4

Sufficient and Nutritious Food

25 • Introduction

There are a number of simple, low-cost systems that can improve food security and nutrition. This can for example be done by increasing the diversity of food crops whereby one at the same time can improve the environment. When more different plants are grown, there is greater chance that some of them will give yields and the food will be more nutritious because it is more varied. Food gardens with many different crops are less likely to exhaust the soil nutrients. They will also have a larger number of insects and birds, which means there is smaller chance that damaging organisms will develop large populations because they can be kept down by their natural enemies.

Food security and environment are also linked because people with better health and livelihood are in a better position to choose long term sustainable solutions even when such solutions demand an extra effort in the beginning.

When people are in good health they can:

- plant living fences - thus reducing losses from their food gardens to animals
- plant trees for food, fodder, fuel and building materials - thus reducing the work for fetching these products and, at

the same time, reducing deforestation
- grow plants to use as biopesticides - thus reducing losses to pests by means of less toxic products
- dig wells to provide water close to food gardens - thus providing an alternative to clearing vegetation along the rivers to establish riverside gardens.

There is need to disseminate such systems to more and more people. This chapter describes a number of systems that improve food security and nutrition by:
- improving nutrition through food processing techniques - such as fermenting, malting and food drying techniques (sections 26-29)
- diversifying food crops - by growing moringa, leafy vegetables and medical herbs (sections 30-33)
- improving yields - by protecting gardens with live fences and biopesticides, as well as using seed priming technique (sections 34-37)

It is useful to use biopesticides to fight pests when storing maize

26 • Fermented Food

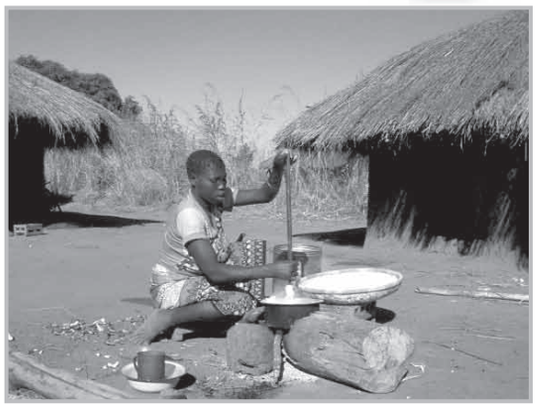
The benefits of fermentation have been known since ancient times, and many products such as milk, cereals, cassava and vegetables have been used. Fermentation is done through the introduction of micro-organisms which cause beneficial chemical changes in food.

In this chapter, the idea is to spread a traditional system of using fermenting porridges as child food.

Fermentation makes food more nutritious and reduces diarrhoea. The acid produced during fermentation also helps to conserve foods.

Introduction

Fermented porridges are traditionally given to young children in Tanzania. Fermentation can be done overnight, and the product can be used with no need to cook it for the next 1-2 days. Swedish studies have shown that children eating porridges which have been fermented (togwa) show much lower incidence of diarrhoea than the ones eating regular porridges (nshima or sadza). The number of diarrhoea cases was nearly halved in the group eating togwa when compared to the nshima group.
Fermenting nshima is a process where the lacteal yeast naturally found on grains are used. Some of these are the same kind as those used for making yoghourt. They change maize sugars into lactic acid. This acid gives the product a fresh taste, and it is also good because it prevents the growth of harmful microorganisms, such as the bacteria which causes diarrhoea.



Making nshima in northern Mozambique

Fermenting organisms are very good to eat because they act in the same way inside the body. They live in the intestines, where they improve digestion and prevent other microorganisms from causing constipation or diarrhoea. They are also necessary for the production of B-vitamins in the intestines. Vitamins are important for the immune system by helping the body to resist diseases. Another plus is that fermentation makes it easier for the human body to assimilate food nutrients - particularly iron, zinc and phosphates.
Fermentation reduces the toxin (cyanide) that is naturally present in cassava, specifically in the bitter varieties.

Production of the starter culture

If it is normal practice in the area to eat fermented porridges, you just need to add a bit of the fermented product where this step is described. If you don't have any fermented products, you can try to add some yoghurt or very ripe fruits, which usually contain suitable ferments. Or try to ferment some grains by leaving them in a humid place.

How to make fermented porridges

- Clean the grains thoroughly by removing small stones or insects
- Soak the grains in clean water for one whole day in a cool place. This process helps to reduce an anti-nutritional

compound (phytin) which, if not destroyed, binds iron in the food. This prevents the body from absorbing it. Iron is important for the human body and particularly in the formation of red blood cells (haemoglobin).
- Boil the grains in the usual way to make nshima/sadza/porridge
- Cover the porridge and let it cool. If there is much - then divide it into smaller portions so that it cools quickly
- When the temperature of the porridge is around 30 degrees - (as your skin) add some togwa from last time or some fermented grains.

The food will be ready next morning - it should taste sour and not smell bad.

27 • Malted Grain

The idea is to use malted grains to rapidly make porridges into a liquid as a way of getting safe and sufficient food for babies.

Introduction

Sadza in Zimbabwe or nshima in Mozambique are porridges - made from maize, sorghum, millet, plantains or cassava. In many developing countries this kind of food is the staple food.
In most places people do not have access to special baby foods and babies, who no longer get breast milk, are therefore fed the same as adults. The only change is that the porridge is diluted with water so it is easier for them to eat/drink it. This causes two problems:
- risk of infections, since the water used often has not been boiled,
- risk that the baby does not get enough calories, because the food is diluted.

When the porridge is diluted, it contains only about one quarter of the energy of breast milk. This means babies do not get enough calories as they can only drink/eat a certain amount. Since most babies are fed only when the rest of the families eat - that is, maybe 2-3 times a day - the result is underweight babies.
It is simple to produce concentrated baby food. Any kind of porridge turns as liquid as water when malted grain is added. It is possible to produce liquid rice, liquid potato, liquid maize, etc. in a very short time.
The reason for this change is that malted grains are rich in an enzyme (amylase) that digests starch into sugars which can be dissolved in water. All grains have this system to make the stored nutrients, starch , available when the new plant, the sprout, starts to grow.
When you add a little malted grain to the boiled porridge you get:
- more concentrated baby food, because starch transforms into soluble sugars.,
- safer baby food, since microorganisms have been killed during boiling and there is no need to dilute with water that could be contaminated.

If you live in a city the easiest is to buy malted grains directly. They are usually inexpensive. The best is malted barley (also used in beer production).
If you do not have access to shops selling malted grain you can make it yourself. This

is very simple and you can use grains grown in your area.

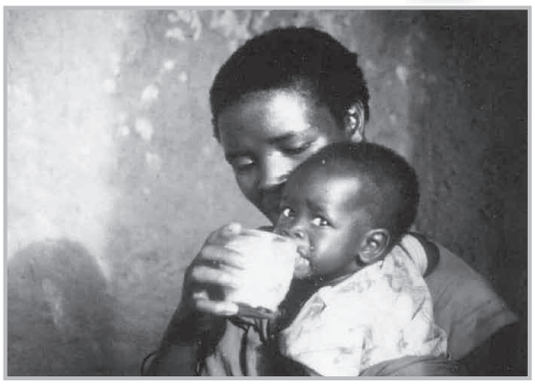
How to malt grain

- Use any whole grain - sorghum, millet, maize, barley, wheat, rice, etc.
- Clean the grains thoroughly, removing small stones or insects. Do not use them if they look/smell bad.
- Soak the grains for one day in clean water - boiled or treated with solar disinfection (SODIS). For soaking, use 1 part grains to 3 parts water.
- Spread the grains on a clean mat or banana leaf in a 2-3 cm layer. Do this in a cool place protected from animals or chicken.
- Cover the grains with leaves so they will not dry.
- Check every day to make sure the grains are moist, and mix the layer to give them air.
- Sprinkle with water if they get too dry
- Do not use the grains if fungi (mould) starts to grow on them.
- When they sprout (the small plant comes out of the grain) dry them well in the sun for a few days.
- Grind the dried sprouted seeds to flour.
- Store the flour in a closed jar in a dry place so you can use it for a long time.

How to use malted grain

A few pinches of malted flour is enough to make one cup of porridge into liquid. The baby can then sip this from a cup or suck from a bottle. The food is now concentrated, so if there is enough of it, the baby will get enough calories.

*** It is important to use clean water when soaking grain. During the soaking harmful microorganisms can multiply and later contaminate the food. ***



Tanzanian child drinking togwa

*** This system only ensures enough calories. To make sure infants get enough proteins and vitamins see the section on how to make soya milk and how to dry fruits and vegetables to keep vitamins off-season***

Photo from the Chalmers University of Technology website, which has studies on the benefits of fermenting food.
www.chalmers.se/en/

28 • Soybean Processing

The idea is to promote the use of soybeans, since they are easy to grow and contain much protein.

Introduction

Soybeans are grown all over the world in both temperate and tropical climates. Seeds are easy to get in most places, and they are easy to grow.
One big advantage of growing soya is that, like other legumes, the plants fertilize the soil with nitrogen because of the bacteria living in nodules on the roots. These bacteria use nitrogen from the air and produce nutrients which the plant need to make proteins. These bacteria are not always in the soil. In that case, you need to inoculate the seeds (which means allowing bacteria and plant to create a symbiosis). This is done by finding a place where the soya does have nodules. If you press or open the nodules they should be red inside - this implies the soil has the needed bacteria. Mix the soil with water and dip the seeds before sowing them.
Soybeans are mostly used for oil production and the leftovers are used as animal feed. It is not often that soybeans themselves are simply cooked and eaten. Some reasons are the long time needed to cook soybeans in order to soften them enough to make nice food, and problems with intestinal air due to the soluble sugars. However, it is possible to solve such problems with a few tips, and make soybeans into good, healthy food.

Soya deserves to be promoted much more as an important part of regular meals because:

- growing soya fertilizes the soil,
- soybeans contain more protein than other beans - up to 40%,
- soya milk is a good source of protein for weaning babies (who no longer get breast milk).

Soya milk is simple to make and does not require any special equipment. It is therefore possible to produce milk to growing children who need a lot of protein.

How to make soya milk

- Let 1-2 cups of beans soak overnight with 3-5 cups of water.
- Next day, rinse the beans with clean water.
- Boil them for about 10 minutes then drain off the water.
- Pound (pulverize) the beans mixed with same amount of boiling water.
- Pour the blended mixture through a clean cloth (T-shirt) - or a very fine sieve - to separate the milk from the rest of the soya.
- Squeeze the bag to get as much milk as possible. Add more boiling water to get the rest squeezed out.
- Bring the milk to boiling point very carefully so that it does not boil over.
- Boil it for 10 minutes while stirring.

Drink it hot or let it cool. If you have honey, ginger or sugar, you can mix in to sweeten.
The reason for boiling the milk is to get rid of a very strong “beany” taste. It also removes some special sugars that create gas in the intestines.
After extracting the soya milk, the remaining material (soya pulp or okara) is as nutritious as soya milk. It is as a fresh product, which cannot be stored for long. Cook with vegetables and spices.

How to make soya yoghurt

Soya milk can also be made into yoghourt using the culture from regular yoghourt. Yoghourt is produced when some special bacteria grow in milk. They produce more proteins and are also very good to eat because they make it more difficult for harmful bacteria to grow in the intestines. Research in Tanzania found that children eating porridges fermented with the same bacteria (togwa) showed much less incidence of diarrhoea than the ones eating normal porridges. Diarrhoea incidence was nearly halved in the group eating togwa. Another advantage is that this process makes it easier for food nutrients, such as iron and phosphates, to be taken in by the body. These minerals are very important for growing children for producing blood and bones. Soya yoghourt is produced and distributed to many children in Cuba.

- Let the milk cool to around 30° - (when you put a drop on your skin and cannot feel it as either hot or cold)
- Add a spoonful of yoghourt culture (the first time you need to buy some or get from somebody - after that, you can use some of the yoghourt already made)
- Keep it in a closed, clean container in a warm place (in the sun) for half a day.
- Eat with fruits, in salads, plain or sweetened with either honey or sugar.

How to make soya sprouts

Soya sprouts can be eaten as a cooked vegetable. They are used in soups, salads, and side dishes. During sprouting some special sugars are used by the soya plant - this reduces intestine air problems and produces Vitamin C.

- Soak the beans overnight.
- Place them in a covered container in the dark.
- Sprinkle them with water every day to keep them cool and moist, but they should not be covered with water.
- After five to ten days, the sprouts will be two inches (5 cm) long.
- Cook them for 2-4 minutes so the "beany" flavour disappears.

Sprouts are a fresh product and must be eaten soon after production or they will spoil.

Apart from being rich in proteins, soya also has specific properties that help the body to keep the insulin level stable better than other protein-rich foods, like meat or chicken. Another plus is that soya contains substances called isoflavones, which are found in plants and help the body to fight diseases. This means that soya is good to boost the immune system.

Children need much protein for growing up. Soya milk can supply much of this

How to make soya flour

- Drop soybeans into boiling water gradually so that the boiling does not stop.
- Let them boil for at least 30 minutes
- Wash the soybeans in clean water.
- Dry the cooked soybeans on a mat or sack in the sun until dry, about 3 days.
- Pound the dry soybeans and sieve to get the flour - or grind them at the grinding mill.
- Store the flour in an air tight container and use it as required.

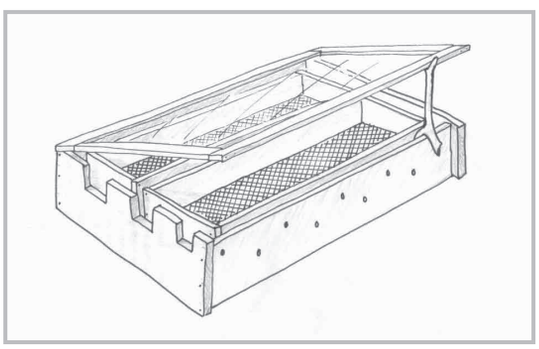
Note: Never take uncooked soybeans to the grinding mill. Uncooked soya is not healthy.

29 • Drying Fruits and Vegetables

The idea is to build and use solar dryers to dry fruit and vegetable so that vitamins can be available outside the fruiting seasons.

Introduction

Fruits and vegetables contain many vitamins - especially Vitamin A and C. It is very important for growing children to get enough of these vitamins.
During its first 6 months, a child gets A vitamin through the mother's milk. Therefore, pregnant women and breastfeeding mothers should make sure they get much Vitamin A. Vitamin A is found in yellow and orange fruits or vegetables (in the form of beta carotene). It is therefore good to eat carrots, mangoes, papaya (pawpaw) in order to obtain vitamin A. Tomatoes, cabbage and especially moringa leaves are also good sources.



The dryer can be made of wood (shown) or mud

Vitamin A is important because it:
- prevents infections,
- keeps eyes healthy,
- is required for good growth.

Good sources of vitamin C are oranges, lemon and lime, but guava, green pepper, spinach and other vegetables also have much of it.

Vitamin C is important because it:
- prevents infections,
- produces brain and nerve substances,
- controls blood cholesterol levels,
- helps the body to obtain iron from food.

The best way to get vitamins is to eat fresh fruits. However, fruits like mangoes are plentiful for a few months only. They often go to waste or are sold much too cheap because there are too many. By drying mangoes it is possible to have a vitamin source all year round.
Many fruits and vegetables are good for drying: mango, banana, guava, papaya, pineapple, tomato, green vegetables and moringa leaves,
Try it with local fruits as well - mahobohobo, morula etc. They are also filled with vitamins and plentiful for short periods.
If fruits and vegetables are dried directly in the sun some of the vitamins are lost. But if one uses a solar dryer most of the vitamins are kept. It is simple to build a solar dryer.

Low cost solar dryer

There are many different models. All look like a box and have a tray inside where fruits and vegetables are placed for drying. This tray can be made of bamboo or straw and must allow air to flow through. Mosquito net or other plastic netting can also be used.

Mud dryer

ITDG (Intermediate Technology Development Group, now called "Practical Action") has successfully developed a low-cost solar dryer made of mud in Nepal.

Materials required for mud dryer construction:.

- mixture of clay and cow-dung or finely chopped hay, sawdust or rice husks,
- bricks or stones,
- small bamboo pipes or pipes for ventilation,
- bamboo or wood for making trays,
- non-corrosive wire mesh (optional),
- non-toxic black paint (optional),
- transparent plastic (Polypropylene 100-200 gauge).

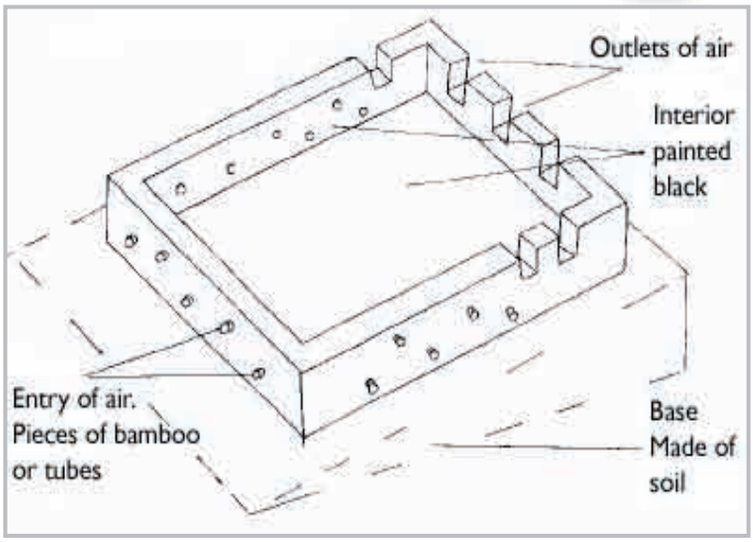
Description of dryer

The dryer should be placed at an angle of about 20 degrees from the ground and should be placed facing the sun in the period when there are food products to be dried (North or South depending on your location).

The body and base of the dryer are constructed with bricks or stones. The mixture of clay and finely chopped plant material is used to bind the bricks/stones together. Clay is mixed with plant material to avoid cracks. Small bamboo pipes (or tubes) are used as an inlet for cool air and a small window (gap) is made at the top end of the dryer to release hot air. Wood or bamboo and wire mesh are used to make the trays for holding food materials to be dried. Other materials such as mosquito nets or straw mats can also be used - the important thing is allowing air to move freely through the tray.

The plastic is fastened to a wood/bamboo frame and this is used to cover the dryer. The cover should be tight enough to prevent flies and other insects from entering through the top.

Blackboard paint (non-toxic) can be used to paint the inside of the dryer, including the trays. This will increase the temperature in the dryer and result in a faster drying of the products. The dryer must have about 3 to 4 inches (7.5 - 10 cm) space under and above the tray. Normally, a dryer of 4 x 6 feet is enough for a household.



Dryer base and body made of mud and bricks

Precaution

Care should be taken while handling the plastic cover of the dryer as it can easily be damaged. It is also recommended to keep children away from the dryer to prevent damage.

The plastic should be replaced every two months or when it is no longer transparent.

Cost

Between US$ 5 and 8 depending on the size of the dryer and availability of local materials, such as bricks and wood.

Solar mud dryer illustration. Information and drawing of mud dryer from "Food Chain 27" ITDG. www.itdg.org

Simple plastic model

This simple dryer has a structure based on the system used for drying dishes in Southern Africa. It is usually made of bamboo or sticks.
The roof is made of plastic. It is best to use strong plastic such as the kind used for greenhouses. The plastic should extend over the edges of the drying table, so that rain runs off the plastic cover and does not enter the dryer from the sides.

The plastic dryer costs around US$ 2

The plastic is rolled around a straight stick at both ends. The stick should be slightly longer than the width of the plastic and tied firmly to the plastic. This will prevent the plastic to be blown away and enable the user to lift the plastic to access the dryer from the sides. The sticks also make it easier to take the plastic off and roll it up nicely at times when the dryer is not in use.

If you have problems with chicken or other birds going into the dryer to take food, you should make a chicken wire system or other loose netting to close the open ends of the dryer.
It is good to use black plastic on the table. This increases the temperature in the dryer. It is also possible to use a mat or clean cloth to cover the table where your food items are spread.

Normally the price of the dryer should not exceed US$ 2.

Dimensions of the dryer

Height: about one m, to be a comfortable working height and high enough to prevent children and animals from reaching.
Length: just under 2 m, as greenhouse and black plastic usually are available in a standard 2 m width.
Width: about 1.5 m (= two arm-lengths, as all parts of the dryer table should be easily accessible).

Wooden model

The sides of the box can be made of timber or metal sheets. In this way, it is possible to easily move the dryer wherever it is needed, turn it to get most sun, and move it inside if it rains. It is important that there are holes on the sides to allow fresh air inlet to dry fruit.
In the simplest model, a box is covered with a frame of black plastic. Fruits and vegetables should not get direct sunlight - that is why black plastic is used.
The drawing shows a model with two parts, where the air can move from a heating chamber to a drying chamber.

Heating chamber

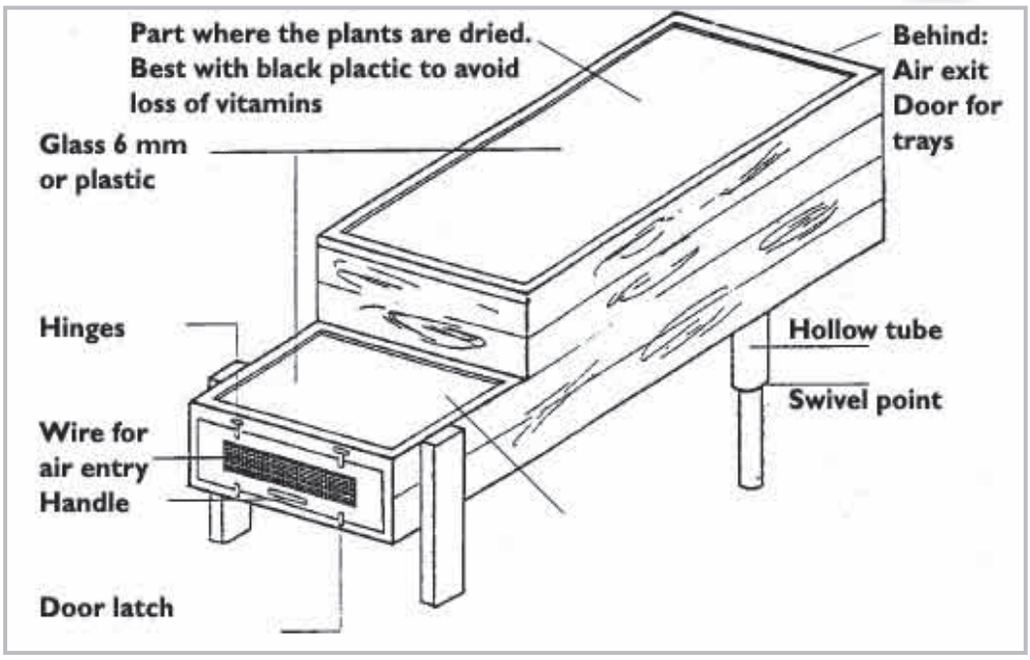
Use clear plastic or glass to get more solar energy inside. You can increase the heating by painting the inside black - or carefully burn the planks black.

Drying chamber

Here black plastic is used to preserve vitamins. The drying tray is placed in this chamber.

This model is placed so the hot air from the heating chamber moves up through the drying chamber. Hot air will always go up just like smoke.
The drawing shows a dryer model that can turn so that it can face the sun. It is also

good to make a system in which it is possible to regulate the air outlet. You can then open more if it gets too hot in the dryer. Make a "door" at the same place, so the tray or trays can be placed without moving the plastic top.



Wooden dryer from the German organisation GTZ)

How to dry fruit

It is important to use firm and ripe fruits. Do not use overripe fruits.

Mangoes and bananas

- Peel and cut in thin slices so they dry fast.
- Dip in lemon juice and water (20:1) - to reduce loss of vitamins.
- Spread them on a tray made of bamboo, plastic, sisal - metal destroys vitamins.
- Cover or keep the dryer inside at night and if it rains.

Fruits will be ready in 3-4 days, when they are dry but still leathery - they do not break
Pack them in plastic bags, close well and make small holes
Keep them in a dark, dry place - for example in a mealy meal bag - hanging inside so rats and mice do not eat them.

Guavas and papaya (pawpaw)

Repeat the same process as for mangoes, but they should be dipped in a syrup made of lemon juice mixed with sugar:

- Mix lemon juice with two parts of water. Heat it gently.
- Dissolve the sugar (twice the volume of the lemon juice) by stirring it.
- Keep stirring until it cools.
- Wash firm, ripe fruits.
- Remove seeds and threads and cut into thin slices.
- Immediately dip the slices in syrup for 15 minutes.
- Remove the slices and drain from syrup.
- Continue as with mangoes and banana.

Drying sweet potato

In many parts of Africa, there are lots of sweet potatoes during the harvesting season. However, they cannot be stored for a long time. If they are dried, it is possible to keep them and have them available off-season.
Sweet potatoes are either cut into small pieces or grated and dried in the solar dryer.

How to dry vegetables

Many vegetables are good for drying. They should also be cleaned well and cut into small pieces.
To keep vitamins and a fresher colour, it is good to blanch vegetables before drying:

Sweet potatoes in a plastic dryer

Blanching

- Boil water with salt.
- Put vegetables in a clean cloth or basket.
- Hard vegetables (such as cabbage) are dipped in boiling water for 3 minutes.
- Softer ones (like spinach and moringa leaves) are dipped for 2 minutes.
- Immediately after taking them up, dip in cold water.
- Spread on trays, dry until they are crispy and pack as with fruits.

Using dried foods

Dried foodstuff can be used by soaking and cooking it or by pounding it into flour.
In Malawi the organisation HEDON is promoting nshima (sadza) out of mixed flour instead of only using maize. It is possible, for example, to use 50% maize, 25% cassava and 25% sweet potato. This process increases food security.

Information and photos from HEDON, Malawi, which also has more useful information on the website: www.hedon.info

1. in boiling water **2. in cold water** **3.drying**

30 • Local Leafy Vegetables

Introduction

Local leafy vegetables include many species which grow in the wild or are partly cultivated. Others are species that are mainly cultivated for their pods, fruits, roots or tubers, but whose leaves are used as a vegetable.
Most rural people in Zambia rely on traditional vegetables for their relish. In a rural survey, it was found that between 50 and 95% of the households use traditional vegetables. The diversity in traditional vegetables gives variety in the diet and helps to ensure food security. More than 175 different species have been documented as local vegetables in Zambia.
The main species are amaranth (pigweed), spider plant, bush okra, leaves of sweet potato and cassava and various cucumber and melon related plants.

Amaranth (Pigweed or African spinach)

(Amaranthus spp.)
Botswana: *Thepe*
Namibia: *Ekwakwa*
Zambia: *Bonko, Bondwe*
Zimbabwe: *Mova, Imbuya*

Description
Amaranth is an erect annual herb, up to 60 cm high. The dark-green leaves are oval and 2-4 cm long. The leaves often have a characteristic dark ring/spot. The flowers are very small and placed close to the stem. The underside of young plants is often purple spotted, which makes the entire seedling look red.

Amaranth species are found wild or as weeds in the fields.

Amaranth - very common in Africa

Cultivation
Seeds take 4-6 days to emerge. Thinning may be done at about 2 weeks where needed. Once established, amaranth can effectively smother most grassy weeds and is remarkably drought-tolerant.
So far, no major pests or diseases have been observed on amaranth.
Seed collection is very easy for this species, by pulling upwards along the stem when the seeds are mature.

Use
Harvesting of leaves and shoots starts about a month after sowing - or 2-3 weeks after the first rains - and ceases with flowering. Picking the leaves stimulates growth.
Shoots and tender leaves are eaten in much the same way as spinach or together with sorghum or maize meal to make porridge. The cooked leaves may be eaten with milk, and salt or oil can be added. Leaves may be dried and stored for use in later periods. It can also be used for small stock feed.
Importance
The leaves are a source of protein and vitamins A and C. They are also rich in the minerals calcium, potassium and iron.
Amaranth is an easy crop to propagate as it produces abundant seed.
It is a readily available vegetable in the rainy season, when other vegetables become scarce.

Spider plant

Spider plant leaves and fruit

(Cleome gynandra)
Botswana: *Lothue*
Namibia: *Ombidi*
Zambia: *Shungwa*
Zimbabwe: *Nyevhe, Elude*

Description

The Spider plant (Cat's Whiskers) is an annual herb which can grow up to a size of 60 cm. The older leaves are divided into five leaflets (like a hand) and the plant is easy to identify by its white flowers. The fruit is an 8-10 cm long capsule. It splits open when mature and scatters the seed.

Spider plant grows in many places and occurs as a weed in arable lands or as a semi-cultivated species.

The first leaves are ready to eat 4-6 weeks after the first rains. It is best when the flowers have not yet developed, but when the younger tops can still be used.

The Spider plant flower

Cultivation

Spider plant is a promising species for cultivation. The plant produces many leaves and is found in large numbers in most fields and gardens.

In pure stands, thinning is done 4 weeks after sowing where density is too high. Weeding may be carried out in the early growth stages to encourage vigorous growth. This is recommended to reduce the bitterness of leaves, making them more palatable.

The picking of leaves and shoots starts in the sixth week after sowing. Picking the leaves also stimulates growth.

Certain pests, including beetles and Harlequin bugs, attack the crop. Pest control includes dusting with ash.

Seed collection is very easy for this species; one need only pick the mature capsules and air-dry them.

Use

Fresh leaves and tender shoots are boiled whole or chopped and mixed with groundnut flour and other ingredients to produce a tasty relish.

The leaves are preserved by blanching and then sun-drying them.

The leaves and the flower buds are washed and boiled in water with a little salt. A relatively long cooking time (2 hours) is normally used to remove the bitter flavour. For drying, the boiled leaves are made into small balls and placed out in the sun. To reconstitute the dried material, which can be stored indefinitely, it is soaked in water and then prepared in the usual manner.

Importance

The leaves are rich in vitamins A and C and contain moderate levels of calcium and iron.

Bush okra

(Corchorus spp.)
Zambia: *Delele*
Zimbabwe: *Nyenje, Idelele, Derere*

Bush okra is known by various other names like long-fruited jute, vegetable jute, jute mallow and jews mallow.

Description
The plant is an erect annual herb with an angular stem, branches without hairs, and leaves with serrated edges.
Harvesting starts when plants are 20-30 cm high. Leaf yield is increased by removal of the terminal shoot. Picking can continue for up to 3 months.
The bush okra virtually disappears in the cold season, having flowered and set seed. This vegetable is particularly important because it grows at an altitude at which rape and other leafy vegetables are scarce.

Cultivation
Bush okra is abundant in Zambia, but it is mostly found in areas that receive less than 1,000 mm of rainfall per year. Two different species grow both wild and as weeds in cultivated lands.
The plant grows and is harvested in the rainy season, though it is also common during summer months in irrigated fields. Villagers tend to protect bush okra plants growing as weeds among cultivated crops. No major pests or diseases have yet been reported.

Use
Tender fresh shoots are mixed with soda and salt and are cooked to produce a relish of a viscous and slippery consistency. Fresh leaves are sun-dried either whole or pounded to preserve them for future use. As a common practice, whole plants are dried in the shade and the leaves removed later.

Importance
Fresh leaves are a source of vitamins A and C. This is a popular local vegetable in rural areas. The viscosity of the preparation makes it easy to mix with nshima/sadza (thick maize porridge).

African eggplant

(Solanum macrocarpon, S. aethiopicum)
Zambia: *Impwa, Zhilo*
Zimbabwe: *Musungusungu (umsobo)*

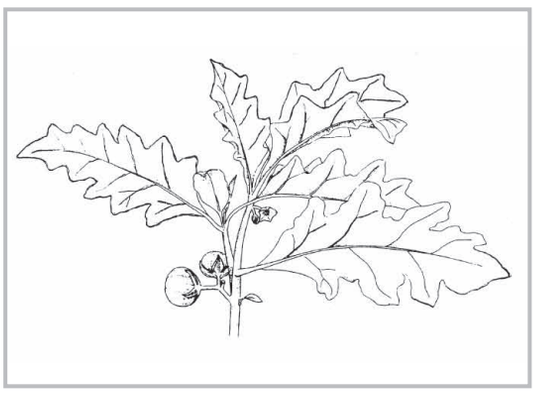
Bush okra- the leaves are nutritous

Description
African eggplants are sturdy and herbaceous crops; they can be annual or perennial.

Cultivation
Growers in the villages collect the seeds from the previous crop. Seed extraction involves fermenting longitudinally cut mature fruits to facilitate separation from the pulp. Fermentation is done by soaking the fruit in water for 2-3 days. Seeds are then squeezed out by hand. The seeds are then dried in the sun and stored in gourds for the following season's planting. Seeds may show dormancy a few weeks after extraction. Under this system of cultivation, the seeds are spread near homesteads in pure stands or in mixture with other traditional vegetable species.
Seedlings can also be raised in nursery beds and later transplanted. The crop is planted in pure stands on the homesteads at a spacing of 100 x 30 cm. Chemical fertilizers and manure are used in much the same way as for the European eggplant.

Use
Only the unripe fruits are eaten. These are chopped up and cooked with cooking oil or soda (NOT recommended since this

destroys the vitamins) and used as a relish. They may also be prepared together with other vegetables. The unripe fruits are sometimes eaten raw. The fruits are preserved for future use by sun-drying.



Leaves and fruit of the African eggplant. More detail can be seen in the drawing below

Importance

The fruits are a source of small amounts of starch and protein and substantial amounts of vitamin A and iron. It is a profitable crop, as it is a popular vegetable sold on streets and markets in urban areas.

The leaves are more nutritious than the fruits and are sometimes eaten in the same way as spinach.

Sweet potatoes

(Ipomoea batatas)

Cultivation

The sweet potato is widely cultivated in the rainy season, primarily for its tubers. Propagation is by stem cuttings planted on mounds about 30 cm high. The leaves are picked over the course of several months. The leaves of wild species of sweet potato are also used as vegetables. Sweet potato has a few serious pests, such as sweet potato weevil.

Use

The leaves may be mixed with groundnut flour, fats or dried fish or meat. They are preserved for use by blanching followed by sun-drying or may be dried directly in the sun.

Importance

Fresh leaves are a good source of protein, calcium and iron and are moderately rich in vitamin C. They are sold in urban markets and provide a reliable source of nutrients in the rainy season.

Cassava

(Manihot esculenta)

Cultivation

Cassava grows well under most soil conditions. Propagation is by stem cuttings at the start of the rainy season. Plantings are often mixed with other crops like finger millet, sorghum, maize and pumpkins.

Leaf harvesting starts once the plant is established and continues for a couple of years.

Use

It is mainly grown for its tubers, but its leaves are also an important vegetable. It is in fact regarded as one of the most convenient vegetable species. Leaves and tender shoots are chopped or ground and boiled with groundnut flour, fats or fish to make a relish.

The young, fully expanded leaves can be eaten cooked and contain 11-39% protein on a dry weight basis. Both the leaves and roots contain cyanide, so the leaves should be cooked for fifteen minutes and the water drained. This reduces the cyanide to a very low level.

The leaves are sometimes preserved for future use by drying either in the shade or in direct sunlight.

Importance
Cassava provides a full meal, as its tubers can be ground as flour, and its leaves provide a protein-rich relish. The leaves are also rich in vitamin A.
It is important for food security because it can survive without water by shading its leaves and quickly grow again when conditions improve.

Cucurbits

(Ipomoea batatas)

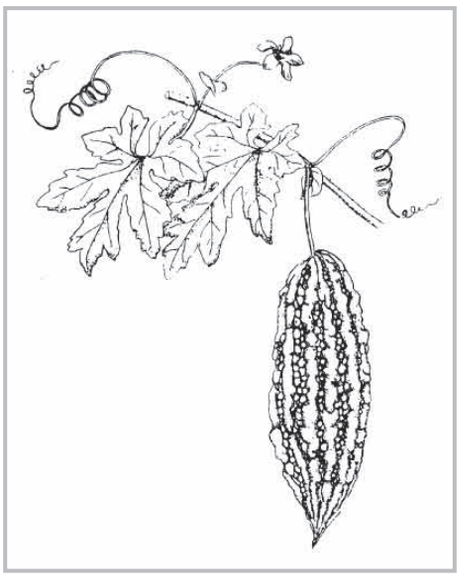
Cultivation
Cucurbits such as pumpkins, local cucumber and melons, are grown mainly for their fruits during the rainy season.
Farmers usually extract their own seeds from mature fruits after harvesting and store them for later use. Seeds are directly sown a few centimetres below the soil surface. Pumpkin leaves are picked only after the plant has started to bear fruit. This can continue for several months if there are few pests and diseases, because the plants often continue to produce new leaves long after the rainy season is over.

Use
Leaves and young fruits are boiled and mixed with various ingredients and used as a relish. Leaves are commonly chopped or pounded and mixed with groundnut flour or cooking oil. Smoked or sun-dried leaves can be stored for a long time for future use.

Importance
Fresh pumpkin leaves are rich in calcium, protein, and vitamin C. Dried leaves are high in protein and iron and moderately high in vitamin C.

Roselle

(Sorrel, Bissap) (*Hibiscus sabdariffa*)
Namibia: *Omutete*



There are many species of pumpkins with nutritious leaves

Description
Roselle is an herb that grows to a height of 50-100 cm. The young leaves are oval, while older leaves are clearly three-lobed. The flowers are bright yellow with a red-brown centre.
When the plant grows older the deep red and purple colours of the stem and the sepals (the outermost layer of the flower) dominate and the entire plant appears purple.

Use
The fleshy red sepals should be picked when about one inch long and can be used in jellies, sauces, and herbal teas. Although the leaves and stems are bitter, they are high in Vitamin A and may be eaten raw, cooked or dried.
The leaves of the roselle are stripped from the plant and cooked in the same manner as spider plant leaves. The red petals are sometimes peeled off the bolls and dried. When pounded and covered with boiling water, these petals produce a red tea.

Cultivation
Roselle is relatively easy to grow. The plants establish well when grown from large seeds. The plants are quite drought resistant and continue to grow long into the dry season.

Roselle - supplies leaves during the dry season

Cowpea

(Vigna unguiculata)
Botswana: *Morogo wa dinawa*
Zimbabwe: *Nyembe, Indumba*
Angola: *Feijão-ma-cunde*

Cultivation

Cowpea is widely cultivated and its leaves are a popular vegetable. A significant amount of leaves can be harvested from the plant without greatly affecting its seed yields.

The types that are first erect and later spread on the ground (semi-spreading) are suitable for use as a vegetable. The leaves are picked 4 weeks after planting, and this continues until the plants start to flower.

Both beans and edible greens can be economically produced from the same field by planting cowpeas in rows 16 inches apart and letting them grow until the leaves begin to touch. Then every other row is harvested for greens without lowering bean yield.

Cowpea is perhaps the best plant for intercropping with grains like sorghum and maize, because they cover the ground and keep weeds down (after one initial weeding), and they fix atmospheric nitrogen and thereby improve the growth of nearby plants.

Two hectares of maize and cowpeas intercropped will usually produce about 30% more than one hectare of maize and one hectare of cowpeas.

A moderate harvest of cowpea leaves and shoots (about 2T/ha - 40 large sacks) at flowering increases seed yield, while harvesting double that amount reduces seed yield.

When grown strictly as a leaf vegetable, a dense sowing of seedlings is harvested 3-6 weeks after planting by cutting at ground level or by uprooting. Planting for leaf yield should be at least twice as dense as a normal planting for bean yield.

Cowpeas cut at 20 cm above the ground will regrow quickly but those cut at 5 cm will regrow slowly if at all.

Use

The leaves are dried for later use and cooked in the same manner as spinach. In Malawi, leaves are dried for 2-3 hours then packed tightly into jars and boiled for 20 minutes. The softened leaves are then spread in the sun again for 2 -3 days; then they are rolled into 2 kg balls and stored for the dry season.

.The intercropping of 4 rows of cowpeas between rows of bananas and plantains has shown a lot of promise. Since the weeds need to be cut from between the banana rows anyway, it makes sense to use that space for a nitrogen-fixing crop.

This information was adapted from various articles in "Traditional African Vegetables." Proceedings of IPGRI Workshop on Genetic Resources of Traditional Vegetables in Africa: Conservation and Use, 1997.

A balanced diet

A healthy and balanced diet does not need to be expensive. Much traditional and cheap food is very healthy. The way the food is prepared is equally important. A healthy diet includes proteins for building up the body, carbohydrates and fats for energy and vitamins and minerals to keep the body strong.

- *Good sources of proteins include: Soybeans, cowpeas, beans, kapenta and other fish, eggs, groundnuts, meat and milk.*
- *Good sources of vitamin/minerals include: Various types of green leaves (rape, amaranthus, leaves of pumpkin, cassava and cowpea), carrots, fruits and pumpkins.*
- *Good sources of oil and fats include: All sorts of nuts and seeds (for example sesame, sunflower and groundnuts), fish.*

Good cooking methods

- *Do not overcook the food. Cook the vegetables until they are tender - leafy vegetables only few minutes. The longer vegetables cook, the more vitamins will be lost.*
- *Steam the vegetables. Use as little water as possible.*
- *Stir fry or boil. Avoid deep frying.*
- *Never add soda or ash to the food as these destroy the vitamins.*

Healthy recipes:

1. Soybean or cowpea sausage

Ingredients:

- *2 cups of soybeans or cowpeas,*
- *1 (green) onion,*
- *1 cup of flour, 2 eggs, salt,*
- *garlic, curry or other spices - optional.*

Method:

- *Soak soybeans or cowpeas overnight.*
- *Boil them until tender.*
- *Pound in a mortar together with the (green) onion.*
- *Mix with eggs and spices.*
- *Form sausages by adding flour.*
- *Fry in a pan with cooking oil.*
- *Serve with nshima and vegetables.*

2. Soya porridge

Ingredients:

- *3 table spoons of cooked soy flour,*
- *1 cup of mealy meal,*
- *2-3 cups of water,*
- *salt and sugar.*

Method:

- *Add the soya flour to boiling water.*
- *Stir and let it boil.*
- *Add water to the mealy meal to make a paste.*
- *Add the paste to the boiling soya.*
- *Stir all the time to prevent sticking.*
- *Let the porridge cook for 20 minutes.*
- *Add salt and sugar.*

3. Vegetables with soya flour

Ingredients:

- *1 cup of cooked soy flour or one cup cooked and pounded soybean mash,*
- *vegetables, tomatoes, onions, salt.*

Method:

- *Add water to the cooked soya flour or soya mash to make a paste.*
- *Wash and cut the vegetables.*
- *Start to cook the vegetables and add the soya when the vegetables start to boil.*
- *Let it cook for about 5 minutes until vegetables are tender.*
- *Add salt to taste and serve with nshima.*

Use leaves from the moringa (drumstick tree) see section 31. They can be pounded or cut and used as any other green leaves.

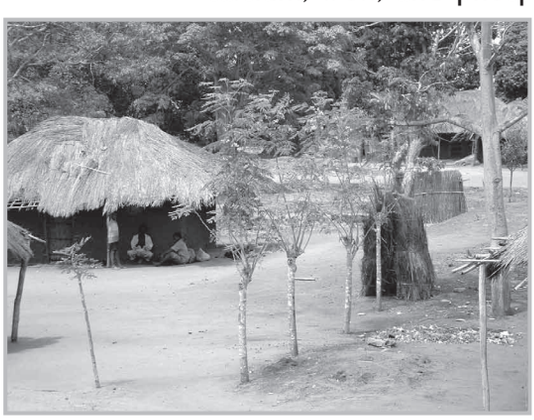
Recipes and information from Development Aid from People to People (DAPP) in Zambia Child Aid and Hope Projects.

31 • *Moringa oleifera* - a Multipurpose Tree

The *Moringa oleifera* (drum stick tree) has already been mentioned in relation to removing suspended matter from water prior to the water being disinfected with solar radiation. Moringa, however, has many other uses.

Very nutritious leaves

The leaves have a high level of protein (27%), and they are also rich in Vitamins A and C, calcium, iron, and phosphorous. A great advantage is that the moringa leaves can be harvested during the dry season when there are no other vegetables available.



Prune the moringas to a height of 1.5 m. People can now reach the leaves, but goats cannot

The small leaves are picked from the branches and can be used, like other vegetables, in food preparation.
It is a good idea to prune the moringa trees to a height of 1.5 m (shoulder height of most adults) so that the goats cannot reach the leaves, but the family can harvest them when needed.
Another great advantage is that the branches cut during the pruning can be replanted. The ideal time to plant them is one month before the start of the rainy season. It is then necessary to irrigate a little bit during the first month.
In many places in the north of Mozambique, the branches are planted and used as stakes in grass fences or as matting around the houses.
The moringa pod is also very nutritious, but it must be pointed out that in the beginning it is better to allow the fruits to produce seeds, so that they can be spread to new areas. Or, if necessary, the seeds can be used to treat water.

Moringa oil

Moringa oil has been used in skin crèmes and in ointments since the times of ancient Egypt. The clear yellow oil has a pleasant taste and has been compared in terms of quality with olive oil. The seeds contain 35 to 40% of oil by weight.

Vegetable oil is an important part of our diet. It is a concentrated source of food energy. Small amounts added to the diet of young children make their food more varied and nutritious. However, the majority of cooking oils are expensive and cannot be produced without machinery.

Oil extraction

The moringa seed is fairly soft, so the oil can be extracted manually using a screw press. First grind the seeds, add 10% water, then heat slowly over a low flame for 10 to 15 minutes, taking care not to burn the seeds. In testing, 2.6 litres of oil was produced from 11 kilograms of seeds.

Traditional methods of extracting oil from plants can also be used, but often these are slow and not very efficient.

These methods involve extracting the oil from the seeds by grinding them and cooking them in water for 5 minutes. After cooking, the seeds should be pressed in a cloth and the liquid placed in a clean container. It

is then left there for one day to allow the oil to separate from the water. It may be necessary to filter off small pieces of seeds floating on the surface of the oil. If you do not have access to a machine press, you can try this method.

Once the oil is extracted, the remaining presscake still contains all the same properties as the whole seeds with regards to water treatment and purification. As this presscake is 60% protein, it can be used as a fertilizer, and studies are being done to find out if it can also be used as fodder for animals and farm birds.

Conclusions

The planting of moringa trees by smallholder farmers should be encouraged. It will improve both their health and income. This valuable tree will provide both fresh vegetables and raw materials for oil extraction. Simple technology can be used which can encourage small-scale oil milling enterprises to be established in the rural areas. The great potential of this tree and its various products has not yet been recognised.

Moringa seedlings are ready to plant after 2-3 months

This information was obtained from PASSO A PASSO No. 20, by Geoff Folkard and John Sutherland TEAR FUND

USES OF MORINGA
Vegetable
Green pods, leaves, flowers and roasted seeds
Oil
Seeds contain 40 per cent of oil by weight
Use for cooking, soap manufacture, cosmetic base and in lamps
Water coagulant
Traditionally used for 'household treatment' in Sudan and Indonesia
Used with success in large-scale water treatment in Malawi
Other uses
All parts of the plant can be used in a variety of traditional medicines
Powdered seed is used in ointment to treat common bacterial skin infections
The leaves and seeds are useful as cattle fodder or as soil fertilizer
Grown as live fences and windbreaks, where the wood can also be a source of fuel
The main branches can be pruned so that other branches will grow
Agro-forestry uses as intercropping with other crops - the trees are good for adding nitrogen to the soil,due to the pods and leaves they produce (moringa is not a legume plant)

32 • The Medicinal Garden

Herbs give a good flavour to food. Many herbs prevent various diseases, and some can even cure them. Cultivate and use a variety of herbs such as:

- ***Aloe vera***. For digestive and skin problems. Helps to relieve constipation. Use as extract. Boil and drink the concentrated water. Use in limited amounts. Stop immediately if it causes cramps or diarrhoea.
- ***Basil***. Helps to relieve nausea and aids digestion. Has an antiseptic function for mouth sores. Add to food to treat nausea and digestive problems. Use as gargle for mouth sores.
- ***Garlic***. Prevents a large number of diseases. Has antibacterial, antiviral and antifungal function, particularly in the gut, intestines, lungs and vagina. Helps digestion and feeling of weakness. Also good for thrush, throat infections, herpes and diarrhoea. It is a good idea to eat two cloves of garlic per day. Prepare tea or energy drink, or use in food.
- ***Ginger***. Improves digestion, constipation and gas, energizes, relieves diarrhoea and stimulates appetite. Used for treating common colds, flu and nausea. Use either as a spice in meals or prepare a ginger tea.
- ***Lemongrass***. Is nutritious and can combat both nausea and high blood pressure. Has a calming effect as well as soothes digestion and alleviates stress. Use as tea.
- ***Mint and peppermint***. Has an anti-inflammatory effect, helps digestion and combats diarrhoea. Use as tea or gargle for mouth sores. Chew mint leaves or take as tea to aid digestion.
- ***Neem***. Brings down fever. Cut a fresh twig, remove the leaves and boil the bark in water; drink as tea. The bark can also be chewed.
- ***Parsley***. Combats nausea.
- ***Pennywort (gotu kula)***. Strengthens the immune system and fights skin diseases and joint pains. Take one teaspoon of dried leaves in a cup of hot water every day.
- ***Piri-piri (Chili)***. Stimulates circulation and appetite, helps fight infection, heals ulcers and intestine inflammation. Add a pinch to cooked or raw foods. For an energizing drink add to fruit juice or water.

Growing herbs

- ***Aloe vera***: Find a plant in the wild and plant it in your garden.
- ***Fenne***l, parsley: Sow the seeds - you can leave the plant to grow and harvest your own seeds the second year.
- ***Garlic***: Plant a piece and it will grow. Use good fertilised soil.
- ***Ginger***: Plant a piece of ginger and it will multiply (like potatoes).
- ***Lemongrass:*** Find a small piece of lemongrass - many people grow it as an ornamental plant.
- ***Pennywort (gotu kula)***, mint, oregano: Find some stems or cuttings and plant them.

Dry the herbs: Sometimes you may have many herbs. Remember to dry them so you can use them later when you don't have as many (See section 29 on solar drying).

Good planting methods

Transplanting

Give the seed beds shade and water during the production of stems for transplanting.

Take care that the roots do not bend when planting - the hole must be bigger than the plant. Press the soil firmly around the plant because it will dry out if the soil is too loose. Plant in the evening or morning.

Keep the soil covered

Put dry grass or other plant material between the plants. This will keep the water from evaporating too much. It will save water, it will save your labour and it will improve the growth of the plants.

Garden hygiene

- Burn diseased material.
- Sterilize soil to prevent diseases such as soil nematodes (microscopic worms which attack the roots) by covering the soil with clear plastic for 2 weeks (the sun rays kill the germs) or by covering the soil with a 5 cm layer of dry grass and burning it.

Pest control

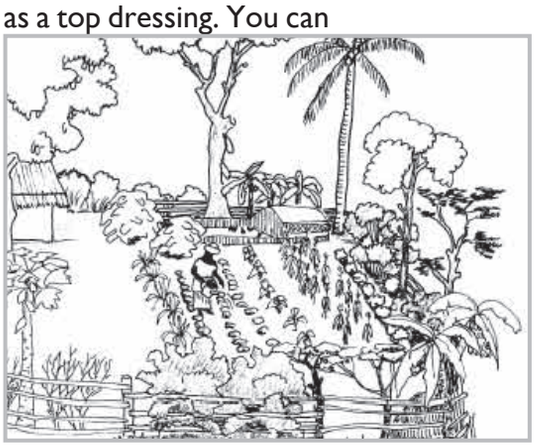
It is a good idea to mix in various plants with a strong odour to repel insects. See more in section 34 on natural pesticides.

If you use chemical fungicides and pesticides, follow the instructions on the package. Do not eat the vegetables before the recommended date. Pesticides normally take between 1 to 3 weeks after spraying before you can eat the sprayed vegetables, while vegetables sprayed with fungicides can be eaten shortly after spraying (just wash the vegetables well).

Liquid nitrogen fertilizer

If the plants turn yellow it means that they need nitrogen. Nitrogen can be produced by putting two to four handfuls of chicken manure in a bucket of water and leaving it for 2 days. Water the beds on the ground with this mixture, but do not pour it on the leaves as it can burn them.

Another method is to fill a drum or an open 20 litre container with water. Place a sack full of manure in the water for 1 to 2 weeks. Use this mixture as a top dressing. You can use the same manure twice and thereafter use the manure to mix into the soil as "normal" fertilizer. Because of having stayed in the water it will spread fewer weeds.



A good garden should have trees, fruits, legumes, and leafy and root crops

Crop rotation

Rotate between root crops (carrots, sweet potatoes, beetroots), leafy crops (cabbage, amaranth), fruit crops (tomatoes, green peppers) and legumes (green beans, cow peas, etc.). This will prevent plant diseases and improve soil fertility.

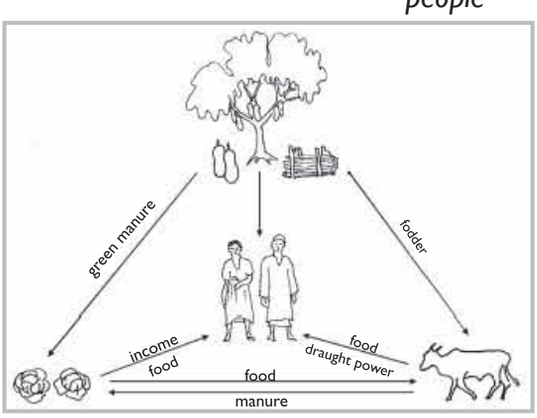
Leafy vegetables

Plant local leafy vegetables because they are very nutritious, they do not easily catch diseases, and they are easy to multiply. See more in section 30.

Grow trees in the garden

If you have enough space, don't forget to grow trees, such as the lemon tree, in your garden. Lemon trees do not need much water and are quite easy to plant. They are very beneficial for many health problems.

- Other fruit trees could include guava, pawpaw (papaya), banana,



Planting trees is advantageous for plants, animals, and people

orange and neem (for use as medicine and as a pesticide)
When you water the vegetables, the trees benefit from the water that filters down through the soil. Choose a good variety of fruit trees, and you will have many fruits.

How to plant the trees
Dig a hole 1 m wide and 1 m deep and fill it up with manure (and, if available, chemical fertilizer) mixed with soil. Make a basin as big as the tree's canopy. A common mistake is to make the basin too small. The feeding roots are not near the trunk, but rather under the edge of the canopy. Cover the soil inside the basin to minimise evaporation and to provide nutrition.

33 • The TCE Immune Tea

TCE is a programme run by Humana People to People organisations to combat HIV/AIDS. TCE stands for Total Control of the Epidemic. Read more about TCE on www.humana.org or get material from a local DAPP/ADPP project (Development Aid from People to People).
This part tells about a tea that you can grow and harvest yourself. The tea is beneficial for everybody, whether HIV negative or positive. Drinking this tea will strengthen the immune system, making you more energetic and better able to resist diseases. It also helps fight joint problems like arthritis and rheumatism, as well as helping with many skin problems. It is very suitable for serving at any school or workplace as well as at home. It tastes delicious. Enjoy this tea. Drink it every day.

Centella (Pennywort) is an ancient medicinal plant from India

How to prepare the TCE immune tea

Dry equal quantities of peppermint, lemongrass, and African wormwood, and three times this amount of pennywort, in the shade as described later.
Dosage:
A flat tablespoon in a cup of boiled water three times per day:
one - in the morning
one - at lunch
one - in the afternoon (at 4 pm)

The four herbs found in the tea:

Pennywort (*Centella asiatica*)

Pennywort is an indigenous plant found in Zimbabwe and neighbouring countries. It was discovered as a medicinal herb in China and India thousands of years ago. It works as a medication for leprosy and cures skin problems. It is a strong immune booster. In France today, for example, it is used against psoriasis, eczema and fungal diseases.

How to grow?
This plant is easy to grow. It grows best in semi-sunny or shady places. It can be planted in gardens or hanging baskets.

Preparation
Harvest the pennywort leaves and dry them on a fishnet or on newspaper inside the house for four days. It must be dried in the shade in a place that is neither too hot nor too cold. On the fifth day, dry the leaves in direct sunlight for 1 hour. After this last drying, crush the leaves into small parts - as other leaves used for herbal teas.

Use
To make the tea from the dried leaves, 1 teaspoon of crushed pennywort is needed.
Put it in a cup of boiling water, wait for five minutes, strain through a sieve and drink once a day.
To make the tea from fresh leaves, put ¼ cup of fresh pennywort leaves in boiling water. Wait for five minutes, strain and drink. The tea should be taken in the morning, as it is energizing.
Pennywort can also be mixed with peppermint, because it does not have much flavour alone.

Peppermint

Peppermint has a very pleasant flavour and is used as anti-flu against influenza. It relaxes the smooth muscles and reduces inflammation. It relieves pain and spasms in stomach aches. It has anti-flatulent properties, and it stimulates bile and digestive juice secretion. It also helps to stop nausea and relieves morning sickness and travel sickness.

How to grow?
Plant the seedlings in fertile soil and water every day. During the cold season you should place extra soil or leaves around the plants so that new shoots do not come up.

Preparation
Pick leaves and dry them at room temperature and in shade for 4 days. On the fifth day place them in direct sunlight and then crush them to make the herbal tea.

Use
Take ¼ teaspoon of the dried, crushed leaves and mix with 1 teaspoon of the dried, crushed pennywort in 1 cup of tea.

Mint is easy to grow, and has many uses

Lemongrass

Lemongrass is, as the name suggest, a grass with a pleasant lemon flavour that can be used together with peppermint and pennywort. It can also be used as a mosquito repellent. It is furthermore a spice that is often used to flavour meat and soy dishes.

How to grow?
It is an easy plant to grow. You can just pull the tillers (shoots) that sprout from the base of the lemongrass tuft, and plant them in rich soil. It grows and multiplies quickly.

Lemongrass: Use in the tea with pennywort and peppermint

Preparation and use
Cut the long leaves with scissors and dry them like pennywort. If they are very fresh then dry them for 6-8 days in the shade. Prepare them in the same way as pennywort.

African wormwood, good for fighting malaria and intestinal worms

To make tea from fresh leaves, cut the leaves into small pieces and mix them with fresh leaves of pennywort and peppermint. This is a fresh and tasty tea.
The leaves and straw can be cut into small pieces and cooked together with food.
You can crush the fresh lemongrass leaves and apply them on the skin to prevent mosquito bites.
You can also put the leaves in the room to repel mosquitoes.

African wormwood (Artemisia afra)

African wormwood can be used to repel mosquitoes and is also used to treat malaria and intestinal worms. It can be laid between clothes to keep away moths and insects.

How to grow?

The plant is highly drought resistant and propagates easily. It needs full sun and heavy pruning in the cold season to encourage new lush growth in spring.

Young peppermint plants

Take 10 cm cuttings, trim off excess leaves at the base of the stems, press into a prepared tray or seedbed and keep moist until established. Transplant into a larger pot and plant out when strong and bushy. Plant with a distance of one metre between plants, as the bushes grow large. Water once or twice daily until they are growing well; thereafter it is enough to water them once weekly. Cut back the plants in July/August and save the leaves. Grow it near cabbages and fruit trees to repel cabbage butterfly and fruit tree moth.

Preparation

The whole herb is used. Cut the plants in July and August after the plant has flowered and has dried. It is best to collect on a dry day after the sun has dried off any dew. Tie the plants loosely in bunches so that air can get to all parts and hang them on strings in mild weather. The drying must be done in shade to avoid losing the aromatic properties of the plant. After 4-6 days the leaves will be crisp and the stalks will quickly finish drying. Crush them into powder and pack the herb in bottles, tins and jars.

Use

Wormwood tea is made from 2.5 grams of the herb. Soak the herb for 10-20 minutes in ½ litre of boiling water. Drink one glass or cup of the tea every day.
The tea can be sweetened with sugar or honey as it is bitter. The plant can be grown near houses to repel mosquitoes and flies. To prevent sweaty feet, place leaves inside your socks.

Information from the TCE (Total control of the Epidemic) Medical Head Quarter, Zimbabwe, www.humana.org

34 • Biopesticides

Introduction

Insect pests are responsible for 20-30 per cent of crop destruction.
There are many safe, natural, and simple methods of protecting plants.
In the long term, modern chemical pesticides increase pest and disease problems rather than solving them.
Modern chemical pesticides are poisonous. They are harmful to human health and destroy the farm environment.
This chapter explains various simple and easily available natural pesticides. There are many more pesticides in addition to those discussed here. You can use the methods you find appropriate in your area.
Remember to always spray selectively, specifically to kill the pest which has become a problem. Do not try to kill friendly insects.
Where spraying equipment is not available, the liquid can be applied to the plants with store-bought brushes or brushes made from local plants.

Aromatic (strong-smelling) plants

Material: Leaves from any strong-smelling plant such as ginger, lantana (see photo), tomato, garlic, pepper, or other spices.
Target: Any insects.
Method: Dry the plant material and then grind it into powder. You may mix two or more types of plant material.
Mix the powder with boiling water and allow it to cool before spraying. Recommended mixes range from 20g to 500g per litre of water.
Frequency: Spray when you see the insects on the plants. Spray more often in the rainy season, because the rain washes the substance off the plants.
Planting some aromatic plants in between crops can also keep away some insects.

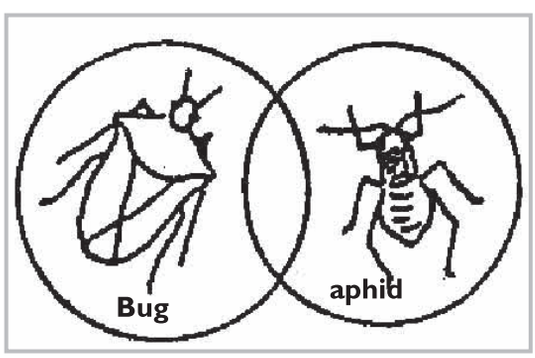
Lantana - often with some flowers yellow, others red and purple

Ash

Material: Wood ash
Target: Soft-bodied insects such as aphids, caterpillars, roundworms, grasshoppers, termites, stalk borers, cutworm, and other insects, as well as mildew diseases.
Method: Dust ash evenly on the leaves to dehydrate soft-bodied insects. Place ashes thickly around the plants or trees to discourage soil pests such as cutworms. Do not let the ash touch the plant stem.
Mix ash into the planting holes when planting trees.

Brushing

Target: Crawling insects and swarms
Method: Insects, larvae and eggs can be swept from leaves, branches, and trunks of fruit trees with a stiff brush. Protect the eyes (wear glasses) from falling insects. Some insects can seriously damage one's eyes.



Pests result in the loss of 20-30% of crops

Sweet Basil *(Ocimum basilicum)*

Target: Used as a mosquito repellent and against pests among stored grains.

Sweet basil. It smells good, but not to pests

Method: Crush the plant and rub it on the skin.
Put plants under the sleeping mat and bed.
Beat the plant against the interior walls of the house.
Leave the plant in the fire.
To protect stored grains, put a 3-5 cm layer in the bottom of the grain bin.

Finger euphorbia

Target:
Aphids, mosquitoes, red spider mites, termites, fungi, and insects in general.
Method:
To repel termites, place chopped leaves in the planting holes, or place branches around the trees.
To make a general mix for spraying against insects, use 10 drops of the milky juice from the stem and mix thoroughly in one litre of water. The mixture should be a slightly milky liquid.
Warning: Dangerous for the eyes and skin.

CAREFUL, IT'S POISONOUS

Manure

Target: Animals, birds, grasshoppers, aphids, fungi and bacteria.
Method: Put one shovel full of dry cow manure into a bucket with 10 litres of water. Stir once a day for at least two weeks.
Dilute the mixture 5 times before spraying (2 litres of the mixture to 10 litres of water). The remaining mixture can be kept for the next spraying. Clay dust can be sprinkled into the bucket to reduce the smell.

Spray the leaves to protect the plant against aphids and to give it resistance to bacterial and fungal diseases.
It can be sprayed on the soil surface to protect the seedlings against cutworms.
Fruits and vegetables that have been sprayed must be washed thoroughly before eating.
Paint tree trunks once a month with a mixture of clay dust and goat, cow, and chicken manure to repel monkeys, antelopes, goats, and rabbits.

Mulch

Material: Dead plant material, e.g. crop residue, weeds, leaves, etc.
Target: Cutworms, grasshoppers, roundworms, snails, and termites
Method: Cover the soil between the plants with at least 1 cm (1 finger) of thick dry plant materials. It is a good idea to mix this mulch with leaves from aromatic plants such as ginger, marigold, and other herbs. A mulch of tobacco leaves or tobacco dust will control snails, caterpillars, cutworms, and many insects.

Soap Solution

Material: Bar soap.
Target: Aphids, caterpillars, leaf miners, mites, psyllids, white fly and other pests.
Method: Dissolve 5 cm (100g) of bar soap into 10 litres of water. Only spray when needed, as soap can destroy the fertility of the soil if overused.

Onions

Target: Aphids, army worms, caterpillars, leaf miner, mites, psyllids, white fly and other pests.
Method: Soak 50 g of onion leaves/pieces in 1 litre of water. Leave for one week in a closed container. Spray the attacked plants.
Alternatively, to make the solution more quickly you can boil the mixture for about 30 minutes and leave it to cool before spraying on to the attacked plants.

Chili

Material: Ripe chili pods and chili seeds.
Target: Insects in general, fungi, bacteria and viruses.
Method: Grind two handfuls of chilies and soak in one litre of water for one day. Shake well, filter and add 5 litres of water (1 small bucket). Add a little soap then spray. Apply powder around the stem of the plant to repel ants, cutworms, snails and other soil pests. Plant in the garden among the other crops to repel various insects.

Mexican Marigold

(*Tagetes minuta* - A strong-smelling weed flower)
Target: Many insects, mildew, pests in stored grains.
Method: Plant in vegetable gardens and orchards to repel pests. Soak crushed parts of one mature plant in two litres of water for 24 hours, then filter and spray. A handful of wood ash can also be added. The mixture can be sprayed onto the soil around plants to protect them from ants.
Leaves rubbed on the skin will repel mosquitoes.
Mix fresh leaves into planting holes to repel termites.
To protect grain stores, place a 3-5 cm layer in the bottom of the grain bin.

Bead tree - Syringa (*Melia azederact*)

Target: Used against many different insects and fungi.
Method: Boil a handful of leaves and berries in five litres of water for 10 minutes. Cool and spray to prevent pests and fungi.
Mix leaves with crops in the storage bin.

Tagetes minuta - marigold. It has a strong smell and small orange-coloured flowers

Tobacco

Target: Works against most insects, plant rust and viruses.
Method: Soak 1 kg of crushed leaves in 15 litres of water for 24 hours, or boil for 30 minutes. Add a little soap, filter, and spray.
Crush into powder to scatter over soft-bodied pests like slugs or snails.
Dust on trees and crops to repel insects.

Warning: Do not spray on tomatoes, potatoes or pepper as it will turn the leaves black. Use the remaining leaves as mulch to combat termites.

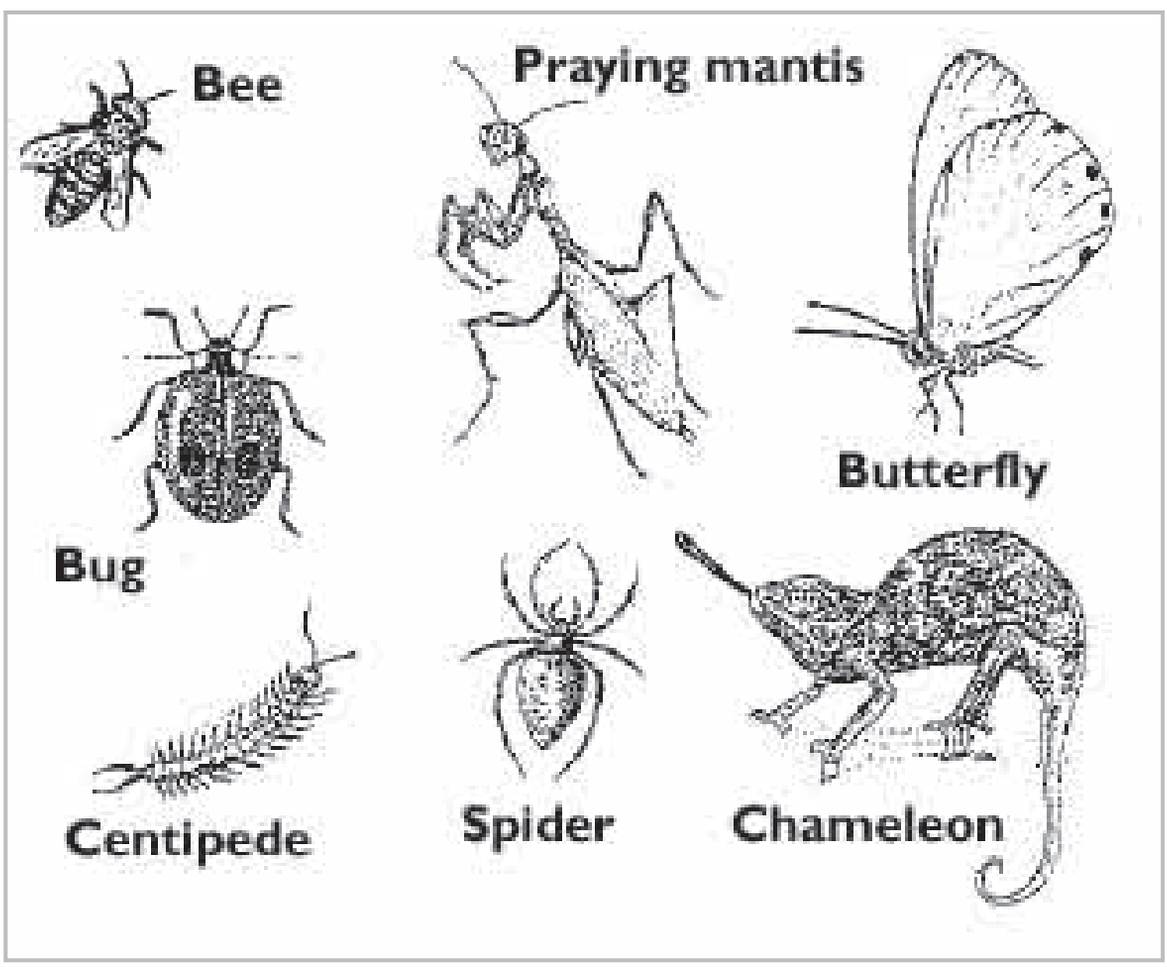
Bead tree (syringa) is common in many parts of Africa

Sunhemp (*Crotolaria*)

Target: Insects in general, pests in stored grain, roundworms and fungi.

Method: Rotate or interplant as a trap crop for roundworm and other pests.

Pound the seeds and mix it with grains in storage bins.



Friendly insects and animals found in the garden and the fields. Do not kill these insects and animals. They are beneficial to your garden, orchard, and field crops.

35 • Tephrosia - A Biopesticide and Much More

Tephrosia vogelii is a plant that grows in the wild in various parts of South Africa. In some places it is known as "fish bean" because its toxic substances can be used to kill fish. However, its use for fishing is not recommended (read why, further below). Presently this plant is grown by smallholder farmers for its multiple benefits, especially as a potent biopesticide and as a fallow crop to improve the fertility of the soil.

Cultivation

Seeds should be soaked in water for about 24 hours before they are planted, so that the germination rate will be higher than 90%.

For maximum leaf coverage, it is recommended to plant 0.5 by 0.5 metres.

Tephrosia is a perennial bush, which means that is grows continuously. Unlike annual plants, it does not stop growing or die at the end of the growing season.

The plant can be attacked from roundworms at the roots' nodes. This roundworm causes severe damage when it infects the roots of various plants (tobacco, tomato, beans, etc.). For this reason, only plants not affected by roundworms, such as maize, should be planted in rotation after tephrosia.

Tephrosia is a leguminous plant that fixes atmospheric nitrogen and increases the fertility of the soil. It is an excellent plant for use as a fallow crop (see section 21).

The vegetable material that results from the prunings can be used as mulch. However, you must be careful as excessive pruning can kill the plant.

Tephrosia improves the soil and is efficient against pests

Traditionally, tephrosia has been used for fishing in lakes and streams, as it can paralyse the fish (which will then float to the surface of the water). This happens because the leaves and roots contain compounds, namely rotenone and others, which are poisonous to mammals, humans, fish, and some insects. The use of this plant for fishing is not advisable because it is poisonous not only for fish but also for mammals and insects.

Pest and disease control

Note: It is recommended to use protective clothing and gloves. Avoid contact with the skin. In case of accidental contact, immediately wash the affected area.

In grain bins

To control weevils and grain borers, collect fresh tephrosia leaves, then sun-dry and crush them. Mix 100g of crushed leaves into 100kg of maize. The maize should be washed carefully before it is eaten.

For animal well-being

To control ticks, lice and flies, dilute soaked leaves and branches in water at a ratio of 1:5 (one part of soaked leaves for every 5 parts of water). Leave the mixture to sit for 8-12 hours before using it. Alternatively, you can boil the mixture for 30 minutes to free the toxins. This mixture should be used to bathe the animals.

Hygiene in the home

As a repellent for mosquitoes, cockroaches, and bedbugs.
To repel mosquitoes, cockroaches, and bedbugs, the walls of the house - especially the corners and the furniture legs - should be beaten with fresh tephrosia branches.

Pest control in the fields

Tephrosia is a biopesticide which works on contact and is effective against aphids, moths, beetles, ants, termites, and other insects found on horticultural plants and grains.
To make the insecticide, mix 20 grams of fresh vegetable material with 100 ml of water. Leave the mixture to soak for 2 hours, keeping it out of direct contact with light. When 2 hours has passed, filter the mixture and transfer the remaining solution to a sprayer. For best results, add 5 ml of liquid soap (if available) to the solution so that a larger area will be covered by the treatment and the pesticide will stick to the plants better. This is a contact spray treatment, and as such the product should be in direct contact with the plants.

The solution should be used immediately. If it is used 24 hours after it is prepared, its effectiveness will be reduced to 60-70%.
To preserve its effectiveness, do not leave the solution exposed to direct contact with light.

For rat control

To prevent rats from entering the farm or field, plant tephrosia along the edges in intervals of 1 metre. After 12 months, the enclosed area will be free of rats.

Information provided by the Pelum Association of Zambia - Participatory Ecological Land-Use Management. www.pelum-zambia.net

36 • Live Fences

Live fences are used to restrict domestic animals to an enclosed area (e.g. a corral where the cattle stays during the night) or to keep them out of a cultivated area such as a vegetable garden.
It is particularly important to protect the garden crops during the dry season when food for animals is scarce.
There are two types of fences using live plants:

Fences with live fencing posts

Live fencing posts are used as posts for the fence and are connected by a mesh made of bamboo strips, tree branches, palm leaves or grass. Wire can also be used.
The desired qualities for this kind of tree are:

1. Easy multiplication from cuttings, allowing the farmer to continue to propagate them even when there is little plant material.
2. Ability to survive regular pruning - cutting the new branches from the top
3. Does not attract termites

Moringa is a very useful tree for this purpose. It grows quickly and vertically, and it can be pruned with no problem. At the same time it provides nutritious leaves for people or animals.
Gliricidia and other acacias are also good trees for use as live fencing posts.

Live fences

These kinds of fences not only reduce the loss of crops to wild and domestic animals, but also reduce evaporation and erosion because with them in place there is less wind.

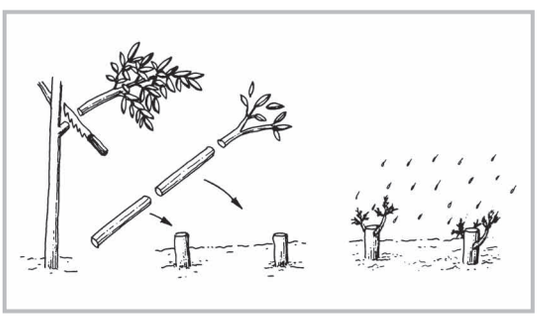
The species should have the qualities described above, and they should also not be edible to animals. This is necessary because it is difficult to protect the entire fence.

A good example of a living fence of Jatropha. See also the photo in section 44

The farmer has to choose what is best according to local conditions:

- To choose a fast-growing species, which means more maintenance work, and pruning 2-4 times per year.
- Or to choose a slow-growing species that will require less maintenance.

Regular pruning reduces the number of flowers and therefore fruitage. When you have a living fence with the purpose of also providing fruits, it is necessary to prune it in the beginning to ensure that the fence is sealed well at the ground level.



Plants for live fences must be easy to multiply from cuttings

It is worth preparing the soil well before planting the live fences, which involves digging a strip sufficiently broad (50 cm) to add manure and, if possible, chemical fertilizer that contains phosphate.
To seed directly on the defined site, the seeds are normally placed in double lines.
The planting or seeding needs to be done at the right time (which is at the beginning of the rainy season), and the new plants need to be protected as much as possible,

Jatropha is easy to propagate from cuttings.

e.g. with a cover of thorny branches.
The fastest way is to multiply moringa and Gliricidia by cuttings of at least 20 cm. These cuttings should be planted before the rainy season. It is then necessary to irrigate until the rain starts. If you plant during the rainy season, you increase the risk of the cuttings being destroyed by fungus.
Giving the necessary attention to the preparation of the land and to planting greatly helps the growth during the first year, shortening the period of establishment even if a slow-growing species was chosen.

Species to use as live fences

Agave (sisal)
Agave makes tightly sealed fences with its big and pointy leaves. It is easy to multiply from sprouts. They die after 10-15 years. Normally new young plants will grow up naturally, so that replanting will not be necessary.

Agave grows slowly

Jatropha
(*Jatropha curcas*)

Jatropha is often used for living fences in the West Africa and, for example, in Tanzania.
It grows very fast and is easy to multiply from cuttings (as well as from seeds) and the animals do not eat it. In addition to these advantages, after 2 years it is possible to collect the seeds for oil production. This oil can initially be used for lamp oil or for making soap. Later when the production is greater it is possible to make bio diesel from this oil.
Read more about jatropha as an energy-producing plant in section 44.

Jatropha gossypiifolia
(Bellyache bush)
A different species of jatropha exists which is used in various parts of Southern Africa. It grows more slowly and is not as tall as the *Jatropha curcas*. However, it can still be used to make closed fences if properly pruned.

Finger euphorbia
(*Euphorbia tirucalli*, pencilbush - Photo in section 34 - biopesticides)
Not fast-growing in semi-arid areas.
BE CAREFUL: the extremely toxic latex (milk) exists in all parts of the plant. When in contact with skin it provokes lesions that can end up as water blisters on the skin.

"Espinhosa"
This plant is often used in Mozambique for living fences. The plants grow well - especially in sandy ground. It is easy to propagate from cuttings. It has long thorns, and therefore the animals do not like it.

Information taken from the Agromisa manual entitled "Agrosilvicultura." Many other publications can be found on their website: www.agromisa.org

37 • Seed Priming

Every year, mankind relies on the miraculous transformation of seeds into plants and back into seeds again. About 60% of all food crops are grown anew from seed each year, producing more than 2.3 billion tonnes of grain.

Yet few people realise how fragile this transition from seed to plant can be. To grow successfully seeds must germinate and seedlings must emerge quickly and uniformly throughout the field so that light, water and soil nutrients may be used with maximum efficiency.

If crops emerge and grow slowly after germination, they often become stunted and sickly. Because such plants are easily damaged by pests and diseases, they produce less grain and straw. Giving crops a good start is therefore of crucial importance.

In Southern Africa unpredictable and erratic rainfall, poor soils and low quality seed all contribute to a situation where good crop establishment is often the exception rather than the rule.

Once sown, seeds spend a great deal of time just absorbing water from the soil. If this time is minimised, seed germination and seedling emergence can be significantly speeded up. The easiest way to do this is to soak seeds in water before sowing. This is not a new idea - the technique has been used by farmers from Nepal to Botswana for generations, but it has never been used on a regular basis.

Researchers from the Centre for Arid Zone Studies (CAZS) have calculated safe limits - the maximum length of time for which seeds can be soaked and which, if exceeded, could lead to seed or seedling damage - for a wide range of tropical and sub-tropical crops. By reducing the recommended soaking time to less than the safe limit, they were able to promote on-farm seed priming as a low-cost, low-risk intervention.

Primed mungbean at right - Pakistan

The results were remarkable. Farmers reported that primed crops emerged faster and grew more vigorously. In many cases crops also matured earlier and grew taller.

No cases were reported where priming was worse than not priming.

Overnight soaking has been shown to be effective, although a superior response is often obtained from soaking rice and maize for 18 hours.

Farmers can prime their own seed if they know the safe limits. These safe limits are calculated for each variety so that germination will not continue once seeds are removed from the water. Primed seed will only germinate if it takes up additional moisture from the soil after sowing. It is important to note this distinction between priming and pregermination - sowing pregerminated seed under dryland conditions can be disastrous.

Maize in India with primed seeds at left

In most cases seed can be primed overnight and is simply surface-dried and sown the same day. Apart from swelling slightly and weighing more, primed seed can be treated in the same way as non-primed seed.

Occasionally, sowing may be unavoidably delayed - by heavy rain for example. If primed seed is surface-dried and kept dry

it can be stored for several days, then sown as usual and still perform better than non-primed seed.
The fast germination results in rapid development of the seedling's root systems while the soil conditions around the seed are still good. With nothing to stop the seeds from growing, the results are vigorous crops.

Steps in seed priming:

1. Soak the seeds when you are ready to sow
2. Soak maize for 12-18 hrs. Sorghum for 10 hours. Cowpea for 8 hours.
3. Make sure they are not soaked longer than the given hours. If they continue to take up water they will start to germinate and you might lose the seeds!
4. Surface-dry them the next day by either drying them with cloth or placing them in the sun.
5. Sow them the same day.
6. If you cannot sow because of bad weather, the seeds can be stored in a dry place for many days.

Photos and information are from the website of the Centre for Arid Zone Studies (CAZS), Bangor, UK:
www.bangor.ac.uk/priming

Results of seed priming for various crops

Crop	Number of hours soaked	Countries	Best improvement %
Wheat	12	India, Nepal, Pakistan	37 %
Barley	12	Pakistan	41 %
Rice (non irrigated)	12-18	India, Nigeria, Gambia, Cameroon	70 %
Maize	12-18	India, Nepal, Pakistan, Zimbabwe	22 %
Sorghum	10	Pakistan, Zimbabwe	31 %
Millet	10	Pakistan	56 %
Cowpea	8	Bangladesh, India, Nepal, Pakistan	50 %