for germination (over 20°C) and a sunny position. Often seeds are soaked for 24 hours before sowing to give quick germination. Seeds are sown 1.5 - 2.5 cm deep with 2 - 3 seeds per hole. Later these are thinned out to one plant. Seeds can be sown in nurseries and plants transplanted. Pinching out the tops of plants when 30 cm high encourages branching. A spacing of about 90 x 45 cm is suitable. About 8 - 10 kg of seed are required for one hectare. Most kinds respond to fertiliser. Seeds do not breed true and can cross with other kinds of okra growing nearby. This is not normally a problem but simply means plants and fruit are not all the same.

**Production:** Plants maintain production if the fruits are harvested regularly. Plants are ready to harvest 8 - 10 weeks after sowing. Seed yields of 500 - 800 kg per hectare are recorded. Pod yields of 4 - 6 tonnes per hectare occur. It takes 2 - 4 months from sowing to harvest of young pods. Pods develop 5 - 10 days after flowering. Pod harvests can continue for 1 - 2 months. Leaving pods on the plants stops new pods developing.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	9.2	1721	23.7	-	-	-	-
leaf	81.0	235	4.4	116	59	0.7	-
pod (fresh)	88.0	151	2.1	185	47	1.2	-
fruit (cooked)	90.0	134	1.9	58	16.3	0.5	0.6

## Vegetables

**English:** Choko  
**Tetun:** Lekeru mutin

**Scientific name:** *Sechium edule*  
**Plant family:** CUCURBITACEAE

**Description:** A vigorously growing climber that can last for several years. It has strong tendrils which can attach to fences and trees so that the plant can climb well. The choko leaves are about 15 - 20 cm across and have a rough feel. The stems have furrows along them. The fleshy fruit contain one large seed. The choko fruit is produced in the angle where the leaf joins the vines. Fruit can be up to 20 cm long and they are rough or irregular shaped on the outside. There are white and green fruited varieties. The flowers are separate. Male flowers are in clusters and female flowers are on their own. A choko plant produces a large thickened root tuber and the plant can re-grow from this tuber and go on growing year after year.



**Distribution:** A tropical and subtropical plant. Choko requires relative humidity of 80 - 85%, annual rainfall of at least 1,500 - 2,000 mm and average temperatures of 20 - 25°C with limits of 12 - 28°C. In equatorial tropical regions, chokos will grow from sea level to about 2,200 m altitude. In the lowlands it grows best in shade. Chokos need a reasonably well drained soil. It can grow in arid places. It suits hardiness zones 9 - 12.

**Use:** The fruit are edible cooked. They can be pickled, baked, steamed, or made into fritters and puddings. The young leaf tips are eaten. The seeds can be eaten cooked. They are often deep fried. The fleshy root can be eaten cooked. They can be boiled, baked or fried. Starch can be extracted from the fruit.

**Cultivation:** The entire fruit is planted as the seed cannot withstand drying out. It is planted flat and thinly covered with soil. Often chokos start to develop shoots and roots while they are still attached to the original plant. These eventually fall off and continue growing if they fall on soft moist soil. A spacing 2 m apart along a fence is suitable. Trellis support is required. A well drained, fertile soil is needed. Cuttings can be used for planting. Plants do not breed true.

**Production:** Fruit can be picked starting 3 - 5 months after planting and continued for many months. The fruit can be stored for several weeks. Tips can be picked regularly. Tubers of 5 kg weight have been recorded. These are normally produced during the second year of growth and after a time of arrested development such as a dry season.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
root	80	331	2.0	-	19	0.8	-
leaf	91.0	105	4.0	75	24	1.4	-
fruit (boiled)	93.4	100	0.6	5	8	0.2	0.3
fruit (raw)	94.0	80	0.7	15	14	0.4	0.7

## Vegetables

**English:** Bitter cucumber

**Tetun:** Baria

**Scientific name:** *Momordica charantia*

**Plant family:** CUCURBITACEAE

**Description:** A pumpkin family plant. It is a slender annual climber with flowers of both sexes on the one plant. It has simple tendrils and vines can be 4 m long. It has bright green lobed leaves 5 - 12 cm long on thin leaf stalks 3 - 10 cm long. The flowers have a sweet smell and 5 small, yellow petals. Fruit are green when young and orange when ripe. The fruit have a lumpy appearance, with ridges along its length and when fully ripe burst open. It has bright red covering on the seeds inside. The seeds are pale brown and 10 - 16 mm long and 7 - 10 mm wide. Considerable variation in the fruit occurs between varieties.



**Distribution:** A tropical plant that grows from sea level up to about 500 m and will probably grow to 1,000 m altitude in tropical regions. They require a well-drained soil preferably rich in organic matter. Seeds do not germinate below 15°C. Plants grow best with temperatures of 18 - 35°C. A soil pH of 6.5 is best. It suits hardiness zones 9 - 12.

**Use:** The young bitter fruit are cooked and eaten. They are boiled, stuffed, fried or pickled. They are used in soups, stews and stir-fried dishes. The seed mass of the ripe fruit is used as a food flavouring. The leaves are also cooked and eaten as a flavouring. The tender shoots and leaves are sometimes eaten. **Caution:** The leaves are considered to cause diarrhoea and vomiting.

**Cultivation:** Plants are grown from seed. For large scale plantings, 6 - 7 kg of seed are required for planting one hectare. Seeds are planted at 50 cm spacing in the place where the plants are to grow and need a stick to climb up. Often plants are grown on raised beds 2 m apart with 0.5 m between plants. The seed has a hard seed coat and germinates slowly. Soaking seeds for 24 hours before sowing gives a quicker more even germination. Regular watering is required.

**Production:** Fruit are ready to harvest 45 - 55 days after planting. Fruit should be harvested when young and tender. Once fruit have begun to change colour to yellow they are past maturity for eating. Early removal of young fruit also ensures continuous fruit setting. This can allow 6 - 8 successive pickings of fruit. Fruit on the plant are sometimes wrapped in paper to prevent fruit fly damage. Seed well stored can remain viable for 4 - 5 years. The young bitter fruit are cooked and eaten. The fruit is blanched or soaked in salt water to reduce the bitter taste.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	8.6	2020	18.6	-	-	-	-
leaf (raw)	84.7	252	5.0	44	170	7.1	0.3
leaf tip (boiled)	88.7	146	3.6	173	57	1.0	0.3
fruit	93.6	105	1.2	-	-	0.2	-
pod (boiled)	94.0	79	0.8	11	33	0.4	0.8
pod (raw)	94.0	71	1.0	380	84	0.4	0.8

## Vegetables

**English:** Moringa  
**Tetn:** Marungi

**Scientific name:** *Moringa oleifera*  
**Plant family:** MORINGACEAE

**Description:** A small, soft-wooded tree that grows 9 - 12 m tall. The tree loses its leaves during the year. The bark is grey, thick, corky and peels off in patches. The leaves are pale green and the leaf is divided 3 times. The whole leaf is 30 - 60 cm long and the leaflets are usually oval and 1 - 2 cm long. The leaflets are jointed with a gland near the joint. The flowers are pale yellow. They occur in long sprays 30 cm long. Each flower has 5 petals and of these one is erect and 4 are bent backwards. The fruit is a long capsule 30 - 100 cm long by 2 cm wide. The seed capsules are up to 45 cm long. They are roughly triangular in shape. The seeds have 3 wings. Often the fruiting kinds are grown as annual plants.



**Distribution:** A tropical and subtropical plant. They suit the dry lowland areas and grow up to 1,350 m altitude in the tropics. They are not hardy to frost. They cannot tolerate water-logging. A pH of 6 - 7.5 is suitable. It can grow in arid places. It suits hardiness zones 9 - 12.

**Use:** The young tops and leaves are eaten cooked. They are eaten as potherbs or used in soups and curries. They can be dried and stored for later use. The very young long pods are eaten cooked, especially in curries and soup. They are also pickled. The young seeds are eaten roasted or fried. Sometimes the roots are used as a horseradish substitute. A gum from the bark is used as seasoning. The bark is used for tea. The roots, leaves, flowers and fruits are eaten cooked in water and mixed with salt and chili peppers. The oil expressed from the seeds is used in salads.

**Cultivation:** It is best to grow plants from 1 metre long cuttings but they can be grown from seed. They can be used as a hedge and pruned regularly to produce more leaves. Properly dried seed can be stored for a long time in sealed containers in a cool place. Normally perennial types are grown from cuttings and annual types are grown from seed.

**Production:** Trees are fast growing. They can be pruned or topped. With one variety the tree flowers and fruits continuously while with the other variety there are flowers and fruit once per year. The fruit ripens 3 months after flowering. Annual types produce fruit 6 months after planting. Leaves are best dried in the shade to retain more of their Vitamin A.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	76.4	302	5.0	197	165	3.6	-
flower	84.2	205	3.3	-	-	5.2	-
leaf (boiled)	87	189	4.7	40	31.0	2.0	0.2
pod (raw)	88.2	155	2.1	7	141	0.4	0.5
seed	6.5	-	46.6	-	-	-	-

## Vegetables

**English:** Lotus root  
**Tetun:** Talas moris iha kolam laran

**Scientific name:** *Nelumbo nucifera*  
**Plant family:** NELUMBONACEAE

**Description:** A herb that grows in water and continues growing for several years. The rootstock is underwater and creeping. The leaf stalk grows 1 - 2 m tall. The leaves can be 20 - 90 cm across. It has large round leaves which stand out of the water. The stalk joins to the centre of the leaf. It has large attractive pink, red or white flowers which stand out of the water on long stalks. Flowers are pink or white and 15 - 25 cm across. The flower stalk can be longer than the leaf stalk. The mature fruit is a spongy cone-shaped structure with several seeds about 1 cm across under the holes in the top. These fruit can be 7 - 15 cm long. The edible rhizome is submerged in mud.



**Distribution:** It is a tropical plant but will grow in cooler places. It needs 20 - 30°C temperatures. It needs full sunshine. It can grow in deep water and does best in fresh water. The pH can range from 5.6 - 7.5. It suits hardiness zones 9 - 12. It will probably grow up to about 1,000 m altitude. It can grow in arid places.

**Use:** The seeds are eaten raw or roasted. Ripe seeds are prepared by removing the seed coat and the intensely bitter plumule and then boiled in syrup. Slightly unripe seeds are also eaten raw. The seeds can be used as a coffee substitute. The white roots or rhizomes are eaten raw with meat. They can also be boiled, pickled, stir-fried or preserved in sugar. It is also a source of starch.

**Cultivation:** It can be grown from sections of the root or from seed. Seed germinate between 25 - 30°C. The hard seed coat needs to be cracked to enable seed to grow. Seed will remain viable for many years. Plants grown from seed vary as seed do not breed true. It needs to be in water at least 30 - 50 cm deep. Rhizomes with 2 - 3 segments are used. They are put in the mud at a 30° angle.

**Production:** Plants grow quickly. Rhizomes are harvested all year round and contain an abundance of starch. Plants grown from seed take 2 years to produce. Plants grown from cuttings can produce the same year.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	38.8	545	8.8	2	3	8.0	0.2
seed (dry)	12.7	1440	16.3	3	-	5.6	1.1
seed (green)	80.8	312	4.1	1	-	1.0	0.3
root (boiled)	81.4	276	1.6	0	27.4	0.9	0.3

## Nuts, seeds, herbs and other foods

**English:** Coastal almond

**Tetun:** Ai ketapang

**Scientific name:** *Terminalia catappa*

**Plant family:** COMBRETACEAE

**Description:** A large tree, up to 25 - 40 m tall. It loses its leaves during the year. The trunk can be straight or twisted. There can be buttresses up to 3 m tall. The branches lie horizontally and come out in layers. The leaves are long, smooth and shiny, with an abrupt point at the tip and a rounded base. Leaves tend to be near the ends of branches. Leaves can be 17 - 29 cm long and 10 - 15 cm wide. Young leaves have soft hairs. The leaves turn red and fall off twice a year. Flowers are greenish-white and in a spike at the end of the branches. The lower flowers on a spike are female, and the others are male. The fruit is about 6 cm long by 3 - 4 cm wide, thick and flattened, with a flange around the edge. The fruit are green and turn red when ripe. The pulp is edible.



**Distribution:** It grows on beaches in almost all tropical countries in the world, including Solomon Islands. It is a tropical plant, and sometimes cultivated as a shade tree. The tree is common in lowland areas particularly on sandy or rocky beaches. Seeds are spread by bats and sea water, as well as being planted by people. It is common along streets in coastal towns. It will grow from sea level up to about 800 m altitude. Plants are frost-susceptible. It can tolerate drought. It suits hardiness zones 11 - 12.

**Use:** The kernel of the fruit is eaten raw. An edible oil can also be extracted.

**Cultivation:** Plants can be grown from seed. Seeds can be stored dry for a year or more. Seeds germinate freely and most seeds grow. Insects can badly damage the leaves of young seedlings.

**Production:** It is fast growing. Nut production is seasonal.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
nut (fresh)	31	1810	15.9	-	4	4.6	4.9
nut (dry)	4.2	2987	20.0	-	2	6.3	8.8

## Nuts, seeds, herbs and other foods

**English:** Nypa palm  
**Tetun:** Bua moris be laran

**Scientific name:** *Nypa fruticans*  
**Plant family:** ARECACEAE

**Description:** A palm with stout creeping underground stems. It forms clumps. The stems lie along the ground or can be underground in soft mud. The leaves have leaflets along a 7 m long axis. The leaves occur in erect clusters. The leaflets are up to 1.3 m long by 5 - 8 cm wide. The fruit are flat and 12 cm long by 10 cm across. They are crowded into a very characteristic large round fruiting head which is borne on a special erect stalk. The female flower is a round head on the end of the stalk and, below it, long male flowers are produced. The centre of the fruit is edible.



**Distribution:** It grows from Asia to the Pacific. It occurs along tidal streams and in tidal mud flats, and thrives in brackish swamps.

**Use:** The kernel inside the nut is edible. It is normally eaten while immature. Also, the base of the "nut" is chewed. Sugar (or vinegar) can be obtained by collecting the sap from the fruit stalk. Young shoots are eaten.

**Cultivation:** Plants can be grown from seed, or by dividing off suckers. Tree densities of up to 2,500 palms/ha occur but only 700 - 750/ha are sap producing. Plants are spaced at 1.5 - 1.7 m giving 390/ha where plantings occur. Plants are pollinated by insects, so contact insecticides need to be avoided. The almost full-grown head is cut off to collect sap. About 2 mm of the tip is removed each day during sap collection. Sap flow is increased by banging the trunk and tapping the fruit stalk regularly.

**Production:** Palms flower and fruit after 3 - 5 years. Yields of up to 1,500 ml of sap/day/palm over one month can be achieved. Tapping can occur for 50 years. Yields can be 87,000 litres of sap/ha.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
nut	88.9	-	1.6	-	2	0.4	-
shoot	94.1	59	0.7	-	-	0.6	4.5

## Nuts, seeds, herbs and other foods

**English:** Candle nut

**Tetun:** Ai-kami

**Scientific name:** *Aleurites moluccana*

**Plant family:** EUPHORBIACEAE

**Description:** A large tree, up to 40 m tall and 1 m diameter at the base. The bark is rough. The leaves are large and can be round, triangular or have several lobes. The leaves have a pale colour, and are alternate, silvery-green and crowded near the tips of branches. Young leaves are hairy and sometimes lobed. The leaves, leaf stalks and flowers are all covered with short, soft hairs. There are two distinct brown glands where the leaf blade and stalk join. The flowers are small and white and in large groups on the ends of branches. Male and female flowers are separate, but on the same tree. The female flowers are on the end surrounded by small, male flowers. The fruit is a large (4 - 5 cm across), green, two-lobed berry with 1 or 2 large (2.5 cm across) seeds in a hard, corrugated shell. They do not open naturally to release the seeds.



**Distribution:** It is a tropical tree. It mostly grows in the lowland rainforest, but can grow up to 2,000m altitude. It suits drier climates. It does well on well-drained sandy soil. It suits hardiness zones 10 - 12.

**Use:** The nuts are normally roasted. The hard, oily nut is used for thickening in Asian dishes. They are used in a sauce for the greens eaten with rice. Mostly, the nuts are roasted in the fire until the shell is blackened and half-burnt, then the kernels are taken out by cracking the shells. The nuts should probably only be eaten in moderate amounts. Because the kernels are high in oil, they can be burnt as candles. **Caution:** The nuts contain a moderately poisonous substance, so should be well-cooked before eating. The raw kernels of candle nut are poisonous. They are a strong purgative.

**Cultivation:** Candle nut trees are often self-sown, growing in the bush where the seeds fall. These small trees can be transplanted to a more suitable place if needed. Seeds are very hard-shelled. The seed coat needs to be cracked to get seeds to start growing more quickly. To do this, a single layer of seeds are put on the ground, covered with dry grass, then burnt. Immediately after burning, while the seeds are still hot, they are thrown into cold water, and then planted. This cracks the shells, allowing more rapid germination. Without this, it may take many months for this hard shell to break down and germination to commence. Trees can also be grown from cuttings.

**Production:** The tree grows quickly. Trees can start producing after one year and 30 - 45 kg of nuts can be produced on a tree in one year.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
nut	24.4	2426	7.8	-	-	2.7	2.7
nut (cooked)	1.4	2836	20.6	-	-	22.6	3.2

## Nuts, seeds, herbs and other foods

**English:** Polynesian chestnut

**Tetun:** Avocado fuik

**Scientific name:** *Inocarpus fagifer*

**Plant family:** FABACEAE

**Description:** A tree from 9 - 30 m tall with buttresses at the base of the trunk. The bark is dark grey and gives a red sap when cut. The branches droop downwards. The leaves are long (20 cm), leathery, shiny and feather-veined. The leaves have short stalks and alternate one after the other along the branch. The leaves are large and reddish when young, and shiny green when adult. The flowers are not obvious. They are pale yellow and hang loosely on the twigs where the leaves join. They have five narrow petals, joined in a tube. The flowers smell sweet.

The fruit is irregular, or kidney shaped, and is a one-seeded pod with ridges on the surface. It can be 8 - 10 cm across and 3 cm thick. The ripe fruit is yellow.



**Distribution:** It grows in most Pacific island countries, including Papua New Guinea, the Philippines and Solomon Islands. It also grows in Asia. It grows in the lowland primary and secondary forest from sea level up to 390 m altitude. It often grows near rivers and swamps and mostly as a clump of trees. It often grows very close to the water front. It grows better where there is no distinct dry season.

**Use:** Seeds are cooked and eaten. The fleshy layer around the seed is eaten after cooking. The nuts are usually roasted, although they can be boiled. Soaked nuts can be grated, mixed with coconut milk, and roasted in banana leaves. Seeds can be stored by partly fermenting them in pits in the ground. Nuts can be stored for a considerable time, but once shelled or cooked, will keep only a short time. It is an important food nut.

**Cultivation:** Plants are grown mostly from seed. Seeds are also naturally distributed by bats. Plants can be reproduced by cuttings of half-ripe wood. Seeds are the more common method of production. Seeds store easily for over a month, but their viability or usefulness declines fairly rapidly in salt water. It prefers swampy ground but also grows satisfactorily on higher slopes. It is presumed the plants have some salt tolerance, as they often grow along the foreshore.

**Production:** Time from planting to the first production of nuts is about 8 years. An average seed weighs 40 g. Fruit production occurs throughout the year, but there is a main fruiting season. Uncooked seeds can be stored.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
nut	43.0	1008	4.5	-	2	3.0	1.3

## Nuts, seeds, herbs and other foods

**English:** Cashew

**Tetun:** Caju

**Scientific name:** *Anacardium occidentale*

**Plant family:** ANACARDIACEAE

**Description:** An evergreen tree, with spreading branches, growing 7 - 14 m tall. The canopy can spread to 12 m. The roots grow deeply and spread widely. The shiny leaves are pale green and large. They are 10 - 15 cm long by 6 - 8 cm wide. They have fine veins. The flowers are produced on the ends of the branches. They are red in colour. The kidney-shaped nut is about 3 cm long and is borne below the "apple" which is really a fleshy stalk.



**Distribution:** It is a tropical plant that suits the lowland tropics but will grow up to about 1,200 m altitude. It only bears well in dry areas because of blight of the flowers. It grows best in temperatures of 22 - 26°C. A rainfall of 1,750 mm per year is considered suitable but good yields have been obtained with rainfall of 750 mm. It can grow on poor soils but needs good drainage.

**Use:** The fleshy "apple" is edible but acid until very ripe. It is used for jams, drinks, candy, chutney and pickles. The nut is eaten after roasting. The young shoots and leaves are edible. They are picked during the rainy season and eaten fresh with hot and spicy dishes. **Caution:** The oil of the nut can blister the skin until roasted. The apple is used to make spirits.

**Cultivation:** It is usually grown from seeds. Seeds germinate poorly and slowly. Only nuts which sink in water (or a solution of 150 g of sugar in a litre of water) should be planted. Seeds are sun dried for 2 - 3 days to improve germination. Seeds can be sown in a nursery then transplanted, or more commonly, are sown directly. Trees are spaced 7 - 10 m apart. The crop is cross pollinated mostly by insects. For good production, complete fertiliser or appropriate organic material should be applied. Pruning to shape the tree is often undertaken in the first 2 - 3 years. Cashews are often planted scattered in gardens or amongst other trees. Clearing under the tree prevents fire and makes finding nuts easier. Allowing nuts to fall before harvesting ensures only ripe nuts are collected. Resin in the cashew nut shell can damage hands and discolour the nuts. Roasting the nuts before removing the kernel avoids this.

**Production:** Trees commence bearing after 3 years. Fruit production is seasonal, normally October - January. Mature nuts are produced in 2 - 3 months. Yields of 80 - 200 kg of nuts per hectare are normal. Trees reach maximum production after 10 years and last for about 100 years.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
nut	4.0	2478	17.5	-	-	2.8	4.8
leaf	69.9	418	5.2	-	-	-	-
fruit	84.7	213	0.8	0.12	265	1.0	0.2

## Nuts, seeds, herbs and other foods

**English:** Ginger  
**Tetun:** Ai-Lia

**Scientific name:** *Zingiber officinale*  
**Plant family:** ZINGIBERACEAE

**Description:** A perennial herb with swollen, underground stems. It can grow 30 - 100 cm tall. The underground stem, or rhizome, branches and is horizontal near the soil surface. It is about 1.5 - 2.5 cm thick. Inside the rhizome is yellow, and it is covered with scales forming a circle around it. The leaves are 30 cm long and 4 cm wide. Each leafy shoot usually has 8 - 12 leaves in two vertical lines on opposite sides. The leaf blade narrows evenly to the leaf tip. The flower is a cone, 6 cm long on a stalk up to 30 cm long. (Flowers are not produced in all locations.)



**Distribution:** It grows in many tropical countries. It is a tropical plant. It is mainly grown from sea level up to 1,900 m altitude in the tropics, but will grow at higher altitudes. It needs a loose, fertile soil. It does best with plenty of humus. It requires a rainfall of 1,500 mm or more per year. It does best where there is a short, dry season and hot temperatures. It cannot stand water-logging and suits hardiness zones 9 - 12.

**Use:** The underground rhizome is eaten. The young shoots are spicy and can be eaten as a vegetable. The rhizome can be dried, powdered and used as a spice. Oil of ginger is used as a flavouring. Ginger is used for drinks.

**Cultivation:** A portion of the rhizome is planted 5 - 7 cm below the surface of the soil. Light shade is sometimes used but it can be grown without shade.

**Production:** It takes 12 months to mature. It is harvested several times. The young shoots are cut when about 7.5 cm high.

**Food Value:** Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
root	87.4	193	1.6	-	-	1.3	-
root (dry)	9.4	1452	9.1	15	7	11.5	4.7

## Nutritional values of food plants by plant Family

Plant Family	Scientific name	Common name (English)	Common name (Tetun)	Common name (Indonesian)	Edible part	Moisture %	Energy kJ	Protein g	Vit A µg	Vit C mg	Iron mg	Zinc mg	Page
Amaranthaceae	<i>Amaranthus tricolor</i>	Amaranths	Modo bayam	Bayram	leaf	91.7	96	2.5	292	43.3	2.3	0.9	29
Amaryllidaceae	<i>Allium cepa var cepa</i>	Bulb onion	Lis mean	Bawang merah	bulb (raw)	92.8	99	0.9	-	10	0.3	0.1	45
Anacardiaceae	<i>Mangifera indica</i>	Mango	Has timor	Mangga	fruit	83.0	253	0.5	54	30	0.5	0.04	40
Anacardiaceae	<i>Anacardium occidentale</i>	Cashew	Caju	Jambu mete	nut	4.0	2478	17.5	-	-	2.8	4.8	56
Annonaceae	<i>Annona muricata</i>	Soursop	Ai-ata boot	Sirsak	fruit	82.4	294	0.88		16	0.3	0.1	37
Araceae	<i>Colocasia esculenta</i>	Taro	Talas	Talas	leaf	85.0	210	5.0	57	90	0.62	0.7	12
Araceae	<i>Xanthosoma sagittifolium</i>	Chinese taro	Talas	Tajam Molek	root	67.1	559	1.6	5	13.6	0.4	0.5	20
Arecaceae	<i>Nypa fruticans</i>	Nypa palm	Bua moris be laran		nut	88.9	-	1.6	-	2	0.4	-	53
Athyriaceae	<i>Diplazium esculentum</i>	Sweetfern	Modo kabura	Pakis/Paku	frond	94	81	2.4	211	2.0	2.4	1.8	32
Basellaceae	<i>Basella alba</i>	Indian spinach	Modo mean (dollar ai leten)	Gendola/remayong	leaf	85.0	202	5.0	56	100	4.0	-	35
Combretaceae	<i>Terminalia catappa</i>	Coastal almond	Ai ketapang	Ketapang	nut (fresh)	31	1810	15.9	-	4	4.6	4.9	52
Convolvulaceae	<i>Ipomoea batatas</i>	Orange Sweet potato	Fehuk-midar kór laranja	Ubi Jalar/Ubi Manis	tuber (baked)	72.9	431	1.7	961	24.6	2.4	1.3	10
Convolvulaceae	<i>Ipomoea aquatica</i>	Kangkong	Kanko	Kangkung	leaf	90.3	126	3.9	40	60	4.5	-	31
Cucurbitaceae	<i>Citrullus lanatus</i>	Watermelon	Pateka	Semangka	seed	5.1	2330	28.3	0	0	7.3	10.2	42
Cucurbitaceae	<i>Sechium edule</i>	Choko	Lakeru mutin	Labu Siam	leaf	91.0	105	4.0	75	24	1.4	-	48
Cucurbitaceae	<i>Momordica charantia</i>	Bitter cucumber	Baria	Pari(Kupang)/Pare(Jawa)	pod (raw)	94.0	71	1.0	380	84	0.4	0.8	49
Dioscoreaceae	<i>Dioscorea esculenta</i>	Lesser yam	Kumbili	Ubi Jalar kuming	tuber	74.2	470	2.1	84	20	0.75	0.5	16
Euphorbiaceae	<i>Manihot esculenta</i>	Cassava	Ai-Farina	Ubi Kayu/Singkong	tuber	62.8	625	1.4	30	15	0.23	0.48	14
Euphorbiaceae	<i>Sauropus androgynus</i>	Sweetleaf		Katuk/Chang Kok	leaf	81	244	4.8	133	85	2.7	-	33
Euphorbiaceae	<i>Aleurites moluccana</i>	Candle nut	Ai-kami	Kemiri	nut	24.4	2426	7.8			2.7	2.7	54
Fabaceae	<i>Psophocarpus tetragonolobus</i>	Winged bean	Duhaen	Kecipir/Kacang Botor	seed	8.5	1764	41.9	-	-	15.0	4.5	21
Fabaceae	<i>Arachis hypogea</i>	Peanut	Forae rai	Kacang tanah	seed (dry)	4.5	2364	24.3	-	-	2.0	3.0	22
Fabaceae	<i>Vigna unguiculata subsp. sesquipedalis</i>	Snake bean	Fore talin naruk	Kacang Panjang	seed (dry, raw)	8.43	1453	24.33	0.16	1.6	8.61	3.5	23
Fabaceae	<i>Cajanus cajan</i>	Pigeon pea	Tunis	Kedelai putih	seed	10.0	1449	19.5	55	-	15.0	-	24
Fabaceae	<i>Lablab purpureus</i>	Lablab bean	Ervilla	Kacang Kara, Kerara(Jawa), Komak	seed (dry)	10.0	1428	22.8	-	-	9.0	-	25
Fabaceae	<i>Phaseolus vulgaris</i>	Red kidney bean	Fore/Koto	Buncis	seed (dry)	10.0	1386	25.0	10	1	8.0	2.8	26
Fabaceae	<i>Phaseolus lunatus</i>	Lima bean	Ervilla nurak	Kacang kratok, kacang jawa atau kekara	seed	12.0	1407	19.8	-	-	5.6	-	27
Fabaceae	<i>Glycine max</i>	Soybean	Fore keli		seed	9.0	1701	33.7	55	-	6.1	-	28

Plant Family	Scientific name	Common name (English)	Common name (Tetun)	Common name (Indonesian)	Edible part	Moisture %	Energy kJ	Protein g	Vit A µg	Vit C mg	Iron mg	Zinc mg	Page
Fabaceae	<i>Inocarpus fagifer</i>	Polynesian chestnut	Kastaña Polinézio	Gatep(Bali), Bosua(Sulawasi), Gayam	nut	43.0	1008	4.5	-	2	3.0	1.3	55
Gnetaceae	<i>Gnetum gnemon</i>	Spinach jointfir		Melimjo	leaf	66.0	378	5.9	308	1.5	2.7	12.1	34
Lauraceae	<i>Persea americana</i>	Avocado	Abokat	Avokat	fruit	74.4	805	1.8	480	11	0.7	0.4	44
Malvaceae	<i>Abelmoschus manihot</i>	Slippery cabbage	Gedi tahan	Daun gedi, daun dedi, daun belender	leaf	88	120	3.4	1.0	7.0	1.5	1.2	30
Malvaceae	<i>Abelmoschus esculentus</i>	Okra	Okra	Kacang Panjang	pod (fresh)	88.0	151	2.1	185	47	1.2	-	47
Moraceae	<i>Artocarpus altilis</i>	Breadfruit	Kulu	Sunkun	fruit & seed	87.1	192	2.0					18
Moringaceae	<i>Moringa oleifera</i>	Moringa	Marungi	Marungga	leaf	76.4	302	5.0	197	165	3.6	-	50
Musaceae	<i>Musa sp (A &amp;/or B genome) cv.</i>	Banana	Hudi	Pisang	fruit (cooking)	65.3	510	2.0	113	18.4	0.6	0.1	36
Myrtaceae	<i>Syzygium malaccense</i>	Malay-apple	Jambu air	Jambu Bol	fruit	91.1	105	0.4	-	15	0.4	0.1	43
Nelumbonaceae	<i>Nelumbo nucifera</i>	Lotus root	Talas moris iha kolam laran	Teratai/Lotus	seed	38.8	545	8.8	2	3	8.0	0.2	51
Poaceae	<i>Setaria italica</i>	Foxtail millet	Batar talin naruk	Rumput Gaja/Rumput Benggala	seed	13.5	1425	9.5	-	-	5.5	3.5	17
Rutaceae	<i>Citrus maxima</i>	Pomelo	Jambua	Jeruk Bali	fruit (raw)	90.3	175	0.6	20	37	0.4	-	38
Sapindaceae	<i>Pometia pinnata</i>	Pacific lychee	Ai-maras metan	Leungsir	fruit	87	211	1.1	3	5	0.5	0.3	39
Solanaceae	<i>Lycopersicon esculentum</i>	Tomato	Tomati	Tomat	fruit	93.0	88	1.2	45	26	0.6	0.1	46
Zingiberaceae	<i>Zingiber officinale</i>	Ginger	Ai-Lia	Jahe	root	87.4	193	1.6	-	-	1.3	-	57



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