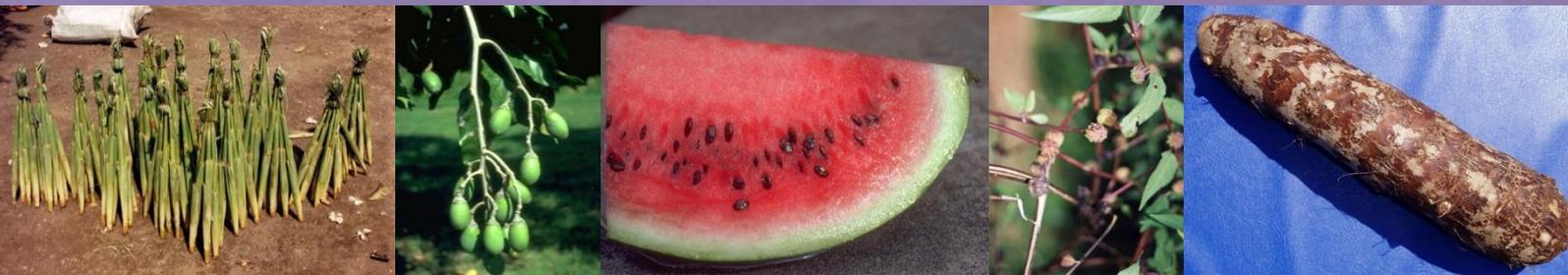


# Potentially Important Food Plants of the Western Pacific



**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)



# Potentially Important Food Plants of the Western Pacific

## **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 John McPhee working in a voluntary capacity using the selection criteria developed by the Food Plant Solutions project. 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. It is intended as a **Draft Guide only** to indicate some important food plants that serve as examples for this purpose. 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 a number of the Pacific Islands. This guide has been developed with the best intention to create interest and improve understanding of the important local food plants of the Pacific Islands, and on the understanding that it will be further edited and augmented by local specialists with appropriate knowledge and understanding of local food plants.

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 a number of the Pacific Islands. 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.

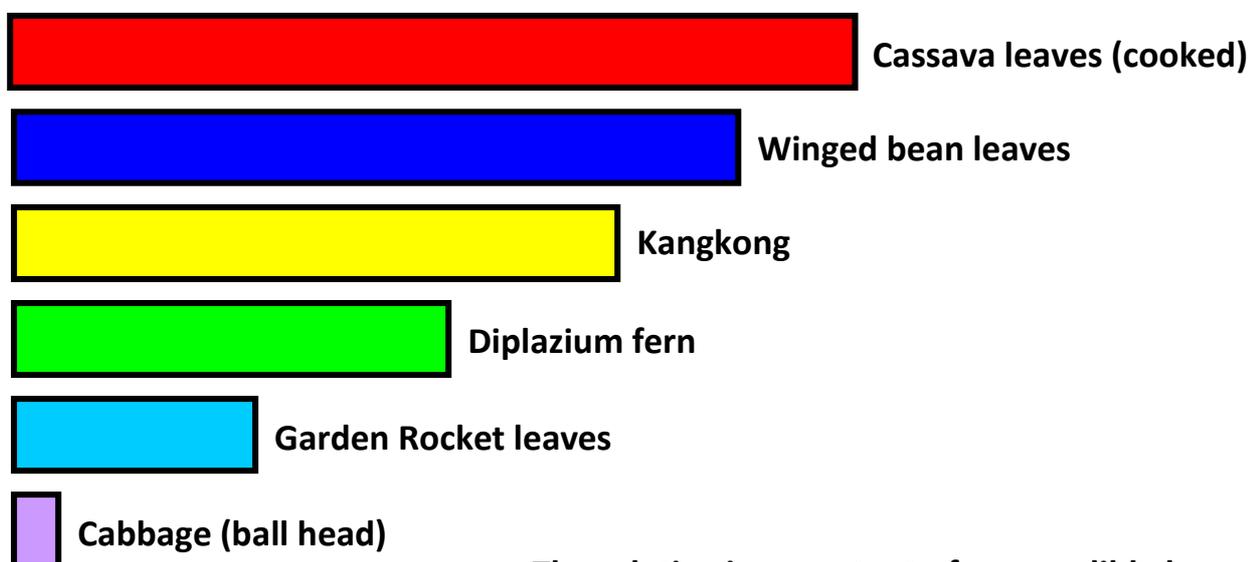
## **Naming of plants**

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.

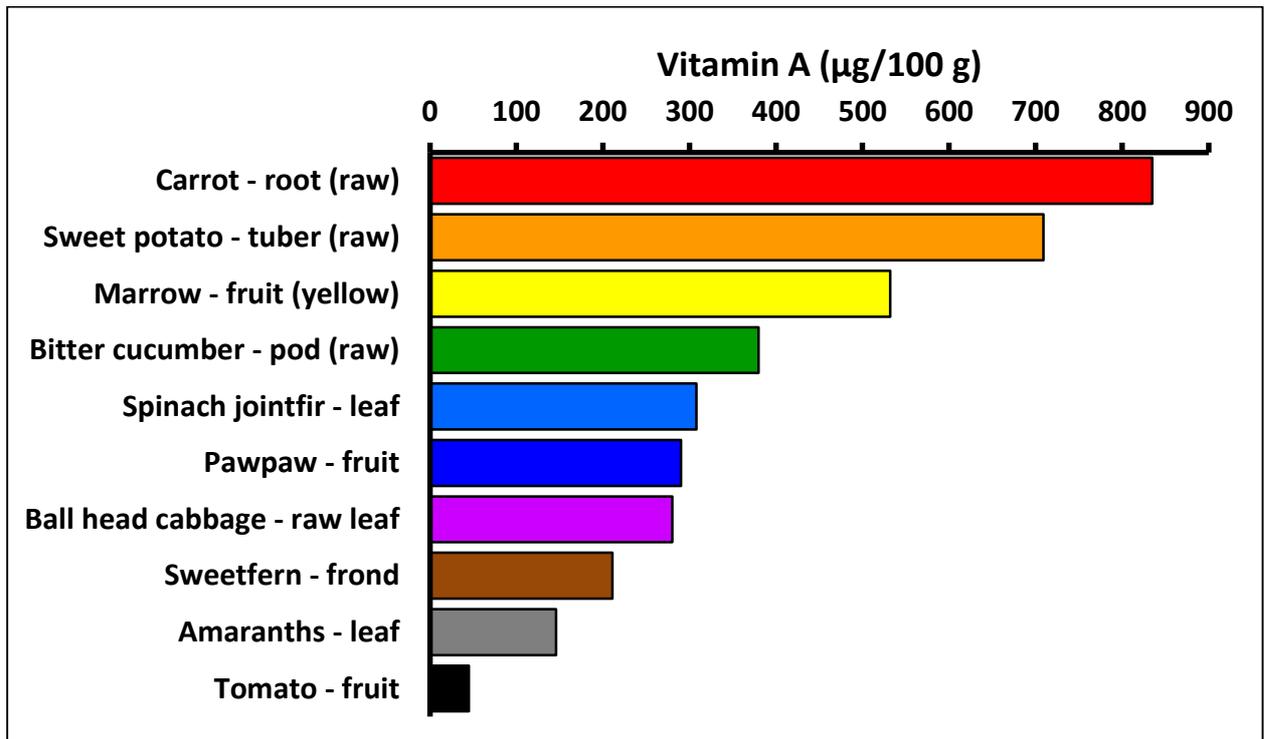
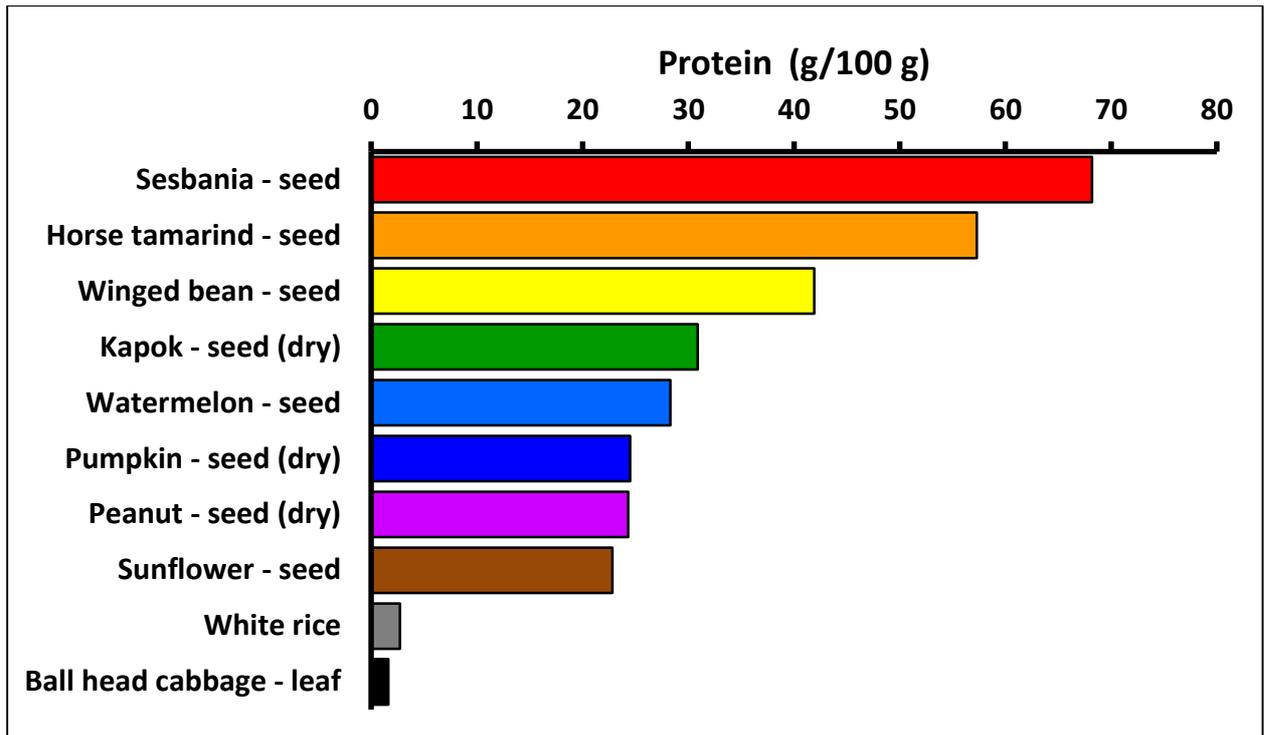
## **Pests**

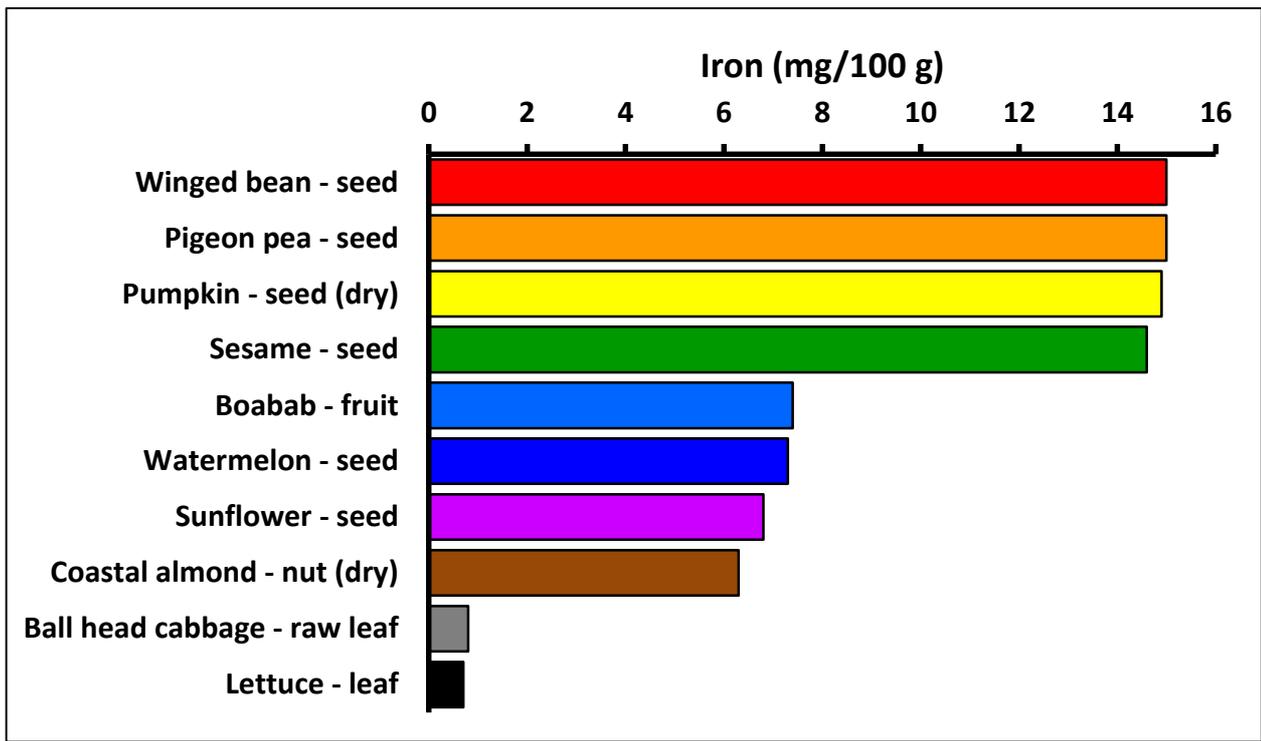
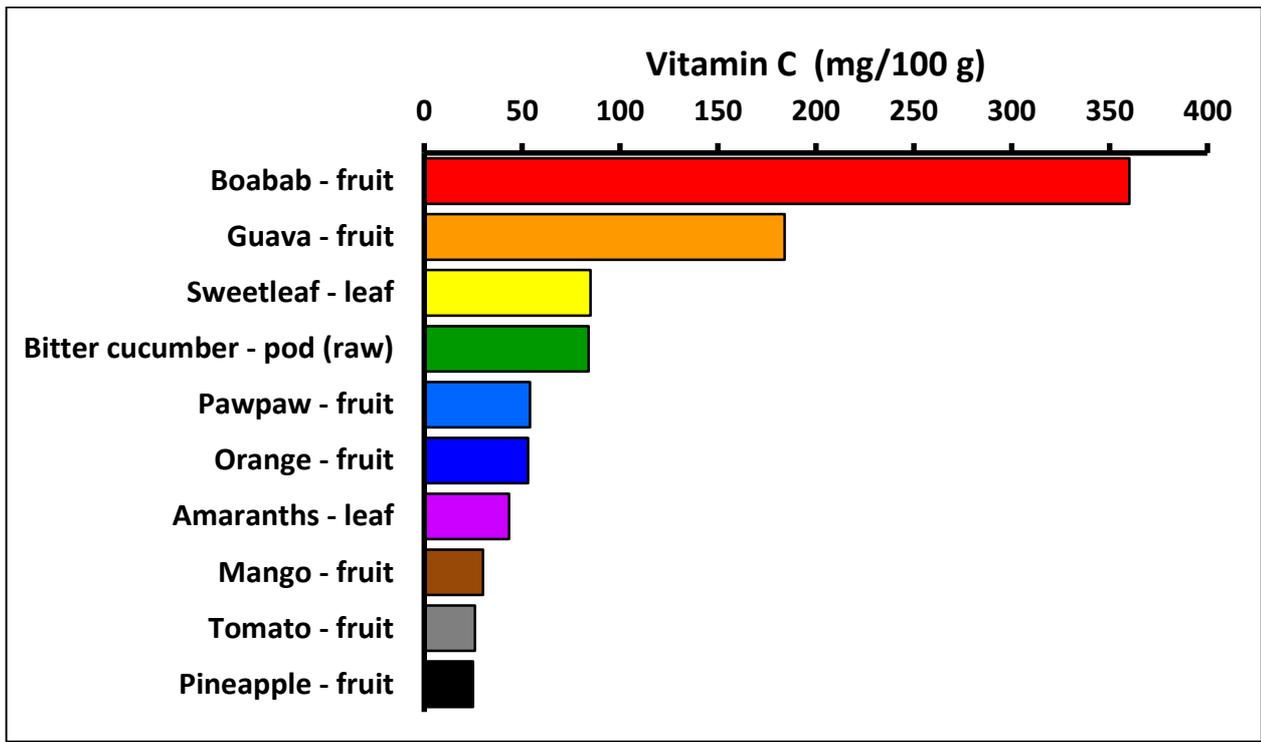
There are a large number of insects that enjoy sharing our food with us! We should not try to kill all these insects as they have an important role to play in keeping everything in nature in balance. What we need to do is to learn to manage these insects so we can all get some food to eat! Some insects 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.

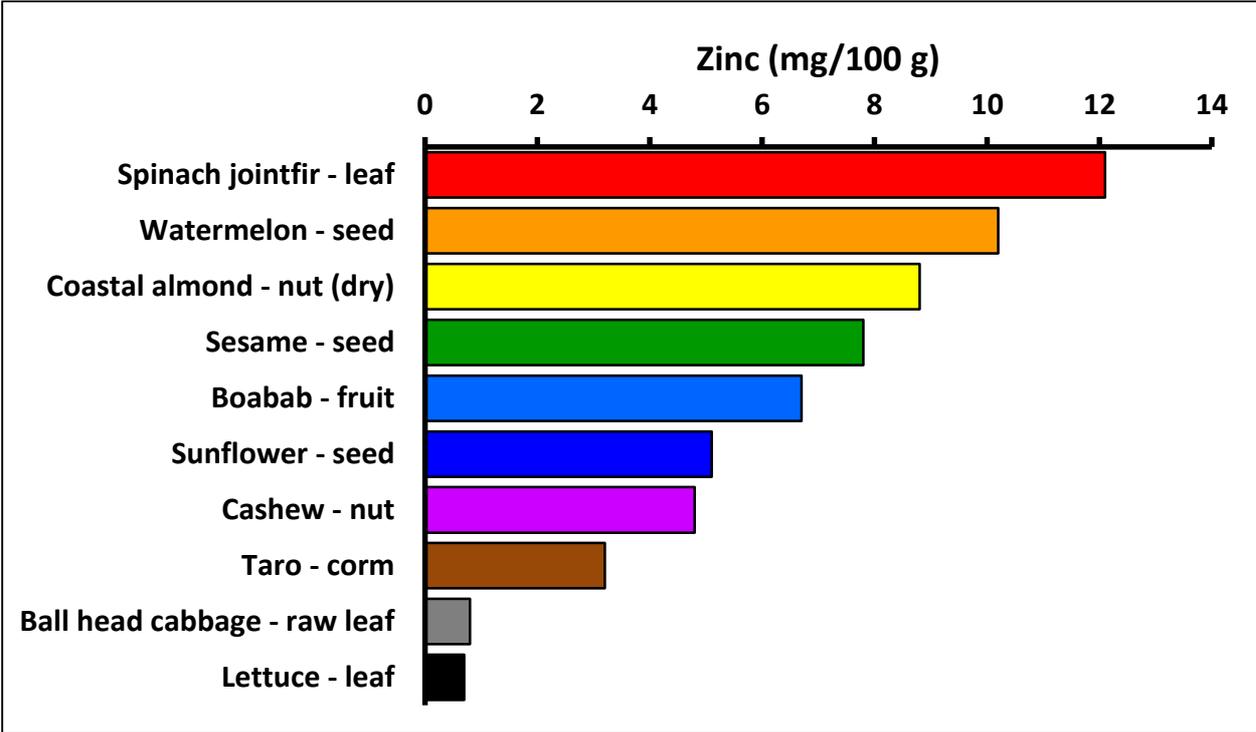
## **Diseases**

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 the Pacific Islands







## ***Starchy staples***

**English:** Sweet potato

**Local:**

**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. Under the ground fattened tubers are produced. 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. Sweet potato are not tolerant to shading. Under shaded conditions, both foliage growth and storage root production are decreased. Some cultivated varieties 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 leaves which are however larger. With increasing shade less tubers are produced and these grow more slowly. Sweet potato tends to be responsive to potassium fertiliser. cultivated varieties 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. 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. Fresh sweet potato seeds germinate relatively easily and lead to continuous production of new cultivars under tropical conditions. 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.

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**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        | 0.5     | 0.3     |
| 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     | -       |

## Starchy staples

**English:** Taro

**Local:**

**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   | Moisture % | 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:** Chinese taro

**Local:**

**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

| <b>Edible part</b> | <b>Moisture %</b> | <b>Energy kJ</b> | <b>Protein g</b> | <b>proVit A <math>\mu</math>g</b> | <b>proVit C mg</b> | <b>Iron mg</b> | <b>Zinc mg</b> |
|--------------------|-------------------|------------------|------------------|-----------------------------------|--------------------|----------------|----------------|
| 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            | -              |

## Starchy staples

**English:** Swamp taro

**Local:**

**Scientific name:** *Cyrtosperma merkusii*

**Plant family:** ARACEAE

**Description:** A large perennial taro family plant usually up to 2 - 3 m tall, although some plants can grow 4 m. The leaves are very large, upright and with points on the bottom lobes. The leaf stalks are up to 2.5 m long and 10 cm across. The leaves are 1.5 m long. Other aspects of the plant can vary, for example, some types are more spiny on the leaf stalks than others. There is a large fattened rhizome, or corm, under the ground. This is shaped like a cylinder and can be up to 70 kg in size. The plant produces a large purple lily-type flower which then produces a group of seeds which are orange in colour. The plant produces suckers. The number of suckers varies with varieties.



**Distribution:** Swamp taro grows in Asia and most Pacific countries including Solomon Islands. It is a tropical plant and grows from 18°N - 20°S. It grows in fresh or brackish swamps up to 150 m altitude. Water 0.6 - 0.9 m deep and rich in humus is the environment used. It can tolerate shade and can withstand flooding. It is found in valleys in central and southern parts of the Philippines. It is grown in Visayas and Camarines in the Philippines. It is an important plant in Bougainville. It grows in fresh or brackish swamps up to 150 m altitude and on atoll islands.

**Use:** The corms are peeled and boiled or roasted. They are also used to make flour. Leaves and young flowers can be eaten. Swamp taro is an important reserve food in damp areas of Solomon Islands.

**Cultivation:** Plants are normally put in swamps or ditches. Parts of the main corm, or suckers, can be used for planting. It can be intercropped with Colocasia taro. A spacing of 1.2 m x 1.2 m is suitable. It normally receives little management. It is known to respond to organic matter.

**Production:** Yields of 10 - 15 tonnes/ha/year have been recorded. It takes 2 - 6 years to mature. Tubers become more fibrous with time, so 2 years is a suitable harvesting time. Individual corms can weigh 2 - 50 kg.

**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        | 72.4       | 343       | 1.1       | 5           | 15.7        | 1.3     | 0.1     |

## Starchy staples

**English:** Cassava

**Local:**

**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

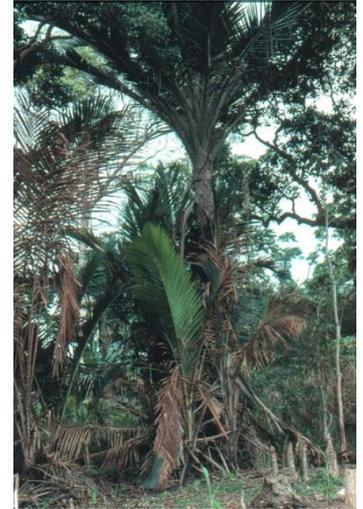
**English:** Sago

**Local:**

**Scientific name:** *Metroxylon sagu*

**Plant family:** ARECACEAE

**Description:** A clumping palm. It can grow 10 - 70 m tall with a fat trunk (50 - 75 cm across). A palm can have 18 -24 leaves which are 5 - 7 m long. The leaflets can be 50 - 160 cm long by 3 - 6 cm wide with up to 100 per leaf. After about 15 years, the palm produces a large flower on top, then the palm dies. The flowering stalk can be 5 - 7 m long. The palm has suckers near the base. Some types have fertile seeds, about 2 - 3 cm across, on the flower. There is a complete range from very long thorns to short or no thorns on the leaf bases.



**Distribution:** It grows in India, Indonesia, Malaysia, Philippines and Thailand in Asia, and Australia, Papua New Guinea and Solomon Islands in the Pacific. A high water table is tolerated by the plant. Temporary flooding does not appear to affect the crop, but permanently flooded sites do not appear to be suitable. Because of the site requirements, sago is almost always on locally level ground. The level ground can be a broad, flat basin or flood plain, or a local depression or stream edge in more hilly countryside. Sago seedlings can tolerate one rather salty flooding per fortnight. The maximum altitude is about 1,200 m, but the optimum is between sea level and 800 m. Sago palms grows well in wet conditions. They can tolerate saline or brackish water. They grow better in well-drained than in poorly-drained conditions. It suits hardiness zones 11 - 12.

**Use:** Sago starch can be processed from the pith. It is cooked and eaten. The bud can be eaten cooked. The sap can be collected for a drink called “tuba” in the Philippines. Sago grubs are often cultivated and eaten. The starch can be used to produce alcohol for motor fuel. One tonne of starch produces about 325 litres of alcohol.

**Cultivation:** Suckers or seedlings are planted in fresh water swamps or along creeks. Once stands are established in swamps, they continue to re-grow from suckers. Plants are thinned by removing some suckers. Some “seeds” will not grow, but those that are fertile need to be planted as soon as they form or they won’t grow. Seeds germinate within 3 weeks. To plant sago, the planting site near a creek or in a damp place is first cleared of trees and rubbish. Then a sucker of a suitable variety is chosen from an old sago clump. Often the fronds of the sucker are up to 3 m high. It should be checked to see if the sucker is old enough. A sucker ready for planting has a tough woody connection to the base of the old palm. It is also checked to see that fresh roots are being produced from the base of the sucker. A suitable sucker probably has fronds 3 - 4 m long and is about 1.5 years old. This is chopped through with an axe. The sucker is then simply taken to a new site and planted in a shallow hole 30 cm x 30 cm x 30 cm. If several palms are being planted, they should be about 7 m apart. The only other attention the new palm needs is an occasional weeding when competing plants get too thick. If a suitable seedling is available, it can be replanted where it is wanted. Once planted, the sago groves renew themselves through suckers and an almost permanent stand is produced. The optimum spacing is considered to be 275 clumps per hectare. This would be thinner than that which occurs in most naturally established stands. It is also considered that for one clump, thinning out suckers so that only 3 suckers of different ages are maintained, gives the best harvestable yield. Higher yields per trunk reduce the amount of labour involved in processing the pith (the centre of the stem).

**Production:** Palms are ready to harvest after about 15 years. In swamps, about 10 - 60 trunks are ready per hectare, each year. An average processing rate is 2.2 kg of starch per hour. A single trunk can yield up to 400 kg of sago. Palms in poor soil grow more slowly. Normally, one main trunk grows up, but several small suckers may shoot up around the base. Sometimes these suckers spread out and the space between the palms becomes crowded. Too much competition between clumps slows down the growth of the main palm, so the grove needs to be thinned out. This is very easily done. A small hole (10 cm x 10 cm) is cut with an axe into the top of the trunk of a sucker that is not wanted. This hole lets the sago beetle in and the sago grubs, which develop quickly, kill the sucker. They don't get into the main palm or other suckers unless a hole is made. After a few months, when the sucker is seen to be dead, it can be split open to provide a feed of sago grubs.

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

| Edible part | Moisture % | Energy kJ | Protein g | proVit A $\mu$ g | proVit C mg | Iron mg | Zinc mg |
|-------------|------------|-----------|-----------|------------------|-------------|---------|---------|
| trunk       | 27         | 1197      | 0.2       | -                | 0           | 0.7     | -       |
| palm heart  | 91         | 179       | 1.8       | 0                | 2.0         | 0.2     | 0.5     |

## Starchy staples

**English:** Lesser yam

**Local:**

**Scientific name:** *Dioscorea esculenta*

**Plant family:** DIOSCOREACEAE

**Description:** A prickly, climbing yam with a spiny vine. It can climb 1.2 - 2.4 m high and spread 1.8 m 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 12 cm 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, 4 mm 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 | Protein | proVit A | proVit C | Iron | Zinc |
|-------------|----------|--------|---------|----------|----------|------|------|
|-------------|----------|--------|---------|----------|----------|------|------|

|       | <b>%</b> | <b>kJ</b> | <b>g</b> | <b>µg</b> | <b>mg</b> | <b>mg</b> | <b>mg</b> |
|-------|----------|-----------|----------|-----------|-----------|-----------|-----------|
| tuber | 74.2     | 470       | 2.1      | 84        | 20        | 0.75      | 0.5       |

## Legumes

**English:** Winged bean

**Local:** Omwitanjoka (Runyankole)

**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:** Snake bean

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

**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    |

## Legumes

**English:** Sesbania

**Local:**

**Scientific name:** *Sesbania grandiflora*

**Plant family:** FABACEAE

**Description:** A shrub or small tree up to 5 - 10 m tall. The trunk has rough bark and the branches often droop. The trunk is thick. The branches are hairy when young. The leaves are made up of 41 - 61 leaflets. These are narrow and oblong. They are 2.5 - 4 cm long by 0.5 - 1.4 cm wide. They have a sharp point at the tip. The flowers are large and white to red. The flower petals can be 5 - 10 cm long. They are produced as 2 - 4 flowers on flowering branches 2 - 5 cm long. It has long narrow pods with up to 30 - 50 small brownish seeds. The seeds with their stalk can be 2.5 - 4.5 cm long in pods 20 - 25 cm long by 7 - 9 mm wide.



**Distribution:** A tropical plant. It grows in tropical and subtropical climates. It grows in places with an average rainfall of 900 - 1,200 mm and a temperature range of 17 - 25°C minimum and 25 - 37°C maximum. It is cultivated in coastal towns. It does well in both dry and moist areas. It probably grows up to about 1,500 m altitude in tropical places. It does best in rich moist soils. It needs a sunny location. It is damaged by frost. It can grow in arid places. It suits hardiness zones 10 - 12.

**Use:** The leaves and flowers are used as a vegetable. The young pods are also eaten. The young leaves are stripped from the stalks and lightly boiled or steamed or served as a vegetable in curries. The edible flowers of the white variety contain a considerable amount of sugar and iron and are said to taste like mushrooms. Flowers of the red-flowered variety are bitter and hence, are only used as an ornamental. The flowers are boiled, fried or used in curries, soups and stews. **Caution:** The seeds are toxic and need to be fermented before use.

**Cultivation:** Trees are grown from seed. The seed often need seed treatment to break the hard seed coat. Seeds germinate best with temperatures above 19°C. It can be grown from cuttings.

**Production:** It is a quick growing, short-lived, tree. Trees flower in their second year. A tree can provide 6 - 9 kg of leaves per year. The leaves can be harvested 120 - 150 days after sowing. Repeat harvests can be made each 30 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        | 82.3       | 323       | 8.7       | 66          | 60          | 4.0     | -       |
| flower      | 89.0       | 92        | 1.8       | -           | 59          | 0.6     | -       |
| seed        | 10.4       | -         | 68.2      | -           | -           | -       | -       |

Image sourced from: [http://academic.uprm.edu/eschroder/Sesbania\\_gradiflora3.JPG](http://academic.uprm.edu/eschroder/Sesbania_gradiflora3.JPG)

## Legumes

**English:** Horse tamarind

**Scientific name:** *Leucaena glauca*

**Plant family:** FABACEAE

**Description:** A small evergreen tree that grows to 10m tall.

**Distribution:** A tropical plant. It needs fairly good soils.

**Use:** The leaves can be eaten in small amounts. The young pods can be boiled and eaten. The mature seeds can be roasted, ground and used as a coffee substitute.

**Cultivation:** Plants are grown from seed. Seed germinate easily.

**Production:** It grows very rapidly, reaching 8 m in 18 months. It can stand only light frosts.



**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        | 13.7       | -         | 57.3      | -           | -           | -       | -       |
| leaf        | -          | -         | -         | 32          | -           | -       | -       |

## Legumes

**English:** Peanut

**Local:**

**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:** Pigeon pea

**Local:**

**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     |

## Leafy greens

**English:** Edible hibiscus

**Local:**

**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:** Sweetleaf

**Local:**

**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:** Sweetfern

**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:** Amaranths

**Local:**

**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:** Spinach jointfir

**Local:**

**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:** Ofenga

**Scientific name:** *Pseuderanthemum whartonianum*

**Plant family:** ACANTHACEAE

**Description:** Small shrubs up to 6 m high. The leaves are oval and narrow to a point at both ends. The veins are easy to see. The flowers are white, with a purple throat.

**Distribution:** It grows in coastal and inland areas in Solomon Islands and Vanuatu.

**Use:** The leaves are eaten cooked. Sometimes, the water is changed to remove bitter tastes. It is an important edible vegetable in Solomon Islands.



**Cultivation:**

**Production:**

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

| Edible part | Moisture % | Energy kJ | Protein g | proVit A $\mu$ g | proVit C mg | Iron mg | Zinc mg |
|-------------|------------|-----------|-----------|------------------|-------------|---------|---------|
|             |            |           |           |                  |             |         |         |

## **Fruit**

**English:** Pineapple

**Local:**

**Scientific name:** *Ananas comosus*

**Plant family:** BROMELIACEAE

**Description:** A perennial herb with a rosette of long, thick, spiky leaves, up to 1 m high and spreading 1 - 1.5 m. The leaves are arranged in spirals. Some kinds have thorns along the edges of the leaves. The plant produces suckers, both near the base of the stem and also higher up the stem near the fruit. These are called slips, or suckers, and are broken off and used for planting. The main plant dies after producing a fruit, but the suckers keep growing. The plant produces a flower and fruit at the end. The fruit is made up of about 150 berry-like fruitlets that are almost fused together. There is a small crown of leaves on top of the fruit. The fruit can be 25 cm long and weigh 0.5 - 4 kg. There are two main types of pineapples. The rough-leafed variety has spines on the leaves and produces a smaller but sweeter fruit. The smooth leaf variety has spineless leaves and larger fruit.



**Distribution:** The plant has been taken to most tropical and subtropical places. It is a tropical plant. It grows up to 1,800 m altitude near the equator. It can survive brief periods down to freezing, but cold retards growth, delays fruiting, and causes fruit to be more acid. A loose, well-drained soil with high organic matter is best. It can survive drought, but adequate soil moisture is necessary for good fruit production. Pineapples need an annual average temperature of 17.2 - 26.9°C. Growth ceases below 20°C. In the equatorial tropics, this is mostly between sea level and 1,800 m altitude. Pineapples need well-drained and fertile soil. It suits an acid soil and can develop roots in soils where lime has been added. The soil acidity can be between pH 3.3 - 6.0. The best range is pH 4.5 - 5.5. Soils which are not sufficiently acid can be treated with sulphur. It suits hardiness zones 9 - 10.

**Use:** The fruit is eaten fresh or used for juice. Unripe fruit are also cooked and eaten. The young, heart-leaves can be eaten. It is an attractive and popular snack food.

**Cultivation:** The suckers, slips, and the top of the fruit, can be used for planting. The time to maturity is the fastest for the suckers near the bottom of the plant and slowest when the top of the fruit is planted. Therefore, use suckers that grow from the stem near the ground for earliest yield. Pineapple flowering hormone can be used for fruit production with thorny varieties and calcium carbide for smooth varieties. Fruiting is less seasonal in the highlands than in the lowlands. Pineapples can be planted with 35,000 - 43,000 plants/ha or 3 - 4 plants per square metre. If plants are spaced more widely, they produce more suckers. Fruits become more acid where plants are closely spaced. If too many suckers are left growing from the main plant, then smaller fruit will be produced. They can grow in partial shade and, in this situation, the plants are normally more green. The red colouring of pineapple leaves is due to a deficiency of the nutrient nitrogen. This shows up more quickly in plants in full sunlight. When the plant is sufficiently large, it responds to changes, such as less available nutrients or water, and starts to produce a flower, then a fruit. The number of hours of sunlight, as well as reducing temperature and reduced sunlight, also help the flowers form. The result of this is that flowering and fruiting is often seasonal. This can easily be changed by using a fruiting hormone which allows fruit to be produced at times to suit the grower. Pineapples can grow in semi-arid conditions because the leaves can store some water. They also

tend to lose only small amounts of water from evaporation through their leaves, but they can grow well with plenty of water. The roots are very sensitive to water-logging, so the soil must be well-drained. Pineapples do not cover the soil well, so it is good to use a mulch of plant material to help weed control, provide some nutrients and to stop soil erosion.

**Production:** Plants usually produce for about 4 years. Fruiting is less seasonal in the highlands than in the lowlands in the tropics. The growth rate for pineapples slows at cooler temperatures. Plants grown in the highlands, or at higher latitudes, take longer to mature. It takes 60 days from when the flower starts to form until the fruit appears, then a further 5 months until the fruit is ready for harvest. The time from planting to harvesting ranges from 11 - 32 months, depending on temperature. The fruit are smaller, poorer shape and more acid where the temperatures are lower or there is less sunlight.

**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       | 84.3       | 194       | 0.5       | 60          | 25          | 0.4     | 0.1     |

## Fruit

**English:** Pawpaw

**Local:**

**Scientific name:** *Carica papaya*

**Plant family:** CARICACEAE

**Description:** Pawpaw is a tropical fruit that grows 3 - 5 m tall and only occasionally has branches. The stem is softly woody with scars from fallen leaves along it. There is a clump of leaves at the top of the plant. The leaves are large (50 cm wide) deeply lobed and on leaf stalks up to 90 cm long. Trees can be male, female or bisexual. Male flowers are small and white and on long stalks. Female and bisexual flowers are on short stalks. These have no fruit, round fruit and long fruit respectively. There are three forms of long fruit. The seeds are black.



**Distribution:** It is a tropical plant that grows from sea level up to about 1,700 m altitude in the equatorial tropics. In cooler regions they have to be planted but in humid tropical regions are commonly self-sown. Sunlight allows germination when forest is cleared. It cannot stand frost. It needs a night temperature above 12°C and don't tolerate water-logging. Plants die after 48 hours in standing water. It needs a pH between 5 - 8 and suits hardiness zones 11 - 12.

**Use:** Fruit can be eaten ripe and raw. Green fruit can be cooked as a vegetable. The young leaves can be eaten cooked, but are bitter. The flowers and the middle of the stem can be eaten. Papayas contain papain which is a meat tenderiser. The dried seeds can be used as a spice.

**Cultivation:** Pawpaw seeds grow easily and plants grow quickly. Fresh seeds can be used. If dry seeds are used they should be soaked before planting. Seeds should be sown when temperatures are 24 - 30°C. They need a reasonably fertile soil. Seeds can be sown directly or the seeds can be put in a nursery and the seedlings transplanted. Seeds in a nursery should be sown 1 - 2 cm deep. Seedlings can be transplanted when they are about 20 cm high. Plants should be about 3 m apart. Continuous fruit production depends on fertility, temperature and moisture being adequate to maintain active growth. The fruit is produced year round but the growth and development rate decreases with temperature. The size and quality of fruit declines at lower temperatures. Pollination is by wind and insects and is not normally limiting. Normally cross and self-pollination both occur. Seeds are dispersed by birds, bats and people and remain viable for a few months.

**Production:** Seeds emerge in 2 - 3 weeks. Vegetative growth before flowering is 4 - 8 months. One or more fruit grow per leaf axil, about every 1 - 2 weeks under good growing conditions. With good growth, 100 fruit can be produced from one plant in a year. Pollination to maturity is about 2 - 3 months. On the coast in tropical equatorial regions, pawpaws start producing fruit after about 4 - 5 months, but in the highlands this may take 12 - 18 months. The first fruit are ready 6 - 11 months from planting. Tree life is about 2 - 3 years, although they may live for 10 - 12 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 |
|----------------|------------|-----------|-----------|-------------|-------------|---------|---------|
| leaf           | 75.4       | 378       | 8.0       | -           | 140         | 0.77    | -       |
| fruit          | 88.0       | 163       | 0.5       | 290         | 54          | 0.4     | 0.18    |
| fruit (unripe) | 92.1       | 109       | 1.0       | -           | -           | 0.3     | -       |

## Fruit

**English:** Banana

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

**Local:**

**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:** Guava

**Local:**

**Scientific name:** *Psidium guajava*

**Plant family:** MYRTACEAE

**Description:** A small evergreen tree 8 - 10 m tall with smooth, mottled bark which peels off in flakes. It is shallow rooted and branches close to the ground. The branches are four-angled. The leaves are opposite, dull green, and somewhat hairy. They are oval and somewhat pointed at both ends, 15 cm long by 2 - 5 cm wide with short leaf-stalks. The showy flowers are white and borne in loose, irregular arrangements of 1 - 3 flowers that grow in the axils of leaves on new growth. The petals are 1.5 - 2 cm long. Both self and cross-pollination occurs. The fruit are rounded and 4 - 5 cm long. They are green, turning yellow when ripe. The skin is firm and encloses a pink, or nearly white, sweet-smelling, edible pulp with many seeds. In better selected varieties, the skin and the seeds are fully edible. Fruit vary from very acid to very sweet.



**Distribution:** A native to Central and South America, it grows in most tropical countries. Guava thrives in humid and dry tropical climates and does best in sunny positions. It is killed by frost and fruits better where there is a cooler season. Temperatures near 30°C are best. It grows in open areas and secondary forests, and can become weedy in some conditions. It prefers a well-drained soil with good organic matter, but can stand brief water-logging. A soil pH of 5 - 7 is best, but can tolerate a pH from 4.6 - 8.9. Trees cannot tolerate salty conditions. It suits hardiness zones 9 - 12.

**Use:** The fruit are eaten raw and can be used for jams and jellies. Half-ripe fruit are added to help the jelly set. The young leaves are eaten raw or cooked. It is an attractive and nutritious fruit.

**Cultivation:** They are mostly grown from seed but seedling trees vary in quality. Seeds remain viable for a year or longer, and usually germinate in 2 - 3 weeks, but can take 8 weeks. Trees can be propagated by budding or grafting, and by layering, root cuttings or stem cuttings if hormones are used. Tips are used for stem cuttings and grown under mist at 28 - 30°C with bottom heat. Suckers can be used. Vegetative propagation preserves better fruit types. Trees self-sow in the lowland tropics. As fruit are produced on new season's growth, pruning does not greatly affect fruiting. Trees should be managed to give the maximum number of vigorous, new shoots and can be pruned for shape. Trees can be grown at 2.5 m within rows and 6 m apart between rows.

**Production:** Seedling trees begin to bear 2 - 3 years after transplanting. Pruning back the tips slightly increases fruit production. Tree-ripened fruit taste best. Ripening after picking can be hastened by placing them in a brown paper bag with a banana or apple. Mature fruit which have not changed colour can be stored 2 - 5 weeks at temperatures of 8 - 10°C and relative humidity of 85 - 95%. Mature fruit ripen in 2 - 3 days at normal temperatures and will keep for 7 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 |
|-------------|------------|-----------|-----------|-------------|-------------|---------|---------|
| fruit       | 77.1       | 238       | 1.1       | 60          | 184         | 1.4     | 0.2     |

## Fruit

**English:** Pacific lychee

**Local:**

**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

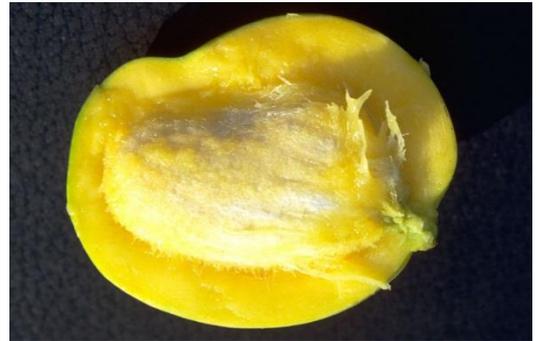
**English:** Mango

**Local:**

**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

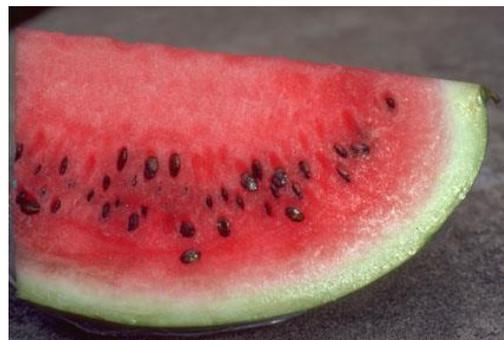
**English:** Watermelon

**Local:**

**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    |

## Vegetables

**English:** Okra

**Local:**

**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:** Marrow

**Local:**

**Scientific name:** *Cucurbita pepo*

**Plant family:** CUCURBITACEAE

**Description:** A bristly hairy annual vine in the pumpkin family. It has branched tendrils. The stems are angular and prickly. The leaves are roughly triangular. The leaves have 5 lobes which are pointed at the end and are toothed around the edge. Male and female plants are separate on the same plant. Male flowers are carried on long grooved flower stalks. Female flowers are borne on shorter more angular stalks. The fruit stalks have furrows along them but are not fattened near the stalk. The fruit vary in shape, size and colour. Often they are oval and yellow and 20 cm long by 15 cm wide. The seeds are smaller than pumpkin and easy to separate from the tissue. The scar at their tip is rounded or horizontal, not oblique. There are a large number of cultivated varieties.



**Distribution:** A subtropical plant. They are more suited to drier areas. They are frost sensitive, and grow best with day temperatures between 24 - 29°C and night temperatures of 16 - 24°C. It suits tropical highland regions. It suits hardiness zones 8 - 11.

**Use:** The young fruit are cooked and eaten. They can be steamed, boiled or fried. They are used in pies, soups, stews and cakes. The young leaves and the ripe seeds can also be eaten cooked. The seeds are dried, salted and toasted and eaten as a snack food. The seeds can also be pressed to produce oil. The sprouted seeds are used in salads. Flowers and flower buds can be eaten boiled. They can be dried for later use.

**Cultivation:** They are grown from seeds. The seeds germinate after one week. They can be grown from cuttings. They are best planted on mounds. A spacing of 2 - 3 m between plants is needed. Hand pollination assists fruit setting. Plants can also be grown from cuttings as plants root at the nodes.

**Production:** The first usable immature fruit are ready 7 - 8 weeks after planting.

**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)           | 3.7        | 2266      | 29.4      | -           | -           | 7.3     | -       |
| leaf                 | 89.0       | 113       | 4.0       | 180         | 80          | 0.8     | -       |
| fruit (mature)       | 92.0       | 105       | 1.6       | 17          | 16          | 2.4     | -       |
| fruit                | 91.3       | 102       | 1.1       | -           | 12          | 0.8     | 0.2     |
| yellow fruit         | 92.0       | 97        | 1.0       | 180         | 8           | 1.4     | -       |
| immature fruit (raw) | 92.0       | 92        | 1.5       | -           | 9           | 0.4     | 0.1     |

## Vegetables

**English:** Carrot

**Scientific name:** *Daucus carota* subsp. *sativus*

**Local:**

**Plant family:** APIACEAE

**Description:** A root crop grown from seed. It normally grows a fattened root one year then forms a flower the next year. It can be 60 cm high and spread to 50 cm wide. The root is long in shape and orange in colour. The stem is erect, tough and furrowed. The leaves are feathery and divided 3 times. The leaves have a sheath clasping the stalk at the base. The flowers are white and lacy. They form a dense compound cluster at the top of the plant. Sometimes flowers are only produced into the second year of growth, depending on temperature.



**Distribution:** A temperate plant. In the tropics it is mostly grown in the highlands, but will grow from sea level to 2,600 m altitude. Sometimes on the coast only leaves are produced. Carrots are frost resistant. In Nepal carrots are grown up to 1,700 m altitude. It needs a deep loose soil. Seed germinate well in the temperature range 7 - 24°C. Plants grow well with a temperature about 15°C. It grows best with a pH of 6 - 7. It suits hardiness zones 3 - 9.

**Use:** Both the roots and the leaves are edible. The young leaves are used in soups. The roots can be eaten raw or cooked. They can be steamed, fried, pickled, made into jam, or used in stews. Carrot seed oil is used as a flavouring. The juice is used raw and fermented. The roots can be dried and the flour used to flavour and thicken soups.

**Cultivation:** They are grown from seeds sown directly. Because seed are very small, seed are mixed with sand before sowing to allow a more even distribution of plants. A spacing 5 cm apart in rows 15 - 20 cm apart is suitable. Often this spacing is achieved by thinning out plants. For seed production a low temperature of 4 - 9°C for 40 - 60 days is needed before flowering to break the dormancy.

**Production:** There are tropical varieties that mature within 90 - 110 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 |
|---------------|------------|-----------|-----------|-------------|-------------|---------|---------|
| root (raw)    | 89.9       | 180       | 1.0       | 835         | 6           | 0.6     | 0.4     |
| root (boiled) | 91.5       | 79        | 0.6       | 852         | 4           | 0.4     | 0.3     |
| leaf          | 87.4       | -         | 2.2       | 65          | -           | -       | -       |

## Vegetables

**English:** Pumpkin

**Local:**

**Scientific name:** *Cucurbita maxima*

**Plant family:** CUCURBITACEAE

**Description:** A pumpkin family plant. It is a creeping vine with tendrils. It is an annual plant. The stems are soft and round in cross section. The leaves are large and hang loose. They are dark green and kidney shaped. The edges of the leaves are entire. There are large nodes at the base of the leaf. The tendrils are fairly stout and are divided half way along their length into many branches. Male flowers are carried on long upright stalks. The 5 petals are united into a long yellow tube. The female flowers are larger than the male and are fewer in number and carried on shorter stalks. The fruit varies in size, colour and patterns on the skin. They can be round, oval or flattened, with yellow, orange or green skin. The surface can be smooth and rough and warty. The flesh is yellow and edible. The seeds are in the centre. The seeds are white or brown. They are flattened but plump and have a slanting scar at the top. The seeds are edible. (*C. moschata* does not have hairy stems but has fruit with a thickened stalk near where it joins the fruit.) There are a large number of cultivated varieties.



**Distribution:** A subtropical plant that grows from sea level to 2,400 m altitude. They need a fertile soil. *C. moschata* is better suited to coastal areas. They are frost sensitive but better suited to cooler areas than *C. moschata*. It can grow in arid places. It suits hardiness zones 8 - 11.

**Use:** The young leaf tips are eaten cooked. They can also be dried and stored. The fruit can be eaten cooked. They are baked, boiled, fried, steamed or mashed. They are used in pies and cakes. The seeds are edible, raw or roasted. They are also ground into a meal. The male flowers are eaten after removing the stamen and calyx.

**Cultivation:** They are grown from seed. Usually 2 or 3 seeds are planted together in a mound. The distance apart depends on the cultivar. Some kinds are better for leaf tips. It is good to save seed of adapted varieties.

**Production:** Fruit are ready for harvest after about 3 - 4 months. Seed can be saved from fruit for re-sowing but as pumpkins cross pollinate different types become mixed.

**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)  | 6.9        | 2264      | 24.5      | 38          | 1.9         | 14.9    | 7.5     |
| fruit       | 69.6       | 439       | 1.4       | -           | -           | -       | -       |
| leaf        | 88.0       | 160       | 4.9       | 260         | 28          | 2.5     | 0.9     |
| flower      | 88.7       | 107       | 1.4       | 173         | 14          | 0.8     | 0.1     |

## Vegetables

**English:** Bitter cucumber

**Local:**

**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:** Long pitpit

**Local:**

**Scientific name:** *Saccharum edule*

**Plant family:** POACEAE

**Description:** A plant in the sugarcane family grown for the edible, unopened flower. Plants grow 2 - 3 m tall and have thinner canes than sugarcane. It produces suckers near the base so that a clump of stalks is normally produced. In one season of the year, it produces a seed head or flower which remains inside the top of the plant. This part is eaten. Several cultivars, or cultivated varieties, occur, differing in colour, height and season of flowering. It is an attractive and nutritious vegetable.



**Distribution:** It grows in Asia, Australia, Fiji, India, Papua New Guinea, the Philippines, Solomon Islands and Vanuatu. It is common in coastal areas and will grow up to about 1,800 m altitude in the tropics. It is commonly grown in old gardens before they return to forest.

**Use:** The unopened flower is eaten raw or cooked. It is often cooked in coconut milk.

**Cultivation:** It is grown from cuttings of the stalks. In fertile soil, cut plants will re-shoot from the base. The cuttings need adequate moisture at planting. Cuttings about 30 cm long are used. They need to be planted soon after cutting to avoid cuttings drying out. Stalks can be planted at any time of the year. It takes 6 - 9 months from planting until a crop is ready to harvest. The time of flowering is controlled by the sun. Early in the year, about February to March, most plants develop a thickened clump of leaves at the top. When these are broken off and opened by removing the outside leaves, the very fine, yellow, unopened flower is seen. It is this flower which is eaten.

**Production:** It takes 6 - 9 months to maturity. In most cultivars, flowering 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 |
|-------------|------------|-----------|-----------|-------------|-------------|---------|---------|
| flower      | 89         | 165       | 4.2       | -           | 14          | 1.1     | 1.1     |

## Nuts, seeds, herbs and other foods

**English:** Galip nut

**Local:**

**Scientific name:** *Canarium indicum*

**Plant family:** BURSERACEAE

**Description:** It is a large tree often up to 40 m tall. The stems are often twisted or rough and 1 m across the trunk. There are usually tall, thin buttresses at the base of the tree. The small branches are more or less powdery. The leaf is made up of 3 - 7 pairs of leaflets. The leaves do not have hairs on them. The leaflets are oblong and can be 7 - 28 cm long and 3 - 11 cm wide. The leaves are distinctly larger on young trees. The leaves are pointed at the tip and rounded at the base. The leaflets are stiff and glossy, dark green on top and light green underneath. At the base of a leaf, where the stalk joins the branch, there is a large stipule with saw like teeth



around the edge. This is important for identifying species. Flowers are mostly produced at the end of the branches. A group of flowers is produced on the one stalk. Male and female flowers are often on separate trees. The male flowers have 6 anthers or pollen containers in a ring. In the female flower these 6 stamens are improperly developed (staminodes) around a 3-celled ovary. The fruit is slightly triangular in cross section and black when mature. The galip fruit has 3 cells (sometimes 4) but mostly only one cell is fertile so that 2 of the cells are empty, and one has a kernel. The fruit has a thin layer of pulp and a very hard inner shell. The oily, edible kernel is inside the shell. Fruit can be 6 cm x 3 cm.

**Distribution:** A tropical plant that grows in coastal areas, and is most common in the islands such as North Solomons Province, New Britain and New Ireland. It also occurs naturally in the Solomon Islands, Vanuatu and Guam. It occurs on the New Guinea mainland and Irian Jaya as well as in Maluku in Indonesia. It has been taken to other countries. Galip nuts are common in lowland rainforest. They mostly grow from sea level up to about 450 m altitude in the equatorial tropics.

**Use:** The kernels are eaten raw or slightly roasted. Seeds can be dried and stored. The nuts can be pressed for oil that is mixed with food. **Caution:** Eating the seed coat causes diarrhoea.

**Cultivation:** Trees are mostly grown from seed that may take several months to start to grow. The seeds should be buried just near the surface. Care is needed to see that the seeds and seedlings do not dry out. As the seed grows or germinates, a well-defined cap is split off the nut. Trees grow fairly quickly. They can be grown by budding or grafting.

**Production:** The main season is April to May, but trees can bear nuts 2 or 3 times a year. An average kernel weighs 3 g. Climbing the trees is difficult and dangerous, so nuts are often harvested after they fall. Nuts are often stored inside houses after the fleshy outer layer is removed but the hard shell remains. Nuts removed from the shell and roasted can be stored in sealed containers for many months. The nuts are often coarsely ground and added to other foods.

**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         | 35         | 1931      | 8.2       | 14          | 8.0         | 3.5     | 2.4     |

## Nuts, seeds, herbs and other foods

**English:** Polynesian chestnut

**Local:**

**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

**Local:**

**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:** Sunflower

**Local:**

**Scientific name:** *Helianthus annuus*

**Plant family:** ASTERACEAE

**Description:** An upright annual plant that varies in height from 1 - 4 m. It has a strong tap root. Plants are mostly unbranched, but may have some branches. The stems are hairy. The leaves are large and oval to heart shaped with teeth around the edges. They are roughly hairy and mid to dark green. Leaves can be 10 - 40 cm long by 5 - 20 cm wide. The leaf stalk is long. The flowers are yellow and daisy like, and 9 - 20 cm across. Sometimes they are tinged red or purple.



**Distribution:** A temperate plant that suits the highlands of the tropics and can stand a light frost. It needs a well drained, rich soil. It is drought and frost resistant. Sunflower grow from the equator to 55°N latitude. It does not suit the wet tropics. It cannot tolerate very acid soils. It can grow in arid places. It suits hardiness zones 4 - 11. It is widely distributed in many environments.

**Use:** An edible oil is extracted from the seeds and used for cooking. Sometimes seeds are eaten raw or roasted. The seeds can be ground into a meal for using in bread and cakes. They are also dried, roasted and ground and used as a coffee substitute. The seeds are boiled with water and honey to make a drink. The germinated seeds are fermented into a yogurt or cheese.

**Cultivation:** Plants are grown from seed. Only well filled seed should be planted. It is easy to save your own seed as dry seed stores well. A plant spacing of 1 m by 0.5 m is suitable. Seed are sown at a depth of 2 - 4 cm. Mature heads are collected by hand, dried and then threshed.

**Production:** Time to maturity is usually 4 - 5 months. Seeds are ready to eat when the flower starts to wither.

**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        | 5.4        | 2385      | 22.8      | 5           | 1.4         | 6.8     | 5.1     |

## Nuts, seeds, herbs and other foods

**English:** Sesame

**Local:**

**Scientific name:** *Sesamum indicum*

**Plant family:** PEDALIACEAE

**Description:** A small, erect annual plant. It is very branched and grows 1 - 2 m tall. The stem is stout, 4 sided and furrowed along its length. It is densely covered with fine, downy, glandular hairs that vary in shape. The lower leaves have long stalks and are spear shaped, often with lobes or a toothed edge. The leaf stalks are 3 - 11 cm long. The leaf blade is 4 - 20 cm long by 2 - 10 cm wide. Upper leaves are narrow and oblong. They are 0.5 - 2.5 cm wide. The flowers occur in the axils of upper leaves, either on their own, or in groups of 2 or 3. They can be white, pink, purplish and with yellow spots and stripes. The fruit can be smooth or rough and there are 2 chambers in the capsule. The fruit are brown or purple. They are oblong and deeply grooved. The seeds are small and oval. They are 3 mm by 1.5 mm and vary in colour from white, yellow, grey, red, brown or black. The fully ripe pods burst open.



**Distribution:** A tropical plant that suits the hot, dry, semi-arid tropics and sub-tropics. It can tolerate short periods of drought once established. It needs a temperature of 20 - 24°C in early growth, then 27°C for ripening. It grows from sea level to about 1,200 m in areas with an annual rainfall of 400 - 1,000 mm. Soils need to be well drained. It is very intolerant of water-logging. It cannot stand high humidity and needs frost free conditions. It needs a dry period for seed drying. It does not like acid soils. It grows in open sunny places. It can grow in arid places.

**Use:** The seeds are eaten. They are used in soups or fried or boiled. They are used in tahini and hummus. Seeds are eaten in the form of sweetmeats. Roasted seeds are used in pickles. They are also put on bread. Oil from the seeds is used in cooking and on salads. The refuse from the seed after the oil has been extracted is boiled in water and made into soup.

**Cultivation:** Plants are grown from seed. Seed will not germinate below 21°C. Seeds are broadcast on well prepared land and then harrowed in using a light harrow, or sown 2 - 15 cm apart in rows 20 - 45 cm apart. Plants can be thinned or weeded during early growth to produce a better crop. Seeding rates of 9 - 11 kg/ha are used. Some varieties shatter easily.

**Production:** Yields of 340 - 500 kg/ha are average. Plants reach maturity in 80 - 180 days. Crops are harvested as the leaves begin to drop. Plants are cut and stooked or dried in racks. The hull is removed by soaking in water overnight, then partly dried and rubbed against a rough surface.

**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)  | 4.7        | 2397      | 17.7      | 1           | -           | 14.6    | 7.8     |
| leaf (raw)  | 85.5       | 188       | 3.4       | -           | -           | -       | -       |
| oil         | -          | 3683      | 0.2       | -           | -           | -       | -       |

## Nuts, seeds, herbs and other foods

**English:** Boabab

**Local:**

**Scientific name:** *Adansonia digitata*

**Plant family:** BOMBACACEAE

**Description:** A large tree. It grows up to 25 m tall. It loses its leaves during the year. The branches are thick, angular and spread out wide. The trunk is short and stout and can be 10 - 14 m around. Often the trunk has deep grooves or is fluted. The bark is smooth and grey but can be rough and wrinkled. The leaves spread out like fingers on a hand. There are 5 - 9 leaflets. Often the leaves are crowded near the ends of branches. The flowers are large and 12 - 15 cm across. The petals are white and the stamens are purple. The fruit hangs singly on a long stalk. The fruit has a woody shell. This can be 20 - 30 cm long and 10 cm across. Inside the fruit are hard brown seeds. They are about 15 mm long. The seeds are in a yellow white floury pulp. The pulp is edible. The thick roots end in fattened tubers.



**Distribution:** It is a tropical plant that grows in the lowlands. It grows in the hot dry regions of tropical Africa, such as the Sahel. It survives well in dry climates. It grows where rainfall is 100 - 1,000 mm a year. It can tolerate fire. It grows where the annual temperatures are 20 - 30°C. In most places it grows below 900 m altitude but occasionally grows to 1,500 m altitude. It requires good drainage. It can grow in arid places and suits hardiness zones 11 - 12.

**Use:** The young leaves are eaten as a cooked vegetable. The dried leaves are also used to thicken soups. The fruit pulp is eaten raw. It is also used for a drink. The flowers are eaten raw or cooked. The seeds can be eaten fresh or dried and ground into flour then added to soups. They yield a cooking oil. The shoots of germinating seeds are eaten. The young tender roots are eaten. The fattened root tubers are cooked and eaten. The bark is eaten and the dried leaves are used as flavouring.

**Cultivation:** Trees are grown from seed. The seed remain viable for several years but before planting the seeds must be treated to break the hard seed coat, by soaking the seeds in hot water for several minutes or by cutting the seed coat. Seeds that float in water should not be used. Seeds can be planted in nurseries in plastic bags then transplanted after 6 months. Plants can also be grown from cuttings.

**Production:** Trees grow quickly reaching 2 m in 2 years. Trees produce fruit after 2 - 15 years. The plant is pollinated by bats, insects and winds. Trees can last 600 or more years. Fruit can be stored for about a 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 (dry)   | 7.8        | 1832      | 33.7      | -           |             | 13.9    | -       |
| fruit       | 16.0       | 1212      | 2.2       | -           | 360         | 7.4     | 6.7     |
| leaf        | 77.0       | 290       | 3.8       | -           | 50          | -       | -       |

## Nuts, seeds, herbs and other foods

**English:** Kapok

**Scientific name:** *Ceiba pentandra*

**Plant family:** BOMBACACEAE

**Description:** A very large tree with a straight trunk and height of 30 -4 0 m. Trees can be 60 m tall and the trunk 8 m around. It has large prickly buttresses near the base. The branches come out horizontally and there is a ring of them around the trunk. The leaves are compound. The leaflets spread out like fingers on a hand, with 5 - 8 leaflets. They are 5 - 18 cm long by 2 - 4.5 cm wide. The leaf stalk is 7 - 20 cm long. The leaves all fall off the tree (deciduous). Flowers are yellowish white, in clusters near the ends of branches. These hang downwards. A long seed capsule hangs from branches. It is 10 -3 0 cm long. It splits into 5 valves. The seeds are embedded in white or grey kapok.



**Distribution:** It is a tropical plant. Mostly in the lowlands and up to about 1000 m. It suits rainforest areas with a heavy rainfall. The soil needs to be well drained. The tree is easily damaged by strong winds. It needs a temperature of 25 - 30°C and not below 15°C. It does not tolerate shade and suits hardiness zones 11 - 12.

**Use:** The young pods can be eaten cooked. The young leaves can be eaten cooked. The seeds can be eaten either roasted fresh, or after sprouting. They are also added to soups. The young flowers can be eaten. They are blanched before eating. The resin from the trunk is put in water and drunk.

**Cultivation:** Seeds germinate quickly and seedlings can be transplanted. It can be easily grown from large cuttings.

**Production:** it is a fast growing tree. Pods are produced seasonally.

**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 (dried) | 6.8        | 2065      | 30.9      | -           | -           | -       | -       |

## Nuts, seeds, herbs and other foods

**English:** Coastal almond

**Local:**

**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 $\mu$ g | 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     |

## Nutritional values of food plants by plant Family

| Plant Family   | Scientific name                                      | Common name         | Edible part    | Moisture % | Energy kJ | Protein g | Vit A µg | Vit C mg | Iron mg | Zinc mg | Page |
|----------------|--|---------------------|----------------|------------|-----------|-----------|----------|----------|---------|---------|------|
| ACANTHACEAE    | <i>Pseuderanthemum whartonianum</i>                  | Ofenga              | leaf           | -          | -         | -         | -        | -        | -       | -       | 34   |
| AMARANTHACEAE  | <i>Amaranthus tricolor</i>                           | Amaranths           | leaf           | 91.7       | 96        | 2.5       | 146      | 43.3     | 2.3     | 0.9     | 32   |
| ANACARDIACEAE  | <i>Mangifera indica</i>                              | Mango               | fruit          | 83.0       | 253       | 0.5       | 54       | 30       | 0.5     | 0.04    | 41   |
| ANACARDIACEAE  | <i>Anacardium occidentale</i>                        | Cashew              | nut            | 4.0        | 2478      | 17.5      | -        | -        | 2.8     | 4.8     | 52   |
| APIACEAE       | <i>Daucus carota</i> subsp. sativus                  | Carrot              | root (raw)     | 89.9       | 180       | 1.0       | 835      | 6        | 0.6     | 0.4     | 46   |
| ARACEAE        | <i>Colocasia esculenta</i>                           | Taro                | corm           | 66.8       | 1231      | 1.96      | 3        | 5        | 0.68    | 3.2     | 12   |
| ARACEAE        | <i>Xanthosoma sagittifolium</i>                      | Chinese taro        | root           | 67.1       | 559       | 1.6       | 5        | 13.6     | 0.4     | 0.5     | 14   |
| ARACEAE        | <i>Cyrtosperma merkusii</i>                          | Swamp taro          | root           | 72.4       | 343       | 1.1       | 5        | 15.7     | 1.3     | 0.1     | 16   |
| ARECACEAE      | <i>Metroxylon sagu</i>                               | Sago                | trunk          | 27         | 1197      | 0.2       | -        | 0        | 0.7     | -       | 19   |
| ASTERACEAE     | <i>Helianthus annuus</i>                             | Sunflower           | seed           | 5.4        | 2385      | 22.8      | 5        | 1.4      | 6.8     | 5.1     | 53   |
| ATHYRIACEAE    | <i>Diplazium esculentum</i>                          | Sweetfern           | frond          | 94         | 81        | 2.4       | 211      | 2.0      | 2.4     | 1.8     | 31   |
| BOMBACACEAE    | <i>Adansonia digitata</i>                            | Boabab              | fruit          | 16.0       | 1212      | 2.2       | -        | 360      | 7.4     | 6.7     | 55   |
| BOMBACACEAE    | <i>Ceiba pentandra</i>                               | Kapok               | seed (dry)     | 6.8        | 2065      | 30.9      | -        | -        | -       | -       | 56   |
| BROMELIACEAE   | <i>Ananas comosus</i>                                | Pineapple           | fruit          | 84.3       | 194       | 0.5       | 60       | 25       | 0.4     | 0.1     | 35   |
| BURSERACEAE    | <i>Canarium indicum</i>                              | Galip nut           | nut            | 35         | 1931      | 8.2       | 14       | 8.0      | 3.5     | 2.4     | 50   |
| CARICACEAE     | <i>Carica papaya</i>                                 | Pawpaw              | fruit          | 88.0       | 163       | 0.5       | 290      | 54       | 0.4     | 0.18    | 37   |
| COMBRETACEAE   | <i>Terminalia catappa</i>                            | Coastal almond      | nut (dry)      | 4.2        | 2987      | 20.0      | 0        | 2        | 6.3     | 8.8     | 57   |
| CONVOLVULACEAE | <i>Ipomoea batatas</i>                               | Sweet potato        | tuber (raw)    | 70.0       | 387       | 1.2       | 709      | 25       | 0.7     | 0.4     | 10   |
| CUCURBITACEAE  | <i>Citrullus lanatus</i>                             | Watermelon          | seed           | 5.1        | 2330      | 28.3      | 0        | 0        | 7.3     | 10.2    | 43   |
| CUCURBITACEAE  | <i>Cucurbita pepo</i>                                | Marrow              | fruit (yellow) | 92.0       | 97        | 1.0       | 532      | 8        | 1.4     | -       | 45   |
| CUCURBITACEAE  | <i>Cucurbita maxima</i>                              | Pumpkin             | seed (dry)     | 6.9        | 2264      | 24.5      | 38       | 1.9      | 14.9    | 0.9     | 47   |
| CUCURBITACEAE  | <i>Momordica charantia</i>                           | Bitter cucumber     | pod (raw)      | 94.0       | 71        | 1.0       | 380      | 84       | 0.4     | 0.8     | 48   |
| DIOSCOREACEAE  | <i>Dioscorea esculenta</i>                           | Lesser yam          | tuber          | 74.2       | 470       | 2.1       | 84       | 20       | 0.75    | 0.5     | 21   |
| EUPHORBIACEAE  | <i>Manihot esculenta</i>                             | Cassava             | tuber          | 62.8       | 625       | 1.4       | 30       | 15       | 0.23    | 0.48    | 17   |
| EUPHORBIACEAE  | <i>Sauropus androgynus</i>                           | Sweetleaf           | leaf           | 81         | 244       | 4.8       | 133      | 85       | 2.7     | -       | 30   |
| FABACEAE       | <i>Psophocarpus tetragonolobus</i>                   | Winged bean         | seed           | 8.5        | 1764      | 41.9      | -        | -        | 15.0    | -       | 23   |
| FABACEAE       | <i>Vigna unguiculata</i> subsp. <i>sesquipedalis</i> | Snake bean          | pod (fresh)    |            | 197       | 2.8       | 43       | 18.8     | 0.47    | 0.37    | 24   |
| FABACEAE       | <i>Sesbania grandiflora</i>                          | Sesbania            | seed           | 10.4       | -         | 68.2      | -        | -        | -       | -       | 25   |
| FABACEAE       | <i>Leucaena glauca</i>                               | Horse tamarind      | seed           | 13.7       | -         | 57.3      | -        | -        | -       | -       | 26   |
| FABACEAE       | <i>Arachis hypogea</i>                               | Peanut              | seed (dry)     | 4.5        | 2364      | 24.3      | 0        | -        | 2.0     | 3.0     | 27   |
| FABACEAE       | <i>Cajanus cajan</i>                                 | Pigeon pea          | seed           | 10.0       | 1449      | 19.5      | 55       | -        | 15.0    | -       | 28   |
| FABACEAE       | <i>Inocarpus fagifer</i>                             | Polynesian chestnut | nut            | 43.0       | 1008      | 4.5       | 0        | 2        | 3.0     | 1.3     | 51   |
| GNETACEAE      | <i>Gnetum gnemon</i>                                 | Spinach jointfir    | leaf           | 66.0       | 378       | 5.9       | 308      | 1.5      | 2.7     | 12.1    | 33   |
| MALVACEAE      | <i>Abelmoschus manihot</i>                           | Edible hibiscus     | leaf           | 88         | 120       | 3.4       | 1.0      | 7.0      | 1.5     | 1.2     | 29   |
| MALVACEAE      | <i>Abelmoschus esculentus</i>                        | Okra                | fruit (cooked) | 90.0       | 134       | 1.9       | 14       | 16.3     | 0.5     | 0.6     | 44   |

|             |                                      |                |               |      |      |      |    |     |      |     |    |
|-------------|--------------------------------------|----------------|---------------|------|------|------|----|-----|------|-----|----|
| MUSACEAE    | <i>Musa sp</i> (A &/or B genome) cv. | Banana         | fruit (sweet) | 70.7 | 337  | 1.1  | 3  | 10  | 0.4  | 0.2 | 38 |
| MYRTACEAE   | <i>Psidium guajava</i>               | Guava          | fruit         | 77.1 | 238  | 1.1  | 31 | 184 | 1.4  | 0.2 | 39 |
| PEDALIACEAE | <i>Sesamum indicum</i>               | Sesame         | seed          | 4.7  | 2397 | 17.7 | 1  | 0   | 14.6 | 7.8 | 54 |
| POACEAE     | <i>Saccharum edule</i>               | Long pitpit    | flower        | 89   | 165  | 4.2  | 0  | 14  | 1.1  | 1.1 | 49 |
| SAPINDACEAE | <i>Pometia pinnata</i>               | Pacific lychee | fruit         | 87   | 211  | 1.1  | 3  | 5   | 0.5  | 0.3 | 40 |





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