

FOOTSTEPS

No.25 DECEMBER 1995

FISH FARMING

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Farming with fish

by Bob Hansford

GOOD FARMERS look after their crops. Before planting they make sure the soil is well prepared. They select good seed or seedlings. They water the young plants regularly and remove weeds. They use manure or fertiliser to increase growth and watch out for pests or diseases. Hard work produces a good crop, but laziness or neglect will result in a poor harvest!

It is the same for farming fish. The fish become the crop, the pond is the field. Weeds are the wild or predatory fish which compete for food or eat the fish. Pests and diseases are there too! Pests are the animals and birds which attack the fish. Diseases are not too common, but patches of woolly fungus sometimes appear on the skin or gills and parasitic creatures may invade the gills or stomach.

A successful fish farmer must provide for the needs of the fish and protect them from their enemies. Farmers who neglect their fish will probably fail!

Fish need...

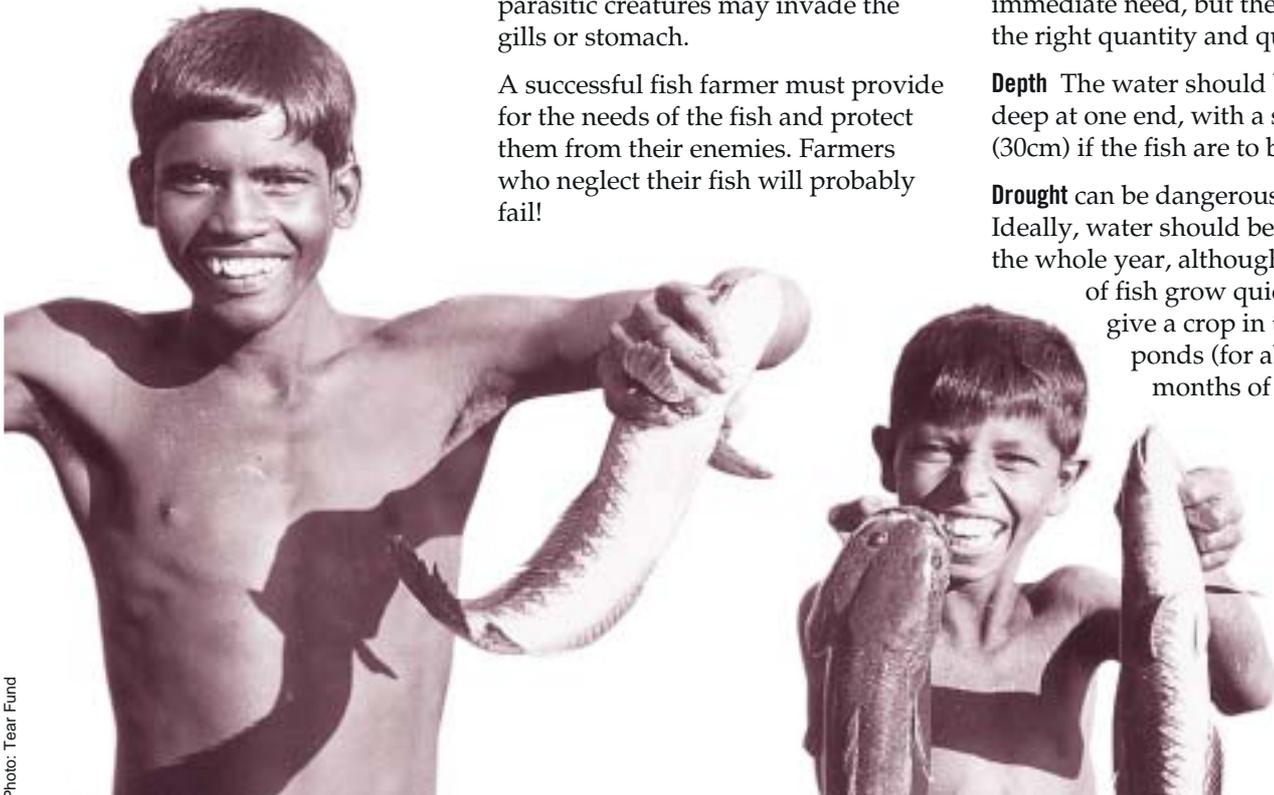
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|----------|----------|
| ■ Water | ■ Food |
| ■ Oxygen | ■ Safety |

■ Water

This is their most obvious and immediate need, but there has to be the right quantity and quality.

Depth The water should be 1–2 metres deep at one end, with a shallower end (30cm) if the fish are to breed.

Drought can be dangerous for fish. Ideally, water should be present for the whole year, although some types of fish grow quickly enough to give a crop in temporary ponds (for about six months of the year).



FOOTSTEPS

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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, Portuguese and Spanish. Donations are welcomed.

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

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CHRISTIAN CONCERN IN A WORLD OF NEED

Photo: J Hurd, SAO



Anxious moments – will there be a good harvest?

Floods may overflow the pond banks during times of heavy rainfall, allowing fish to escape. Make sure the pond banks are high enough to withstand the highest recorded flooding in your area. Fit a screened overflow pipe or channel to take away surplus water.

Water quality depends on substances dissolved or suspended in the water. If the right nutrients are there in sufficient quantity then the pond will produce a lot of microscopic organisms called plankton. Stream water flowing through fertile farmland will be rich in these nutrients and good for the pond. Water from a spring or well may not be so good, depending on the underlying rock.

Will it hold water?

Dig a hole 1–1.5m deep on the proposed site of your pond. If it fills with water from below, the site is likely to give you enough water. If it doesn't fill naturally, pour in some buckets of water. Come back the next day. If the water has gone, then the site is likely to be too dry unless a lining is used (see page 5). If the water is still there, then you may have a suitable site but will need water from an outside source to fill the pond.



Food

There are two sources of fish food: **natural** and **supplementary**.

Natural foods – plants and animals living in the pond and dead or decaying organic material on the pond bottom. Different types of fish eat different natural foods. Some will search along the bottom for insects and worms. Some will eat submerged or trailing plants; others will strain out tiny plants and animals from the water.

Organic fertilisers (compost and manure) are usually the best and the cheapest. Compost is made by mixing vegetable wastes, straw and animal manure in a pile away from the pond. Cover to protect from the rain, and leave to rot for 2–3 months. Sprinkling a handful of triple super phosphate will increase its effectiveness (1 part TSP to 40 parts compost).

Add organic fertiliser once a week to a basket in the corner of the pond. For a pond measuring 10 metres by 15 metres you will need...

- 10kg of compost
- or 5kg of well rotted cattle manure
- or 2.5kg of well rotted chicken manure.

If instead, you choose chemical fertilisers, it is best to seek advice from the government fisheries department, as many different fertilisers are available. As a guide, 150gm of urea and 400gm of TSP would be needed for a 10m x 15m pond each week. Reduce the amount of fertiliser (organic or chemical) in the dry

Measuring the natural foods

The amount of natural food in the pond can be measured by placing your arm in the water until your elbow is at the water surface. If the water is so green that you cannot see your fingers, then there is a lot of food in the water. If your fingers are clearly seen, then you need to increase the natural food by using manure, compost or chemical fertilisers. If the water is so green that you cannot see any of your arm, there may be too many nutrients in the water. Stop adding fertiliser or compost until the water becomes clearer.



Fishing can be enjoyed by all the family!

season, when there is less water in the pond.

Muddy water does not contain much food. It is often seen in new ponds or ponds with bare soil around the banks. Muddiness can be reduced by planting grass on the pond banks and by adding a measured quantity of lime to the water. Consult the government fisheries department for advice. A general guideline is two teaspoons of lime per square metre.

Supplementary foods are brought in from outside as extra feed. The types used will depend on the type of fish and the availability of suitable materials at a cheap price. Examples include:

- rice bran
- kitchen waste and scraps
- termites
- chopped grass
- various oil cakes (some may first need heat treatment to destroy toxins)
- cassava peelings.



How much food? Generally fish will eat about 5% of their weight in supplementary food every day. For example, 100 fish weighing 250gm each (25kg total weight) will require about 1.25kg of supplementary feed each day.

Food should be supplied from the same place each day, preferably half in the morning, half in the evening. Fish will soon form the habit of coming for food. If some food is uneaten, then reduce the amount given the next day.

Keep a variety of fish

Mix the different kinds of fish in the pond (but not predatory ones) so that all the different foods will be used.

■ Oxygen

The unseen need of fish is oxygen to breathe. Fish obtain oxygen from the water as it passes through their gills. Some types of fish (such as catfish) can survive in water with very little oxygen because they can breathe from the air.

The amount of oxygen in the water rises during the day, but falls during the night with the lowest level around dawn.

Oxygen shortage is usually caused by one of the following...

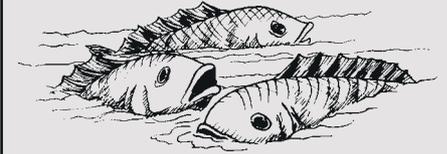
- too much organic matter rotting in the pond (dead leaves, uneaten food, excess compost)
- too many fish
- too many plants or green algae in the water (the water will look very green and there may be a green scum on the water).

Action required...

- Add clean stream water to the pond, taking care to screen or net the inlet pipe. (Well or spring water will not help because they contain very little oxygen.)
- Reduce the amount of food, perhaps stopping altogether for a few days.
- Remove the compost basket, if there is one, from the pond.

Can your fish breathe?

Check your pond each day, early in the morning. If the fish are all at the surface gasping for air, then this means that the oxygen level is dangerously low. The next morning, the fish may all be dead! Action is needed.

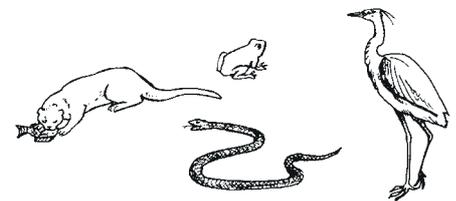


- Harvest some of the fish.
- Beat the water surface with bamboo branches.

Do not enter the pond, as the stirring up of the pond bed may make the problem worse.

■ Safety

Fish need to be protected from their enemies. These include predatory fish, otters (or other fish-eating animals), birds, snakes and fish thieves!



Predatory fish can enter a pond by various routes:

- an open ditch, drain or pipe – so protect using screens, nets or fine fish traps
- mixed with baby fish – examine them carefully and buy from a trusted supplier
- as eggs in the mud at the pond bottom – make sure the pond is dried and treated with lime before filling and stocking.

Otters are known as *udh* in Bengali. You may have other names for them. The only protection is to build a closed fence around the pond or to have a human guard!

Birds can be scared away by people. It is helpful to dig the pond close to where people live or work.

Snakes are difficult to keep out. Try keeping the edges of the pond clear of

long grass or building tightly woven fences.

Thieves usually strike during the night and use nets and other ways of catching fish. Some farmers fix sharp bamboo poles into the bed of the pond or lay tree branches in the water. This makes theft more difficult.

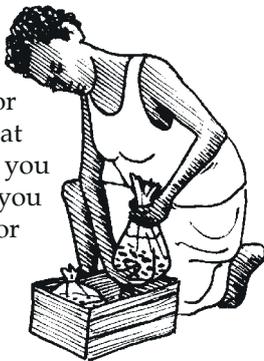
Poisons Fish also need protection against poisons. There are three main sources...

- pesticides – used against insects in the home or field
- cattle/sheep dips – used to control skin parasites
- seeds from trees.

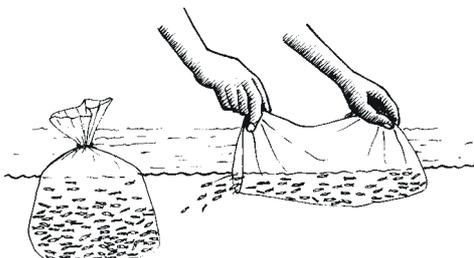
Never wash out a pesticide container or spray machine in or near a fish pond. Cut down the branches of any seed bearing trees which hang over the pond.

Stocking the pond

To get started you will need a supply of fish. Some of the common fish species used are carp, tilapia and catfish. If you are going to have more than one kind of fish, make sure they can live together easily. For example, catfish eat other baby fish. If you keep only catfish you may have to buy or raise small fish to feed them.



Transporting fish is stressful for them and should always be done as quickly as possible. So the closer your fish supply is, the better it is for the fish. When you get your baby fish, leave the container of fish sitting in the pond until the water in the container is the same temperature as the water in the pond. The fish can then be let out very gradually into the pond.



Suggested stocking levels for tilapia...

Fish size	Quantity per square metre	Quantity in 10m x 15m pond
50gm	2	300
200gm	1	150

The number of fish which can live in a pond depends on four factors...

- the size of the pond
- the types of fish stocked
- the size of the fish
- the amount of extra food you are able to give the fish
- the depth of water.

If you have a government fisheries department or other fisheries project near you, ask their advice.

If you stock at a high rate to begin with when the fish are small, you must reduce the numbers rapidly as the fish grow larger. For tilapia, it is recommended that you start with a stocking rate of two per square metre. With Indian and Chinese carp, the stocking rates are lower – less than one fish per square metre (100 in a pond 10m x 15m).

Fish production

This will be determined by the type and number of fish in the pond, the amount of supplementary feeding and the level of management. Typical

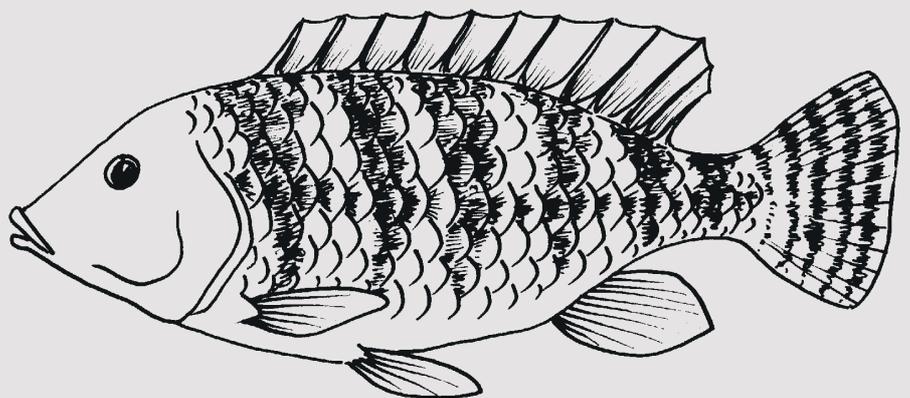
A good pond has...

- green water, 1–2 metres deep
- no large overhanging trees
- grass growing on the banks, cut short to avoid giving cover for snakes
- no floating plants (unless needed for fish breeding)
- screened or netted inlet and outlet pipes
- a fence to keep out otters
- a compost basket in the corner
- a controlled, mixed population of fish

production figures range from 20kg to 50kg of fish per year from a 10m x 15m pond (equivalent to 1,250–3,370kg per hectare per year).

Bob Hansford worked in Bangladesh for six years with Tear Fund. He trained local farmers in fish farming techniques. He is now with the Asia Desk at Tear Fund.

Know your fish!



Tilapia (*Oreochromis* species)

Oreochromis niloticus is considered the best for warm countries.

Sealing fish ponds

FEW FARMERS use aquaculture in Latin America, though it could have great potential there. One of the reasons is that the soils are often too porous – they do not hold water well. It is possible to make artificial linings – using polyethylene or rubber sheets or cement. However, these methods are expensive.

Gleying

There is one way of sealing ponds which does not cost anything. It is not a new method – it was first used in Russia, but has been rediscovered and adapted.

- Dig the pond and compact the soil really well.
- Clear the pond of stones and rocks.
- Cover the bottom and sides with a thick layer (2–3cm) of fresh manure – pig manure is best.
- Cover the manure with a layer of fresh grass cuttings or fine chopped leaves (eg: bananas).
- Add a layer of soil and press down firmly all over. You can use your feet to compact the layers. The soil keeps out the air and allows a biological process known as ‘gleying’ to take place.
- Leave to dry for 2–3 weeks without disturbing the layers. Do not try this during the rainy season.

After 2–3 weeks, fill the pond with water. Tests using this method have been tried with great success in Costa Rica and on sandy soil at ECHO in Florida, US.

You will need to be careful not to disturb the bottom of the pond too much by scooping out the bottom mud, walking or stirring with sticks. Try this

method first on a small pond.

Clay lining

Another ‘traditional’ method of water-proofing a pond was used many hundreds of years ago in the UK. Dew ponds were built on the chalk downs which normally hold no water at all.

- The pond site is prepared as above.
- A thick covering (2–4cm) of lime is added to prevent damage by earthworms.
- Heavy clay is then dug and carried from elsewhere and puddled in with the

feet – beginning work from the centre outwards. The clay layer should be at least 5–6cm thick and must be kept wet all the time.

- As more clay is added, the centre of the pond must be kept filled with water. If the clay is allowed to dry it will crack and leak.

Hundreds of years later, many of these dew ponds are still in use for livestock.

Information on gleying from ECHO, USA and William McLarney and J Robert Hunter. Information on dew ponds from Mike Withers, Bishop



FROM THE EDITOR

If you give a person a fish, they will have food for one day. But if you teach them to fish, they will have food for the rest of their life. ANCIENT CHINESE PROVERB

THIS PROVERB is a very well known one. In some parts of the world – particularly communities living near lakes and large rivers – fishing is part of their traditional way of life. In many other parts of the world, fish farming is a recent idea – maybe even a totally new one. Bob Hansford helpfully compares fish farming to all other types of farming. In this issue we look at small scale fish farming – in ways that would be easy for anyone to try out on a small piece of land. If the idea of fish farming (or *aquaculture*, as it sometimes called) is new to you, we hope this issue will give you enough confidence to try it out for yourself. The resources page gives details of further information, resource centres and training. You may also find your local department of agriculture or fisheries very helpful.

If fish farming is not new to you, maybe this issue will be useful in training and enthusing other farmers. In a world where there is a growing shortage of food, especially protein food, not only do fish provide a valuable source of protein and vitamins, but there are benefits to crop growing, too, from combining fish and crop farming – as we learn from ITAG’s experience. Raising fish or fingerlings can also be a useful source of income.

Fish farming is well suited to community groups. Building the pond is a lot of work – much easier when shared. Harvesting the fish is also fun if a community group are all involved.

In this our 25th issue, the circulation of *Footsteps* has now reached 25,000. This is very encouraging as circulation is only increasing as you, our readers, tell others about it. We now have posters explaining *Footsteps*, together with a promotion pack – ideal to use if you are running a workshop or training course. If you would find one useful please write with details of the event.

Isabel Carter



Bees for beginners

THANK YOU FOR *PASO A PASO*. In issue 10 of the magazine it mentions that many farmers who are unable to keep cattle, instead keep sheep or goats. They provide a source of cash when needed to pay for school fees, hospital bills etc.

Why not think of beekeeping as well? This doesn't require planting and looking after crops, nor herding animals in and out. It's only necessary to decide to keep them and provide them with a hive or box. Then their products can be obtained – honey, pollen, wax, propolis, honeycomb and even medicine from their poison.

Honey has a high nutritional value from childhood to old age. Bee keeping is easy to do – by both women and men. Bees also bring benefits to farming as they pollinate crops and trees, giving more fruit and seeds.

Here in Peru, swarms of Italian bees can be purchased for as much as \$50 but native bees can be found in any corner of the forest, in hollow trees, houses, literally crying to be put in a



Photo: Silas Leiva

The children also help – although they also like to fill themselves up with honey!

box – the operation is called shuffling. It is necessary first to get training from a beekeeper and either buy or make the necessary tools. Bees are very hard working – they work from 6 am until about 6.30 pm. In our community, which is in the jungle, there are plenty of local trees and forest flowers which the bees like. We keep bees on a family basis and find the products easy to sell. Honey should be extracted naturally, never cooked or boiled.

Bees' worst enemies are ants – these can be kept away by spreading hot ashes around the hive. I have found a few difficulties. The bees in our area are very aggressive. I also find it difficult to change the wax in the breeding combs since some of the hives are three or more years old. I would appreciate hearing some new ideas.

*Silas Santiago Leiva
Comunidad Campesina Paz y Esperanza
Apartado 18
Moyabamba
San Martin
Peru*

EDITOR:

Bee keeping is a subject that we plan to look at in detail in a future issue. Please send in your experiences in this subject.

Bamande Pygmy Project

THANK YOU for our copies of *Pas à Pas*. The issues on literacy, the environment and drug abuse were of particular interest. I work with the Bamande Pygmy Project in the centre of the equatorial forest in Zaire. It is not easy for these forest dwellers to understand the dangers facing them if they destroy the forest.

It is very important to understand how the pygmies live and to respect their traditional customs in order to gain their trust. Each group of pygmies is linked to a patron or chairman (*mukpala* in the local dialect). He has authority over them and offers them equipment, food, clothing and other things. The pygmies prefer listening to him than to any outsider.

The pygmies are heavy drinkers and smokers. In particular, they like to smoke Indian hemp. Even small children are encouraged to smoke

because they say hemp gives them strength to work and to hunt. Do readers have any advice about this problem?

*Emilu Ezabo Bob
Bamande Pygmy Project
c/o Green House Nyankunde
PO Box 21285
Nairobi
Kenya*

Rural and urban animation

THROUGH LUCK, issue No.22 of *Pas à Pas* fell into my hands. After studying it, I want to tell you how much I have appreciated it. I hope I can share some experiences in training others through my work with APICA.

I regard animation as the ability of a person or a social group to recognise the reality in which they live – to analyse it, to identify gaps and potential – and then to consider solutions to make it better.

Whether in a rural or urban environment, the aim of the individual or community is identical – to improve living conditions. Often this animation may come from people from outside the area (development workers). Their task is to lead the people to examine and analyse their environment, encouraging awareness which will result in positive activities.

Often development workers ask about the differences in animation between rural and urban settings. At village level, there are often poor communications, lack of organisation in trading and marketing, poor wages, an ageing population due to the migration of young people to the urban areas and few social structures.

In towns, there are differences in social status, unemployment leading to anti-social behaviour and poor social models such as theft, violent crime, prostitution and drunkenness.

It seems that the key differences lie at the level of the problems to be tackled and not in the steps leading to animation. Animation comes through questioning which leads to reflection, then to awareness.

All animation work centres around such fundamental questions as:

- What sort of economic set-up are we considering changing?
- What situations are working against improvements in social and economic conditions?
- What economic mechanisms prevent development of the area?
- What potential resources are there which could be used to encourage development?

The actions and attitude of the animator should be influenced by the state of mind of each social group and their particular surroundings and problems, whether rural or urban. This is the only real difference, I believe.

Philippe Nkounkou
APICA
BP 7485
Yaounde
Cameroon



Problems with alcohol

FOLLOWING ISSUE 23 on drug problems, I would like to share about the problems we have in Karamoja with alcohol. Traditionally we had one type of local alcohol available which was distilled in the towns of Moroto and Kotido. This was called *regular*. A potent brew called *lira-lira* was first introduced in 1986, and now people have shifted to drinking this instead.

Young men began selling off their animals in order to raise cash to buy this liquor – the people here are pastoralists. Elders raised complaints and also say that this strong drink has reduced the fertility rate in the area. Some weaker family members are dying because there is often not enough money left for food.

The authorities (Resistance Councils) are trying to stop the buying and selling of this alcohol but it remains a big problem. Do any readers have any advice?

Peter Buiton
Karamoja Seeds Scheme
PO Box Kotido
Uganda

The footsteps are getting closer

THIS IS A STRATEGY which I have worked out and would like to share with readers. Many communities today find that the difficulties and losses of everyday life have left them vulnerable, powerless and feeling inferior. To challenge this feeling of powerlessness, we need to find approaches that will encourage involvement.

My strategy has three parts:

1. Step by step This encourages communication. It is a democratic process which encourages everyone to express themselves and to develop their thoughts. This process is a slow one in which new ideas are discussed and considered at length.

2. The footsteps are getting closer When trainer and trainees have accepted each other, this will create openings to analyse their situation. If people want to attain power they will have to:

- analyse their strengths and weaknesses
- analyse their resources and potential
- plan to use these resources well
- obtain necessary information.

Our villages have a history – not just of their ancestry, but also the tradition of their constant battling with their environment. This long experience in rural life leads to traditional practices and knowledge. From these traditions may appear new ideas and organisations that may help with tackling environmental problems. This stock of knowledge, together with the capacity to react and adapt to any situation can provide a rich resource. When communities begin to reflect on and organise their potential, one can say, 'The footsteps are getting closer.'

3. The footsteps have merged When groups progress with the organisers towards solutions for solving problems, we can then talk of 'merged footsteps'.

I hope this brief outline of my strategy may help other readers.

Nohoune Lèye
PO Box 10
Khombole
Republic of Senegal

Bottle-feed your trees

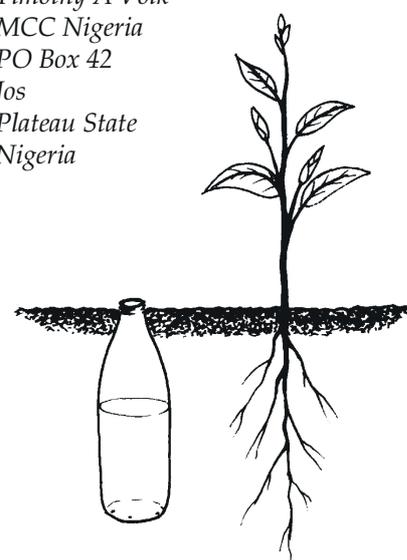
I AM WORKING in Northern Nigeria on a variety of agroforestry and agriculture projects and would like to share a simple technique for watering trees.

The long dry season of 5–7 months makes it difficult to encourage tree planting. Watering trees during the dry season takes a lot of work and needs a lot of water, which is often in short supply.

One way to avoid these problems is to bury a container beside each seedling when it is planted, about 40–50cm away. It can be an old tin can or cracked plastic water bottle. Before burying the container, two or three small holes should be punched in the bottom and sides if there are none already. Bury the container in the soil so that only the lip can be seen.

During the dry season the container is filled with water and then covered with a stone to reduce evaporation. In this way the water is slowly released into the soil at a lower level, encouraging deeper root development. Almost no water is lost through evaporation. With this system, the trees only need to be watered one to three times a week. One bucket of water is enough for 5–10 trees, depending on the size of the container. This system is so effective that tree seedlings can actually be planted during the dry season, when the demands of farming are low.

Timothy A Volk
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Nigeria



Building a Pond

by Dennis and Meredith Murnyak

Choosing the site

You will need a good source of water – such as springs, streams and ground water. You can also rely on rain water. Rain-filled ponds often dry up in the dry season, so you must harvest the fish before the water level falls too low.

Soil containing clay is the best for building fish ponds because it holds water well. To examine the soil, dig a hole 1m deep and take a sample of soil



from the bottom. Moisten this soil and squeeze a handful of it into a ball, throw it about 50cm into the air and then catch it. If the ball falls apart in your hand this means it is not good for building ponds. Look for another site or use one of the methods of lining ponds described on page 5. If the ball holds together it probably has enough clay for a fish pond.

Pond design

Fish ponds should be built so they can be filled easily and drained completely. Rectangular ponds are easier to build and harvest than round or square ponds. The smallest pond we recommend is 10m x 15m (150 square metres). Ponds can be much larger, but for family use it is better to have several small ponds than one

1 Prepare the site

Remove trees, vegetation and rocks. Measure and stake out the pond.

Remove the top layer of soil and keep it outside the pond area.

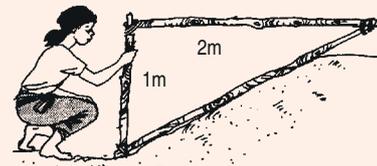
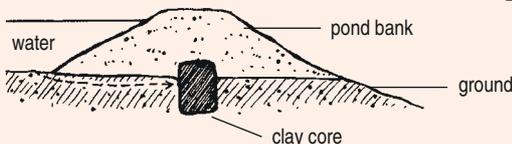
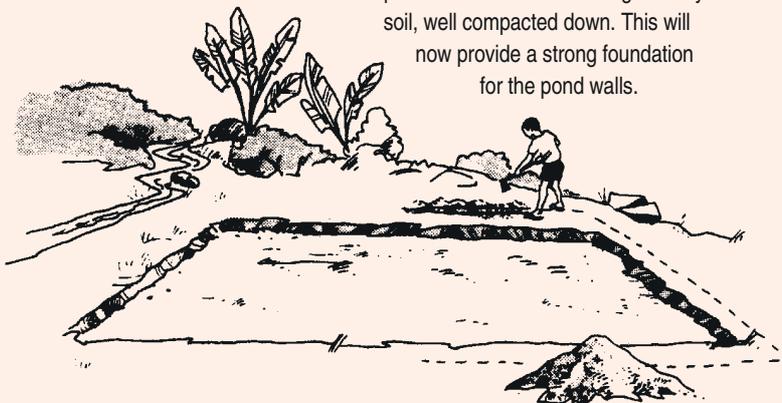
3 Dig the pond and build the walls

As you dig down, use the soil to build up the walls. Compact the soil as you build the walls by trampling it with your feet or pounding it with a heavy log. If you find poor sandy soil, throw this outside the pond area – don't use it for building the walls. The pond walls should be about 30cm above the water level in the pond. They should have a gentle slope, rising 1m in height for every 2m in length.

2 Build a clay core

(if you are building a contour pond)

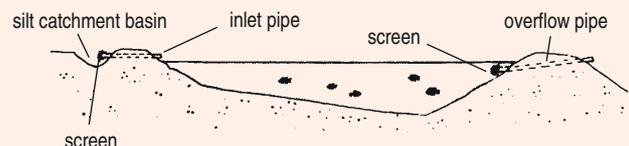
A clay core is like a foundation for the pond bank which makes it strong and prevents leaks. Dig a trench 50cm wide and 30–60cm deep (or until you reach the clay subsoil). This trench should be just outside the lower side of the pond and halfway up each side of the pond. Fill in the trench with good clay soil, well compacted down. This will now provide a strong foundation for the pond walls.



4 Build the inlet and outlet

The inlet pipe carries water for filling the pond. This water often contains a lot of soil which could make the pond very muddy. When digging the channel to bring in the water, dig a hole beneath the inlet pipe. This will allow soil to settle and prevent the pond from filling up with dirt.

The inlet pipe runs through the pond wall into the pond. It should be screened to prevent wild fish from entering. It should be about 15cm above water level. This prevents fish from escaping through it and mixes air into the water as it splashes into the pond.

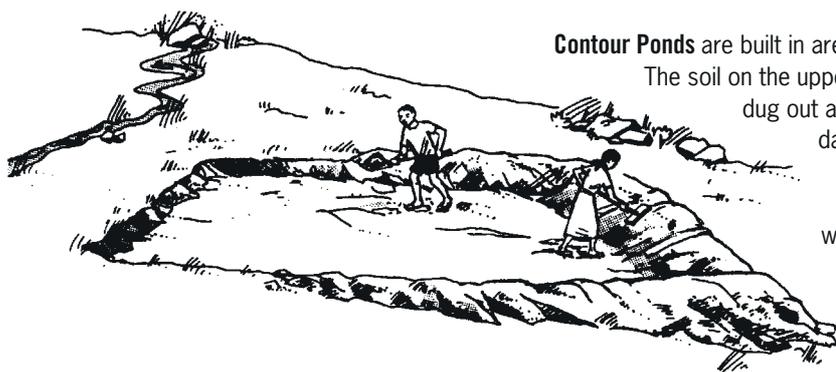


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If you ge
runoff wa

large one. The water should be 30cm deep at one end and 1m deep at the other. You can dig it deeper, but make sure all the water can be drained out for harvesting the fish.



Dugout Ponds are built in flat areas by digging out the soil. Water level is below the original ground level.



Contour Ponds are built in areas with sloping land. The soil on the upper side of the pond is dug out and used to build up a dam on the lower side.

The dam must be strong because the water level in the pond will be above the original ground level.

Adapted with permission from Raising Fish in Ponds by Dennis and Meredith Murnyak (see page 12). Illustrations by Barbara Knutson.

Protect the pond banks

When you finish building the banks, cover them with the soil that you saved when digging the pond. Press on the banks to prevent them from erosion.

ditch to divert run-off



At heavy rains, dig a run off ditch along the upper side of the pond to carry water away from the pond, preventing damage to the walls.



The outlet is an overflow pipe through the pond wall which is only used in emergencies. Water should **not** normally flow out of the pond. The outlet should always be screened to stop fish leaving the pond.

Suitable screens (right) can be made from...

- wire mesh
- a clay pot with holes
- a piece of metal with holes
- mosquito netting.



6 Build compost fences and add fertiliser

Build the compost fences when the pond is dry, using sticks that will not rot. Fill the baskets and spread a layer of manure on the bottom of the pond, before filling with water.



7 Filling the pond

Place rocks on the pond bottom where the water will splash in from the inlet pipe. This will keep the water from digging a hole and eroding the pond bottom. Do not over fill the pond so that water flows out.

Fill the pond at least two weeks before you stock the fish. This allows the pond water to become warm and fertile before fish are stocked. The pond may seep water at first, but should seal eventually as mud and fertiliser build up on the bottom.

Raising your own fish fingerlings

IF YOU WANT to raise fish, you need a supply of young fish. You can raise your own baby fish instead of buying them or catching them in the wild.

Newly hatched baby fish are called *fry* and when they are finger size they are called *fingerlings*. With a little extra time and care you can have fingerlings to put in your ponds and to sell to other farmers.

Here is a way to produce common carp. You will need two ponds – a spawning pond and a nursery pond. Spawning is when adult fish breed and lay their eggs. A spawning pond is a pond where fish can breed and lay eggs. The spawning pond is also where the eggs will hatch into fish fry.

The spawning pond

In a separate spawning pond more baby fish will hatch and survive because there are fewer predators and less disease.

When choosing a site for the spawning pond, look for soil that holds water. Dig a pond about 2m x 3m in size and about 1m deep. Leave the pond empty

until the sun has baked the soil completely dry to kill any insects that might eat the newly hatched fry. Once the soil surface is full of cracks, let fresh water into the pond. When the water is at least 50cm deep, the spawning pond is ready for breeding stock. A mat of pond weeds such as water hyacinth, covering no more than a quarter of the pond area, encourages spawning as eggs are laid among the roots.

Choosing carp for spawning

When choosing carp as breeding stock, choose big, healthy adults that are ready to spawn. Females that are ready to spawn have soft swollen bellies. Males that are ready to spawn will secrete a white milky substance when gently squeezed. Choose about ten of the biggest, healthiest females and ten of the biggest, healthiest males.

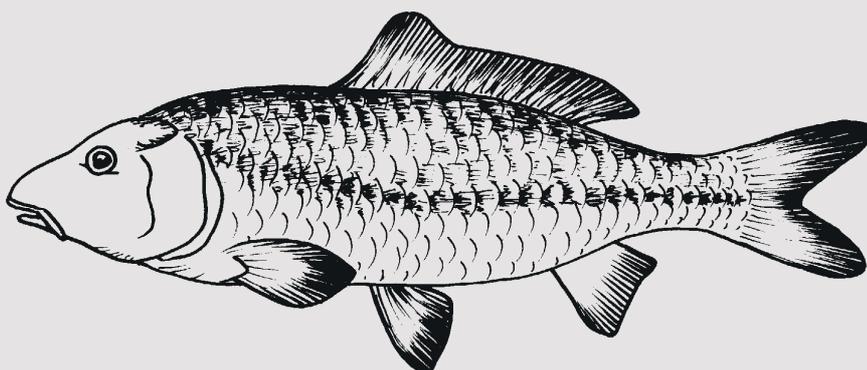
It takes only one day for the fish to spawn. After one day, remove the adults from the spawning pond and put them back in the pond.

Carp eggs hatch in about two days. In a few days the fry will be about the size of an eyelash – 0.5cm long and very thin. When the fry are at least 1cm long, put them in a nursery pond. You can catch them by using a very fine mesh net or a net made out of loosely woven cloth. Handle them **very** carefully.

The nursery pond

The nursery pond is a little shallower than the spawning pond, but it is prepared in the same way. Dig a pond about 6m x 6m and about 70cm deep.

Know your fish!



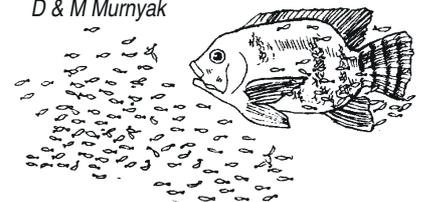
Common carp (*Cyprinus carpio*)

Raising Tilapia

Tilapia mature at 3 to 4 months of age. When breeding begins, the male makes a round nest on the pond bottom by waving his tail back and forth. Then he attracts a female to lay eggs in the nest. The male fertilises the eggs, then the female picks them up and keeps them in her mouth to protect them. After several weeks the eggs develop into 'fry'. They begin to swim around but keep near their mother's mouth in case of danger. They leave the mother after two more weeks.

A female tilapia can reproduce 3 or 4 times a year, producing up to 1,000 eggs each time. It is easy to understand how a fish pond can quickly become overcrowded with small tilapia! Small fingerlings can be removed from the pond edges and sold to other farmers. When you see many small fish in your pond, this means it is time to prepare for a total fish harvest as overcrowded fish will not grow well.

D & M Murnyak



Let the soil bake in the sun. When the soil is full of cracks, sprinkle well rotted manure or compost and slowly fill the pond. The nursery pond must have an inlet for fresh water coming into the pond and an outlet for water to leave the pond. The outlet will prevent the pond from overflowing and washing away the carp fry. Don't forget to cover the inlet and the outlet with a fine mesh to keep the fry in and the predators out.

If possible, feed the fry first with a little powdered egg yolk and, later, finely powdered oil cake (heat treated) and rice bran. Carp fry also eat small plants and animals that live in the water, and they will reach finger size in six to eight weeks. When your carp are fingerlings you can transfer them into your fish ponds or sell them to other farmers.

Adapted from DCFRN Notes No.35

Fish in the rice paddy



Fish can be raised with most crops that grow in paddies.

RICE PADDIES have lots of natural food for fish. This is one of the advantages of raising fish and rice together. Fish help the farmer by eating weeds and insects in the paddy field. Fish manure fertilises rice and increases rice yield.

It costs very little to keep fish in your paddies. You may even save money because keeping fish in your rice paddies reduces the need for expensive pesticides and fertilisers.

Keeping fish in rice paddies is not a new idea. Fish such as catfish or mudfish used to live naturally in rice paddies. Your grandparents may even remember catching them.

Making a pond

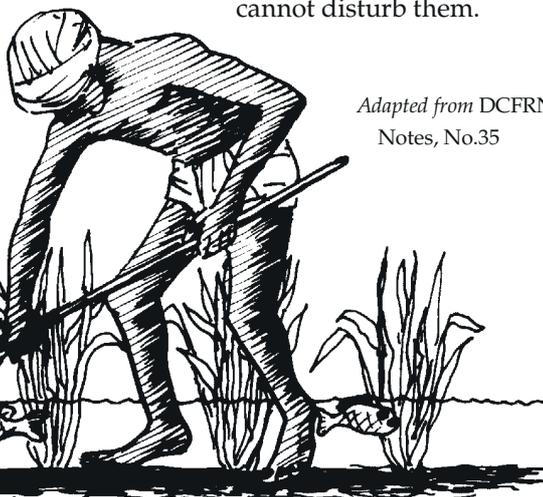
You will need a pond next to the paddy so the fish will have a place to go when you harvest your rice or when there is a shortage of water. Choose an area of the field that holds water. This is often the lowest spot in the field.

Your pond should be about 6 metres square

and about 1 metre deep. Slope the sides of the pond to help prevent erosion. As you dig out the pond, add soil to the banks of the pond to help prevent the pond from overflowing during heavy rains.

One side of the pond should open into the rice paddy. This way the fish can swim in and out of the pond, and the pond will be a refuge for the fish when the water level is low. When you drain the paddy for the rice harvest, do it slowly to give the fish time to retreat to their pond. When the field is drained, all the fish will be in the pond and they will be easy to catch. If the fish are not yet big enough to eat, you can feed them in the pond until the field is ready for rice again.

Fish dig and swim around rice plants, searching for food. If you have just transplanted your rice seedlings, wait about ten days to three weeks before you put fingerlings in the paddy. This way the rice transplants will be well established and the fingerlings cannot disturb them.



Adapted from DCFRN Notes, No.35

TEST YOUR AIDS AWARENESS

THIS QUIZ has proved a useful tool in discussion groups and AIDS teaching sessions. It was prepared by Karen Homer and Deborah Ventimiglia. Answer true or false for each of the following questions and then check your answers below.

- 1** Most HIV infected persons do not know they are infected.
- 2** One child in three born to an HIV-infected mother will be infected.
- 3** One can tell by people's appearance if they are HIV-infected.
- 4** Talking about sex with children encourages them to try it.
- 5** Most people with the virus caught it through unprotected sex.
- 6** There is little time between HIV infection and AIDS-related illness.
- 7** Fifty percent of the world's new HIV infections are women.
- 8** Mosquitoes can transmit HIV and AIDS.
- 9** Research indicates that a vaccine will be developed soon.

With thanks to Together No.47 for permission to include this.

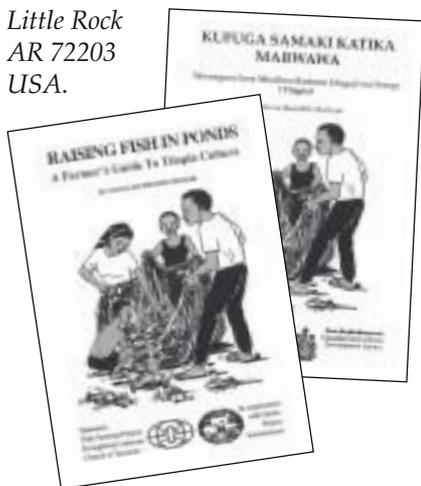
TEST YOUR AIDS AWARENESS - ANSWERS: 1 True 2 True 3 False 4 False 5 True 6 False 7 True 8 False 9 False

Raising Fish in Ponds

A Farmer's Guide to Tilapia Culture
by Dennis and Meredith Murnyak

This booklet results from many years' experience raising tilapia in Tanzania. It is very highly recommended – straightforward to read with excellent illustrations and very practical. A section of the book has provided the information for the centre pages on building a pond. The booklet has 76 pages and costs \$6.00 (including postage) from:

Heifer Project International
Box 808
Little Rock
AR 72203
USA.



A KiSwahili version is also available and costs \$5.00 including postage within East Africa only. Write to...

D and M Murnyak
Fish Farming Project
ELCT Diocese
Box 519
Arusha
Tanzania.

Raising Healthy Fish under Primitive Conditions

This booklet – and there are currently seven in the series, covering various animals – is produced by the Christian Veterinary Mission. It contains ten sections, covering subjects such as: water quality, facilities, nutrition, management, fish health, economics and shrimp culture. The booklet has 80 pages, is well illustrated and provides detailed information. It is available free of charge from:

Christian Veterinary Mission
Box 33000
Seattle
Washington 98133
USA.

Water Harvesting and Aquaculture Manuals

The International Center for Aquaculture and Aquatic Environment, Auburn University, produce a wide range of very useful books on fish farming, covering all kinds of subjects in detail. There are too many titles to list here but they include:

Organic Fertilisers for Fish Ponds
Fish Culture in Rice Paddies
Feeding your Fish
Transporting Fish
Introduction to Tilapia.

All titles are available in English, French and Spanish. They are also available on computer disc (Macintosh). Please write, asking for further details of booklets and cost, to:
ICAAE Publications
Swingle Hall
Auburn University
Alabama 36849
USA.

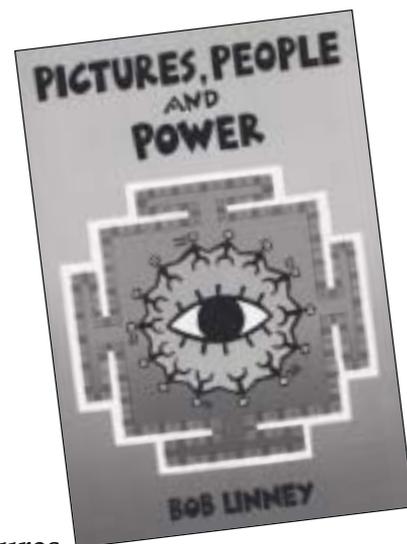
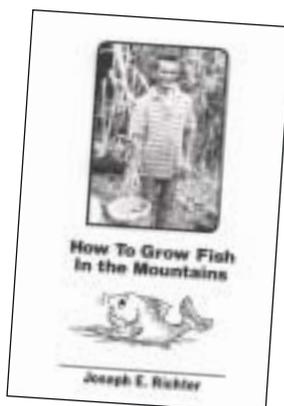
How to Grow Fish in the Mountains

by Joseph Richter

This booklet is written for the farmer – simple, yet containing a lot of practical information and well illustrated. Topics include: why grow fish?, common cultured fish, pond construction, fingerlings and their production, sexing brood fish, predators, feeding, harvesting and common mistakes.

The booklet has 40 pages and costs \$3.00, including postage. It can be ordered from:

Farms International Inc
PO Box 270
Knife River
MN 55609
USA.



Pictures, People and Power

by Bob Linney

Published by Macmillan and TALC

This book is for people who want to make and use pictures for development. It is aimed at health and community workers and gives practical guidelines for those who are not artists!

The book is divided into two parts. The first part looks at the ways in which visual aids are used. The second part looks at practical ways of encouraging the local production of appropriate pictures. It includes sections on how to use colours, how to copy and adapt pictures, how to make people-centred visual aids and how to plan workshops on visual communication.

The book has 195 pages and is available for £7.50 surface mail and £8.00 airmail from TALC:

TALC
PO Box 49
St Albans
Herts
AL1 5TX
UK.

Freshwater Fish Pond Culture and Management

by M Chakroff

Published by VITA

A practical manual covering planning, construction, management, harvesting and preserving fish. Available for £14.40 (including postage) from:

IT Publications
103–105 Southampton Row
London
WC1B 4HH.

Step by Step Surgery of Vesicovaginal Fistulas

As a follow-up to the last issue of *Footsteps*, this detailed description of the surgical repair of fistulas is an excellent guide for doctors involved in such surgery. Available free of charge from:

AMREF
PO Box 30125
Nairobi
Kenya.

How to Manage a Health Centre Store

A revised edition of this book has just been published by AHRTAG. The 66 page manual provides practical guidelines for health workers and pharmacists responsible for ensuring a reliable supply of essential drugs. It describes how to:

- plan and prepare the store
- arrange the store to make best use of space
- make storage equipment
- calculate quantities needed, order and receive supplies
- issue and pack supplies and organise a dispensary.

It is written in clear English and well illustrated. Copies can be ordered for £7.50 surface mail or £8.00 airmail from TALC (address above).

Training courses in fish farming

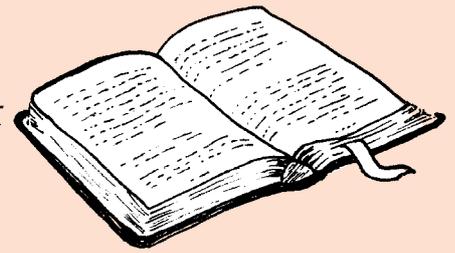
A training centre has recently opened in Dareda, Babati District, 175km south of Arusha, Tanzania. The centre has about 30 fish ponds for research and demonstration. In the surrounding area there are about 200 ponds owned by local farmers. The courses provide training in raising tilapia and include a lot of 'hands-on' practical work and visits to farmers. They are taught in KiSwahili. Courses are usually 2 weeks long for 32 students each time. If there was sufficient demand, the courses could be held in English. For further information write to:

D & M Murnyak, Fish Farming Project,
ELCT Diocese, Box 519, Arusha, Tanzania.

BIBLE STUDY

The Lord's breakfast

by Dr Paul Brand



THE TILAPIA FISH is also known as Saint Peter's fish. In this study we look at the disciple Peter.

When Jesus first came into his life (John 1:40-42), Peter was a fisherman – rough, tough and resentful of the rule of the Romans over Israel. It took real courage for Peter to give up his boats, his nets and fishing and follow Jesus. He believed the risk was worth it and was prepared to fight against the Romans. No doubt he was puzzled at Jesus' lack of military preparations, but recognised that people had to repent and turn humbly to God so that the people of Israel could once again be God's special people. He reacted strongly when Jesus spoke of coming suffering and death – which Peter felt was going too far (Matthew 16:21-23).

Then came the crucifixion. All that Peter had believed and lived for was shattered. He denied his connections with Jesus three times (John 18:17, 25-27). He wept bitterly – for the loss of Jesus and for the frustration of three years lost out of his life. Then, to his amazement, Jesus came back to life and appeared to the disciples (John 20:19-21). His hopes were raised again – until Jesus spoke to them, 'As the Father has sent me, so I am sending you.' With this, Jesus made it clear that there was to be no glorious, earthly future for the disciples, no victory over the Romans, no thrones or crowns. They were to continue to live and work as Jesus had done, facing rejection, poverty, persecution and possible death.

Read John Chapter 21:1-17. Peter was very confused. He needed time to think. He told the others he was going fishing and they joined him. For Peter, this night of fishing was a time of temptation – his chance to run away from Jesus. He thought his old skills in fishing would return. Maybe he could start again as a fisherman.

But that night they caught nothing... Nothing until a man on the shore told them to cast their nets on the other side. A huge catch of fish – 153 great fish – which threatened to break the nets. What

a catch! But Peter knew now that this was Jesus' catch, not his own. As they joined Jesus for breakfast, this became a time of truth for Peter.

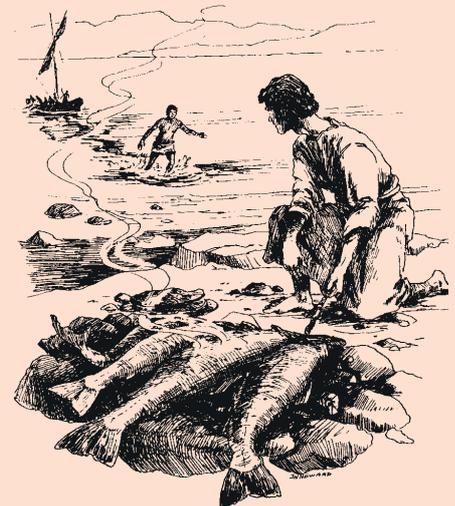
Jesus asked Peter, 'Do you love me more than these?' Some people think Jesus was asking if Peter loved him more than the other disciples did, or if Peter loved him more than his other friends? But if we think of the beach, and the huge pile of fish lying there, I'm sure Jesus was asking Peter which came first in his life – his skills and pride in fishing or his love for Jesus, which might mean giving up his fishing and following a life of servanthood.

To discuss:

- What kind of difficult choices did you make when choosing to follow Jesus?
- Were there things you needed to put to one side?
- Are you still putting off decisions about things you need to put right in your relationship with Jesus?

Jesus chose the early hours of the day for some of the prayers that meant the most in his life. He is ready to meet with us as we set aside time to renew our faith each day at 'The Lord's Breakfast'. Do you take time to meet with him each morning before rushing into the day's work?

Condensed from a chapter of Dr Brand's book, *The Forever Feast*. Text and illustration used with kind permission of Servant Publications.





Experiments with neem

by Dr Rachel Reuben

THE NEEM (*Azadirachta indica*) is a common tree in towns and villages in India. Its distinctive leaves and sprays of small, white, sweet smelling flowers are a familiar sight in avenues and gardens. It is sometimes called 'Nature's Pharmacy', because of its many uses as a mild antibiotic, pesticide and insect repellent.

At least 35 active chemical principles have been found in its leaves, bark and seeds. The use of neem as a pesticide and the practice of cleaning one's teeth with neem twigs have already been mentioned in *Footsteps*, and there are many other uses for this tree. For example, fresh green leaves mixed with grain in closed containers will keep the grain free from pests for two to three months. Farmers in Pakistan know this, and regularly plaster the inner surfaces of large storage bins for wheat with a mixture of mud and neem leaves. Neem leaves dried in books and kept at the bottom of drawers and in woollen clothing, keep away silverfish and moths.

Harvesting the seeds

The most effective of the chemicals found in neem is azadirachtin. The highest concentrations are found in the seed kernels. Neem flowers in



April in South India, and the ripe fruit fall off the tree and can be collected in about July. Birds and ants eat the flesh, but leave the bitter tasting skin and seeds. These must be carefully dried or they will grow fungus.

A lot of seeds are now being bought up by industry, but there are still plenty available for local use. The seeds are crushed in either bullock-powered grinders in the villages, or in mechanical grinders, to extract the oil, which has many uses – from soap making to medicinal uses. The residue after the oil is removed is known as neem cake, and is traditionally used as a fertiliser in rice fields and to control root nematode in the cardamon crop.

Neem cake

Modern science has confirmed many of the traditional beliefs about the properties of neem, and has discovered several new possibilities.

Mixing neem cake into the soil of rice fields at the rate of 250kg per hectare (1kg for a 10m x 4m plot) protects the crop from attack from sucking pests such as brown plant hopper, which has developed resistance to all the commonly used chemical insecticides. At the same time, active neem chemicals discourage the breeding of *Culex* mosquitoes in the rice-field water. This is important, because these mosquitoes include species which carry the virus of Japanese encephalitis, which kills large numbers of children up to the age of twelve years

in rice growing areas in Southeast Asia.

An even better way of using neem is to coat urea with neem cake powder before broadcasting it in the field. The neem slows nitrifying bacteria in the soil and prolongs the useful life of urea. The result is both a higher grain yield and the control of mosquito breeding.

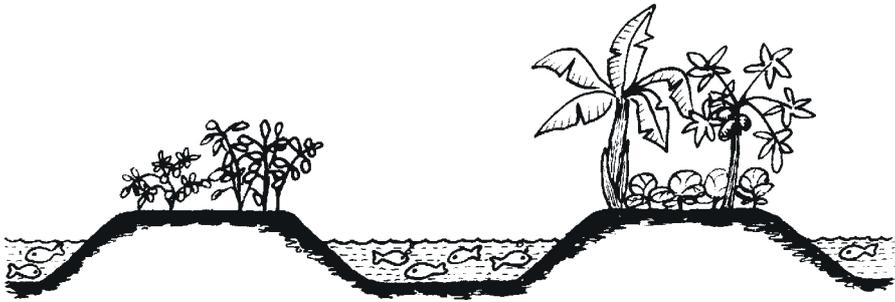
Neem cake must be used when fresh. Heat and moisture cause the growth of fungus, making the neem less effective. This can often be a problem because farmers may not be able to get good quality neem cake when they need it. It is also very bulky to store. An alternative is to use commercially available neem fractions that are now available in India in handy sachets. They have the advantage of being relatively stable and cheap at 2.8 US \$ per hectare. Experiments carried out at our centre showed that, when mixed with urea and broadcast in the rice fields, they were just as effective as neem cake.

Grow your own

So, if you live in a part of the world where the climate favours the growing of neem, plant some trees for your own use. Put the leaves in your rice or wheat storage containers, your clothes and your books. Replace the leaves every month or two, but take care not to remove too many leaves from young trees, as this might damage their growth. Boil the leaves to get a mildly antiseptic solution which is very soothing for prickly heat and minor skin ailments. Pound the seeds yourself if there is no grinder available and plough them into your fields. Check whether commercial neem fractions are available in your area and use these when possible. The small investment involved will bring rewards of better harvests and fewer disease-bearing mosquitoes.

Dr R Reuben is the Director of the Centre for Research in Medical Entomology, PO Box 11, Chinna Chokkikulam, Madurai 625002, India.

Raising fish and crops together



A SYSTEM has been developed in Thailand by a group known as ITAG (International Technical Assistance Group) which combines fish farming with the growing of vegetables and crops on raised beds. Long narrow fish ponds are dug in between long narrow raised beds. Both ponds and raised beds are about 2m x 15m. The ponds are about 1m deep. The top-soil (the top fertile layer of soil about 30–40cm deep) from digging the ponds is added to the raised beds.

The soil is double dug in the raised beds. First, the top layer of soil is dug well and mixed with compost. Then the top-soil (30–40cm deep) is removed at one end of the bed and placed to one side. The lower layer of the soil is then loosened. Top-soil is turned over onto the loosened subsoil and the process repeated right along the bed. This method allows water – both from the pond and from rain – to soak deep into the soil.

A mixture of crops and fruit trees are planted on the raised beds. Water from the pond will seep into the soil, allowing the roots to grow deeply, resulting in healthy plants. Because the beds are raised, they cannot be flooded. Mud from the pond bottom is added to the raised beds and is a valuable fertiliser. Plant wastes and weeds can be added to the pond for feeding the fish.

The fish species commonly used are tilapia, catfish and carp. The narrow pond allows for careful observation of fish for any signs of disease or parasite infections. Fish that show any sign of poor health are removed immediately.

There are many benefits from combining the two together. Both fish and vegetable husbandry benefit. Traditional methods produce 1–2.5 tons/ha/year. However, these methods produce 5 tons/ha in the first year, 10 tons/ha in the second and 20 tons/ha in the third year – a huge increase in production! The amount of labour is greatly reduced as there is no need to transport compost or water for irrigation. In addition, by using simple sand filters, water can be cleaned for household use.

This process was developed for ITAG in Thailand by Dr Richard Neve.

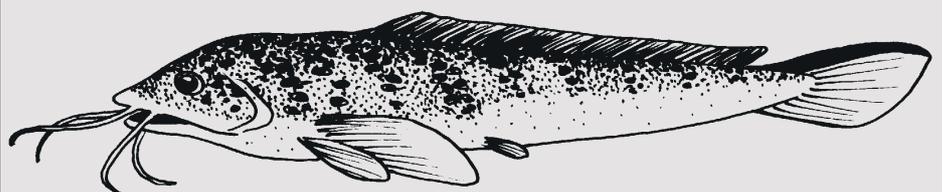
Fish and ducks



Fish farming is also ideal for combining with duck farming. The duck house can be built either over the pond or on the bank (see below). Manure from the ducks goes directly into the water, providing fertiliser. The ducks can be shut up at night so that eggs can be collected.



Know your fish!



Catfish (*Clarias* species)

Agroforestry in the Dominican Republic

by Joachim Boehnert

OUR ORGANISATION – NATURALEZA – works in the Dominican Republic, encouraging agroforestry work. Our first priority was soil conservation. Then we began to establish community tree nurseries and hedges.

We work in cooperation with eight small farmers' groups (*campesinos*) and four women's groups. We are encouraging these groups to form a federation to take over project planning and management in the future. We work in a mountainous area in the province of Santiago Rodriguez. Much of the land here is only suitable for forest. However, because land is in such short supply, people still practise slash and burn



Alley cropping.

cultivation to survive. As in many Latin American countries, 2% of farmers are landlords, owning nearly half of the land – particularly the better land. Most farmers have very little, poor land on which to survive. Nearly 75% of the streams and rivers have dried up during the last ten years due to the clearing of forests.

We plan activities that need little labour and resources. We encourage alley cropping and hedge planting. When people clear the forest these methods help to protect the soil from erosion. Farmers can then continue to use the land instead of moving to clear new forest after a few years. We use A-frames to measure out the contours and then plant hedges on them.

We cut back the hedges to 50cm when they reach a height of 2m, and then spread the cut leaves in the alleys to improve the soil. They can also be used for animal fodder. Instead of using just one or two species of trees, we try to encourage growing a variety of trees, particularly local species. For

'Re-afforestation is a social issue. Its main aim should be the improvement of the living conditions of the rural people'.

Jesus Enrique A Rius, President of PROGRESSIO

alley cropping and hedges we look for trees with these characteristics...

- easy to grow
- rapid growth
- deep root system
- will regrow easily after cutting back
- easy to clear
- different uses – fuel, fodder, fruit, etc
- leguminous – adding plant foods to the soil
- drought resistant
- resistant to pests and diseases.

These are the species we use so far...

- *Acacia angustissima*
- *Calliandra calothyrsus*
- *Crotalaria anagyroides*
- *Diphysa robiniodes*
- *Flemingia congesta*.

We are also trying out other species. Farmers plant traditional crops in the alleys. Local farmers are very interested in this 'new form' of agriculture. We work together with them to find out the best combinations of trees and crops. We meet with other organisations involved in this sort of work to exchange ideas and information regularly.

Planting trees that are out of reach of livestock

In countries with long dry seasons, newly planted trees have to survive both lack of water and livestock browsing. Fences are often ineffective. An alternative idea is to plant much larger seedlings which are then out of reach of livestock.

In Zambia we find that around hospitals, schools or low density housing, many self-sown trees (or *wildings*) can be found. These can often be easily transplanted during wet spells with a ball of soil attached. It is helpful to remove all but the topmost leaves to reduce loss of water through transpiration.

We also find that large cuttings can be made from branches of many trees. You will need to experiment, as some root much more easily than others. Allow the cut base to dry out first, then plant very deeply and remove the leaves. Here is a list of those we have found grow readily from cuttings:

- *Commiphora africana*
- *Euphorbia tirucalli*
- *Manihot glaziovii*
- *Morus nigra*
- *Moringa oleifera*
- *Pterocarpus angolensis*
- All *Ficus* species

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