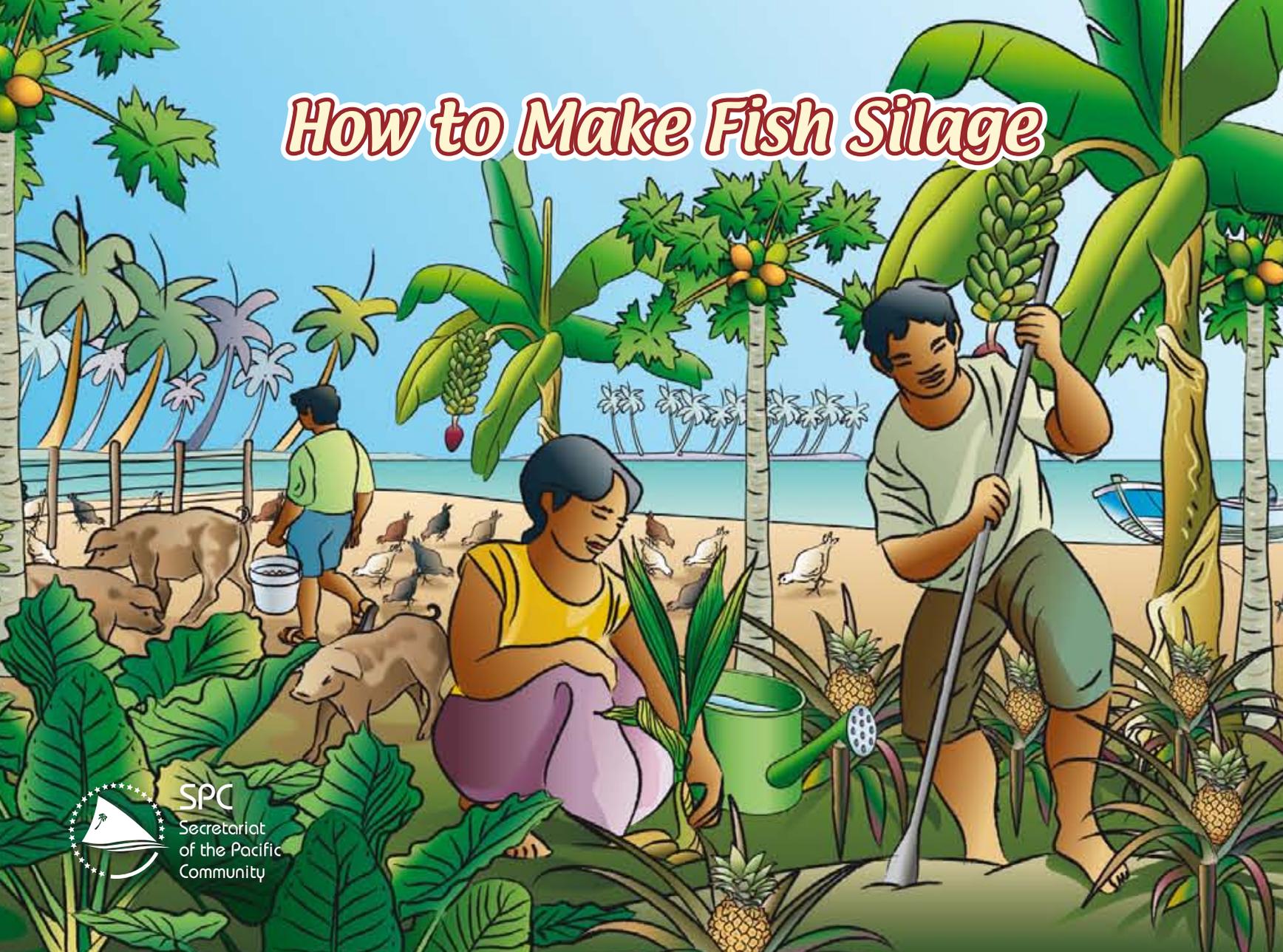


# *How to Make Fish Silage*





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Written by Michel Blanc and illustrated by Jipé Le-Bars

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Secretariat of the Pacific Community  
Noumea, New Caledonia  
2009

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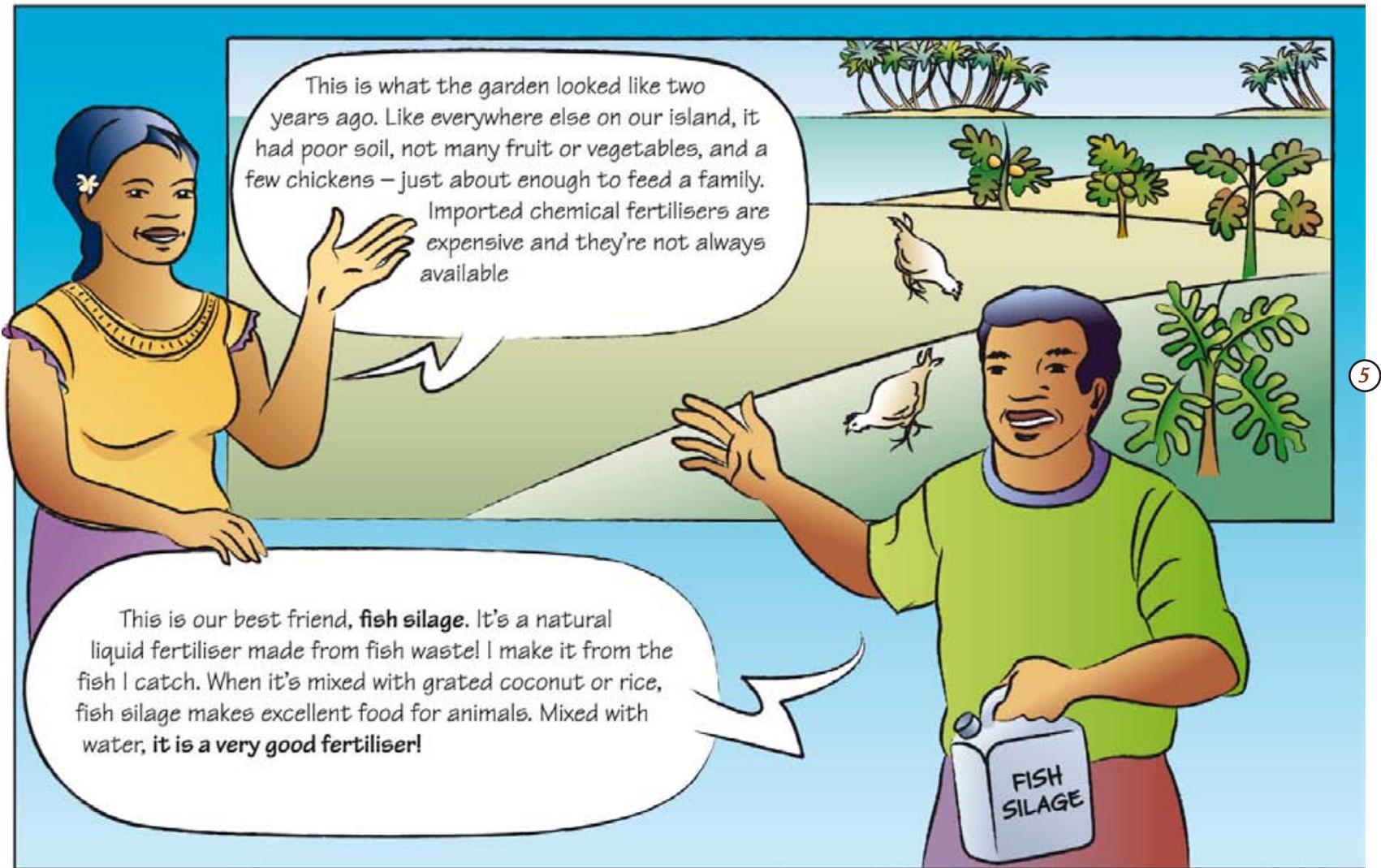
# SOMEWHERE IN MICRONESIA...

Thanks to their garden – the best one on the atoll – and their domestic animals, Candice, Glen and their family enjoy a healthy, balanced diet. They sell their surplus production and the money they earn gives them a better standard of living.

Their garden is a success because of their work and also because they follow technical advice from the Fisheries Department. This guide explains how fish waste can be used in an environmentally friendly way to help small Pacific Island communities have a healthier diet and a better life.



# MAKING FISH SILAGE

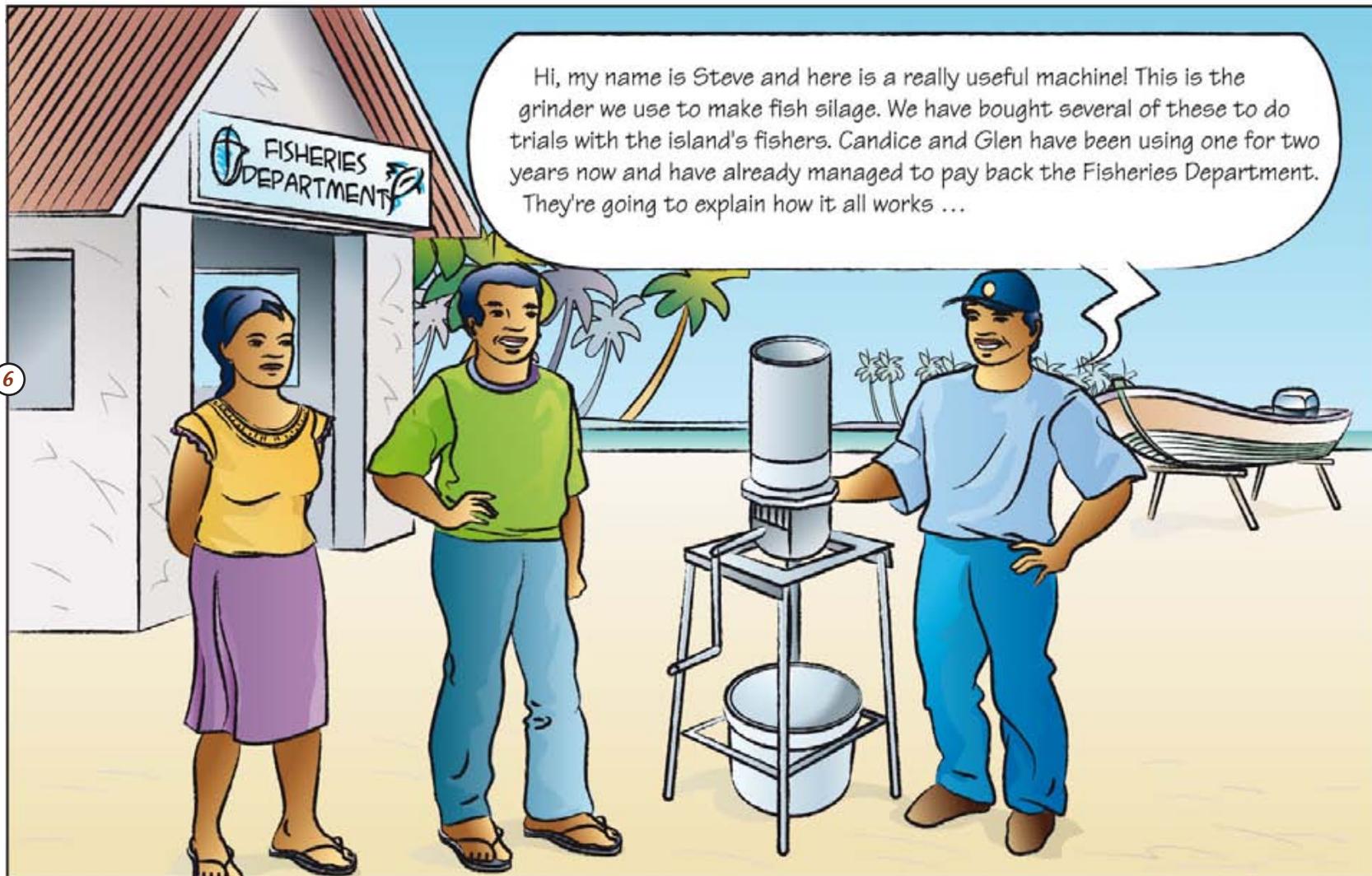


This is what the garden looked like two years ago. Like everywhere else on our island, it had poor soil, not many fruit or vegetables, and a few chickens – just about enough to feed a family. Imported chemical fertilisers are expensive and they're not always available

This is our best friend, **fish silage**. It's a natural liquid fertiliser made from fish waste! I make it from the fish I catch. When it's mixed with grated coconut or rice, fish silage makes excellent food for animals. Mixed with water, it is a very good fertiliser!

# THE HAND GRINDER

Hi, my name is Steve and here is a really useful machine! This is the grinder we use to make fish silage. We have bought several of these to do trials with the island's fishers. Candice and Glen have been using one for two years now and have already managed to pay back the Fisheries Department. They're going to explain how it all works ...



# EQUIPMENT NEEDED TO MAKE SILAGE

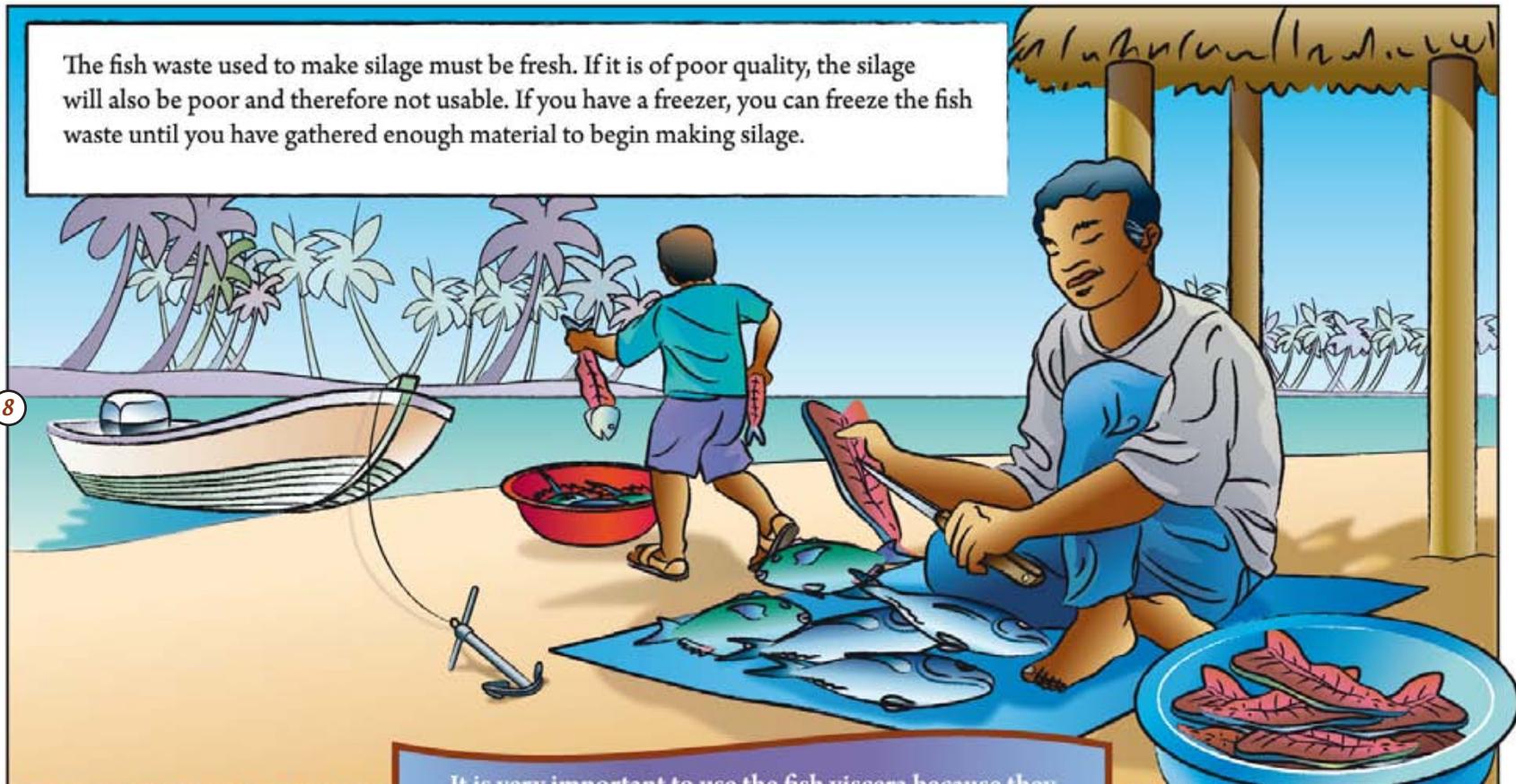


Using the tools that Glen showed you, you add the main ingredient, fish waste. Let's hope that our children will still be able to find enough fish to eat in the lagoon and to make their silage!



# THE ROLE OF THE VISCERA (GUTS)

The fish waste used to make silage must be fresh. If it is of poor quality, the silage will also be poor and therefore not usable. If you have a freezer, you can freeze the fish waste until you have gathered enough material to begin making silage.



It is very important to use the fish viscera because they contain the enzymes which will break down the waste and turn it into silage.

# THE ROLE OF ACID

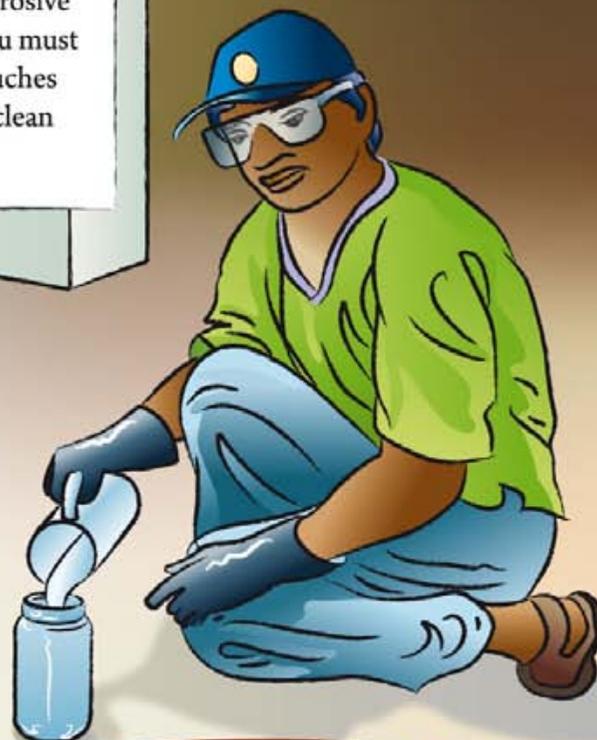


The acid added to the waste plays an important part. It prevents the waste from rotting. And there are no flies or bad smells! When the silage is ready, the acid also means it can be stored longer.



# SAFETY

The recommended acid is formic acid. Although it is not as corrosive as hydrochloric or sulphuric acid, it can still cause burns. So you must carefully protect your eyes and hands when handling it. If it touches your skin, you need to carefully wash the area concerned with clean water for several minutes.



Before starting to make silage, you can prepare small batches of acid in glass containers, which are easier to handle than a big drum of acid. Use glass containers or acid-resistant plastic ones. Never use metal containers.

# GRINDING THE WASTE

The fish carcasses are ground one by one to avoid overfilling the machine.



Large pieces of waste, like the heads of big fish, should first be chopped into smaller pieces to help the machine cope with them. You need to be very careful when doing this work!

# WEIGHING THE GROUND WASTE

Prepare batches of around 15 kg of ground waste one after another. The exact weight of the ground waste must be noted for each batch, so you can work out how much acid to add.



The acid accelerates the processing of the waste into silage and prevents it from rotting. It is important to carefully use the recommended ratio of 35 ml of formic acid per kilogram of ground waste.

# MEASURING THE ACID

35 ml of  
formic acid  
per kilogram  
of waste



Prepare the amount of acid required for each batch, using the measuring glass. For example, for 16 kg of ground waste, you will need  $16 \times 35 = 560$  ml of formic acid.

# MIXING THE ACID WITH THE WASTE

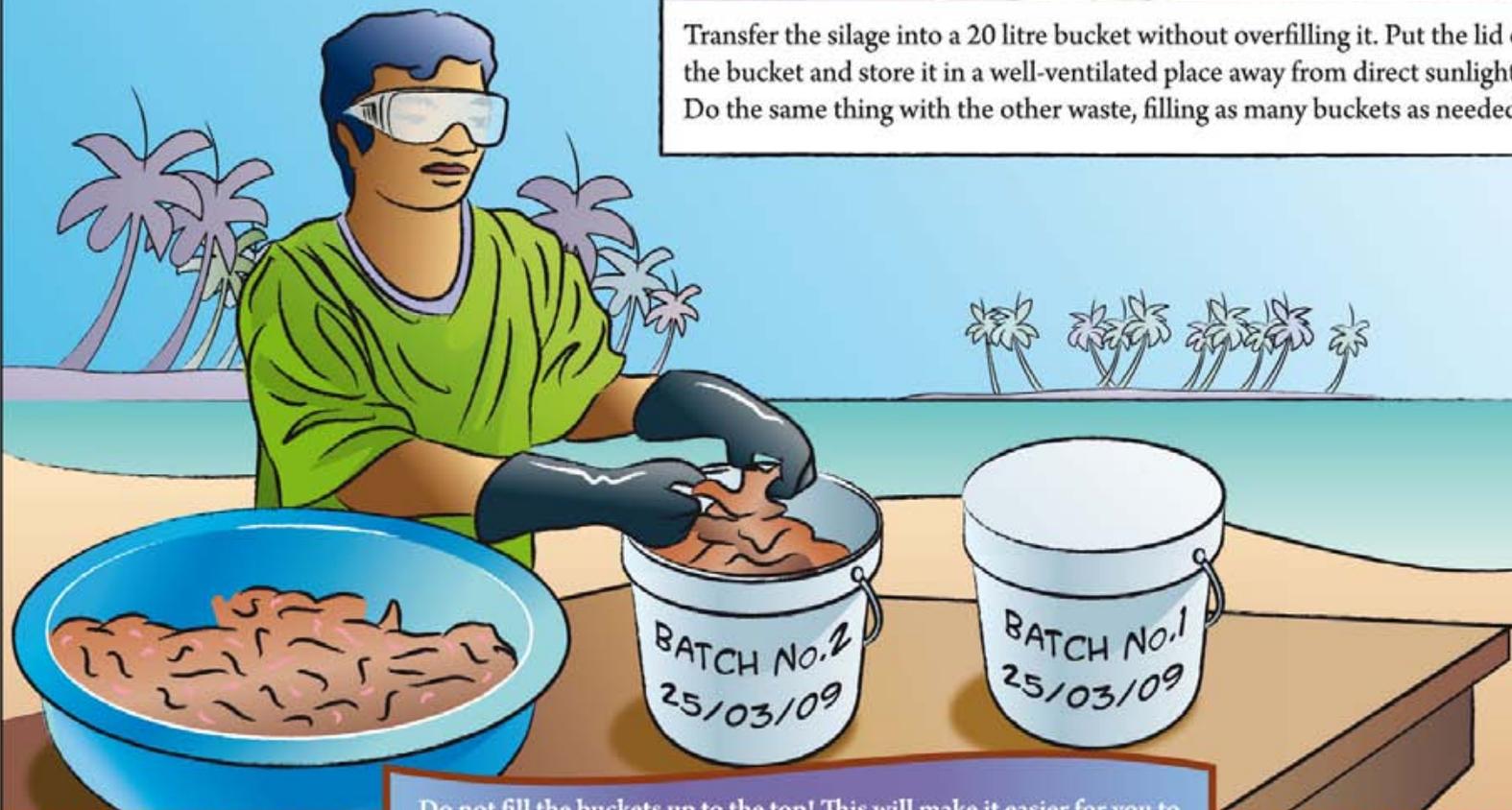
Pour the acid in slowly and be careful to spend 2 to 3 minutes stirring it in. This makes it possible to fully mix the waste material and acid together and is essential for the silage to mature properly and avoid unpleasant smells and flies!



When it comes into contact with the acid, the waste quickly changes texture and colour.

# PACKAGING THE BATCHES OF SILAGE

Transfer the silage into a 20 litre bucket without overfilling it. Put the lid on the bucket and store it in a well-ventilated place away from direct sunlight. Do the same thing with the other waste, filling as many buckets as needed.



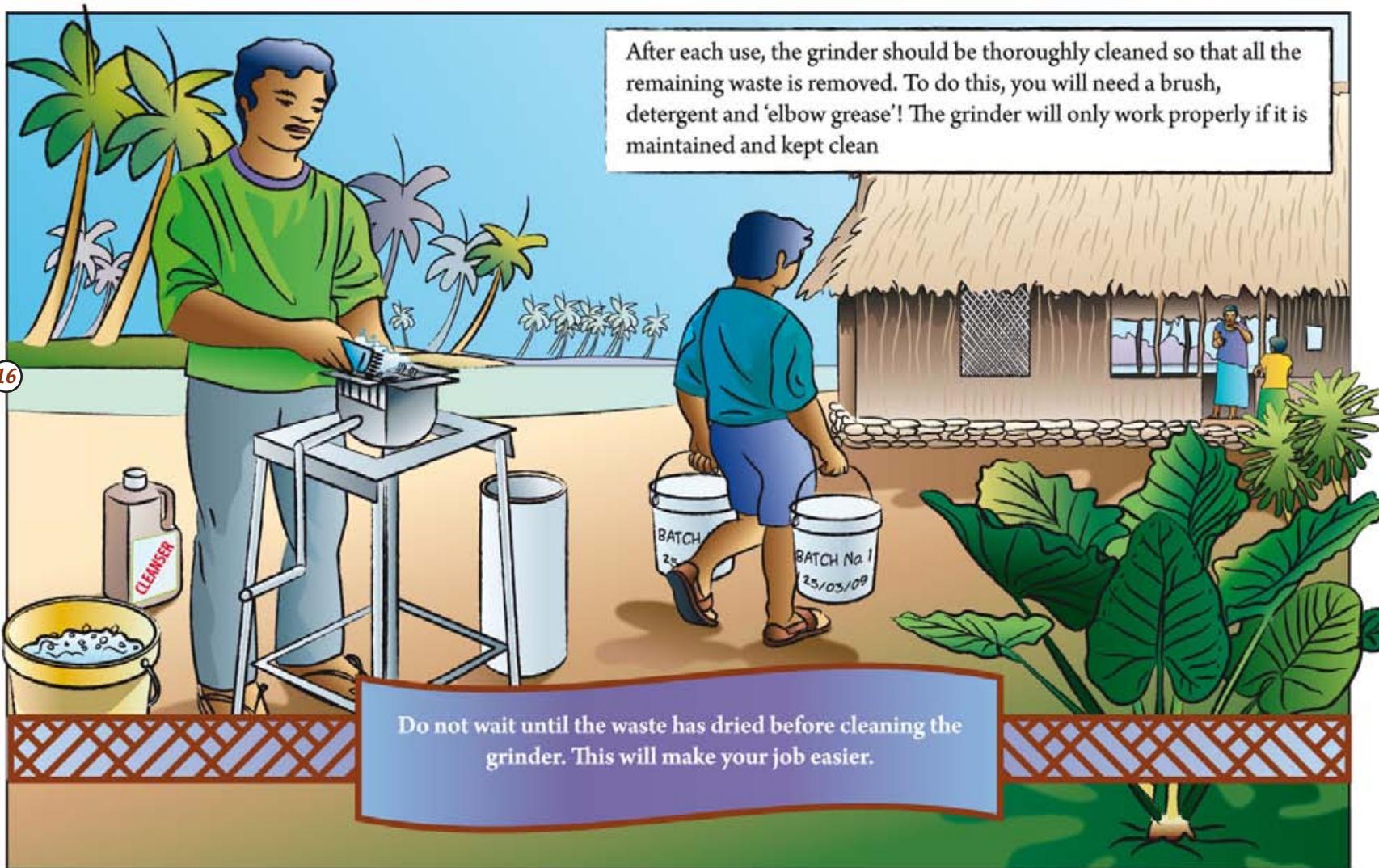
Do not fill the buckets up to the top! This will make it easier for you to mix the batches of silage on the following days. It is advisable to date the various buckets used because this makes it easier to monitor production.

# CLEANING THE GRINDER

After each use, the grinder should be thoroughly cleaned so that all the remaining waste is removed. To do this, you will need a brush, detergent and 'elbow grease'! The grinder will only work properly if it is maintained and kept clean

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Do not wait until the waste has dried before cleaning the grinder. This will make your job easier.



# MATURATION OF THE SILAGE

The silage can take from 4 to 6 days to mature, depending on the air temperature during maturation and the amount of fish viscera in the waste. During this stage, you should check your silage batches every day.

It is useful to know the acid content or pH of the silage. The pH can be estimated using special paper called litmus paper. For good quality silage, the pH should be between 3.5 and 4. If you have added the right amount of acid to the various batches, they will have the right acidity (pH between 3.5 and 4) and your liquid silage can be stored for several months in a cool, dry place. If one of the batches has a pH above 4, you should add a little acid (one third of the initial volume of acid) to it, making sure that you again mix the batch together thoroughly.

Once a day, thoroughly stir each batch of silage to give the mixture a smooth consistency. Continue until you obtain liquid silage, orangey-brown in colour.

There are instruments available at various prices that can accurately measure the pH of liquids; these are called pH-meters.

# BOTTLING

Since we have learnt how to make silage properly, I sell a lot of what we produce at the municipal market. I fill 1 litre bottles of silage and stick on labels saying what it is, how it can be used and the recommended rate of dilution. It sells so well that Glenn and I have had to purchase the Fisheries Department's grinder!



BATCH NO.3  
25/03/09

Fish  
Silage

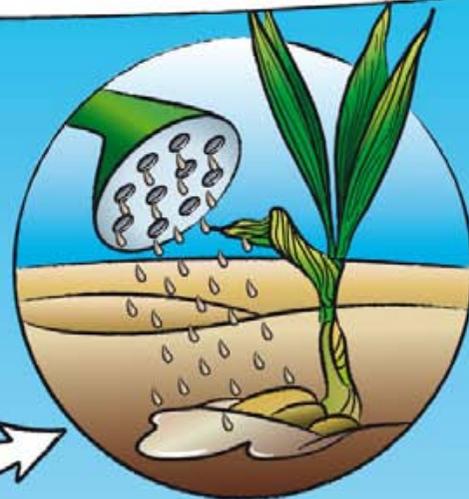
Fish  
Silage

Fish  
Silage

Fish  
Silage

# USE OF SILAGE AS A ROOT FERTILISER

Fish silage is an excellent natural fertiliser for your vegetables and fruit trees. It is a concentrated fertiliser so you should dilute it before pouring it on to the soil around your plants. The recommended dilution rate is 2% or in other words, a large glass of silage (300 ml) for 15 litres of water. Add more fertiliser once or twice a month, especially in the early stages of plant growth.

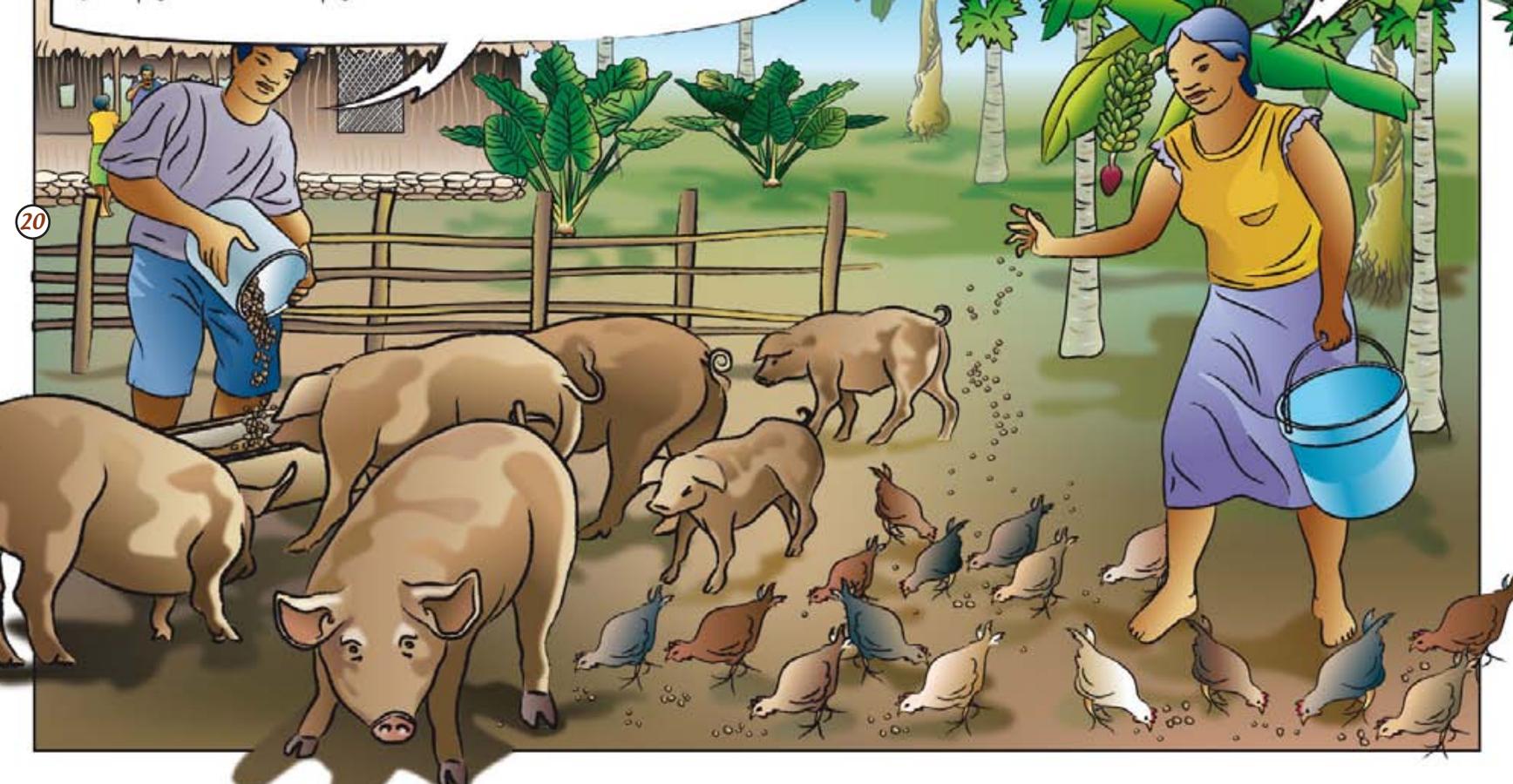


Do not pour pure silage straight on to your plants. Excess nutrients can harm their health.

## USE OF SILAGE AS A FOOD SUPPLEMENT FOR ANIMALS

Fish silage contains proteins and a lot of other nutrients. It can also be used as a food supplement for domestic animals. You can regularly mix a little silage with grated coconut or rice and feed your pigs with it. Our pigs love it!

You can also feed your chickens with it once or twice a week.



# LARGE-SCALE PRODUCTION

Hi Steve, How are you? Thanks to your advice and help from the Agriculture Department, our silage is of high quality and we are producing more and more. Our garden is beautiful, our animals are healthy and we are earning a little money by selling our surplus production on the local market. We are so grateful to you for all that!

I was glad to help you my friends! Your results are so encouraging that some other families also want to buy a fish grinder! The longline fishing company has even imported a large electric grinder to process tuna carcasses. Come and have a look!



# THE ELECTRIC GRINDER



# SILAGE AS A LEAF FERTILISER

The fishing company is going to export its silage. The finished product must be very fluid so that it can be sprayed as a leaf fertiliser straight on to plants. This means you need to mix some raw silage and then filter it before storing it in screw-top containers or 200 litre drums.



# TOWARDS ORGANIC AGRICULTURE IN THE PACIFIC

Every year, hundreds of tonnes of fish waste are thrown away in the Pacific Islands. This waste is often disposed of in rubbish dumps, where it attracts flies, rats and other pests that can carry diseases and contaminate water. As we have just seen, fish waste can easily be processed into liquid fish silage. The potential for fish silage production in the Pacific is therefore very high.

## Fish silage offers many benefits:

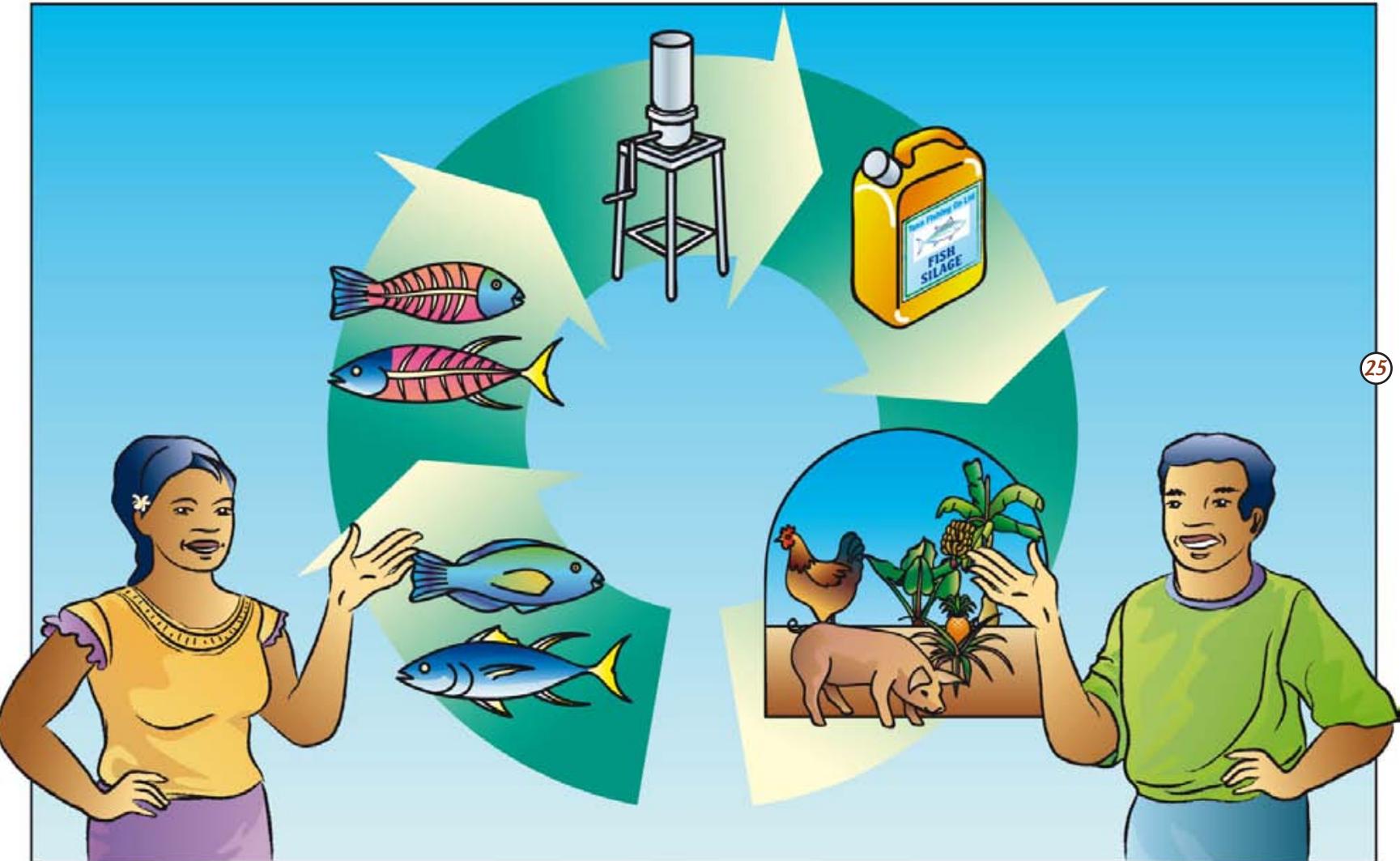
- It contributes to a more sustainable use of increasingly scarce fishery resources and adds value to them.
- It helps reduce costly imports of chemical fertilisers.
- It is a low-cost solution for improving the poor soils of coral atolls.
- The process used to make fish silage is environmentally friendly, as the only chemical required is a small quantity of organic acid.



- Fish silage production does not require highly qualified people. It can therefore be made in most of the island communities of the Pacific. It can also offer women a new income-generating activity.
- Producing fish silage on varying scales offers a good economic development opportunity to many different fishers, including those working in the longline fishing industry.

**Fish silage is an easy way of improving food security and the quality of daily life for Pacific Island communities.**

# TOWARDS ORGANIC AGRICULTURE IN THE PACIFIC



# **FOR MORE INFORMATION**

**For further information on the production of fish silage, you can visit the SPC website:**

**[http://www.spc.int/coastfish/news/Fish\\_News/126/McNeil\\_126.pdf](http://www.spc.int/coastfish/news/Fish_News/126/McNeil_126.pdf)**

**Or contact the SPC Nearshore Fisheries Development and Training Section:**

**Nearshore Fisheries Development and Training Section, Secretariat of the Pacific Community,**

**BP D5, 98848 Nouméa Cedex, New Caledonia**

**Tel.: 687-26 20 00; e-mail: [Capture@spc.int](mailto:Capture@spc.int)**



