Farm Technology

Protecting food security through adaptation to climate change in Melanesia

LIVE&LEARN
Environmental Education

Farm Technology

Protecting food security through adaptation to climate change in Melanesia

Australian Government
AusAID

LIVE&LEARN
Environmental Education

This resource was developed by Live & Learn Environmental Education with funding through AusAID's International Climate Change Adaptation Initiative – Community-based Adaptation Activity Grants.

Contents

Introduction

Climate change and farming

People from Melanesia heavily rely on their land for their livelihoods. They depend on their environment for food and income from cash crops, for clean water, fertile soil, forests for building materials, medicine and for hunting.

Compared to other countries, most Melanesians have very small 'carbon footprints' having contributed very little to global warming and climate change. Unfortunately they will be among those most vulnerable to the impacts of climate change due to their high dependency on their immediate environment and close proximity to the coast. While the challenges ahead are enormous, farmers' innovations can make a great starting point for strengthening food security in Melanesia.

How to use this guide

This guide aims to provide a range of traditional and innovative technologies that make a positive contribution to strengthening food security in Melanesia in response to climate change. It aims to encourage rural farmers in Papua New Guinea, the Solomon Islands and Vanuatu to think about, and start to prepare for, the impacts of climate change in their communities. It is written for farmers and field or extension workers, teachers and others who work with farmers.

It is part of an innovative program that seeks to strengthen food security as an adaptive measure to the effects of climate change in Melanesia. It has been developed by Live & Learn Environmental Education through funding from the Australian Agency for International Development (AusAID).

The guide can be used on its own, or during discussions and workshops.
It is divided into six chapters:

1. Introduction to climate change
2. Alternatives to shifting cultivation
3. Agro-forestry
4. Soil fertility
5. Emergency or food security gardens
6. Low islands, atolls and small areas of land

How this guide was developed

Producing this guide was done in an unusual way. The manuscript was produced in a workshop modeled on the 'writeshop' approach of the International Institute of Rural Reconstruction. Rather than presenting theoretical ideas about adaptation to climate change, these pages share the ideas of a group of active lead farmers and field workers currently practising in the field. The technologies were reviewed by the group and a consensus decision made on what to include in the guide.

All technologies described are innovations, and make a positive contribution to strengthening food security in response to climate change. Some also contribute directly to carbon sequestration or reduction of emissions: by increased planting of long-term tree crops, and by various means of keeping more carbon in the soil through organic farming approaches.

Not all presented technologies can or should be applied everywhere. Rather, farmers are encouraged to learn from each other and adapt the ideas and methods to their own places.

It is hoped that this guide will improve farming systems and the resilience of local environments in two key ways; by functioning as a practical resource for farmers and those supporting farming practices on the ground, and to support the testing and integration of innovative, low-cost technologies into national and regional policies and practices. It is envisioned that this guide complements, and strengthens existing adaptation initiatives to better equip Melanesian communities to focus on the importance of food security as a response to the impacts of climate change.

As with any key resource, this guide is a 'work in progress' and comments and contributions are invited for future versions. We welcome your feedback and have provided a form on page 131 which can be submitted to your local Live & Learn office.

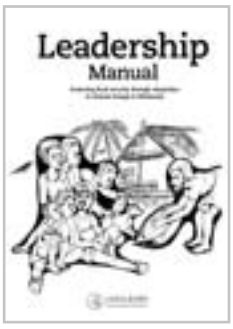
Other resources

There are two other resources in Live & Learn's current program which work together to support and educate on climate change and food security. They can be used together or separately depending on the needs of the community.

Leadership Manual, Protecting food security through adaptation to climate change in Melanesia

The purpose of the Leadership Manual is to assist leaders in the community to strengthen local agriculture for climate change. Leaders will be equipped with information and lessons to raise awareness, identify vulnerabilities and plan actions at the community level.

The manual is written as a companion to be used with this handbook and the Fact Sheets. The manual includes references to some specific farmer technologies.



Leadership Manual

Fact Sheets

The set of fact sheets promote simple, innovative and low-cost technologies for climate change adaptation and food security. They can be distributed as a set or given out individually to suit farmers' needs.

Fact Sheet

Further information

If you require more information, contact the relevant support organisation in your country:

Solomon Islands

Live & Learn Environmental Education - Solomon Islands
DSE Building, Lombi Cresent Street, New China Town, Honiara, Solomon Islands
T: +677 23697 F: +677 24453 E: solomons@livelearn.org

Kastom Gaden Association
PO Box 742, Honiara, Solomon Islands
T: +677 39138, F: +677 30840

Papua New Guinea

Live & Learn Environmental Education - Papua New Guinea
Section 35, Allotment 16, Kimbe Town, West New Britain Province,
Papua New Guinea
T: +675 983 4716 F: +675 983 4237 E: png@livelearn.org

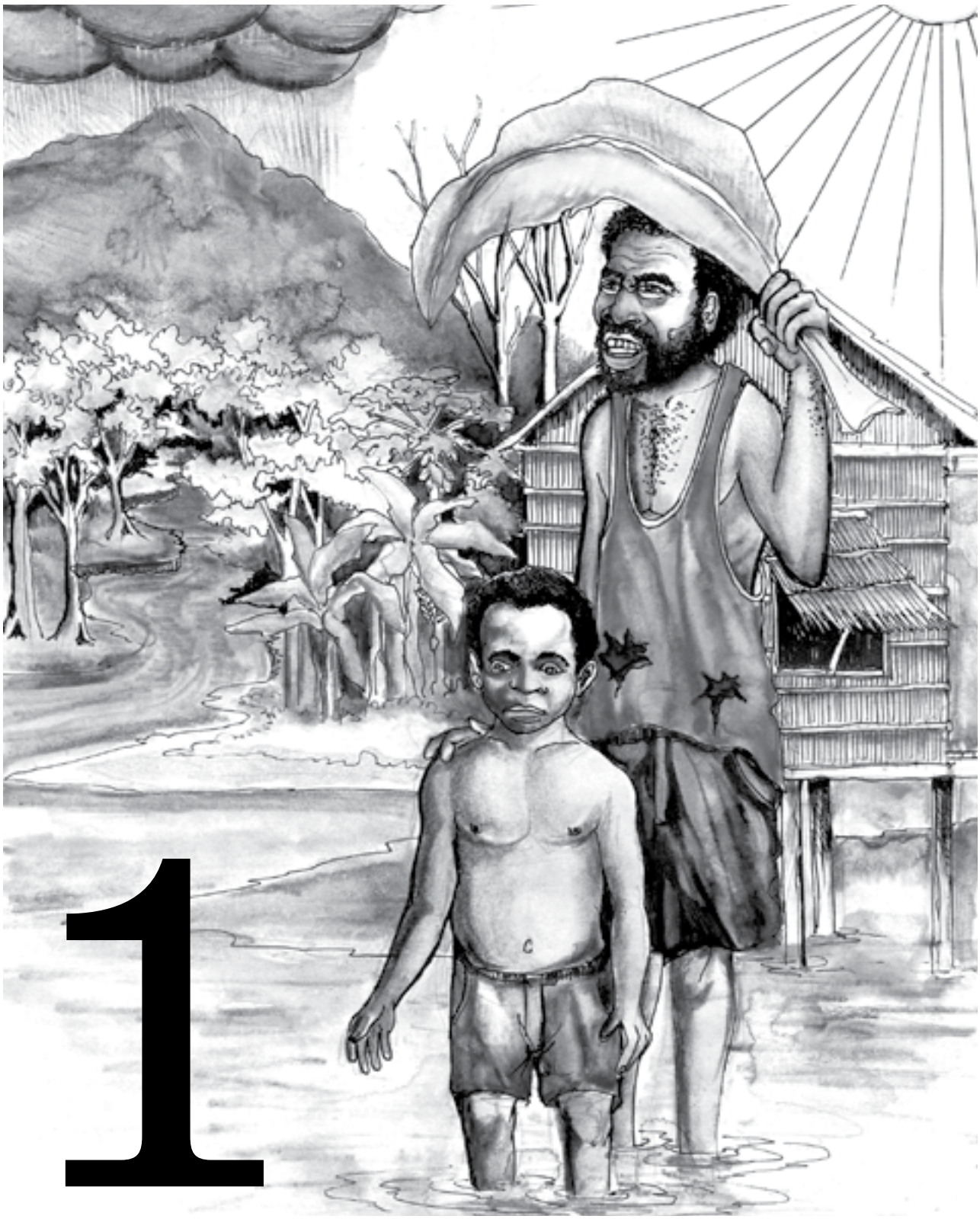
National Agricultural Research Institute (NARI)
Head Quarters
Kana Aburu Haus, Sir Alkan Tololo Research Centre, Bubia
PO Box 4415, LAE 411, Morobe Province
T: +675 475 1444/475 1445 F: +675 475 1450 E: narihq@nari.org.pg

Vanuatu

Live & Learn Environmental Education - Vanuatu
Fresh Wota Four (opposite Fresh Wota School), Port Vila, Vanuatu
T: +678 27448 F: +678 27445 E: vanuatu@livelearn.org

Vanuatu Farm Support Association
Syndicat Agricole & Pastoral de Vanuatu (SAPV), PO Box 17, Port Vila, Vanuatu
T: +678 25717 F: +678 25717 E: sapv@vanuatu.com.vu

Department of Agriculture, Rural Development Division
PMB 9040, Tagabe Station, Port Vila, Vanuatu
T: +678 22525 F: +678 25265



1

Climate change

This section gives a brief overview of climate change and how this is expected to affect Melanesia.

What is climate change?

The atmosphere

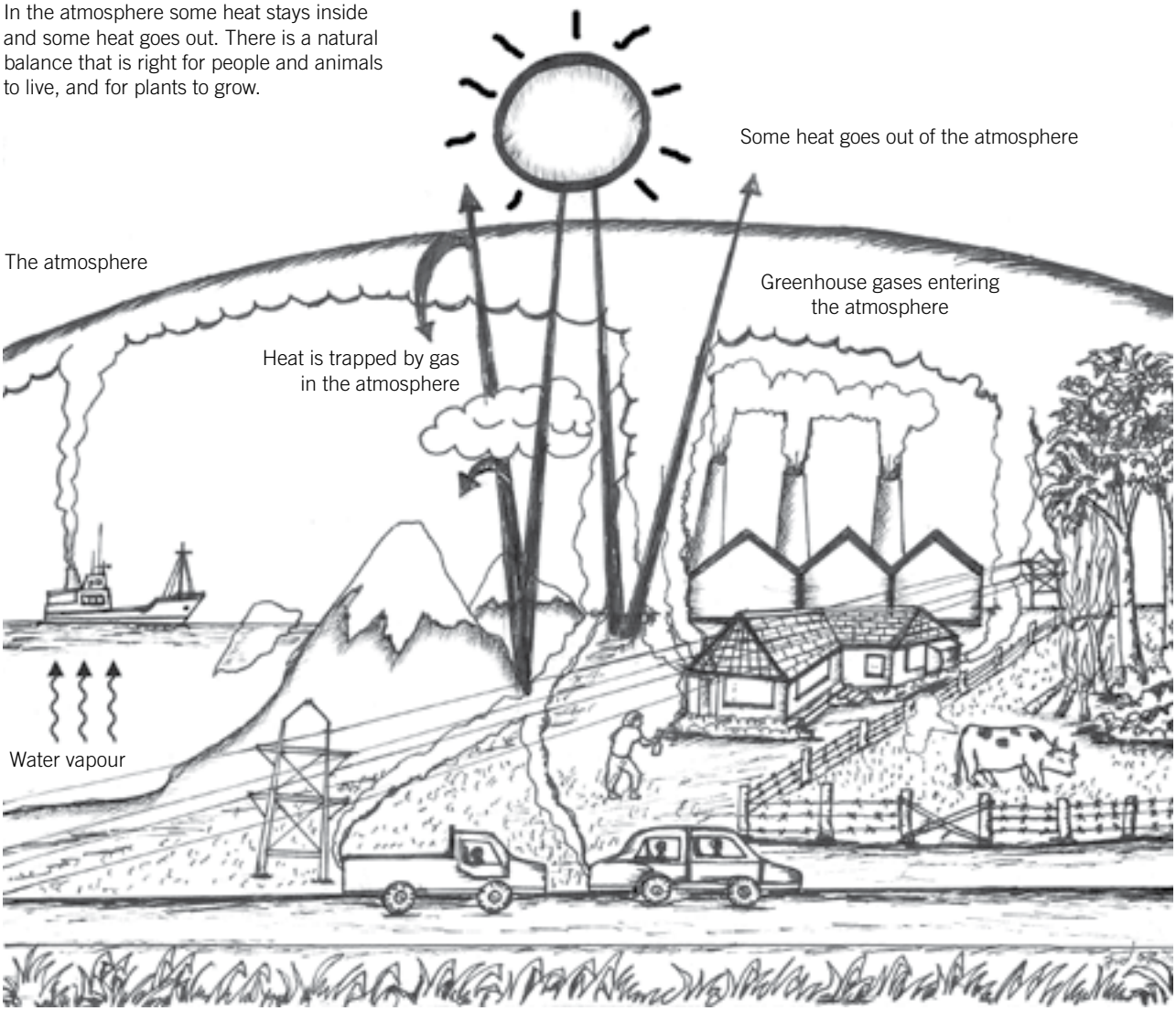
The Earth has an atmosphere that covers it like a blanket. The sun shines down on the Earth. Some heat is trapped on Earth and in the atmosphere. Some of the heat radiates back out.

The blanket is made up of different gases. One is water vapour that comes from water molecules that have floated up from the ocean (by a process called evaporation). Water helps to keep the Earth warm: just right for people and animals to live and plants to grow. The atmosphere helps maintain a natural balance, for example when water molecules combine to make rain.

But increased amounts of gases make the natural blanket of the atmosphere thicker. The main pollutant is carbon dioxide which comes from burning fuel in fires, cars, planes and industry.

Increased carbon dioxide gas is entering the atmosphere through many different ways, especially as a result of the modern lifestyle and economy. Carbon dioxide traps heat and so increased levels of it has a 'greenhouse effect', with global warming as a result.

In the atmosphere some heat stays inside and some heat goes out. There is a natural balance that is right for people and animals to live, and for plants to grow.



Gases trapping heat

Carbon dioxide and some other gases such as carbon monoxide and methane trap heat. That's why they are known as greenhouse gases. Instead of mentioning them separately as pollutants, we usually talk about them as carbon entering the atmosphere.

Most greenhouse gases are produced when fuels such as diesel or coal are burnt, to power a car or to make electricity. Burning trees also releases greenhouse gases. You cannot see the thicker blanket these gases make, because these gases are an invisible part of smoke.

Countries like Australia, the United States and China produce much more greenhouse gases than the islands in Melanesia. This is because people in these countries drive more cars, have more factories and use a lot more electricity in their homes and businesses.

Global warming

The gases from cars, factories and airplanes float up into the sky and make the atmosphere thicker and denser, similar to a blanket. This thick blanket lets heat from the sun in, but stops heat from leaving the Earth. Over time, more heat is trapped between the blanket and the surface of the Earth. This thicker blanket wrapped around the Earth is causing the Earth to become hotter and hotter. This effect is called global warming.

Climate change

The thick blanket of gases in the sky not only makes the Earth hotter: global warming is also causing normal wind and rainfall patterns to change. For example, in Melanesia, this could change the planting seasons for crops. Cyclones could also become stronger. Together such changes are called climate change.

Impacts of climate change

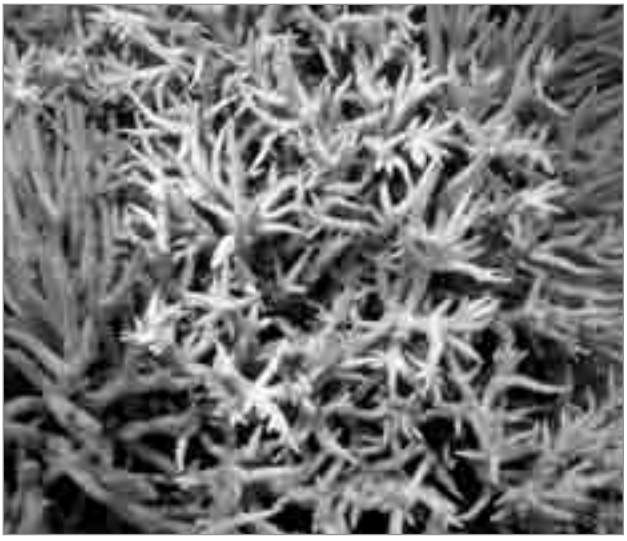
Sea-level rise

Climate change is affecting every country, not just the countries that produce the extra greenhouse gases. People in many Melanesian villages have noticed that the sea-level is rising. This is happening for two reasons. The first reason is melting ice. There is a lot of ice at the bottom and the top ends of the Earth, known as the North and South poles. As the Earth is warming, more of this ice is melting. The water runs into the sea and raises the sea-level. The sea is also getting bigger as it gets warmer, because warm water takes up more space than cold. This is the second reason why the sea-level is rising. In Melanesia, the rising sea is already washing away beaches and coconut trees, covering graveyards and destroying crops. The salt water is also getting into wells and other places where people usually collect fresh water.

Bad weather

Climate change means there will be more and stronger cyclones, floods and droughts (long dry periods). Tropical cyclones in Melanesia cause strong winds, high waves and flooding from heavy rains. These cause damage to houses and gardens, and can harm people, coral reefs and fish.

As global warming causes the sea to become warmer, there will be negative effects on fish and corals. Coral reefs are very important in Melanesia. They provide a home and food for reef fish, on which other types of fish feed in turn. Without the corals, fish cannot survive. Corals also supply sand to beaches and help make reef islands. If the sea becomes too hot, corals will not survive. If corals get too hot for a long period of time, they turn white. This is called bleaching. Bleached corals are sick and sometimes they die, as has happened in some warmer seas. More coral may die if global warming is not stopped.



Bleached coral off Keppel Island in Australia. When sea water gets warmer, the corals die.

Ocean acidification

As more carbon dioxide goes into the air, the sea will absorb some of this which will make the ocean more acidic. When the ocean is more acidic it makes it difficult for living things such as shellfish and corals to make their shells or hard coral coating. The result may be further decay of reefs.

Changes to the atmosphere from human activities:

- Increased carbon in the atmosphere largely results from burning fossil fuels
- Burning and other destruction of natural carbon stores and sinks (such as forests)
- Increased methane from domestic animals
- Possible 'feedback loops'

Impacts:

- Global warming
- Changing weather patterns
- More and stronger extreme weather events
- Rising sea-levels

Global response

There are global efforts underway to try and bring climate change under control. This can be done by reducing the amount of greenhouse gases that are released into the atmosphere.

Several different approaches are possible:

1. Carbon pollution reduction
2. Carbon absorption/sequestration
3. Climate change adaptation
4. Improved climate monitoring and studies.

Here are some further details on how to go about these approaches:

1. Carbon pollution reduction

- Increase energy efficiency
- Use less energy and fossil fuels (drive cars less, use less power)
- Better design of buildings and settlements
- Increase use of renewable energy (such as solar panels)
- Other new technologies
- Slow down and stop the destruction of carbon sinks (forests), or places that hold a lot of carbon.

Reduction has proven very difficult with growing economies and world populations.

2. Carbon absorption and sequestration (plant more trees to soak up carbon from the atmosphere)

- Development of a carbon trading system
- Reforestation
- Increasing soil carbon by organic farming
- Other new technologies

3. Climate change adaptation (prepare for the changes that are coming)

- Accept that some climate change is now inevitable – it's already occurring
- Help developing countries prepare and adapt – in particular where there are threats to food security

4. Studies of likely climate change impacts in different regions (research how our lives are going to be affected)

- Global monitoring systems
- Support for local level responses and capacity building

There are many technologies that farmers and households may use to adapt to the impacts of climate change. These methods can also contribute to reducing carbon pollution and absorbing carbon – for example by planting more trees in agriculture.

This guide focuses on the third area, adaptation to the impacts of climate change.

How will climate change affect Melanesia?

We are certain that changes will happen, but we can't predict them accurately for each Pacific Island

Scientists have 'models' that try to predict what will happen in the future. These models are designed to predict broad-scale future changes in climate patterns over very large areas (such as continents). But they are not very accurate in predicting climate changes on a local level, that is by country or by island. Generally, a variety of changes can be expected:

- Air temperatures are expected to rise
- Sea temperatures are expected to rise
- Sea-levels are expected to rise
- Sea water is expected to become more acidic
- Rainfall is expected to rise in the north and decrease in the south
- More rain is expected to fall in summer and less in winter
- Cyclones may become more intense

Air temperature

By 2099, scientists expect an increase in the surface air temperature of 1.8 degrees Celsius (°C) in the Melanesian region on average, but predictions vary between 0.99 and 3.11°C. Therefore water will evaporate faster and plants will dry out more quickly, causing potential problems for farmers.

Rainfall

Current modelling predicts that climate change may result in drier weather in southern Melanesia (New Caledonia) and wetter weather in northern Melanesia (New Guinea) and parts of Solomon Islands.

More rainfall is expected in summer, the traditional wet period, and less in the already dry months. Therefore droughts could be more intense, but floods could also become more severe.

Drought and flood

Drought presents problems for farming everywhere in the Pacific, particularly because irrigation is not usually practised. Crops may suffer from lack of water.

Increased risk of flooding also threatens food production. Heavy flooding of the Wainibuka and Rewa rivers in Fiji in 2004, for example, damaged between 50 to 70 percent of crops.

Climate change will bring different changes to our islands. It is likely that islands will face increased flooding, stronger cyclones, more droughts and dry periods, periods of increased rainfall, coral bleaching, and rising sea-levels.

Cyclones

The relationship between climate change and tropical cyclones is uncertain. Cyclones are likely to become stronger, last longer, have higher wind speeds and produce more rain.

In many Pacific Islands, cyclones are already a cause of injury, death and widespread crop damage. Cyclone Ami, for example, caused over US$35 million in lost crops in Fiji in 2003.

Sea-level rise

Scientists predict an average worldwide sea-level rise of between 0.5 and 1 metre by 2099. But the sea won't rise the same amount across the globe. The South Pacific Sea-level and Climate Monitoring Project (2006) recently estimated the trend of sea-level rise in Papua New Guinea is +6.2 millimetres per year: if accurate, this would be significantly higher than the global average. It can be expected that there will be an above-average sea-level rise for northwestern Melanesia (specifically the eastern side of the island of New Guinea); other parts of the region may experience slightly higher than average sea-level rises.

Sea surface temperature

Sea surface temperature (SST) is expected to increase more rapidly towards the equator and less rapidly away from the equator. In the north and north-eastern part of Melanesia (the northern part of Papua New Guinea and Solomon Islands) it is predicted by 2100, SSTs will be on average 2.1°C higher than they are today. In the same time period, average SSTs in central and southern Melanesia (Papua New Guinea, eastern Solomon Islands, Vanuatu) are expected to increase 1.7°C to 1.9°C higher than today. While these increases may seem small, they can have a major effect on corals.

Coral bleaching

'Coral bleaching' occurs when the microscopic algae that live within coral die or leave the organisms that build the coral. The coral usually dies and turns white. Coral bleaching usually happens when the temperature of water rises by 1 to 2°C above the usual temperature where the coral is living.

Several major bleaching events have been reported in Melanesia. Examples are in Papua New Guinea's Port Moresby, Kimbe Bay, and Milne Bay in 1981/82 and 1999/2000; and in Fiji's Suva Harbour, Beqa, and Kandavu in 1999/2000.

Ocean acidification

Seawater absorbs carbon dioxide from the air. In doing so the water becomes more acidic (its pH is decreased). Acidic water makes it difficult for organisms such as shellfish, corals, and starfish to make their shells or create hard coral skeletons. Acidic water can also 'eat away' or erode existing reefs. Scientists are worried about what will happen to reefs and shellfish in Melanesia. It is not known whether or not the animals will be able to adapt to the changed water conditions.

The combination of ocean acidification with coral bleaching and the expected sea surface temperature rise provides a grim prospect for the coral reefs in the Pacific. By the second half of the 21st century, large reef areas in Melanesia may be pushed beyond their normal environmental limits and large areas may die. Farming will become even more important in providing food for the growing population when reefs become less productive.

Summary – Impacts on food security

Rising sea temperatures, coral bleaching and ocean acidification are expected to reduce the availability of fish and shellfish. Fish is an important source of protein for most coastal communities in Melanesia. Per-capita consumption of fish is very high by global standards, with an average of 70 kilograms of fish consumed per person per year.

Severe weather, intense rainfall and flooding could damage crops, while drought and higher temperatures can make it harder to produce certain crops. Rising sea-levels could flood land and make it unavailable for growing food. Severe weather may damage infrastructure (including boats, docks, and roads) and make it harder to access markets.

The changes are unpredictable; they may vary from island to island and throughout the region. One thing is clear: Pacific Islanders must start planning and changing practices as soon as possible in order to ensure future food security. This book aims to help with just that.

This information is sourced from:

Stephen J. Leisz, J. Burke Burnett & Allen Allison (2007) *Consensus Report Climate Change and Biodiversity in Melanesia: What do we know?* Bishop Museum Technical Report.

John Barnett (2007) Food Security and Climate Change in the South Pacific. *Pacific Ecologist*, Winter Edition, pp 32–36.

2

Alternatives to shifting cultivation

Many farmers in the rural areas of Melanesia follow the traditional method of shifting cultivation, also known as ‘slash and burn’ or bush fallow agriculture. In this method, an area of bush is cleared, burned and cultivated to make food gardens.

Many farmers in the rural areas of Melanesia still follow the traditional method of shifting cultivation, also known as 'slash and burn' or bush fallow agriculture. In this method, an area of bush is cleared, burned and cultivated to make food gardens.

When all the crops have been harvested (and sometimes there are two to three crop cycles), the area used to be left to grow back into bush over a period of 7 or more years while the farmers move on to clearing another area for planting.

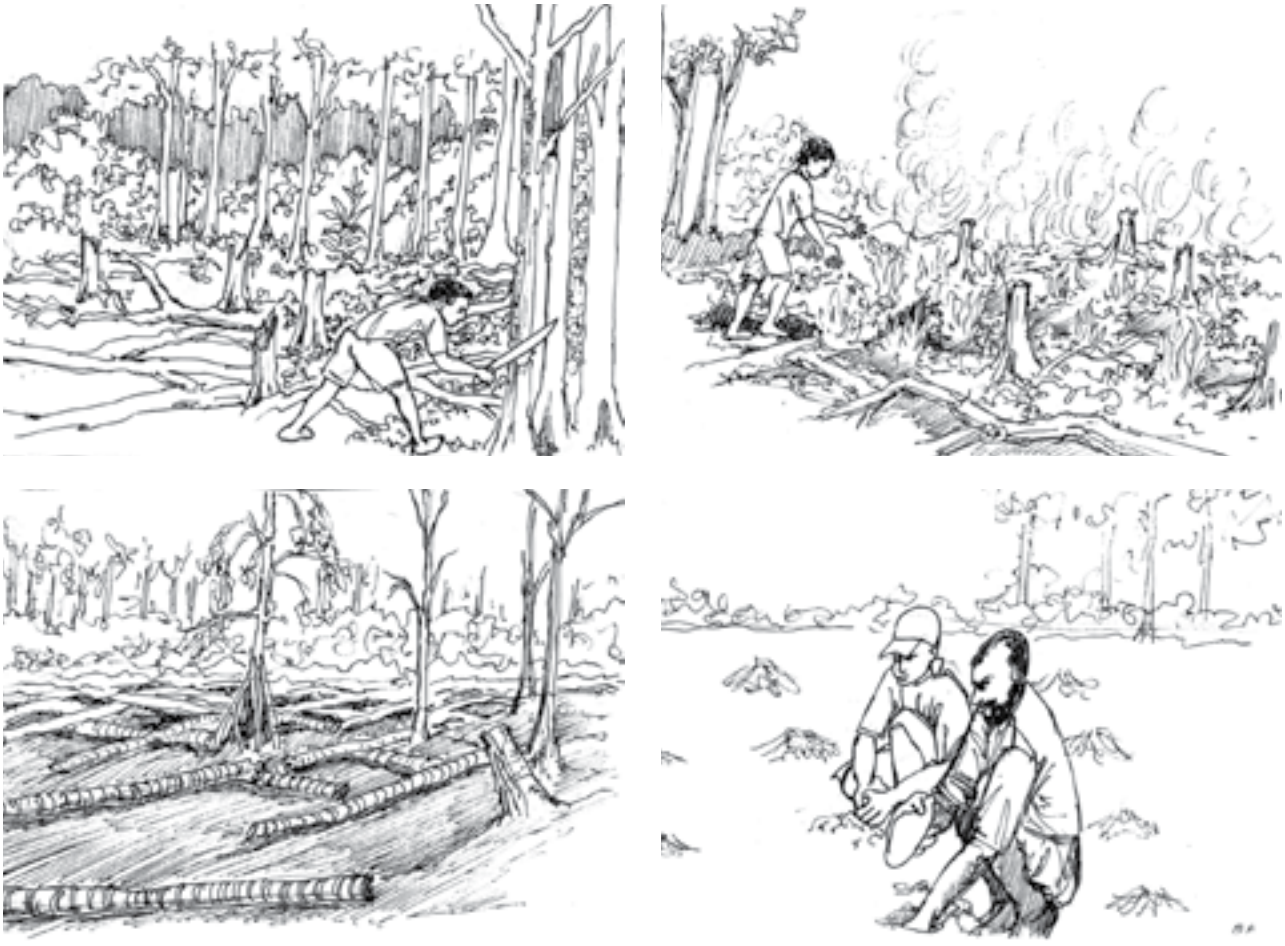
This method is no longer sustainable for the increasing island populations. The period when the area is left to grow back into bush is often only 2 or 3 years. During this time, only weeds are the major plants that grow there and little soil improvement takes place to increase soil fertility.

Shifting cultivation requires a lot of land, it can degrade the soil, and contributes greenhouse gases to the atmosphere through burning valuable organic matter.

Documenting simple, practical and useful farming methods that add organic matter to the soil will improve farming systems in rural areas.

This chapter presents several new and improved traditional methods of using land more permanently. Applying these methods does away with the need to burn valuable organic matter.

In traditional shifting cultivation, the forest is cut down and left to dry and then burned. The ash provides a boost to crops but valuable organic matter is lost to the soil and the burning releases carbon into the atmosphere. After burning, the garden is divided into blocks and then crops are planted. Most crops are planted in mounds and then tubers or cuttings placed into the mounds.



2a 'Brush and hoe' method

by Joyce Mary Dola, Mana'abu, Malaita, Solomon Islands

Introduction

Manabu is a densely populated area located on Malaita, Solomon Islands. Shifting cultivation is practised where the bush is cleared, burnt and cultivated or 'hoed' for planting (mostly sweet potato). Through this method the bush is burnt every 1 to 3 years, reducing soil fertility and increasing the amount of weeds. In the past this method worked well when the population was small and there was abundant virgin forest. But today there is not enough land for this to continue. As a result, gardens are left fallow for only a very short time.

A much better method than 'slash and burn' is to 'brush and hoe'. Rather than burning the regenerating forest and baring the soil, the area is cleared by cutting away the vegetation to just above ground level. Weeds, shrubs, and young trees are shredded and used for mulch and compost. Rather than burning the cleared secondary bush, the area is cleared using a bush knife and the slashed organic material is left to cover the ground. The soil is then cultivated with a hoe into mounds for the sweet potato. Sometimes the organic matter is heaped into rows between the mounds. Once the garden is growing it is weeded as normal but weeds are laid on the ground as mulch instead of burning them.

The bush or fallow vegetation is cleared with a bush knife. The leaves and branches are laid on the ground. The soil is then cultivated into mounds followed by planting. The organic matter from the branches and leaves rots and adds fertility to the soil. The mulch also helps protect the soil from erosion and keeps it moist and cool.

How I moved from burning to mulching

Our land has been degraded by shifting cultivation and too much burning. If we keep burning then all the soil micro-organisms die and the soil just gets dry and infertile. This new method starts to improve the soil. When I started planting without burning – leaving the organic matter from clearing the bush on the ground as mulch – other people made comments about it in the village. Some said that this type of gardening has a lot of rubbish in it. Some said that only lazy people do this type of gardening. Some said the garden doesn't look good. There were also other comments.

I did not give up, I just continued with what I was doing. After some time some women and youths visited me in my garden. They asked me why I was gardening this way, and why I was using mulch. So I explained to them the importance of mulching and why I do this kind of gardening.

After a while some people in and around other villages nearby started to apply this type of gardening. Some of them did a trial first. They made two rows next to each other. They burned one row and mulched the other row. Some tried to compare which row had more fruit or tubers and healthier plants. When they did these trials they found that not burning the organic matter is better for the plants. The method is now spreading in our area and many women and youth practise 'brush and hoe'.

Steps

Cut the bush down and pull out roots. Then hoe and plant as you normally do, leaving some of the organic matter as a mulch to cover the soil after planting.

Brushing

Clear the bush to make planting space. If there is too much organic 'rubbish' then move it to the side to be used on the mounds later during planting – mulch is hoed into the ground if no brushing is required.

Hoeing

Hoe along raised beds using a stick or a hoe, or else just make mounds as you usually do. Cover beds with mulch. Note that raised beds tend to produce higher yields than small mounds.

Planting

Plant your cuttings of sweet potato and cassava. When planting taro, use raised beds and the traditional digging stick to plant kong kong taro, and then a hoe to gather the soil around the plants. For edu (*Alocasia taro*) and yams, use a stick to plant straight into the ground.

Weeding

Maintain the garden by weeding and use the dead weeds as mulch.

Benefits

- Better use of the land as it is more fertile
- Can be used for many crop cycles
- Improved soil due to the organic matter
- Greater weed control due to mulching
- Less maintenance required

2b Integrating alley cropping and improved Temotu traditional tree planting

by Simon Peter Leyinga and Jasper Maike Bonie

Introduction

Improved Temotu tree planting is a system whereby a multi-storey forest is planted with many different types of food plants: large trees, medium-size trees, shrubs, and then an understorey of shade-adapted root crops.

In this method two different farming or gardening systems are combined into one workable gardening system. This is a proven model for small islands such as those in the Reef Islands in Temotu Province, Solomon Islands. Both systems are used here: the mixed food forests of traditional and improved tree crops, and the modern gardens of annual crops that use alley cropping to keep the soil fertile (see below). Some people have been chopping down their fruit and nut trees to plant new gardens, including alley cropping. We wanted to show that the two systems should work together and that fruit and nut trees should not be cleared.

The Improved Temotu Traditional Agriculture (ITTA) was developed in the 1980s and 1990s as a method for farmers to improve degraded land. It was also meant

Improved Temotu Traditional Agriculture is a system where trees are planted carefully in a system. Tall, medium and small food trees are planted with an understorey of shade loving yams and, root crops and edible leaves. The system is similar to a forest structure but all the plants and trees produce food.

Alley cropping is a method that allows one area of land to be used for a long time for crops. The legume trees are cut regularly with the nitrogen rich leaves and branches used as mulch on the ground to improve the soil fertility.

to increase food production. That method is covered in more detail in the agro-forestry chapter of this guide.

Alley cropping was introduced in 2006 using gliricidia as a hedgerow tree for improving soil fertility. Gliricidia is called 'shade tree' in the Solomons, as it is often used to shade cocoa trees. 'Hedgerow' refers to a row of legume trees planted in wide-spaced rows through the garden. The trees are regularly cut back and the nitrogen-rich leaves and branches are used as mulch on the crops to improve the soil fertility. This is also covered elsewhere in this manual. Both systems are currently used by farmers in the Reef Islands and Santa Cruz, and both have potential and shortfalls.

The Reef Islands group in Temotu Province has many people living in a small land area. The islands are a mix of low-lying islands and atolls. They are likely to be heavily impacted by the effects of climate change. King tides have occasionally flooded low-lying coastal gardening areas with salt water. Weather patterns have become unpredictable and increased temperatures are experienced. Extreme dry periods have become more frequent. There is occasional food shortage in these islands. Farmers are not fully utilising the limited agricultural land that is available. For these reasons it is very important for farmers to plan the use of their limited lands.

The ITTA involved over 400 farmers in the 1980s, 1990s and early 2000s. The aim was to revive degraded soils and conserve all the traditional food plants. Most of the food plants from the tree-based system are seasonal and therefore not meeting the people's daily dietary needs for the whole year. It is necessary to grow crops like kumara (sweet potato) in annual crop gardens. But there is not enough land available for shifting cultivation to continue, so this system was developed for permanent use of land.

Our solution is alley cropping, where plants are provided with enough sunlight, green manure, compost and space to grow well. This is suitable for growing crop plants such as cassava, kumara and other vegetables. Both systems, tree forests and alley cropping, are useful. To avoid using more land than is necessary the systems are integrated. Working together side by side, these systems will make sure that food production can meet everyone's needs now and in the future.

Steps

A site intended for gardening is inspected and surveyed. An area is measured. An area of 30 by 30 metres or 40 by 40 metres will be sufficient for one family.

A farm design is drawn up by the farmer. Strips are planted according to the ITTA model with a mix of different tree species. The alley cropping component uses strips of annual crops with alleys or rows of legume trees in between.

Crop selection is based on the preference of the farmer's family. It should cover a wide range of traditional food plant trees (breadfruit, cut nut, gnali nut, king tree, inkori, fruiting akwa and others) as well as full-sunlight staple crops such as yam, sweet potato, cassava and taro.

The plot is then pegged. This needs careful planning so that tree food plants and permanent root crops such as wild yams, shade pana and shade giant taro are planted in their proper positions. The organic gardening area for alley cropping will be used continuously.

A nursery is established to raise young tree seedlings to be planted. Cover crops (pueria or mucuna) help with controlling weeds under the trees as they grow and also cover the ground with legume before the soil is prepared for a subsequent crop.

The result is a multi-storey forest-like structure comprised of traditional food plants. The tallest fruit trees occupy the upper storey with other crops with varying heights forming the other layers. Root crops are at the ground level in the shade. The alley cropping component is at least 20 by 20 metres. This organic garden contains all other full-sunlight crops such as cassava, kumara and other vegetables. Gliricidia legume hedgerows are used to improve soil fertility.

Mucuna leaves, flower and fruit. Mucuna is used as a cover crop to improve soil fertility.

Benefits

This improved system can recreate forests, promote organic gardening of annual crops, and traditional food gardens. It can also revive land that has been degraded by continuous mono cropping and other activities detrimental to the soil ecology such as logged out areas.

- When mature, trees produce every year with no labour required
- Provides habitat for forest organisms and improves ecosystem
- Improves soil structure and fertility through soil restoration
- Increases food production of both shade-tolerant and full-sunlight crops
- Provides nutritious food
- Can improve a farmer's financial status by providing varieties of crops, fruit and vegetables for sale

2c Land restoration and farming using vetiver grass

by Farm Support Association, Vanuatu

Introduction

Vetiver grass is a very useful plant for Melanesia. It is mainly used to restore land after erosion (washing away) and to support farming of crops. The grass has straight and vertical blades which also makes a good mulch. Vetiver can be raised in a nursery for use on damaged land, especially land on slopes. It does not produce seed and so will not spread or become a weed in the garden. It is very deep rooted and will live for a long time as clumps wherever it's planted.

There are many benefits of planting vetiver. It has a deep and extensive root system which means that it can hold soil together, locking in the nutrients and improving the fertility of the soil. Planting vetiver on slopes holds the soil together and reduces soil erosion. Intercropping vetiver grass with the legume tree glyricidia also adds nitrogen and mulch to the soil. Both terrestrial and marine biodiversity can also be restored when vetiver is planted. Marine biodiversity is protected by reducing the amount of soil washing into the sea and lagoon which can damage reefs.

Planting vetiver can help protect food security against the impacts of climate change: land that would otherwise be useless because of soil erosion and other effects can be returned to production and use. Farmers can also sell the surplus crops they harvest from areas where vetiver grass is planted, to supplement their income.

Rows of vetiver grass planted across the slope can be used to restore land, reduce soil erosion and increase soil fertility.

Vetiver grass can be planted on degraded and eroded land to stop the soil from washing away. Over time the vetiver rows will allow trees to re-establish and the soil to regenerate. Further degradation of the land is stopped. This is very useful in erosion gullies – for example after logging.

Steps

- Transport vetiver seedlings from the nursery to the site (or divide existing vetiver grass clumps)
- Choose and mark where to plant vetiver – this is best done in contour lines across sloping land areas or across gullies
- Plant vetiver seedlings close together along the marked contour lines and in marked frames in gullies
- Plant mature gliricidia cuttings in every metre along the same marked lines. Plant gliricidia cuttings of 1 metre long: 60 centimetres goes into the soil with 40 centimetres sticking out (planting of GlyricidIa is optional).

Once vetiver grass has been established for a period of time, land that was first degraded and eroded will be able to support trees again.

2d Contour farming

by Lionel Maeliu, Guanafiu Farmer School, Malaita, Solomon Islands

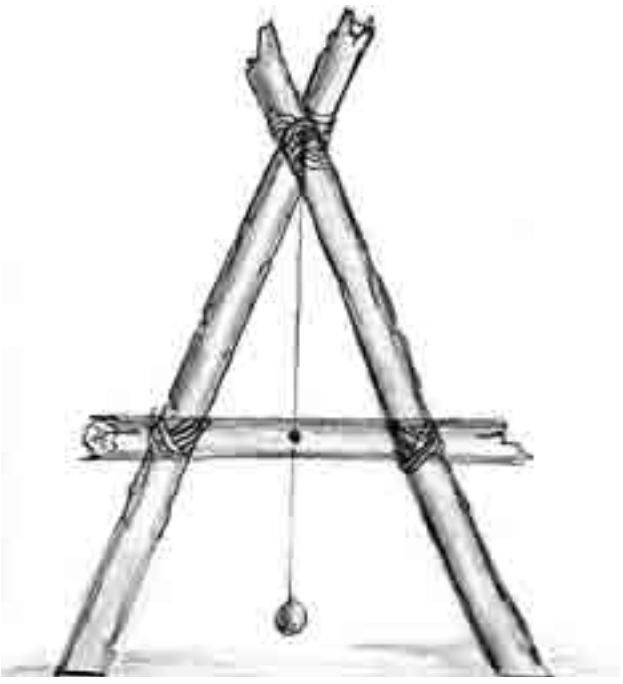
Introduction

Contour farming is a practice used to control soil erosion on sloping land, allowing farmers to continue using the same area of land for cropping. This method is particularly useful for wasted or degraded sloping land as it will improve the land over time. An A-frame is used to mark contour rows which are then planted with vetiver grass and gliricidia. Crops are planted between these contour rows. This is especially useful on slopes and in the bush or mountains.

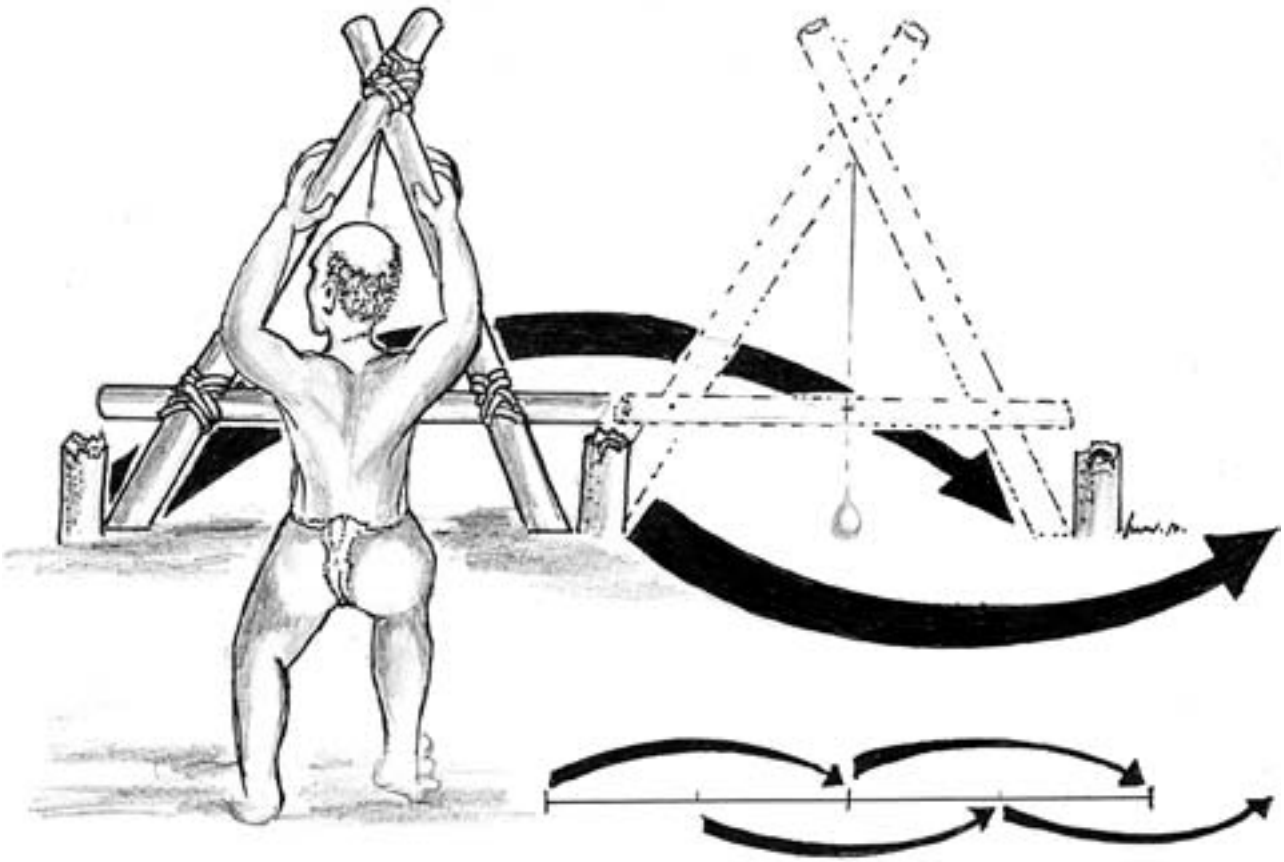
Steps

Construct your A-frame (from bush materials and with bush rope). Tie a stone or other heavy object at the end of the rope. Place the A-frame on a level surface such as the floor of your house and mark the level on the cross beam of the A-frame – this will be your level to guide you on the contours.

Contour farming is where crops are planted across the slope. This method uses rows of vetiver grass which prevents valuable soil from being washed away on hilly and steep land. Mulching and crop rotation keep the soil fertile between the vetiver grass rows.



An A-frame made from bush materials is used as a level to mark the contour line across the slope.



Get the A-frame level on the slope by moving one leg of the A-frame up or down until the stone and rope is in line with the level mark. Then swing one leg of the A-frame around to mark the next peg. Continue doing this for the length of the garden area. Then move the A-frame up the slope to start marking the next line.

Mark contour lines starting at the bottom of the slope. Put pegs (small push sticks are fine) in place along the contour as you use the A-frame. Walk the A-frame across the slope by swinging it around on its legs, and put a peg at each step.

A contour line is not a straight line. It is a level line: that means if you walk along it you will not be going up or down the slope but staying at the same level. Usually it will curve with the shape of the land.

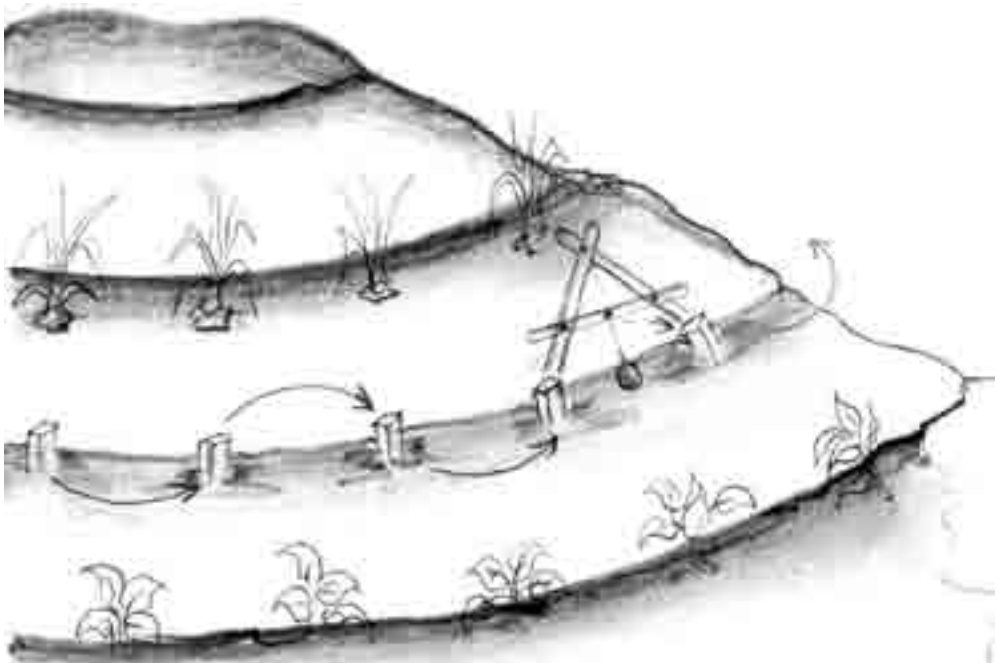
Plant vetiver grass and gliricidia along the contour lines one after the other (one line of vetiver grass followed by a line of gliricidia). Plant close together so soil will not wash through the vetiver rows. Usually about one hand width between each vetiver grass plant will ensure if forms a solid hedge that soil cannot wash through.

Using the A-frame, mark the next contour line 5 metres apart and plant legume trees. The rows can be closer on steeper land and further apart on more gentle slopes.

Plant any legume beans (mucuna, cow pea, long beans, and peanuts) and flowers in any of the blocks. After harvest, practise crop rotation – after the food crop is harvested, plant a legume crop which fertilises the soil.

Mulching of the land means covering the soil with leaves and organic matter. This is very important to maintain soil moisture; it also helps to prevent soil washing away. Any soil that is washed down the slope will be caught by the rows of vetiver grass.

Mucuna plant



Walking the A-frame across the slope.

Vetiver grass can be regularly pruned with a bush knife to provide mulch for the rows of crops in between. Cut vetiver grass makes very good mulch.

Benefits

- Contour farming addresses climate change issues by reducing soil erosion and not releasing carbon into the atmosphere
- Improves food production on land that is not useful
- Maintain and improve land quality by preventing important nutrients from washing away
- Environmentally friendly and sustainable because it restores degraded land and biodiversity. It also reduces soil erosion and protects rivers and seas
- Natural pest control can be achieved if flowers such as marigolds are planted and when mixed planting and crop rotation are applied as recommended
- Better food quality as food is grown using mulch and is organic
- Surplus crops provide opportunities for better financial returns
- Rural community (women, men and youth) can easily take part in this farming practice
- Seed saving practices – keep a diversity of your own planting materials for replanting next time
- Model of organic farming – no chemical spray is used
- Bulking and maintaining different varieties of sweet potatoes
- Fruit trees can be planted in a mixed orchard with rows of vetiver and glyricidia to control erosion
- By reducing the need to clear forest for shifting cultivation we help to conserve the remaining forest
- Can even provide an opportunity for home stay tourists interested in sustainable farming!

2e Improving farming systems in rural areas

by Farm Support Association, Vanuatu

Introduction

In places where population density is high and there is little land available to grow crops, farmers need to practise soil enrichment to increase soil fertility after a harvest. The following methods are being used in Vanuatu to improve the soil:

- Alley cropping
- Cover crops
- Planting legumes
- Crop rotation

Alley cropping is where crops are planted alongside legume plants or legume trees and is described below.

Legumes trees are mainly used by farmers to quickly enrich the soil. All legumes have nodules on their root systems that allow them to add nitrogen

Rows of pruned legume trees in alley cropping add organic matter to the soil to grow plants such as ginger (as shown above).

Ginger (left) and kong kong taro (xanthosoma) (right) are planted as strip crops between rows of legume trees. The legume trees provide nitrogen and organic matter for the crops to grow.

Alley cropping, crop rotation, cover crops allow land to be used more intensively. The result is more permanent or long lasting gardens where trees are combined with food crops and soil fertility is maintained.

into the soil. This method allows a farmer to use an area of land for at least 3 to 4 years before leaving the area to recover. Because legume trees are already planted, the fallow period is only 2 to 3 years. Alley cropping can be practised on flat land as well as on slopes.

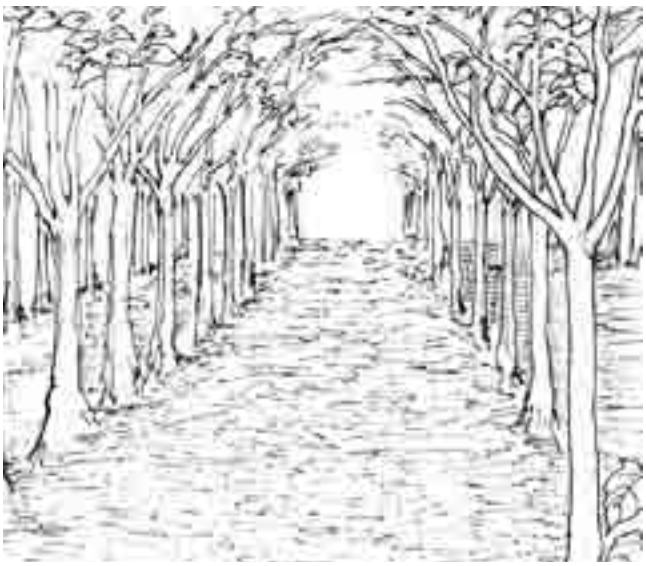
Steps

Choose a planting site and mark out the space for the alleys. A good spacing is 20 by 25 metres.

Plant legume trees along the side that is 25 metres long. The rows should be at least 5 metres apart and there should be a space of 1 metre between each gliricidia plant. Start 2.5 metres from the side of the area: this should give you 5 rows of gliricidia. Make sure the cuttings of gliricidia are 1 metre long and that the dug holes will accommodate 0.5 metres of the planting material underground and the other 0.5 metres above ground level. It is best to use gliricidia cuttings that are mature and not too young (at least 2-year-old branches). Gliricidia has a lot of sap, so after cutting the planting material leave it in the shade for at least a week before planting.

View of alley cropping strip ready for planting. Rows of gliricidia are spaced at 5 metres with cultivation area for crops in between the rows. Glyricidias are planted 1 metre apart. Crops that are planted in the alleys should be at least 1 metre away from the gliricidia plants. There can be four rows of crops in one alley and the spacing between those crops should usually be 1 by 1 metre. Remember that the gliricidia plants will grow tall but farmers should not allow them to grow too high. Prune them regularly and use the cuttings as mulch for the crops grown in the alleys.

Alley cropping with cassava planted in the rows. Alley cropping trees should be pruned regularly. They can be left to grow larger under fallow and then harvested for firewood before the next crops are planted.



Generally the legume trees should not be allowed to grow too tall. However sometime the farmer may leave the plot for a longer fallow of 2-3 years. During this time the trees will grow tall and can be harvested for firewood. This longer fallow will also be a bigger boost to soil fertile after a long period of many years of cropping.

Benefits

- Reduce soil erosion (washing away of soil)
- Pruned branches and leaves of gliricidia can be left on the soil as green manure and to reduce soil erosion
- Improve soil fertility

Case study: Experiences of alley cropping at Montmartre Farm, Vanuatu

On Montmartre Farm, where the Farm Support Association has established trials, the food crops have been grown in rotation (yams/sweet potato/ taro/maize) continuously for almost 10 years in alley cropping without any fallow period. Yields of all crops have remained economical without fertilizer inputs, except the prunings from the hedgerows. Hedges used are *Flemingia macrophylla*, *Gliricidia sepium* and leucaena. These techniques can improve soil fertility quickly and produce good yield of crops.

2f Erythrina for improved fallows

by Farm Support Association, Vanuatu

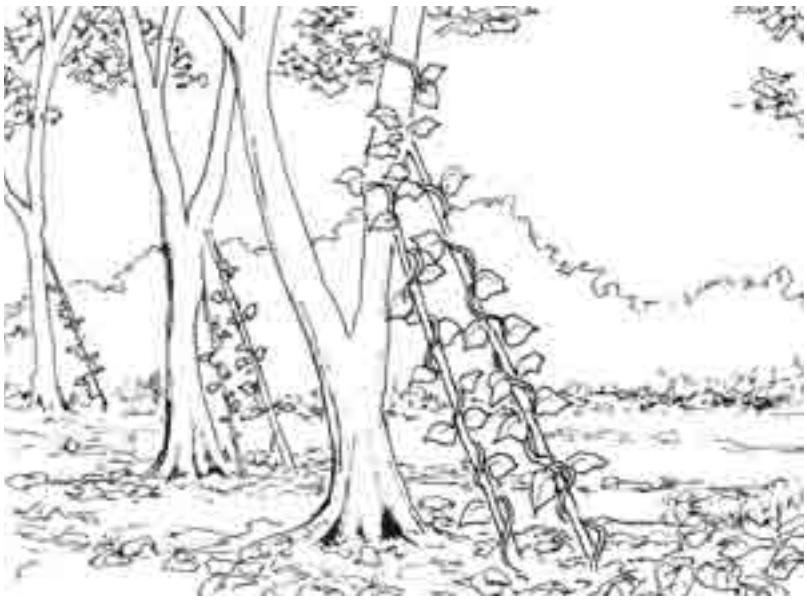
Introduction

Planting legume trees (gliricidia or erythrina) after crop harvesting is a proven method for increasing soil fertility. It involves an improved fallow where legume trees are planted rather than the traditional method of just leaving the bush to regrow on its own.

Steps

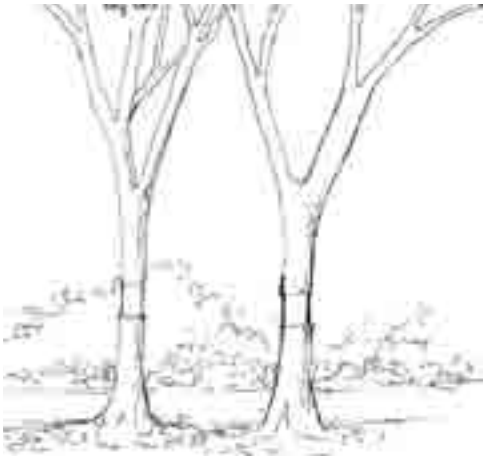
- Prepare the cuttings (1 metre in length) and plant them 1 or 2 metres apart (at 60 centimetres deep in the soil, with 40 centimetres above the soil surface). The cuttings must be planted before weeds start to grow.
- After 2 to 3 years the legume tree can produce a good canopy, reduce weeds and improve soil fertility. Dry leaves decompose into the soil.
- Erythrina trees also make good living stakes for wild yams to be planted and allowed to climb the trees. This still provides a crop for the farmer during the fallow.
- After the fallow, the farmer can clear the area and use the gliricidia for mulch. One way to kill the trees is to ringbark them. They will then drop lots of mulch on the garden and the dead trees can be used for firewood.

Farmer standing in a food garden where erythrina trees have been planted for an improved fallow.



During fallow wild yams can be planted to climb the erythrina trees.

Annual crops growing among the ring barked erythrina trees.



The erythrina trees are ring barked prior to replanting in the garden. The trees will drop their leaves as mulch on the garden and allow sunlight to reach the crops.

These techniques can improve soil fertility quickly and produce high-yielding crops.

Benefits

- Quickly improves the soil after cropping
- Keeps the soil protected
- Legumes are good for firewood
- Easy transition from traditional 'slash and burn' or shifting cultivation
- This technique is appropriate in areas with a high population

Erythrina can also be used to grow wild yams during the fallow period, with the erythrina trees providing living stakes for the yams as shown in the drawing above.

2g ‘Fix’ gardening

by Francis Wehi, Tetena Community Learning Center, Makira, Solomon Islands

Introduction

‘Fix’ gardening involves planting legume trees for contour planting (see section 2d) to improve land fertility and quality. Farmers are able to implement and adapt the method to improve their farming. This method can be used in small areas of land, such as backyard farming, or in larger farming areas. It is therefore very suitable now there is shortage of land, population increase and climate change. Adapting new farming technologies better utilises the available land resources.

Steps

- Identify and mark an area for farming
- Cut gliricidia (legume tree) branches of about 1 metre
- Plant gliricidia in rows 5 metres apart with 1 metre between plants in each row
- Plant any root crops or vegetable in the blocks
- Cut gliricidia branches now and again, using the leaves for mulching and the branches for firewood

Gliricidia cuttings are planted in rows 5 metres apart through the garden area. The cutting will soon start to grow and can be cut regularly as mulch for the garden.

Benefits

- Environmentally safe and friendly and provides habitat for birds and animals
- Increased firewood production: gliricidia makes good firewood
- Legume trees enrich soil with nitrogen and organic matter

2h Hohoti gardening method for taro and yam in mountainous areas

by Kevin Sese, Guadalcanal, Solomon Islands

Introduction

The Weather Coast, on the south of Guadalcanal in the Solomon Islands, is very mountainous. There is little or no arable land for farming. In these regions the hillsides are exposed to high winds and heavy rains for most parts of the year. Over hundreds of years our people have developed farming techniques that work with or complement the environment.

The Hohoto gardening method means nothing is wasted. When pruning trees, leaves of the branches fall, decompose and increase the fertility of the soil, and

The understorey of the forest is cleared and then yams are planted using a traditional digging stick. All this work is carried out under the intact forest canopy. After planting, the trees are climbed and the side branches and leaves are removed to allow sunlight to reach the crops on the forest floor. The trees do not die and will regrow.

the branches are used for yams to creep on. In this method, only the trees are pruned, so the whole tree does not die. The roots continue to retain most of the soil and the branches grow back with time. This method can be used on flat areas, mountainous regions, hillsides and any areas that have high rainfall.

Steps

- Identify an area on the hillside that you want to farm. This could be a small plot of about 1,000 square metres (20 by 50 metres, 25 by 40 metres, or 30 by 30 metres)
- Clear small shrubs, seedlings, saplings or grass off the forest floor. Make sure you do not cut down any big trees
- Climb and prune any trees inside the farm plot, ensuring that the tree does not die. The tree roots are needed to retain soil from that could be washed away through erosion
- Now plant your taro or yams near the cut branches. Yams can use these branches to creep on when they grow
- Once the crops are ready to be harvested, the pruned trees will have grown new branches

Benefits

- Promotes agro-forestry, combining forest and food production
- Stops soil erosion
- Conserves trees
- Improves soil fertility
- Saves labour: no need to cut stakes for yams!

2i Gardening on sloping land

by Francis Wehi, Makira Province, Solomon Islands

Introduction

This local farming method is used by most farmers in San Cristobal in Makira Province of the Solomon Islands on hilly areas that have been logged or other waste land.

Steps

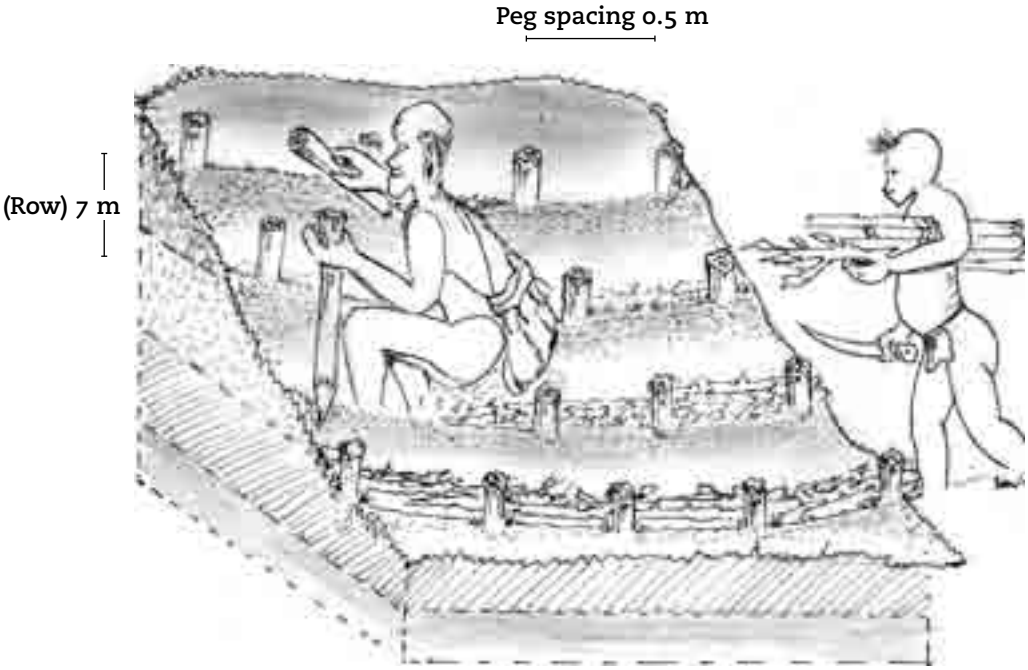
- Identify sloping land and prepare, brush and clear land for gardening
- Cut 1-metre long sticks from felled trees in the bush fallow
- Put sticks in the ground, 0.5 metres apart across the slope with 7 metres between rows

A traditional method of reducing soil erosion is to lay rows of cut tree trunks and branches across the slope. Along these lines of composting vegetation planting of banana, sugarcane and taro is done. These crops will benefit from the rotting organic matter and also help to trap any soil that is washed down the slope from above.

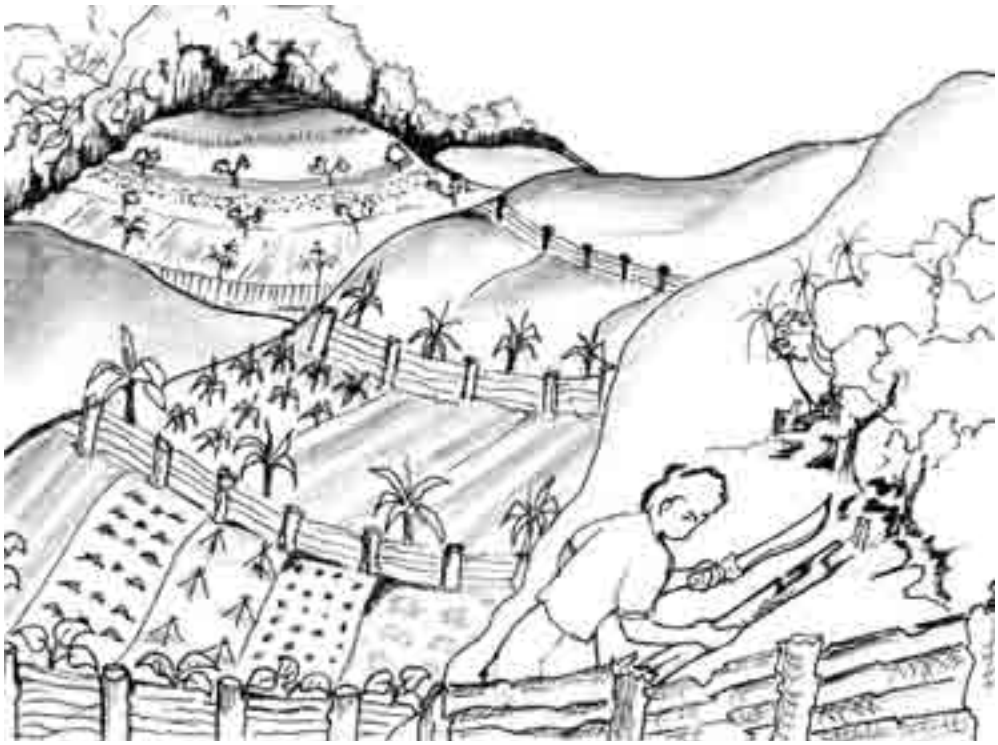
- Stack leaves, branches and other organic matter along and across the contour stick rows
- Plant taro and banana along the rows
- Plant potato or yam between the rows in mounds

Benefits

- Reduces soil erosion
- Environmentally friendly: there is no burning involved
- Makes working the garden easy
- Uses idle sloping land and increases its quality
- Encourages food security



When piling up the rows of sticks and tree trunks it is good to place pegs in the ground to help hold the rows in place. Generally the spacing between rows should be about 7 metres.



Gardening on sloping land

2j ‘Look and learn’ garden: cultivating a small garden using organic methods

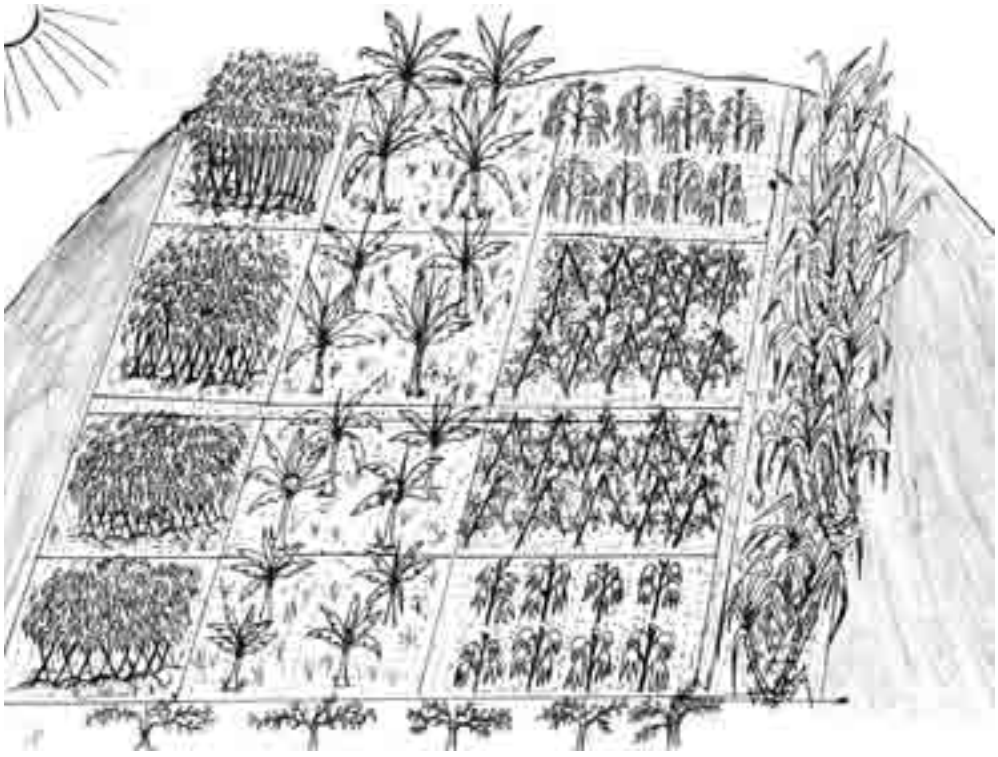
by Gwendlyn Pitavavini, Choiseul, Solomon Islands

Introduction

After many years of practising organic farming in different gardens, I started a new permanent garden in the bush where I am using organic methods. The garden is in a hilly area, where I have made raised beds. I have made this to be an organic ‘look and learn’ garden – to show people how they can use areas with bare and poor soil where you would normally not think to make a garden. I want to show that we can bring back the good soil to these areas.

Steps

- First I spent 2 days brushing and clearing: it was only a small bush. I got some help and rewarded my assistants with some cooked food, following our traditional ways.
- Then I started to make rows of mulch through the garden area. I measured out about three blocks. Without a measuring tape, I just estimate what I considered a good block size.



A mix of different methods is used to make a permanent garden: legume trees planted around the outside, mulching with organic matter and crop rotation with legumes.

- I dug raised beds in rows with mulch between them. Then I covered the raised beds with mulch too. Because the garden is on a slope, the mulch cover is important. The raised beds are made across the slope (rather than pointing down) to help prevent erosion.
- I left the beds covered with mulch for one day. The next day I planted cassava and pana in one block each, slippery kabis and bean mixed in another block, and sugarcane around the outside: especially on the west side to give shade in the afternoon so the garden would not dry out.
- I then planted gliricidia around the outside of the garden. I cut the gliricidia branches and leaves and carried the mulch into the garden.
- I practise rotation – to begin with I planted a lot of beans to improve the compacted clay soil. After their harvest I just planted root crops. I will keep rotating different crops and adding more and more mulch. I have also encouraged pueraria, a legume cover crop grown in the oil palm plantations on Guadalcanal.

This garden is my place to experiment with new methods. The crops are growing well, I am getting a good harvest. The soil is improving and starting to turn black and soft with organic matter. Before it was very compacted but now it is loose and fertile. I expect it to keep getting better.

2k Integrated farming

by Roselyn Kabu Maemouri and Thecla Vapusi,
Kastom Gaden Association, Solomon Islands

Introduction

For more than 15 years, the Kastom Gaden Association (KGA) has been working on an integrated organic farming method at its Burns Creek seed garden, just outside Honiara in the Solomon Islands. Their methods have been adapted by many farmers who are members of the Planting Material Network (PMN) throughout the Solomon Islands.

This integrated approach combines different types of farming techniques for demonstration to farmers. It includes nursery management, mulching, crop rotation, seed saving and feeding local kokorako (poultry). The methods have worked well for the seed garden and after years the soil is still productive. Many farmer-members of KGA have applied some or all of the methods in their area.

Farmers also practise this and other methods in their family units to prove they are active PMN members. The methods work well together to improve the soil and provide nutritious food for health. Some of the practices that KGA has been promoting since it began are setting up a nursery and using mulching.

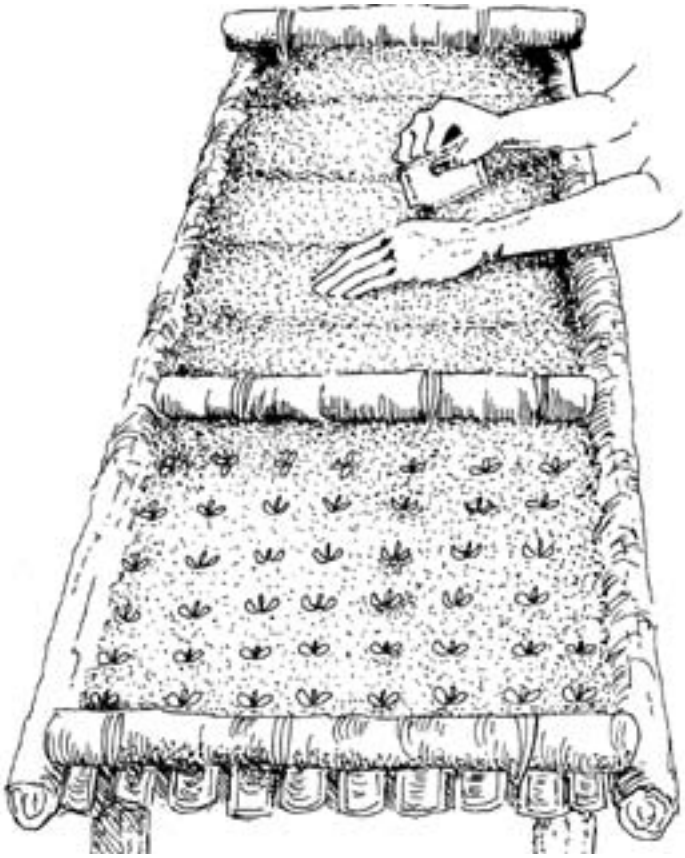
Integrated farming methods can be applied to grow food around the house: living fence protects the garden, mulching, composting and crop rotation keep the soil fertile.

Plant nursery

The nursery is where the many seeds of vegetables are germinated and grown, before being transplanted into the garden. Nursery is where most of the small seeds are grown when they need shelter and special care.

Materials

- Timber boards for nursery boxes or beds, nails; bamboo can also be used
- Seeds
- Coconut husks (already soft and composted)
- Soil sterilised with hot water or cooked over a fire to prevent fungus infection



Plant nursery – seeds planted into seed box filled with three parts coconut husk to one part soil.

Mulching the soil feeds the plants. As the mulch is decomposed it becomes humus in the soil which releases nutrients to the plants roots - allowing them to grow strong and healthy.

Steps

- Collect timber for nursery beds
- Build the raised bed with separate sections inside for each box
- Collect rotten coconut husk and grate it
- Collect soil and sterilise it in hot water, or cook it over fire and leave for a day or until cool
- Mix soil and grated coconut husk together: use 3 parts coconut husk to 1 part of soil for germination trays, and 2 to 1 parts for transplanting trays
- If the soil has not been sterilised then you can pour hot water over the mixture to kill soil fungus and let it cool down
- When it is cool, sow the seeds and water them regularly

Benefits

- This method has been widely proven by farmers
- All materials are local
- Seedlings can stay in the sun until transferred to the field – the soil mix allows seedlings to grow well, even in the full sun, so seedlings are already hardy and adapted to the sun in the field
- Once adapted to the sun, there's no need for a greenhouse for shade in the open air

Mulching

Mulching is the method of adding organic materials such as leaves or grass to protect the top soil from the sun and rain. It helps to keep the soil cool and also feeds the micro-organisms in the soil, so they can produce humus. This is essential for plants to grow well.

3

Trees and agro-forestry

Trees are very important for the environment and also for providing many of our needs. Agro-forestry is the method of planting trees in a planned way to provide for our needs.

Agriculture, our food security, in fact the future of people on this earth depends very much on trees and forests. Trees provide us with oxygen to breathe, they rebuild and hold the soil, take carbon out of the atmosphere, filter water, and keep rivers clean and flowing.

Agro-forestry uses trees to meet our needs in agriculture. It is a very good way to combine food security with the functions of trees that help our environment and reduce carbon in the atmosphere by absorbing it into their wood as they grow. More and more, agriculture will need to include forestry as our natural forests are disappearing. The methods in this section share ideas on how trees can be brought back into agriculture – some are improved traditional methods and others are new ideas developed by farmers on their own. Trees can be grown on large islands, on small islands, and even on artificial islands.

In this section we include:

- How to grow fruit trees on artificial islands without soil
- Mixed-species food forests and organized orchard systems of traditional and exotic fruit trees
- A detailed description of the improved Temotu traditional agriculture mixed food tree cropping system
- A couple of crop processing methods to keep food for times of need
- Fuel-efficient stove technology to reduce the need to cut down so many trees for firewood

These methods are important for climate change adaptation because they all involve adding, protecting, and using trees in new ways. Trees absorb carbon from the atmosphere, and they provide a buffer for extreme weather because they usually still produce fruit even when it's drier or wetter than normal.

3a Bougainville integrated mini-forest

by Bruno Idioai and Inia Barry, Bougainville, Papua New Guinea

Introduction

Here is one of the innovative designs created by the visionary farmer Bruno Idioa in the mountains of Bougainville. Resource management and sustainable development projects from Ipa demonstrate new ideas of looking after the environment that can be adopted in a changing situation – especially in the event of climate change. The mini forest technology originally grew out of the isolation and struggle of the war in Bougainville when total self-reliance was required.

This innovation is using degraded land – old gardens, river sides and ridges – to create an integrated multipurpose mini-forest. This is done by planting a mixture of local species of trees for fruit, nut, timber, medicine, and building materials. The mini-forest has many layers and different trees are stacked from the top level to the middle and down to the ground level. This is just like a natural rain forest, which has traditionally been one of the sources of food and also important to our livelihood for materials and medicine.

Bougainville food forest

Establishing a mini-forest is best done in an area that has been used for some time in slash and burn gardening: the integrated mini-forest is a new, permanent use of the land and restores it at the same time.

Materials

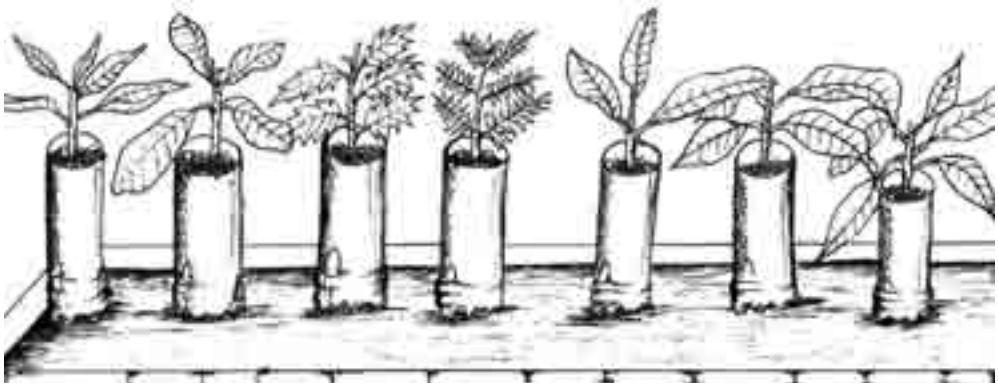
In any mini-forest planting programme it's important to have a plant nursery. So start by establishing that first:

- Decide on the best location
- Make sure there is, or bring in, good top soil
- Have tools such as a pruning saw, spade, knife, secateurs and watering can handy
- Organise the family for human labour
- For materials, use dry bamboo

Steps

- Cut dry bamboo into lengths of 8 to 10 centimetres
- Punch holes in bamboo pieces that have a joint in them, so the piece is open like a pipe
- Fill the bamboo lengths with the top soil (family labour). Soil that is a little bit sticky is good as it will hold well in the bamboo
- Line up the filled bamboo in your nursery location, in the shade under a tree: all the bamboo 'pots' must be straight up
- Now collect seedlings or wildlings (that is, naturally growing seedlings) from the garden, bush or any other communal spot where you see them growing
- Transplant these seedlings or wildlings into the bamboo pots
- Do the planting in the early morning or late afternoon
- Water thoroughly and regularly in the early morning and late afternoon, for as many days as needed until the plants are recovered
- When ready for transplanting, take the bamboo pots with a range of seedling varieties intact to the planting area
- At the planting site, use a digging stick to make holes: the depth of each hole must be the same as the length of the bamboo pot
- Then place the bamboo pot with seedling in the hole. Don't remove the bamboo, it's going to rot very fast and help the plant to grow well!

While planting in the field, please don't make monoculture clusters. The planting must take an integrated approach: an ecological sound system means many different mixed types of trees. Now you have the beginning of a forest that consists of everything useful to you, and also performs environmental functions.



Bamboo nursery

Benefits

Integrated mini-forestry or agro-forestry has the following characteristics:

- Mixed use – food, medicine, timber, animal fodder, firewood
- Multi-storey cropping – large trees, understorey trees, ground cover, shrubs, vines, and diversified legumes
- Chicken forage in the understorey
- Fulfils ecological functions of the forests by creating soil-binding habitat, windbreak, and protection of the water catchment

Bruno Idioai has been planting Bougainville Integrated Mini-forests for more than 20 years. His daily routine, and that of his family members, includes collecting seedlings in the forest and in the bush as he walks the mountain tracks. He aims to collect 100 wild seedlings each day – all the family members also help. At the end of the day the seedlings are transplanted into bamboo pots in the nursery to grow for some time. Each morning, he transplants young trees that are ready into the newest planting area. Bruno chooses areas along rivers, ridges, and other steep land not suited to gardens. He spends about an hour a day on the planting and nursery care. In total he has planted more than 250,000 trees and whole valleys have been returned to forest with regular flowing rivers, thanks to his vision.

3b Banana circles: growing bananas and fruit trees on artificial islands

by Selina Wale, Langalanga Lagoon, Malaita Province, Solomon Islands

Introduction

This method encourages the use of organic matter to grow fruit trees on artificial islands.

Such artificial islands are made from coral stone piled into a lagoon. This is done to create more land for people who have little or no land on the mainland. The islands are just above the level of the highest tide. Their construction is based on special traditional skills that has been carried out for centuries. There is no soil on these artificial islands. Still, it is possible to grow fruit trees and bananas by feeding them compost. This method is much better than throwing organic matter away into the sea, or burning it which is a common practice.

Steps

- Prepare holes for the banana plants and the fruit trees. Dig out all the stones and put them around the rim. Prepare 'holes' for the plants by building up raised stone walls as a border for the garden. You can also use coconut logs or banana trunks for the garden bed edges.

The garden bed is made on the piled stones of an artificial island. Layers of organic matter and soil compost make a fertile space for bananas, slippery cabbage, pawpaw and other vegetables.

- Collect compost material such as dry grass, rotten leaves, rotten coconut husks, soil, waste paper, food scraps, peelings, and empty tins.
- Make lots of layers of about 5 to 10 centimetres thick in the raised beds or holes, alternating the organic material with layers of soil collected from the mainland.
- Collect the best banana suckers from harvested banana plants, and young fruit trees from a nursery.
- Plant one banana sucker or fruit tree in the middle of each hole, and continue to add compost materials until the hole is filled.
- Put mulch around the plants and water the plants every day as needed. Keep mulching the plants regularly with organic material such as organic waste from the kitchen, coconut husk and cold wood ash from cooking. It will take a while until the bananas are ready but the pits can produce for many years to come.

Benefits

- Increases food production
- Supplies herbal medicine
- Increases local food for balanced diets – especially fruit for children
- Easy access to food on the artificial islands

The same method can be used to grow pawpaw or vegetables like slippery kabis (aibika), eggplant, beans, and tomatoes. Do not mix banana and pawpaw in the same pit.

3c Improved Temotu traditional agriculture

by SP Lenga and Jasper Bonie, Temotu, Solomon Islands

Introduction

Improved Temotu Traditional Agriculture (ITTA) is an agro-forestry gardening system used by over 400 farmers in the Temotu Province of Solomon Islands. This method reduces the need for the 'slash and burn' system. It can revive degraded lands, conserve and protect traditional food plants from being destroyed, and increase food production and thus improve food security. It has been a long-term programme of the Temotu Provincial Agriculture Department for over 20 years with much input from local farmers.

In the 1960s and 1970s, big areas of land were cleared to plant coconuts for copra as an export crop. Sweet potato also became the new staple as it was easy to grow. Both crops occupy large areas of land. The soil became exhausted due to over-cropping. The clearing of land destroyed many traditional tree food plants with many important mother trees cut down and burnt. There remains a need to protect these important trees.

Layers of ITTA

Collecting mulch from the ITTA forest

In 1993, ITTA produced a book and handed it to farmers to guide a new model of replanting traditional food trees, in an integrated and well planned system. Farmers today are enjoying the fruits of these replanting efforts. This system has potential to be used in other parts of Melanesia.

The main characteristic of the ITTA farm is that it is an intensive gardening system. It uses 23 species of crops: 14 tree crops, 6 root crops species and 3 vine crop species. Each species has been given a position for planting. They are positioned as:

- 'boundary line'
- 'mainline'
- 'subline'
- 'interline'
- 'companion' or
- 'below canopy'

This is an agro-forestry system forming a tree-based multi-storey structure containing diverse food plants. It uses all available space because of the many crops and the layers of crops. The system provides food from all the layers and levels. ITTA farms contain a balanced mixture of annual root crops such as yams, pana, and perennials (the long-lived tree and vine crops). Some trees bear fruit in their season while other trees bear fruit continuously.

3d Replanting quana

by Salathiel Sore, Choiseul Province, Solomon Islands

Introduction

Trees and agro-forests are a good thing for the world. Trees help to protect the world and our lives, in my way of thinking. That why it's important to keep planting more of them. I want to stop logging companies from spoiling our forests because they protect our island. That's why I support Kastom Gaden for looking after and encouraging replanting fruit trees in a nut orchard, or quana. Quana is the name for our traditional place where we grow fruit and nut trees.

I decided to make a new quana so I have been collecting and planting trees. Our people planted these trees hundreds of years ago: people in Choiseul are still harvesting from the trees planted by our ancestors. That's why planting many more fruit and nut trees will help our future generations. My plan is for my children and relatives to benefit from the trees I am planting now. They will earn money from selling the fruits and nuts, they can then use this money to achieve their aims to improve their lives, and they can eat too!

In my area, lots of people are starting to plant their own quana again. We are looking at how we can keep our remaining forests, and replant our agro-forests. Our fruit and nut trees are very important for us. We don't want anyone to come and spoil our trees and our land.

Replanting quana

Trees are very useful for many things – for fruit and nuts, for timber and for firewood, and to support future generations.

Steps

- Make a nursery in a protected area, under a tree. Prepare the ground by collecting and mixing top soil with grated coconut husk. Plant seed in the nursery and look after the seedlings. Water as needed.
- When the plants are about 20 centimetres high, they are ready for planting in the field
- Clear the area around each tree for planting and brush down the other vegetation in the same way you would clear your coconut plantation.
- Planting is usually done in stages of 15 to 20 trees at a time
- I keep an eye on the young trees: they are weeded regularly while they are young
- Immediately after weeding I plant clover to keep the bush under control and to provide nutrients for the trees
- Weeding is important to get the ground cover clover established

Planted fruit trees in one family block:	
Cut nut	50
Chestnut	50
Ngali nut	50
Five corner	50
Bush lime	50
Mandarin	6
Ngali nut small	20
Betel nut	over 100

I also first planted an area of local timber species – Melina, teak, buni, vasa, galu, vuraka (mamafua) and am now also planting jua – tulip (a wild edible leaf and fruit) as an understorey.

3e Fruit tree planting

by Makiva Gazamakana, Choiseul, Solomon Islands

Introduction

I wanted to do something to help my future. I planted fruit and nut trees to help meet the needs of my family needs and the community. When I started I was concerned about paying my daughter's school fees in the future – so I planted trees to provide the income for that. Fruit trees have never been planted in a commercial scale like this on our island before. It's easy to plant the fruit trees but it takes quite a long time before harvest.

Steps

Clearing

I usually clear an area and plant about 20 trees per month. The current area I have planted took me about one year to do, while I was also doing other work at home.

Nursery

If I make a nursery it takes 4 to 6 months before the seedlings are ready to plant in the field. I had never had any training about how to set up a plant

Young fruit trees are grown first as seedlings and then transplanted to the field. Small circles of weeds are cleared around the trees with bush allowed to grow in between them.

nursery. I just loosen soil at the bottom of a big tree, to make my nursery in the ground. I then mix in rotten husk of coconut. I chose the ones that are soft and just break up in my hands, and mix these with the soil. Then I plant the fruit tree seeds that I have collected in the soft soil. I move them out into the field when they are 30 to 40 centimetres high. I plant the seeds widely in the nursery to allow enough space to dig them out with a spade.

I do not always grow plants in a nursery first – sometimes I just dig out seedlings from the ground at the bottom of an existing fruit tree in the area. Then I transplant straight into field. You have to be careful to not damage the roots.

Planting

When I started I did not know how to space the trees. So I went and observed the established fruit trees in my area. I found mature trees and looked at how they grew and what their shape was. I then estimated the spacing accordingly. These trees grow well. Later when some tree planting specialists came, they agreed with this spacing – so I was pleased with my observations.

I put in blocks of trees – mandarins and oranges in the same area. I plant cut nut on the boundary around the whole orchard. Around the house I plant mixed trees for shade and to decorate the living area. I only plant trees that produce fruit. I am not interested in taking time to look after trees which do not provide fruit.

Cleaning

I brush around the trees every month, I can clear most of the trees in that period. Every two years I check all the trees. If they are not growing well or not getting much fruit, then I prune them and mulch them. I have also planted cover crop (pueria) as a legume to feed the trees. Once the cover crop is established then there is little need to brush because the cover crop keeps the weeds away. The cover crop really keeps the trees healthy – leaves are green and the branches carry lots of fruit.

Fruit trees (number)	Spacing (m)
Mandarin (170)	4 by 5
Chestnut (100)	6 by 6
Cut nut (250)	4 by 4
Orange (20)	5 by 5

Benefits

"The main purpose of the trees if for future health and income. One of the most important things is to teach children to plant more and more trees. Other people have also taken trees from me to plant, I have trained them to do the same thing. People have seen what I have done and are interested to do the same. Fruit trees have never been planted on a commercial scale like this on our island before."

3f Planting a fruit and nut tree forest

by Gwendlyn Pitavavini, Choiseul, Solomon Islands

Introduction

I planted the fruit trees for my children's health in the future, to help them with their diet. Also I don't want them to go and take fruits from other people without permission – they will have their own trees to harvest. It will educate my children that trees are part of their life and their future.

Trees can clean the air, so this is my contribution to help the environment. It can help us with climate change.

Planting trees can also help us earn money. In the future I plan to do more marketing of the fruits. I am already selling some oranges in the market.

So I started to think about what I learned from Kastom Gaden: I had worked with them for many years and had learned about agro-forestry. I wanted to make this for myself and started in 1997.

Steps

- Clear the area: Around the house I made a supsup garden. I planted beans, slippery kabis, borneo kabis, some snake beans. I mulched the plants to give them nutrients to grow and to protect the soil.

'Quana' is the traditional fruit and nut tree forest of Choiseul. Every family should have their own quana.

- Nursery: I then made a nursery for germinating fruit tree seeds that I collected, other seedlings I just collected underneath other fruit trees and transplanted them direct to my garden.
- Plant in a mixed pattern: While the fruit trees were growing, I planted banana and pineapple among them.
- Leave the bush around young trees: I did not clear the weeds around the young trees too much. I found that if I let the weeds and bush grow up a bit, the trees grow faster and stay healthy. So I usually would leave them for at least 2 months before weeding.
- Mulching: In the beginning I put mulch around the trees. I collected mulch from underneath an old mango tree and nut tree. Once the trees are big there is no need to mulch them anymore because they produce their own litter.
- Maintenance: Once the trees are established, the only work is to cut off any vines that start to climb up, as these can damage the trees.
- Harvesting: I am now harvesting cut nuts, apples, and oranges. It took three years to get the first fruits. Some trees are faster than others, with soursop, tulip, other bush foods (cut nut, ferns) planted inside. It's good to plant a mix of species.

3g Nabo drying

by Simon P. Lenga, Temotu, Solomon Islands

Introduction

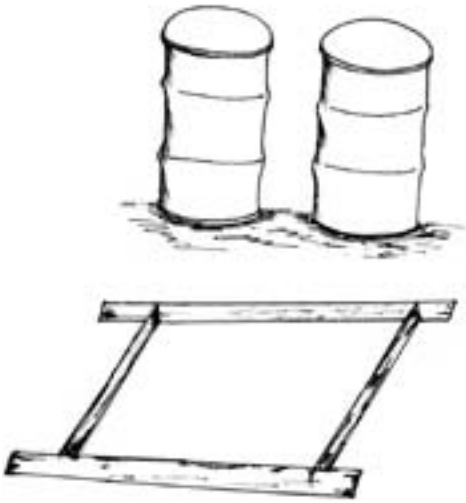
Nabo is a dried, chipped breadfruit and one of the traditional nutritious and staple foods of Temotu province in the Solomon Islands, more so in the Reef Islands. Nabo is a product of all varieties of breadfruit and there are more than 100 varieties of them. Nabo is always served at customary and cultural ceremonies, or in times of disaster. Nowadays it is also a source of income for people.

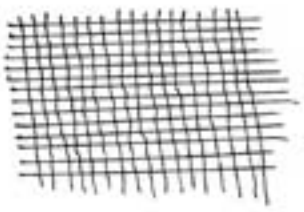
Nabo is part of the identity of the Temotu people. It is a staple carbohydrate that is ready to eat at any time and can be stored for long periods. Although breadfruit is found throughout the Solomon Islands, most people do not know how to produce nabo from it. With climate change occurring, it is now more important than ever for Solomon Islanders to know how to produce nabo.

Materials

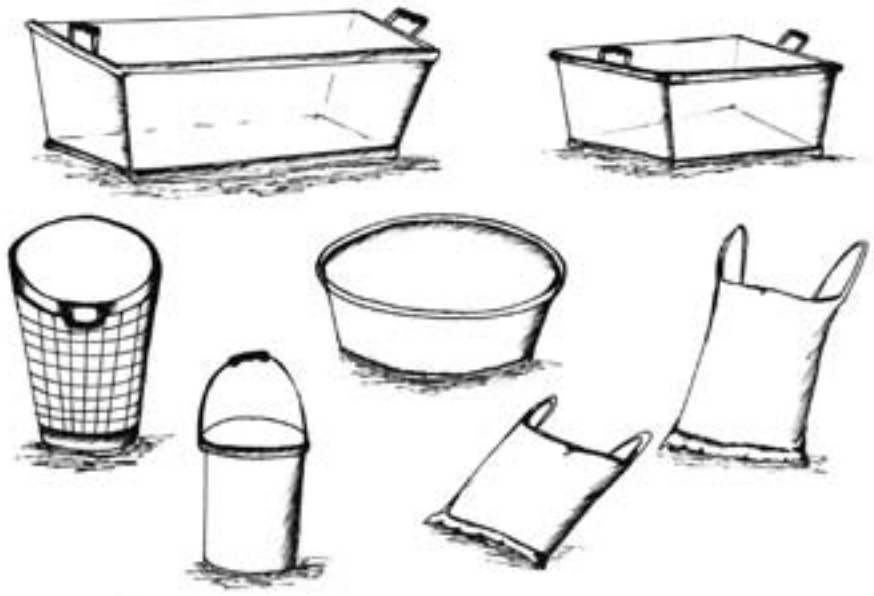
- Axes, bush knives, and small flat knives for the chipping process
- Drums, wire netting, and timber to make the roasting pit
- Containers, large or medium-size trays and dishes
- Trays and large bowls for storage
- Plastic bags to store the cooked nabo chips (1 to 2 kilograms)
- Plastic bags to store the nabo (30, 40, or 50 kilograms)

Materials required: an axe for chopping firewood, bush knives to cut firewood, chipping knives for cutting up breadfruit.





Preparation tools: the drum stove can be made from a drum with wire netting over the top.



Preparation tools: bags and other storage containers.

Steps

1. Preparation

When the breadfruit flower (male) and the breadfruit head (female) are seen at their early stages, prepare the following:

- Gather and cut firewood and bring to the drying area
- Make stoves (these could be a simple as drums with wire netting over the top)
- Gather and store bags and other storage containers
- Gather chipping tools for cutting up the breadfruit

Firewood is gathered and brought to the drying area.

Harvesting: usually about 1,000-2,000 breadfruit are collected at a time. They are roasted on an open fire.

2. Harvesting

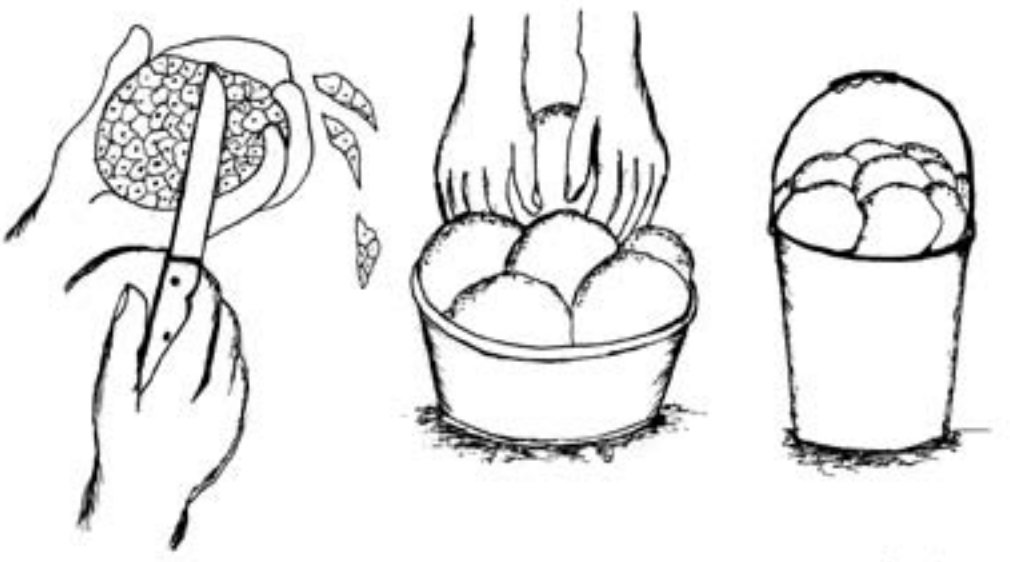
- Harvest the breadfruit and roast on an open fire (a normal day's harvest should be 1,000 to 2,000 breadfruit)

3. Roasting

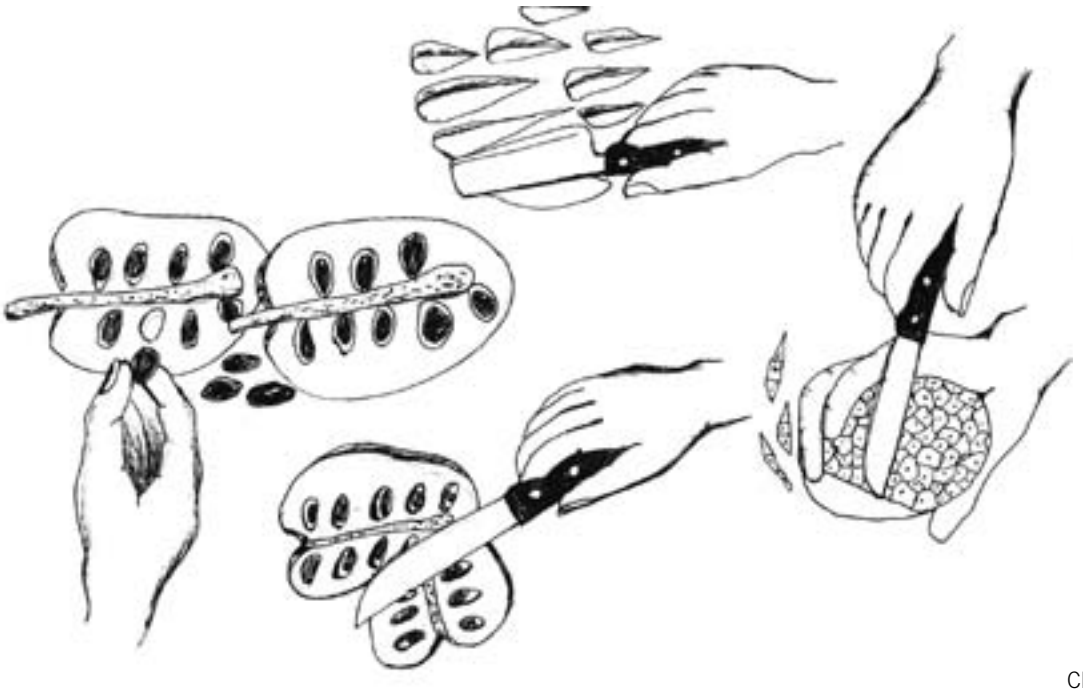
- Roast breadfruits, and cool overnight for the skin to cool off

4. Peeling

- Peel off the skin and put the flesh put in containers, dishes, buckets, and trays



Peeling: the skin is peeled and the flesh put into containers.



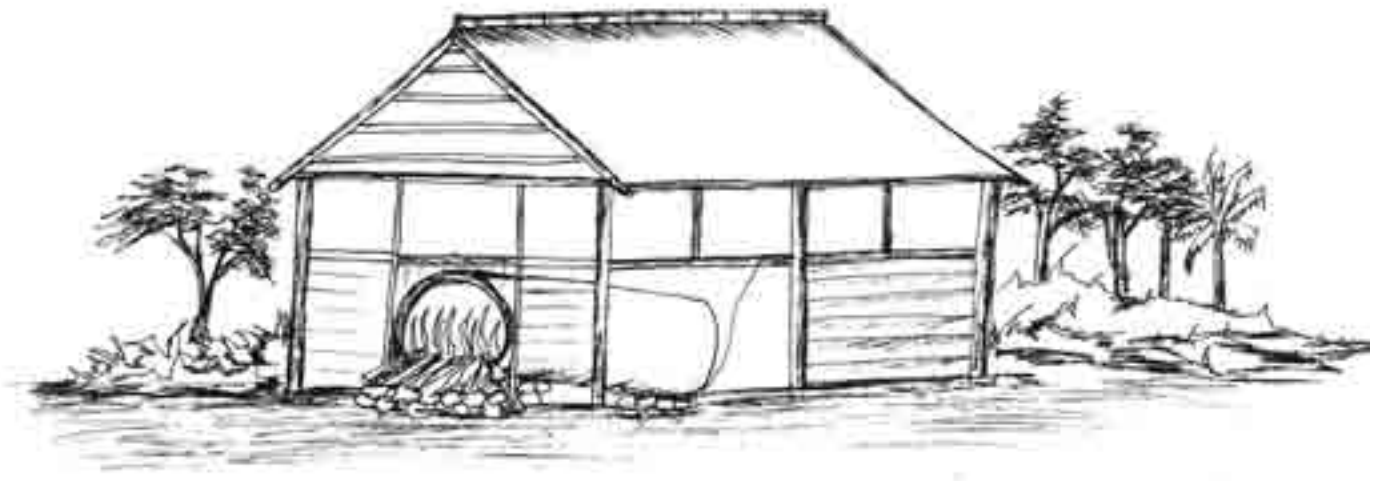
Chipping: seeds are removed and fruit is cut into halves and quarters.

5. Chipping

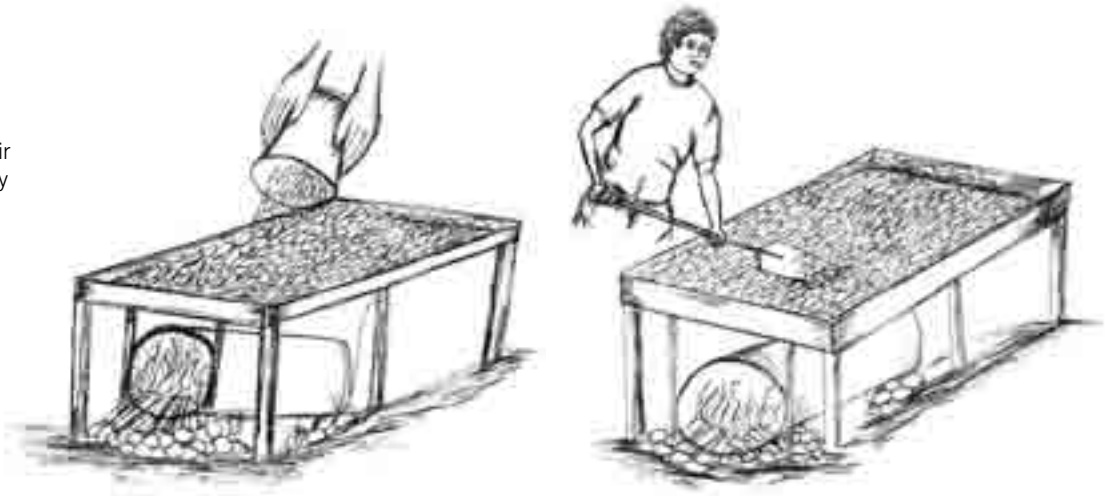
- Cut the breadfruit into halves and then quarters. Remove the seeds and any other unwanted parts
- Chip the breadfruit pieces into the right sizes

6. Drying

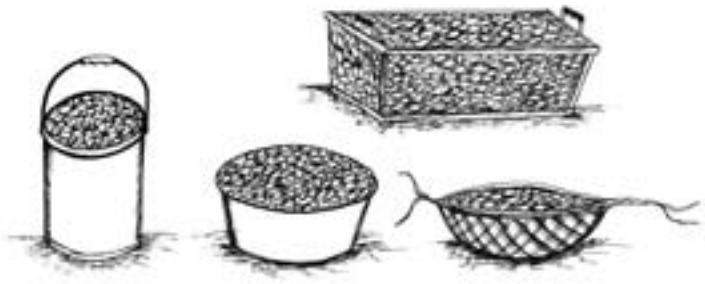
- Light the oven and leave to burn for 20 to 25 minutes
- Pour the chips into the bed
- As soon as you see the chips turn hard, stir and turn
- The heat of the fire must be constant to make sure that the nabo is crunchy



Drying: fire is lit in the oven drum.



Drying: chips are poured onto the bed or the netting wire. Stir and turn chips so they dry evenly.



Storing: dried crunchy Nabo chips can be stored.

7. Storing

- As soon as the chips are thoroughly and completely dried, stored them in containers: baskets (traditional), bags, buckets (empty flour buckets), or any other suitable container

Preservation

Traditionally the chips are packed in baskets woven out of coconut leaves, and left over the beds above the fireplaces used for cooking. Nowadays people use plastic containers to store the nabo, but better preservation methods are still being investigated.

Uses

- Nabo can be served as biscuits with tea
- Cooked with taiyo (canned fish) and coconut milk they become soft again
- Eat with any vegetables and meat
- Pounded into flour, to use as porridge or served as a continental breakfast (in place of cornflakes or weetbix)

Benefits

- Food storage
- Source of income
- Food in case of disaster
- Very nutritional
- Peelings and seeds produce compost
- Bait for fishing
- Feed for livestock

3h Fuel-efficient stoves

by Roselyn Kabu Maemouri and Kastom Gaden Association, Solomon Islands

Introduction

In the Pacific Islands, many people use firewood for an open fire. They need lots of firewood for cooking which produces much smoke in the kitchen. The thermal efficiency of an open fire is very poor. If we improved our stoves, we could make some good changes in our kitchen use.

Can you guess that in the future you won't have enough trees around you? Many countries all over the world face shortages of trees. Cutting down trees for firewood causes environmental destruction. Many logging companies are cutting down your trees and take them away. Also as populations are increasing, many people clear the forest for cultivation. We should realise that the shortage of trees is coming now and will be worse in the future.

What can we do to preserve our nature and forests around us in our islands? One way is to reduce the amount of firewood you use in your kitchen. In other countries, they do this using solar cooking. But we can also improve our stoves and cooking methods to reduce how much firewood we need every day.

Improving our stove leads to important changes including reducing:

- The amount of firewood required for cooking
- Smoke during cooking
- The time to cook food

These changes improve your life by reducing the time collecting firewood, and preserve your environment by needing fewer trees for firewood. All of these things are usually done by women, so fuel-efficient stoves are good for helping women.

You might think that you need money to buy the materials to make a stove. However, all materials can be collected around you.

The clay stove is made to fit each pot. It uses much less firewood and produces less smoke than the traditional open fire cooking method used across Melanesia. The stove is easily made from local available materials.

All you need is 1 bucket of clay soil which is sticky and heavy soil, 1 bucket of garden soil, 1/2 bucket of cold ashes, 1/4 bucket dried grass and 1/2 bucket of water.

Steps

- Collect clay soil, garden soil, ashes, dried grass, and water.
- Strain garden soil and ashes to take out large pieces. Cut dried grass into lengths of about 5 centimetres. If the clay soil is hard like stone, you need to break it down into small pieces and strain it.
- Mix all materials. You can use your hands and legs to mix. Pour small amounts of water at a time into the mix.
- When all materials are mixed well, make balls of a few centimetres in diameter. Squeeze them hard or knead the mixture like bread to remove all the air.
- Get the pot you normally use in the kitchen. On a hard surface, pile up the balls around (and under?) the pot to make a rim of about 20 centimetres high; leave two air holes at the opposite end of where the fuel goes.
- Dry the stove for two weeks in a dry spot in the shade.
- Now the stove is ready to use. Because the rim keeps the heat inside, you need much less fuel underneath the pot to boil the water or cook the food inside it.

Benefits

Another advantage of reducing the use of firewood is less work to collect and carry firewood so you have more time for other jobs. For example, you could cook one more meal during the day to balance the food intake of your children!

Clay stoves on demonstration and for sale in Gizo market, Solomon Islands.

4

Soil fertility

The soil is the basis of our food security. We must look after the soil if we want healthy food now and in the future. The soil needs organic matter to feed and protect the micro-organisms which produce nutrients for plants to grow.

Growing food, and food security, depends on looking after the soil. In many parts of Melanesia fertile soils are becoming degraded. They are increasingly over-cropped and often over-burned. Looking after the soil means protecting it from erosion and feeding the soil micro-organisms with organic matter or humus. This can be done in many ways and some farmer experiences are shared in this chapter.

Adding organic matter to soil is a way of reducing carbon release into the atmosphere and improving the soil at the same time. Reduced burning or no-burn agriculture also helps reduce climate change that comes from burning forests and forest fallows.

A few methods of pest management using organic approaches are also included here. They are relevant because ecosystems under stress from climate change are likely to create more and new pest and disease problems.

This chapter includes:

- Improving soil using cover crops and crop rotation with legumes
- Seaweed fertilizer and the use of mangrove soil
- Urban gardening through the example of a school garden
- Plant-based pesticides as part of integrated pest management

4a Cover crops

by Farm Support Association, Vanuatu

Introduction

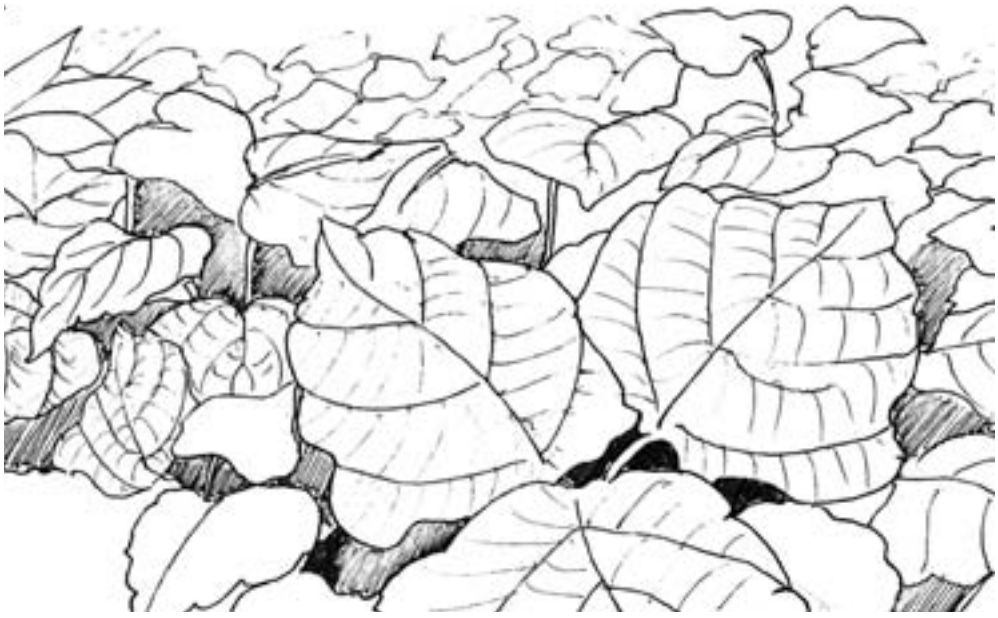
Cover crop is planting seed of legumes such as the lablab or hyacinth bean and mucuna as a ground-covering crop, after the main crop is harvested from a plot. Cover crops are known as an improved fallow. It requires collection of seeds of the legume for the next planting.

Glycine

This plant, related to soybean, has small green leaves and white flowers. This creeping legume produces seed and has roots on its ropes or vines. The roots make it hard to dry out so it can be used in gardens that are not left to fallow for long periods.

Lablab or hyacinth bean (Dolichos lablab or Lablab purpureus)

There are several kinds of lablab bean. The leaves are bigger than of glycine and the flowers are white and purple. It doesn't have roots on the vines so it can die off after 12 months and is easier to remove. Farmers have to look after the young plants, weeding until they are mature or established. The leaves are very thick; when dried they can greatly enrich the soil.



Lablab bean is a vigorous ground cover once established.

Mucuna plant

Mucuna

Mucuna has been newly introduced in Vanuatu and we find it's the best of the three cover crops. The leaves are bigger than of lablab and it grows fast. A single planted seed can grow to cover up to 10 to 20 metres surface area. It has no roots on ropes but its heavy canopy covers weeds well. It dries off when the seeds are formed.

Note that this cover crop can become a weed without maintenance. It is the responsibility of the farmer that creeping legumes do not become a weed. Managed well they can improve your soil.

Steps

- Collect dry seeds for planting
- Choose site for fallow and plant directly in the ground
- Plant your cover crop in lines: use a rope or plant by eye. Spacing: 30 centimetres between plants and 60 centimetres between rows for lablab beans and glycine. For mucuna leave 1 metre between plants and 1 metre between rows
- Plant seeds 3 centimetres deep, put two seeds in each hole

Note that the seeds of these cover crops can only last one year in storage. *You must plant them quickly* each season.

- When the cover crop flowers, it's a good time to slash it: leave it as a mulch or dig it back into the soil. This is the time when nitrogen production is highest so the soil gets the best fertilisation effect.

Benefits

- Increases soil fertility quickly compared to natural bush fallow
- Most cover crops improve soil fertility within 12 months and then die off, but glycine plants can live for a long time
- It covers other weeds and slows down or stops their growth

Limitations

- Mucuna may become a weed itself through its many seeds that regenerate easily
- Caterpillars love feeding on young pods of lablab bean, making it difficult to collect quality dry seeds for next planting. Lablab beans are not readily available elsewhere.
- Weeding is needed at early stages, especially to remove any creeping weeds that smother the young legume seedlings.

4b Seaweed fertiliser and healthy plants

by Margaret Sui, LangaLanga, Malaita, Solomon Islands

Introduction

In some coastal communities in the Pacific, soil fertility is very low. On the eastern end of the Solomon Islands, communities have found a unique technique of increasing soil fertility and controlling pests: they use seaweed collected from the lagoon. This is a very important method for improving crop cultivation.

Areas where this can be used:

- Coral reef islands
- High raised atolls
- Artificial islands
- Any other garden close to the sea

How to make seaweed fertiliser - see instructions on next page.

Materials

- 20-litre bucket with lid
- Seaweed
- Fresh water
- Stick

Steps

1. Put seaweed into a bucket
2. Add 5 litres of water and firmly close the bucket with the lid
3. Leave for 2 weeks
4. Strain out the liquid
5. The seaweed can be used in mulching for making compost
6. Take half a cup of seaweed solution and mix it with three-quarters of a cup of fresh water to make your pest control and fertiliser solution. The solution has a dual function: it controls pests and keeps the soil healthy. It is full of many useful nutrients and minerals for plants to grow.

Benefits

- Controls pests and diseases
- Acts as a natural fertiliser
- Controls black spots and fungus
- Inexpensive: free!
- Increases the health of the soil

4c Household compost method

by Jerry Anderson, Weather Coast, Solomon Islands

Introduction

This method of making compost does not require much work and provides nice compost soil for use in the garden.

Materials

- Bamboo – split the bamboo
- 4 bush posts of 2.5 metres length
- Bush rope or any tying rope
- Top soil
- Dead leaves and grass
- Chicken manure
- Kitchen waste

Steps

Building the bin

- Mark an area of 1.5 by 1.5 metres for the base of the compost
- At each corner, dig and secure the 2.5-metre posts. Build a bed and frame to contain the compost on the top. Build the frame 1.5 metres off the ground
- Build a horizontal screen out of bamboo to allow fine compost to fall through the base of the heap
- Make walling on the sides of the bamboo edges. The box can be open at the top, or you can build a lid or shutter out of bamboo. That will stop flies from entering the compost and spreading diseases
- Close in the bottom section with bamboo walling and install a door on one side – this is where the compost is removed

Making the compost

- Lay a layer of grass or banana leaves inside the bin or bed
- Add a layer of soil
- Add a layer of chicken manure or any animal manure
- Add a layer of brown leaves
- Repeat these steps once more
- On a daily basis add any organic waste or chicken manure

- After 3 months the compost will start to fall through the bamboo screen. The compost collected at the bottom is now ready and can be used to fertilise the garden
- This compost is very good for slippery kabis (cabbage)

Notes

- The size of the compost bin is up to the owner
- In wet areas, the rain will keep the compost moist
- In places with little rain, water the compost to keep it moist

Benefits

- Enriches the soil and makes it more fertile – also very good for a nursery
- Cuts down women's workload – no need to turn compost or carry soil from far away: just collect organic fertilizer from beside the house
- It can be used in places where plants don't grow well and support good production there

4d Urban farming with school students – Supsup garden

by Helen Filia, Honiara, Solomon Islands

Introduction

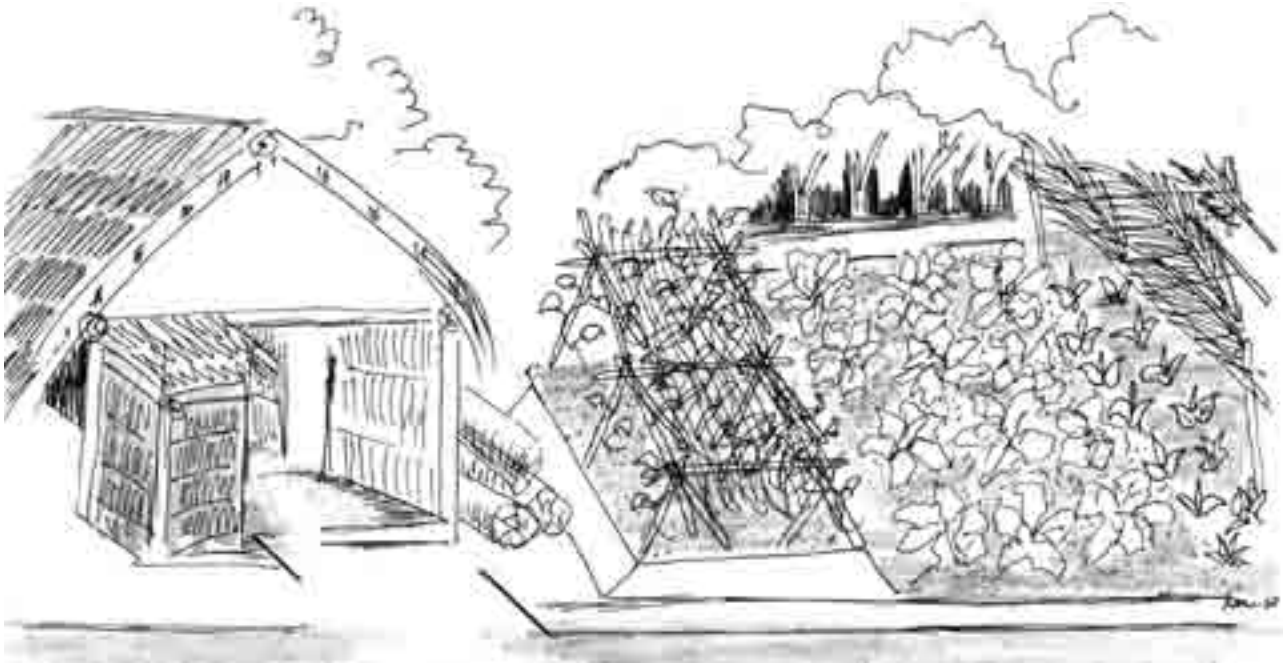
This method can be used to set up a small garden with secondary school students so they can grow vegetables that can be used in supsup (soup) and eaten fresh. The aims are for students to learn what Chinese cabbage is, how it is grown, how to improve the soil with mulch and compost, and what benefits are received from the supsup garden.

Students come from different background languages, tribes and families. This method takes a participatory approach which makes learning easy and enjoyable. It uses a questionnaire to find out about:

- Chinese cabbage and other preferred vegetables
- The stages involved in planting the vegetables
- The importance of students learning about planting cabbage
- The benefits of growing a supsup garden

Students then grow cabbages from seed and are asked to:

- Identify how many plants survived after 2 weeks and calculate the percentage of survival



Kitchen garden next to house

- Learn about the percentage of plants that survived up to harvest
- Compare the differences in percentage for seeds grown in, and out of the nursery, and explain any difference

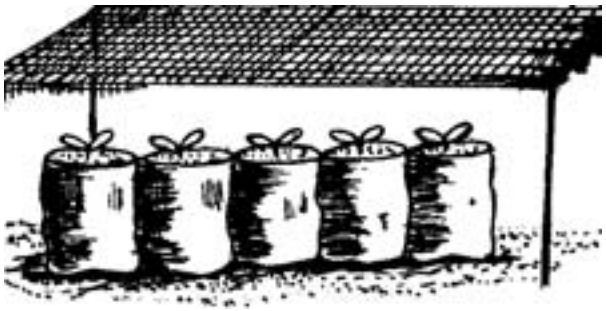
Materials

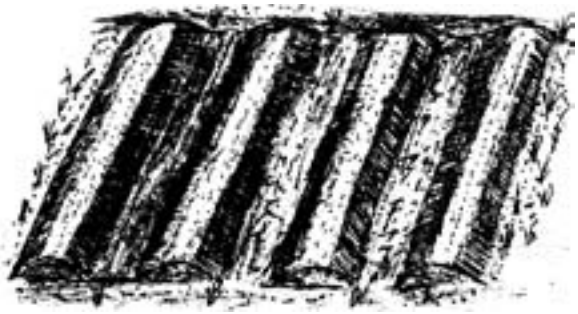
- Plastic cups (50)
- Vegetable seeds (cucumber, beans, cabbage)
- Mosquito netting
- Top soil
- Chicken manure
- Dead grass

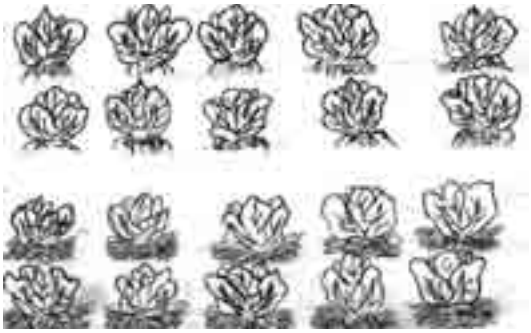
Steps

- Make a small shade house by covering an area with a mosquito net
- Place the plastic cups under the netting. This will be your nursery plots
- Fill the cups with soft compost
- With your finger make a small hole in the soil, put 2 seeds in each hole and cover them lightly with soil
- Water every morning and evening for 2 weeks, while the seeds sprout or grow
- Meanwhile identify land with the best soil and start clearing a plot to plant your supsup garden.
- After 2 weeks remove the cabbage seedlings from the cups and transplant them into the cleared land. Arrange them in a regular plot, about 0.5 metres apart
- Water your seedlings as needed
- If you see the plants not growing well in 2 or 3 weeks, you can try and mix the topsoil with chicken manure or dead grass. This fertilises the soil, so that your cabbage grow healthy
- Harvest your plants when ready

Chinese cabbage is grown in a nursery under shade, then transplanted into the mulched rows in the garden.







Benefits

- The exercise broadens the knowledge of students of types of cabbage and vegetables introduced into urban centres. It helps the students differentiate between traditional and urban gardening
- Marketing and selling Chinese cabbage can provide families a sustainable livelihood, so they can buy clothes and food, and pay for school fees
- The money gathered at school can be used to pay for school activities such as an end-of-year picnic trip.

4e Building soil fertility with legumes

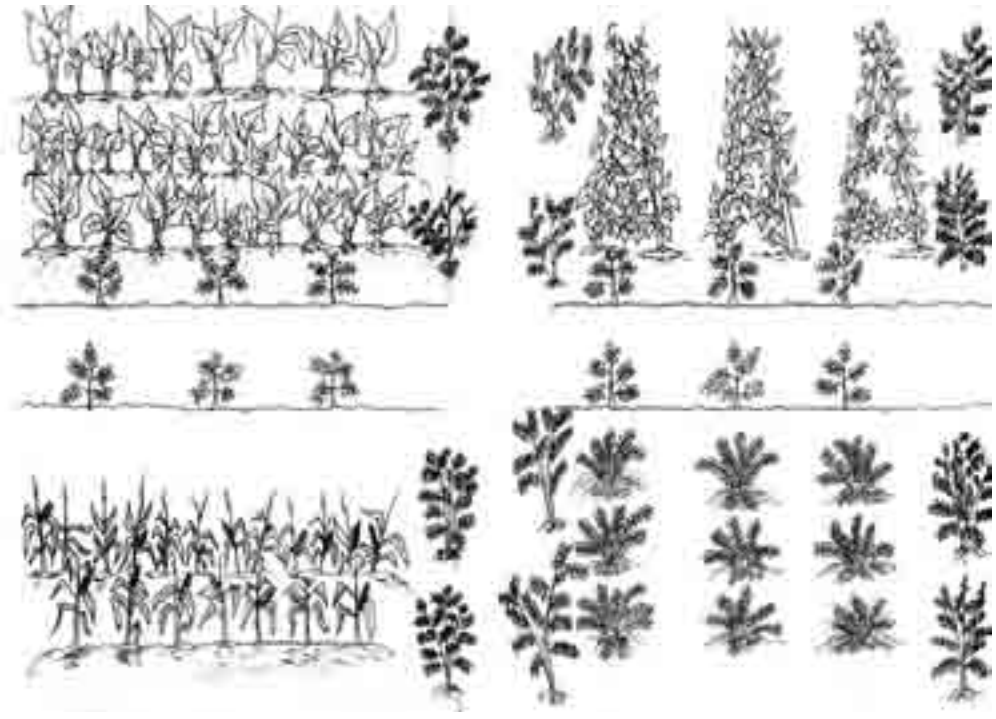
by Joyce Mary Dola, Mana'abu, Malaita, Solomon Islands

Introduction

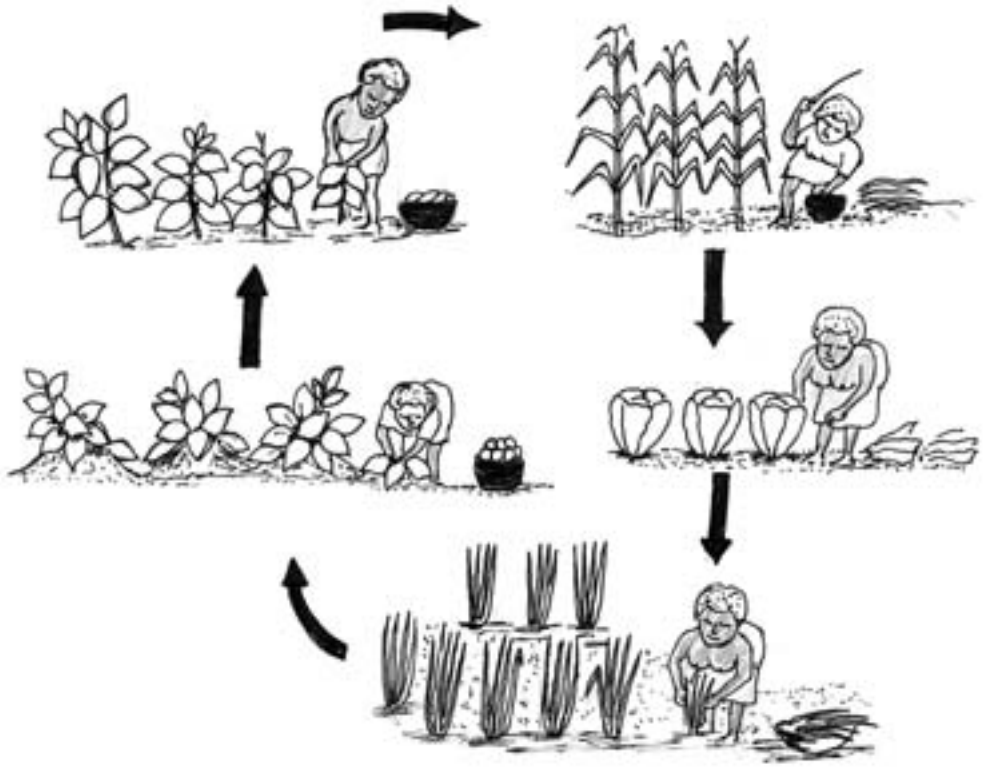
In Mana'abu village where I come from, our soil is very poor. The research division of the Ministry of Agriculture and Livestock (MAL) has confirmed that. People used the slash-and-burn method for gardening, moving from one site to another site. As the population increases, this practice is no longer suitable for my area, and there is no remaining fertile land for gardening. Fallow periods are reduced from 6 years to 1 year. That is not sustainable for gardening in the future.

In 2008 I started a trial of so-called 'alley cropping' using gliricidia, which helps to improve the soil (gliricidia is the cocoa shade tree). I planted a block of 50 by 50 metres, with crops between the alleys of gliricidia. I am also using legumes such as mucuna bean, beans and peanut as cover crop for improving the soil. The gliricidia trees are spaced 3 metres apart.

It is very important to know that legume plants have the ability to fix nitrogen from the air and so fertilise the soil. Legumes are nature's own way of replenishing the soil with nitrogen.



Legumes can be used to improve the soil and allow for land to be used for cropping for a longer time. Here legumes are planted around the garden (gliricidia) and also rotated through the garden in one of the four blocks through the use of mucuna and long beans.



Crop Rotation: from top left: A legume is planted and then slashed when it starts to flower. This is followed by a crop of corn, then Chinese cabbage, then shallots and then kumara (sweet potato) before legume such as mucuna is planted again.

With this in mind I started a permanent garden where I practise soil improvement as an important aspect of farming. This method can provide fertile garden land for the young population and provide food security for them and their families. I found that legumes really make a big difference to the soil and I have seen improvements already.

Materials

- Cocoa shade tree cutting (gliricidia) of 1.5 metres, do not split them
- Bush knife
- Bean, peanut and mucuna plants or seed for crop rotation: this also improves the soil.

Steps

Plant the following crops in different plots. After harvesting a plot, plant the next crop on the list:

- Rotation 1: Sweet potato
- Rotation 2: Beans
- Rotation 3: Taro or cassava
- Rotation 4: Mucuna (until it sets seed)

Benefits

- Improve soil by using organic materials and legumes
- More living organisms in the soil keep it healthy
- Plants grow better and have more tubers
- Using the same area of land rather than shifting to a new area

4f Piggery and compost production

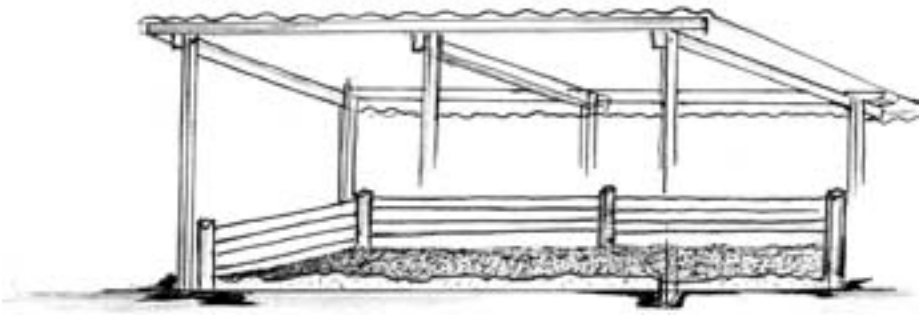
by Koto Simione, Live and Learn Environmental Education, Fiji

Introduction

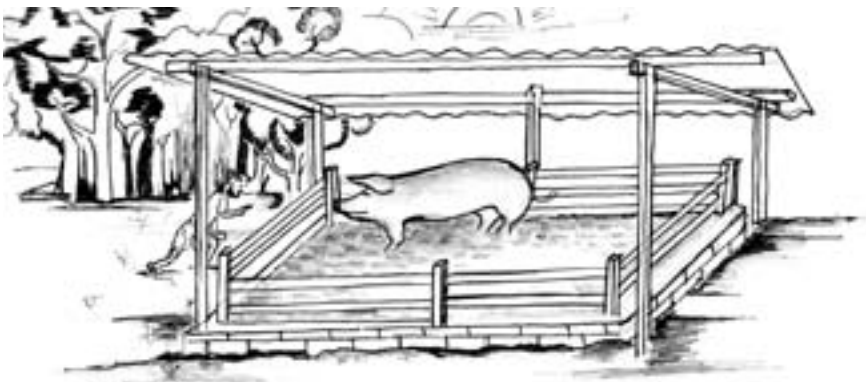
This method is a form of piggery farming with fewer odours and flies than usual, and the waste can be used for manure. It has been developed by Live & Learn Environmental Education Fiji, with the support of the Secretariat of the Pacific Community (SPC).

Steps

- Have your pig pen well fenced, with good shelter from rain (best with roofing iron)
- A good concrete floor is best and will last a long time
- Cover your pig pen floor with untreated sawdust to 3 to 4 inches (8 to 10 centimetres)
- See that the whole floor is covered so all pig waste will be soaked into the sawdust
- Use a spade to turn the sawdust once every two weeks



A well constructed, covered pig pen is filled with sawdust.



Turn the sawdust every two weeks as it mixes with pig manure.

Remove the composted manure and sawdust after 3-4 months. This can be placed in a compost heap for 2-3 weeks and then used on the garden as a fertiliser.

- Remove the waste after 3 to 4 months, when you can no longer see any sawdust
- Stack this material under a tree and use for manure when it's ready (usually after 2 to 3 weeks)

Benefits

- Sustainable way of managing waste in communities
- Utilises excess family kitchen waste
- Increase family finances
- Whole family can participate in the activity
- Improves social status of family
- Improves family diet
- Produces healthy meat and meals

Note: watch out that sawdust doesn't blow into watering holes or food.

4g Integrated pest management

by Roselyn Kabu, Kastom Gaden Association, Malaita, Solomon Islands

Mix bar laundry soap and chillies together to make one type of botanical pesticide. This spray is then applied to the leaves of plants in the garden.

Introduction

Integrated Pest Management (IPM) is a natural, environmentally friendly approach to controlling pests and diseases in the garden. This natural way to control pests and disease also helps to reduce pest in gardens. (If not controlled, pests and disease can damage our food crops.) The method is cheap and materials are easily available.

Steps

Different types of pest control techniques can be used in your garden to manage pests:

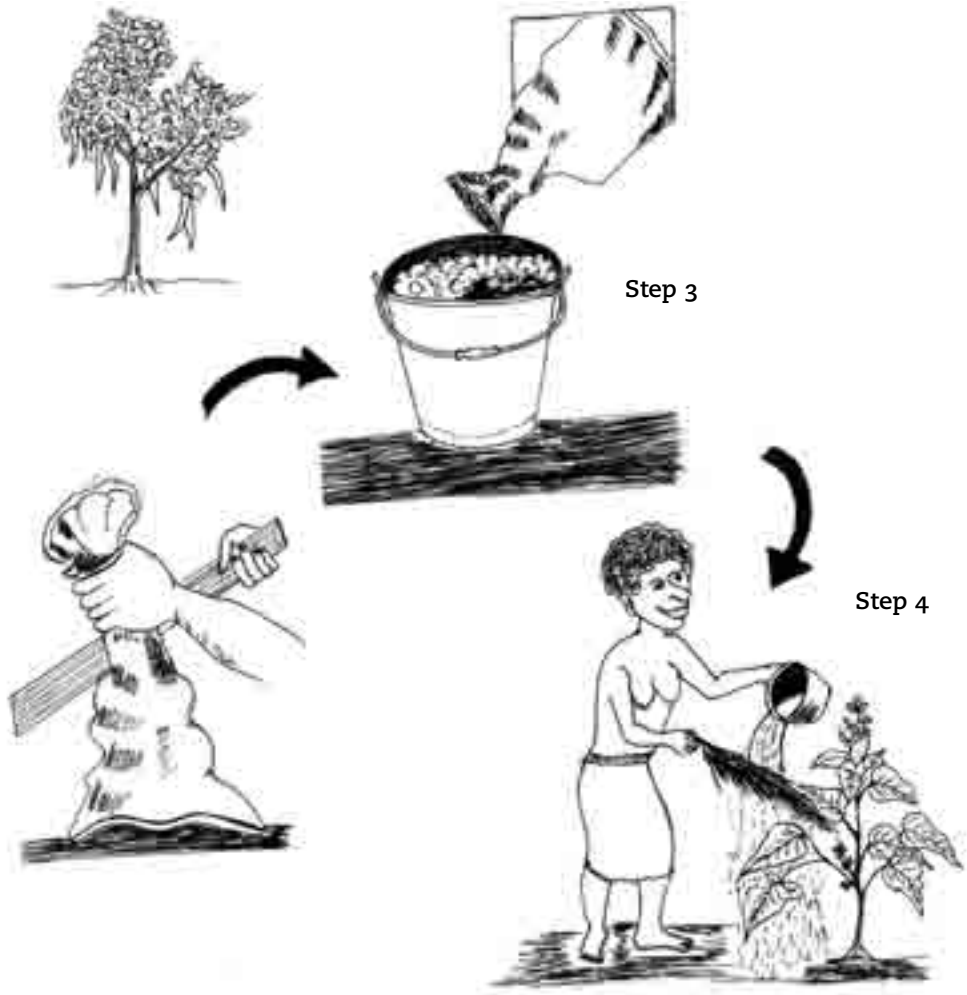
- Biological control: use other insects to control pests. For example, spiders and lady bugs are ways to get rid of harmful pests in your garden
- Plant derived pesticides or biological sprays
- Natural environment-friendly sprays
- Chillies and other strong smelling plants can be used

Garden management

- Use well drained soil
- Use raised beds
- Physically remove harmful insects or plants, for example by hand-picking
- Cultural control: traditional methods used by ancestors
- Garden barriers: grow bushes between gardens to stop insects from migrating between them
- Mixed cropping
- Planting strong smelling plants

Advantages

- Materials for use are locally available
- No need to spend money on materials
- Environmentally friendly



Chilli Spray: Harvest chilli from the plant; crush the fruits in a bag (be careful not to make contact with your skin); mix the crushed fruits in a bucket of water; apply to the leaves of the plants, pouring over a leaf to spread the liquid across the plants and throw some up underneath the leaves.

Disadvantages

- Natural sprays may not work in rainy conditions
- Some insects are resistant to natural sprays or they are not effective
- Sprays must be used with care as some are poisonous

Chilli spray

- Use 1 coconut shell of chilli fruits and 5 litres of water or soapy water
- Mash the chilli fruit in a bag: be careful not to get it on your skin or in your eyes, it stings!
- Mix the mash with (soapy) water
- Strain and leave overnight
- Spray in the morning

Benefits

- Helps control garden pests
- Environmentally friendly
- Uses natural control methods that are readily available
- Saves money – you don't have to buy pesticides

4h Home-made pesticide (tomato leaf)

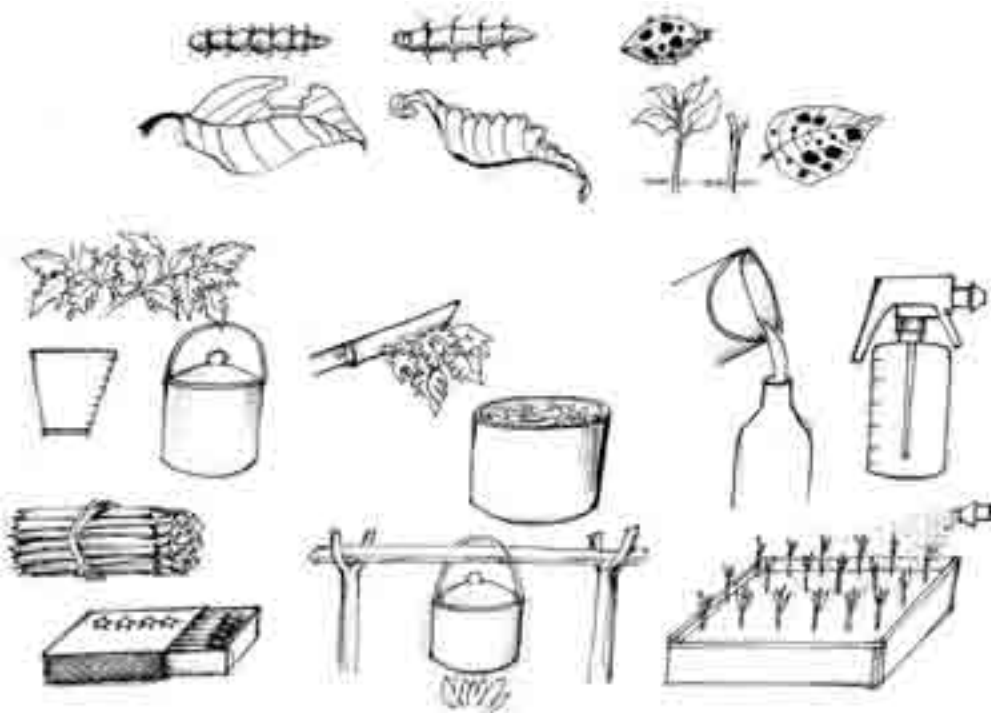
by Celestine Aloatu, Weather Coast, Guadalcanal, Solomon Islands

Introduction

Home-made pesticide has been used and proved suitable in vegetable gardens. This home-made pesticide is made from readily available tomato leaves.
It helps control tiny chewing insects by spraying, it kills especially the harmful insects such as cutworm, leaf-roller caterpillar and black-spot beetles.
Apply it in your open-air nursery on newly planted vegetables, especially Chinese cabbage.

Materials

- 500 grams bundle of tomato leaves
- 1 to 5 litres of water
- Old cooking pot (medium size)
- Small bundle of firewood
- Matches



Tomato leaf botanical spray is good for insects such as caterpillar and leaf eating beetles. Boil the leaves in an old cooking pot, leave to cool and then apply to the garden or nursery.

Steps

- Collect and chop tomato leaves in half
- Put chopped tomato leaves in pot and add water
- Light the fire and add firewood
- Bring pot with combined materials to the boil on the fire
- Boil for 2 minutes
- Remove the hot pot from the fire using a glove or other protection against burning your hand
- Let it cool before extracting the liquid
- Pour into a storing container or bottle and label it
- It will be ready to use on the next day

Application

Put the liquid product into 1-litre spray cans and apply to newly planted cabbages. You can also use a bucket and pour over a leaf to dribble on plants. The application should happen early in the morning when there's no rain.

Advantages of home-made pesticide:

- Technically very simple to do
- Environmentally friendly
- Economically viable
- Social involvement by local farmers
- As recommended safe to use (note safety precautions)
- Store product in secure place

Many plants can be used to derive pesticides. These are generally safer than store pesticide, but still you should be careful to wash produce before eating it, and leave it for some time before taking it to market. Other plants that you can try apart from chilli and tomato are tobacco, custard apple leaves and seeds, neem leaf, derris leaf and root.

5

Emergency gardens and diversity

Melanesian farmers have always maintained different foods for emergency - times when their food gardens cannot provide their needs. Having emergency foods ready is an important part of getting prepared for climate change.

Future food security in Melanesia will very much depend on having a wide range of different food sources for many households. Why? Because having different food sources reduces risk. Foods that last a long time in the ground and are resilient to pest and disease are ideal to plant, for use in emergencies or difficult times.

The traditional and new methods presented here allow households to have sources of food ready for times of stress. They will prove useful in times of disaster, drought, pest and disease on other food crops, unusual weather or even during human-caused problems like civil unrest. Being prepared, and having diversity, provides resilience. But this takes time, and farmers need to think ahead and plan for the future. The technologies in this chapter will help with that.

Technologies presented include:

- Planting crops that, once established, can be harvested over a long period of time when needed: giant swamp taro, wild yams
- Planting more bananas: a crop well adapted to extra rain (compared to sweet potato)
- Diversification of varieties through farmer breeding of taro and yam
- Collecting and sharing varieties to increase diversity of root crops, seeds, and other food security crops

5a Bulking of crop diversity garden, yellow and orange flesh sweet potato for improving nutrition

by Joyce Mary, Mana'abu village, North Malaita, Solomon Islands

Introduction

Crop diversity is important when we have problems with the weather patterns that affect our planting season. Plants differ in their ability to cope with weather and disasters, so it's good to have a diversity of crops in our food gardens. If you have only one type of crop or variety in your garden you may lose them all if a disaster happens or when crops are damaged by pests.

In 2008 I started bulking, by which I mean collecting materials and growing a lot of different varieties of crops in my garden. I realized the importance of crop diversity if a disaster happens.

There are different varieties of taro, sweet potato, cassava, yam, kong kong taro, and vegetables. I have bulked 20 varieties of orange-flesh sweet potatoes including 16 orange-fleshed sweet potato and 4 varieties from the Secretariat of the Pacific Community (SPC) in 2009 and 2010. I have distributed these varieties to 65 farmers, especially women farmers and women's groups.

Benefits

When you have crop diversity, your family nutrition improves. Orange-flesh sweet potato and other vegetables with orange flesh have high nutritional value. They contain vitamin A which is good for eyesight, heart disease, and against other malnutrition problems.

A bulking garden is a collection of carefully collected root crops that are grown in order to share planting material with other farmers. When the crops are ready to harvest, organise a diversity fair: you invite lots of people from the area to come and taste the different varieties, and let them take planting materials home with them.

5b Seed saving using the bucket system

by Thecla Limai (Kastom Gaden Association), Choiseul, Solomon Islands

Introduction

Farmers in developing countries need a reliable supply of seed to achieve a reasonable level of food security. Food security means the availability of a food supply all year round. This supply should be diverse and plentiful enough for supporting a high standard of nutritional health. Without it, communities lack an important basic human need that is critical to any further development they might choose to take: good nutrition and self-reliance in food.

Non-hybrid seed is seed that can be saved and planted to produce future crops. Its availability is important in the approach to agricultural development used by Kastom Gaden Association (KGA). Unlike some other farmers in developing and developed countries, financially poor farmers cannot afford the so called 'improved' seeds. Those ones are supplied by the big seed corporations and successful growing of these seeds needs the farming inputs such as fertilizer, pesticide and herbicide.

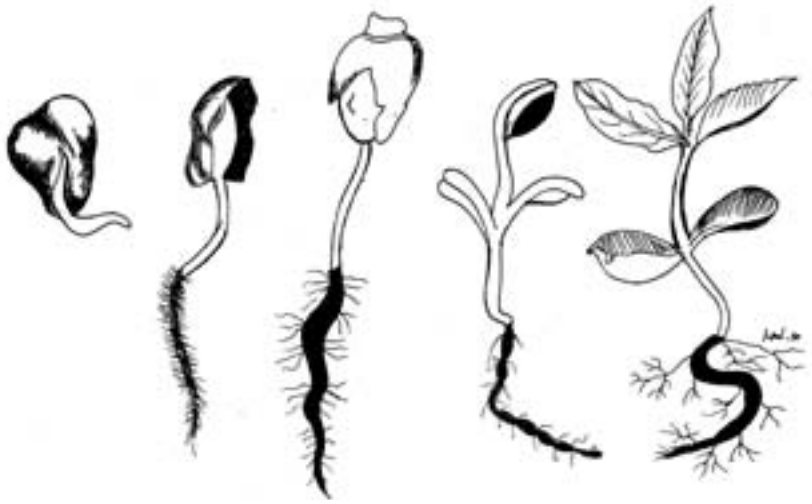
In the Solomon Islands, the Planting Material Network (PMN) is supported by the KGA. It conserves seeds by propagating them and keeping them safe in the

The bucket system is a practical way of producing good quality seeds on the local level. This system could be used by women's groups, schools, or rural training centres or other NGOs or farmer groups.

hands of many farmers. Seed contributed by farmers or held in the seed bank by the PMN are first multiplied in the garden. Then they are distributed to farmers who are members of the organisation. Those farmers donate some seed from the crops they grow, back to the PMN; there they are planted out and again multiplied. Farmers also share with others in their own areas. Unlike larger seed banks that hold seeds in storage for a long time, the PMN relies on storage for a shorter time. To maintain supplies PMN relies on the continual distribution and growing seeds by member farmers in their own gardens.

Materials

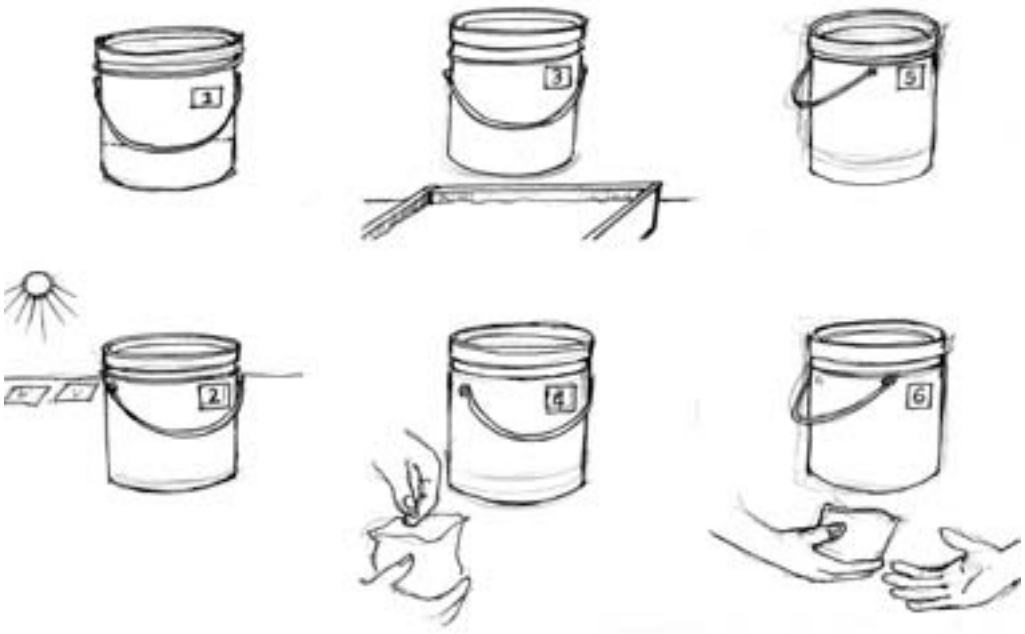
- Buckets (6) with tight sealing plastic lid: this method works only for buckets with good seals
- Ash from the fire/kitchen, cooled down
- Paper (newspaper or any waste paper)
- Germinating tray (tray that is divided into several boxes – usually made from timber or bamboo)
- Good-quality oxygen-proof plastic bags
- Seed packets – can be made from paper, or better, from foil
- Tight lid bottes/tins - anything with a tight seal is acceptable for seed saving. The seal is to stop moisture disturbing the quality of seeds and reducing the time they can be stored.



A seed germinating. Seed saving (or collecting seed for replanting next time) is an important part of food security.

Steps

- First label each of the buckets with numbers 1 to 6.
- Fill buckets with fresh fire ash (cooled down), about 15 to 20 centimetres high in the buckets. Put a clean sheet of newspaper on the top of the ash layer.
- Take the fruit or vegetable seeds, wrap them in paper and label the parcel: write the crop name, date harvested and accession number (if you have one). Different varieties of seeds must be wrapped separately, ensure they do not mix.
- Place each individual parcel of seed varieties into the first bucket: (1) Drying bucket. These parcels must be removed and dried out in the sun daily. Make sure they are put back before rain and not left outside overnight.
- Once all the seeds have dried out they can be transferred to the second bucket (2) Sitting bucket. You can test if the seeds are dry by biting them: they should be quite hard and not easy to dent with your teeth marks. If soft they need further drying. The sitting buckets hold the seeds until testing.



Six buckets with strong well sealing lids are needed for the bucket seed bank system.

- The seeds will undergo germination tests to test if they can grow in the third bucket (3) Germinating bucket. To test if the seeds will germinate, make a small selection of all the total seeds kept, 10 to 100 seeds maximum of each variety). Place these selected seeds in the germinating tray: it is filled with grated soft coconut husk to help the seeds grow. The seeds must be watered daily and given adequate sunlight.
- If less than half of the tested seeds germinate and grow, then the parcel of seed is moved to the fourth bucket (4) Garden bucket. If the result of seed germination and growth is 60 to 100 percent, then move the parcel of seed to the fifth bucket (5) Packaging bucket. In this bucket the seed is ready to be divided into small portions. Make small packets of around 500 grams each.
- Once the seeds are packed into proper packets, move them to the sixth bucket (6) Distribution bucket. The packed seeds are now ready for distribution to farmers for growing.

Benefits

- Using local varieties of open pollinated (non-hybrid) seed means the varieties can be conserved and re-planted.
- Local varieties are already adapted to local conditions of climate and soils, they remain available. Farmers in the future can continue to use them as food and for plant breeding.
- Establishing seed saving and exchange networks improves local and regional self-reliance in the supply of seeds. This is very important in countries where climate change, natural disaster, war or internal conflict could disrupt the availability of food.
- Seed production is a relatively easy process. By allowing the plant to go through its full life cycle and by collecting the seed, you will have the planting material for the next season.
- Saving seeds from the healthiest of your plants and replanting only the best of these seeds allows plant variety to adapt to local conditions.

5c Growing local root crops and wild yam in talise

by Lianga Ngelebosi, Guadalcanal Weather Coast, Solomon Islands

Introduction

In the area I come from, most families are often facing food shortages. This can be because of extreme wet weather, soil erosion, declining fallow periods, increasing population, poor agro-diversity, labour division with women doing most gardening work. Most farmers lack an understanding of planting crops at different times of the year. There are also many pest and disease problems, including rats damaging our root crops. I always feel sad when I see children and women go without food.

Wild yam can be collected from the forest and planted close to the house. Wild yams last for a long time in the ground and are good for food security.

Cassava

Taro

Sweet potato

Yam

Pana

Kakake or swamp taro

Root crops are the basic food we eat every day. We need many varieties of them for our food security.

The work of Kastom Gaden Association (KGA) in promoting food security on the Weather Coast first became known to me in 2006. I was fortunate to attend a training course on pest and disease management organised by them. During the training I also learnt the importance of sharing plant materials with other farmers.

After the training, one of the KGA field staff provided me with some kinabeo (a very productive type of yam), African yam, two varieties of edu (*Alocasia taro*), and two varieties of pana (*Dioscoria esculenta*) tubers. I returned to my village and talked to my wife about starting a root crop collection garden. In my garden I planted all the materials I received from KGA staff. I also went to farmers in my area to collect other local root crops. These included bush leafy vegetable such as kamau, boto (wild fern) and bonieo (all types of perennial edible greens).

Now, farmers often come to my garden to collect tubers like yam and pana for planting, and also sweet potato cuttings and cassava stalks. Some buy some root crops for consumption and other farmers work in my garden – then I give them free root crops for eating.

Steps

- Land preparation: clearing of land, about 20 by 20 metres for each variety
- Collection of planting materials: using a stick to dig the mound over, ready for planting
- Planting out of materials, caring for and maintaining garden
- Distributions of planting materials

Benefits

- Demonstration garden where other farmers come to learn
- Farmer access to a different agro-diversity of root crops
- Maintain local plant genetic resource
- Income

5d Emergency food gardening for food security – long-term food for times of disaster

by Nancy Pule, Central Province, Solomon Islands

Introduction

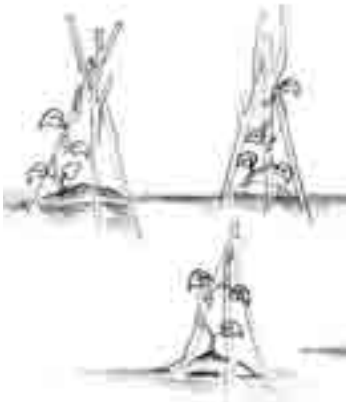
Emergency food garden keep crops for food security. Yam, wild yam, giant swamp taro, swamp taro stay edible for a long time, so can be used during and after natural disasters such as cyclones and floods. This practice is common with farmers of the Hanipana Pulking Center Farm in Florida of Solomon Islands; it was also used by our ancestors.

Steps

Straight yam

- Prepare the land well and cover it with grass and organic waste as a thick mulch
- Dig holes for planting using sticks; the holes should be about 30 centimetres deep and 1 metre apart

Black lip shell is used traditionally to cut the yams into pieces ready for planting.



Above: Yams need staking to grow well.

Right: Weeding of yams.

- Prepare and cut yam for planting
- Label all yam plants after planting
- Maintain garden regularly by mulching and weeding

Wild yam

Wild yam

- Protect the area, no burning at all times
- Mark area clearly for easy harvest
- Label all yams clearly in plantation
- Replant the shoots after harvest
- Label and store in bulking hut for later planting
- Label yams planted in back yard
- Planting gliricidia beside the yam mounds is good practice for increasing soil fertility and yield; it also functions as a live stake.

Giant swamp taro

Giant swamp taro has a very large tuber that can last for a long time in the ground – ready to be harvested when needed.

- Mark and protect swampy areas from animals and people
- Collect other varieties of swamp taro and plant them
- Harvest when needed
- Plant more than one after each one is harvested

Benefits

- Food is available during disaster and after long period
- Environmentally friendly
- Whole family can participate in this farming practice
- Sustains traditional farming knowledge and practices
- Promotes good health and healthy foods

5e Six-month pudding – traditional preservation of swamp taro in Makira

by Francid Wehi and Maggie Sui, Makira, Solomon Islands

Introduction

Making a feast in Makira is a cultural activity that brings people together, highlights the connections between people, and builds relationships. It can also help to restore peace and security among tribes, as well as strengthen ownership. Six-month pudding preparation is part of the whole period celebration. Activities range from making gardens to building a feast house, and includes breaking the coconuts, picking swamp taro (or garden taro), preparing the coconuts and making the pudding. Pudding preservation is a fermentation process that is completed in 3 to 5 weeks.

The production of six month pudding is usually part of a big feast involving the whole community.

Ingredients for the 6-month pudding are:

- 2,000 dry coconuts
- 200kg grated swamp taro
- 20 kg ngali nut kernel

Steps

Step 1: Grate the swamp taro

- Make pudding balls to size of volley ball and count them
- Estimate by ratio to find out how many coconuts will be needed
- Ratio: 4 pudding balls to 30 coconuts

Step 2: Baking

- Prepare oven (traditional stone motu) fire or burn stones for baking the dough
- Place swamp taro leaves on oven and place dough inside
- Baking is done after 3 hours. Open stone oven after 3 hours and take out.

Step 3

- Men should now start scraping coconut
- Squeeze the coconut flesh using wooden press
- Make fire or heat up stones for the coconut milk
- Place milk in wooden bowl or strong pots that can stand heat
- Next to the fire, have a bowl of water for soaking hot stones to clean off the ashes
- Pick up hot stones with tongs, rinse in water and then place in bowls with coconut milk
- Continue process until coconut milk turns into clear oil

Step 4

- During the boiling of milk process, let someone uncover oven and pudding
- Pound the pudding - be sure it is soft and ready
- Pour milk in pudding and pound carefully until the milk dissolves in the pudding and pure clear coconut oil covers the entire pudding

Step 5

- Divide pudding into feasting wooden bowls
- Leave bowls uncovered overnight in a safe place (do not cover it, moisture will make pudding stale)
- Pudding can stay inside the wooden bowl for many months
- You can turn and stir it to keep it fresh – make sure that oil is covering it

Step 6

- Sending invitations
- Bringing pigs home
- Invited people arriving
- Killing and cooking of pigs
- Feasting!

5f Diversity gardening

by Nancy Pule, Central Province, Solomon Islands

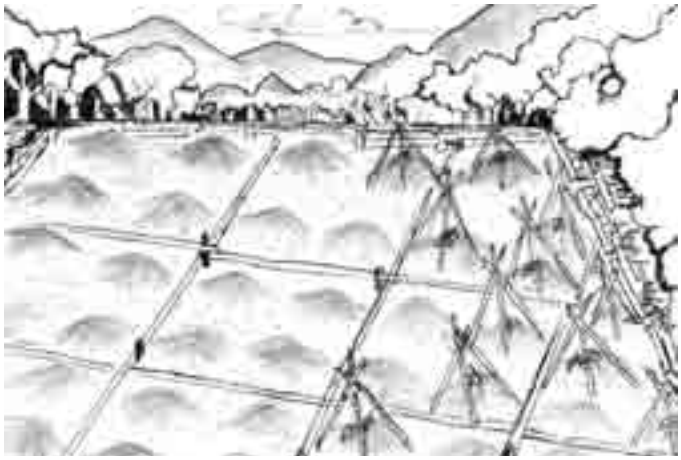
Introduction

Diversity gardening is a system of farming where many varieties of root crops, vegetables and fruit trees are planted in the same place. This method is ideal for gardening on flat land as well on slopes.

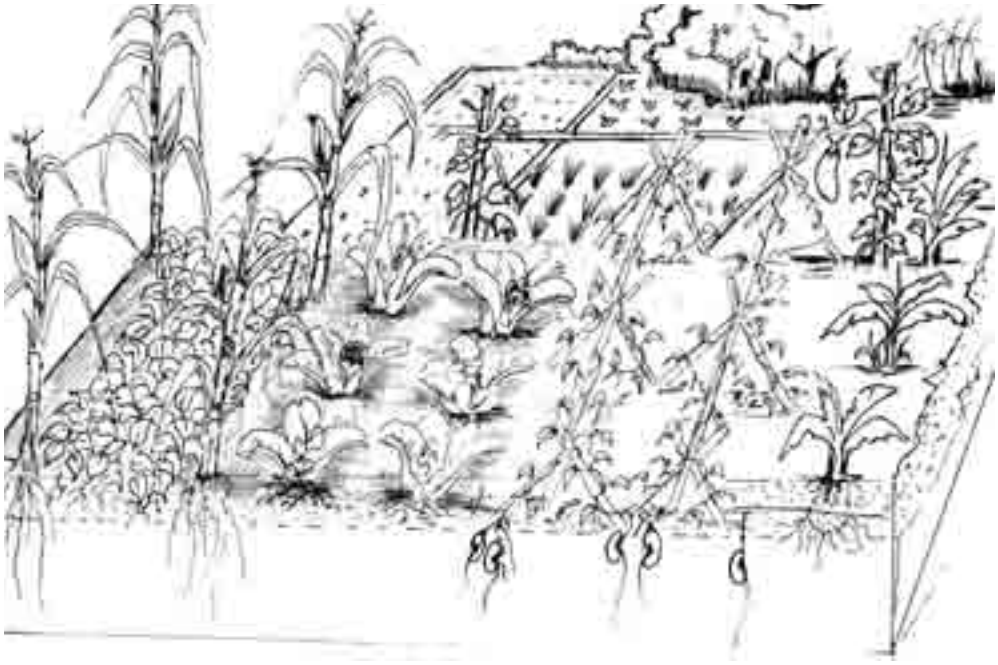
Steps

- Clear marked area for garden
- Plant legume and fruit trees around your marked area
- Prepare as many plots, 10 by 10 metres each, as the different varieties of the crops, vegetables and fruits that you have

Planning the diversity garden area.



Prepare 10 metre by 10 metre plots. Each will be used for a different crop. Some blocks will need staking for climbing plants – yams and beans.



A diversity garden is a garden which is organised into blocks with each block containing a collection of varieties of that crop.

- Allow access through 1 metre paths between plots
- Plant pineapple, banana and edu for fencing around the plots
- Label or code crops if needed
- Maintain and harvest when required
- Rotate gardening after harvesting; plant a different crop in the same space next time
- Spacing for plots is entirely up to the farmer, dependent on how much land is available for planting

Benefits

- Improved soil fertility
- Better access to varieties of crops when needed
- Easy access to nutritious and fresh root crops and vegetables
- Improved family financial status
- Whole family can participate

5g Banana diversity for food security

by Francis Wehi, Makira, Solomon Islands

Introduction

This method encourages collecting and planting all kinds and varieties of bananas in Makira, Solomon Islands. There are 109 varieties of banana on Makira. There are three types: short-term, long-term and karat. Bananas bear fruit 9 to 10 months after planting. The people of Makira use the diversity farming technology as it is effective and practical for them. Bananas are a good staple food and when ripe all family members or school children benefits from having them.

Steps

- Make a list of banana species that you don't have yet
- Go into the community, identify species that you don't have
- Ask for suckers to take, collect them and carefully label all the varieties that you collected
- Take them home and plant in your garden
- After planting, make permanent labels showing that variety's name and where it came from

To improve food security, farmers can exchange banana suckers of other varieties they don't already have, and plant in their own garden.

Benefits

- Food security for family
- Increased financial status for family and school
- Increased food production for big family and institution
- Improved knowledge on all varieties and species of bananas
- Can be a commercial product – banana chips, canned banana fruit – to sell in the market
- Increased healthy diet for family and school – karat bananas are especially high in vitamin A
- Good staple food

5h Growing wild yams the Weather Coast way

by Clement Hadosaia, Guadalcanal, Solomon Islands

Introduction

Wild yams are very common in Melanesia. About eight varieties are currently planted and harvested in the wild in the Solomon Islands. They can be easily maintained and can prove useful when other food crops are destroyed by natural disasters.

Materials

- Farming tools
- Wild yam varieties

Wild yams are planted next to trees which provide them with shade and also a living trellis to grow on. Wild yams live for many years so plan where you plant them carefully. They are planted in a mound using a digging stick. Make sure the tubers are planted upright.

Steps

- Collect wild yams: this can be tuber stalks or vines of yam
- Get your plot ready by clearing the land (don't burn the debris!). It is preferable that you plant under a big strong tree
- Tubers must be planted upright to ensure that the vines come out easily
- Vines can be laid on their side or planted upright in the soil
- Once you have planted the yams, make a box around it (1 metre radius away from the plant) and add soil, leaves, peelings from the kitchen or and cold ash from fire stoves as compost and fertiliser

Benefits

- Wild varieties can be harvested at any time of the year
- They need little or no maintenance
- There is some disaster food in case of emergencies

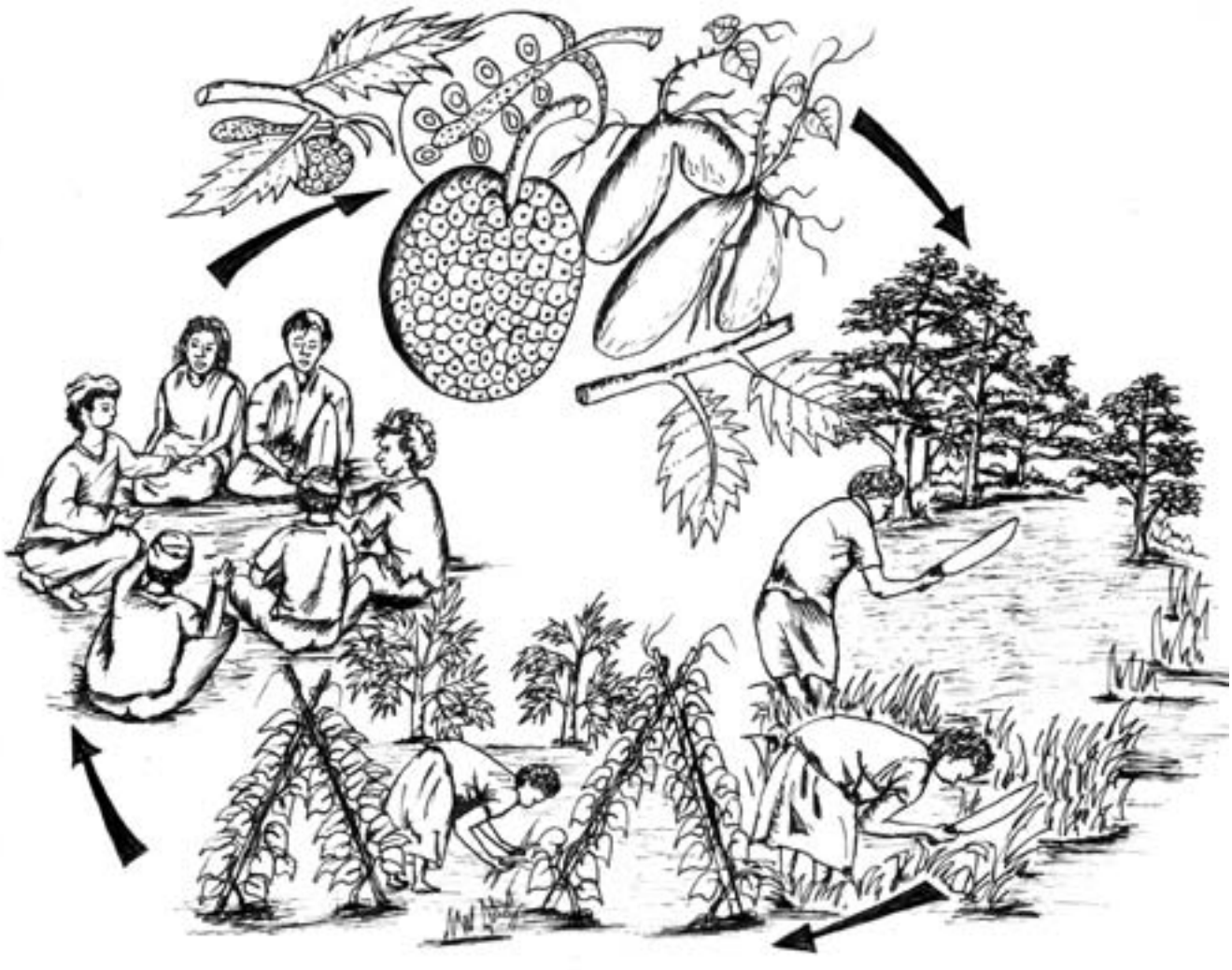
5i Breadfruit and wild yam planting

by Claudine Watoto based on Kastom Gaden Association technologies, Solomon Islands

Introduction

On the Weather Coast, koburu or west winds begin around the month November. From January to April there are tropical depressions, when cyclones and heavy rain, destructive winds, high seas and flash floods are common. This weather

Breadfruit yam food security cycle. Raising awareness in the community about the need for food security; taking action with practical planting of breadfruit and wild yams; looking after the trees and wild yams, harvesting to eat and sharing planting materials with others – the cycle continues.



pattern is quite different from most of the Solomon Islands. It results in rainfall of 5,000 to 8,000 millimetres a year, with up to 13,400 millimetres in the hinterland. This makes the Weather Coast among the wettest places in the world.

Five main soil types are recognised on the Weather Coast. The most widespread are moderately shallow to deep, yellowish to red loams and clays, with low base saturation, found on the steep hills. These are relatively infertile. The river deltas and coastal strips have more fertile alluvial soils.

Gardens are usually made on steep hillsides or on narrow flats along wide, meandering rivers. Neither terrain is secure: hillsides are prone to landslides and rivers often change their course, erode their banks and flood.

May to July or, in some years, April to September, is the 'time hungry', a period that brings a sense of insecurity. Because of the poor weather pattern, most harvests of sweet potato fail at the end of the year. This is partly due to a lack of understanding on what type of crops can grow well during the wet period. Sweet potato is not a useful alternative during 'time hungry'. It either fails to form tubers in waterlogged soils or the tubers rot.

Other crops with potential to fill the void, such as banana, kongkong, taro and breadfruit have limited plantings. Cassava plays an important role during time hungry, but most farmers complain their cassava has white scale infection. More alternatives are needed.

Communities

Our team visited 15 communities in Weather Coast (Avuavu to Duidui) to raise awareness. We talked mainly with the villagers to look into different options for increasing their food security. One of several actions was to plant breadfruit trees and promote uvematua (bush yam) around village kitchens.

After the consultation, community leaders agree to plant breadfruit and uvematua. We then sourced 2,000 trees of the two best varieties of breadfruit roots, from a key farmer of the Planting Material Network in Temotu. The roots were shipped from Temotu to Honiara; 1,500 roots came with our team and were planted out in 15 communities of the Weather Coast and 500 more roots were sent to the Weather Coast of Makira.

Each community planted 10 roots and each family was encouraged to plant wild yam as well – near their kitchen for easy maintenance.

Steps

- Community participatory planning identifies potential root crops' response to short- term stress period
- Sourcing planting material from other farmers, through farmers' diversity fair or exchange programme
- Community identifies a site, followed by clearing and planting of breadfruit tree
- Regular monitoring of families, including visits by key farmers of the Planting Material Network

Benefits

- Increases household food security
- Varieties planted bear fruit year-round
- This process helps families grow more crops

5j Diversification of local root crop and wild yam

by Ngelebosi Lianga, Talise, Tasimauri (Weather Coast), Guadalcanal, Solomon Islands

Introduction

Kastom Gaden Association (KGA) contacted me, Mr Lianga, to assist with the collection and distribution of potential root crops to improve food security. This was done through the Sustainable Livelihoods for Isolated Rural Areas Project (SLIRAP).

Most of the crops I planted were sourced from other farmers on the Weather Coast. Varieties collected and bulked in the garden are: cassava, taro, varieties of yam with resistance to fungus, pana and edu (*Alocasia taro*). Fruit trees include cut nut, five corner, sopsop, orange, and wild apple.

Crop rotation knowledge was introduced which reduces pest and disease. It also allows farmers to use the land for a longer period before bush fallow.

Food security: Women sharing food with children and sharing planting materials with other women.

Steps

- Land preparation: clearing of land, about 20 by 20 metres for each variety
- Collection of planting materials: using a stick to dig the mound over, ready for planting
- Planting out materials, caring for and maintaining garden
- Distribution of planting materials

Benefits

- Reduced slash and burn
- Maintain plant genetic resources
- Fewer pests and diseases
- Increased diversity of planting materials for other farmers
- Increased potential planting material that can meet short-term lack of food

5k Taumana emergency food

by Kevin Sese, Veramogho village, Tasimauri, Guadalcanal, Solomon Islands

Introduction

Taumana is the name given to a traditional food crop that is popular with the people of the Weather Coast of Guadalcanal. This food is a luxury snack at the best of times and an emergency food at the worst of times. Among other wild plants, **taumana** has proved its worth in sustaining the livelihood of the people here in times of disaster since before the arrival of Europeans. This wild creeping plant is a form of yam with aerial and in-ground tubers. It is found in the forest undergrowth, climbing on other plants to reach sunlight.

When cooked, the tubers are very bitter to the taste but not poisonous. Here is a description of how to prepare food from this wild plant. The whole preparation has but one objective and that is to wash or leach away the bitterness so **taumana** can be eaten. (Terms in **bold** are explained in the box).

Processing of **taumana** involves washing it in water for many days and then grating it and rinsing the grated tubers in the water – see instructions.

Steps

The first step is to collect the **taumana**, clean and boil it with the skin in plenty of water. When cooked, pour out the water and let it cool. Collect all the items you will need: **hiri**, **emba**, a piece of bamboo, a small knife. Put them all into a bira, being careful not to forget anything. Now carry the **bira** and the pot of **taumana** and head for a cool clean stream.

At the stream, make a small **pura**. Locate a small spring, preferably higher than, but flowing into, the main stream and not turbulent. Where the spring flows into the stream, position large rocks in a circle like you do when you make an **umu**. Place smaller rocks at the bottom of the **umu** to keep the sand from being washed into the **pura**. The **pura** is almost completely submerged in the water.

Now line the **pura** with the emba and leaves of **kauva**. Position the piece of bamboo (split it if you need to) in such a way as to pipe some of the spring water into the **pura.** Roll up a **kauva** leaf and tie it with a vine or plant fibre to form a pipe; connect it to the piece of bamboo to the bottom of the **pura** so that the water runs smoothly into the pura rather that drops into it. Your **pura** is now ready.

Peeling the **taumana**: Now take the **taumana** out of the pot, place them in the stream beside the pura and peel the skin with your fingers. The skin should come off easily. Take the **hiri** next; while holding one end with one hand, rest the other end on the rocks in the bottom of the **pura**. You are now ready to grate the **taumana**.

Grating the **taumana kakava**: Grate the cooked **taumana** on the **hiri** slowly to produce a fine residue and keep it submerged in water. The continuous flow of the water into the **pura** dilutes and washes away the bitterness of the **taumana**. Occasionally dip a spoon into the residue and give it a slow stir, being careful not to move it too much. When all the **taumana** has been grated, cover the whole **pura** with a bag (rice bag – cut open to form a rectangular piece of cloth) and leaves. Leave for one hour or more. When the bitterness is gone it is ready for eating – the longer you leave it, the better it tastes and the cooler it gets.

This traditional food is prepared by women for the men returning from the **uma** or **chelachela** on hot afternoons. What cannot be consumed can be wrapped in kauva leaves and baked in the **umu**. When baked it can be preserved for up to 3 days.

Glossary of terms for Taumana:

Bira: A bowl made by weaving coconut leaves together

Chelachela: To clear a space in the forest especially by cutting down trees and branches

Emba: Material made from large wild palm leaves used especially for lining the inside of the pura

Hiri: A small grater made from the skin of sago palm or lawyer cane. It is now being replaced by tin ones made by hammering many small holes in straightened out milk tins

Kakava: The act of grating, especially taumana; usually refers to the process of making taumana at the stream

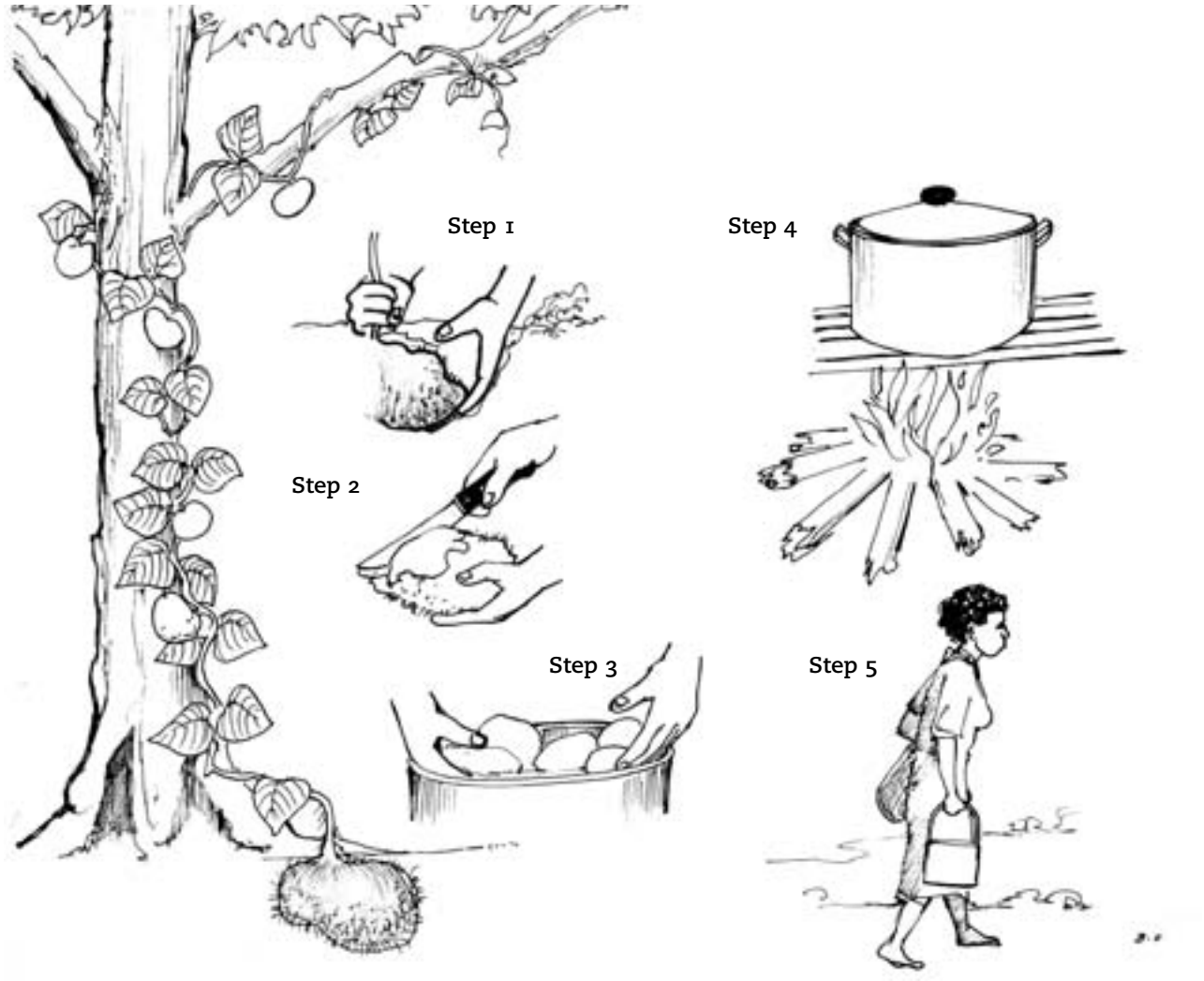
Kauva: A native ginger plant with large leaves and red flowers, favoured as traditional food wrapper for its mild smell or taste

Pura: Made by arranging river rocks in a circle. It is usually under the water and especially made for preparing taumana

Taumana: A wild native yam-like plant that grows in the jungle. Also refers to the food made from tubers of this plant

Uma: To clear a space in the forest for a garden

Umu: The ground oven, made by placing large rocks in a circle and smaller ones in the floor of the circle. It is used for roasting food.



The steps of processing **taumana** to eat - see instructions above

Benefits

- **Taumana** plants are well adapted to extreme weather conditions and are plentiful in the forest undergrowth and secondary forest.
- The plant does not really have a season – just high or low crop times.
- Being a native wild plant, **taumana** does not have any natural enemies. It does not really need pest control measures for minimising the risk of crop damage from pests and diseases.
- If more people could realise the value of the **taumana**, they would take better care of the rainforests: taumana is a wild plant and cannot really be domesticated.

5l Role of giant swamp taro (kakake) in extreme weather conditions

by Jerry Anderson, Tasimauri (Weather Coast), Guadalcanal, Solomon Islands

Introduction

The Guadalcanal Weather Coast is one of the wettest places in the Solomon Islands. Some of the rugged mountains are only a few feet above sea-level, restricting gardening space and resulting in many farmers gardening on the hill side.

The Weather Coast often experiences food insecurity during rainy periods which cause food shortages. Therefore, Turusuala Community Based Training Centre promotes diversification of kakake (giant swamp taro) and increased planting. Currently the Weather Coast has only two varieties.

Kakake plays an significant role towards food security. Some families in the Solomon islands use kakake as a staple food while others only consume this during droughts and other periods of food shortage.

As the name implies, giant swamp taro grows in swamps. It is a very large plant and a big area is needed for its cultivation. It can grow under the shade of big trees.

Materials

- Knife
- Axe
- Kakake comb (planting material)
- Stick for digging
- Yam spade

Steps

- Collection – this can be done in many ways: collect new shoots from existing stock (old kakake garden) or source kakake shoots from Planting Material Network members
- Swamp area preparation
- Selection of best materials: choose healthy suckers before planting
- Planting: dig hole 30 cm deep and plant kakake
- Maintenance: kakake requires very low maintenance for first 3 to 6 months
- Harvesting: this is done after 1 to 2 years
- Distribution: farmers can access and exchange planting material during harvesting of kakake
- Sustainable breeding of root crops: Farm Support Association, Vanuatu

Benefits

- Improve food production
- Reduce food insecurity during hunger period
- Food source responds well during extreme weather
- Low-cost gardening with little maintenance
- Long-term food

5m Sustainable breeding of root crops

by Farm Support Association, Vanuatu

Taro with flower

Introduction

This method is used by farmers to breed their own seeds for root crops like yams and taro. Breeding roots introduces and produces new varieties for farmers and the community. This will help them to have:

- access to alternative source of income
- better nutritious value
- new varieties with better quality: better taste, greater yield, and can grow in different conditions

Steps

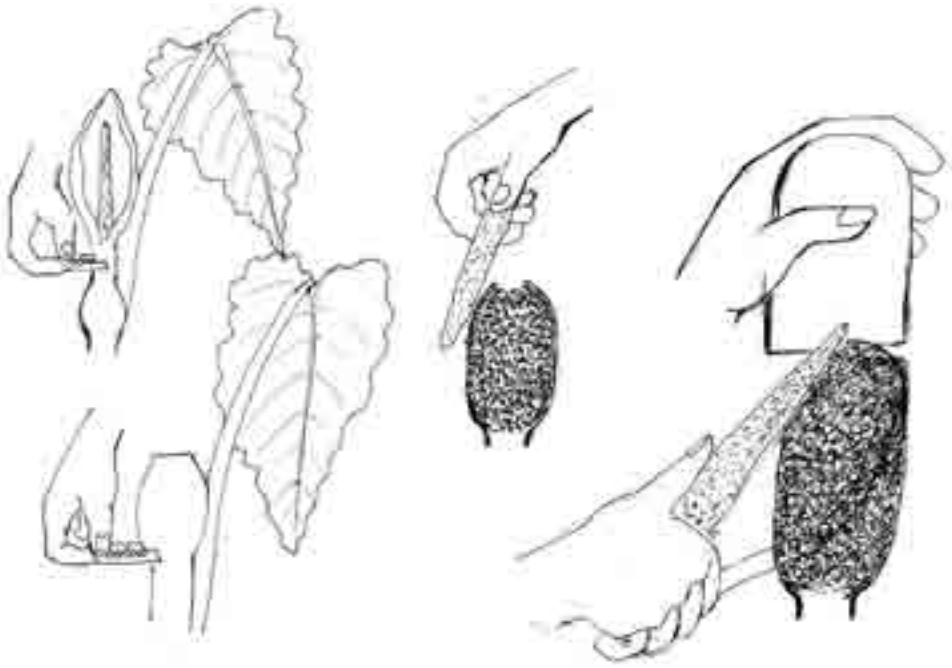
Breeding yam seedlings:

- Grow the yam up stakes to encourage flowering
- Collect seeds before harvesting yam
- Preserve seeds for 2 months in shade
- Prepare and clean ice cream containers, trays, old pots
- Fill tray with soil mixed with ash or fine charcoal (3/4 soil, 1/4 ash or charcoal)
- Remove cover of seeds and plant in tray
- Place tray in nursery and water regularly
- Transplant seedlings after a month to prepared shaded plots

Yams growing on a trellis and then left to encourage flowering. Collect seed pods from the yams.

Breeding taro seeds

- Identify taro species suitable for breeding
- Look for female flowers that are ready to pollinate
- Remove a male flower from another taro plant
- Cut the seed cover of the female flower and sprinkle pollen ('male seed') over that flower
- Put female flower cover back
- Leave plant to develop seeds
- Collect seeds when ready
- Dry seeds, store and germinate as for yam (above)



Taro flower hand pollination

5n Promoting food security by planting bananas

by Celestine Aloatu, Talise Community Based Training Centre, Weather Coast, Guadalcanal, Solomon Islands

Introduction

Food security on the Weather Coast of the Solomon Islands is one of the most important issues locally and nationally. Banana is a great starch food that is also important for food security. Banana plants grows well on the wet Weather Coast, some varieties grow throughout the year and only need basic management. During periods of disaster, families can feed on bananas for survival. Farmers could solve food shortage problems by planting more banana; it could serve as a source of income as well.

Uses of fruit

- Produce banana chips
- Cooking
- Pudding
- Eat when ripe
- Feeding animals

Banana and taro plant

Management

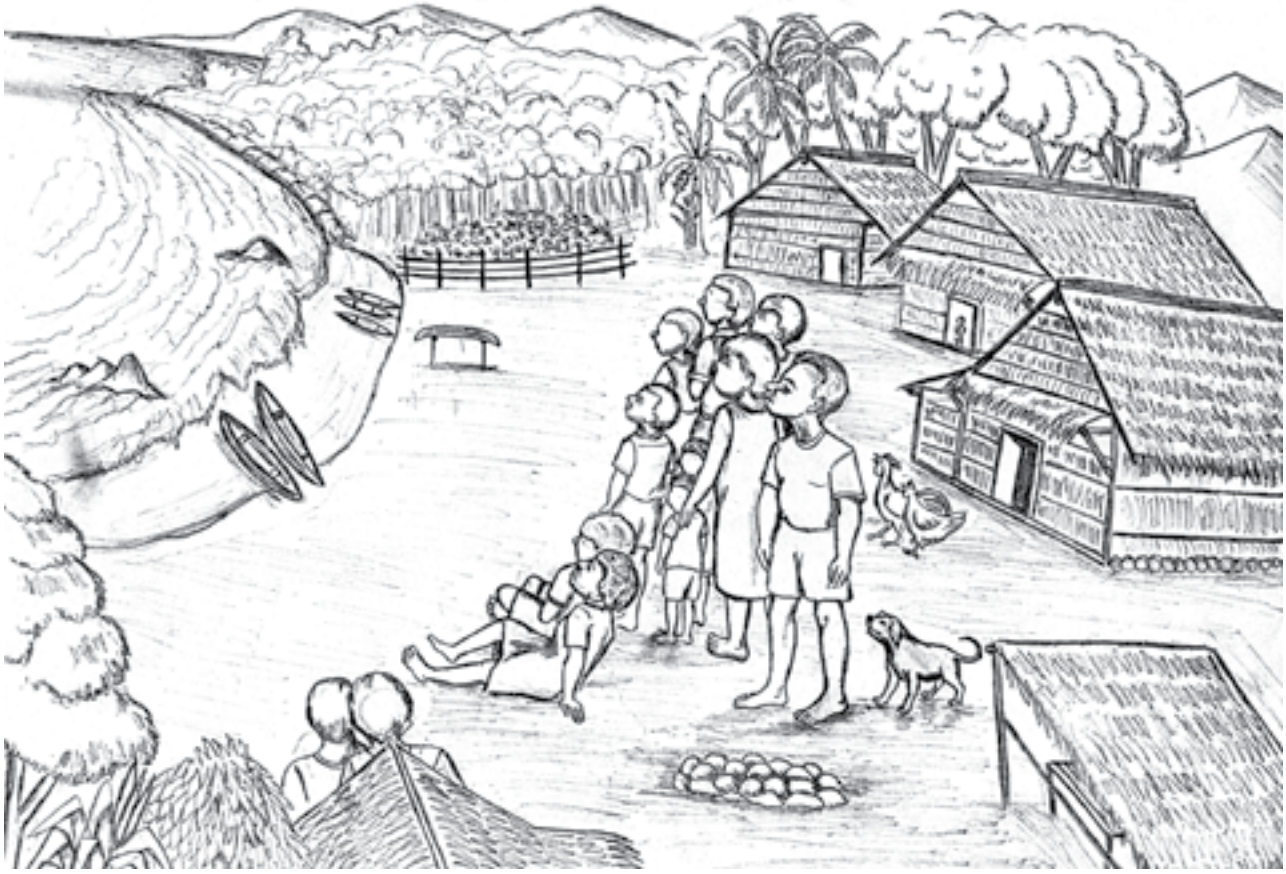
- Brushing
- Pruning (remove unwanted suckers from the bottom)
- Remove dead leaves that hang on the trees

Case study

In 2005, the Turusuala Community Based Training Centre organized a training workshop that focused on value adding food processing training. It was facilitated by Dr Richard Beyer from the Kastom Gaden Association (KGA). Women were encouraged to participate. Participants could become a member if each woman started to grow at least 100 banana suckers. In follow-up stages by Turusuala staff, this training was spread to other areas. Initially there was a good turn-out, with 25 women involved. In 2006 the Weather Coast experienced very heavy rain for one month; that stopped them from processing, but they were able to feed on banana for survival, until the rain slowly stopped. In the past they would have had to find other food. This was one way to encourage women farmers to grow more banana.

Benefits

- Creates new varieties of taro and yam
- Helps farmers to gain new skills in crop selection



6

Low islands, atolls and small areas of land

Low islands and atolls often have poor soil without much organic matter and will be the first to be impacted by rising sea-levels. Special approaches are needed to grow more food in these places.

Small, low islands and atolls are very vulnerable to the effects of climate change. For example, gardening for the future needs to be designed to deal with salt intrusion caused by sea-level rise. The idea is to develop a system that is:

- ecologically sound
- technically possible
- economically viable
- culturally and socially feasible

This is not easy to do!

A variety of methods is promoted in the following sections. They include multi-story agro-forestry structure, raised beds to get plants out of salt, vertical farming for areas with no soil, and use of mangrove mud for soil creation. These methods are not only for atolls – they can also be applied around the house and in coastal areas everywhere.

Atoll gardening is based on several concepts including permaculture, Improved Temotu Traditional Agriculture, agro-forestry, Kastom Gaden, supsup garden, modern scientific and technological knowledge, and traditional and cultural knowledge.

We need gardening systems that are not so prone to external inputs. Ideally, they need to be salt-tolerant, permanent, self-regenerating, self-sustaining, and self-mulching. The different parts of the systems must work together: they must be 'synergistic'. Improved agriculture needs to continuously replenish the soil, because only then can it continue to deliver plant foods. Atoll agriculture is no different.

According to visionary agriculturalist Bill Mollison[1], permaculture is the way to go for sustainable land use design. Applying ecological and biological principles leads to patterns that occur in nature, maximising the effect while minimising interference (and work!).

The ecological processes of plants, animals, their nutrient cycles, climatic factors and weather cycles are all part of the picture. Proven technologies can provide islanders with food, energy, shelter and infrastructure. All elements in a system are viewed in relationship to other elements: the output of one process becomes the inputs of another. Within a permaculture system, 'waste' becomes a valuable resource, productivity increases, as do yields, and the environment is restored.

So permaculture aims to create stable, productive systems that provide for human needs, harmoniously integrating the land with its inhabitants.
The sections that follow are guided by those principles.

Introduction by Jasper Bonie

1 http://permaculture-media-download.blogspot.com/2010/12/bill-mollison-global-gardener-i-in.html

6a Kitchen gardening

by Kastom Gaden Association, Solomon Islands

Introduction

In some parts of the Solomon Islands, traditional gardens are usually located in a forest, two to three hours walk from the village. Most of the arable farm lands close to the villages are normally occupied by coconut and cocoa plantations. But most of the food in the families' diets is sourced from gardens that are far away from their villages. It is common in the Solomon Islands to find taro and vegetable gardens deep inside forested areas, where farmers work and gather food at least twice a week. That means that most of the meals prepared at home are without healthy vegetables: these are usually eaten as soon as they are brought in. By contrast, a 'kitchen garden' or supsup garden is grown close to the house and ensures easy access to green leafy vegetables every day.

A kitchen garden is grown close to the house. Sometimes fencing will be needed to keep out chickens or pigs. Mulch or compost need to be added to the soil regularly.

Materials

- Farming tools
- Sticks for fencing

Steps

- Clear area for the garden
- Use sticks to make a fence around the garden
- If you don't have soil on hand, bring it in from the gardens and mix with chicken manure
- Plant seed or seedlings
- Organic matter must be added regularly in the form of mulch or compost

Benefits

- A kitchen garden gives access to vegetables and greens every day
- Women do not have to walk hours to gather vegetables for meals
- Families have a well-balanced diet
- Save money

A kitchen garden is easy to harvest vegetables and beans from ready to cook in the family meal.

6b Vertical farming

by Ministry of Agriculture, Fiji

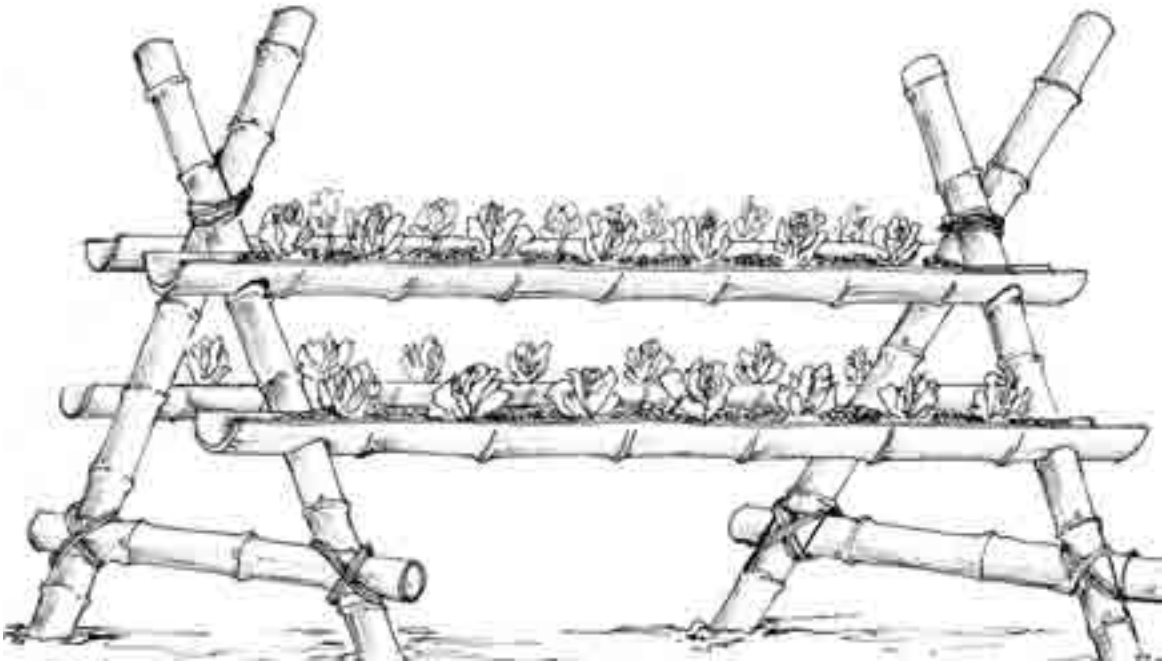
Introduction

Vertical farming is a cost-efficient approach to growing food. It can be used where there is little or no land for farming.

Steps

- Cut four bamboo sticks lengthwise in half. Each stick should be about 4 metres in length.
- Cut slots into each 6 bamboo sticks at distances of 30 centimetres. This is where the halved bamboo sticks will be slotted in.
- Using the slotted bamboo sticks, make two simple A-frames, 5 metres in height by strapping the bamboo together. The angle between them could be 90 degrees. Each third bamboo stick makes the bottom of the A: lay it over both sides and firmly strap them together.
- Plant the A-frames firmly in the ground, about 4 metres apart and facing each other. Then join them together by strapping another bamboo stick at the top, to give more strength to the A-frames.

Vertical garden



- Strap the split bamboos into the slots in the A-frames. Make sure the split side is facing up.
- Fill the split bamboos with compost or soil.
- Plant your seeds in the compost, for example cabbage.

Benefits

- Does not require a lot of land
- Can be used on artificial islands, low-lying atolls
- Ideal for kitchen gardening in backyards

6c Planting sweet potatoes or yams in sacks

by Ministry of Agriculture, Fiji

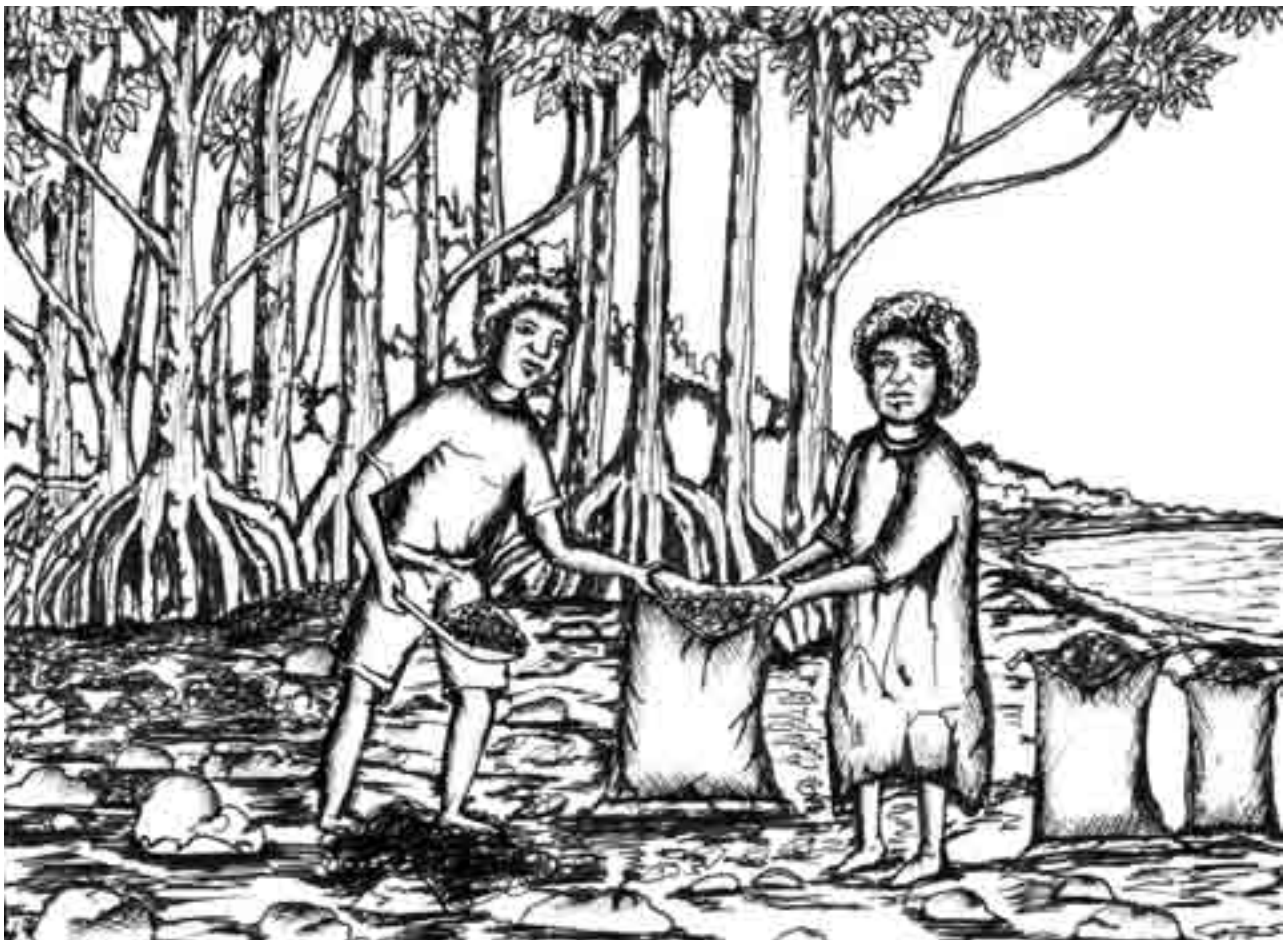
Introduction

This is an easy method for growing crops if you have no fertile land at your disposal at all.

Materials

- 50-kilogram sack
- Sewing needle (big)
- Wire
- Yams (ivi) or sweet potatoes (kumara).

Fill a sack with soil and compost. This is then used for planting yams or sweet potato around the house.



Steps

- Fill a sack with soil and compost. The more compost the better.
- Seal the sack by sewing the mouth closed with wire
- Lay the sack down flat on the ground
- Cut six holes into the sack side that is facing up
- Plant the tubers into the holes that you have cut out
- Water enough to keep the soil moist but not too wet

Benefits

- Can be used on atolls or artificial islands
- Sacks can be stored on shelves
- Do not have to be weeded
- Sacks stop insects from getting into the sweet potatoes
- Time is reduced when harvesting
- Sack ensures that you harvest all the crops

6d Artificial island gardening using mangrove mud

by Selina Wale, Langalanga Lagoon, Malaita Province, Solomon Islands

Introduction

This method uses mangrove mud in containers, to grow kitchen gardens close to people's homes. This is very useful on artificial islands where land is rare.

For people living on the artificial islands of the Langalanga lagoon of the Malaita province, it is difficult to find garden food. The Langalanga people are well known as innovators in many fields, ranging from boat building and fishing to shell money production.

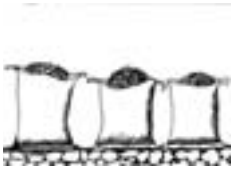
Another innovation is their artificial island backyard gardening. This idea stems from the Langalanga church-based women's group. They tried to use dried

Mix mangrove soil with grated rotten coconut husks (soft ones that are easy to break in your hand). This makes a very good soil mixture for growing inside.

mangrove mud in a dugout canoe, thinking that if mangrove can grow in the mud, then maybe other garden plants could grow there too.

They planted a few vegetable plants in the mud secured in the canoe, and it worked. The crop plants grew and were harvested for use. Today, it is not uncommon to see a canoe or container filled with mud from mangroves, supporting food plants outside each house.

Steps



Step 1

Collect mangrove soil for backyard gardening (used empty rice bags to carry the soil) during the dry season or low tide.

Step 2

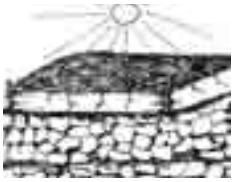
Pour bags of the mangrove soil in the garden area. Leave soil exposed to rain to wash off the salt and let the sun dry it for 2 to 3 weeks.

Step 3

After 1 week turn the soil over, using your hand or a spade.

Step 4

Check soil in week 2. Work the soil loose, removing any sticks or small stones. In week 3, check the soil again. It should now be ready for use in the backyard garden.



Step 5

Combine your mangrove garden soil with river sand (for air) and other organic materials, such as rotten grated coconut husk, tree bark husk or leaves, chicken manure.

You can grow beans, tomatoes, and slippery cabbage, Chinese cabbage, eggplants, shallots, bananas or any other type of vegetables in this soil.

Benefits

- Suitable for island communities
- Island farmers can readily use available soil for garden
- Improves household nutrition
- Promotes food security
- Generates income
- Educates farmers and children

6e Gardening on low-lying atolls: Ontong Java Atoll: Luaniua and Pelau Islands, Malaita Province

by Jasper M Bonie

Introduction

The greatest challenge facing subsistence agriculture in the atolls of the Solomon Islands is to develop viable farming systems for its rain-fed subsistence agricultural lands. As sea-level rises because of climate change, the underground water level in the atolls becomes polluted with saline water.

Many crops that used to grow well in these soils are no longer growing well or even dying. High saturation of saline water causes swamp taro to wilt and the tubers to rot – finally killing the plants. True taro has been virtually wiped out and can no longer be grown in the old way.

Gardening on atolls needs to look at providing the right conditions for crops in the soil, particularly to decrease salinity. Biomass is very important in producing mulch and plant foods in these sandy soils.

Crop selection for atolls needs to focus on varieties that are salt-tolerant, permanent, self-regenerating, and self-sustaining, that grow well with each

Raised garden beds which are topped up regularly with organic matter are an increasingly important method where sea-levels are rising and effecting atoll swamp gardens.

other and can adapt to changing environments. People's prevailing cultural norms and traditions also need to be taken into account. We can design atoll farms to suit a high level of infiltration of salt by selecting salt-tolerant crops, or we can raise the crops above the salt to protect and enhance growth.

Confronting the salinity problem uses permaculture, agro-forestry, Improved Temotu traditional Agriculture, Kastom Gaden and supsup garden. This diverse approach stands a good chance of food production.

In our subsistence farming practices two subsystems are actively at work:

First, there is a tree-based subsystem that is structured by fruit tree, vine and root crops components. Many crops in this subsystem, especially the root crops, are shade tolerant. The subsystem is permanent because the crops do not need replanting: they are self-generating and self-sustaining.

Secondly, there is the subsystem that incorporates mulch in wide alleys, for growing crops in full-sunlight. These crops need to be replanted after the garden is harvested. Between harvest and planting, the old garden is prepared with more organic material.

The gardening system shown here is ideal for low lying atolls. It can also be used in other areas with good soil in larger islands, as a permanent system of food production.

Steps

- Site survey and measurements - the farmer inspects the land and uses a tape measure to mark a plot commit to gardening: size should be 40 by 40 metres or 60 by 60 metres
- Farm design considerations
- Multi storey structure

The gardening system is a form of agro–forestry, with the farming in layers of the food-based plants. The tallest fruit trees make up the upper storey, medium and smaller trees grow underneath and beside them. At the ground level are root crops. Plants in the lower canopies must be able to grow well in the shade. Root crop vines are trained to grow up live trellis plants such as the king tree.

Raised garden beds which are topped up regularly with organic matter are an increasingly important method where sea-levels are rising and effecting atoll swamp gardens.

Crop species

The main crop species that are to be used are listed below. Other important species do not tolerate salt – these have to be grown on raised beds or other structures above the salt level.

Species that tolerate salt:
Alite (*Terminalia catappa*) Polynesian chestnut (*Inocarpus fagifer*) Breadfruit (*Artocarpus altilis*) Funny face/inkori (*Spondias cytherea*) Malay apple (*Eugenia malaccensis*) Local avocado (*Burckella obovata*) Stem taro (*Alocasia* species) Topia (*Alocasia* species)
Species suited for raised beds (not salt-tolerant):
Banana (*Musa* species) Cassava (*Manihot esculenta*) Kong kong taro (*Xanthosoma* species) True taro (*Colocasia esculenta*) Shade pana (*Dioscorea esculenta*) Pacific yam (*Dioscorea nummularia*) Egg plant (*Solanum melongena*) Slippery cabbage (*Hibiscus* species) Pawpaw (*Carica papaya*) Pumpkin (*Cucurbita pepo*) Sweet potato (*Ipomoea batatas*) Yard-long bean (*Vigna* [*unguiculata* ssp.] *sesquipedalis*) Chilli pepper (*Capsicum frutescens*)

Soil type and condition

Low-lying atolls have sandy soils in salty conditions. Soil fertility is limited, it needs quite a bit of work to incorporate mulch and compost.

Crop spacing

Crops are spaced on a 15 by 15 metre grid in the tree based system – especially the upper canopy trees. The lower canopy trees are planted on the mid points of the 15 by 15 metre squares.

In the full sunlight system, the crops are spaced as commonly known for these crops. For example, taro will be planted 0.5 to 2 metres apart, depending on the variety.

Crop positioning

Each tree crop species has its own position, dependent on what they play in the overall system, and how well they are compatible with other crops in the system.

Preparing land

Land clearing

Clear away unwanted trees and stones. After felling the trees and bush, do not burn the debris and logs. They help to keep the soil cool.

Pegging

After clearing, put out pegs where you want the tree crops positioned. Also peg out the full-sunlight crop areas so that raised beds can be constructed and prepared for planting crops.

Building structure

Structures that may be needed include raised beds and trellis. Also set out planting positions for shade pana, Pacific yam, lucaena legume tree and small crops such as beans, shallots, tomatoes and eggplants.

Nursery

The nursery is the most important place for establishing atoll gardening. Put up a 20 metre long and 10 metre wide green screen under which young seedlings are raised in polybags. Water the plants each day except on rainy days.

When seedlings are ready to be put out in the field for planting, inspect them carefully. Bad ones need to be destroyed and only healthy trees planted. When planting, carry the seedlings carefully by hand or use a wheelbarrow.

Planting

It is a good idea to dig planting holes first (especially for tree crops) before carrying over the seedlings. Put them directly in the hole and bury their roots. Press the soil firmly around the newly planted seedlings. Water the plants daily (except on rainy days) for the next month or so. That encourages the growth of new roots and shoots to make them strong. Plant a taller cover crop: that keeps down weeds, keeps the newly planted seedlings cool, and prevents burns from sandy soil.

Caring of crops

Maintain the plants by keeping them free of weeds. Kill insects that may attack the plants. Watch out for any diseases, check them daily. Consult your agriculture officer for diseases you may find difficult to deal with.

Benefits

- Restoring soil condition supports growing of crops
- Recreate natural forest conditions to allow regeneration of ecosystem
- Diversification of crops increases food production and enhances nutritional balance for daily needs
- Surplus can be produced for markets
- The permanency of the system saves cost, time and labour
- Tree crops provide high biomass that is useful in mulching for full-sunlight crops
- Provides long-term food security

6f Growing island food in raised beds in low-lying islands

by Jasper M Bonie

Introduction

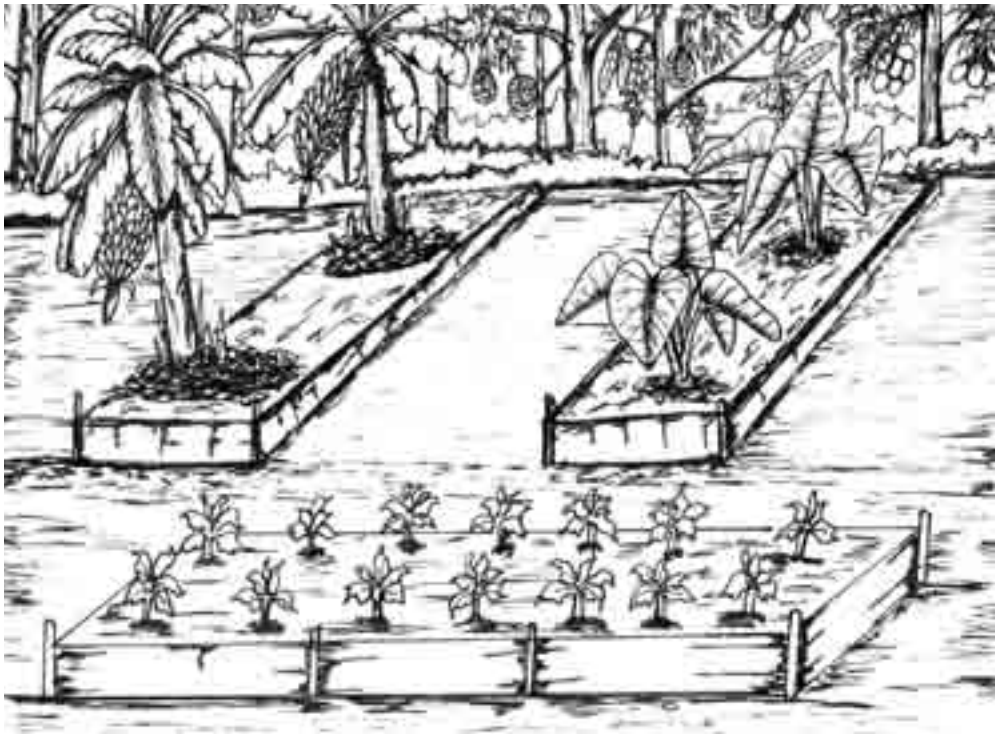
Growing food in raised beds is a good approach for responding to a changing climate in low-lying islands. Raised crops are not so much affected by sea-level rise, storm surges, coastal flooding and salt intrusion.

Steps

- Inspect site for garden
- Measure out 20 metres long by 20 metres wide
- Make 7 raised beds, each 20 metres long by 2 metres wide, with a metre wide walking space between them

For each raised bed:

- Dig the earth to about 1 foot (0.3 metres) deep
- Fit commercial plastic over the entire length
- Refill pit with rotting planting materials/mulch/sawdust/rotting coconut husk



Raised beds can be used for vegetables, bananas and root crops such as taro.

- Cover with earth and build up side to 1 foot above ground level
- Put coconut logs along the sides and ends to support and hold ground
- Cover with legume vines to prepare soil for planting crops
- Plant crops in raised bed, water as needed, and harvest when ready!

Benefits

- Many crops such as taro, bananas, pawpaw, slippery cabbage, beans, cassava, sweet potatoes can be grown on raised beds
- Crops are grown above the depth where salt has contaminated the soil
- Commercial plastic (black) underneath raised beds prevents salty water table seeping upwards to the crops
- Long-lasting

Feedback form

Please help us to improve this handbook. Let us know what you think by answering the questions below and sending them to us. We suggest you photocopy this form or write/type out the questions and your responses, rather than tearing out this page, so other users of these materials can also tell us what they think. You can fax or mail this form to one of the Live & Learn offices listed on page 132.

Or you can provide feedback via email: resources@livelearn.org

Your name and location: .....

Organisation or community: .....

Contact details (optional): .....

.....

.....

1. Briefly explain how you used this handbook. (e.g. are you a farmer, extension officer, or NGO worker?)

.....

.....

.....

2. Is this guide easy to follow? (if not please tell us what was not clear)

.....

.....

.....

3. Was there information that you think was missing?

.....

.....

.....

4. How could this handbook be improved?

.....

.....

.....

5. Please list any other comments or suggestions below:

.....

.....

.....

Thank you!

This resource was developed by Live & Learn Environmental Education with funding through AusAID's International Climate Change Adaptation Initiative - Community-based Adaptation Activity Grants.
Protecting food security through adaptation to climate change in Melanesia

Acknowledgements

International Institute of Rural Reconstruction for allowing us to use the 'Writeshop' approach.

Live & Learn wishes to acknowledge the input and support from Kastom Gaden Association, Solomon Islands. Most of the technologies in this manual have been developed by farmers working together with Kastom Gaden Association over many years or through partners of the Kastom Gaden initiated Melanesia Farmer First Network.

Special thanks to Tony Jansen for facilitating the creative and innovative process to produce this resource.

Contributors (in alphabetical order):

Celestine Aloatu
Jerry Anderson
Inia Barry
Jasper Bonie
Joyce Mary Dola
Makiva Gazamakana
Clement Hadosai
Diana Hinge
Helen Filia Hosui
Judy Kate Inapi
Tony Jansen
Jimmy Kelvin
Simon Peter Leyinga
Peter Lianga
Thecla Limai
Lionel Maeliu
Roselyn Kabu Maemouri
Senikarawa Mar
Gwendolyn Piatavavini
Nancy Pule
Kevin Sese
Koto Simione
Salatheil Sore
Maggie Sui
Selina Wale
Claudine Watoto
Francis Wehi
Jacob Zikuli

Lead editor: Tony Jansen
Supporting editors: Jaap Jasperse and Tamara Logan
Design and production: Karen Young and Kate Vandestadt

Illustrators (in alphabetical order):

Brian Feni: Pages 1, 4, 7, 11, 16, 20, 27-34, 51, 67, 69, 82, 88, 89 top, 90, 107, 109, 112, 113, 117, 121
Joyce Kotinah: 15, 17, 76
Fred Oge: cover, 8, 19, 46-50, 58-62, 91-93, 103, 110, 120, 123-138
Frank Sauni: 18, 37, 39, 43, 45, 52-56, 74, 77, 87, 119
Lawrence Talo: 21-26, 35, 36, 40, 65, 68, 73, 78-81, 85, 94, 97-101, 105, 114.

Organisations represented:

Baetona farmers school, Mana'abu
Farm Support Association
Guanafiu Farmer School
Kastom Gaden Association
Talise Community Based Training Centre
Tetena Community Learning Centre

Live & Learn offices:

Australia
247-251 Flinders Lane
Melbourne
T: +61 3 96501291
F: +61 3 96501391
E: livelearn@livelearn.org

Solomon Islands
DSE Building, Lombi Cresent Street
New China Town
Honiara - Solomon Islands
T: +677 23697 F: +677 24453
E: solomons@livelearn.org

Papua New Guinea
Section 35 Allotment 16, Kimbe Town
West New Britain Province
Papua New Guinea
T: +675 983 4716
F: +675 983 4237
E: png@livelearn.org

Vanuatu
Fresh Wota Four
(opposite Fresh Wota School)
Port Vila, Vanuatu
T: +678 27448
F: +678 27445
E: vanuatu@livelearn.org

Website: www.livelearn.org

Cover made from 100% recycled plastic. Pages printed on 100% recycled paper.

LIVE&LEARN
Environmental Education