Potentially Important Food Plants of Ecuador

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.

Food Plant Solutions Field Guide – Ecuador, Version 1, August, 2015

Preface

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

The selection of plants included in this guide has been developed by John Fisher 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 Ecuador. This guide has been developed with the best intention to create interest and improve understanding of the important local food plants of Ecuador, 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 useful, and sometimes under-utilised, food plants of Ecuador. 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 in favour of introduced varieties. The principle behind Food Plant Solutions is to encourage the use of these local plants.

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. While this is sometimes true, it is often not the case. Many of the newer or introduced food plants, such as the round or ballhead cabbages and lettuce, 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 showing there are often much better choices of local foods with higher levels of important nutrients.

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 local regions. Others have hundreds of varieties and are the main food for people in different regions. Information on these plants, and in many cases, 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. Potatoes should be grown from new seed pieces each year to prevent build up of virus diseases. Tomatoes will yield fewer but larger fruit if lower branches are pruned. 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.

An Important Note

As noted above, a guiding principle behind Food Plant Solutions is to encourage the use of local plants. It is acknowledged that some of these may be major agricultural crops that are already well known, such as:

- Rice
- Wheat
- Oats
- Maize/corn
- Mango
- Banana

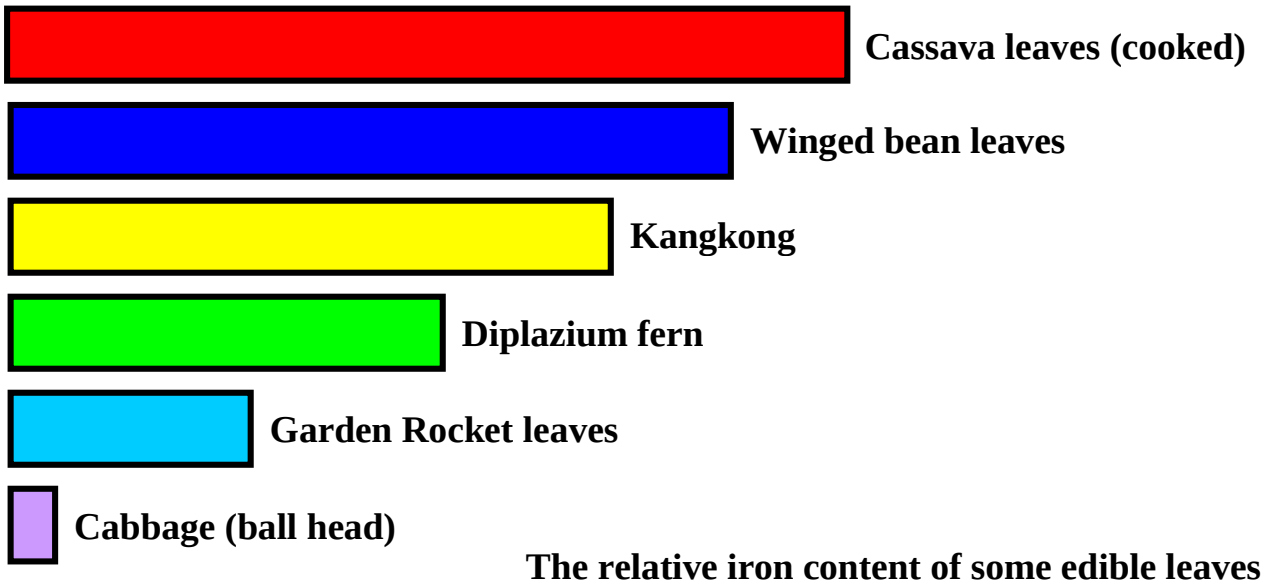
There are others, but these serve as examples.

As a general principle, these types of plants are not included in a field guide, as they are well known, and in some cases (e.g. corn), can be relatively high input crops. However, if they are particularly important in a country, such as rice in many Asian countries, they may still be included. The main purpose of the Food Plants Solution project is to look beyond these types of crops, and focus on plants that are less well known and, as noted above, often have superior food value and lower input requirements.

It is also important to note that while some plants have extremely high levels of some nutrients, many of these are used as flavouring foods (condiments), and are generally used only in small amounts. Therefore, the nutritional contribution they make to the diet will be relatively small. Typical of these types of plants are coriander, parsley etc. Once again, these should not be considered as major food sources. A few may be included in the *Nuts, Seeds, Herbs and other foods* section of the field guide.

Nutrient Value

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. Some plants contain 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) becomes more readily 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 region. 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, (and keeping it watered), 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 some 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. In many cases, small tubers of yams, taro etc. are stored for planting for the next crop. This is not always good practice, as the small tubers could be the result of diseases (such as viruses) in the plant. A good rule is to take cuttings or save tubers from the best plants for re-planting.

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. 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. This is not to say that imported varieties might not be better, but it is worth checking that the new plant will perform as well as, or better than, those currently grown, before going to the trouble of importing seed. *If you can't get seeds or planting material from local gardens, it is probably not a suitable local plant! Once again saving seed from the better plants helps ensure that you have better crops the next time you 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. 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 tubers will store well for a few months in the right conditions.

Crop rotation

Crop rotation involves planting different crops in succession to improve soil fertility and reduce the impact of insect pests and diseases. The crops in the rotation should be selected to reduce the risk of carry-over pests and diseases from one crop to the next. A three-year rotation would normally involve growing a legume to increase soil nitrogen levels, and then two different crops before a legume is planted again. Maximum suppression of diseases and insects should be achieved if the non-legume crops are alternated between grass and broad-leafed plant families. Crops planted in a mixture of two or more species will provide greater diversity, and hence reduce losses due to pests and diseases.

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.

Control of soil erosion

Erosion, or loss of soil, occurs when wind or running water carries soil away from cultivated areas. If erosion continues year after year, the land will become unproductive. Trees and shrubs can be planted in strips across the direction of the dominant wind to reduce wind erosion, or across the slope to help slow water that flows over cultivated soils. Growing crops with good leaf cover, or leaving crop residues to cover the soil surface, will significantly reduce soil loss during windy or wet seasons. When possible, any soil disturbance, such as tillage, should occur after the risk of windy weather or wet weather run-off has passed. In steep areas, tillage should be on the contours around hills, rather than up and down the slope. Various techniques can be used to leave ridges or terraces in the tilled soil to help slow water, or reduce the effects of wind, and hence reduce soil loss. Always reduce tillage to the minimum amount possible while still achieving a successful crop.

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. Cutting it into small pieces will help it break down more quickly into usable compost.

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 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 an 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. Compost returns nutrients to the soil, improves the soil's ability to retain moisture and also helps improve soils that are acid or saline.

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. Cutting the plant material (especially stems), into small pieces no longer than about the width of a finger, will help it break down quicker. If possible, make layers of plant material, then a small layer of soil, and then scatter fire ash on top. Keep repeating this process to make a heap. A good compost heap should be warm inside. Be careful with diseased plant material. This should be burnt, otherwise the disease may be spread when you use the compost at a later date.

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. A handful of compost placed at the base of each plant can be beneficial.

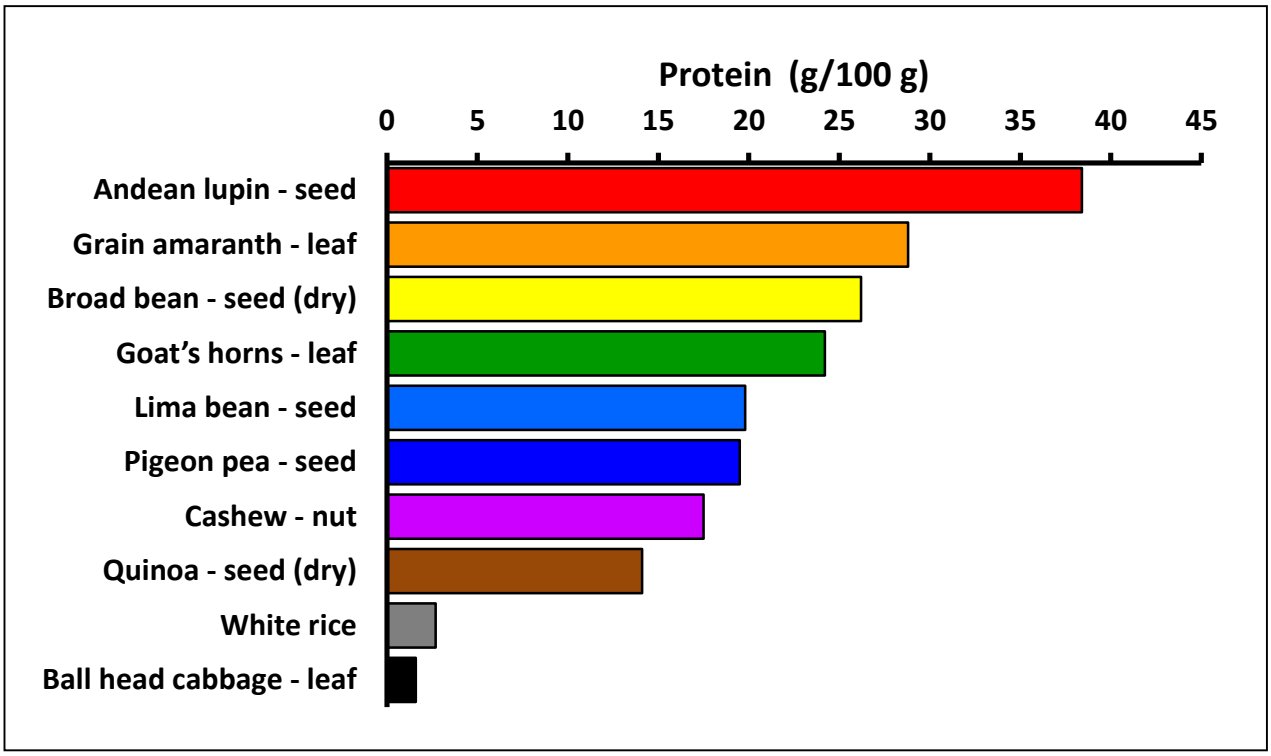
Pests

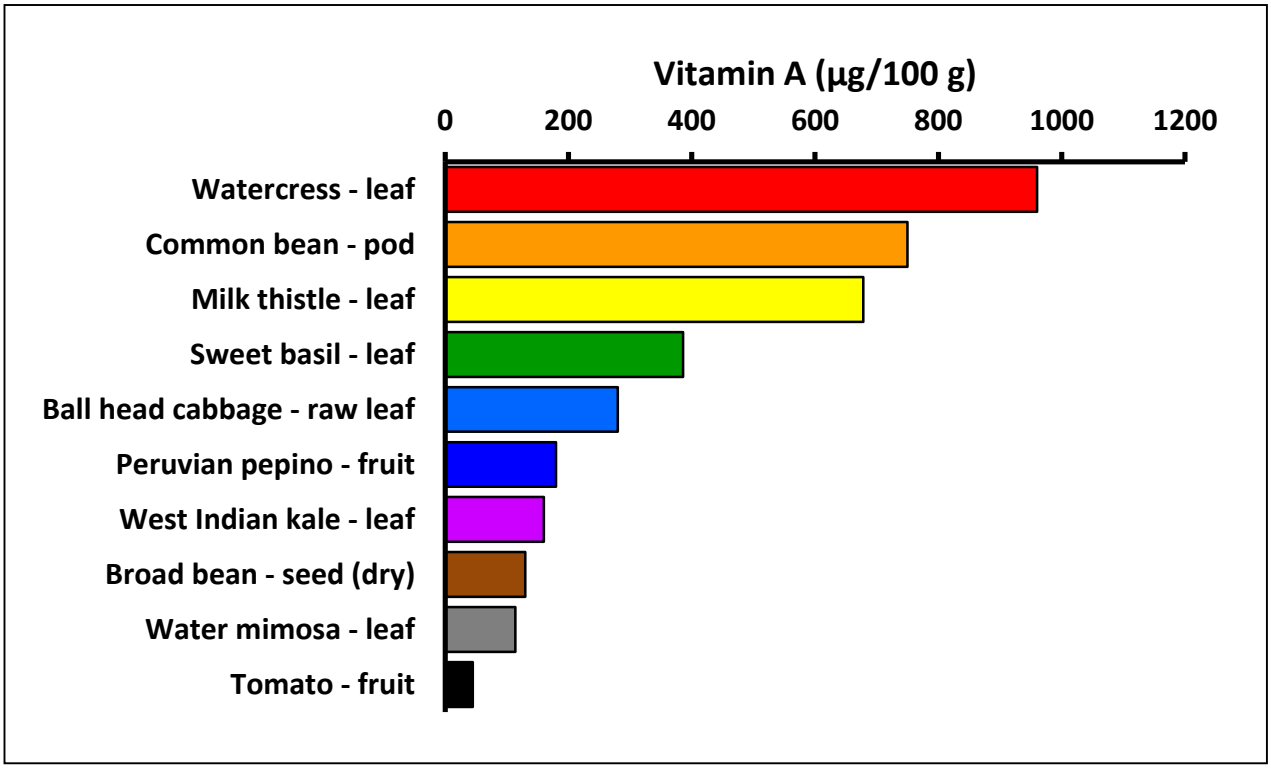
There are a large number of insects that enjoy sharing our food with us! We should not try to kill all these insects as they have an important role to play in keeping everything in nature in balance. What we need to do is to learn to manage these insects so we can all get some food to eat! Some insects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

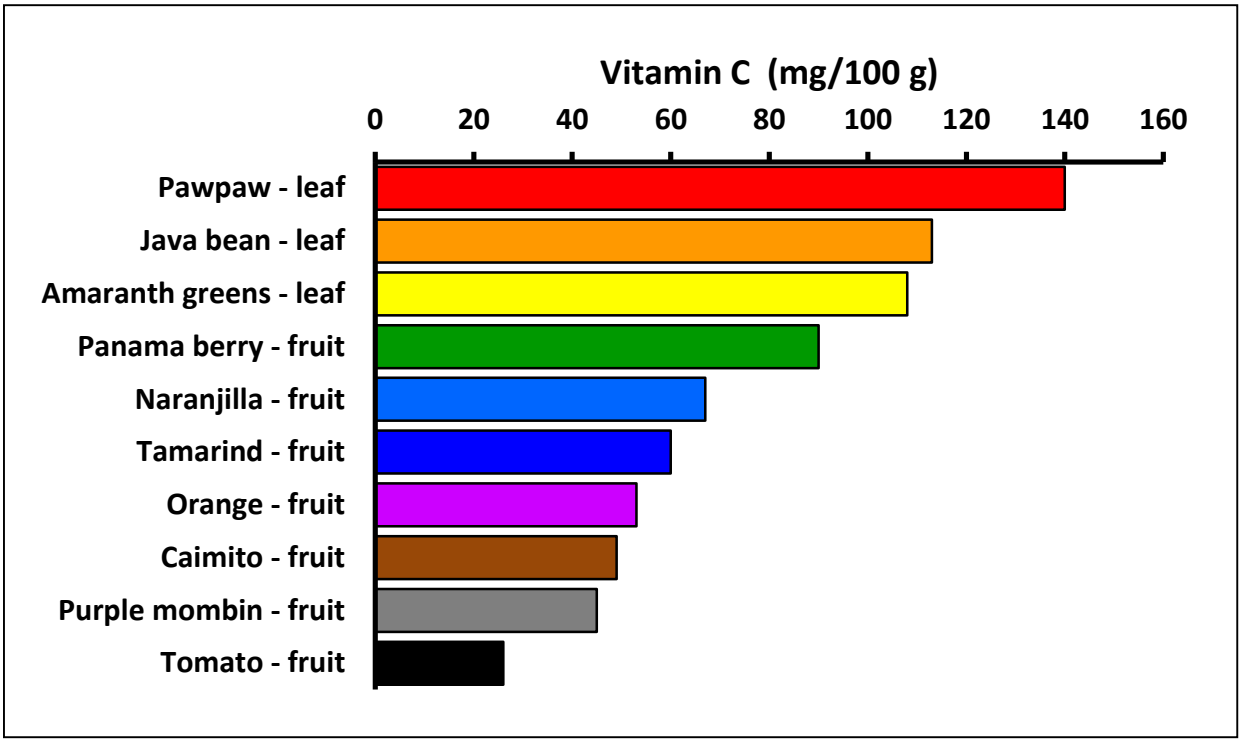
Diseases

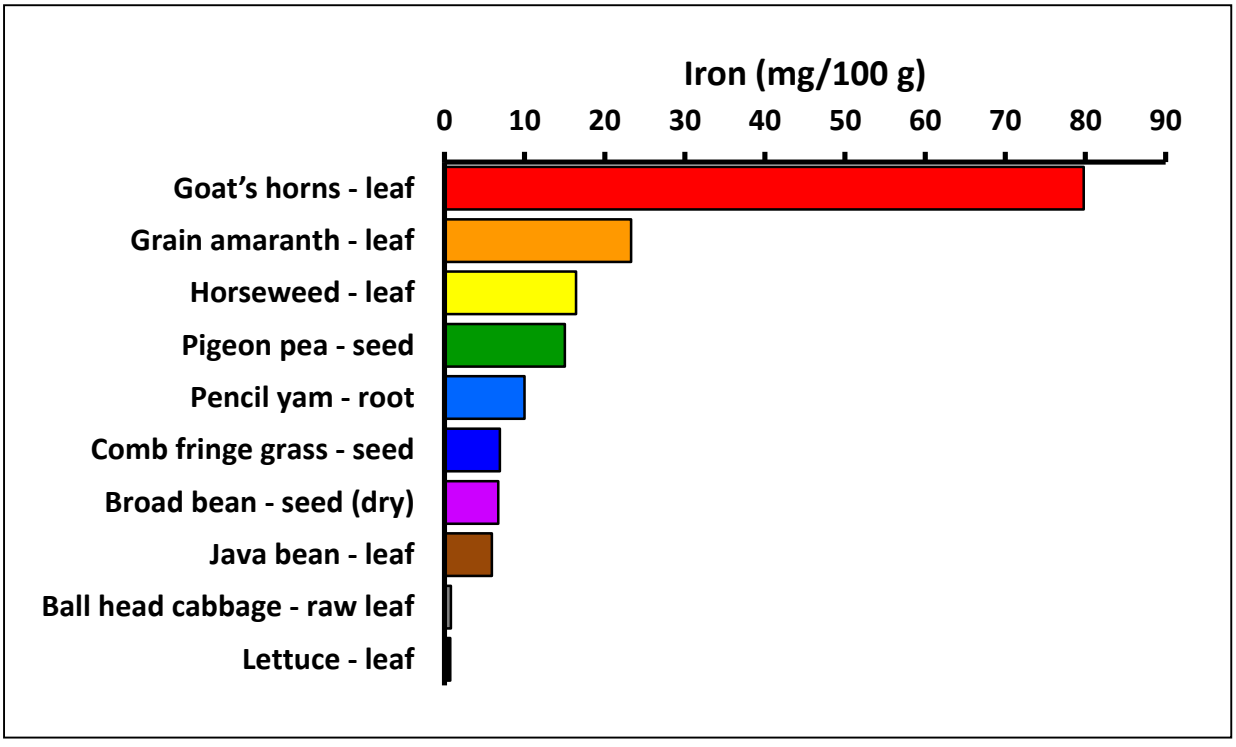
The living organisms that cause disease are much smaller than insects. These disease organisms can often only be seen with a microscope. There are three main kinds of disease organisms - fungi, bacteria and viruses. Fungi are like the mushrooms we eat, only very much smaller. They usually make distinct 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. Plants infected by viruses are often yellow, and may be stunted, or have curled or unusual shaped leaves. 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.

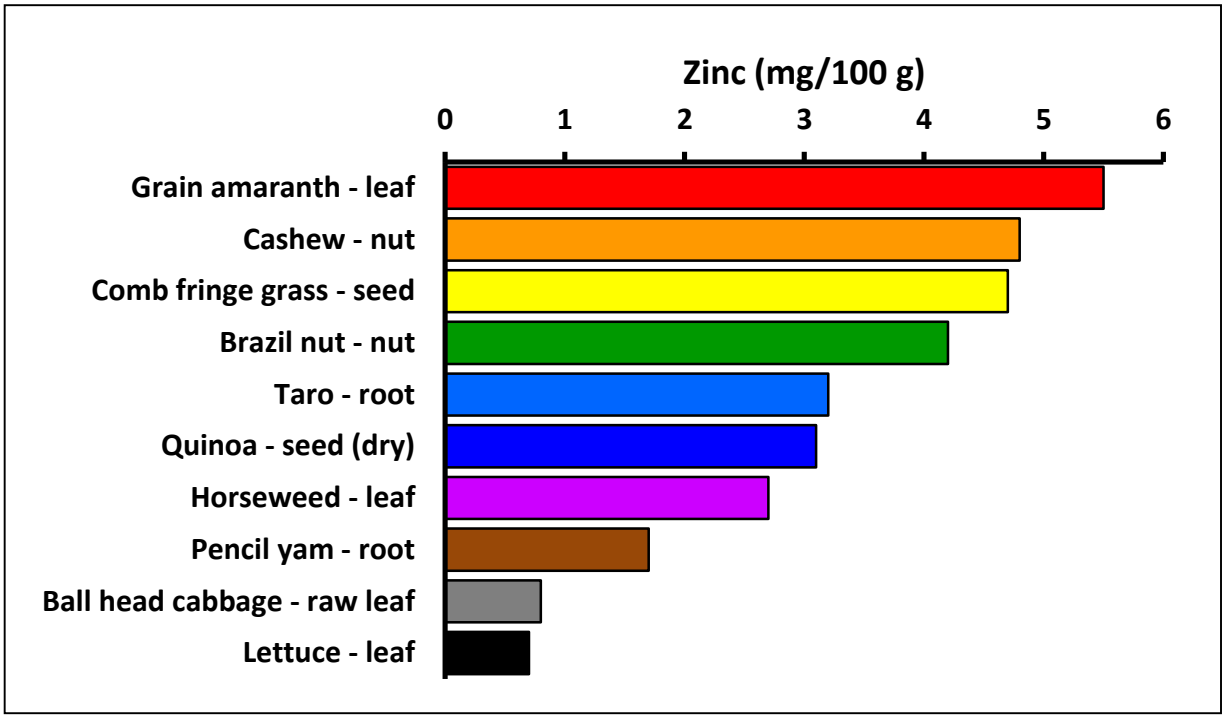
Food value charts for a selection of plants from Ecuador






Vitamin C (mg/100 g)
0
20
40
60
80
100
120
140
160
Pawpaw - leaf
Java bean - leaf
Amaranth greens - leaf
Panama berry - fruit
Naranjilla - fruit
Tamarind - fruit
Orange - fruit
Caimito - fruit
Purple mombin - fruit
Tomato - fruit


Iron (mg/100 g)
0
10
20
30
40
50
60
70
80
90
Goat's horns - leaf
Grain amaranth - leaf
Horseweed - leaf
Pigeon pea - seed
Pencil yam - root
Comb fringe grass - seed
Broad bean - seed (dry)
Java bean - leaf
Ball head cabbage - raw leaf
Lettuce - leaf



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 projectto concentrate on plants that are less well known and/or underutilised.

Starchy staples

English: Indian shot
Local:

Scientific name: *Canna indica*
Plant family: CANNACEAE

Description: A herb which grows 1 - 2.5 m tall. The leaves are large and smooth. They are dark green but can be reddish in some varieties. The leaf base forms a sheath around the stem. The flowers can have narrow petals but more often are large and colorful. They can be red, yellow or orange. The rhizome or underground stem has roots attached. The seeds are black and hard. They are 5 - 7 mm across.

Distribution: It grows in the tropics and subtropics. It suits hardiness zones 8 - 12.

Use: The rhizomes are a source of starch. The rhizomes are eaten after cooking. They are boiled or baked. The leaves and rhizomes are used for animals. Starch can be extracted from the roots. This is achieved by rasping the tubers, then washing the starch out and straining out the fibres. The large starch grains are very digestible. The starch is used to make transparent noodles.

Cultivation: They can be grown from seed, but it is more easy to grow them by dividing the plant. The crowns should not be planted too deeply. The end section of the rhizome is planted. Well developed tubers with one or two undamaged buds should be used. A spacing of 1 m x 1 m is suitable. Tubers are planted about 15 cm deep and need to be kept weed free during early growth. About 2.5 tons of tubers are required to plant a hectare. The tubers are dug from between 6 and 19 months. The tubers can be stored if cool and dry. For starch manufacture they need to be processed immediately.

Production: Harvesting occurs after about 8 months. Parts of the underground root are harvested as needed. High yields of tops and rhizomes are possible. Yieds of up to 38 t/ha of rhizomes and 50 t/ha of tops have been achieved.

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	88.8	142	1.7	-	5.6	-	-

Starchy staples

English: Quinoa
Local:

Scientific name: *Chenopodium quinoa*
Plant family: CHENOPODIACEAE

Description: A small herb that grows 20 - 3 cm tall. The taproot is branched. The leaves vary in shape. They are toothed and somewhat grey-green. The flowers are grouped in clusters on the stalk. The flowers are small and without stalks. They occur in dense clusters at the top of the plant. The seeds are 1 - 2.6 mm across. They can be white, yellow, red, purple, brown or black. Plants vary a lot in colour, flowering and other ways.

Distribution: It is a tropical plant. It grows between 2,300 and 3,900 m altitude in the Andes. It can adapt to cold and drought. Plants grow with annual rainfalls from 250 - 1,500 mm. Once established, plants can tolerate temperatures down to -5°C. The soil needs to be well drained. Some varieties are suited to acid soils with a pH of 4.5, and others to alkaline soils with a pH of 9.5. It suits hardiness zones 8 - 11.

Use: The seed is used for soups and stews. They can be puffed or eaten as a side dish like rice. The seeds can be eaten or ground into flour. Young leaves can be cooked and eaten as a vegetable. Sprouted seeds are used in salads. The flower clusters are steamed like broccoli. They can be mixed with cheese, dipped in egg batter and fried.

Cultivation: Seed germinate whenever conditions are suitable. Seeds are scattered. Rates of 15 - 20 kg of seed per hectare are used. Normally a range of varieties are mixed to allow for variations in conditions.

Production: A life cycle varies between 120 - 240 days. Plants are harvested when mature then allowed to lie for 30 - 45 days before threshing. Yields of 400 - 1,200 kg per hectare occur.

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)	13.3	1539	14.1	1	-	4.6	3.1
seed (cooked)	71.6	503	4.4	0	0	1.5	1.1
leaf (raw)	85	202	5	1800	100	4.	-

Starchy staples

English: Taro
Local:

Scientific name: *Colocasia esculenta*
Plant family: ARACEAE

Description: This plant has large flat leaves on the end of upright leaf stalks. It grows up to 1 m high. The leaf stalk or petiole joins the leaf towards the centre of the leaf. The leaves are 20 - 50 cm long. Near the ground a thickened rounded corm is produced. Around this plant their 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 in beneficial. Setts from corms normally give higher yield than that from cormels. The greater leaf area and root production may be responsible for this. Setts of about 150 g are optimum.

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

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

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

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

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

Spacing affects total yield, and marketable, harvestable yield, of corms. Close spacing increases the corm yield per area, and the shoot yield per area, but decreases the corm yield per plant, and the contribution of sucker corms, to the yield. Where spacings of 30 cm x 30 cm are used, giving about 110,000 plants per hectare, a very large amount of planting material is required, which reduces the net return per unit of planting material. A spacing of 60 cm x 60 cm in 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	92.2	2.7	424	35.5	1.2	0.2

Starchy staples

English: Cassava
Local:

Scientific name: *Manihot esculenta*
Plant family: EUPHORBIACEAE

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

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

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

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

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

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

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

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

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

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

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

Food Value: Per 100 g edible portion

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

Starchy staples

English: West Indian arrowroot
Local:

Scientific name: *Maranta arundinacea*
Plant family: MARANTACEAE

Description: A perennial plant with an erect stem growing to 2 m tall with large fleshy underground rhizomes. There are 4 - 8 large leaves on long stalks near the base and 1 - 8 leaves on the stem. These stalks can be 3.5 - 20 cm long. The leaf blade is 12 cm long and the leaf stalk clasps the stem. Flowers are small and white. There can be several on each leafy shoot and they occur on the ends of branches. There are 1 - 2 bracts under each 2 - 3 flowers. The rhizomes can be 20 cm long and about 3 cm across. They are covered with fleshy scales. The fruit are capsules which are green and tinged red-brown. They are oval and 7 - 8 mm long by 4 - 5 mm wide. The seeds are brown.

Distribution: It is a tropical plant that grows well in hot humid climates. A temperature of 20 - 30°C is best. Plants grow from the coast up to 900 m altitude in the tropics. It needs an annual rainfall of 1,500 - 2,000 mm. It suits plant hardiness zones 10 - 12. It is cultivated in South China for starch.

Use: The rhizomes are used in soups or sauces. They can be just scraped and boiled. They can be used for making flour. It is an easily digested starchy flour and is a good thickener in sauces. The fresh rhizomes can be stored for 7 - 8 days. **Caution:** It is important to peel off the skin scales or they give a bitter taste to the starch.

Cultivation: Plants are grown from pieces of rhizome or sometimes suckers. A spacing of 1 m x 0.5 m, or closer, is suitable. 3,000 – 3,500 kg of planting material are required for one hectare. The pieces are planted 6 - 8 cm deep. It needs a deep, well drained, fertile and slightly acid soil. Flowers are mormally removed to allow as much starch storage as possible in the rhizomes.

Production: Rhizomes are ready for harvest after about 11 months. Successive crops are grown in the same site for 5 - 7 years. Yields of 12.5 t per hectare are average. These produce 8 - 16% starch.

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 (starch)	12.2	1515	0.4	-	-	1.2	-
root (raw)	80.8	272	4.2	2	1.9	2.2	0.6

Starchy staples

English: Peruvian parsnip
Local:

Scientific name: *Arracacia xanthorhiza*
Plant family: APIACEAE

Description: A stout herb that grows about 1 m high. The above ground parts are somewhat like celery. The roots are long and like carrots. They have rings around them. There is a coarse central core. This grows 10 cm high. A number of parsnip-like side shoots develop. They look and smell like parsnips. These side roots are 5 - 25 cm long and 5 cm wide. The stems are coarse and leaves can be 0.6 - 1.2 m. The leaves are dark green or purple. They are deeply divided and have long stalks. These are 15 - 30 cm long and sheath at the base. The flower head occurs at the end of the plant. The flowers are small. They are usually purple or yellow.

Distribution: A tropical plant that does best at temperatures between 15 - 20°C throughout the year. It takes longer to grow in cooler places. Higher temperatures seem to reduce root size. It needs a moderate and even rainfall of 600 - 1000 mm each year. It needs a deep friable, well-drained soil. A pH of 5 - 5.5 is good. In Colombia it grows between 1,800 – 2,600 m altitude. In Peru it grows between 1,000 - 3,000 m above sea level. It needs a short day length.

Use: The roots are boiled and eaten. They can be fried or used in stews. The roots are also used for starch. The young blanched stems can be used in salads or as a vegetable.

Cultivation: It can be grown from seed. Mostly it is grown from offshoots at the crown of the main rootstock. Pieces 2 - 3 cm long with buds and leaves are used and 20,000 sets are needed per hectare. Some of the leaf area is reduced. The base of the cut end is cut several times to increase sprouting. The offsets are left to dry for 2 - 3 days before planting. Adding phosphorus normally increases yield, while adding nitrogen normally reduces yield. The offsets are planted so that the base is below ground and the top above ground. Sometimes the whole offset is covered with soil. A spacing of 0.8 m between plants is suitable. Crops are harvested when leaves turn yellow. Harvesting needs to be done as soon as ready or roots become tough and develop a bad flavour.

Production: Tubers take 10 - 14 months to be ready for harvesting. Young roots can sometimes be harvested 4 - 8 months after planting. Tubers can normally only be stored for 5 - 7 days. Cold storage allows longer storage. Each plant can produce 6 - 10 side tubers weighing 2 - 3 kg. Yields can be 3 - 10 tonnes per hectare.

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	13.9	1446	5	-	-	-	-

Image accessed from: http://tropical.theferns.info/image.php?id=Arracacia+xanthorrhiza

Starchy staples

English: Sweet yam
Local:

Scientific name: *Dioscorea trifida*
Plant family: DIOSCOREACEAE

Description: A yam vine. The stem is square in cross section and does not have spines. The leaves are 25 cm long. They are opposite. The leaf is divided like fingers on a hand into 3 or more segments. The male flower is on a long stalk and the female flower stalk is short. It easily produces seed. The underground tuber is irregular in shape. It can be 70 cm long. Varieties can range in colour from white to purple and black.

Distribution: It is a tropical plant that is indigenous to Central America. It suits a cooler climate than other yams. It grows in areas with temperatures between 25 - 30°C. The best rainfall is 1,500 - 2,000 mm per year. It cannot tolerate frost.

Use: The tubers are cooked and eaten. They can be baked or boiled.

Cultivation: Normally small whole tubers are used for planting. Large tubers can be cut into small pieces and planted. Top pieces of the tuber are best. It can be grown from seed in a nursery and the seedlings transplanted.

Production: Plants take 9 - 10 months to mature. Tubers will store in cool, dry, well-ventilated places for a while. Yields of 15 - 20 tonnes per hectare have been achieved.

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	80.7	284	2.5	-	-	0.5	0.4

Image accessed from: http://www.saintlucianplants.com/cultivated/diostrif/diostrif.html

Legumes

English: Pigeon pea
Local:

Scientific name: *Cajanus cajan*
Plant family: FABACEAE

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

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

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

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

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

Food Value: Per 100 g edible portion

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

Legumes

English: Water mimosa
Local:

Scientific name: *Neptunia oleracea*
Plant family: FABACEAE

Description: A plant which grows in water. It has stalks which lie along the ground and also ones which stick upwards. The stems are up to 1.5 m long. The floating parts have spongy white balls around each internode. These only develop when plants grow in water. From each internode roots extend downwards and leaves extend upwards. The leaves are 3.5 - 8 cm long with 2 - 3 pairs of leaflet stalks. Along these are 8 - 18 pairs of leaflets. These are 4 - 10 mm long by 1.2 - 3 mm wide. They are dark green. The flowers are in round heads. They are 1.5 cm long. The flower stalk is 12 - 30 cm long. The fruit is a pod. It is oblong and flat. It is 2 cm long by 1 cm wide. There are 4 - 8 seeds. These are 4 - 5 mm long by 2.5 - 3.5 mm wide.

Distribution: It is a tropical plant. It floats in ditches and ponds.

Use: The young leaves and stalks are eaten as a vegetable. (The white section is removed.) They can be eaten raw but also fried or served with vermicelli and peanut curry. It is also used in sour vegetable salads and hot and sour soup. The young seed pods are cooked and eaten.

Cultivation:

Production: It is grown in tanks.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	88.0	142	5.2	114	-	3.0	-

Legumes

English: Lima bean
Local:

Scientific name: *Phaseolus lunatus*
Plant family: FABACEAE

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

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

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

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

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	12.0	1407	19.8	tR	0	5.6	-
seed (young, cooked)	67.2	515	6.8	37	10.1	2.5	0.8
seed (young, raw)	70.2	473	6.8	30	23.4	3.1	0.8

Legumes

English: Common bean
Local:

Scientific name: *Phaseolus vulgaris*
Plant family: FABACEAE

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

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

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

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

Production:

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	10.0	1386	25.0	10	1	8.0	2.8
seed (young)	92.0	142	3.0	-	20	0.8	0.2
pod	88.0	151	2.5	750	27	1.4	0.2
sprout	90.7	121	4.2	0	38.7	0.8	0.4

Legumes

English: Broad bean
Local:

Scientific name: *Vicia faba*
Plant family: FABACEAE

Description: An upright plant up to 1 m tall. Plants vary in height from 30 - 180 cm. It has a well developed taproot. It has square stems which are hollow and have wings at the angles. There can be 1 - 7 branches from near the base of the plant. The leaves have leaflets along the leaf stalk and end in a short point. There are 2 - 6 leaflets. These are 5 - 10 cm long. Flowers occur in the axils of leaves and there are 1 - 6 flowers on a stalk. The flowers are white with black spots. Pods are large and fat and contain several large beans inside. The pods are 5 - 10 cm long in field varieties and can be 30 cm long in garden varieties. They are fleshy with a white velvety lining. They become tough and hard at maturity. The seeds can vary a lot in shape and size. They can be flat or rounded and white, green, brown, purple or black. They are 1 - 2.6 cm long. The hilum along the seeds is prominent.

Distribution: A temperate plant only suitable for the highlands over about 1,200 m. in the tropics. It mainly occurs from 1,900 - 2,700 m altitude in equatorial zones. It is frost tolerant and is resistant to drought. It can grow with temperatures down to 4°C. In the lowland hot tropics it often flowers but does not set seed. It requires fertile soils. It does best with adequate lime needing a soil pH of 6.4 - 7.2. It can tolerate some salinity.

Use: It is mostly the young beans that are eaten. The ripe beans and leaves are also edible. The dried beans can be boiled, ground into flour and added to soups or used for making tofu. Sprouted seeds are cooked and eaten. The tender pods are eaten as a vegetable. **Caution:** Some people, mainly of Mediterranean origin can get a disease called Favism from these beans. The beans should be well cooked. They can react with some people using some antidepressant drugs.

Cultivation: The crop is grown from seed which are sown at 15 - 40 cm spacing. If the seed pod formation is poor, it can be improved by pinching out the tops of the plants when in flower. Hand pollination also helps. Plants are self pollinated but also cross pollinated by insects.

Production: Time to maturity is 12 - 16 weeks. Yields in the cool tropics vary from 1 - 2 tons per hectare.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	10.0	1448	26.2	130	16	6.7	-
seed (fresh, raw)	76.0	315	7.1	35	140	1.9	0.6
seed (fresh, boiled)	83.7	259	4.8	27	20	1.5	0.5

Legumes

English: Andean lupin
Local:

Scientific name: *Lupinus mutabilis*
Plant family: FABACEAE

Description: An erect annual herb that grows to 1.5 m tall. It has a thick taproot. It can keep growing from year to year. The stems are branched, woody and mostly without hairs. The leaves have leaflets arranged like fingers on a hand. There are 7 - 9 leaflets. These are oblong and about 6 cm long by 1.4 cm wide. They are hairy underneath. The flowers are large and have a smell. They are about 2 cm long. The standard is white and blue with a yellow mark in the centre. Many flowers (50 - 70%) fall off without forming pods. The fruit is a pod. It is finely hairy and does not split open before falling in cultivated varieties. The pods are oblong but pointed at both ends. There can be 130 pods on a plant. The seeds bulge towards the centre. They are 8 - 10 mm long and 6 - 8 mm wide. The colour can vary from black to light grey.

Distribution: A tropical plant with cold resistance. In the Andes they grow from 2,000 - 3,850 m altitude. It does not do well under high humidity and cannot tolerate drought at flowering. It requires 350 - 800 mm rainfall. It can grow in arid places.

Use: The seeds are soaked overnight and the water discarded, then the beans cooked. The seeds are used in soups, stews and made into flour. Up to 15% of lupin flour can be added to bread flour. **Caution:** The seeds contain poisonous alkaloids which are bitter, and require soaking and washing before eating. Varieties free of alkaloid are available.

Cultivation: Plants are grown from seed. Rates of 100 - 120 kg per hectare are used. The seed is broadcast.

Production: The growing cycle varies between 150 and 360 days. Average yields in the Andes are 300 - 600 kg per hectare although yields from 3,500 kg - 7,000 kg are possible.

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	8.2	1723	38.4	-	-	-	-
pod	9.5	1671	37.8	-	-	-	-

Image accessed from: https://en.wikipedia.org/wiki/Lupinus_mutabilis from Peruvian Field Lupines (*Lupinus mutabilis*), Pisac, Peru, D. Gordon E. Robertson

Legumes

English: Pencil yam
Local:

Scientific name: *Vigna vexillata*
Plant family: FABACEAE

Description: A variable climbing herb that keeps growing from year to year. It has a narrow woody rootstock that is dull white and wrinkled. The hairy vines are 30 cm to 3 m long. The leaves have 3 leaflets and these are oval or long. They can be 3 - 16 cm long by 0.4 - 8 cm wide. They taper towards the tip and are rounded at the base. The leaf stalk is 2 - 11 cm long. The flowering stalks are in the axils of leaves and have 2 - 6 flowers. The flowering stalk is 5 - 36 cm long. The pea like flower has a standard which is 2 - 3 cm long and not the same on both sides. Flowers are pink or purple. The keel is paler with a beak curved back at the end and twisted to one side. The fruit are pods which are held erect. They are 4 - 14 cm long by 3 - 4 mm wide and covered with short brown hairs. There are 10 - 18 seeds. The seeds are light brown to black. They are kidney shaped and 3 - 4 mm long by 2 mm wide.

Distribution: It is a tropical plant that mostly grows naturally in open woodland on sandstone soils. It will grow in dry, acid and high aluminium soils that are infertile. It can grow in arid places.

Use: The tuberous roots are eaten raw or cooked. They can be boiled or roasted. The seeds are cooked and eaten.

Cultivation: Plants can be grown from seed or tubers.

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
tuber	79.6	302	2.1	-	11.6	0.8	0.5
root	68.9	287	2.3	-	-	10.0	1.7

Image accessed from: http://farm3.static.flickr.com/2347/1651731806_c282f57a3c.jpg%3Fv%3D0

Leafy greens

English: Amaranth greens
Local:

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	-

Leafy greens

English: Watercress
Local:

Scientific name: *Nasturtium officinale*
Plant family: BRASSICACEAE

Description: A cabbage family herb. It is a small leafy plant that grows in water and lasts for several years. It grows 30 cm high and has runners 2.5 m long. It has hollow stems and roots freely from the nodes. It branches freely. The leaves consist of 3 - 7 pairs of small leaflets then a larger leaflet at the end. The flowers are small and white and grow grow in a cluster. Flowers are not always produced and need days with more than 12 hours of sunlight to form. A small narrow curved seed pod about 2 cm long can develop. It grows attached to the banks of streams.

Distribution: This is a temperate climate crop. It is common in tropical highland creeks especially those flowing off limestone hills with pH 6.5 - 7.5. It needs to be in running water. In the tropics it occurs from about 1,000 m to at least 2,900 m altitude. It grows in streams, ditches, lakes, swamps, marshes from near sea level to 3,700 m altitude in China. It suits plant hardiness zones 6 - 10.

Use: The leaves and stems are eaten raw or cooked and have a spicy flavour. Cooking should be used if the water in the stream is not pure and clean. The seed can be germinated to produce sprouts. The seeds can be ground to make a mustard flavouring.

Cultivation: It is grown from cuttings planted along the edges of clear running water. Cuttings of 10 - 15 cm long are suitable. The plant has roots along the stem at the node and cuttings quickly form roots in water. A spacing of 30 cm is suitable. This small plant keeps living for many years once established. It can also be grown from seeds. Plants can float on the water. It will not tolerate drying out. Watercress has a high phosphate requirement.

Production: Harvesting can occur 4 - 6 weeks after planting. Regular picking encourages branching and increases production. Tips 5 - 10 cm long are harvested. This can be repeated every 4 - 6 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
leaf	95.0	63	2.4	960	35	3.4	0.1

Leafy greens

English: Purslane
Local:

Scientific name: *Portulaca oleracea*
Plant family: PORTULACACEAE

Description: A spreading branched herb. It lies flat on the ground. It grows each year from seed. The plants spread 10 to 50 cm wide. The stems are purplish. The leaves are fleshy, flat and shaped like a wedge at the base. They are 1.5 to 2.5 cm long and 0.3-1 cm wide. The flowers are yellow and occur in a few rounded heads. They are 0.8-1.5 cm across. They bloom about the middle of the day. The capsules are 0.5 cm long and oval. The seeds are black and shiny.

Distribution: It grows in tropical and temperate regions. They are common in waste places throughout the Philippines. It is a common self sown plant in lowland areas and up to 1,700 m altitude. It prefers sandy well drained places. It can grow on salty soils. It can grow in arid places. It suits hardiness zones 7-12.

Use: The stems and leaves are cooked and eaten. Usually the skin is scraped off then the plant is boiled and mashed. It thickens stews and other dishes in which it is cooked. It is used as a pot herb. The fleshy stems are pickled. Sprouted seeds are eaten in salads. The seeds are ground for use in cakes and bread. **Caution:** In areas where a lot of nitrogen fertiliser is used plants can cause nitrate poisoning. Plants can also have oxalates.

Cultivation: It roots easily from broken pieces. It can be grown from stem cuttings. It can be grown from seed.

Production: The first harvest of leaves can be a month after planting. In the tropics it can complete its lifecycle in 2-4 months. Often it is harvested in the dry season when other vegetables are in short supply.

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	9.1	1405	336	-	-	-	-
plant	87.0	43	4.0	-	11	2.5	-
root	79	210	3.52	-	-	-	-
leaf	82.2	108	3.1	54	20	0.8	1.5

Leafy greens

English: Sweet basil
Local:

Scientific name: *Ocimum basilicum*
Plant family: LAMIACEAE

Description: An erect, branched, woody shrub. The branches are hairless and smooth. The leaves are hairless and oblong, with a narrow tip and blunt base. The base of the stems is tinged red. The leaf stalk is 1.5 cm long. The leaf blade is 2.5 - 5 cm long by 1 - 2.5 cm wide. The flowers are somewhat purplish, with very short stalks. The small nuts are smooth, oval and slightly flattened. Plants vary a lot, and several varieties have been selected. They can have licorice, cinnamon or lemon flavours, and vary in size.

Distribution: It grows in many warm temperate countries, but also in the tropics. It suits both the lowlands and the highlands in the tropics. It cannot stand frost. It suits warm and hot climates. It needs some shade in tropical areas. It needs protection from wind. It needs rich, moist, well-drained soil. Soil should be at 25 - 30°C for seed to germinate. It suits hardiness zones 10 - 12.

Use: The seeds are soaked in water and eaten. The leaves are used raw or boiled to flavour foods. The seed yields an oil used to flavour sauces, pickles, meats and confectionary.

Cultivation: It is grown from seed. Seed should be sown 2 - 3 mm deep and covered with a light sand or soil. Seeds germinate within 3 - 5 days. Seedlings are thinned out to 20 cm apart. Seedlings can be transplanted. If top shoots are picked off, a more bushy plant is produced and flowering is delayed.

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	91.0	113	2.5	386	18.0	3.2	0.9
seed	6.4	1051	14.4	938	61.2	42.0	5.8

Leafy greens

English: West Indian kale
Local:

Scientific name: *Xanthosoma sagittifolium*
Plant family: ARACEAE

Description: A herb that grows up to 2 m tall. It has a short stem with large leaves at the top. A corm is produced at the base of the plant. It produces about 10 flask-shaped cormels, about 15 - 25 cm long, on the underground corm. They get wider towards the tip. There is a vein around the edge of the oval leaf blade which is 50 - 75 cm long. The leaf has triangular lobes at the bottom. The flower is produced below the leaves. The large bract around the flower is pale green and about 20 cm long. The bases of this 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: *Xanthosoma* taro is normally planted by using the top piece of the main central corm or stem. 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 presprouted 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 reasonably 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	-

Leafy greens

English: South American amaranth
Local:

Scientific name: *Amaranthus hybridus subsp. quitensis*
Plant family: AMARANTHACEAE

Description: An annual plant which grows to 1 m tall.

Distribution: A tropical plant.

Use: The leaves are edible when cooked. The seeds are ground into flour and cooked. The red flower provides colouring for foods. **Caution:** This plant can accumulate poisonous nitrates if grown with high nitrogen inorganic fertilisers.

Cultivation: It can be grown from seed or cuttings.

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	81.0	249	4.1	-	25.7	-	-

Image accessed from: http://www.botanicayjardines.com/amaranthus-hybridus-subsp-quitensis/

Leafy greens

English: Goat's horns
Local:

Scientific name: *Sida cordifolia*
Plant family: MALVACEAE

Description: An erect, woody shrub that grows about 0.4 - 1 m high. It keeps growing from year to year. It is covered with short and long hairs that make the plant feel soft. The leaf stalk is 1 - 2.5 cm long. The leaves are one after the other and heart shaped at the base. They are toothed at the edge and 1.5 - 4.5 cm long. The flowers are yellow and occur in the axils of the leaves. The fruit are about 6 - 8 mm across and have 20 fine bristles on the top.

Distribution: A tropical plant that grows in open waste places in the tropics and sub-tropics. It is common and widely distributed in the Philippines. It grows in hot arid places with a marked dry season. It grows in places with an annual rainfall below 520 mm. It grows in dry sandy soils and can grow in salty soils. It grows below 1,100 m altitude. It can tolerate shade and can grow in arid places.

Use: The leaves are edible when cooked.

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
leaf	6.6	1296	24.2	-	-	79.8	-

Image accessed from
http://upload.wikimedia.org/wikipedia/commons/f/f4/Sida_cordifolia_(Bala)_in_Hyderabad,_AP_W_IMG_9420.jpg

Fruit

English: Cape gooseberry
Local:

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: Purple mombin
Local:

Scientific name: *Spondias purpurea*
Plant family: ANACARDIACEAE

Description: A medium sized tree that grows 4 - 10 m tall. It has an irregular trunk and broad crown. Often it is low and sprawling. It loses its leaves during the year. The leaves are made up of 5 - 12 pairs of leaflets that are 2 - 4 cm long. They fall before flowering. The flowers are red and in groups 3 - 5 cm long. They occur on the small branches. The edible fruit are small, red and sub-acid. They are round or oval and 2.5 - 5 cm long. They often grow in clusters of three. The fruit has a woody kernel which contains the seed. The flesh is creamy-yellow.

Distribution: It is a tropical plant that suits the hot tropical lowlands. It is resistant to drought and will produce on poor soils. It grows from sea level to 1,200 m altitude in Mexico. It grows naturally in tropical America.

Use: The fruit are eaten fresh or cooked or used for jelly. They are also used for drinks. The stone or kernel can be roasted and eaten. The leaves are cooked and eaten.

Cultivation: Seeds do not normally germinate. Plants are grown by cuttings and stem sprouts. Straight cuttings 6 cm thick and 1.5 m long are used. The cuttings are made at the start of leaf production and kept in the shade for a couple of weeks. They are then planted 8 m apart and at a depth of 30 cm. Flowers bud on the current year's growth so pruning can be done yearly. Pruning increases the size and weight of fruit.

Production: The fruit matures in about 120 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	76.2	347	0.16	30	45	1.1	-
leaf	88.6	146	4.3	-	-	2.8	-

Fruit

English: Panama berry
Local:

Scientific name: *Muntingia calabura*
Plant family: MUNTINGIACEAE

Description: A small tree that grows 5 - 12 m tall. The trunk is 15 - 20 cm across. Branches are wide spreading and almost horizontal. The young shoots are covered with hairs. The leaves are alternate and elliptical. They are 4 - 5 cm long and 3 - 4 cm wide. The leaves are unequal at the base. The leaves have teeth along the edge. The leaf is dark green on top and dull below. The flowers are small and white or cream. They occur as one or two in the axils of leaves. The fruit stalk is 1.5 cm long. The fruit are small red berries 1 - 2 cm across. They have many tiny seeds. The fruit are edible.

Distribution: A tropical plant that is native to the West Indies and South America. They suit sandy coral soils of low islands. They grow from sea level up to about 1,000 m altitude in the tropics. They need a warm, sunny, sheltered position. It suits hardiness zones 10 - 12..

Use: The berries are eaten raw. They can be used for jam. They can be used for pies and tarts or added to cereals. The leaves can be used for tea.

Cultivation: Trees can be grown from seed. They can also be grown from cuttings of half ripe wood. Seed germinate more readily if they have passed through bats. This means the plant often spreads naturally. Seedlings do not tolerate shade.

Production: Trees grow fairly quickly. Fruit is produced in the second year. Trees flower and produce fruit all year round. Fruit ripen in 6 - 8 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	76.3	380	2.1	15	90	1.1	-

Fruit

English: Sweet granadilla
Local:

Scientific name: *Passiflora ligularis*
Plant family: PASSIFLORACEAE

Description: A vigorous climbing vine. It grows up to 26 m long. It is woody at the base. The fruit is larger, yellow skinned and sweeter with larger seeds than the more common purple passionfruit. Leaves are entire, heart shaped and up to 20 cm long. Flowers are large and pale green. They can be 8 - 10 cm across. The fruit have a purple tinge and turn orange when ripe. The pulp is white or translucent and sweet. The fruit are 6 - 7.5 cm long.

Distribution: It is a tropical plant that suits the tropical highlands. They grow between 1,300 and 2,400 m altitude in the tropics. It needs rich soil with good drainage. It cannot tolerate frost. It does not do well in very hot places.

Use: The fruit are eaten. They can be eaten fresh or used in drinks.

Cultivation: They can be grown from cuttings. Plants need a fence or trellis to grow on. They can also be grown from fresh seed.

Production: Fruit production is seasonal. Vines bear in 1 - 2 years.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	78.5	393	2.8	20	20	0.9	-

Fruit

English: Caimito
Local:

Scientific name: *Pouteria caimito*
Plant family: SAPOTACEAE

Description: A medium sized tree. It usually grows 10 - 15 m tall but can be up to 40 m tall. The trunk is 30 cm across. The tree branches at about 1 m high. The leaves are simple and alternate. The flowers occur singly or in small groups. They are usually on leafless twigs. The fruit is medium to large and is oval with a smooth skin. It is yellow and sweet. It is usually 5 - 10 cm across. It has a sweet translucent pulp. Unripe fruit contain a gummy latex. There are several named cultivated varieties. There are 1 - 4 seeds. These are brown and shiny.

Distribution: A tropical plant. It suits the hot, wet tropical lowlands. It needs a warm climate and year round moisture. It will grow in subtropical places. It enjoys wet soil. It grows naturally in the Amazon and Andes. It grows to 1,200 m in the Andes. It cannot tolerate frost. It suits hardiness zones 10 - 11.

Use: Occasionally they are used in ice-cream.

Cultivation: Plants are grown from seed. Seed germinate easily. Seedling trees vary in quality. Grafting and air-layering can also be used. Fresh seed are planted and germinate in 4 - 6 weeks. Some trees are self-fertile and others need cross pollinating.

Production: Trees will produce fruit after 7 - 10 years from seeds and after 3 years from grafts. Mature trees can produce 100 – 1,000 fruit per year. Fruit mature in about 180 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	74.1	397	2.1	-	49	1.8	-

Fruit

English: Peruvian pepino
Local:

Scientific name: *Solanum muricatum*
Plant family: SOLANACEAE

Description: A small herb or bush. It grows to about 1 m high and spreads 1 - 2 m. It has a woody base and fibrous roots. The leaves are bright green with small hairs. The leaves can vary in shape. The flowers are blue or purple. Fruit shape can vary from small and oblong to heart shaped. The number of seeds also varies. The fruit can be green or with purple stripes. Fruit are often 5 - 12 cm long and oval.

Distribution: A tropical plant that suits the tropical highlands. It grows in the temperate Andes region. It grows from 500 m up to 3,200 m altitude in these regions. It does best in a warm frost-free environment. It will survive temperatures of -2°C for short periods. It does not suit hot dry areas. The plants will not set fruit until night temperatures are above 18°C. It does best in a free draining soil. A neutral pH of 6.5 - 7.5 is best. It suits hardiness zones 9 - 12.

Use: Fruit can be eaten fresh or used in drinks. The taste is similar to a cantaloupe. They can be made into sauces, jams and preserves.

Cultivation: Plants can be grown from seed. Often cuttings are used. Stem cuttings 9 - 14 cm long with about 4 leaves are suitable. Rooting hormone, bottom heat and mist help propagation. A spacing of 1 m is appropriate.

Production: Plants normally fruit in 9 - 12 months. Although fruit can form without pollination, a heavier crop occurs with self or cross pollination. The fruit matures in 30 - 80 days after pollination. Fruit should be picked when ripe to get the best flavour and sweetness. Fruit bruise easily so need careful handling. Fruit can be 500 g to 1 kg each.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit	93.4	93	0.6	180	31	0.1	-

Fruit

English: Naranjilla
Local:

Scientific name: *Solanum quitoense*
Plant family: SOLANACEAE

Description: A small shrub that grows up to 2 m tall. It is hairy or thorny. The leaves are large (60 cm) and angular and hairy on both surfaces. They have thorns along the veins. Young leaves are purple. The flowers are pale violet and 2 - 4 cm across. The fruit are produced in clusters on the trunk. The fruit is bright orange in colour and covered with short hairs which can be removed by rubbing. The fruit is about 6 cm across. The flesh is yellow-orange to green. It has numerous small edible seeds.

Distribution: A tropical plant that suits tropical highland areas. The best altitude is probably 800 – 2,000 m. In the Andes it grows from 1,500 - 2,800 m altitude. The best temperatures are 14 - 22°C. It is frost sensitive. It likes humidity. It grows well with rainfall of 1,500 mm per year. It suits hardiness zones 10 - 12.

Use: Fruit is eaten fresh or used for jams and drinks. The juice is used to flavour ice creams and sherberts.

Cultivation: They are grown from seeds. Seeds can be bought in stores or collected from the fruit. Seeds germinate in 25 - 40 days in warm soil. A spacing of 1 - 2 m is suitable. Plants can be grown from cuttings. Cuttings need to be about 15 cm long. The cuttings should be stored for a few days to allow the cut surfaces to heal before planting. Grafting onto more resistant root stocks is possible.

Production: Plants commence bearing fruit after 6 - 12 months. They bear fruit throughout the 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	88.5	184	1.0	100	67	0.5	-

Vegetables

English: Bulb onion
Local:

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

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

Distribution: A temperate plant. It is easier to get onions to grow and form bulbs in the highlands in the tropics but they can be grown from sea level to 2600 m altitude in Papua New Guinea. In Nepal they grow to 3000 m altitude. They do not suit the wet humid tropics. Because the day lengths are short near the equator, onions often do not produce a bulb. Some newer varieties will yield in the tropics. The plant grows best at 12-21°C and the bulb forms best at 15-25°C. It grows best with a pH 5.7-6.6. It suits hardiness zones 5-10.

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

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

Food Value: Per 100 g edible portion

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

Vegetables

English: Breadfruit
Local:

Scientific name: *Artocarpus altilis*
Plant family: MORACEAE

Description: A large tree up to 20 - 26 m in height. The trunk can be 6 m tall before branching. The trunk can be up to 1 m across. It is an evergreen tree, but can lose its leaves in dry weather. The divided leaves are large and vary in the number of divisions. They can be entire or divided into 5 - 11 lobes. The leaves are bright green on the upper surface with yellow veins and pale and dull on the under surface. They have very small, stiff, hairs underneath. Male and female flowers occur on the same tree. The male flowers are cylindrical spikes which droop and are 12 - 30 cm long. The female flowers are grouped in a round head. The flower head develops into the compound fruit. The fruit are large and green. They can be 20 cm across. Seeded kinds have spines, and seedless kinds have a smoother surface. Seeded, small-seeded and non-seeded types occur. There are a number of cultivars of each. Seed can be 2 cm across.

Distribution: This is a Pacific region plant that has now been taken to many tropical countries. It occurs in the hot, humid, tropical lowlands. The plant is purely tropical and normally occurs below about 650 m altitude, but can grow up to about 1,150 m. Seeded types are more dominant in the west of Papua New Guinea. The tree is killed by temperatures below 5°C. It tends to grow in the temperature range 16 - 38°C. It probably requires an average temperature over 22°C to grow well. It grows on a range of soils, provided they are well-drained. There is some cultivar difference in drought tolerance and salt tolerance. Uniformly, warm, humid climates, with an annual rainfall of 2000 - 2500 mm and a relative humidity of 70 - 80%, suit it best. It suits hardiness zones 11 - 12.

Use: The large seeds are boiled in salted water or roasted and eaten. The flesh of the fruit is eaten cooked. The young leaves are edible. The male and female flowers are edible. Pit preservation of breadfruit involves lactic acid fermentation. The fermentation needs to be done 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.

Cultivation: Seeded forms are self-sown by birds or bats, and also grown from seed. The presence or absence of seeds influences how plants are grown. Seeded trees are mostly propagated by seed which needs to be sown fresh, without the 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. They need to be kept moist and shaded. Using intermittent mist improves root formation and cutting establishment. Use of rooting hormones also assists. 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 do not grow well in 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, or copies, and the variation is presumably therefore just in the leaves and not the seeds. Fruit set can be improved by dusting male flowers onto female flowers 3 days after they emerge. Because trees often occur from natural seed dispersal by fruit bats and marsupials, they are often randomly spaced and common in secondary forest. A spacing of 10 – 13 m is suitable between trees. Fruit can be 12 - 22 cm long and 9 - 17 cm wide. The fruit shape varies from round to oblong. Leaves vary from entire to deeply-lobed and from rough to smooth and shiny. The central core of the fruit and the skin

are not eaten. Seeded fruit have projecting tuberances on the surface. Seedless fruit have either rounded, or 5 to 6 sided, bumps on the surface.

Production: Male and female flowers grow separately on the same tree. Male flowers form an oblong catkin, while female flowers form a globular head. The flowers are in the axils of leaves (where the leaves join the stem). Both flowers normally appear at the same time. Artificial pollination has resulted in increased yields in some places. This is due to 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. Seeded fruit have 30 - 90 seeds per fruit. 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% of 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 and efficiently. 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 high in 10 - 12 years. Mature trees can be 30 m high. Fruiting can occur over 5 - 8 months in some locations, and this is partly due to varieties with overlapping fruit seasons. A young tree can produce 50 - 150 fruit per year. Fruit can weigh 1 - 1.6 kg each. 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. It is an important seasonal fruit and nut.

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	56.5	799	7.4	26	6.6	3.7	0.9
fruit	74.4	506	1.5	4	25	0.4	0.2

Vegetables

English: Marrow
Local:

Scientific name: *Cucurbita pepo*
Plant family: CUCURBITACEAE

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

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

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

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

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	3.7	2266	29.4	-	-	7.3	-
leaf	89.0	113	4.0	180	80	0.8	-
fruit (mature)	92.0	105	1.6	17	16	2.4	-
fruit	91.3	102	1.1	-	12	0.8	0.2
yellow fruit	92.0	97	1.0	180	8	1.4	-
immature fruit (raw)	92.0	92	1.5	-	9	0.4	0.1

Vegetables

English: Small flowered quickweed
Local:

Scientific name: *Galinsoga parviflora*
Plant family: ASTERACEAE

Description: An annual herb. It grows to 75 cm high and has a spread of 50 cm. The stem is erect and much branched. The stem is rather weak. The leaves are oval and opposite. The leaves have leaf stalks and the leaves are toothed around the edge. The flowers are small and daisy-like. They occur in small clusters and have white rays and a yellow disk. The flowers are produced in the axils of the upper leaves.

Distribution: A tropical and subtropical plant. It will grow in most soils and under most conditions. It can tolerate drought and frost. It can grow in arid places but is best with medium to high rainfall. Seeds need a temperature of 10 - 35°C and light to germinate. It grows in many African and Asian countries. In Zimbabwe it grows from 1,370 - 1,660 m above sea level. In Papua New Guinea it grows from 900 - 2,500 m altitude.

Use: The leaves and the young stems can be eaten raw or cooked. They are used as a potherb or added to soups and stews. It is also dried and ground into a green powder and added to soups and stews especially with chicken. The fresh juice is drunk with other vegetable juices.

Cultivation: Plants are grown from seed. Often they are self sown. The seeds germinate quickly and young plants grow rapidly.

Production: The leaves should be picked before plants start to form seeds.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	88.4	653	3.3	-	-	5.3	-

Vegetables

English: Java bean
Local:

Scientific name: *Senna obtusifolia*
Plant family: FABACEAE

Description: An annual or perennial herb that grows 0.6 - 2.5 m tall. The leaf has leaflets in 3 pairs that are oval and 1 - 6 cm long by 0.5 - 3.9 cm wide. The top of the leaf is rounded but with a sharp tip. It is wedge shaped at the base. The flower stalks have 1 or 2 flowers. The stalk for the flower cluster is very short, but the stalk for the individual flowers is 1 - 3.5 cm long. The flower petals are orange-yellow and 1-2 cm long. The fruits are thin, slightly curved and tapering pods. They are 13 - 23 cm long and 4 - 7 mm wide. The seeds are brown. They are 4.5 - 6.5 cm long by 2 - 4mm wide.

Distribution: A tropical plant that grows throughout the tropics. It is mostly a weed of roadsides and waste places. It grows from sea level to 2,000 m altitude. It grows along rivers and near lakes. In Africa it grows up to 1,700 m altitude. It can grow in arid places.

Use: The young leaves are cooked and used as a vegetable. The leaves are fermented into a high protein supplement to meat. The juice during fermentation is made into a stew with okra, beef and salt. The seeds are occasionally dried and ground into powder and cooked and eaten. Seeds are also roasted and used as a coffee substitute. **Caution:** Older leaves can cause diarrhoea. The seeds are possibly poisonous and should be well cooked.

Cultivation: It can be grown from seed.

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	79.7	251	5.6	-	113	5.9	-

Vegetables

English: Milk thistle
Local:

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

Vegetables

English: Oca
Local:

Scientific name: *Oxalis tuberosa*
Plant family: OXALIDACEAE

Description: A small annual herb that grows up to 30 cm tall with leaves of 3 leaflets. The stems are round and succulent. The leaves are spirally arranged. The flowers are orange-yellow. Three different kinds of flowers occur associated with three different kinds of tubers. The tubers have scales which cover long deep eyes. Tubers vary considerably in shape. The tubers are wrinkled and vary in colour between red, orange, yellow, or white. Some varieties have bitter tubers. They are about 5 - 8 cm long and 2 - 4 cm across. The plant rarely sets seed in the field but seed can be produced by self-pollinating. When seed form, they occur in 5 celled locules with 1 - 3 tiny seeds in each.

Distribution: A temperate plant. It mostly grows in the Andes from Colombia to Chile between 3,500 and 3,800 m altitude. The plant is frost hardy and grows in the high altitude tropics. In the hot tropical lowlands, tubers perish quickly. A day length of 9 hours is best for tuber formation. Vegetative top growth occurs under long day lengths. It suits hardiness zones 7 - 11.

Use: The tubers are acid when fresh but are dried slightly then cooked and eaten. The bitter kinds are freeze dried and stored for later use. They can be used in soups and stews. The young leaves and shoots can be eaten. **Caution:** Fresh tubers contain calcium oxalate.

Cultivation: Plants are grown from tubers or cut pieces of tubers which contain 1 - 3 eyes. Planting is normally done at the beginning of the rainy season and plants are weeded and soil mounded around them. A spacing of 20 - 40 cm x 20 - 36 cm is recommended.

Production: Tubers mature in about 8 months. Average yields in the Andes are about 3.7 t / ha. After digging tubers are cured in the sun for several 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
tuber	83.4	255	2.1	-	-	-	-

Image accessed from: http://www.pacificbulbsociety.org/pbswiki/index.php/Oxalis_tuberosa

Nuts, seeds, herbs and other foods

English: Pawpaw
Local:

Scientific name: *Carica papaya*
Plant family: CARICACEAE

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

Distribution: It is a tropical plant that grows from sea level up to about 1700 m altitude in the equatorial tropics. In cooler regions they have to be planted but in humid tropical regions are commonly self-sown. Sunlight allows germination when forest is cleared. It cannot stand frost. It needs a night temperature above 12°C and don't tolerate water-logging. Plants die after 48 hours in standing water. It needs a pH between 5 – 8 and suits hardiness zones 11 - 12.

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

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

Production: Seeds emerge in 2 - 3 weeks. Vegetative growth before flowering is 4 - 8 months. One or more fruit grow per leaf axil, about every 1 - 2 weeks under good growing conditions. With good growth, 100 fruit can be produced from one plant in a year. Pollination to maturity is about 2 - 3 months. On the coast in tropical equatorial regions, pawpaws start producing fruit after about 4 - 5 months, but in the highlands this may take 12 - 18 months. The first fruit are ready 6 - 11 months from planting. Tree life is about 2 - 3 years, although they may live for 10 - 12 years.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf	75.4	378	8.0	-	140	0.77	-
fruit	88.0	163	0.5	290	54	0.4	0.18
fruit (unripe)	92.1	109	1.0	-	-	0.3	-

Nuts, seeds, herbs and other foods

English: Cashew
Local:

Scientific name: *Anacardium occidentale*
Plant family: ANACARDIACEAE

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

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

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

Cultivation: It is usually grown from seeds. Seeds germinate poorly and slowly. Only nuts which sink in water (or a solution of 150 g of sugar in a litre of water) should be planted. Seeds are sun dried for 2 - 3 days to improve germination. Seeds can be sown in a nursery then transplanted, or more commonly, are sown directly. Trees are spaced 7 -1 0 m apart. The crop is cross pollinated mostly by insects. For good production, complete fertiliser or appropriate organic material should be applied. Pruning to shape the tree is often undertaken in the first 2 - 3 years. Cashews are often planted scattered in gardens or amongst other trees. Clearing under the tree prevents fire and makes finding nuts easier. Allowing nuts to fall before harvesting ensures only ripe nuts are collected. Resin in the cashew nut shell can damage hands and discolour the nuts. Roasting the nuts before removing the kernel avoids this.

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

Food Value: Per 100 g edible portion

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

Nuts, seeds, herbs and other foods

English: Grain amaranth
Local:

Scientific name: *Amaranthus caudatus*
Plant family: AMARANTHACEAE

Description: An annual plant which can be 2 m high and 45 cm across. The stems are angular and it can have a single stem or be branched. It is often limp in the upper parts. Plants are hairy at first but become smooth. Often they are tinged purple. Leaves are 2 - 4 cm long by 0.7 - 1.6 cm wide on a leaf stalk 0.5 - 1.5 cm long. Leaves can taper to a tip at the end. They can also thin towards the base. The veins are pale underneath. The flower clusters are in spikes on the side or top branches. The flowers are sometimes branched and can droop over. They can be 45 cm long. The fruit is oval. Seed are 1 - 1.3 mm across.

Distribution: A tropical plant. It can grow in warm temperate places. It cannot tolerate frost. Plants do best under high light, warm conditions and dry conditions. They need a well drained soil. Some varieties can tolerate pH up to 8.5 and there is some salt tolerance. It can grow in arid places. In the Andes it grows between 500 - 3,000 m above sea level. It suits hardiness zones 8 - 11.

Use: The leaves and young plant are eaten cooked. They are also used in stir fries and added to soups. The seeds are ground into flour and used to make bread. **Caution:** This plant can accumulate nitrates if grown with high nitrogen inorganic fertilisers and these are poisonous.

Cultivation: Plants can be grown from seed if the soil is warm. Seeds are small and grow easily. Cuttings of growing plants root easily. Amaranths are mostly grown from seeds. The seeds are collected from a mature dry seed head of an old plant. These dry flower stalks are stored and then the flowers rubbed between the hands over the garden site. Collecting the seeds is fairly easy by banging flower heads on a mat or piece of cloth then the rubbish can be blown out of this mixture by dropping it and blowing gently as it falls. The very small seeds of these plants are scattered over the ashes or fine soil in fertile ground. Some types are self sown.

Amaranthus seeds are very small. A thousand seeds weigh about 0.3 g. It is very difficult to sow such small seeds evenly over the ground. So there are a few different methods you can use to try and get the plants well spaced. One way is to mix the seeds with some sand and then when you sprinkle this along a row it will only contain a few seeds among the sand. The other way is to throw the seeds over a small plot of ground which will be a nursery. After 2 or 3 weeks the seedlings can be transplanted into the garden bed where they are to grow. If the seeds are just scattered over the garden, the small seedlings can be thinned out and either eaten or transplanted to a different spot. Seedlings are transplanted when about 5 - 7 cm tall. Plants can be harvested when small by thinning out and either transplanted or eaten cooked. Plants can be harvested whole or have top leaves harvested several times. Harvesting begins after 4 - 7 weeks and can continue over 2 months.

A spacing of about 8 cm x 8 cm is used if the plants are to be harvested by pulling up the whole plant. If the harvesting is to be done by picking off the top leaves, a wider spacing is normally used. When the tops are picked out 3 or 4 times over the life of the one plant, a spacing of about 30 cm x 30 cm is used.

As far as producing a large amount of food is concerned, the spacing is not very important. Having between 200 and 1,000 plants per square metre gives about the same total amount of food. The main thing that varies is the size of the leaves. Mostly people like larger leaves so a wider spacing of 8 cm

to 10 cm for plants to be pulled out is suitable. For plants to be harvested by picking out the tops, they can be picked down to about 15 cm high. Picking lower makes the plant flower later, but it also recovers more slowly from picking.

Amaranths grow quickly. Seedlings come up above the ground in 3 - 5 days. They are 5 - 7 cm high and big enough for transplanting after about 20 days. The plants can be pulled out and used after 6 weeks. If they are harvested by picking out the tops, this can be started at 5 - 7 weeks and continued 3 - 4 times over the next 2 months.

Amaranths eventually stop producing leaves and grow flowers. Flowering occurs after about 3 months and seed can be recollected about a month later. Amaranths are called day-length neutral plants because they still produce flowers at about the same stage, irrespective of whether there are many or few hours of daylight. Because flowering stops harvesting of leaves, it is a problem, but there does not seem to be any easy way of slowing down flowering. Flowering can be delayed a little by picking out the tops down to a lower level. Also it is made a little later if plants are grown in the shade. But lower picking and growing in the shade mean the plants produce less food, so there is no point. Plants need to be harvested and used when they are ready. If plants are left growing the amount of harvestable leaf gets less and the quality gets poorer.

Nitrogen deficiency shows as the oldest leaves near the bottom of the plant going yellow. This is because the plant needs more nitrogen to grow more new leaves at the top and there is not enough nitrogen in the soil for it to get it from there. So it reuses the nitrogen it used in the oldest leaves. These leaves therefore go yellow. Potassium deficiency shows as the edges of the oldest leaves going yellow. These shortages of nutrients could be corrected by adding some nitrogen or potash fertiliser but it is most likely too late for the current crop.

Production: Plants take 4-6 months from sowing to harvesting the seed, but up to 10 months in some Andean highland regions. Yields from 1-5 tonnes per hectare of seed are common. Yields of up to one kilogram of edible leaves have been harvested by pulling out plants from an area of one square metre. The young leaves or whole plants are eaten cooked. If plants are picked 3 or 4 times over 6-8 weeks then two kilograms of edible leaves can be harvested. From a plant that grows so quickly and is such good quality food this is a very high 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	6.0	1034	28.8	33	-	23.3	5.5

Nuts, seeds, herbs and other foods

English: Comb fringe grass
Local:

Scientific name: *Dactyloctenium aegyptium*
Plant family: POACEAE

Description: An annual grass. The stems are slender. They can lie along the ground. These can form roots at the nodes. They can have runners and form mats. It is 15 - 60 cm high. The edges of the leaf sheaths have small hairs. The leaf blades are flat and 5 - 20 cm long by 0.2 - 0.6 cm wide. The surfaces are lumpy/hairy. It tapers to the tip. The flowers spread like fingers on a hand. There are 2 - 9 flower stalks. They are long and narrow. They often spread out horizontally. The spikes are on one side of the stalk. The tip is bare. The seed grains are about 1 mm across.

Distribution: A tropical plant. It grows in disturbed weedy places especially on sandy soils. It grows in tropical to warm temperate regions. It grows on clayey, sandy or black soil along the borders of ponds, swamps and bogs. In West Africa it grows from sea level up to 2,000 m altitude. It grows in alkaline and salty soils. It grows in areas with an annual rainfall between 100 - 1,580 mm. It can grow in arid places.

Use: The seeds are husked then boiled into a porridge. They are also roasted in a hot pot to soften them. It is then pounded into flour and cooked into porridge. The rhizome or runners are eaten raw.

Cultivation: Plants can be grown from seeds.

Production: The seeds are collected during the dry season. The seeds can be stored for several 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	7.5	1234	9.8	-	-	6.9	4.7

Image sourced from: Giles Tran AFZ @feedipedia.org

Nuts, seeds, herbs and other foods

English: Brazil nut
Local:

Scientific name: *Bertholettia excelsa*
Plant family: LECYTHIDACEAE

Description: A very large tree growing up to 60 m tall. The trunk can be 14 m around. The bark is rich red or grey and deeply cracked. Leaves are dark green and turn reddish brown as they die off. The leaf stalks are 5 - 6 cm long. The leaves are 25 - 35 cm long by 8 - 12 cm wide. The flowers occur in long loose flower stalks. The flowers are about 2.5 cm wide. The fruit is a large woody capsule or pod 10 - 15 cm across and 15 - 20 cm long. It is brown and has a rough surface. The fruit can weigh over 2.5 kg. It grows at the ends of the thick branches. It ripens then falls from the tree. A lid type structure on the fruit opens and lifts off at maturity. Each fruit pod can contain 12 - 25 nuts. Each nut has its own shell. The nut is three sided. They are 3.5 - 6 cm long. The creamy white kernel inside the nut is edible.

Distribution: A tropical plant that requires a hot, humid tropical lowland climate. It grows naturally in areas with an average temperature of 24 - 27°C. It needs a minimum annual temperature of 20 - 23°C and a maximum of 30 - 33°C, and an annual rainfall of 1,400 – 2,800 mm. The best annual average humidity is between 79 - 91%. It is damaged by drought and frost. It suits hardiness zone 12.

Use: The nuts can be eaten raw or roasted. They are also salted and are used in ice cream. They are also sometimes grated with the stilt roots of Socratea palms and added to cassava flour. An oil can be extracted from the seeds.

Cultivation: The flowers are self-sterile so a group of trees need to be planted near each other. Plants are grown from seed, cuttings or grafts. The seeds need to have the hard shell broken to help them to germinate. Seeds can only be stored for about 4 - 5 months. Because of the hard seed coat, seed may take 6 - 16 months to germinate. Treating seed by removing the seed coat and treating with phenyl mercuric acetate allows seeds to germinate in 3 months. Early germination can also be achieved by putting the nuts into a container with moist sand and storing it in a dry shady place for 6 months then removing the hard shell and planting the seeds.

Production: Trees grow very slowly. They begin producing nuts 8 - 10 years after planting. The fruit take 14 - 15 months to ripen. One tree can produce 300 or more pods per year. One fruit can weigh 2.2 kg. The nuts are harvested when the fruit fall to the ground.

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	8.5	2545	12.0	-	-	2.8	4.2

Nuts, seeds, herbs and other foods

English: Tamarind
Local:

Scientific name: *Tamarindus indica*
Plant family: FABACEAE

Description: A large spreading tree up to 24 m tall. It has a broad, dense, evergreen crown. The trunk can be 1 m across. The bark is rough and grey with a checkered pattern. The tree can lose its leaves in dry areas. The leaves are carried one after another along the branch. The whole leaf is 6 - 12 cm long and it is divided into 10 - 17 pairs of leaflets. These are oblong and without stalks. The whole leaf has a leaf stalk about 15 cm long. The leaflets are 1 - 2.5 cm long and 4 - 9 mm wide. They are a dull dark green with a rounded tip. The flowers are pale yellow with brown markings. The flowers are about 2.5 cm across and hang on long, many flowered stalks. The fruit is an oblong, thin-skinned, fleshy capsule. The brown seeds are inside this long rough surfaced, sausage-like fruit. This pod is 6 - 8 cm long and about 2 cm wide and contracted between the seeds. The pod cracks when mature. The seeds are shiny and hard. The edible pulp is date like and reddish brown.

Distribution: A tropical legume. The tree is cultivated in a number of coastal towns in the tropics as a street tree. It is probably best grown below 800 m altitude in the tropics. It is drought resistant and cannot stand water-logging. It does well on coastal dunes above high water level. It suits semi-arid areas. It grows in the Sahel and must be in frost free locations. In Kenya it grows from sea level to 1,600 m altitude. It suits hardiness zones 11 - 12.

Use: The pulp of the fruit is edible and is also used for drinks. The seeds are also edible when cooked. They can be roasted and ground into flour. The outer skin is removed. The young leaves, flowers and young pods are also edible and are eaten in curries. They are used to make dishes acid. They are used in sauces and chutneys. The young seedlings are also edible.

Cultivation: It can be grown by seeds or cuttings. It is best to sow seedlings in pots then transplant them, but seed can be sown direct. There are about 1,400 seeds per kg. Seed should be soaked in hot water or the seed coat nicked before sowing. Seed can be stored for 2 years if kept dry, cool and away from insects. Trees can be topped or cut back and allowed to re-grow. Nothing grows under the trees due to the acidity of the leaves. Trees can be grown by air layering or cuttings.

Production: Trees are long-lived and grow very slowly. Fruiting is seasonal from April to June. It takes 8 - 9 months from flowering to ripe fruit. If plants are grown for shoots, they are planted close together.

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	38.7	995	2.3	20	60	1.1	0.7
flower	80.0	314	2.5	-	-	1.4	-
leaf	78.0	305	3.1	-	-	2.0	-

Nuts, seeds, herbs and other foods

English: Horseweed
Local:

Scientific name: *Conyza bonariensis*
Plant family: ASTERACEAE

Description: A robust, erect herb that grows from seed each year. The stems are hairy and 1 m long. The leaves are alternate and grey green. They are narrow and have small hairs. There can be fine teeth along the edge. The flowers are at the top and have pales yellow flower heads. The fruit are oblong. They have pale brown bristles.

Distribution: It is a subtropical plant. It grows in waste ground and hot arid places. It grows in areas with a marked dry season. It is often on stony and sandy land. It can grow on larva flows and deserts. It grows from sea level to 2,850 m altitude.

Use: The leaves are boiled and eaten as a vegetable.

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
leaf	79.4	236	3.2	-	17.0	16.4	2.7

Image accessed from: http://www.biolib.cz/en/image/id193683/

Nutritional values of food plants by plant Family

Plant Family	Scientific name	Common name	Edible part	Moisture %	Energy kJ	Protein g	Vit A µg	Vit C mg	Iron mg	Zinc mg	Page
AMRANTHACEAE	*Amaranthus hybridus*	Amaranth greens	leaf	87.4	189	4.9	-	108	5.7	-	29
AMARANTHACEAE	*Amaranthus hybridus subsp. quitensis*	South American amaranth	leaf	81.0	249	4.1	-	25.7	-	-	34
AMARANTHACEAE	*Amaranthus caudatus*	Grain amaranth	leaf	6.0	1034	28.8	33	-	23.3	5.5	53
AMARYLLIDACEAE	*Allium cepa var cepa*	Bulb onion	leaf	90	-	1.4	49	-	0.5	0.5	43
ANACARDIACEAE	*Spondias purpurea*	Purple mombin	fruit	76.2	347	0.16	30	45	1.1	-	37
ANACARDIACEAE	*Anacardium occidentale*	Cashew	nut	4.0	2478	17.5	-	-	2.8	4.8	52
APIACEAE	*Arracacia xanthorhiza*	Peruvian parsnip	root	13.9	1446	5	-	-	-	-	20
ARACEAE	*Xanthosoma sagittifolium*	West Indian kale	leaf	90.6	143	2.5	160	37	2.0	-	33
ARACEAE	*Colocasia esculenta*	Taro	root	66.8	1231	1.96	3	5	0.68	3.2	15
ASTERACEAE	*Galinsoga parviflora*	Small flowered quickweed	leaf	88.4	653	3.3	-	-	5.3	-	47
ASTERACEAE	*Sonchus oleraceus*	Milk thistle	leaf	94	109	2.3	678	22.0	1.6	0.7	49
ASTERACEAE	*Conyza bonariensis*	Horseweed	leaf	79.4	236	3.2	-	17.0	16.4	2.7	58
BRASSICACEAE	*Nasturtium officinale*	Watercress	leaf	95.0	63	2.4	960	35	3.4	0.1	30
CANNACEAE	*Canna indica*	Indian shot	root	88.8	142	1.7	-	5.6	-	-	13
CARICACEAE	*Carica papaya*	Pawpaw	leaf	75.4	378	8.0	-	140	0.77	-	51
CHENOPODIACEAE	*Chenopodium quinoa*	Quinoa	seed (dry)	13.3	1539	14.1	1	-	4.6	3.1	14
CUCURBITACEAE	*Cucurbita pepo*	Marrow	fruit (mature)	92.0	105	1.6	17	16	2.4	-	46
DIOSCOREACEAE	*Dioscorea trifida*	Sweet yam	tuber	80.7	284	2.5	-	-	0.5	0.4	21
EUPHORBIACEAE	*Manihot esculenta*	Cassava	tuber	62.8	625	1.4	30	15	0.23	0.48	17
FABACEAE	*Senna obtusifolia*	Java bean	leaf	79.7	251	5.6	-	113	5.9	-	48
FABACEAE	*Tamarindus indica*	Tamarind	fruit	38.7	995	2.3	20	60	1.1	0.7	57
FABACEAE	*Cajanus cajan*	Pigeon pea	seed	10.0	1449	19.5	55	-	15.0	-	22
FABACEAE	*Neptunia oleracea*	Water mimosa	leaf	88.0	142	5.2	114	-	3.0	-	23
FABACEAE	*Phaseolus lunatus*	Lima bean	seed	12.0	1407	19.8	tR	0	5.6	-	24
FABACEAE	*Phaseolus vulgaris*	Common bean	pod	88.0	151	2.5	750	27	1.4	0.2	25
FABACEAE	*Vicia faba*	Broad bean	seed (dry)	10.0	1448	26.2	130	16	6.7	-	26
FABACEAE	*Lupinus mutabilis*	Andean lupin	seed	8.2	1723	38.4	-	-	-	-	27
FABACEAE	*Vigna vexillata*	Pencil yam	root	68.9	287	2.3	-	-	10.0	1.7	28
LAMIACEAE	*Ocimum basilicum*	Sweet basil	leaf	91.0	113	2.5	386	18.0	3.2	0.9	32
LECYTHIDACEAE	*Bertholettia excelsa*	Brazil nut	nut	8.5	2545	12.0	-	-	2.8	4.2	56
MALVACEAE	*Sida cordifolia*	Goat's horns	leaf	6.6	1296	24.2	-	-	79.8	-	35
MARANTACEAE	*Maranta arundinacea*	West Indian arrowroot	root (starch)	12.2	1515	0.4	-	-	1.2	-	19
MORACEAE	*Artocarpus altilis*	Breadfruit	fruit	74.4	506	1.5	4	25	0.4	0.2	44

MUNTINGIACEAE	*Muntingia calabura*	Panama berry	fruit	76.3	380	2.1	15	90	1.1	-	38
OXALIDACEAE	*Oxalis tuberosa*	Oca	tuber	83.4	255	2.1	-	-	-	-	50
PASSIFLORACEAE	*Passiflora ligularis*	Sweet granadilla	fruit	78.5	393	2.8	20	20	0.9	-	39
POACEAE	*Dactyloctenium aegyptium*	Comb fringe grass	seed	7.5	1234	9.8	-	-	6.9	4.7	55
PORTULACACEAE	*Portulaca oleracea*	Purslane	leaf	82.2	108	3.1	54	20	0.8	1.5	31
SOLANACEAE	*Solanum quitoense*	Naranjilla	fruit	88.5	184	1.0	100	67	0.5	-	42
SOLANACEAE	*Physalis peruviana*	Cape gooseberry	fruit (mature)	84.2	201	2.0	36	30	1.5	-	36
SAPOTACEAE	*Pouteria caimito*	Caimito	fruit	74.1	397	2.1	-	49	1.8	-	40
SOLANACEAE	*Solanum muricatum*	Peruvian pepino	fruit	93.4	93	0.6	180	31	0.1	-	41

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