FOOTSTEPS

No.7 JUNE 1991 HOME GARDENS

Small Gardens for Food Production

by Dr Pamela M Goode

And God said "Let the earth put forth vegetation, plants yielding seed, and fruit trees bearing fruit in which is their seed, each according to its kind upon the earth." And it was so. And God saw that it was good.

Genesis 1:11–12

In many parts of the world there is a struggle to provide sufficient food for the family, especially staple foods. In general, food crops are grown either on a large scale under farming conditions, or on a small scale in a garden near the home. Home gardens are most common in South East Asia and West Africa and can be of great importance in improving the variety and nutritional value of the family's diet.

Home gardens have the following features:

- They are small and sometimes fenced.
- The plots are close to the house.
- A mixture of annual and perennial crops are grown closely together.
- The land is cropped heavily.
- The land is cultivated several times a year.
- The land is always under cultivation.
- Hand tools are used to cultivate the crops.

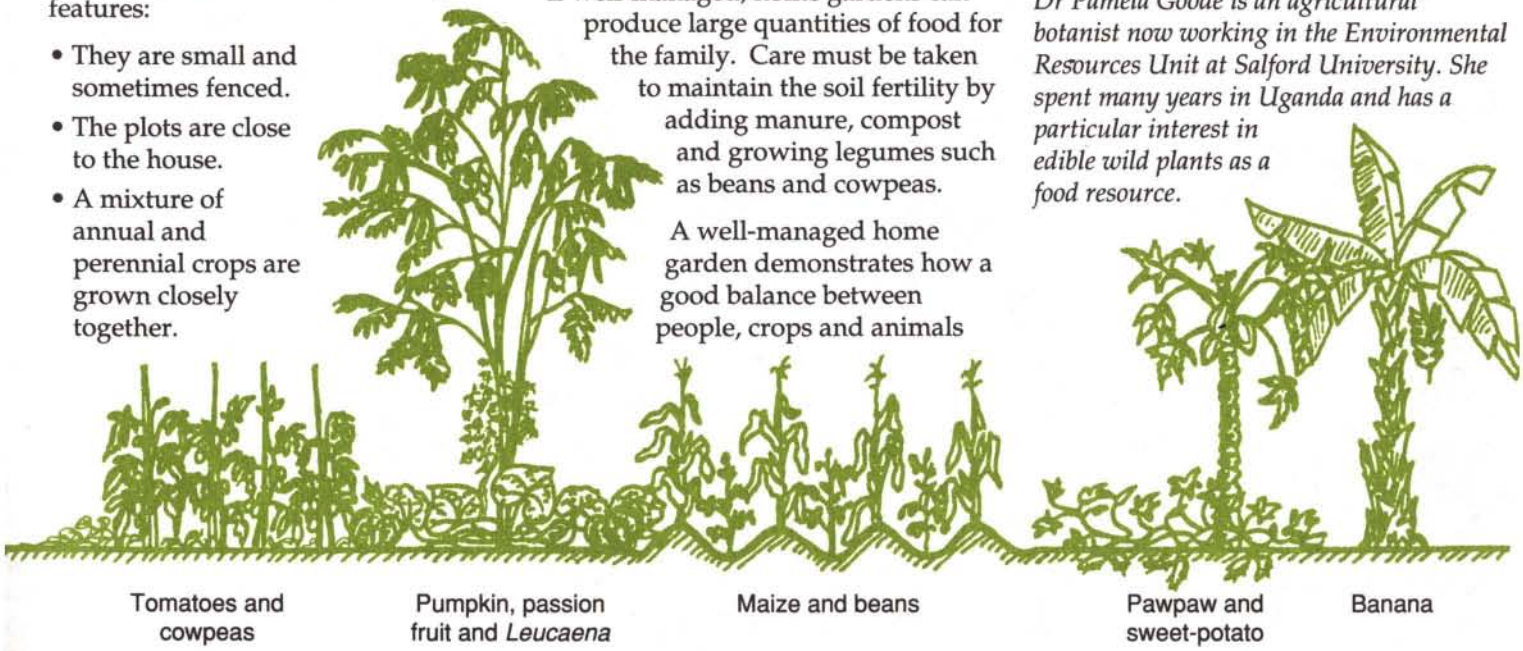
Most home gardens have a mixture of trees (for fruit or firewood), perennial crops such as cassava and pigeon peas, many varieties of vegetables, some staple crops such as yams, maize or sorghum and ground covering plants such as beans and cowpeas. Plants are usually grown mixed together to make the best use of the small space available. So there may be a plot of maize, tomatoes and beans growing around banana and pawpaw trees. Small livestock, such as chickens, rabbits and ducks may also be part of the home garden.

If well-managed, home gardens can produce large quantities of food for the family. Care must be taken to maintain the soil fertility by adding manure, compost and growing legumes such as beans and cowpeas.

A well-managed home garden demonstrates how a good balance between people, crops and animals can be achieved. This, I believe, is the key issue in our understanding of the stewardship of God's creation. God made the world and "He saw that it was good".

Dr Pamela Goode is an agricultural botanist now working in the Environmental Resources Unit at Salford University. She spent many years in Uganda and has a particular interest in edible wild plants as a food resource.

IN THIS ISSUE



FOOTSTEPS

Footsteps is a quarterly paper linking health and development workers worldwide. Tear Fund, publisher of Footsteps, hopes that it will provide the stimulus of new ideas and enthusiasm. It is a way of encouraging Christians of all nations as they work together towards creating wholeness in our communities.

Footsteps is free of charge to individuals working to promote health and development. It is available in English, French and Spanish.

Readers are invited to contribute views, articles, letters and photos.

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TEAR FUND
CHRISTIAN CONCERN IN A WORLD OF NEED

Improved farming for better nutrition

by Martin Rowland

KAGANDO RURAL DEVELOPMENT CENTRE is situated in the foothills of the Ruwenzori Mountains in Western Uganda. It started as a small hospital in 1965 and has continued to grow and develop since then.

A community health project was established and it was observed that the nutrition of the local people was sometimes poor. This led to the beginning of an agricultural extension programme, eight years ago, with the aim of helping people grow a better variety of food crops and improve other aspects of their agricultural activities. Equal emphasis is placed on three subjects:

• Care of the environment • Cash crops • Food crops

We include providing firewood in "Care of the environment", and encourage farmers to plant trees to provide firewood for the future.

THESE THREE SUBJECTS are often closely related: for example, a crop of beans obviously provides food for the family but, if they are grown well with a good yield, the surplus can be sold as a cash crop. In the same way, when using a mulch to conserve water and increase the yield of tomatoes, soil erosion is also reduced, thus protecting the environment. So, instead of encouraging just one aspect of agriculture such as food crops, we try to encourage farmers to be aware of all three aspects and to see the links between them.

Regular weeding and crop inspection is vital.

Members of the agricultural extension team travel from Kagando to visit nearly forty groups of farmers in the surrounding area. Because Kagando is situated in the foothills of a large mountain range, the land is hilly and sometimes quite steep. Soil erosion is a common problem. The growing population increases the pressure on land. Land is often used repeatedly without resting, resulting in reduced soil fertility and increased soil erosion. The demand for firewood results in many trees being cut down, again increasing the possibility of soil erosion.

The rains are usually good and reliable and there are two growing seasons each year. In general, the soil is fairly fertile and a wide range of crops can be grown. The staple food crops are matoke (bananas), cassava and beans. Traditional cash crops of coffee and cotton are common. Oil-seed crops such as sesame and sunflower are increasing in popularity. Kagando is able to process the sunflower seed into cooking oil. About 40 tonnes were processed last year.

As people have learnt from the community health programme about

the importance of a balanced diet, many have been keen to learn how to grow crops such as soya, tomatoes, vegetables and various different fruits that can improve the diet. These crops can be grown close to the house and need only small areas of land in order to produce a reasonable amount of food. Indeed, some crops need virtually no land – passion fruit can be grown up existing trees which provide a good framework and enable heavy cropping to be achieved.

The community health workers and agricultural extension workers at Kagando teach people the importance of good nutrition. They show them how they can provide suitable foodstuffs from the small amount of land they have available, to provide a satisfying and balanced diet.

Yowasi Kamalha is the extension worker responsible for visiting the forty groups of farmers. He travels daily to different groups, visiting each group every five or six weeks. Members of the groups express appreciation for the help they are receiving and the knowledge they are gaining both about agriculture and about the Bible, as a result of the Bible studies that are held at each visit.

Yofesi Rwabulyanga is a farmer and member of one of the groups in the agricultural extension programme. He lives in the hills about ten kilometres from Kagando. He talked with Yowasi about his involvement in the programme:

❛ During 1986 some visitors from Kagando came to visit me at my home in Kantale. They told me that the aim of the Kagando Agricultural Extension Programme was to give information on how to improve crop production and other agricultural topics. After this visit, I started growing tomatoes on a small scale. Before I grew my own, I had to buy from the market – now I even manage to sell the surplus ones. I managed to buy a good kettle and clothes for myself and my family, as well as having a healthier diet.

My home is on the hillside and I have about half a hectare of coffee next to my house. It was not yielding well and I asked the people from Kagando for advice.

FROM THE EDITOR

OUR HEALTH is affected by what we eat. Without a healthy, balanced diet, we will not have healthy bodies able to fight off diseases. In this issue we are looking at ideas to help with farming for better nutrition.

As Dr Pamela Goode reminds us, God was pleased with his creation. We are to be good stewards of the land which we have. Productive home gardens are one way of ensuring not only that we are caring for the land and maintaining the soil, but also producing a varied and nutritious diet for our families. In some parts of the world, home gardens are not common, but most people will find that the ideas in this issue can be adapted to their own situation.

Maintaining soil fertility is vital for continued good yields. Try out some of the techniques on your own land. Rainfall is something about which we can do little, but the simple rope-washer pump may help to irrigate land during dry periods. The idea of inoculating legumes may be new to many, but this is a simple technique which can greatly increase production and improve the soil.

If you are involved with primary health care, consider how you could include gardening for better nutrition as part of what you teach.

Thank you to those who have written in with contributions. In future issues we will look at mother and child care, sanitation and small livestock. Please write in and share with us any useful comments you may have on these subjects. With our new readers in Spanish and French speaking areas, *Footsteps* now reaches a very wide range of countries. Ideas which are useful in your country, may be new and helpful to readers elsewhere.

Isabel Carter

They suggested that the soil was thin due to soil erosion and that I should dig contour ridges. They also advised that trees such as *Leucaena* and *Sesbania sesbans* should be planted on the ridge to make it stronger. I did these things and there has been a big change. The coffee is now healthier and more productive.

The agriculture team from Kagando have continued visiting our group since 1986 and given further advice and teaching about a variety of subjects. They taught us about keeping bees and I now have four local log hives and one improved box hive. My family have benefited by getting honey for home consumption and the surplus honey is sold to earn money for other home uses.

I am grateful for the work being done by the agriculture team from Kagando and I hope to continue improving my agricultural practices. ❜

Martin Rowland works with Tear Fund in Kagando, Uganda.

Wild edible plants and leafy vegetables

by Dr Angelika Dietz

WILD EDIBLE PLANTS and leafy vegetables often make an important contribution to the diet, particularly in a rural population. This can often be overlooked by community workers. The role of wild edible plants in the diet is described here for the subsistence farming community of Magar, living in a remote area of the mid-west region of Nepal.

The staple food of this group was maize. They also ate some rice, millet, wheat and pulses. Meat (mainly pork) was consumed only occasionally on a few festival days during the year. Milk and milk products were rare. If available, they were given first to the children. Most of the eggs were used for hatching. The meat of chickens was reserved for guests or for religious ceremonies. Vegetables were traditionally grown in fields around the village. Pumpkins and their leaves, rape leaves, radish and its leaves, potatoes and taro (a kind of yam) as well as snake gourds, sponge gourds and bitter gourds were the main vegetables consumed.

On average, people had enough to eat from what they grew in their fields, for eight to nine months of the year.

THESE LEAVES ARE GOOD FOR YOU!

Amaranth (tropical spinach)

Winged bean leaves

Pumpkin leaves

Taro (*Colocasia*)

Cassava leaves

Wild growing ferns

But during the dry season from February to June, many people had to purchase staple foods. This time of food scarcity was also a time when people had to work very hard in cultivating their land. Money to buy food came from the sale of goats, spices, fruits and handicrafts.

People who did not have the funds to buy sufficient food to feed their families had to dig for starchy roots in the forests. But most families also picked leaves and flowers in the forests to improve their diet of starchy food. Although they did this in the hot, dry season before the monsoon, many of the wild plants grew new shoots and flowers at that time.

In a detailed study carried out by the author, at least 24 different wild edible plants were identified, which were collected and eaten by village people. These fruits and vegetables were not only improving the taste of the diet, but they also provided vital nutrients.

Almost all green leaves are a good source of protein, vitamins and minerals, but dark green leaves usually have a greater food value than light green leaves. For example, dark green amaranth, which grows wild in many parts of the world, is more nutritious than pale green European cabbage. The protein value of leaves

People with special needs...

should eat the amounts of cooked green leaves listed below each day:

Children, 4-6 months to 2 years (soft leaves with no stems are the best)	1-2 tablespoons
Children, 2-5 years	$^1/_4$ cup
Schoolchildren	$^1/_2$ cup
Pregnant women	$^1/_2$ cup
Nursing mothers	$^1/_2$ cup

As an example, two cassava leaves, which contain sufficient provitamin-A for one child per day, will reduce in size after cooking to just one tablespoonful.

can be relatively high – about equal to that of seeds – if calculated on a dry-matter basis. Problems due to vitamin deficiency were unusual among the Magar, due to the high vitamin A and B content of the wild edible leaves.

An average portion of leaves of 100g provides sufficient iron for a small child each day and contributes considerably to the recommended intake of an adult. Some green leaves of very good nutritional value are shown above.

Usually, special methods of preparation and cooking of local vegetables have developed by experience, over generations, to make them edible. Most green leaves need only a short cooking time, either in a small volume of salty water or when stir-fried.

Some leaves, such as taro or cassava, are very bitter or cause the mouth to itch or burn. They need to be prepared in a special way:

1 Wash leaves and place in a pot with enough water to cover.
2 Bring to the boil and boil for 5–10 minutes with the lid off.
3 Drain the water off and throw it away.
4 Add enough fresh water to cover the leaves again, add a little salt and spices as desired, put a lid on and steam gently until tender (15–20 minutes).

The Magar use a similar method to prepare taro leaves – the leaves are not cut into pieces, but rolled and the ends tied together. Then they are well cooked in water, without stirring.

Leafy vegetables with dark green leaves should be grown in all home gardens. Wild edible plants play an important role in the diet of many communities in developing countries and their use should be encouraged. But one should be aware that they can thrive only when their environment – the forest – is saved.

Dr Angelika Dietz is a nutritionist who has worked in Nepal.

WARNING
Some leaves can be highly toxic. Local wisdom should always be respected.

ECHO FOR YOU

by Dr John Townsend, Medical Director of ECHO

AN ANXIOUS MOTHER brought her child to me: "What's the problem?" I asked. "She pushed a hard black bean into her ear three days ago and it won't come out. Now it's really hurting her."

They sat, forlorn, on the wooden bench in the rural clinic in Thailand where I was working. The two year old girl crouched on her mother's knee, crying and pulling at her ear.

With careful examination I could see the bean, but none of my three different types of forceps was any good: one was too big, one too small, and the third could not go far enough into the ear.

Only one kind of forceps would have done the trick – and I didn't have one. That left all three of us upset. I referred them to a hospital a day's journey away – not knowing if they would even go.

That same year, 1966, ECHO was born: its task has been to get exactly the right instruments, at low prices, to those who urgently need them in remote areas of the developing world. We supply the basic essential medicines for village health workers.

Does your programme need solar-powered vaccine cold chain carriers? We have them. Has AIDS affected your community? We have low-cost HIV testing kits and support materials like syringes and gloves.

Most recently, with the Diocese of Central Tanganyika and Tear Fund workers Sam and Gill Rutherford, ECHO has been involved in starting a workshop to train Tanzanian hospital maintenance men in the repair of the right equipment for the right job.

Please write, telex or fax us for more information. Better still, visit ECHO when you're in the UK.

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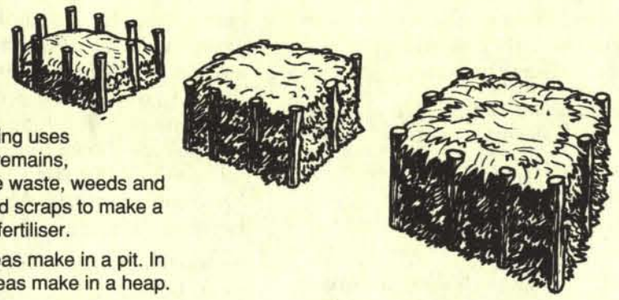
Sam Rutherford training a technical student in Tanzania.

MAINTAINING SOIL FERTILITY

Compiled by Isabel Carter

Soil used for growing crops must have plant nutrients and organic matter added in order to maintain the fertility and quality of the soil. Soil which is well cared for will continually produce good yields. If plant nutrients and organic matter are not added, soil will become exhausted after a few years, and yields will drop. Chemical fertilisers will add plant nutrients, but are expensive. The methods on this page are inexpensive and will add both plant nutrients and organic matter to the soil.

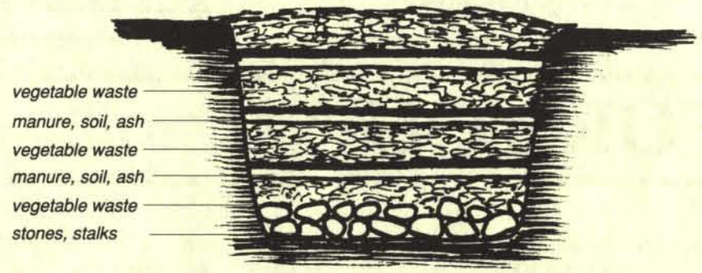
COMPOSTING



Composting uses old crop remains, vegetable waste, weeds and household scraps to make a valuable fertiliser.

In dry areas make in a pit. In wetter areas make in a heap.

The compost is built up in layers. First, some large stones are placed at the base for drainage, then a first layer of loose stalks (eg of maize) is made to let air circulate. Layers of vegetable waste are then added with small layers of manure, soil and ash in between, if these are available.



The heap builds up until about one metre in depth. Keep damp – **not** wet. Add water if the heap becomes too dry. Cover with plastic sheeting, sacking or matting to keep off rain.

Turn the heap after a few weeks.

The compost is ready to use usually within one or two months when it is brown and crumbly.

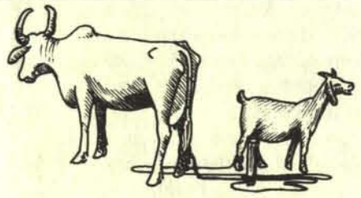
Old stalks of maize, sorghum and cassava should not be added to compost heaps unless they are well chopped up. Leave these to rot down in large heaps – either in the field, at the edge of fields, or along the contours.

Advantages
- *A rich plant fertiliser from material that would otherwise be wasted*

Disadvantages
- *A lot of work*
- *Not appropriate for large areas of land*
- *Rats or snakes may be a problem*

MANURE

Pen or tie up animals at night. Collect the manure regularly and store in a heap.



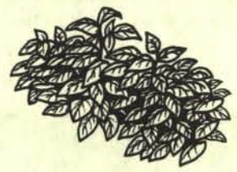
Provide chickens with simple perches so that the manure will collect in one place, making it easier to gather.

Store manure in heaps. Protect from rain and sun either by a simple shelter or by plastic or sacking. Without protection many of the plant nutrients will gradually be lost. Store for one to three months before using on the soil.

Advantages
- *An excellent fertiliser if available*

Disadvantages
- *Adequate quantities rarely available for large areas of land*
- *Fresh manure may damage growing crops*

GREEN MANURING



Green manuring means planting a crop **not** to harvest – but to improve the soil. Seed is sown close together and after 4-6 weeks of growth the young plants are ploughed in. Green manuring can add a lot of organic matter to the soil, and if the crop is a legume, nitrogen will also be added.

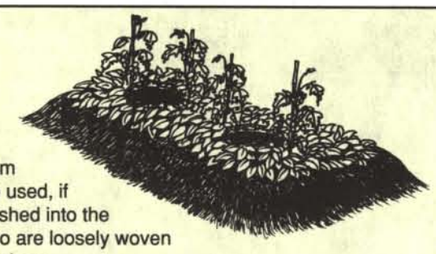
Alley cropping is another useful method of green manuring (see *Footsteps No.5*, p4).

Some recommended species:
- **Stylosanthes gracilis**
- **Phaseolus acutifolius**
- **Indigofera hirsuta**
- **Centrosema pubescens**
- **Mucuna pruriens**

Advantages
- *Excellent for badly eroded or exhausted soil*
- *Useful for large areas*
- *Protects from soil erosion after main crop is harvested*
- *Little labour involved*

Disadvantages
- *Cost of seed is high (except with alley cropping)*
- *In very dry areas, moisture will be taken from the soil and the main crop will not grow so well*

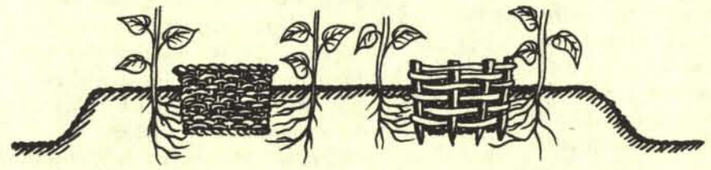
BASKET COMPOSTING



Holes are dug in the soil 1 metre apart, 30 cm in diameter and 30 cm deep. Old, broken baskets can be used, if available. Small stakes can be pushed into the soil, and old crop stalks or bamboo are loosely woven in between the stakes to make baskets.

The baskets are then filled with weeds, crop waste, manure as available. All watering is done through the baskets to wash the plant nutrients into the soil. Crops are planted all around the baskets and their roots will grow towards the baskets.

When the crop is harvested the contents of the baskets are dug into the soil.



Advantages
- *Not much work involved after baskets are made*
- *Plant nutrients are immediately available*
- *Useful for small areas*

Disadvantages
- *Not appropriate for large areas of land*

MANURE TEA

This method provides a valuable liquid fertiliser in only 2 weeks.

Fill a sack (not plastic) with fresh manure and tie it up. Place in a large drum and fill with water. Leave to stand for about 2 weeks. Use this liquid to water vegetables, diluting with at least half water.

After use, the manure in the sack can be added to soil or compost.

Start again with fresh manure and water. Because of the risk of disease, pig manure should not be used for this method.

Advantages
- *Useful for small quantities of manure*
- *Quickly available*

Disadvantages
- *Useful only for small areas*

MULCHING

The soil around growing plants is covered with a layer of organic matter (e.g. rice husks, straw, grasses).

Advantages
- *Keeps the soil moist*
- *Adds organic matter to the soil*
- *Prevents soil erosion*
- *Reduces weeding*
- *Keeps soil cool*

Disadvantages
- *Termites may be a problem (keep mulch away from stem)*
- *Useful usually only for small areas*

LETTERS

Empowering people

It is with interest that I have been reading your magazine, *Footsteps*. It is indeed a thought-provoking paper aimed at creating a sense of communion with others, thus empowering people to listen to others in a variety of ways within the wholeness of creation.

Gabriel J Bagui, URTNA Family Health Broadcast Project, Nairobi, Kenya

In the dark

I am working as a nutritionist in Western Ethiopia and am always interested to read your publication in order to get new ideas for our work here. Since the beginning of 1989 I have been assessing local nutrition-related problems and trying to find solutions. While reading your article about traditional beliefs during childbirth in rural Peru, I realised that we have some similar problems here.

Here women stay in bed in a dark room after childbirth for at least two weeks. In this culture we even see a special advantage for the women to get some rest and attention. The neighbouring women will come and bring food in turn. The work-load of a woman in the country is so high that we appreciate this culture. The biggest problem is that the baby often doesn't get enough sunshine because people are afraid of the evil spirits outside. The child is always totally covered while being carried outside, and the women prefer to leave them at home when they go to the field or market place.

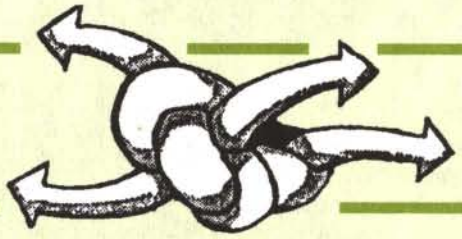
Veronika Scherbaum, PO Box 56, Addis Ababa, Ethiopia

Cooked tree seeds!

In *Footsteps No.5* on Forestry, the middle pages contained information on establishing tree nurseries. In order to encourage certain tree seeds with hard coats to germinate, readers were recommended to soak some seeds overnight in very hot water. Readers might think that the water should be kept warm all night – which would not help either the seeds or their firewood supply! The seeds should be placed in hot water – which is then allowed to cool.

Dr Julian Evans

KNOTTY PROBLEMS



ANASTAUSIA WAS COUNTING THE DAYS until her baby would be born. Would it be a boy? A fine son to give her husband? Her mother kept watching to see signs of the pains starting. Was that one? She thought it was, perhaps not... There! – another one. But so few, with so long in between them.

The baby moved within her as if to say "I'm alright". Her mother sighed and left the hut. Two hours later she returned. "I've been to see the medicine man" she said. "Chew this root – the pains will come and your son will be born".

Anastausia chewed the root. The more she chewed, the more the pain came. The baby kicked her – did he not like the pain? But soon he would be born, her son, her husband's first-born. She chewed, the pain increased and the baby stopped kicking – had he gone to sleep? Then the pain suddenly got worse. Could she bear it? Everything was going black.

They carried her to the hospital. The doctor spoke to her husband. The medicine she had chewed from the medicine-man was too strong. The womb had burst, the baby was dead. She must operate on Anastausia to remove the baby and stop the bleeding. He and his brother must give blood, otherwise Anastausia too might die.

They gave blood, the baby was removed and given to his father, his firstborn son, dead before he had ever lived.

This is a true story sent in by Dr Heather-Louise Williamson who worked in Western Kenya. Can readers help with solutions to the difficulties of working in an area where both the medical doctor and medicine man or witch-doctor are often tried out in turn?

BIBLE STUDY

by Peter Batchelor

Responsibility to God and to our neighbours

Read Deuteronomy 6:4–5, Genesis 1:26 and 2:15.

These verses all teach us something about our responsibility and duty towards the land and other things created by God. Discuss the part that God expects us to play. What does this mean in practical terms in our own lives?

When we work in our farms and gardens, look after our animals and care for the sick, on whose behalf are we really working? See Psalm 24:1-2.

When we, or our children or neighbours are sick, or unhealthy because they are not properly fed, who is most concerned?

In which ways is it possible for us to spoil things that belong to God? How can we learn to be faithful stewards?

Read Proverbs 30:7–10.

What should be our attitude to:

- What we get from the land?
- The way we treat other people, especially those less fortunate than ourselves?
- Money?

Our reasons for wanting to improve our health and farming are not just in order to raise our standards of living – it is so that we can glorify God in everything that we do.

Peter Batchelor is a consultant with RURCON.

Agriculture in African Farming Communities

by Hugues Dupriez and Philippe De Leener

English Edition, 1988 (294 pages)
ISBN 0-333-44595-3

French Edition, 1986 (282 pages)
ISBN 2-87105-000-7

An excellent book, full of illustrations on agriculture, crops and soils in African farming communities. It is aimed at rural workers, extension agents and students.

African Gardens and Orchards

by Hugues Dupriez and Philippe De Leener

English Edition, 1989 (333 pages)
ISBN 0-333-49076-2

French Edition, 1987 (354 pages)
ISBN 2-87105-005-8

Another excellent book, also illustrated on every page. It is full of details about growing vegetables, fruit trees and spices in Africa. It contains details of maintaining soil fertility, crop growth, pruning, grafting, pest and disease control, propagation methods, sowing and transplanting. It is aimed at rural workers, extension workers and students.

Both of these books are part of the CTA *Land and Life* series. They are available completely **free of charge** to field workers in Africa in either English or French.

They would be a very valuable resource for anyone working in agriculture. Write to:

Technical Centre for Agricultural and Rural Co-operation (CTA), Postbus 380, 6700 AJ Wageningen, The Netherlands.

Two Ears of Corn

by Roland Bunch of World Neighbours

(250 pages)
ISBN 0-942716-03-05

This is a very useful and practical guide to people-centred agricultural development. It gives well-tested guidelines for planning, encouraging participation and appropriate technology inputs.

It is available in English, Spanish and French at a cost of US $9.95 (including postage) from:

World Neighbours
5116 North Portland Avenue
Oklahoma City, OK 73112, USA.

PRIMARY HEALTH CARE COURSES

Introducing Primary Health Care in Developing Countries

This is an introductory one week course for health workers providing a basic introduction to primary health care in developing countries. It will be run by AHRTAG and BOMs and based in London. Contact:

AHRTAG, 1 London Bridge Street, London, SE1 9SG, UK.

A New Course in Health Education/Promotion for Primary Health Care

This is a new, three-month course to improve skills in health education and promotion. It is aimed at health, education, agriculture and community workers, who already have some experience of working in health education/promotion.

The first course will be held in January 1992 and then annually, based at the Liverpool School of Tropical Medicine, UK. Methods of teaching will include groupwork, practical workshops and individual project work.

For further information write to:

The Course Organiser (Health Education/ Promotion for PHC), Department of International Community Health Liverpool School of Tropical Medicine Pembroke Place, Liverpool, L3 5QA, UK.

Post-graduate Diploma course: Forestry for Rural Development

This is an eight month course based in Holland for foresters, extension officers and others involved with rural development. It covers a wide range of forestry techniques and extension methods and encourages use of indigenous knowledge.

Some fellowships are available to applicants from developing countries. Write to the editor for more details.

TECHNOLOGY FOR

GARDEN IRRIGATION

by Robert Lambert

LIFTING AND CARRYING water in buckets or cans to irrigate crops is very hard work and can take a lot of time. In Zimbabwe, some families spend up to 200 hours per month on this exhausting job. This can mean three to four hours every day for two or three people in the family. The only alternative presently available is a diesel or petrol pump – out of reach of most small farmers because of the high cost, the problems in obtaining fuel and spare parts and the need to have a lot of land to justify such a large investment.

A solution?

To deal with this problem, simple pumps for garden irrigation have been developed under a research project funded by the Overseas Development Administration and based at Loughborough University of Technology and the University of Zimbabwe. These pumps are now being used by farmers in many parts of Zimbabwe. In some cases the pumps are made by village pump-makers who have been trained in how to make them. The farmer pays for the pump and the pump-maker installs the pump at the farmer's well. This has the advantage of creating jobs for pump-makers and ensuring that the farmer knows who to turn to if there is a problem. In other cases farmers have been shown how to make their own pumps.

Pumps for lifting – Pipes for carrying

A pump can only lift the water from a low point, such as a well or river, to a high point, such as a tank on the ground. An old 200 litre drum is ideal as a tank. The water must then be taken to the crops. Plastic hose piping is a very effective way of doing this. This will save the effort of walking to and from the well.

What do such pumps cost?

One of the simplest and most effective pumps that can be made cheaply is the rope-washer pump. Historically the principle is very old, having been used in Roman times, but it has been adapted to use materials which are now widely available and cheap. For example, in Zimbabwe, with all materials bought at shop prices, the cost of the materials amounts to about Z$70.00 (about UK £15.00). Some farmers have made the pump for less than Z$20.00 (UK £4.00) by using materials available on their own farms.

The rope-washer pump can:

- lift water from open waterholes, hand-dug wells and streams but **not** from narrow machine-drilled boreholes.
- pump up water very quickly when the water is near the surface. A number of farmers in Zimbabwe have made pumps that can fill a 200 litre drum in one minute. Of course, at the end of that minute you would be quite tired! You can have a rest while the water empties from the drum through a pipe onto the vegetable beds.
- lift water from deep wells. Water has been lifted from depths of more than 20 metres. However, in deeper wells, water flows from the pump more slowly because it is harder work.
- lift water into overhead tanks.
- be operated by one or two people at a time.
- cope easily with mud, weeds, etc.
- be easily understood and repaired by the farmer when something goes wrong.

What size garden can be irrigated in this way?

As an example, an area of 0.1 hectares (a little over 30m x 30m) would take about six hours per week to irrigate, or a little over an hour a day, if pumping up water from a 5 metre-deep well. To irrigate such a garden with a watering can would take at least four hours each day.

How does it work?

The pump consists of a continuous rope, with rubber washers attached, which is pulled up through a pipe by means of a pulley-wheel. The rubber washers are slightly smaller than the inside of the pipe. When the bottom of the pipe is inserted in water, the rubber washers, moving upwards, draw the water with them. As they

emerge at the top of the pipe, the water falls into a collecting tank.

What materials are needed?

Pipe, rope and an old tyre are the most important materials. Where available, strong PVC pipe is ideal. Steel pipe may also be used. If piping is unavailable then a square pipe may be made out of wooden boards. Strong water-resistant rope, such as nylon braid, is the best, although ropes made of sisal, manila or even strips of car tyre may be used. Steel bars, strips of inner tube, some poles, wire and nails are also required.

A sharp knife, a hammer, a pair of pliers, a wood-saw and wood chisel and a hack-saw are all the tools required. Although not required, basic welding facilities can improve the quality of the handle.

An experienced pump-maker, with all the materials ready, can make and install the pump in one day.

Training and extension

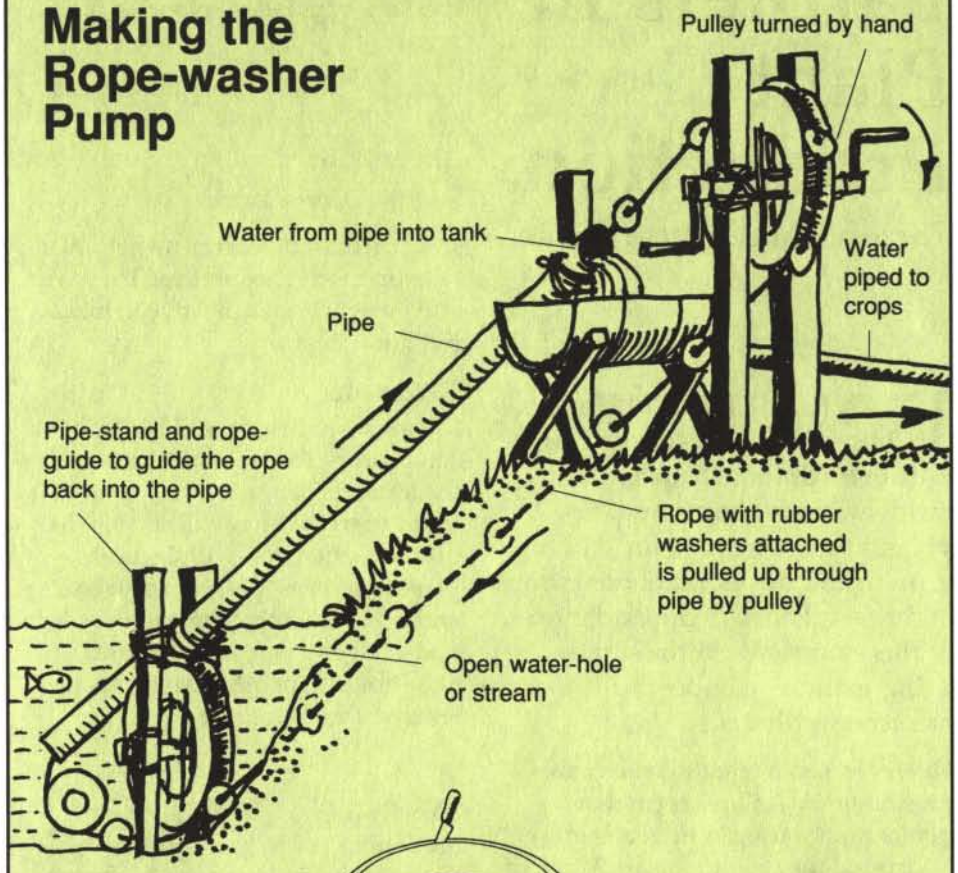
In order to make this technology widely available, good training is required. A detailed manual has been published in English, on the construction of the rope-washer pump. A 20-minute video is available, showing the main steps in making the pump. There is no narrative, so this can be used whatever the local language.

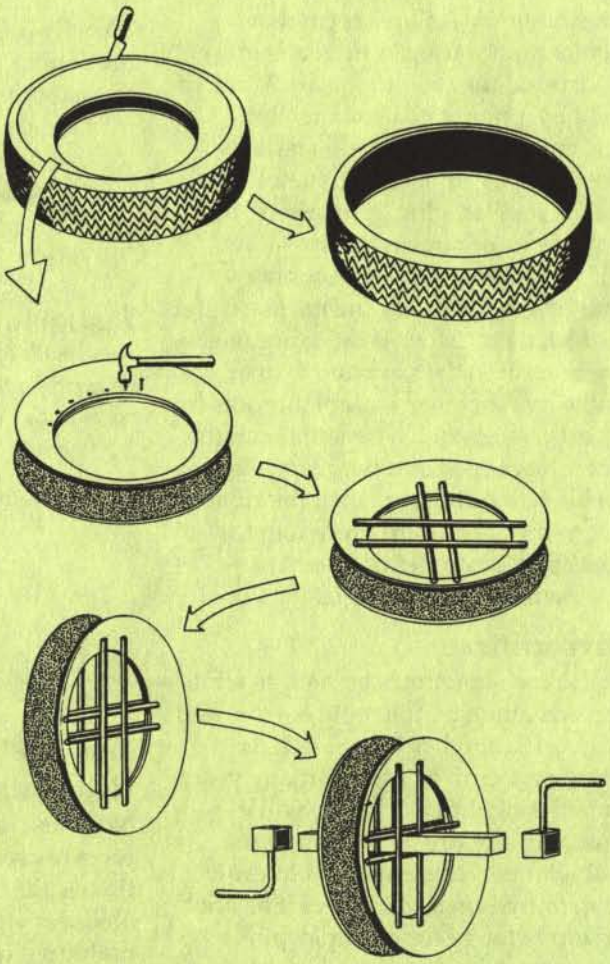
The manual costs £4.95 including air-speeded postage (£5.55 to Far East and Australasia). The video costs £19.95 including postage (£22.25 to Far East and Australasia). Both are available from: *Intermediate Technology Publications, 103 Southampton Row, London, WC1 4HH, UK.*

Training in the construction of the pump is only the first step. Training in garden irrigation for farmers, and in business methods for pump-makers, would also be useful. A number of such courses have already been run in Zimbabwe and more are planned in other countries such as Kenya. For details of such courses and further information about the rope-washer and other simple irrigation pumps please write to:

Robert Lambert, School of Development Studies, UEA, Norwich, NR4 7TJ, UK.

Making the Rope-washer Pump





Pulley construction

1. Cut the inner walls from an old tyre to give the two pulley halves (minimum width 5cm). The outer part is kept for making the washers.
2. Nail the two halves together.
3. Place bars on each side of the pulley to form the hub. These are clamped together by hand and tied tightly with wire near the inner rim of the tyre.
4. Fit the wooden axle, centre it and secure by tying the parallel bars tightly together. Fit handles at each end.

Robert Lambert comes from a farming background and has worked with rural water supplies in Tanzania, Zambia and Zimbabwe. He is at present lecturing in Development Studies at the University of East Anglia.

Partners in Plant Production:

Rhizobia and Mycorrhizae

by Mike Carter

PLANTS, LIKE PEOPLE and animals, need feeding. Plant nutrients (or foods) such as nitrogen, phosphorus and potassium are needed for the growth and development of crops and trees. Farmers can add more of these nutrients to the soil by using manure, compost or artificial fertilisers.

However, some plant nutrients are present in the soil in a form that the plants cannot use. Nitrogen is present all around the crop in the air. Much of the phosphorus in a soil may be difficult for plants to use. These nutrients are of no use to the plants unless they are first "processed" by tiny micro-organisms in the soil. A single teaspoonful of soil contains millions of micro-organisms like fungi and bacteria. Most of these organisms are helpful to the crop and farmer. Some live together with plant roots in a partnership which benefits both the micro-organism and the crop. Crop yields will be higher when the right micro-organisms are present in the soil. Two examples of these are mycorrhizae and rhizobia.

Mycorrhizae

These can sometimes be seen as white threads amongst the roots of trees and crops. If a soil has been used for growing a crop or tree for many years, then the right mycorrhizae will probably already be present in the soil. But perhaps you want to grow a crop or trees in a soil where it has not grown before – for example, pine trees on a hillside covered with grass.

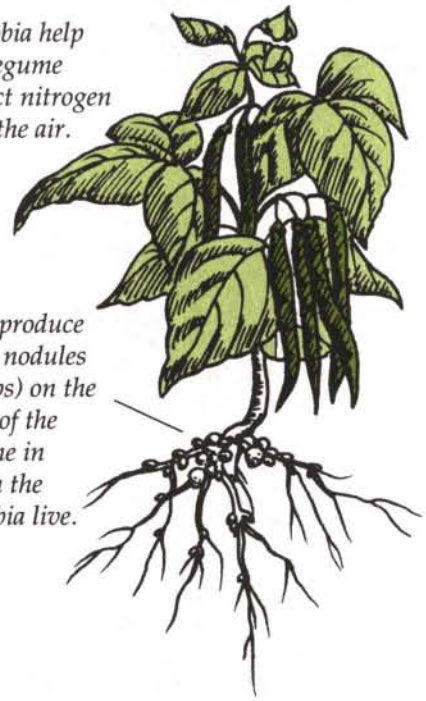
Include in the soil mix that you use to fill seedling bags or boxes, some soil taken from underneath adult trees of the same type. Here, for example, is a mixture used in Nepal for filling seedling bags before planting pine seeds:

1 part	*Unsieved pine forest soil with mycorrhizae*
3 parts	*Sieved soil*
3 parts	*Coarse sand*

In particular, mycorrhizae help plants take up more phosphorus. They will still grow without the mycorrhizae, but not as fast.

Rhizobia

Rhizobia are helpful soil bacteria that can process (or "fix") nitrogen from the air and change it into a form that crops or trees can use. Rhizobia do this in partnership with legumes – plants like peas, peanuts, soyabeans and beans that produce their seeds in pods. Pigeon pea, *Leucaena*, *Acacia* and *Prosopis* are other examples of legume shrubs and trees.



Rhizobia help this legume extract nitrogen from the air.

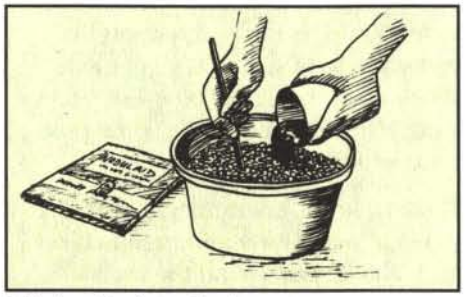
They produce small nodules (lumps) on the roots of the legume in which the rhizobia live.

How do I know if a legume is fixing nitrogen from the air?

Nodules can easily be seen on the roots of crops and trees. Flowering time is the best time to examine them. Nodules vary in shape. Not all nodules effectively fix nitrogen. Effective nodules are plump – cut them open and they are pink, red or sometimes black inside. Ineffective nodules are usually shrivelled, small and green or white inside. Unless the right strain of rhizobia is present in the soil, then effective nodules will not form.

What can I do if a legume is not fixing nitrogen?

This can often happen if you are introducing a legume into land where it has not grown before. The right rhizobia may not be present in the soil. In many countries inoculant of the correct strain can be obtained, perhaps from a farmers store, the Ministry of Agriculture, from a research station or university. Usually the inoculant is mixed with peat. Read the packet label and follow the instructions. It should be kept cool and dry until used. The inoculant is usually mixed with the legume seed in a bowl with a little water, before planting.



Mixing the inoculant.

What if I cannot obtain inoculant?

Obtain some soil from a field that has well-nodulated plants of the crop or tree you want to grow. Try mixing your seed with this soil before planting. Include in the soil some roots with nodules.

Rhizobia and mycorrhizae are friends of the farmer. They can help increase crop and tree production. They improve soil fertility. With the benefits they bring, it is important that the farmer makes use of them.

Mike Carter works for T-CORD at Bishop Burton Agricultural College.

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