

Potentially Important Food Plants of Tanzania



**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

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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 LearnGrow project), and many volunteers who have assisted in various ways.

The selection of plants included in this guide has been developed by Lyndie Kite working in a voluntary capacity using the selection criteria developed by Food Plant Solutions. These selection criteria focus on the local plants from each of the main food groups with the highest levels of nutrients important to human nutrition and alleviation of malnutrition. 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 Tanzania. This guide has been developed with the best intention to create interest and improve understanding of the important local food plants of Tanzania, 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. 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 Tanzania. 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.

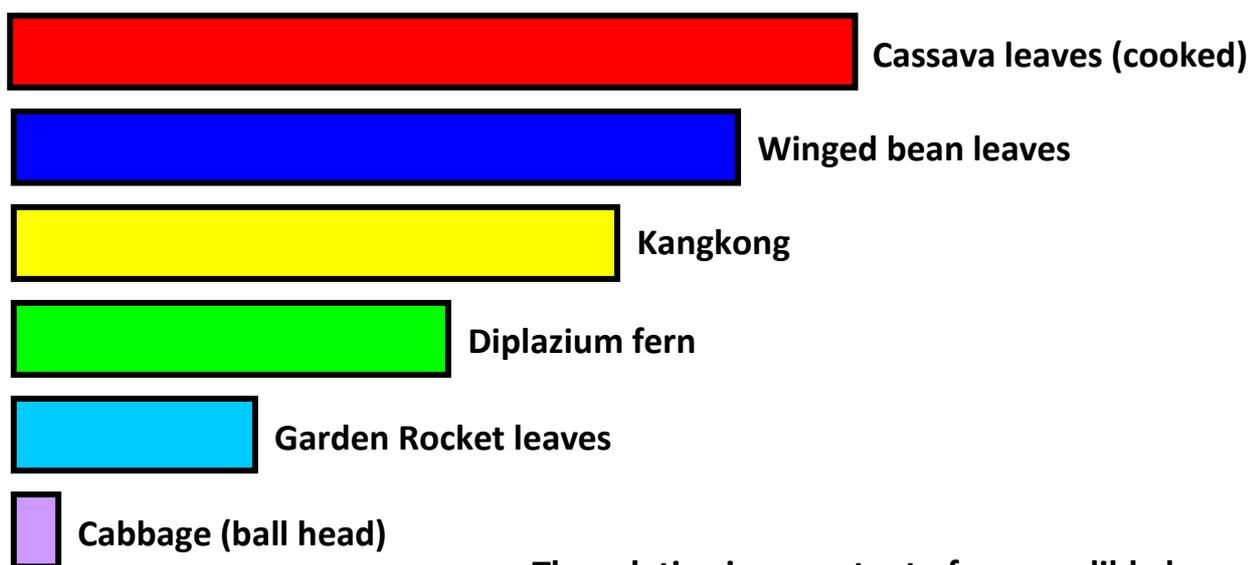
Naming of plants

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.

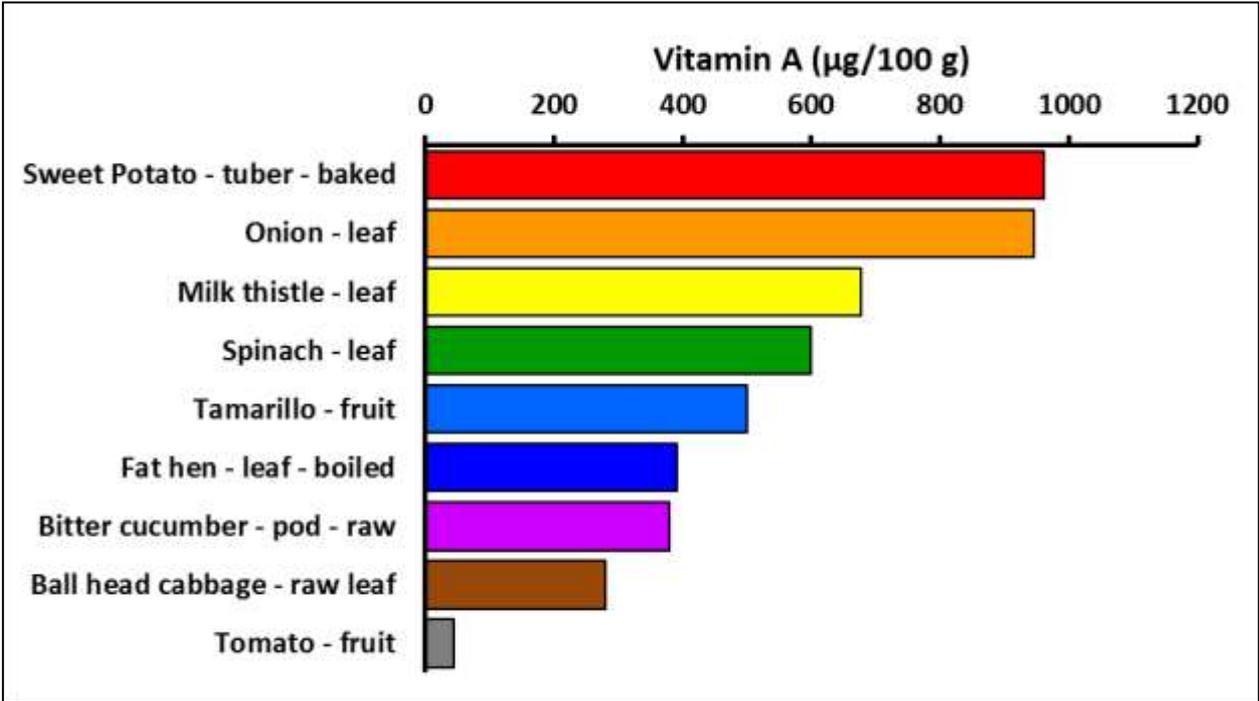
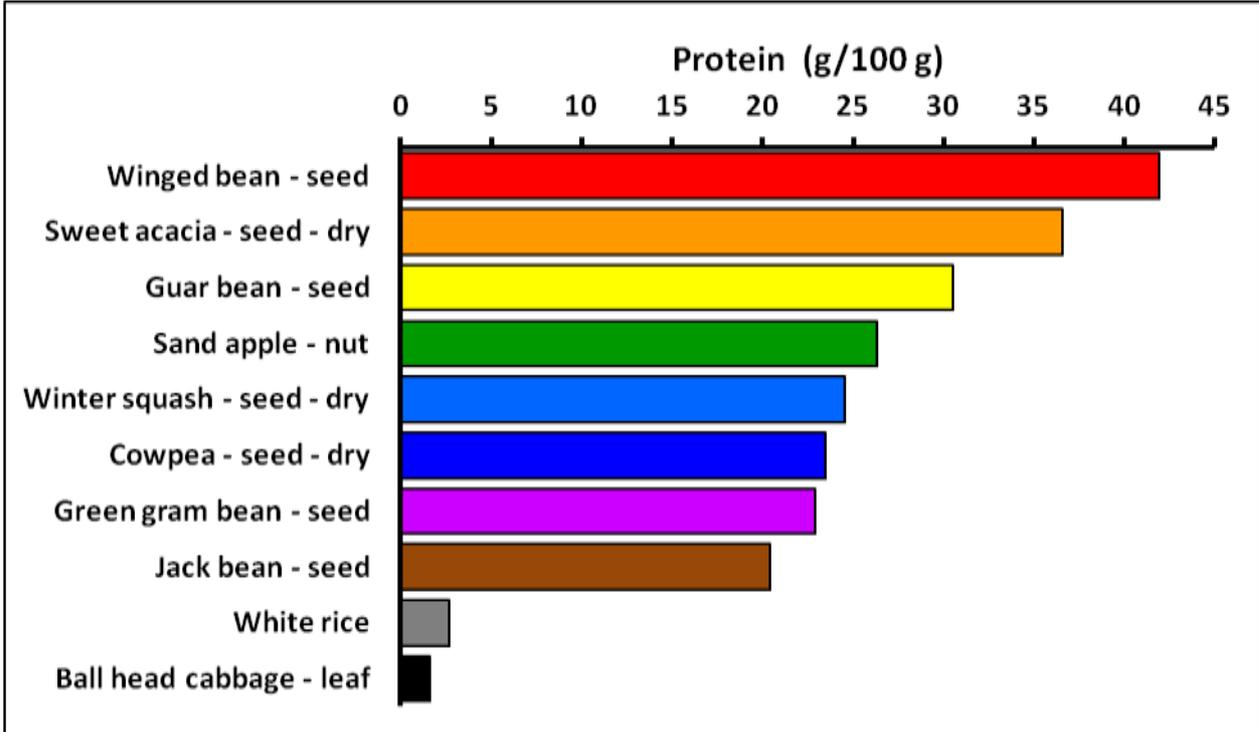
Pests

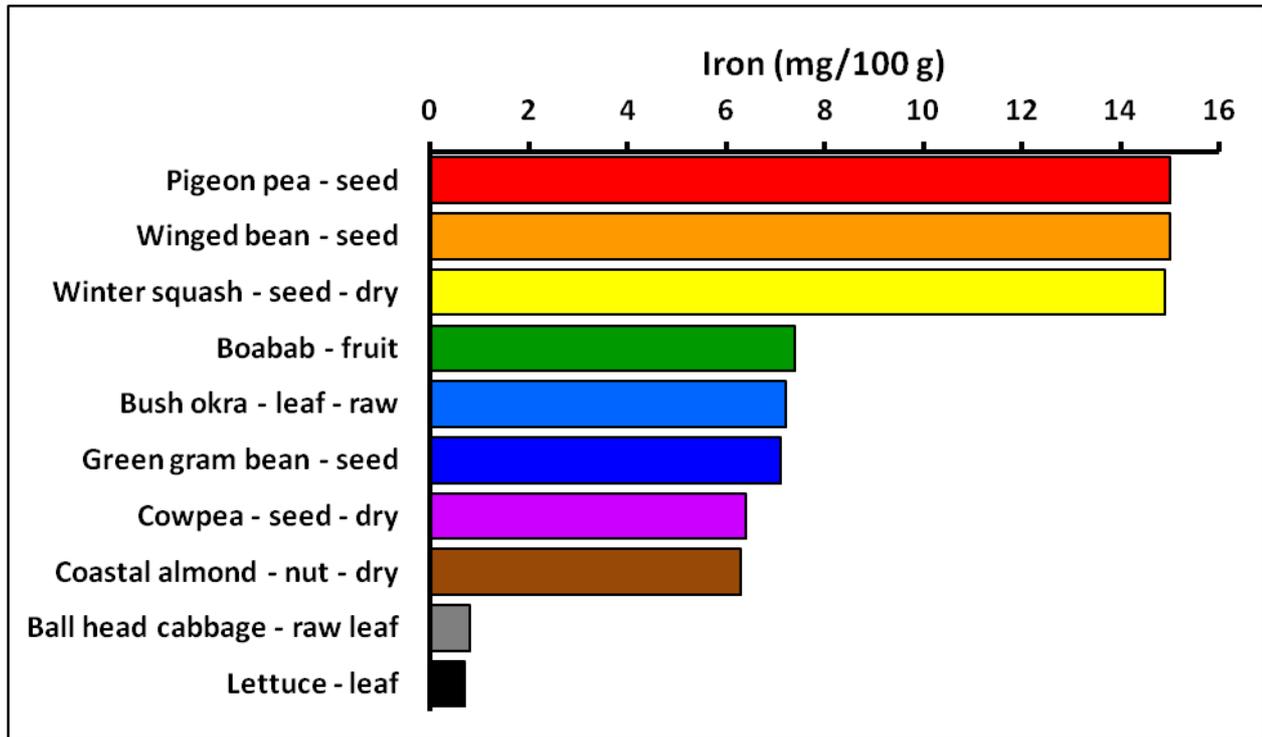
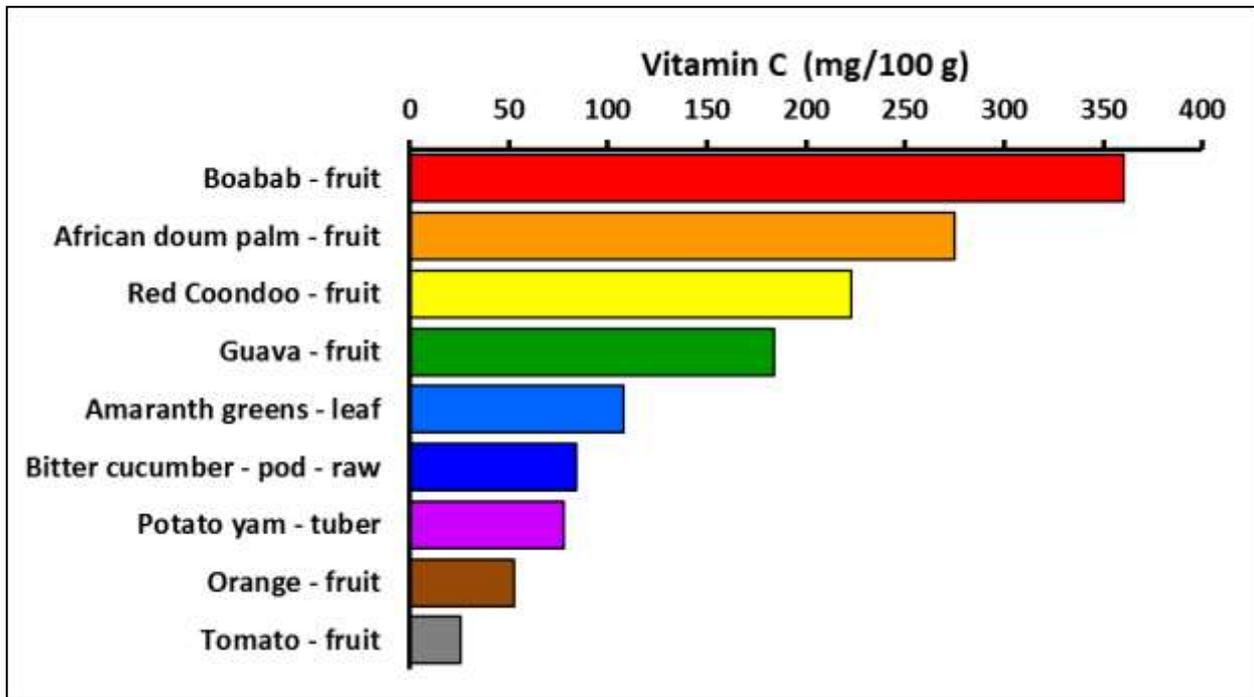
There are a large number of insects that enjoy sharing our food with us! We should not try to kill all these insects as they have an important role to play in keeping everything in nature in balance. What we need to do is to learn to manage these insects so we can all get some food to eat! Some insects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

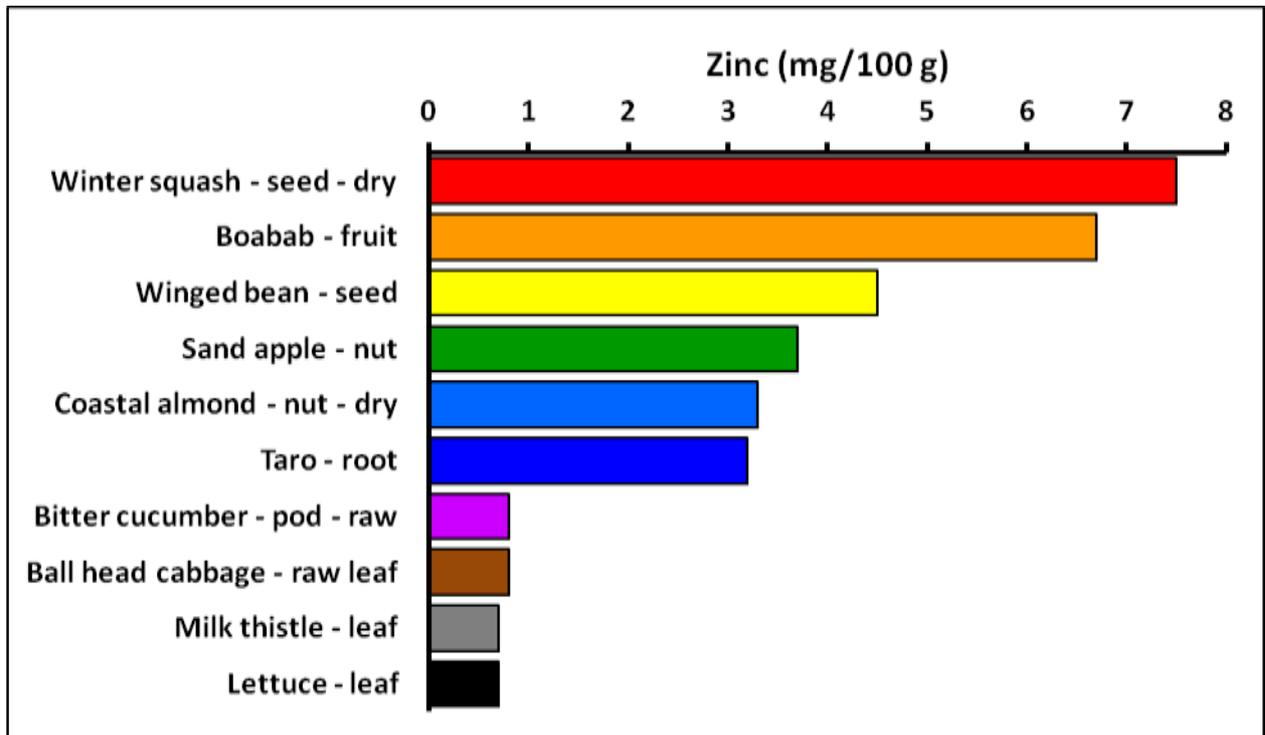
Diseases

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 Tanzania







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

Starchy staples

English: Taro, Yams

Kiswahili: Magimbi

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 corms. 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: Potato yam

Kiswahili: Viazi vikuu

Scientific name: *Dioscorea bulbifera*

Plant family: DIOSCOREACEAE

Description: A yam with a long smooth stemmed vine, round in cross section and without spines. The vine winds to the left, can climb into trees and grow to long lengths. The large leaves (14 - 30 cm across and slightly longer than wide) have pointed tips and round bases. About 7 veins arise from the tip of the leaf stalk. It produces often flattened bulbils (potatoes) in the leaf angles along the vine. They can be grey brown or purple. The smaller tuber underground is normally covered with roots. The flowers are large. The male flowers are in spikes up to 20 cm long. The female spikes are usually in pairs. The winged fruit are about 2.5 cm long by 1.5 cm across. The seeds have wings. The bulbils normally have few fibres through the tissue compared to some yam tubers. Many varieties have yellow flesh.



Distribution: An annual tropical plant. It will grow from the coast up to about 1,700 m altitude in equatorial zones. It is common near the edge of grassland and forest at mid altitudes. Both wild and cultivated forms occur. It is common near secondary forest at low and medium altitudes.

Use: The cooked tubers aerial bulbils are eaten. Some kinds are bitter and inedible or at least require special processing and cooking. Some varieties are poisonous.

Cultivation: Either the vine bulbils or the underground tubers are planted. The long vines can be trained up trees. The bulbils need a set storage time before sprouting. The leaves die off for 1 - 4 months each year before re-sprouting from the tuber. Bulbils only grow shoots from one end unless the bulbil is cut into pieces. If larger bulbils are cut, the cut surfaces should be dried and healed in a shady place for 2 - 3 days before planting. Bulbils are planted 8 - 12 cm below ground at a spacing of about 100 cm by 100 cm. Nitrogen and potassium fertilisers give greater responses than phosphorus. Friable well drained soils are most suitable. Often little cultivation or mounding is done. A high level of organic matter improves yield. Strong staking is required with branched 2 m stakes, or with trees or living stakes. Vine and tuber growth can be extensive and heavy.

Production: Bulbils or aerial yams are produced as leaves begin to unfold, continue until plant maturity, and often fall. Harvesting can start 3 months after planting but immature tubers have less starch. Underground tubers are normally not harvested until leaf die back. Wounds and damage to the tubers normally heal naturally given dry aerated conditions. Some varieties have seasonally dormant aerial tubers which only grow after an extended storage period. Others germinate quickly.

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	70.8	357	2.7	-	78	3.1	0.4
bulbil	79.4	326	1.4	-	-	2.0	-

Starchy staples

English: Ethiopian Banana, Banana

Kiswahili: Ndizi

Scientific name: *Ensete ventricosum*

Plant family: MUSACEAE

Description: A banana like plant that grows to 6 - 12 m tall. The lower part of the leafy false stem is swollen. Many different varieties exist. The leaves are bright green with an obvious red midrib. The leaves can be 5 m long and 0.9 m wide. The flower is a very large hanging spike 2 - 3 m long. The flowers are cream coloured. There is a single petal in a large red bract. The fruit resemble small bananas. They are 6 - 8 cm long and 3 cm thick. They have a yellow skin. The seeds are pea like and fill the fruit. The seeds are black and about 6 mm across.



Distribution: It grows in tropical Africa. It does best with a temperature of 18 - 28°C and a relative humidity of 60 - 80 %. In Ethiopia it grows between 1,500 and 3,000 m altitude but does best between 1,700 and 2,450 m altitude. In Malawi it is usually on the edges of forests or in sheltered gullies. It is damaged by frost or drought. It can grow in arid places. It suits hardiness zones 10 - 12.

Use: The fermented pulp (kocho) of the stem is eaten. It is used as a flour to make bread. The leaf bases and fresh corms are cut up and boiled as a vegetable. The milky white juice extract is allowed to ferment in pits lined with ensete leaves then cooked. The young flowers are eaten as a relish. The fruit are eaten only in times of food scarcity. It is the endosperm of the seeds that is eaten.

Cultivation: It can be grown by seed. It is normally grown by bud suckers or shoots. To get bud suckers, a 4 - 6 year old plant is cut off at 20 - 30 cm height. The central bud (which would normally grow one shoot) is removed and the hole filled with soil. The corm is then replanted into a manured pit about 5 days later. After 4 - 8 weeks this produces 40 - 200 buds. These can be separated and grown in a nursery for one year before being transplanted into the field. These plants are normally then transplanted to wider spacing after 2 years, and again after 4 years. Plants reach harvest maturity in 6 - 7 years. Suckers can be used for transplanting and reach maturity in 2 years. The final spacing for bud suckers is 3 m x 1.5 m. Large amounts of organic manure are often applied. Plants are harvested before the onset of flowering.

Production: An average family cultivates 200 - 400 plants per year and they eat about 10 - 20 plants per person per year. In Ethiopia, using 1,600 plants per hectare at a spacing of 2.5 m gave about 5,000 kg per hectare of refined product.

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)	12.4	1472	13.3	-	-	-	-
pith	56.3	715	1.2	-	-	5.3	-

Starchy staples

English: Bullrush millet, Pearl millet

Kiswahili: Uwele

Scientific name: *Pennisetum glaucum*

Plant family: POACEAE

Description: An annual grass that grows to 3 m tall. The leaf blades are 20 - 100 cm long by 2 - 5 cm wide. The flower is dense and 40 - 50 cm long by 1.2 - 1.5 cm wide. They also vary in shape and size. Plants that tiller produce smaller heads. The species varies a lot. There are 13 cultivated, 15 weed and 6 wild races of this grass. It has a cylindrical ear like a bullrush. The grains are small and round and have a shiny grey colour like pearls. There are thousands of cultivated varieties.

Distribution: A tropical plant that suits regions with a short growing season. It grows in areas with less than 600 mm of rainfall. It is replaced with sorghum between 600 - 1,200 mm rainfall and then by finger millet or maize above 1,200 mm rainfall. It is important in the drier areas of India and Pakistan. It can grow in arid places.

Use: The seeds are eaten like rice. They are also ground into flour and made into bread and cakes. They are used to make alcoholic drinks. They are mixed with other grains and seeds to make fermented foods. Some kinds have sweet stalks that are chewed. The young ears can be roasted and eaten like sweet corn.

Cultivation: Plants are grown from seed. It is usually sown directly into the field. The plant density is adjusted to suit rainfall and soil fertility. The spacing is 45 cm apart up to 200 cm apart. It is also intercropped with other crops such as cowpea, sorghum and peanut. Crops are normally weeded 2 or 3 times.

Production: It takes from 75 - 180 days to maturity. The heads can be picked by hand or the plant removed. Some types need to be picked 2 or 3 times as heads mature.

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	11.6	1442	10.5	-	-	6.5	1.7



Starchy staples

English: Sweet potato

Kiswahili: Viazi vitamu

Scientific name: *Ipomoea batatas*

Plant family: CONVOLVULACEAE

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



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

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

Under lowland conditions in the tropics sweet potato tubers undergo active tuber enlargement from 6 - 16 weeks. Weed control is essential especially during early stages of growth. The rate of

ground coverage by foliage varies greatly with growing conditions and cultivar, but once ground coverage has occurred, weed control is less of a problem. Sweet potato tuber initiation is subject to aeration in the soil. Either heavy clay soils, waterlogged conditions or other factors reducing aeration can result in poor tuber production. For this reason, sweet potatoes are often grown on mounded beds. In well drained or high organic matter soils, digging or mounding is not as essential. Leaf scab (*Elsinoe batatas*) can significantly reduce yield especially in sites where leaf production is low due to low soil fertility. To reduce sweet potato weevil damage, plants need to be hilled or have the tubers well covered with soil. Cracking soils can allow the weevil access to tubers.

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
tuber (baked)	72.9	431	1.7	961	24.6	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

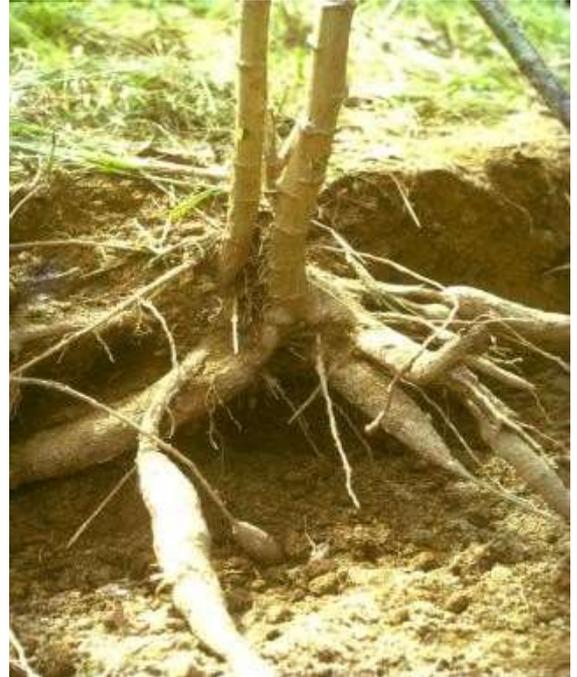
English: Cassava, manioc, tapioca

Kiswahili: Mihogo

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	-

Legumes

English: Jack bean

Kiswahili: Njegere

Scientific name: *Canavalia ensiformis*

Plant family: FABACEAE

Description: A perennial climber, although short kinds do occur. Often it is a more bushy plant than the sword bean. Plants grow up to 1.5 m long. Stems can be hairy. Leaves have 3 leaflets. The leaflets are oval and 5.7 - 20 cm long by 3.2 - 11.5 cm wide. The leaf tends to be wedge shaped at the base. The leaf stalks are 2.5 - 11 cm long. Flowers are red/purple. They occur on flower clusters 5 - 12 cm long and with flower cluster stalks which are 10 - 34 cm long. The individual flower stalks are 2 - 5 mm long. Pods are long and sword shaped. Pods can be 15 - 35 cm long. Seeds are white with a light brown hilum half as long as the seed. Seeds are 2 cm long, by 1 cm across.



Distribution: It grows in tropical and subtropical places. It requires a fairly high temperature (15° - 30°C). It will possibly grow up to 900 m altitude. It is fairly drought resistant and also has some resistance to water-logging and salt in the soil. It can tolerate shade. It can tolerate pH from 4.5 - 8.0 but does best at about 6.1. The optimum mean annual temperature is 14.4° - 27.8°C. Seed germinate between 24 - 27.5°C. It is a short day plant growing well with a day length of 10 - 12 hours of sunlight. It can grow in arid places.

Use: The leaves and top shoots are eaten. The very young pods are boiled and eaten. The flowers can be eaten. The young seeds are eaten boiled, roasted, or peeled and cooked. The seeds are also fermented. The ripe seeds are roasted and used as a coffee substitute. **Caution:** The ripe seeds can contain poison and need to be well cooked and the water changed before eating. They are also often left under running water or fermented.

Cultivation: It is grown from seeds. Seeds need to be 2 cm deep. A spacing of about 60 cm is suitable. Plants preferably need a support to climb over. It benefits from a fertile soil but adding nitrogen depresses yield.

Production: Green pods are produced in 3 - 4 months, but ripe seeds need 6 - 9 months. Yield of seeds can range from 700 - 5,400 kg/ha.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	10.0	1423	20.4	160	-	4.9	-
pod (fresh)	88.0	155	2.4	-	-	-	-

Legumes

English: Guar bean, Clusterbean

Kiswahili: Jamii ya Maharage

Scientific name: *Cyamopsis tetragonolobus*

Plant family: FABACEAE

Description: An upright bushy plant often only 1 m tall. Some kinds grow to 3 m. The branches are stiff and usually with white hairs. The branches stick upwards and are angled and with grooves. The leaves are produced alternately and have 3 leaflets. The leaflets are oval and with slight saw teeth around the edge. The leaf stalks have grooves. The flowers are small in clusters in the axils of leaves. The flowers are white with pink wings. It produces clusters of thick fleshy pods. They are stiff and straight. There is a double ridge along the top of the pod and a single one below. There are also 2 ridges along the flat sides. The pods have a beak at the end. There are 8 - 10 small oval seeds inside.



Distribution: A tropical plant. It is a hardy, drought resistant plant that suits dry areas. It grows well on alluvial and sandy soils and in areas with high summer temperatures and low rainfall. It can tolerate an alkaline soil with pH 7.5 - 8.

Use: The green immature pods are eaten cooked. They are added to curries. They can be fried in oil, salted or dried for later use. The seeds are eaten. The seeds contain a gum used as a thickening agent. It is used in ice cream, baked goods, gluten free foods and salad dressing. The sprouted seeds are also eaten.

Cultivation: They are grown from seed, often in mixed cropping situations. It requires 15 - 24 kg of seed to sow a hectare. Seeds are sown 2 - 3 cm deep. They are often put 20 - 30 cm apart in rows 65 cm apart. Seeds germinate within one week.

Production: Plants mature in 3 - 3.5 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
seed	9.9	1452	30.5	-	-	-	-
pod (fresh)	82.0	-	3.7	198	49	5.8	-

Legumes

English: African yam bean

Kiswahili: Soya

Scientific name: *Sphenostylis stenocarpa*

Plant family: FABACEAE

Description: A vigorous climbing vine. It grows 1.5 - 2 m high. The leaves have 3 leaflets. They are 14 cm long and 5 cm wide. The flowers are pink, purple or greenish-white. They are 2.5 cm long. They occur on stout stalks in the axils of leaves. The seed pods are smooth and 25 - 30 cm long by 1 - 1.5 cm wide. They are flat but have both edges raised. The seeds vary in shape, size and colour. They can be 1 cm long by 0.7 cm wide. They can be cream or brown. Small narrow tubers grow under the ground. They can be 5 - 7.5 cm long and weigh 50 - 150 g. The flesh is white and watery.



Distribution: It is a tropical plant that grows from sea level up to 1,800 m altitude. It grows in grassland and woodland and sometimes in marshy sites. It can grow in arid places.

Use: The pods, leaves, seeds and tubers are cooked and eaten. They are used in soups or with maize or rice. The hard seeds need to be soaked in water for 12 hours before cooking and being ground. The tubers are cooked and eaten.

Cultivation: It can be grown from seed or tubers.

Production: Tubers are ready for harvest about 8 months 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	9.0	1470	19.2	-	-	-	-
seed (boiled)	67.9	542	3.8	-	-	-	-
tuber	64.0	542	3.8	-	-	-	-

Image accessed from http://zimbabweflora.co.zw/speciesdata/species.php?species_id=132430

Legumes

English: Pigeon pea

Kiswahili: Mbaazi

Scientific name: *Cajanus cajan*

Plant family: FABACEAE

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



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

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

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

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

Food Value: Per 100 g edible portion

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

Legumes

English: Winged bean

Kiswahili: Jamii ya Maharage

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, 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. They 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 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 grow on a wide variety of soils and on soils with pH from 3.6 - 8.0. They are sensitive to acid and waterlogged soils.

Use: Young leaves and pods, flowersripe 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: Green gram bean, Mung bean

Kiswahili: Choroko

Scientific name: *Vigna radiata*

Plant family: FABACEAE

Description: An upright hairy bean plant which can grow to 1 m tall. It has many branches. The leaves have 3 leaflets, are dark green and grow on long leaf stalks. There are oval stipules at the base of the leaf. Flowers are pale yellow and small. They occur in bunches of 10 - 20 on the ends of long hairy flower stalks. Pods are black and straight. They do not have a beak. Pods contain 10 - 20 seeds which are usually green or golden yellow. They are smaller than black gram. The beans can be black. They have a flat white hilum. There are 2,000 varieties.



Distribution: A tropical and subtropical plant. The plant will grow from sea level up to about 2000 m in the tropics. It is drought resistant but can't stand water-logging. Plants are damaged by frost. They cannot stand salinity. Rainfall at flowering is detrimental. It requires a deep soil. Both short day and long day varieties occur. It can grow where annual temperatures are from 8 - 28°C. It can tolerate a pH from 4.3 - 8.1. It suits a drier climate and can grow in arid places. It suits hardiness zones 10 - 11.

Use: Seeds are eaten ripe, raw or roasted. They are added to soups and stews. They are also fermented. Young pods and leaves can be eaten. The seeds can be germinated for sprouts and used in salads and stir-fried dishes. The seeds are ground and used for starch to make noodles.

Cultivation: Plants are grown from seed. In some areas these are broadcast while for small plots often 2 - 3 seeds are sown in holes 50 - 60 cm apart. Seeding rates of 6 - 22 kg per ha are used in different locations. It normally requires phosphorus fertiliser for adequate growth. Seeds germinate in 3 - 5 days.

Production: Green pods are ready after about 2 months and ripe pods may take another 1 - 2 months. For ripe beans the whole plant is harvested and dried before threshing. Yields of 450 - 560 kg/ha of seeds are common.

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	11.0	1432	22.9	55	4	7.1	-
seed (cooked)	-	439	7.0	2.4	1.0	1.4	-
seed (sprouted)	90.4	126	3.0	2	13.2	0.9	0.4

Legumes

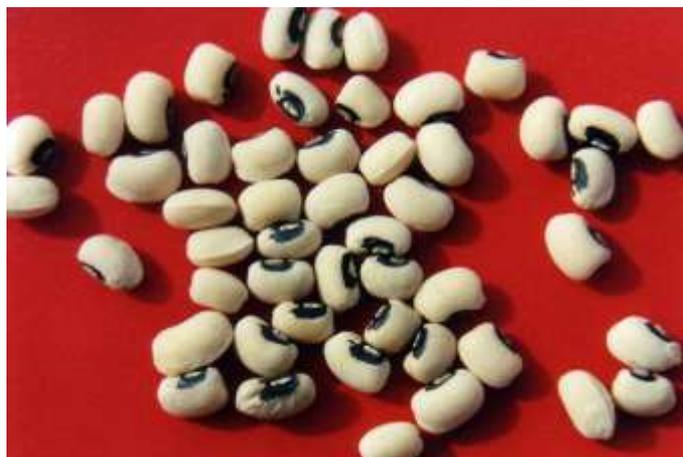
English: Cowpea

Kiswahili: Kunde

Scientific name: *Vigna unguiculata subsp. unguiculata*

Plant family: FABACEAE

Description: A creeping bean type plant with straight firm pods. There is a deep tap root and many branches occur from it in the surface of the soil. The root nodules are large and round. The leaves have 3 leaflets. The end leaflet can be 12 - 16 cm long. The side leaflets are asymmetrical. The stipules at the base of the leaf are large and with spurs at their base. Flowers occur often in pairs on the end of long flowering shoots. Only 2 - 4 flowers in each stalk produce pods. Flowers are white, yellow or blue. They are large and showy. The pods are about 15 cm long. The seeds are white except for a dark scar.



Distribution: It grows in tropical and subtropical climates. It grows from sea level to 1,800 metres altitude in the tropics. Plants can stand high temperatures. Some kinds can tolerate drought. They are sensitive to cold and killed by frost. Plants germinate with a temperature between 11.5 - 15.5°C. The best growth occurs between 20 - 35°C. They can grow on a range of soils providing they are well drained. They are a short day plant. They do well in the semiarid tropics. It will not tolerate acid or alkaline soils. It grows in areas with an annual rainfall between 280 - 410 mm. It can grow in arid places.

Use: The young leaves, young pods and ripe seeds are all eaten. They can be steamed, boiled, stir-fried etc. The leaves can be dried and stored. The dried seeds are used in soups and stews. They are ground into flour or fermented. The seeds are also used for bean sprouts. Roasted seeds are used as a coffee substitute.

Cultivation: It is grown from seeds. Seeds remain viable for several years if carefully stored. A seeding rate of about 20 kg per ha is suitable and seed are sometimes broadcast then thinned.

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)	11.2	1189	23.5	-	1.5	6.4	-
seed (young, boiled)	75.5	406	3.2	79	2.2	1.1	1.0
leaf	88.4	143	4.2	36	35	4.7	0.3
young pod + seed (boiled)	89.5	142	2.6	45	17.0	0.7	0.2
leaf (boiled)	91.3	92	4.7	29	18	1.1	0.2

Leafy greens

English: Amaranth greens, Green Vegetable

Kiswahili: Mchicha

Scientific name: *Amaranthus hybridus*

Plant family: AMARANTHACEAE

Description: An upright annual herb that grows 80 cm - 2 m tall. It is often green but can be dark red. The leaves are simple and alternate, oval shaped and can be 15 cm long. The flowers can be red, yellow or white. They occur in spikes at the top of the plant and in the axils of leaves. The seeds are small, shiny and black.



Distribution: A tropical plant that grows well in fertile soil. It can grow in warm temperate places as well as the tropics. In Kenya it grows from 900 - 2,600 m above sea level.

Use: The leaves and young shoots are cooked and eaten. They are also dried.

Cultivation: Plants are grown from seeds.

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
leaf	87.4	189	4.9	-	108	5.7	-

Image sourced from: https://en.wikipedia.org/wiki/Amaranthus_hybridus

Leafy greens

English: Silver spinach

Kiswahili: Spinachi

Scientific name: *Celosia trigyna*

Plant family: AMARANTHACEAE

Description: A branched and straggling herb that grows 25 - 120 cm tall. The lower leaves have long leaf stalks. The plant looks like *Amaranthus hybridus* until it starts to flower. Where the leaf stalk joins the stem there is a pair of small moon-shaped leaflets that lie around the stem. The small white or silvery flowers are crowded together in separate clusters. The fruit is a capsule which is almost round and has several seeds.



Distribution: A tropical plant that grows in tropical lowlands and highlands in Africa. It is often along the coast but grows from sea level to 1,960 m above sea level. It needs an annual rainfall of up to 2,500 mm and an average temperature of 25 - 30°C. It cannot tolerate a temperature below 15°C. It grows best on fertile, well drained soils.

Use: The young shoots and leaves are cooked and eaten. They are finely cut and used in soups, stews and sauces. Because they can be bitter, they need extensive cooking or mixing with other foods.

Cultivation: Plants are grown from seeds which germinate in 4 - 5 days. It grows for 90 - 120 days. Because the seeds are small, they are best mixed with sand to give a more even distribution when sowing.

Production: Plants can be uprooted and harvested or leaves removed. Harvests of 4 - 5 t/ha can be achieved from weekly harvests over 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	89.0	139	2.7	94	10	5.0	-

Image accessed from <http://www.flickr.com/photos/36517976@N06/5063937939>

Leafy greens

English: Fat hen, Green Vegetable

Kiswahili: Mboga

Scientific name: *Chenopodium album*

Plant family: CHENOPODIACEAE

Description: An annual plant that grows to 1 m tall and spreads to 1 m across. The stem is erect and succulent with no hairs. They often have soft mealy lumps which can be rubbed off. The leaves are simple, with one at each node, and occurring alternately up the stem. The leaves are oval and wedge shaped with saw like edges. They are 5 - 12 cm long by 3 - 10 cm wide. The leaf stalk is usually shorter than the leaf blade. The under surface of the leaf often has a white mealy layer which can be rubbed off. The flowers occur in dense white spikes at the tip and ends of branches. The fruit is a small, roundish, papery pod that opens around the tip. The pod contains large numbers of shiny black seeds that are 1.2 - 1.8 mm across.



Distribution: A temperate plant that also grows in the tropics. It grows best on light to medium well drained soil. It suits an open sunny position but can tolerate shade. It is drought and frost resistant. It commonly occurs as a weed in old fields. In Zimbabwe, it grows from 1,100 - 1,600 m above sea level. It can grow in arid places and can tolerate temperatures of 5 - 30°C.

Use: The seeds can be ground into flour. They contain saponin which should be leached out. They are used for bread, pancakes, muffins and biscuits. The tender leaves are cooked and eaten as a vegetable. They are also used in stews. Young flowers are cooked and eaten. The sprouted seeds are edible.

Cultivation: Plants are grown from seed. Seedlings can be transplanted at a spacing of 30 cm. It does well in soils with lots of nitrogen. It is self-sown and harvested from potato crops in India.

Production: The tops can be eaten before and after flowering. They are harvested after 40 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
seed	-	1654	16	-	-	-	-
leaf (boiled)	88.9	134	3.2	391	37.0	0.7	0.3
leaf	87.7	113	5.3	33	108	-	-

Leafy greens

English: Jute, Bush Okra

Kiswahili: Bamia Pori

Scientific name: *Corchorus olitorius*

Plant family: MALVACEAE

Description: An annual plant. It is upright, branching, and slightly woody. Plants vary in height, shape, leafiness and hairiness. Plants grown for leaves are usually only 30 cm tall. They also have many branches. Leaves are shiny and have leaf stalks. The leaves have teeth along the edge. The tips of the lowest leaves in each side, have long bristle like structures. Small clusters of yellow flowers grow in the axils of the leaves. The fruit are ridged capsules. They can be 7 cm long. These have partitions across them between the seeds. A ripe capsules contains 180 - 230 seeds. The seeds are dull grey and with four faces and one long point. Each seed has one pale line along it.



Distribution: A tropical plant. It is mostly coastal, below 250 m altitude. Temperatures of 22°-35°C are suitable. It can stand both drought (2 - 3 weeks) and water-logging, except when young. A well-drained soil is best. They require humus-rich soils. A soil pH of 5.5 - 7.0 is best, but they can grow in soils with pH up to 8.5. They also need adequate moisture for good leaf production. A rainfall of 1,000 mm is suitable. A high relative humidity (80 - 90%) is best. It produces seeds when day lengths are short. It grows in most African and Asian countries.

Use: The young leaves and stem tops are eaten cooked. They are slimy unless fried. They are also used to make a thick soup. Leaves can be sun dried, pounded to flour, then stored for a long time.

Cultivation: Plants grow from seed, and they can be transplanted. Seeds are often broadcast into fine seed beds at the beginning of the wet season. Mixing the small seeds with sand makes it easier to sow them evenly. Often seeds are slow to start growing. This can be overcome by soaking them in hot water. A spacing of 20 - 30 cm between plants is suitable. For vigorous varieties this could be increases to 45 - 50 cm. Seeds are saved from pods for re-sowing.

Production: First leaves can be harvested after 5 - 6 weeks. Tips about 20 - 30 cm long are picked. Production of edible green tips, is not large. 7 - 8 kg of leaf tips can be harvested from 3 - 8 pickings over 3 - 4 months. Seeds can be collected after 13 - 15 weeks. If seeds of a particular variety are desired, it is necessary to grow these plants 16 m away from other plants, to avoid cross pollination. Seeds can be stored for 8 - 12 months in well-sealed jars.

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 (raw)	80.4	244	4.5	574	80	7.2	-
leaf (cooked)	87.2	155	3.4	156	33.0	3.1	0.8

Leafy greens

English: Milk thistle, Sow thistle, Green Vegetable

Kiswahili: Mboga za Majani

Scientific name: *Sonchus oleraceus*

Plant family: ASTERACEAE

Description: An erect, bluish-green, annual, hairy herb with milky sap. It grows 40 - 60 cm tall. The leaves are alternate. They do not have stalks and half clasp the stem. Leaves are 10 - 20 cm long and very coarsely lobed. Flower heads are about 1 cm long and yellow. The fruit is dry and 3 ribbed. It opens to a round white ball. The seeds blow in the wind.



Distribution: It is found occasionally in disturbed or cultivated soil. It occurs between 1,000 m and 2,500 m altitude. It can grow in arid places.

Use: The tender leaves are cooked and eaten as a vegetable. They are also used in salads. The young stalks are peeled, boiled and eaten. The roots are also used as food. **Caution:** Some forms and species are bitter.

Cultivation: It grows wild from seeds. Seeds can germinate at temperatures of 7 - 35°C.

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
leaf	94	109	2.3	678	22.0	1.6	0.7

Leafy greens

English: New Zealand spinach

Kiswahili: Spinachi

Scientific name: *Tetragonia tetragonoides*

Plant family: AIZOACEAE

Description: A perennial, branched herb. It starts growing erect, but then lies over and grows along the ground. It grows to 12 cm high. The stems can spread out to 1 m along the ground. The triangular leaves are small and thick on round fleshy stems. They are 4 - 6 cm long and have distinct veins underneath. The flowers are yellow and 8 mm across. They are hidden at the base of the leaves. The fruit is up to 1 cm long and with 4 or 5 horns on top.



Distribution: A temperate plant that will grow in hot, dry climates. It is better suited to high altitude areas above 1,000 m in tropical countries. It grows to 2,700 m in Papua New Guinea. It grows on rocky or sandy ground often close to the seashore. It can grow in salty soils. It requires good drainage and full sun. It can grow in arid places. It suits hardiness zones 7 - 9.

Use: The fleshy leaves and tops are eaten. They can be eaten raw, steamed, boiled, stir-fried, creamed, served with mushrooms, or made into quiche. **Caution:** They can contain oxalates and nitrates which can be poisonous. These can be removed by boiling in water for 2 minutes and discarding the water.

Cultivation: It is grown from seeds or cuttings. It is easy to save seed. Seeds often grow better if soaked in water overnight. Seedlings are not easy to transplant so it is better to sow direct. Often 3 - 4 seeds are planted in a mound with the mounds 70 cm apart. Cuttings form roots quickly.

Production: Plants grow rapidly. The tips of plants can be cut regularly.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	90.9	61	1.7	600	50	2.6	0.5

Fruit

English: Boabab, Cream of tartar tree

Kiswahili: Mbuyu

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.



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	-	-

Fruit

English: Tree tomato, Tamarillo

Kiswahili: Matunda

Scientific name: *Cyphomandra betacea*

Plant family: SOLANACEAE

Description: A small, soft-wooded fruit tree in the tomato and tobacco family. It grows as a shrub up to 4 m tall and is shallow rooted. The brittle stem is 5 - 10 cm across. The leaves are large (25 cm x 12 cm) and soft and heart-shaped at the base. The sweet smelling flowers are 1 - 2 cm across and occur in loose clusters near the ends of branches. Flowers are normally self-pollinating but need wind. The red or orange egg-shaped fruit are 6 - 12 cm long and hang off the ends of the branches. The skin of the fruit is somewhat tough, but the



flesh around the seeds is soft and juicy. The edible flesh varies from yellow to dark purple. The edible seeds are black, thin and nearly flat. There are several named cultivated varieties.

Distribution: A subtropical plant suited to tropical highlands. It grows at 750 - 2,200 m altitude in the equatorial tropics, and up to 3,000 m in the continental tropics. It is more cold hardy than tomato, and does best where average temperatures are 15 - 21°C. It cannot stand much frost, although mature trees will survive short periods of light frosts. It can't stand water-logging or drought. Trees can grow under shade but do better in sun, unless it is hot and dry. Deep, fertile, permeable, disease-free soil is best. Plants don't fruit at low altitudes in the tropics due to constant high temperatures. They need shelter from wind. It suits hardiness zones 9 - 11.

Use: The fruit is eaten raw or cooked. The layer just under the skin can be bitter. The layer around the seeds is sweet. The seeds can be eaten, or strained out. The outside skin is easily removed by immersing fruit in boiling water for 1 - 2 minutes. The fruit can be boiled, stewed, grilled, baked or pickled, or used in jams, jellies, chutneys, conserves, pies, preserves and sauces.

Cultivation: They can be grown from seed or cuttings. Seeds grow better if they are washed and dried, then placed in a freezer for 24 hours before planting out. Seeds produce a high branched erect tree. Cuttings produce a lower bushier plant. Cuttings of 60 - 90 cm long stalks are suitable and should be taken from 1 - 2 year old wood which is 1 - 2 cm thick. Root cuttings can also be used. It has shallow roots, so needs careful weeding. A spacing of 3 m apart is sufficient. Because the roots are easily damaged by nematodes, plants grafted or budded onto nematode resistant rootstocks will live longer. Root rot fungus can make it difficult to get plants established in old gardens. High humidity can also cause stem rots. Young plants can be pruned to produce lower branches and fruiting. Fruit is produced on new branches, so branches which have fruited can be pruned out. Flowers are self-compatible so pollination by wind can occur within the one plant.

Production: Fruiting commences in the second year when grown from seed. Trees bear hundreds of fruit throughout the year. Yields of 20 kg per plant are possible. Trees live 5 - 6 years, although if infested with root knot nematodes, may live only 3 - 4 years. Fruit are ready to harvest when the red or yellow colour develops. Fruit can be stored above 3°C in a refrigerator for 10 weeks.

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	86.2	113	2.0	500	28	0.7	-

Fruit

English: African doum palm, Palm tree

Kiswahili: Mawese

Scientific name: *Hyphaene compressa*

Plant family: ARECACEAE

Description: A tall branched palm with 2 - 4 main stems which can branch 4 or 5 times. It grows 20 m tall. The leaf colour is mostly deep green, but can be silvery or bluish-green. The fruit are oblong or pear shaped. They are orange or light brown and smell like gingerbread when broken open.

Distribution: A tropical plant that grows on the coast and extends inland along streams and rivers. It grows to 1,500 m altitude in East Africa. It needs full sun. It can grow on poor soils and survive in drier climates. It grows in areas with an annual rainfall of 200 - 900 mm. It is salt tolerant and can grow in arid places. It suits hardiness zones 10 - 11.

Use: The pulp of the ripe fruit is eaten raw. The juice of young fruit is drunk. It is also used for making beer. The outer coat of the fruit is removed from the seed and dried, ground, mixed with blood and eaten. The kernel from inside the nut is eaten. The young germinating seedling is dug up and the embryo eaten.



Cultivation: Plants are grown from seeds after the pulp is removed. Seeds are slow to germinate. Germination can be improved by breaking the hard seed coat. They should be planted in deep moist sand.

Production: It is slow growing. In Tanzania, fruit are collect during the dry season.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	10.7	-	1.6	-	275	-	-

Image accessed from http://www.fastonline.org/CD3WD_40/CD3WD/AGRIC/H1093E/EN/B567_6.HTM

Fruit

English: Mango

Kiswahili: Embe

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 μ g	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: Red Coondoo, Spanish cherry

Kiswahili: Matunda

Scientific name: *Mimusops elengi*

Plant family: SAPOTACEAE

Description: A large tree that grows 10 - 15 m tall. It has a tall trunk. The crown is dense and umbrella shaped and spreads 5 - 15 m across. The bark is rough, hard and dark grey, and is cracked along its length or forms a checkered pattern. The leaves are produced alternately and are simple. They are smooth and crowded. They are oval and 5 - 14 cm long by 2.5 - 6 cm across. They are glossy and dark green on top and paler underneath. The midrib is easy to see. Leaves have a sharp pointed tip. The scented flowers are star-shaped, cream and hairy. The flowers are 0.5 - 1 cm long in clusters in the axils of the upper leaves. The outer ring of flowers form a spiky cup at the base of the fruit. The oval berries have soft hairs that become smooth. They are 1.3 - 1.5 cm long by 1 - 1.2 cm wide. The fruit are orange-red when ripe and contain several orange-red wedge-shaped seeds.



Distribution: A plant that suits the hot tropical lowlands. It is native in Asia from India to the Pacific. Plants need well-drained soils. It grows naturally in coastal monsoon vine forests and will grow on a range of soils. It is often on sand dunes and cliffs near the beach. In tropical Australia it grows from sea level to 320 m altitude. It is drought resistant. Plants need a sunny position and are damaged by frost. It suits hardiness zones 10 - 12.

Use: Ripe fruit are eaten raw. They can be used in preserves or pickles. The kernels yield a fatty oil which can be used for cooking. The bark is used in the distillation of *arrack*.

Cultivation: Plants can be grown from seed. The seed should be sown fresh. They germinate in 6 - 14 days. They can be transplanted when the first true leaf appears. The plants can be pruned.

Production: Plants are slow growing. In Australia, plants flower from November to January and fruit from April to June.

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	46.6	825	2.9	-	223	-	-

Fruit

English: Cape gooseberry

Kiswahili: Matunda

Scientific name: *Physalis peruviana*

Plant family: SOLANACEAE

Description: A perennial herb that grows 45 - 90 cm tall. They are often grown as annuals. It is hairy and slightly branched. The spreading branches are purplish and ribbed. The leaf blade is 6 - 15 cm long by 4 - 10 cm wide. The leaves are heart shaped at the base and taper to the tip. They are slightly wavy and toothed along the edge. The flowers occur singly and hang down in the axils of leaves. The flowers are white with violet anthers and slightly spotted petals. The fruit is a berry 1 - 1.5 cm across.



They are orange-yellow or pale brown. This is inside an inflated husk. The seeds are yellow and 2 mm across. There are several named cultivated varieties.

Distribution: A temperate plant that grows in the tropical highlands. It suits warm climates and does best in warm sunny conditions. It needs well drained soil. Plants are not killed by a slight frost but it grows best free from severe frosts and strong winds. In Indonesia plants are found from 700 - 2,300 m altitude, but fruit best above 1,500 m. It can grow in arid places and suits hardiness zones 8 - 10.

Use: The ripe fruit are eaten fresh or cooked. They are used for jam. They can be dried, preserved, stewed, pureed, or used in pies, cakes, jellies and sauces. Roasted seeds are pickled. The leaves have been used instead of hops in beer. The leaves are also used as a potherb.

Cultivation: Plants are grown from seed that is broadcast over the soil. Seeds should be sown 1.5 cm deep in loose soil. Seed germinate irregularly. Plants should be spaced 45 cm apart. In the tropics, plants keep growing from year to year, but in the subtropics they regrow from seed each year. Plants can be grown from softwood cuttings from the upper parts of the shoots. Seedlings can be transplanted.

Production: Plants produce fruit in 1 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
fruit (mature)	84.2	201	2.0	36	30	1.5	-

Fruit

English: Breadfruit
Kiswahili: Sheli sheli

Scientific name: *Artocarpus altilis*
Plant family: MORACEAE

Description: A large tree that grows 20 - 26 m in height. The trunk can be 6 m tall before branching, and up to 1 m across. It is an evergreen tree, but can lose its leaves in dry weather. The leaves are large and vary from rough to smooth and shiny, and from entire to deeply lobed. They can be entire or divided into 5 to 11 lobes. The leaves are bright green on the upper surface with yellow veins and are pale and dull on the under surface. They have very small stiff hairs underneath. Male and female flowers



grow separately on the same tree and normally appear at the same time. The flowers are in the axils of leaves. Male flowers form a drooping, oblong catkin 12 - 30 cm long. Female flowers form a globular head. The flower head develops into the compound fruit. The fruit are large and green and vary from round to oblong. They can be 12 - 22 cm long and 9 - 17 cm wide. Seeded fruit have projecting tubercles on the surface of the fruit. Seedless kinds are smoother with rounded or 5 to 6 sided processes on the surface. Seeded, small-seeded, and non-seeded types occur. There are a number of cultivars of each. Seeded fruit have 30 - 90 seeds per fruit. Seed can be 2 cm across and with darker lines.

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

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

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

propagation. The vegetatively propagated trees are therefore clones and the variation is presumably therefore somatic.

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

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

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

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

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

Food Value: Per 100 g edible portion

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

Fruit

English: Guava
Kiswahili: Mapera

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

Vegetables

English: Okra, Lady's fingers

Kiswahili: Bamia

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: Pumpkin, Winter squash

Kiswahili: Mamung'unya

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 or 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: Marrow
Kiswahili: Maboga

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.



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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: Angled loofah

Kiswahili: Jamii ya Maboga

Scientific name: *Luffa acutangula*

Plant family: CUCURBITACEAE

Description: A herb of the pumpkin family plant. It is an annual climber with square stems. They have 4 - 7 branched tendrils which attach to objects helping the plant to have a climbing habit. Leaves are pale green, hairy and shallowly five lobed. The leaves have a bad smell when rubbed. Male and female flowers are separate. Male flowers are in clusters, female flowers singly (ratio 43:1) Flowers open late in the afternoon and stay open during the night. The flowers are yellow. Fruit can be up to 40 cm long and with 10 long ridges. It is green-brown outside and white inside. Three varieties have been distinguished.



Distribution: A tropical plant. It grows from sea level to 500 m altitude in the hot humid tropics. It won't tolerate excessive rainfall so does best in drier areas or in the dry season in wetter areas. Day temperatures above 25°C are suitable. Some varieties require short day length. Adding additional nitrogen fertiliser can stimulate female flower formation in short day varieties. In Nepal it grows from 1,000 - 1,600 m altitude. It can grow in arid places.

Use: The immature fruit are cooked and eaten as a vegetable. The ridges are removed with a vegetable peeler. The fruit are boiled, steamed or stir-fried. They can be added to soups, stews and curries. The leaves are edible. They can be eaten in salads or cooked as a vegetable. The flower buds are dipped in batter and sauteed. Mature seeds are roasted, salted and eaten as a snack.

Cultivation: Seeds are sown direct at 40 cm by 80 cm spacing and need stakes to climb. Because seeds can have a hard coating, soaking seed in water for 24 hours before planting can assist germination. 5 kg of seed per hectare are required. The plant benefits from full sunlight. Good soil fertility is beneficial. The soil needs to be well drained and adequate organic matter helps. Pinching out the growing tips when plants are 1.5 - 2 m long can promote fruit development. Hand pollination once female flowers develop helps fruit set. This is best done in the evening.

Production: Immature fruit are ready 6 - 10 weeks after planting. On maturity the fruit become bitter and inedible. Fruit do not store well so are harvested when they are to be used.

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	94.6	71	0.7	-	-	0.5	-
leaf	89.0	-	5.1	-	98	11.5	-

Vegetables

English: Bitter cucumber

Kiswahili: Jamii ya matango

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: Choko, Chayote, Chook

Local: Jamii ya Maboga

Scientific name: *Sechium edule*

Plant family: CUCURBITACEAE

Description: A vigorously growing climber that can last for several years. It has strong tendrils which can attach to fences and trees so that the plant can climb well. The choko leaves are about 15 - 20 cm across and have a rough feel. The stems have furrows along them. The fleshy fruit contain one large seed. The choko fruit is produced in the angle where the leaf joins the vines. Fruit can be up to 20 cm long and they are rough or irregular shaped on the outside. There are white and green fruited varieties.



The flowers are separate. Male flowers are in clusters and female flowers are on their own. A choko plant produces a large thickened root tuber and the plant can re-grow from this tuber and go on growing year after year.

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

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

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

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

Food Value: Per 100 g edible portion

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

Vegetables

English: Chinese taro, Tannia, Small Yams

Kiswahili: Magimbi madogo

Scientific name: *Xanthosoma sagittifolium*

Plant family: ARACEAE

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



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

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

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

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

Food Value: Per 100 g edible portion

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

Nuts, seeds, herbs and other foods

English: Sweet acacia, Prickly Moses, Sweet Fruits

Kiswahili: Matunda

Scientific name: *Acacia farnesiana*

Plant family: FABACEAE

Description: An evergreen shrub. It grows 5 - 7 m tall and 3 m across. The stem is slender and erect. The crown is open. It is a spreading, densely branched shrub. The bark is smooth and brown. The leaves are branched and green. There are 4 - 6 pairs of larger leaves and 10 - 20 pairs of small leaflets. They have tiny leaflets and thorns up to 2 cm long, occur in pairs. The leaf stalk has a gland at or above the middle. The flowers are large orange balls. They are strongly perfumed. (The oil is used as a perfume in France.) The pods are long and dark brown to black. They are 5 - 8 cm long by 0.5 - 1 cm wide. They are inflated and sausage like. Often they are curved. They are marked with narrow lines. The pods have hard grey seeds imbedded in a pithy substance. The pods do not split open at maturity. The seeds are chestnut brown and 7 - 8 mm long by 5.5 mm wide.



Distribution: It is a tropical plant. This tree occurs naturally in Australia, Asia and Africa. It will grow on most soils. It is drought and frost resistant. It most commonly grows naturally on clay soils. In Papua New Guinea the plants are coastal below 60 m altitude. It grows in areas with an annual rainfall between 400 - 4,000 mm. It can grow in acid or alkaline soils. It can grow in arid places. It suits hardiness zones 11 - 12.

Use: The pods have been recorded as eaten after cooking. The gum is eaten. The ground up seeds are eaten. The germinated seeds are claimed to be eaten. The gum is used to prepare sweets. The young leaves are used in India as a substitute for tamarind in chutneys.

Cultivation: It is grown from seed.

Production: It is fast growing. Flowering can occur almost continuously if watering is regular. In northern Australia, flowering is normally May to July, with pods available from September to November.

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)	8.1	1522	36.6	-	-	6.0	0.6

Nuts, seeds, herbs and other foods

English: Shallot, Everlasting Onion, Onions

Kiswahili: Kitunguu Maji

Scientific name: *Allium cepa* var *aggregatum*

Plant family: AMARYLLIDACEAE

Description: These onion like plants produce a cluster of bulbs. They are narrowly oval. It grows to 1.2 m high. The leaves are round and hollow. This is a genuinely perennial form of *Allium cepa*, the bulb grows deeper in the soil and divides to produce a number of underground bulbs each year in much the same way as shallots. Large bulbs divide to form 5 - 15 bulbs whilst smaller bulbs grow into one large bulb. They do not produce bulbils in the flower-head.



Distribution: A temperate plant. They can be grown throughout the country but do best in the cooler higher places. They need a fertile well drained soil. They are frost resistant. They tolerate a pH in the range 4.5 - 8.3. It suits hardiness zones 5 - 10.

Use: The bulbs are eaten raw or cooked. The leaves are eaten raw or cooked. The flowers are used raw or to flavour salads.

Cultivation: Normally plants are grown by planting one bulb. It is best to plant them on slightly raised beds. Plants should be about 20 cm apart.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	90.0	126	1.8	945	19	3.7	-
bulb	81	281	1.9	-	2	0.8	-

Nuts, seeds, herbs and other foods

English: Sand apple, Dwarf mabolo, Apple

Kiswahili: Epo

Scientific name: *Parinari capensis*

Plant family: CHRYSOBALANACEAE

Description: A shrub with underground stems that are woody and up to 1 cm thick. These form a branching network. Aerial stems arise from these. These can be 20 cm high. There are a few erect leaves. The leaf blade is sword shaped and 8 cm long by 1.5 cm wide. The lower surface has a white felt. The flowers are in loose clusters. They are cream coloured. The fruit is oval and fleshy. They are 1.8 cm long and have one seed. The fruit has a strong smell.



Distribution: A tropical plant. It grows amongst rocks and in sand and clay soils. It can be in seasonally flooded grassland. It grows between 900 - 1,200 m above sea level. In Zimbabwe it grows between 1,200 - 1,600 m above sea level. It can grow in arid places.

Use: The sweet outer layer of the fruit is eaten. It is buried in the sand to become ready to eat. It can be dried and eaten as a soft cake. It is also used to make beer. Juice of the fruit can be drunk fresh or boiled to a firm consistency. The crushed kernels are eaten as a relish with meat.

Cultivation:

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
nut	1.9	2919	26.3	-	-	4.7	3.7

Nuts, seeds, herbs and other foods

English: Java almond, Coastal almond

Kiswahili: Mtende

Scientific name: *Terminalia catappa*

Plant family: COMBRETACEAE

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



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

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

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

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

Food Value: Per 100 g edible portion

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

Nutritional values of food plants by plant Family

Plant Family	Scientific name	Common name	Kiswahili	Edible part	Moisture %	Energy kJ	Protein g	Vit A µg	Vit C mg	Iron mg	Zinc mg	Page
AIZOACEAE	<i>Tetragonia tetragonoides</i>	Spinach	Spinachi	leaf	90.9	61	1.7	600	50	2.6	0.5	31
ALLIACEAE	<i>Allium cepa var. aggregatum</i>	Onion	Kitunguu Maji	leaf	91.0	126	1.8	945	19	3.7	-	53
AMARANTHACEAE	<i>Amaranthus hybridus</i>	Amaranth greens	Mchicha	leaf	87.4	189	4.9	-	108	5.7	-	26
AMARANTHACEAE	<i>Celosia trigyna</i>	Silver spinach	Spinachi	leaf	89.0	139	2.7	94	10	5.0	-	27
ANACARDIACEAE	<i>Mangifera indica</i>	Mango	Embe	fruit	83.0	253	0.5	54	30	0.5	0.04	36
ARACEAE	<i>Colocasia esculenta</i>	Yams	Magimbi	root	66.8	1231	1.96	3	5	0.68	3.2	10
ARACEAE	<i>Xanthosoma sagittifolium</i>	Chinese taro	Magimbi madogo	leaf	90.6	143	2.5	160	37	2.0	-	50
ARECACEAE	<i>Hyphaene compressa</i>	African doum palm	Mawese	fruit	10.7	-	1.6	-	275	-	-	35
ASTERACEAE	<i>Sonchus oleraceus</i>	Milk thistle	Mboga za Majani	leaf	94	109	2.3	678	22.0	1.6	0.7	30
BOMBACACEAE	<i>Adansonia digitata</i>	Boabab	Mbuyu	fruit	16.0	1212	2.2	-	360	7.4	6.7	32
CHENOPODIACEAE	<i>Chenopodium album</i>	Fat hen	Mboga	leaf - boiled	88.9	134	3.2	391	37.0	0.7	0.3	28
CHRYSOBALANACEAE	<i>Parinari capensis</i>	Sand apple	Epo	nut	1.9	2919	26.3	-	-	4.7	3.7	54
COMBRETACEAE	<i>Terminalia catappa</i>	Coastal almond	Mtende	nut - dry	4.2	2987	20.0	0	2	6.3	3.3	55
CONVOLVULACEAE	<i>Ipomoea batatas</i>	Sweet Potato	Viazi vitamu	tuber - baked	72.9	431	1.7	961	24.6	0.5	0.3	15
CUCURBITACEAE	<i>Cucurbita maxima</i>	Winter squash	Mamung'unya	seed - dry	6.9	2264	24.5	38	1.9	14.9	7.5	44
CUCURBITACEAE	<i>Cucurbita pepo</i>	Marrow	Maboga	fruit - yellow	92.0	97	1.0	180	8	1.4	-	45
CUCURBITACEAE	<i>Luffa acutangula</i>	Angled loofah	Jamii ya Maboga	fruit	94.6	71	0.7	-	-	0.5	-	46
CUCURBITACEAE	<i>Momordica charantia</i>	Bitter cucumber	Jamii ya matango	pod - raw	94.0	71	1.0	380	84	0.4	0.8	47
CUCURBITACEAE	<i>Sechium edule</i>	Choko	Jamii ya Maboga	leaf	91.0	105	4.0	75	24	1.4	-	49
DIOSCOREACEAE	<i>Dioscorea bulbifera</i>	Potato yam	Viazi vikuu	tuber	70.8	357	2.7	-	78	3.1	0.4	12
EUPHORBIACEAE	<i>Manihot esculata</i>	Cassava	Mihogo	tuber	62.8	625	1.4	30	15	0.23	0.48	17
FABACEAE	<i>Canavalia ensiformis</i>	Jack bean	Njegere	seed	10.0	1423	20.4	160	0	4.9	-	19
FABACEAE	<i>Cyamopsis tetragonolobus</i>	Guar bean	Jamii ya Maharage	seed	9.9	1452	30.5	-	-	-	-	20
FABACEAE	<i>Sphenostylis stenocarpa</i>	African yam bean	Soya	seed	9.0	1470	19.2	-	-	-	-	21
FABACEAE	<i>Cajanus cajan</i>	Pigeon pea	Mbaazi	seed	10	1449	19.5	55	-	15.0	-	22
FABACEAE	<i>Psophocarpus tetragonolobus</i>	Winged bean	Jamii ya Maharage	seed	8.5	1764	41.9	-	-	15.0	4.5	23
FABACEAE	<i>Vigna radiata</i>	Green gram bean	Choroko	seed	11.0	1432	22.9	55	4.0	7.1	-	24
FABACEAE	<i>Vigna unguiculata subsp. unguiculata</i>	Cowpea	Kunde	seed - dry	11.2	1189	23.5	-	1.5	6.4	-	25
FABACEAE	<i>Acacia farnesiana</i>	Sweet acacia	Matunda	seed - dry	8.1	1522	36.6	-	-	6.0	0.6	52

MALVACEAE	<i>Corchorus olitorius</i>	Bush okra	Bamia Pori	leaf - raw	80.4	244	4.5	278	37	7.2	-	29
MALVACEAE	<i>Abelmoschus esculentus</i>	Okra	Bamia	pod	88.0	151	2.1	185	47	1.2	-	43
MORACEAE	<i>Artocarpus altilis</i>	Breadfruit	Sheli sheli	fruit	74.4	506	1.5	4	25	0.4	0.2	40
MUSACEAE	<i>Ensete ventricosum</i>	Banana	Ndizi	seed - dry	12.4	1472	13.3	-	-	-	-	13
MYRTACEAE	<i>Psidium guajava</i>	Guava	Mapera	fruit	77.1	238	1.1	31	184	1.4	0.2	42
POACEAE	<i>Pennisetum glaucum</i>	Bullrush millet	Uwele	seed	13.5	1363	12.7	-	-	3.5	-	14
SAPOTACEAE	<i>Mimusops elengi</i>	Red Coondoo	Matunda	fruit	46.6	825	2.9	-	223	-	-	38
SOLANACEAE	<i>Cyphomandra betacea</i>	Tamarillo	Matunda	fruit	86.2	113	2.0	500	28	0.7	-	33
SOLANACEAE	<i>Physalis peruviana</i>	Cape gooseberry	Matunda	fruit	84.2	201	2.0	3.6	30	1.0	-	39



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