Potentially Important Food Plants of Northwest China



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

Potentially Important Food Plants of Northwest China

(incorporating Qinghai, Gansu, Ningxia, Inner-Mongolia, Shaanxi and northern Sichuan)

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 – NW China, Version 1, September, 2013

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 Dr Matthew Rodda 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 Northwest China. This guide has been developed with the best intention to create interest and improve understanding of the important local food plants of Northwest China, 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.

Contents

Introduction

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

Growing food

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

A country with very special plants

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

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

Getting to know plants

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

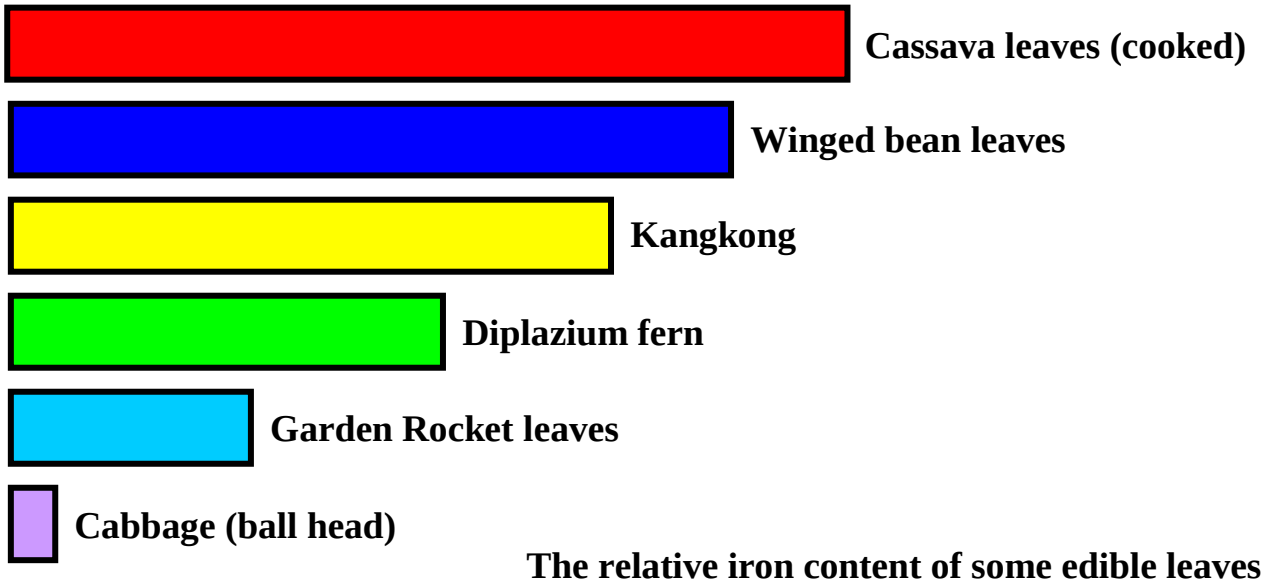
Naming of plants

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

Local food plants are often very good

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

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



The relative iron content of some edible leaves

A healthy balanced diet

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

Learning to cook well

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

Learning to grow "wild" food plants

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

Saving better types of plants

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

Growing from cuttings and suckers

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

Saving seed

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

Growing a garden of mixed plants

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

Different types of plants for food security

There is another reason for growing a range of food plants in a local garden or around a village. If something goes wrong, like extreme insect damage to plants, some disease occurring in the garden, or a poor growing season, some plants will be more damaged than others. With a variety of plants, there will still be some food to eat until the other plants recover and grow again. Also, a wide variety of plants will mean that different ones will be maturing at different times, which helps ensure a

continuous supply of food. There are shrubs that can be planted as edible hedges around houses, and fruit and nut trees that need to be planted as a gift for your children, several years before they will be able to enjoy them. Some nuts can be stored and eaten when other foods are not available. Most yams will store well for a few months.

Looking after the soil

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

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

Building up the soil

When a new garden has been cleared, it has lots of leaf mulch and other old plant material. This provides plant nutrients for new plants to grow. There is a simple rule for growing plants and improving the soil-"If it has lived once, it can live again." Any old plant material can provide nutrients for new plants to grow, but it must be allowed to rot into mulch or compost for this to happen. If this plant material is burnt, some nutrients, especially phosphorus and potassium ("potash"), get left behind in the ashes for new plants to use, although it also allows these important nutrients to be lost by being washed away by rain. But with burning other important nutrients, such as nitrogen and sulphur, get lost in the smoke and disappear from the garden and soil. These last two plant nutrients are especially important for growing green leaves and when their levels are low, plants grow small or pale green. When nitrogen is lacking, the old leaves of the plant go pale and fall off early, and when sulphur is lacking, the young leaves go pale. Wherever possible, old plant material should be covered with some soil to allow it to rot down and not simply dry out or get burnt.

Poor soils where crops won't grow

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

Soil nutrients

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

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

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

Making compost

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

dry and brown, it will not break down, and if it gets too green, it will go slimy. Using a little bit of compost from an old heap will make sure the right bacteria are there to start the whole process off. As soon as the plant material is broken down to a fine mulch it can be put onto the garden. It is best if it is dug in, but if it is regularly put onto the surface of the garden, worms will mix it into the soil.

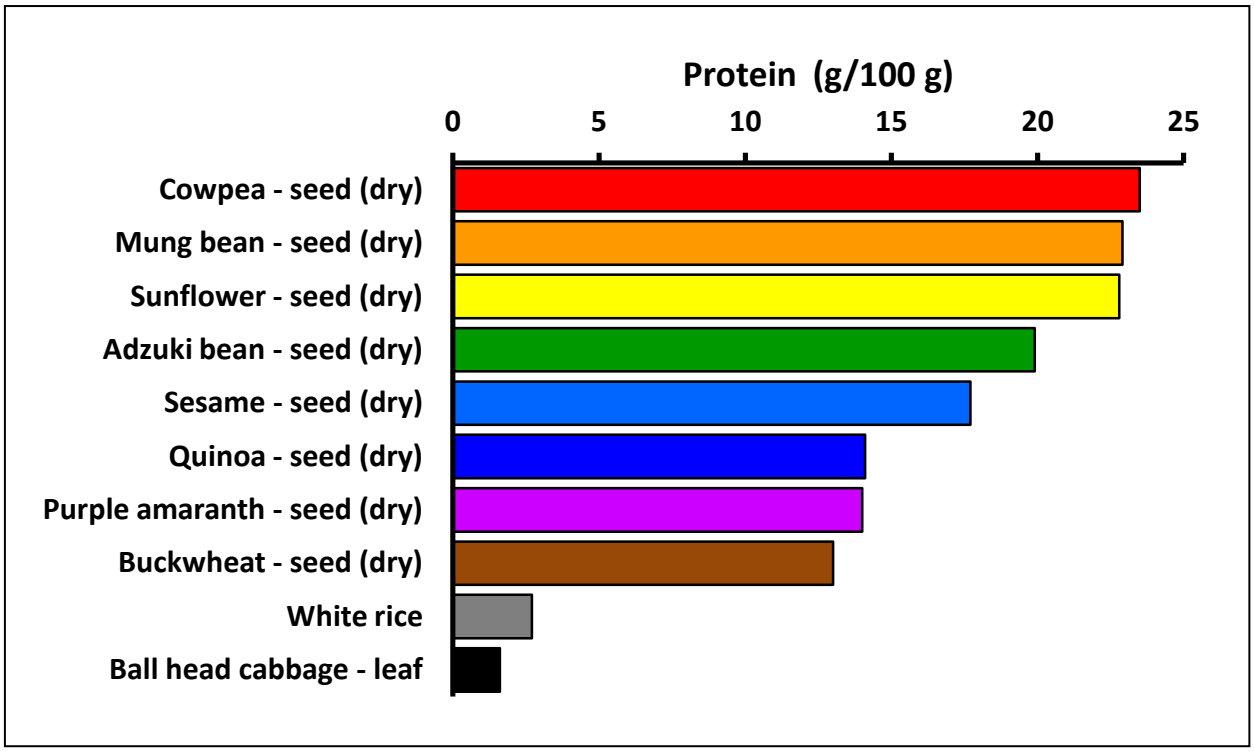
Pests

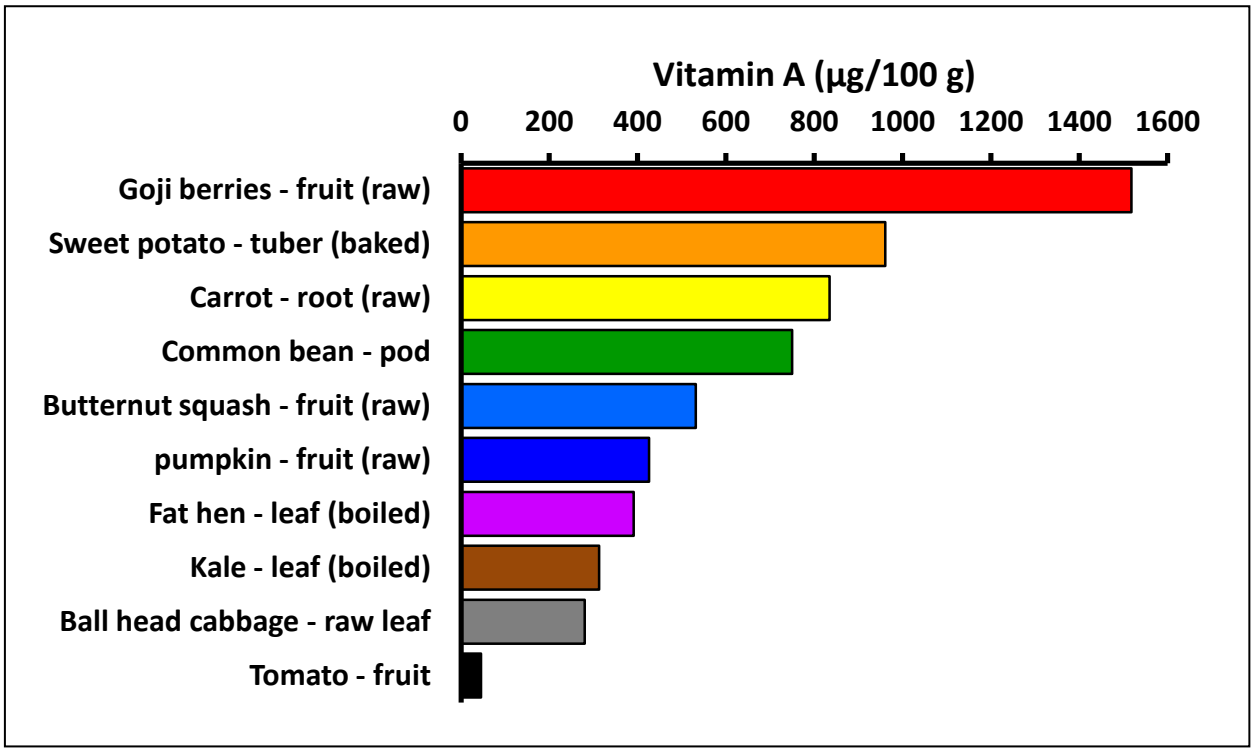
There are a large number of insects that enjoy sharing our food with us! We should not try to kill all these insects as they have an important role to play in keeping everything in nature in balance. What we need to do is to learn to manage these insects so we can all get some food to eat! Some insects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

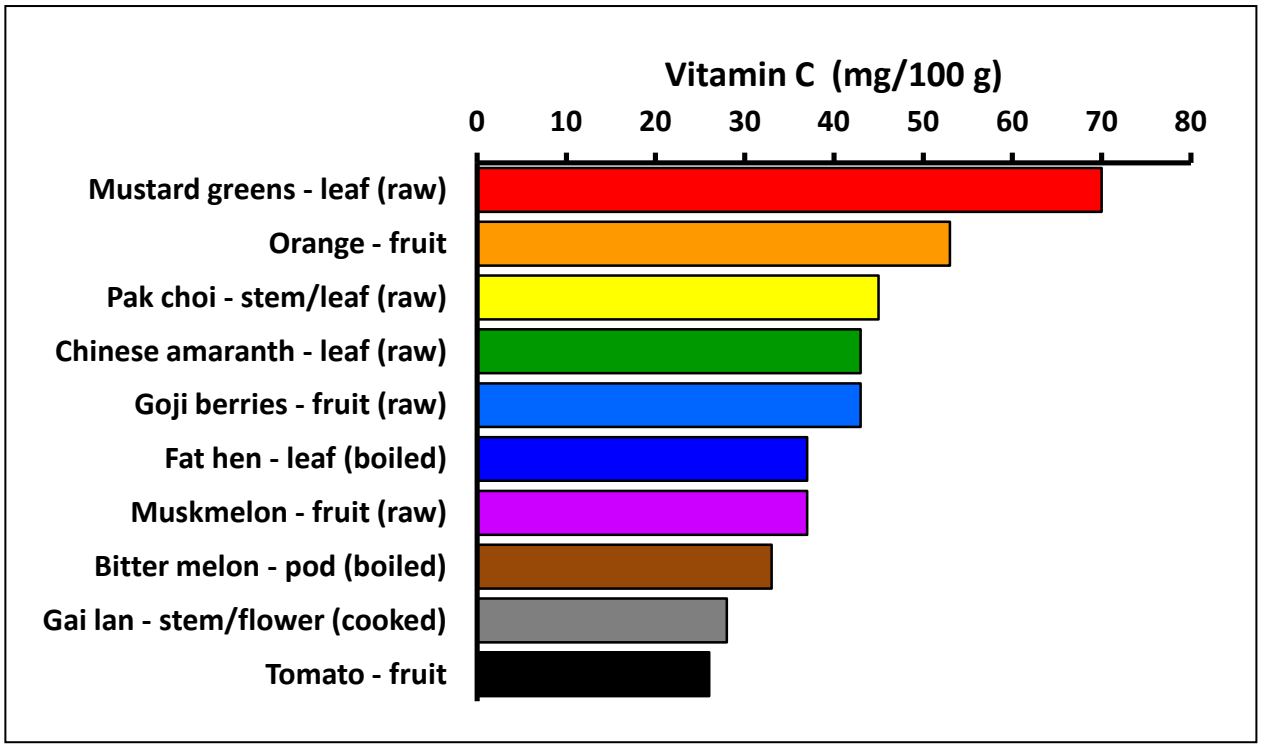
Diseases

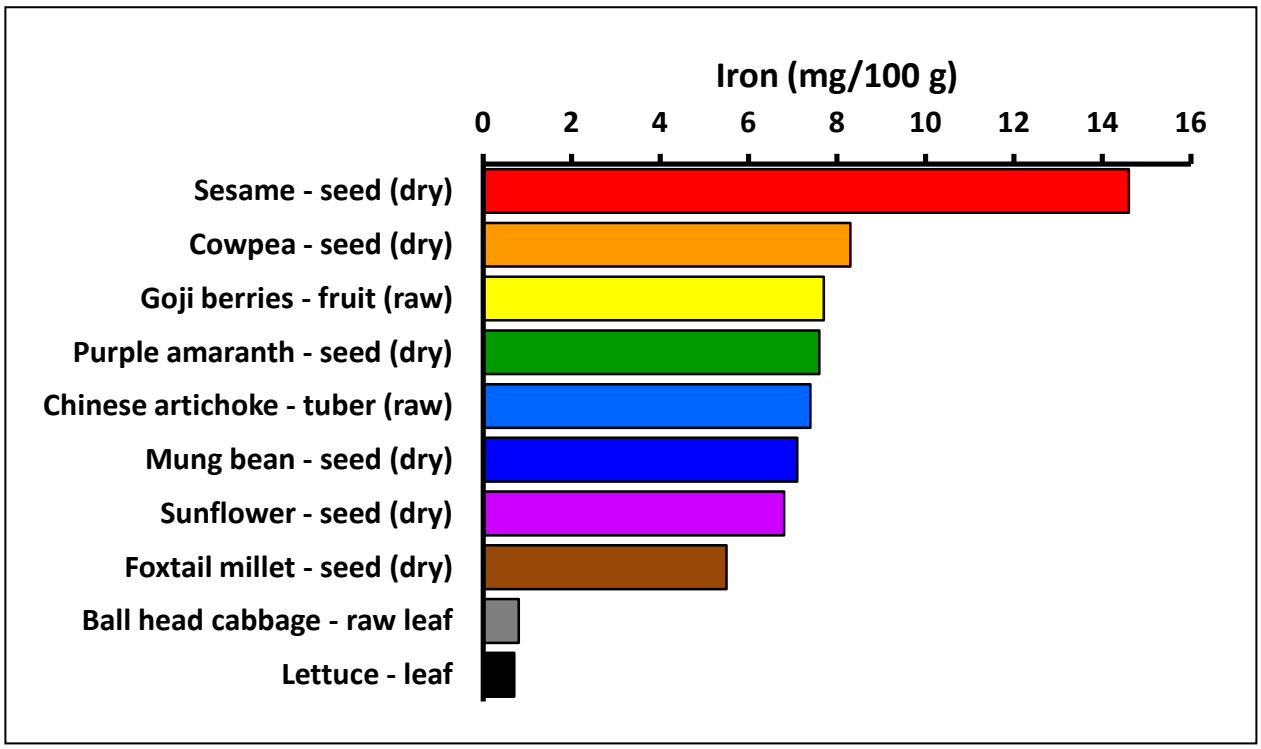
The living organisms that cause disease are much smaller than insects. These disease organisms can often only be seen with a microscope. There are three main kinds of disease organisms-fungi, bacteria and viruses. Fungi are like the mushrooms we eat, only very much smaller. They usually make distinct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

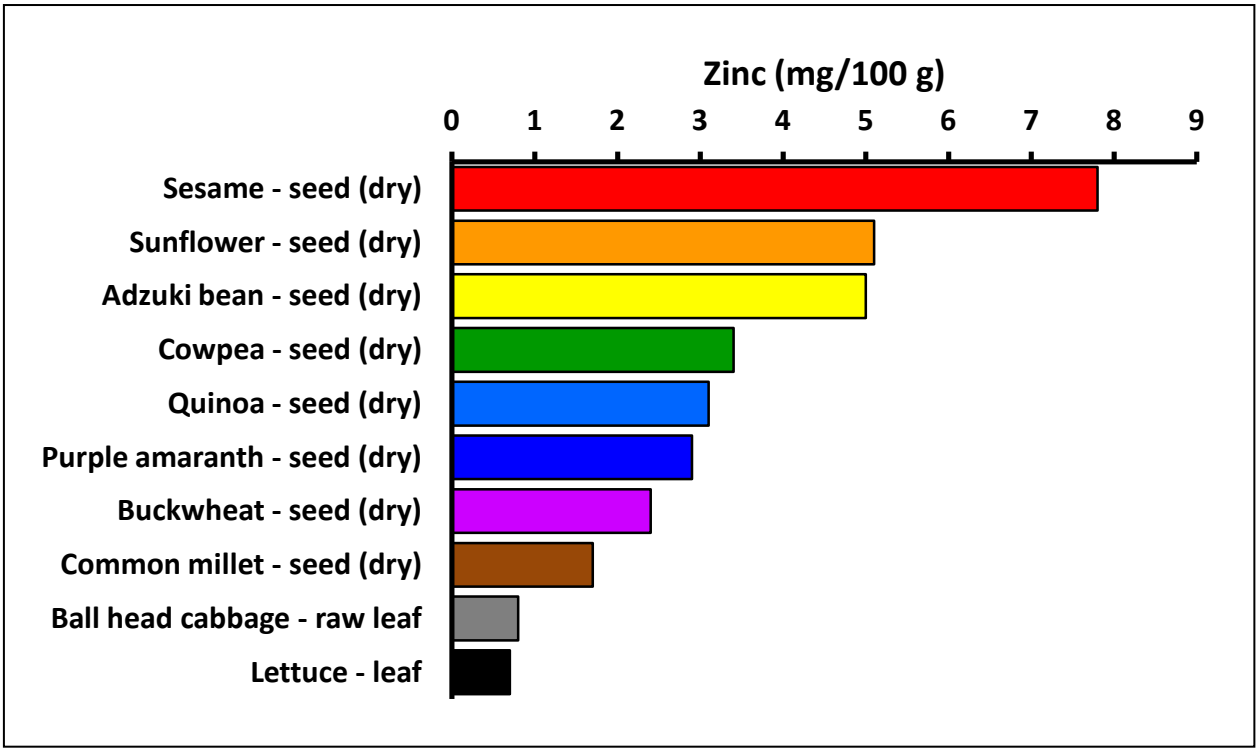
Food value charts for a selection of plants from Northwest China






Vitamin C (mg/100 g)
0
10
20
30
40
50
60
70
80
Mustard greens - leaf (raw)
Orange - fruit
Pak choi - stem/leaf (raw)
Chinese amaranth - leaf (raw)
Goji berries - fruit (raw)
Fat hen - leaf (boiled)
Muskmelon - fruit (raw)
Bitter melon - pod (boiled)
Gai lan - stem/flower (cooked)
Tomato - fruit


Iron (mg/100 g)
0
2
4
6
8
10
12
14
16
Sesame - seed (dry)
Cowpea - seed (dry)
Goji berries - fruit (raw)
Purple amaranth - seed (dry)
Chinese artichoke - tuber (raw)
Mung bean - seed (dry)
Sunflower - seed (dry)
Foxtail millet - seed (dry)
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). This does not mean that they are not useful, but merely reflects a desire to concentrate on plants that are less well known and/or underutilised.

Starchy staples

English: Purple (grain) amaranth
Local: 谷子苋菜 (gǔ zi xiàn cài)

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

Description: An annual erect plant. It grows to 2 m high. The stems are angular. It often branches in the upper section. It is smooth but may be hairy on younger plant parts. The young parts can be tinged purple. The leaves are oval to sword shaped and can be 10 - 15 cm long by 3 - 6 cm wide. They have a leaf stalk 1 - 7.5 cm long. The leaves often narrow towards the tip. They can also become thinner towards the base. There may be hairs on the midrib. The leaf may be tinged purple underneath. The flowers clusters are often branched and on side branches. The stiff branched flower arrangement at the top can be 15 - 25 cm long. The fruit is oval and the seed can be 1 - 1.3 mm across. The seed is dark brown but pale brown forms are used as grain in Central America.

Distribution: It grows in the tropics and more temperate regions. It needs a night temperature above 15°C and preferably a day temperatures above 25°C. It grows best in fertile, well drained soil and suits hardiness zones 8 - 11.

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

Cultivation: Plants can be grown from seed if the soil is warm. Seeds are small and grow easily. They can be put in a nursery and then transplanted after 2 - 3 weeks. Cuttings of growing plants root easily.

Production: Yields of 800 – 1,500 kg per hectare are achieved. Plants can be harvested by pulling up the entire plant or by removing leaves over several harvests.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	11	1554	14	0	4	7.6	2.9
leaf (raw)	92	97	2.5	146	43	2.3	0.9

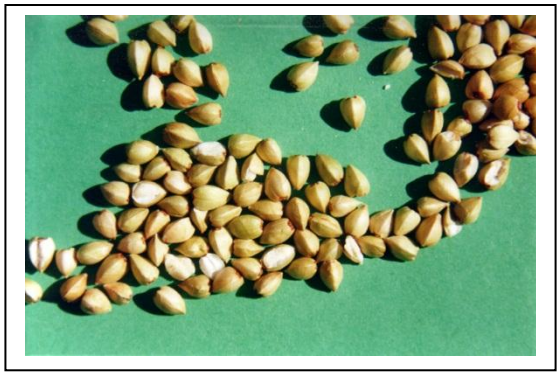
*Equivalent species also grown for grain production:

- *Amaranthus caudatus*: foxtail amaranth; 谷子苋菜 (gǔ zi xiàn cài)
- *Amaranthus hypochondriacus*: amaranth; 谷子苋菜 (gǔ zi xiàn cài)

Starchy staples

English: Buckwheat
Local: 荞 (qiáo)

Scientific name: *Fagopyrum esculentum*
Plant family: POLYGONACEAE



Description: An upright annual plant up to 1 m high. It spreads to 1 m across. It has angular hollow stems. These are erect and branching. Leaves are heart shaped or triangular and small. It has groups of white or pink flowers. These have a smell. They occur in clusters at the ends of branches. Fruit are small and 3 angled. The plants are not grasses but the seeds are normally grouped with other grain crops.

Distribution: It is a temperate plant. It will grow on poor soils but prefers rich soils and a protected sunny position. It is resistant to frost but damaged by drought. In Nepal it grows between 1,000 – 2,500 m altitude. It can grow up to 4,400 m altitude. In Uttar Pradesh it grows up to 3,000 m altitude.

Use: The seeds are eaten in porridge and biscuits etc. The seeds can be made into flour and eaten in pancakes, noodles and breads or for thickening soups and gravies. Seeds can be soaked overnight then sprouted and eaten. The tender leaves and shoots are cooked and eaten. The young leaves can be stored for 4 - 5 days after harvest. The seeds are used mainly for flour and stock feed. **Caution:** Seeds are bitter. If they are eaten in large amounts they can produce an unpleasant skin disorder.

Cultivation: Plants are grown from seed.

Production: Seeds usually germinate in 5 days. It has a very short growing period from sowing to maturity. It can produce a crop of leaves in 8 weeks and seeds in 12 weeks. Seed ripen irregularly over several weeks making harvesting difficult. Under cool conditions plants flower in 7 - 9 months. Commercial grain yields in Australia have been up to 2.5 tonnes/ha. In India, yields of 600 - 800 kg/ha are 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
seed (dry)	10	1435	13	0	0	2.2	2.4

Starchy staples

English: Sweet potato
Local: 红薯 (hóng shǔ)

Scientific name: *Ipomoea batatas*
Plant family: CONVOLVULACEAE

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

Distribution: A tropical and subtropical plant. They grow from sea level up to about 2,700 m altitude in the tropics. Plants can grow with a wide range of rainfall patterns and in different soils. Plants are killed by frost and can't stand water-logging. Plants grow well with temperatures between 21 - 26°C. It can grow with a pH between 5.2 - 6.8. Sweet potato are not tolerant to shading. Under shaded conditions, both foliage growth and storage root production are decreased. Some cultivated varieties can be selected for increased production under mild shade but not heavy shade. The survival of cuttings at planting is also reduced under shaded conditions. Under shaded conditions plant become more climbing and with fewer leaves which are however larger. With increasing shade less tubers are produced and these grow more slowly. Sweet potato tends to be responsive to potassium fertiliser. cultivated varieties are often selected for yield under low fertility conditions. Under lowland conditions in the tropics sweet potato tubers undergo active tuber enlargement from 6 - 16 weeks. Weed control is essential especially during early stages of growth. The rate of ground coverage by foliage varies greatly with growing conditions and cultivar but once ground coverage has occurred weed control is less of a problem. Sweet potato tuber initiation is subject to aeration in the soil. Either heavy clay soils, waterlogged conditions or other factors reducing aeration can result in poor tuber production. For this reason sweet potatoes are often grown on mounded beds. It suits hardiness zones 9 - 12.

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

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

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

Sweet potato tends to be responsive to potassium fertiliser. Cultivars are often selected for yield under low fertility conditions.

Under lowland conditions in the tropics sweet potato tubers undergo active tuber enlargement from 6-16 weeks. Weed control is essential especially during early stages of growth. The rate of ground coverage by foliage varies greatly with growing conditions and cultivar but once ground coverage has occurred weed control is less of a problem. Sweet potato tuber initiation is subject to aeration in the soil. Either heavy clay soils, waterlogged conditions or other factors reducing aeration can result in poor tuber production. For this reason sweet potatoes are often grown on mounded beds. In well drained or high organic matter soils digging or mounding is not as essential. Leaf scab (*Elsinoe batatas*) can significantly reduce yield especially in sites where leaf production is low due to low soil fertility. To reduce sweet potato weevil damage plants need to be hilled or have the tubers well covered with soil. Cracking soils can allow the weevil access to tubers.

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

Food Value: Per 100 g edible portion

Edible part	**Moisture %**	**Energy kJ**	**Protein g**	**proVit A µg**	**proVit C mg**	**Iron mg**	**Zinc mg**
tuber (baked)	72.9	431	1.7	961	24.6	0.5	0.3
tuber (raw)	70.0	387	1.2	709	25	0.7	0.4
tuber (boiled)	72.0	363	1.1	787	15	0.6	0.3
leaf (raw)	86.3	168	3.9	105	58	2.9	-

Starchy staples

English: Proso (common or broomcorn) millet **Scientific name:** *Panicum miliaceum*
Local: 黍子 / 小米 (shǔ zi / xiǎo mǐ) **Plant family: POACEAE**

Description: An annual grass which grows up to 1 m high. It spreads to 15 cm across. It has a fibrous root system. The stalks are tufted. They are hairy at the base and on the nodes. The leaves are 30 - 50 cm long by 1 - 5 cm wide. They are narrow and flat. The edge is slightly rough with a few long hairs near the base. The seed head is much branched. The flower is yellow. The fruit is a grain. There are several races.

Distribution: It requires a moderately fertile well-drained soil in full sunlight. Once established it can tolerate heat and drought. It suits warm temperate and subtropical climates. Plants are frost sensitive. It can grow in arid places. It suits hardiness zones 5 - 9.

Use: The seeds can be cooked and eaten whole or ground into flour. They can be used in bread, pasta or dumplings. They are often browned in a skillet before using in casseroles, stews and for stuffings. It suits people with Coeliacs disease because it contains no glutin. It has a high alkaline content that makes it easily digested. The seed can be sprouted and added to soups and salads. They are fermented into *tempeh* or *miso*.

Cultivation: It is grown from seed which take one week to germinate.

Production: Seeds for harvest can be produced in 10 weeks.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	9	1582	11	0	0	3.0	1.7

Starchy staples

English: Foxtail millet
Local: 谷子小米 (gǔ zi xiǎo mǐ)

Scientific name: *Setaria italica*
Plant family: POACEAE

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

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

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

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

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

Food Value: Per 100 g edible portion

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

Starchy staples

English: Potato
Local: 土豆 (tǔ dòu)

Scientific name: *Solanum tuberosum*
Plant family: **SOLANACEAE**

Description: A branched annual plant up to 50 cm tall. The stems are soft and 4 angled with compound leaves. The leaves are irregular shape and have 6 - 8 pairs of leaflets as well as small irregular leaflets between the others. It has swollen stem tubers under the ground. The tubers can vary in colour from white to red and purple. The tuber shape can also vary greatly. The flowers are white pink or purple. The fruit is a berry. It is smooth, round and green but often striped.

Distribution: In the tropics they mostly grow at high altitude above 1,500 m, but they are grown between 900 and 2,800 m. Tubers form best when soil temperatures are 15.5°C. Tuber formation stops with a soil temperature of 30°C and decreases with temperatures above 20°C. Potatoes should have a mean temperature below 18°C. They are damaged by frost but slightly more frost tolerant than sweet potato. Short daylength helps tuber production. They can grow with a soil pH of 5.2 - 6.6. It suits hardiness zones 7 - 11.

Use: The tubers are cooked and eaten. They are also fried, canned and made into starch. The tubers are boiled, baked, roasted, mashed and used in soups, stews, dumplings, pancakes and potato salads. Potatoes are also use for alcoholic drinks. The tender leaves are also occasionally eaten. **Caution:** The green tubers and leaves contain a poisonous alkaloid solanine.

Cultivation: Plants are grown from tubers. Due to virus diseases, it is necessary to get fresh seed tubers each few years. Large tubers can be cut to include a bud or "eye". A seed piece of 40 - 50 g is suitable. It is best to inter-crop as this stops bacterial wilt spreading. The plant is surrounded by dirt when 20 - 25 cm tall. Later the tubers need to be kept covered with dirt. Providing extra light (4 - 5 hours) allows plants to form flowers and true seed to be collected.

Production: The time to maturity is between 17 and 24 weeks. Yields of 5 - 12 t/ha can be expected. Higher yields can be obtained with good care.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
tuber (baked)	71.2	456	2.3	0	12.9	1.4	0.3
tuber (raw)	77.0	344	2.0	25	21	0.8	0.27
leaf (raw)	86.1	-	-	3.4	-	-	-

Legumes

English: Common bean
Local: 菜豆 (cài dòu)

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

Legumes

English: Adzuki bean
Local: 小豆 (xiǎo dòu), 红豆 (hóng dòu), 赤豆 (chì dòu)

Scientific name: *Vigna angularis*
Plant family: FABACEAE

Description: An erect bushy bean plant that re-grows from seed each year. Plants grow up to 60 cm tall. The flowers occur as clusters of bright yellow flowers. The fruit are pods 6 - 12 cm long and contain up to 12 small oblong seeds. These can vary between red, brown and black. They are 0.5 cm long. There are several named cultivated varieties.

Distribution: A tropical plant. They cannot stand frost but can tolerate some cold. They are short day plants, forming flowers and pods when daylengths or hours of sunlight are getting shorter.

Use: The young pods are eaten cooked. The seeds can be eaten cooked. They are added to soups, stews and salads. They are boiled, mashed and sweetened. The seeds are germinated for sprouts. They can be popped liked corn or used as a coffee substitute.

Cultivation: Seed can be pre-germinated on wet paper to get it growing more quickly. The soil temperature needs to be above 15°C. A spacing of 15 cm is suitable.

Production: For green pods, these should be picked regularly. For dry beans, plants can be allowed to go to maturity, then pulled up and dried.

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)	13.4	1377	19.9	1	0	5.0	5.0
whole bean (fresh)	69.6	396	6.6	-	0	2.5	2.5

Legumes

English: Mung bean, green gram
Local: 绿豆 (lǜ dòu)

Scientific name: *Vigna radiata*
Plant family: FABACEAE

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

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

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

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

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	11.0	1432	22.9	2.8	4	7.1	-
seed (cooked)	-	439	7.0	2.4	1.0	1.4	-
seed (sprouted)	90.4	126	3.0	2	13.2	0.9	0.4

Legumes

English: Snake/yardlong bean **Scientific name:** *Vigna unguiculata* subsp. *sesquipedalis*
Local: 长豇豆 (chǎng jiāng dòu) or 豆角 (dòujiǎo) **Plant family: FABACEAE**

Description: A climbing bean with long pods. The vines can be 3 m long. They normally twine around sticks. Dwarf kinds also occur. Leaves have 3 leaflets. The leaflets are oval and side leaflets are at an angle. Leaflets can be 2 - 16 cm long by 1 - 12 cm wide. There can be few or several flowers. The flowers can be white, yellow or blue. Flowers are 1 - 3 cm long by 1 - 3 cm wide. Pods are long (up to 90 cm) and flexible. The seeds can vary between white to dark brown. They are oblong or kidney shaped. Seeds are 4 - 12 mm long by 2 - 6 mm wide.

Distribution: A tropical plant that grows in coastal areas in the tropics from sea level up to about 300 m in equatorial regions. Seeds germinate in moist soil over 22°C. For growth, day temperatures between 25 - 35°C and night temperatures above 15°C are required. It suits wet areas. Plants are day length neutral. They perform best under full sunlight but can tolerate some shade. It has a high water requirement for the full grown crop (6 - 8 mm per day). It can tolerate a wide range of soils with pH of 5.5 - 7.5.

Use: The young pods, ripe seeds and leaves are eaten. They can be steamed, stir-fried and used in other dishes. The seeds can be sprouted and eaten.

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

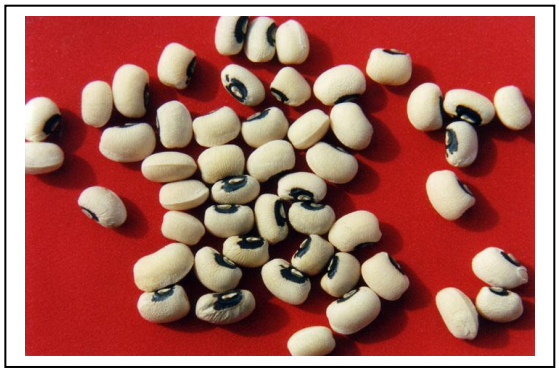
Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (fresh, raw)	87.9	197	2.8	11.3	18.8	0.47	0.37
seed (boiled)	87.5	197	2.5	20	16.2	0.98	0.36
seed (dry, raw)	8.43	1453	24.3	0.16	1.6	8.61	3.5

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

Legumes

English: Cowpea (incl. black-eyed pea) **Scientific name:** *Vigna unguiculata* subsp. *unguiculata*
Local: 豇豆(jiāng dòu) or 豆角 (dòujiǎo) **Plant family:** FABACEAE



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

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

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

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	12.0	1406	23.5	3	1.5	8.3	3.4
immature seed (fresh)	77.2	376	3.0	41	2.5	1.1	1.0
leaf (raw)	88.4	143	4.2	36	35	4.7	0.3
immature pod + seed (boiled)	89.5	142	2.6	45	17.0	0.7	0.2
leaf (boiled)	91.3	92	4.7	29	18	1.1	0.2

Leafy greens

English: Amaranth; Chinese amaranth
Local: 苋菜 (xiàn cài)

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

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

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

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

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

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf (raw)	92	96	2.5	146	43	2.3	0.9

*Equivalent species also grown for leaves: *Amaranthus dubius, A. gangeticus* and *A. oleraceus*

Leafy greens

English: Mountain spinach, Orache
Local: 榆钱菠菜 (yú qián bō cài)

Scientific name: *Atriplex hortensis*
Plant family: AMARANTHACEAE

Description: An annual plant that grows up to 2 m tall and spreads 40 - 50 cm wide. The leaves are triangular and greyish-green, red or yellow. They are 10 - 15 cm long and have small teeth along the edge. The flowers are in clusters at the ends of the plant. These can be 20 cm long. They are green or red but insignificant. The fruit are very small brown plate like seeds. There are several named cultivated varieties.

Distribution: It is a temperate plant. It grows best in nitrogen rich soils and suits hardiness zones 6 - 11.

Use: The leaves can be eaten raw or cooked. They are used in salads and soups. Seeds are used in soups and muffins. **Caution:** It contains some toxic substances so should not be eaten for long periods.

Cultivation: Plants can be grown by seed or cuttings. In warm weather, pinch out the flower heads to prevent the plant running to seed.

Production: It is fast growing. Leaves are harvested after 30 - 35 days.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf (raw)	-	85	3.2	-	-	-	-

Leafy greens

English: Good King Henry
Local:

Scientific name: *Chenopodium bonus-henricus*
Plant family: AMARANTHACEAE

Description: A annual or perennial plant. It grows 60 - 100 cm tall and spreads to 60 cm wide. The roots are fleshy and thick. The stem is hollow. It has triangular shaped, deep green leaves. They are 10 cm long. The flower spikes do not have leaflets. The flowers are greenish in spikes at the top of the plant. The seeds are rust coloured.

Distribution: It is a temperate plant. It will grow on a range of soils. It is resistant to drought and frost. It suits hardiness zones 5 - 10.

Use: The young leaves are eaten as a potherb. The young shoots can be cut under the ground and peeled and used as an asparagus substitute. The tender flower clusters are eaten.

Cultivation: It can be grown by seed.

Production: Plant can take a couple of years to get established but then continue to produce leaves. They self seed, if allowed.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf (raw)	-	162	6.5	-	-	-	-

Leafy greens

English: Mustard greens
Local: 芥菜 (jiè cài)

Scientific name: *Brassica juncea*
Plant family: BRASSICACEAE

Description: It is an erect leafy annual cabbage plant. It grows to about 1 m high. The plant can vary a lot. The dark green leaves are elliptical and deeply divided. The end segment of the leaves is oval. The leaves taper towards the stem and have a strong mustard flavour. The flowers are pale yellow. They have 4 petals. It produces a flower and seed pods at the top. The seed pod is 3 - 5 cm long and narrow. The seeds are reddish-brown.

Distribution: A warm temperate plant. Most varieties are not frost tolerant. It needs a fertile, well drained soil. A soil pH of 5.5 - 6.8 is suitable. It can tolerate poor soils and can grow in arid places. It suits hardiness zones 9 - 11.

Use: The leaves are cooked and eaten. They have a bitter taste, so the cooking water needs changing. They can be stir-fried, or added to soups and stews. They can be eaten crystallised in vinegar or salt. They can be used in salads. The seeds can be fried then used as a spice. They also yield an edible oil. They can be sprouted. The leaves are also pickled.

Cultivation: The seed is broadcast. They can be put in a nursery and transplanted. A spacing of 25 cm x 25 cm is suitable. Seed germinate in 5 days at 20 - 25°C.

Production: Plants grow rapidly. Leaves can be harvested one month after planting. Leaves can be harvested several times. Whole plants can be harvested in about 45 days from transplanting.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf (raw)	91	114	2.9	151	70	1.6	0.25

Leafy greens

English: Kale; collard greens
Local: 羽衣甘蓝 (yǔ yī gān lán)
Scientific name: *Brassica oleracea* var. *acephala*
Plant family: BRASSICACEAE

Description: A cabbage plant. The leaves are ruffled or crinkled but some are more smooth than normal kales. The leaf shape and colour varies considerably. The flowers are yellow or white.

Distribution: The leaves grow best in cool weather. It suits hardiness zones 8 - 11.

Use: The leaves are eaten boiled. They can also be steamed and used in soups and stews. The unopened flower buds are used like broccoli.

Cultivation: Plants are grown from seed or transplanted. Plants should be spaced 30 - 45 cm apart no more than 1cm deep.Well-drained moist, neutral pH soil is best. Cooler seasons are the normal time to grow kale but it can be grown in seasons and climates outside of this. Kale can tolerate temperatures as low as -7ºC, but will start to turn bitter and become tough in temperatures over 27ºC.[1]

Production: The flavor, output and duration from seed to harvest will change depending on the temperature, weather patterns, variety and soil condition.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf (raw)	84	210	3.3	70	120	1.7	0.3
leaf (boiled)	91.7	109	2.1	313	18	0.5	0.4

[1.] Additional notes: Rutherford-Fortunati, A. (2013) http://gentleworld.org/kale-an-easy-beginners-guide-to-growing (accessed online: 22/9/13)

Leafy greens

English: Chinese broccoli, Gai lan
Local: 芥兰 (jiè lán)

Scientific name: *Brassica oleracea* var. *alboglabra*
Plant family: BRASSICACEAE

Description: A cabbage plant with a single fleshy stem. Although it keeps growing from year to year it is normally grown as an annual. It grows 45 cm high and spreads 40 cm across. The leaves are dark green and rounded on long stems. Plants start to flower when 10 leaves are present. Flowers are white but there are varieties with yellow flowers. There are several named cultivars.

Distribution: It does best in a fertile soil. The soil needs to be well drained. It prefers a soil pH of 6 - 7. Temperatures during the day of 18 - 28°C are best. It can tolerate frost. It grows well in tropical regions but cool temperatures are necessary for flowering.

Use: The flower stalk, flower heads, buds and tender leaves are all eaten. The stems are steamed or braised and often served with oyster sauce. They are also used in soups.

Cultivation: Plants are grown from seed. Seed can be sown direct or put in a nursery then transplanted. Seed is sown about 0.5 cm deep and germinate in 3 - 10 days. A spacing of 15 cm is suitable. Wide spacing causes stems to become thick and tough. Because plants are shallow rooted, they need regular watering.

Production: Chinese broccoli is fast growing. Flower heads are harvested after about 9 weeks. Heads are harvested individually to allow others to form. Harvesting is done before buds start to open.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
stem/flower (cooked)	93.5	94	1.1	82	28.2	0.6	0.4

Leafy greens

English: Bok/pak choi; Choy sum
Local: 小白菜 (xiǎo bái cài); 菜心 (cài xīn)

Scientific name: *Brassica rapa* subsp. *chinensis*
Plant family: BRASSICACEAE

Description: A leafy cabbage grown as an annual. It grows 40 - 60 cm high. The taproot is not fleshy. The stem is short. The leaves are arranged in spirals. They are simple and broadly oval. They can be 30 cm long by 10 cm wide. The leaves form a rosette. They do not form a head. The leaf stalk is thickened. It forms a half cylinder in cross section and does not have wings. The leaf blade is entire and can have a wavy edge. Flowers are small and yellow with 4 petals. The fruit is a pod 3.5 cm long. The seeds are black and 2 mm long. Several different kinds occur.

Distribution: A tropical plant. More common in lowland areas but will grow in the highlands. It suits cool seasons but will not tolerate frost.

Use: The stems and leaves are cooked and eaten. In Chinese cooking most often stir-fried whole.

Cultivation: Plants are grown from seed and often transplanted. A spacing of 40 cm x 40 cm is suitable. Seeds are sown direct. They are sown 1 cm deep. They germinate in about 7 days with soil temperature of 21°C. Plants are thinned to about 20 cm between plants.

Production: The whole plant is harvested after 2 - 3 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
stem/leaf (raw)	95	55	1.5	223	45	0.8	0.2

Leafy greens

English: Chrysanthemum greens
Local: 茼蒿 (tong hāo); 皇帝菜 (huáng dì cài)

Scientific name: *Chrysanthemum coronarium*
Plant family: ASTERACEAE

Description: An annual herb eaten at the seedling stage when it is not more than 20 cm high. It has many branches and grows 2 m tall. Leaves are succulent with a light silvery tinge and broadly serrated edges. There are a range of variations in leaf size and shape. They can be toothed or deeply indented. The flowers are golden. They are produced in large numbers. There are several cultivated varieties.

Distribution: A Mediterranean climate plant. It can grow in dry soils and in arid places.

Use: The tender shoots are eaten as cooked vegetable or in soups. They are also eaten raw in salads. Fresh petals are put in soups and in tea like drinks. The sprouted seeds are eaten as a snack.

Cultivation: Seeds are sown in early spring and autumn. The vegetable grows very well in mild or slightly cold climates, but will go quickly into premature flowering in warm summer conditions.[1]

Production: It is a commercially cultivated vegetable. In spring sowing, in order to promote and speed germination, seeds can be soaked in water for about 24 hours, then keep them at 15 - 20ºC for germination. They are ready for sowing when "white tips" appear. When the plants reach up to 10 cm tall, more nitrogenous fertilizer is recommended. Generally, when the plant reaches up to 20 cm tall, it can be harvested. A second harvest can be gained if the stem is cut 2 - 3 cm above the soil and let grow again for another 1 - 2 months. In most cases, it should be fertilized after the first cut.[2]

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
leaf (raw)	91	100	3.4	94	1.4	2.3	0.7

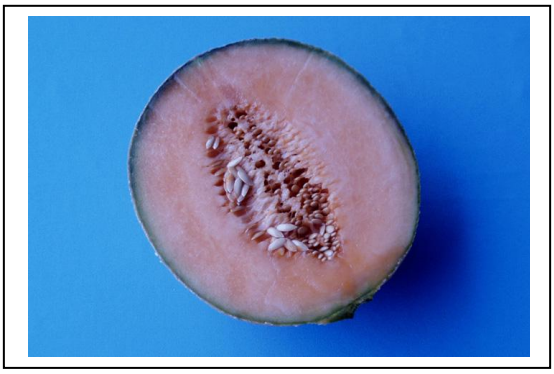
Notes:
1. http://en.wikipedia.org/wiki/Garland_chrysanthemum

2. http://www.agrohaitai.com/leafveg/tongho/tonghoinfo.htm

Fruit

English: Muskmelon, Canteloupe
Local: 哈密瓜 (hā mì guā)*

Scientific name: *Cucumis melo*
Plant family: CUCURBITACEAE



Description: A pumpkin family plant. It is an annual climber with tendrils. It grows to 0.5 m high and spreads to 1.5 m across. The stems are soft and hairy and often angled. The leaves have lobes and often a wavy or toothed edge. They are on long leaf stalks. The leaves are often hairy underneath. The tendrils are not branched. The flowers are yellow and funnel shaped with expanded lobes. The male flowers occur in clusters and are produced before the female flowers. The fruit is round, mostly with a rough or streaky skin. It is green or yellow inside. The fruit is edible. Different kinds of melons occur. Some have a hard, warty, scaly skin. Others have a network of fine ridges over the surface.

Distribution: A tropical plant, but not suited to places with high rainfall. It suits hot dry places with a fertile well drained soil. It needs a sheltered sunny position. It is drought and frost tender. A temperature range of 24 - 28°C is best but much higher temperatures are tolerated. Mostly they are grown below 500 m altitude in the tropics. A pH of 6 - 6.7 is best. Acid soils are not suitable. It can grow in arid places. It suits hardiness zones 9 - 12.

Use: The ripe fruit are eaten raw. They are also dried, candied and made into jams, jellies and preserves. The seeds are sometimes eaten roasted. The seeds are blended with fruit juice to form a drink. Sometimes the immature fruit are cooked as a vegetable. The seeds contain an edible light oil. The young leaves are eaten as a potherb.

Cultivation: They are grown from seed planted about 1 - 4 cm deep. Plants need to be 1 - 2 m apart. Seedlings can be transplanted when about 10 - 15 cm high.

Production: Plants are ready 3 - 4 months after planting. Yields of 20 kg per10 sq m is 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
seed (dry)	7.0	2319	15.8	-	-	-	-
leaf (raw)	85.0	172	4.2	72	-	-	-
fruit (raw) (cantaloupe)	90.0	141	0.8	169	37	0.4	0.2
fruit (raw) (honeydew)*	90.0	150	0.5	3	18	0.2	0.1

Notes:
*Other white/green varieties (var. Inodorus):

- honeydew; 白兰瓜 (bǎi lán guā)
- casaba; 甜瓜 (tián guā)

Fruit

English: Loquat
Local: 枇杷 (pí pa)

Scientific name: *Eriobotrya japonica*
Plant family: ROSACEAE

Description: A small evergreen tree up to 6 - 10 m high. It has a round crown. Leaves are large and strongly ribbed. They are 12 - 30 cm long and 8 - 10 cm wide. They are dark green and glossy on the upper surface and woolly white underneath. They are leathery with slight teeth. The new growth is tinged with red. Flowers have a strong scent. Flowers are small and white and in clusters at the ends of branches. They have a scent. Fruit are in loose clusters of about 10. They are pear shaped. They are 3 - 5 cm long and yellow when ripe. There are 3 - 5 large brown seeds in each fruit.

Distribution: It is native to China and Japan. They suit subtropical and warm temperate areas. It can grow in the highlands in teh tropics. Trees grow best between 750 and 1750 m altitude in the tropics, and are best about 1,000 m. It is not suited to the coastal tropics and can't stand heavy frosts on the flowers or fruit. It does better in drier areas and needs good drainage. A well distributed rainfall of about 100 cm per year is suitable. Well established trees can tolerate a low temperature of -11°C. The killing temperature for the flower bud is about -7°C, and for the mature flower about -2°C. At -4°C the seed is killed, causing the fruit to fall. Trees need good drainage and do best in full sunlight. Trees can stand drought but yield best with water at flowering and fruit development. It can grow in arid places. In Nepal it grows between 1,300 – 2,000 m altitude. It suits hardiness zones 8 - 11.

Use: The ripe fruit is eaten fresh. If the fruit is cooked, the seeds should be removed as they give a bitter taste. Fruit are also used for jam, jellies and sauces. They can be stewed or used in pies. The roasted seeds are used as a coffee substitute.

Cultivation: It can be grown from cuttings or layering. It can also be grown from seeds or by grafting. Seeds grow easily. Seeds need a temperature of 13 - 16°C or above to germinate. Trees should be planted in groups to cross pollinate. A spacing of 6 m is suitable. Trees grow quickly. Trees need light pruning of the tips of branches to maintain tree shape and avoid excessively thin fruit bearing branches.

Production: Seedling trees begin to bear in 6-8 years compared with 2-3 years for grafted trees. A tree can last 40 years. Biennial bearing occurs. Thinning in heavy bearing years can give larger fruit. The fruiting is seasonal. The season is August to October in the Southern Hemisphere. Fruit should be allowed to ripen fully before harvesting. Fruit reach maturity after about 90 days from full flowering. Ripe fruit can be stored in a refrigerator for 1 - 2 weeks. A tree may produce 20 - 45 kg per 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 (raw)	86.7	197	0.4	76	1	0.4	0.07

Fruit

English: Goji berries; Chinese wolfberries
Local: 寧夏枸杞 (níng xià gǒu qǐ)

Scientific name: *Lycium barbarum*
Plant family: SOLANACEAE

Description: A deciduous, woody perennial shrub/vine. It can be erect or spreading. It grows 3 m high. The branches are weak and arching. The side branches end in short leafless spines. It forms suckers freely. The leaves are oval and grey-green. They are 2 - 5 cm long and 1 cm wide. The flowers are lilac-purple and shaped like tubes. They are in clusters of 1 to 4. The fruit are oval and orange red berries. These are 25 mm across.

Distribution: It is best in full sun. It can with stand cold temperatures. It can also tolerate hot summers. It can grow on a wide range of soils. It cannot tolerate water-logging. It suits hardiness zones 6 - 10.

Use: The dried red fruit are eaten in soups and stew. The leaves and fruit are used for making tea. The fruit can be eaten fresh or dried for later use. They are used for juice, jams, pies, desserts and sauces.

Cultivation: The can be grown from seed. Plants can also be grown from young shoot cuttings. The stems can be pegged down and roots allowed to form by layering. These can then be separated and planted. Plants should be spaced 1 m apart.

Production: It is fast growing. Plants start fruiting in the second year. Plants live for 5-10 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 (raw)[1]	-	467	3.6	1518[2]	43	7.7	-

Notes:
1. http://caloriecount.about.com/calories-eatraw-tibetan-goji-berries-i119927
2. 8500 IU, based on conversion factor of 0.05 for beta-carotene (http://ods.od.nih.gov/factsheets/VitaminA-HealthProfessional/)

Fruit

English: Pomegranate
Local: 石榴 (shí liu)

Scientific name: *Punica granatum*
Plant family: LYTHRACEAE

Description: A shrub that grows up to 10 m tall. It has short thorns. Trees usually lose their leaves in one season during the year. The trunk is covered by reddish-brown bark. Trees often sucker near the base. The leaves are opposite, entire and 8 cm by 1.5 cm. Leaves narrow towards the base. It has large scarlet flowers at the ends of branches. 1 - 3 flowers occur together. The fruit is round, leathery skinned and up to 10 cm across. It is yellow-brown in colour. Inside there are angular hard seeds in a juicy yellow pulp. The seeds are 10 mm long. There are many named varieties.

Distribution: A Mediterranean climate plant that occurs naturally from SE Europe to the Himalayas. It suits drier sub-tropical climates, and areas with a long, hot, dry summer and cool winter. A temperature of 35 - 38°C is best for good fruit development. A humid climate affects fruit formation. They can tolerate some salinity. They grow mostly from the coast up to 500 m in the tropics. Trees are severely damaged by temperatures below -11°C. It suits hardiness zone 8 - 11.

Use: The juicy pulp around the seeds is eaten. The juice can be used for a drink. It provides a red colour. The seeds are dried with their aril and used in the Indian condiment Anardana. The fruit are used in sauces, soups, meat dishes, salads and other dishes. The flowers are eaten. Boiled leaves are also reported as eaten.

Cultivation: They are easily raised from seed. They are best propagated by layering or grafting but cuttings or root suckers can be used. Cuttings root easily. Cuttings 30 - 50 cm long of one year old wood can be used. Pruning of sucker growth and surplus branches is needed. A spacing of 4 - 5 m is suitable.

Production: Trees bear after 2 - 3 years. Fruiting is seasonal from Dec - May. The tree loses its vigour after about 15 years but trees can live for many years. The pomegranate is self-pollinated as well as cross-pollinated by insects. Cross-pollination increases the fruit set. Fruit matures 5 - 7 months after flowering. Fruit need to be picked when mature to prevent splitting. Fruit do not ripen further after harvesting. Fruit develop a distinctive colour and when ripe, have a metallic sound when tapped. A well maintained tree can produce 150 - 200 fruit in a year.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit (raw)	81.0	285	1.0		6	0.3	0.1

Fruit

English: Apricot
Local: 杏 (xìng)

Scientific name: *Prunus armeniaca*
Plant family: ROSACEAE

Description: A medium sized deciduous tree. It grows to 10 m tall. It is a broad spreading shape. The bark is dark red-brown and smooth and shiny. The leaves have stalks. The leaves are broadly oval. They are 10 cm long by 6 cm wide. They are rounded at the base and taper to the tip. They have shallow round teeth along the edge. The leaves are glossy and dark green. The flowers are 2.5 cm across and pale pink or white. They are almost without stalks and have 5 petals. They occur singly on old shoots. The fruit is fleshy and rounded. It is yellow and can be flushed with red. There is a hard covering over the seed. This stone is smooth. The seeds are oval. The flesh is edible. The seeds are edible (but contains toxins).

Distribution: It is native to C. Asia and N. China. It grows in cool areas with hot dry summers. They do best on a free draining soil. In Nepal, plants grow from 2,500 – 3,500 m altitude. It does well in areas with 100 cm rainfall, cool winters with 300 - 900 chilling hours below 7°C and a frost free spring. A soil pH of 6 - 6.8 is suitable. It needs good sunlight. It suits hardiness zones 5 - 10.

Use: The ripe fruit are eaten. The kernels can be eaten. If sweet they are eaten fresh and if bitter they are roasted. The seed oil is used for cooking. The fruit are also used for juice and are dried and eaten dry. They are also used for jam, and in pastries, pies, cakes, and picked. **Caution:** The bitter kinds of apricot kernels contain amygdalin which releases cyanide and is poisonous unless removed by cooking.

Cultivation: Plants can be grown from seed but are often grafted onto rootstocks. The flowers are self fertile. Plants require some winter chilling.

Production: Trees fruit in 3 - 4 years. Fruit are picked by hand.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit (raw)	86	201	0.6	96	10	0.4	0.2
fruit (boiled)	82.6	92	0.4	59	5	0.3	0.1

Fruit

English: Peach/nectarine
Local: 桃子 / 油桃 (táo zi / yóu táo)

Scientific name: *Prunus persica*
Plant family: ROSACEAE

Description: A small deciduous tree, that grows 3 - 8 m tall. It has an open growth habit. The leaves have stalks that are 5 - 10 mm long. The leaves are oblong to sword shaped. They have fine teeth along the edge. The leaf blades are 7 - 15 cm long and 2 - 3 cm wide. They are acute at the base and taper to the tip. The flowers occur singly. They appear before the leaves. The flowers are small and pink or white. The fruit varies in shape and size. It is round with a groove down the side. It is 5 - 8 cm across. It is yellow when ripe. It has one hard stone inside with holes in it. There are a very large number of cultivated varieties.

Distribution: It is native to China. They need a specific cold requirement below 7°C to start flowers and leaves forming but a warm period for fruit ripening. Some low chill varieties are available. It likes a warm sheltered position. It will tolerate mild frosts. Mild-hot summers and cool-cold winters are best. Temperate. In Nepal it grows between 1,100 – 2,000 m altitude. Some varieties can be grown in some highland regions in the tropics if the leaves are picked off. It needs a soil pH of 5.7 - 6.9. It suits hardiness zones 5 - 10.

Use: Ripe fruit are eaten fresh, preserved or made into wine. They are canned, stuffed, made into jam and juice and used in cakes, pies and pickles. The seed oil is used for cooking. **Caution:** The bitter kinds of kernels contain amygdalin which releases cyanide and is poisonous unless removed by cooking.

Cultivation: Trees can be grown from seed but do not breed true. It is better to graft. Branches which have borne fruit should be removed to allow new fruit bearing wood to grow.

Production: Budded trees commence fruiting in 2 - 3 years. Trees often need zinc and borax sprays. Trees tend to be fairly short lived (20 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 (raw)	86.2	37	0.6	25	8	0.4	0.1

Fruit

English: Jujube; Chinese date
Local: 红枣 (hóng zǎo)

Scientific name: *Ziziphus jujuba*
Plant family: RHAMNACEAE

Description: A small deciduous tree that can grow to 13 m tall. It has drooping branches with thorns on the branches. The plant sends up thorny suckers often at a distance from the tree. These need to be cut off. The leaves are small and oval. They are 2 - 5 cm long and bright shiny green. The leaves turn bright yellow before falling. During the growing season, each node of a woody branch produces one to 10 small branches. These fall off later. The flowers are small and 0.5 cm across. They are white to green and produced in large numbers in the angles of leaves. The fruit are round of long and vary from cherry to plum size. They are 2 - 3 cm long. They have a single hard stone with two seeds. The fruit changes from green to yellow with red spots as it ripens. When fully red and ripe it softens and wrinkles. There are many named varieties.

Distribution: A subtropical plant. It can stand high temperatures in summer then due to winter dormancy can tolerate very cold temperatures. It only requires a small winter chill to enable it to fruit. They do best in warm sunny positions. They cannot grow in shade. They do best in sandy well drained soils. They can grow in soils with high salinity or alkalinity. It can tolerate drought but fruits best with adequate rainfall. It suits hardiness zones 7 - 10.

Use: The fruit are eaten fresh, dried or preserved in sugar. They can be stewed, baked, pickled, or used in puddings, cakes, breads, jellies, soups and sweetmeats. The ripe fruit are powdered and cooked with millet or rice. The kernels are edible.

Cultivation: Plants can be grown from seed but these do not breed true. Grafting, budding or cuttings can be used. Root suckers can be used. Although cross pollination is not required for fruit production it is needed for producing viable seed. A spacing of 3 - 4 m is suitable.

Production: Fruit are produced 4 - 5 years after planting. Fruit do not ripen at the same time so fruit can be picked from the one tree over several weeks. Fruit need to be picked when ripe. Ripe fruit can be stored at room temperature for about one week. Tree dried fruit stores for a long time.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit (dried)	19.7	1201	3.7	-	13	1.8	0.2
fruit (raw)	77.9	331	1.2	2	69	0.5	0.05

Vegetables

English: Winter melon
Local: 冬瓜 (dōng guā) or 毛瓜 (máo guā)

Scientific name: *Benincasa hispida*
Plant family: CUCURBITACEAE

Description: A climbing, pumpkin family plant. The vine can grow to 3 m long. The plant re-grows from seed each year. The vines are thick, furrowed and hairy. The leaves are heart shaped with 5 - 7 lobes. They are rough to touch. Flowers are yellow. The immature fruit can have skin of various colours depending on variety. The fruit is up to 30 cm long and 20 cm across and green with a waxy covering when mature. This waxy layer enables the fruit to be stored for a long time. Fruit shape and size can vary with variety. The flesh is firm and white. The fruit are heavy, weighing from 8 - 45 kg.

Distribution: A tropical plant. It is suited to warm, lowland, tropical conditions. It does better in dry areas or drier seasons. They are reasonably drought tolerant. The best temperature for growing is 23 - 28°C. They need a well-drained soil. They grow best with a soil pH of 6.5.

Use: The white flesh is added to stir fried dishes. The seeds can be fried and eaten. Young leaves and flower buds can be eaten. The young fruit are used as a vegetable. The mature fruit are peeled, cut in pieces and candied.

Cultivation: It is grown from seeds. There are about 1,800 seeds per kg. Seeds are sown 3 - 5 cm deep with a spacing of 60 - 80 cm between plants. Seed can be sown in nurseries and transplanted when 15 - 20 cm tall. They are usually planted in mounds and allowed to grow over a strong trellis. They can be allowed to stay on the ground. If plants are going to be allowed to trail over the ground, a spacing of about 3 m is necessary. Decayed manure or compost is used where available. Plants are responsive to sulphate of ammonia. Flowering normally starts 60 - 80 days after planting. Flowers are open in the early morning. Hand pollination may assist fruit development. This becomes more important in colder areas. Thinning of fruit gives larger fruit. The growing tips of plants can be pruned out to encourage branching or to restrict growth.

Production: Fruit are ready 3 - 5 months after planting. The fruit keeps well when fully mature. They can be stored for 6 months at 13 - 15°C in a dry atmosphere. The pulp of wax gourds can be shredded and dried for later use.

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	92.0	118	0.7	0	15	0.6	0.6
fruit (cooked)	96.6	54	0.4	0	10.5	0.4	0.6

Vegetables

English: Pumpkin/winter squash
Local: 南瓜 (nán guā)

Scientific name: *Cucurbita maxima*
Plant family: **CUCURBITACEAE**

Description: A pumpkin family plant. It is a creeping vine with tendrils. It is an annual plant. The stems are soft and round in cross section. The leaves are large and hang loose. They are dark green and kidney shaped. The edges of the leaves are entire. There are large nodes at the base of the leaf. The tendrils are fairly stout and are divided half way along their length into many branches. Male flowers are carried on long upright stalks. The 5 petals are united into a long yellow tube. The female flowers are larger than the male and are fewer in number and carried on shorter stalks. The fruit varies in size, colour and patterns on the skin. They can be round, oval or flattened, with yellow, orange or green skin. The surface can be smooth and rough and warty. The flesh is yellow and edible. The seeds are in the centre. The seeds are white or brown. They are flattened but plump and have a slanting scar at the top. The seeds are edible. There are a large number of cultivated varieties.

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

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

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

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	6.9	2264	24.5	38	1.9	14.9	7.5
fruit (raw)	91.6	109	1.0	426	9.0	0.8	0.3
leaf	88.0	160	4.9	260	28	2.5	0.9
flower	88.7	107	1.4	173	14	0.8	0.1

Vegetables

English: Pumpkin/squash (incl. butternut) **Scientific name:** *Cucurbita moschata*
Local: 冬南瓜 (dōng nán guā) **Plant family: CUCURBITACEAE**

Description: A pumpkin family plant. It is a creeping plant with long creeping stems and softly hairy but without prickly hairs. The stems are rounded or 5 angled and moderately hard. They can grow 15 - 20 m long. The leaves are large and shallowly lobed and divided like fingers on a hand. Occasionally the leaves have white blotches. They have rounded lobes. They are 20 cm by 30 cm. The leaf stalk is 12 - 30 cm long. The flowers have male and female flowers separately on the same plant. The fruit stalk is distinctly expanded where it joins the fruit. The fruit are not hard shelled and are dull in colour. The flesh is yellow and often has fibres through it. The seeds are plump and white to brown. They separate easily from the pulp of the fruit. The edge of the seed is scalloped and irregular in outline. There are a large number of cultivated varieties.

Distribution: A tropical plant that suits the wet tropics. It will thrive in humid as well as in very hot climates. A temperature of 18 - 30°C is best. It can tolerate some shade. It can grow in soils with a pH of 5.5 - 6.9. It suits hardiness zones 8 - 11.

Use: The fruit are eaten cooked. They are boiled, fried or baked. They can be mashed and used in pies, soups, bread and cakes. They can be dried, ground into flour and used for bread. The young leaves and flowers are edible. They can also be dried and stored. The seeds are eaten roasted. They can also be roasted in salt.

Cultivation: Plants are grown from seed. Seeds can be put in a nursery and transplanted.

Production: Fruit mature in 70 - 180 days after sowing depending on variety.

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)	5.2	2339	30.2	1	1.9	8.8	7.8
leaf (raw)	93.6	88	3	95	10	2.1	-
fruit (raw)	86	188	1.0	532	21	0.7	0.15

Vegetables

English: Carrot
Local: 胡萝卜 (hú luó bo)

Scientific name: *Daucus carota* subsp. *sativus*
Plant family: APIACEAE

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

Distribution: A temperate plant. Carrots are frost resistant. It needs a deep loose soil. Seed germinate well in the temperature range 7 - 24°C. Plants grow well with a temperature about 15°C. It grows best with a pH of 6 - 7. It suits hardiness zones 3 - 9.

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

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

Production: There are varieties that mature within 90 - 110 days.

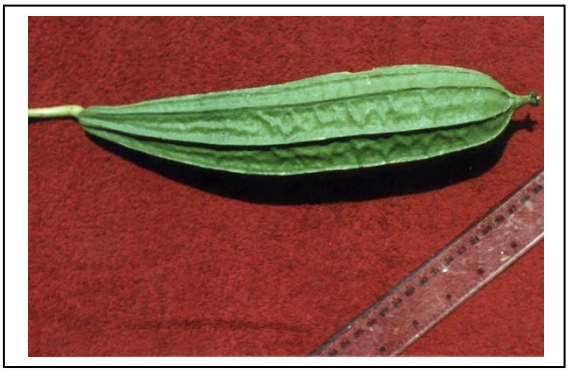
Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
root (raw)	89.9	180	1.0	835	6	0.6	0.4
root (boiled)	91.5	79	0.6	852	4	0.4	0.3
leaf	87.4	-	2.2	65	-	-	-

Vegetables

English: Angled loofah
Local: 丝瓜(sī guā)

Scientific name: *Luffa acutangula*
Plant family: CUCURBITACEAE



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

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

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

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

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
fruit (raw)	94.6	71	0.7	-	-	0.5	-
leaf (raw)	89.0	-	5.1	-	98	11.5	-

Vegetables

English: Bitter melon/gourd
Local: 苦瓜(kǔ guā)

Scientific name: *Momordica charantia*
Plant family: **CUCURBITACEAE**

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

Distribution: They require a well drained soil preferably rich in organic matter. Seeds do not germinate below 15°C. Plants grow best with temperatures of 18 - 35°C. A soil pH of 6.5 is best. It suits hardiness zones 9 - 12.

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

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

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

Food Value: Per 100 g edible portion

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

Vegetables

English: Eggplant/aubergine
Local: 茄子 (qié zi)

Scientific name: *Solanum melongena*
Plant family: SOLANACEAE

Description: A perennial shrubby herb up to 1 m tall. It is often grown as an annual. It has a deep taproot and branched side roots. The stem is thick and covered with many woolly hairs. The plant has many branches. Often the plant is spiny. Leaves can be 20 cm long and wavy along the edge. Leaves are covered with hairs. Flowers are bluish red and 5 cm across. They are either solitary or in small groups opposite the leaves. They have 5 large woolly lobes which continue to surround the base of the fruit. Fruit are white, blue, green or purple. The fruit colour and shape vary. Sometimes the fruit is spiny. Often the fruit are 10 - 20 cm long and 5 - 8 cm wide. Numerous kidney shaped seeds are in the flesh of the berry. There are many cultivated varieties.

Distribution: A tropical plant. Plants grow from sea level up to 2,200 m altitude in the tropics. It suits wet climates but does well in dry climates with irrigation. It needs a long warm growing period. A daily mean temperature of 20 - 30°C is most suitable. They are frost tender. They need a rich, friable, well tilled soil. In the sub-tropics they can be grown as a summer crop.

Use: Fruit are mostly fried then eaten. They can also be grilled, baked, stuffed and stewed. They are used in curries. The fruit are also dried and stored. The leaves, although edible, are hairy and not good flavor.

Cultivation: Plants are grown from seeds. Seeds germinate slowly. At the best temperature, they germinate in 8 - 12 days. Seed are sown in nursery beds. Seedlings can be transplanted when about 8 cm tall or 4 - 6 weeks old. Plants need to be about 60 - 100 cm apart. Because some cross pollination can occur, seed crops need to have varieties planted 400 m apart.

Production: Fruit are ready for harvest after 3 months. They continue to yield for 3 - 4 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
fruit	91.8	117	0.83	6	1.3	0.4	0.2
fruit (fresh)	93.4	62	0.7	50	5	0.4	0.3

Vegetables

English: Chinese artichoke
Local: 宝塔菜 (bǎo tǎ cài);
甘露子(gān lù zi) or 草石蚕(cǎo shí cán)

Scientific name: *Stachys sieboldii*
Plant family: LAMIACEAE

Description: A herb. It keeps growing from year to year. The underground stems or rhizomes are white. The stems above ground are 30 - 120 cm long. The leaf stalks are 1 - 3 cm long and the leaf blades are oval and 3 - 12 cm long by 1.5 - 6 cm wide. The base is wedge shaped. The flowers are red to purple. The nutlets are black-brown and oval. They are 1.5 cm across.

Distribution: It can grow in cold places. They need a temperate climate, full sun and a well drained soil. It suits plant hardiness zones 4 - 8. In China it grows on wet hillsides and areas covered with water up to 3,200 m altitude in northern regions. It needs a soil pH of 6 - 6.5 for best growth.

Use: The rhizomes are eaten. The tubers are salted or preserved in plum vinegar. The leaves are eaten raw or boiled or salted. The tubers are usually boiled for a few minutes then eaten. They are also fried, roasted, steamed or pickled. The tubers discolor when exposed to air and lose flavour when peeled.

Cultivation: It can be grown from seed or tubers. Tubers can be planted 5 cm deep and 30 cm apart. The tubers are harvested after the plant dies back.

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 (raw)	66.7	226	2.3	-	-	7.4	-

Nuts, seeds, herbs and other foods

English: Spring onion
Local: 葱 (cōng)

Scientific name: *Allium fistulosum*
Plant family: ALLIACEAE

Description: An onion family plant with an indistinct bulb. It grows to 60 cm high and 20 cm wide and has fibrous side roots. They grow in large clumps. The leaves are rounded in cross section and hollow. They grow 15 - 30 cm long by 5 - 20 mm wide. The bulbs are very small, 4 - 8 cm long but only 5 - 25 mm across. The plant produces many side buds which develop as offshoots. Flowers grow on a stalk which comes from underground and there are many flowers on stalks around one head. This hollow stalk is 40 - 80 cm long. The flowers are yellow and they open from the top of the flower head downwards. There can sometimes be bulbils on the flower head.

Distribution: A temperate plant that prefers a sunny position and a light, well drained soil. It prefers a soil pH in the range 6.5 - 7.5, but it tolerates a pH in the range 4.9 - 7.5. A hardy plant which produces leaves throughout the winter. They are also tolerant of high temperatures and can grow in the tropics. Temperatures above 25°C reduce production.

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

Cultivation: It can be grown from seed or division of the bulbs. Bulbs should be planted fairly deeply. These multiply, producing more bulbs. Seedlings are transplanted when 10 cm high. A spacing of 7 - 10 cm is suitable. In China, soil is heaped up around the bulb to make it elongated. Seed production in the tropics is possible above about 1,000 m above sea level.

Production: Plants are ready for harvest 50 - 60 days 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
leaf/bulb (raw)	89.8	135	1.8	50	19	1.5	0.4

Nuts, seeds, herbs and other foods

English: Chinese chives; garlic chives
Local: 韭菜 (jiǔ cài)

Scientific name: *Allium tuberosum*
Plant family: ALLIACEAE

Description: An onion family plant. It is a herb which keeps growing year after year. It can grow to 40 cm tall. It grows in clumps. These onions have rhizomes but no real bulbs. The leaves are long and grass like, and flat and solid. They are 15 - 30 cm long and about 5 mm wide. The young leaves are erect but the mature leaves bend gracefully down. The blades of the leaves are not folded length-wise, as are those of garlic and leek. Flowers are white. The flowers are produced at the top of a flower stalk which grows from the underground stem. The flower head is round due to the small flowers being on the same length stalks and arising from the same point. The flower stalk can be 45 cm long. A dense clump of plants is produced.

Distribution: A temperate plant. They are native to eastern Asia. Seeds are rarely formed in the lowland tropics. It is naturalised in Southern China. It suits hardiness zones 7 - 10.

Use: The leaves and young flowers are used to flavour foods. The bulbs are used like garlic.

Cultivation: Plants can be grown by dividing the clump of plants or by seed. Seed production is not easy. Plants are sown in rows 30 cm apart.

Production: Chives may be cultivated for its flowers which are plucked together with the stalks before the buds emerging from the sheath. They can also be grown for its edible leaves which have a special flavour considered fragrant by some people.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
stem/leaf (raw)	-	-	-	-	-	-	-

Nuts, seeds, herbs and other foods

English: Fat hen; lamb's quarters
Local: 藜 (lí)

Scientific name: *Chenopodium album*
Plant family: CHENOPODIACEAE

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

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

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

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

Production: The tops can be eaten before and after flowering. They are harvested after 40 days.

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	-	1654	16	-	-	-	-
leaf (boiled)	88.9	134	3.2	391	37	0.7	0.3
leaf	87.7	113	5.3	33	108	-	-

Nuts, seeds, herbs and other foods

English: Quinoa
Local: 藜麦 (lí mài)

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.	-

Nuts, seeds, herbs and other foods

English: Sunflower
Local: 葵花 (kuí huā)

Scientific name: *Helianthus annuus*
Plant family: **ASTERACEAE**

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

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

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

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

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed	5.4	2385	22.8	5	1.4	6.8	5.1

Nuts, seeds, herbs and other foods

English: Sesame
Local: 芝麻 (zhī ma)

Scientific name: *Sesamum indicum*
Plant family: PEDALIACEAE

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

Distribution: A tropical plant that suits the hot, dry, semi-arid tropics and sub-tropics. It can tolerate short periods of drought once established. It needs a temperature of 20 - 24°C in early growth then 27°C for ripening. It grows from sea level to about 1,200 m in areas with an annual rainfall of 400 - 1000 mm. Soils need to be well drained. It is very intolerant of water-logging. It cannot stand high humidity and needs frost free conditions. It needs a dry period for seed drying. It does not like acid soils. It grows in open sunny places. It can grow in arid places.

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

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

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

Food Value: Per 100 g edible portion

Edible part	Moisture %	Energy kJ	Protein g	proVit A µg	proVit C mg	Iron mg	Zinc mg
seed (dry)	4.7	2397	17.7	1	0	14.6	7.8
leaf (raw)	85.5	188	3.4	-	-	-	-

Nutritional values (per 100 g) 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
ALLIACEAE	*Allium fistulosum*	Spring onion	leaf/bulb (raw)	90	135	1.8	50	19	1.5	0.4	46
ALLIACEAE	*Allium tuberosum*	Chinese chives	stem/leaf (raw)	-	-	-	-	-	-	-	47
AMARANTHACEAE	*Amaranthus cruentus*	Purple amaranth	seed (dry)	11	1554	14.0	0	4	7.6	2.9	11
AMARANTHACEAE	*Amaranthus tricolor*	Chinese amaranth	leaf (raw)	92	96	2.5	146	43	2.3	0.9	23
AMARANTHACEAE	*Atriplex hortensis*	Orache	leaf (raw)	-	85	3.2	-	-	-	-	24
AMARANTHACEAE	*Chenopodium bonus-henricus*	Good King Henry	leaf (raw)	-	162	6.5	-	-	-	-	25
APIACEAE	*Daucus carota* subsp. *sativus*	Carrot	root (raw)	90	180	1.0	835	6	0.6	0.4	41
ASTERACEAE	*Chrysanthemum coronarium*	Chrysanthemum greens	leaf (raw)	91	100	3.4	94	1	2.3	0.7	30
ASTERACEAE	*Helianthus annuus*	Sunflower	seed (dry)	5.4	2385	22.8	5	1.4	6.8	5.1	50
BRASSICACEAE	*Brassica juncea*	Mustard greens	leaf (raw)	91	114	2.9	151	70	1.6	0.3	26
BRASSICACEAE	*Brassica oleracea* var. *acephala*	Kale	leaf (boiled)	91.7	109	2.1	313	18	0.5	0.4	27
BRASSICACEAE	*Brassica oleracea* var. *alboglabra*	Gai lan	stem/flower (cooked)	94	94	1.1	82	28	0.6	0.4	28
BRASSICACEAE	*Brassica rapa* subsp. *chinensis*	Pak choi	stem/leaf (raw)	95	55	1.5	223	45	0.8	0.2	29
CHENOPODIACEAE	*Chenopodium album*	Fat hen	leaf (boiled)	89	134	3.2	391	37	0.7	0.3	48
CHENOPODIACEAE	*Chenopodium quinoa*	Quinoa	seed (dry)	13	1539	14.1	1	-	4.6	3.1	49
CONVOLVULACEAE	*Ipomoea batatas*	Sweet potato	tuber (baked)	72.9	431	1.7	961	24.6	0.5	0.3	13
CUCURBITACEAE	*Benincasa hispida*	Winter melon	fruit (baked)	97	54	0.4	0	10.5	0.4	0.6	38
CUCURBITACEAE	*Cucumis melo*	Muskmelon	fruit (raw)	90	141	0.8	169	37	0.4	0.2	31
CUCURBITACEAE	*Cucurbita maxima*	pumpkin	fruit (raw)	92	109	1.0	426	9	0.8	0.3	39
CUCURBITACEAE	*Cucurbita moschata*	Butternut squash	fruit (raw)	86	188	1.0	532	21	0.7	0.2	40
CUCURBITACEAE	*Luffa acutangula*	Angled loofah	fruit (raw)	95	71	0.7	-	-	0.5	-	42
CUCURBITACEAE	*Momordica charantia*	Bitter melon	pod (boiled)	94.0	79	0.8	11	33	0.4	0.8	43
FABACEAE	*Phaseolus vulgaris*	Common bean	pod	88.0	151	2.5	750	27	1.4	0.2	18
FABACEAE	*Vigna angularis*	Adzuki bean	seed (dry)	13	1377	19.9	1	0	5.0	5.0	19
FABACEAE	*Vigna radiata*	Mung bean	seed (dry)	11.0	1432	22.9	2.8	4	7.1	-	20
FABACEAE	*Vigna unguiculata* subsp. *sesquipedalis*	Yardlong bean	seed (boiled)	87.5	197	2.5	20	16.2	0.98	0.36	21

Plant Family	Scientific name	Common name	Edible part	Moisture %	Energy kJ	Protein g	Vit A[#] µg	Vit C mg	Iron mg	Zinc mg	Page
FABACEAE	*Vigna unguiculata* subsp. *unguiculata*	Cowpea	seed (dry)	12	1406	23.5	3	1.5	8.3	3.4	22
LAMIACEAE	*Stachys sieboldii*	Chinese artichoke	tuber (raw)	67	226	2.3	-	-	7.4	-	45
LYTHRACEAE	*Punica granatum*	Pomegranate	fruit (raw)	81.0	285	1.0		6	0.3	0.1	34
PEDALIACEAE	*Sesamum indicum*	Sesame	seed (dry)	5	2397	17.7	1	0	14.6	7.8	51
POACEAE	*Panicum miliaceum*	Common millet	seed (dry)	9	1582	11.0	0	0	3.0	1.7	15
POACEAE	*Setaria italica*	Foxtail millet	seed (dry)	14	1425	9.5	-	-	5.5	-	16
POLYGONACEAE	*Fagopyrum esculentum*	Buckwheat	seed (dry)	10	1435	13.0	0	0	2.2	2.4	12
ROSACEAE	*Eriobotrya japonica*	Loquat	fruit (raw)	87	197	0.4	76	1	0.4	0.1	32
ROSACEAE	*Prunus armeniaca*	Apricot	fruit (raw)	86	201	0.6	96	10	0.4	0.2	35
ROSACEAE	*Prunus persica*	Peach	fruit (raw)	86.2	37	0.6	25	8	0.4	0.1	36
RHAMNACEAE	*Ziziphus jujuba*	Jujube	fruit (dried)	20	1201	3.7	-	13	1.8	0.2	37
SOLANACEAE	*Lycium barbarum*	Goji berries	fruit (raw)	-	467	3.6	1518	43	7.7	-	33
SOLANACEAE	*Solanum melongena*	Eggplant	fruit (raw)	93.4	62	0.7	50	5	0.4	0.3	44
SOLANACEAE	*Solanum tuberosum*	Potato	tuber (baked)	71.2	456	2.3	0	12.9	1.4	0.3	17

Notes:

*Majority of food nutritional values obtained from: U.S. Department of Agriculture, Agricultural Research Service. 2011. USDA National Nutrient Database for Standard Reference, Release 24-26. Nutrient Data Laboratory Home Page, (http://www.ars.usda.gov/ba/bhnrc/ndl).

[#] Vitamin A levels listed in retinol activity equivalents (RAE)