Tuvalu

Technical & Vocational Skills Development Programme

INTRODUCTION TO HORTICULTURE IN TUVALU
Introduction to Horticulture in Tuvalu

This course was written for people who want to learn more about horticulture by the National University of Samoa. It is presented according to the National Competency Standard of the Samoa Qualifications Authority - HIP 001 Introduction to Basic Horticulture in the Pacific – Level 2.

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Icons Used in the Unit

In these units, you will find the pictures - or icons which tell you what to do:

- This is where you start a new topic of the Unit
- Here you can read the Objectives of the unit
- This directs you to complete a task. Completing all the suggested tasks learn and apply new ideas.

Explanatory notes

In order to demonstrate the skill and knowledge in this unit students should be able to:
- Speak and understand Basic English.
- Perform basic addition, subtraction, multiplication and division.
- Follow basic horticultural safety.
- Identify soil types.
- Demonstrate an interest in plants.
- Identify different types of plants.

Resource information

The following resources may be required for training and practical activity:
- Green house
- Arable piece of land for demonstration or available demonstration farm.
- First aid equipment
- Tools and equipment required to perform skills outlined in the course
- Clean water and comfortable environment.
- Proper storage rooms.
- Safety warning instructions in all areas of practical work.
Course Introduction

This basic horticulture programme aims to help you develop a positive attitude towards farming in general, and especially towards growing fruits and vegetables. It should also help you to gain knowledge, understanding and appropriate skills for growing greenhouse crops. You will also learn how to grow both local and introduced food plants using good farming methods.

Taking this unit should help you to grow crops in your home garden. Doing so will also improve the nutritional quality of your diet and provide you with extra income.

Objectives

By the end of this course, you should be able to:

- Cultivate soil using hand tools
- Recognize the different types of organic and inorganic fertilizers and soil conditioners
- Know how to apply fertilizers and lime
- Prepare a seedbed by hand for sowing
- Sow seeds by hand in outdoor seedbeds using broadcast or drilling methods
- Maintain seedbeds to raise seedlings

What is this course for?

This course is a basic introduction to Horticulture in Tuvalu. It is intended for school leavers and community groups who have limited knowledge or experience of Horticulture.

The purpose of this unit is to equip students with the knowledge and skills of safety practices that they will require when working in the horticulture industry. You will work with materials and tools that are available locally to carry out basic Horticulture.

When you have finished this course you should be able to work on simple projects on your own.

You will still need to work under supervision for more complex activities such as working with tools, cultivating soil, and sowing seeds.
What does the course cover?

*Basic Horticulture* covers five separate topics:

**Topic 1: Cultivating soil using hand tools**
Learn how to cultivate soil to a fine tilth by using simple hand tools. You will learn about different hand tools with their specific functions in cultivating soil to obtain a fine tilth.

**Topic 2: Recognise fertilizers and their applications**
Learn how to identify the different types of fertilizers and ways in which they are stored and applied.

**Topic 3: Prepare seedbed by hand sowing**
Learn how to select the best site for planting, the steps in preparing the ground for a seedbed, choosing the best seeds, what to do when selecting seeds, aerating, watering and mounding seedbeds.

**Topic 4: Sowing in a nursery**
Learn how to raise seedlings in a nursery, prepare seed trays for planting seedlings, and care for seedlings before they’re transplanted to the actual field.

**Topic 5: Maintain seedbed to seedling stage of growth**
Learn how to maintain seedbeds by ensuring good seed germination and seedling development by weeding, and controlling pests and diseases in the field.

How to work through this unit

This unit contains the information and guidance you need so that you can complete the practical tasks. Read the information for each section, and do the practice work if any is suggested, before you do the tasks. You may need to ask your trainer for advice if you are not sure of something.

This unit also contains a list of technical and specialist terms used in horticulture. These terms are contained in a glossary, which you will find at the end of the unit. Have a look now, and see what is there, and then turn to it as you are reading if you want to check any terms.
Please note:
It may take you several months to complete this unit, as there are many things you need to do:

- Prepare a garden
- Prepare a seedbed
- Sow a crop
- Maintain your seedbed.

The course must be led by a trainer or experienced person who can show you the steps, teach you how to use tools correctly, and guide you with your developing skills.

The course will work best with small groups of students who can talk about things and learn from each other.

Two different kinds of tasks
The unit contains two different kinds of tasks:

- For some tasks, you will need to write your answers.
- For other tasks, you will need to show your trainer the work you are asked to do and ask them to complete the Student Checklist at the end of the task.

Student workbook
Your workbook has exercises, pictures and explanations as well as space to make your own notes. The five topics in your workbook have separate sections for most of the big steps such as soil cultivation, fertilizers, seedbed preparation, seedlings in nursery and maintaining seedlings. Your trainer will work through each section with you, talking about the tools and materials and showing you how to use them.

There is a Student Checklist at the back of the workbook for you to tick off the work you do.

The role of your trainer
Your trainer for this course is a competent person with general knowledge of Basic Horticulture skills in using tools and raising seedlings. They will show you how to work with the required materials correctly and tell you how well your skills are developing.

Your trainer will:

- Have sample tools and materials such as fertilizers, greenhouse tools and equipment for you to work with
- Lead you through the course
- Explain the written material
- Watch you work and tell you how you are doing
- Complete your student checklist to record the work you have done.
Projects

During the course you will work on a project where you can practice the skills you have learned. You will be able to make something like:

- A nursery
- A small vegetable plot
- A tool room
- Fertilizer equipment

This course tells you a lot about Basic Horticulture, but you need to be able to raise seedlings in a nursery, prepare seedbeds and use farm tools – not just talk about them. The course books and your trainer can show you how to use tools, but you need lots of practice to develop the skill in using those tools. Take plenty of time for practice during the activities.

Whenever you can, work with two or three other students. You can watch and give each other feedback on how you are doing.
TOPIC 1: Cultivate soil using hand tools

At the end of this topic you should be able to:

- Cultivate soil with a hand tool.
- Know the purpose of cultivating soil
- Provide organic matter for soil organisms to live on
- Identify hand tools
- Demonstrate safe use of hand tools

Introduction:

Cultivating is one of the most important tasks for a farmer. When you cultivate the soil with a hand tool such as a fork, you do so for two reasons.

- Firstly, you need to prepare a firm, fine seedbed for best possible seed germination.
- The second most important purpose of cultivation is to control weeds.

Cultivating helps aerate the soil and enables you to turn over crops or plant residues that are left on the soil surface, providing organic matter for soil organisms to live on.

Using tools

When you are using tools for gardening, choose the right ones for the job. This will

- make the job easier
- ensure that there is less danger of injuring yourself or anyone else.

When not using tools, put them down in ways that no injuries can occur. For example,

- put down a rake with the teeth pointing downwards.
- maintain and store them safely and correctly once you have finished with them.

Safety will be an important aspect of your training throughout this course.
## Tools and their Functions

<table>
<thead>
<tr>
<th>#</th>
<th>TOOLS</th>
<th>CORRECT USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digging Fork</td>
<td>Tilling the soil, Manure spreading, Mixing compost</td>
</tr>
<tr>
<td>2</td>
<td>Spade</td>
<td>Removal of soil from pits, Digging drains, Digging light soils, Leveling loose soil</td>
</tr>
<tr>
<td>3</td>
<td>Post-hole spade</td>
<td>Digging holes for posts and pits</td>
</tr>
<tr>
<td>4</td>
<td>Hoe</td>
<td>Inter row cultivation, Hilling soil around plants, Breaking of clods</td>
</tr>
<tr>
<td>5</td>
<td>Push-pull hoe</td>
<td>Weeding in places where it is inconvenient using a knife e.g. in between pineapple plants</td>
</tr>
<tr>
<td>6</td>
<td>Garden Rake</td>
<td>For collecting rubbish, cut grass or trash on the surface of the soil</td>
</tr>
<tr>
<td>7</td>
<td>Sickle</td>
<td>Harvesting rice, Cutting pasture grasses for livestock</td>
</tr>
<tr>
<td>8</td>
<td>Cane knife</td>
<td>Weeding plantations, Harvesting sugarcane, Clearing bush</td>
</tr>
<tr>
<td>9</td>
<td>Hand fork</td>
<td>Hand cultivation and hilling soil around plants in a vegetable plot</td>
</tr>
<tr>
<td>10</td>
<td>Axe</td>
<td>Felling trees, Chopping wood</td>
</tr>
<tr>
<td>11</td>
<td>Hand trowel</td>
<td>Transplanting seedlings, Putting soil in polythene bags, General light cultivation of seedbeds</td>
</tr>
</tbody>
</table>
Cleaning and storing tools

If tools are kept clean and maintained properly, they will last much longer and work better. It is important to take good care of tools because they are expensive. Proper care and storing of tools also helps to prevent injuries.

Cleaning tools
Practice cleaning all the tools you use after you have finished with them, so that they are ready again for use the next time. This also helps to increase their working life. Ask your trainer about the best way to clean each tool.

Storing tools
Tools must be hung up neatly in their correct position so that they do not fall and cause injuries. Before storing a tool it should be cleaned first.

Keeping tools sharp
Tools such as knives, axes and picks should be kept sharp because it makes work much easier when tools have sharp edges. Blunt cutting tools do not cut well, which makes work a lot harder.

Preventing rust
Most farm and gardening tools are made of metal; if they are stored when wet, they will rust quickly. Rusty tools do not last very long. To prevent tools from rusting, they should be cleaned, oiled and stored in a dry place.

Always store tools correctly to save everyone the frustration of looking for something and also to prevent injuries. If you are hanging tools up, hang them up safely.

How to store tools and equipment in tool shed
Introduction to Horticulture in Tuvalu

Activity

Your first activity is to demonstrate that you can identify tools suitable for the task and use them safely. You also need to follow procedures for handling, maintaining and storing tools.

You need to be able to safely use a

- Spade
- Garden fork
- Bush knife
- Hoe
- Pick axe, and
- Rake

Task: Using and caring for tools

Complete the following table.

<table>
<thead>
<tr>
<th>PICTURE</th>
<th>NAME</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Spade" /></td>
<td>Spade</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Hoe" /></td>
<td>Hoe</td>
<td></td>
</tr>
</tbody>
</table>
REVIEW QUESTIONS

Talk about the answers to these review questions with one or two other students. Ask your trainer for help if you’re not sure of the correct answers.

What is the best place for storing tools?

Why do we store tools?

Why should tools and fertilizers not be kept together?

What should be done after using tools?

Why should we sharpen our tools before working?

Digging over the ground

Once you know how to use and maintain gardening tools correctly, you need to learn how to dig the ground over so that you do not damage the soil structure, and also create a nice tilth or even soil texture to a uniform depth.

Tilth is the cultivation of land, to a texture that is best suited for sowing seeds. An experienced farmer can determine whether the soil is of right tilth for sowing seeds.

The best way to dig ground using a spade is to work using the single-spit approach. A ‘spit’ is the width of soil that can be prepared. It is usually about 30-40 centimeters wide and 20 –50cm deep. The lower levels are then exposed and aerated. At the same time annual weeds are turned in and buried so that they will provide valuable humus to the plants.

Ask your trainer to show you, then practice the technique of single-spit digging to create a good tilth on your own.

Activity

For your next task, you need to demonstrate that you can dig over a garden, using techniques that suit the soil characteristics.
What you will need:

- area to dig
- Required tools

Practice:
Practice digging the ground over using the single spit digging method.

Preparing the soil and digging in nutrients

You should know how to spread any organic matter or other material you are given to put into your garden. You then need to incorporate it evenly throughout the soil, and then you should finish off by raking the area and levelling it evenly.

Practice doing this.
Dig some holes to check that you have got an even mix.

Activities to give and get back most out of the soil are classified as

a. Pre-planting: Activities such as bush clearing, burning, tilling and ridging are all classified under pre-planting operation.

b. Planting: This is the placing of seeds or stem cutting and plants in the soil.

c. Post-planting: Actions such as thinning, fertilizing, weeding, mulching, spraying, watering, harvesting and, lastly, taking crops to the market to be sold.

Activity

When you have finished preparing your soil, ask your trainer if you

a) have made a suitable soil tilth?

b) your tilth has suitable depth?

c) your soil is well aerated?

d) have created an even soil surface?

e) have removed all debris and tiny stones from the bed?
TOPIC 2: Recognize fertilizers & their applications

At the end of this topic you should be able to:

- Identify why you might use the following fertilizers:
  - Lime
  - Nitrogen
  - Phosphorous
  - Potassium

- Know the difference between compost and mulching
- Explain the value of using organic fertilizers
- Make compost

Identifying Fertilizers

Fertilizers are plant nutrients and are divided into two parts

1. Macro-nutrient (needed in large amount)
2. Micro nutrients (needed in small amount)

TYPES OF FERTILIZERS

- *Organic fertilizers* are obtained from natural sources such as kitchen waste, poultry waste, & compost

- *Inorganic fertilizers* are obtained from manufactured (man-made) fertilizers from chemicals

Different fertilizers can be used in planting. They differ in

- Form and appearance
- Effects and mode of action
- Fast acting or slow releasing agents
- Organic or synthetic
Timing of fertilizer application has a significant effect on crop yields. Proper timing of fertilizer application

- increases yields
- reduces nutrient losses
- increases nutrient efficiency and
- Prevents damage to the environment

Too much fertilizer causes:

- Wilting
- Death
- Burnt plants

Wilting occurs when plants loses water causing the stem and leaves to droop down (fall over).
TYPES OF FERTILIZERS

Organic matter refers to dead plant and animal remains present in the soil, which are in the process of being decomposed (broken down to form soil).

Lime is a compound of the element calcium which will reduce soil acidity. Types of Liming

1. **Ground limestone** (Calcium carbonate – CaCO₃)
   This is obtained by quarrying the limestone and grinding it to a fine powder. It is the commonest liming material used at present.

2. **Coral Sand** (Calcium Carbonate - CaCO₃)
   This may also be used as a liming material after grinding it to a fine powder.

<table>
<thead>
<tr>
<th>Lime</th>
<th>Ntralized soil acidity (soil pH)</th>
<th>Increase nutrient status (soil fertility)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N)</td>
<td>Needed for vegetative and leafy growth</td>
<td>Very important in building proteins.</td>
</tr>
<tr>
<td>Phosphorous (P)</td>
<td>Essential for cell division.</td>
<td>Healthy root development.</td>
</tr>
<tr>
<td></td>
<td>Helps in Nitrogen fixation in leguminous plants</td>
<td></td>
</tr>
<tr>
<td>Potassium (K)</td>
<td>Needed for healthy skin and fruit formation</td>
<td>Helps the formation of proteins and carbohydrates.</td>
</tr>
<tr>
<td></td>
<td>Regulates water in the plants.</td>
<td>Helps in plants metabolism</td>
</tr>
<tr>
<td></td>
<td>translocation of starch to all parts of the plant</td>
<td></td>
</tr>
<tr>
<td>Organic manure</td>
<td>Add nutrients to soil</td>
<td>Increase soil fertility</td>
</tr>
<tr>
<td></td>
<td>Increase plant yield</td>
<td></td>
</tr>
</tbody>
</table>
3. **Burnt Lime/Quick Lime** (Calcium Oxide – CaO)
   This is produced by burning limestone in a kiln.
   Burnt lime may scorch growing crops because it readily takes water from the leaves.
   It should be incorporated into the soil prior to planting.

4. **Slaked Lime** (Calcium Hydroxide – Ca(OH)$_2$)
   This is a good liming material but is usually too expensive for liming the soil.

**MAKING COMPOST**

Compost is a mixture of decaying vegetation and manure, and is used as a fertilizer. Compost is one of the best organic fertilizers, supplying various nutrients into the soil. The compost is ready for use after about 2 months or when the materials are completely decomposed.
The effects on plants if they lack the following fertilizers:

**NITROGEN**
- When plants don’t have enough nitrogen: pale green to yellow leaves/poor growth of leaves and stem

**PHOSPHORUS**
- When plants don’t have enough phosphorus: leaves turns blue-green with purple edges/very poor root growth
POTASSIUM

(Source: Taken from friendly garden)

When plants don’t have enough potassium: Dead spots on leaves/death of leaves from base upwards

MULCHING

Mulching is the covering of topsoil with dead grass and leaves to:
- Maintain moisture in the soil
- Prevent growth of weeds
- Increase organic matter when decomposed

The usage of grasses for mulching in taro gardens.

Activity

Your task requires you to show to your trainer that you can identify a range of fertilizers by studying their characteristics.

What you will need
Samples of the fertilizers, limes and manures discussed above.

Practice
Check the various fertilizers used at work and practice identifying as many as you can.
Look for distinguishing features in appearance, colour, and odour. Test yourself often until you can recognize them easily.

Your trainer will select lime and three other fertilizers for you to identify. You need to identify each fertilizer, and say how you identified it. For example – colour (is it light or dark?), texture (how does it feel? is it smooth or rough?), smell (no smell? Strong smell?) Write the name of the fertilizer and how you identified it in the space below:

Name of Sample 1: ____________________________________________________________
How you identified it
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Name of Sample 2: ____________________________________________________________
How you identified it
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Name of Sample 3: ____________________________________________________________
How you identified it
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Name of Sample 4: ____________________________________________________________
How you identified it
__________________________________________________________________________
__________________________________________________________________________
Measuring and spreading lime and fertilizer

Activity

The next task requires you to show that you can measure lime and fertilizers accurately and spread them evenly over a soil surface in appropriate amounts.

For commercial bags of fertilizers, the appropriate rates of spreading fertilizers are usually provided on the outside labels. For natural fertilizers, you will need to ask your trainer how much to spread.

What you will need

- Fertilizers and lime
- Container
- Scales
- Selected area of ground
- Instruction from your trainer

Practice

Learn how to check that the measuring scales you use are set up correctly. Gain as much experience as you can measuring out and applying fertilizers and lime.

PRACTICAL Task: Measuring and applying fertilizers

a) List the names or types of materials to be incorporated into the soil.

---------------------------------------------------------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------------------------------------------

b) Ask your trainer to assess you as you measure and apply fertilizer or lime.

c) Make notes here about the process and the important points you need to remember:

---------------------------------------------------------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------------------------------------------
Handling and storing fertilizer and fertilizer equipment

Fertilizers and lime are very *hygroscopic*, meaning they can absorb water very easily, from moisture in the atmosphere and from the floor and walls of buildings. Fertilizers should be stored in a dry, clean place because, once they get wet, they are very difficult to use.

*Different types of synthesized fertilizers kept locked and secured in the tool shed.*

**Activity**

Your next task requires you to show that you understand the importance of correctly storing fertilizer and fertilizer equipment.

**What you will need**

- The fertilizer measuring scales
- Containers
- Fertilizers and limes you have been using
- Appropriate storage areas.
Your Task: Storing fertilizers and fertilizer equipment

(Work with a partner or a small group. These questions can be answered in writing or in conversation with your trainer.)

a.) Briefly describe how and where fertilizer, lime and its associated equipment are stored at work.

b.) Comment on whether or not you think these storage methods and facilities are adequate, and list any improvements that you think need to be made.

i. Comment

ii. Improvements

c.) List the most important points that you need to remember when storing fertilizers, lime and associated equipment.
Topic 3: Prepare a seedbed by hand for sowing

At the end of this topic, you should be able to:

- Prepare a seedbed for planting
- Identify a suitable site for growing vegetables
- Select the best seeds for planting

SEEDS

Some seeds can be planted directly into the part of the garden in which they will grow. Most seeds, however, need to be started in a specially prepared seedbed that will encourage germination and early growth. Once they have grown strong enough in the seedbed, they can be planted out to where they will grow to full size. In this section, you will be asked to look at a seedbed constructed by hand and ready for sowing.

Seedbed preparation

- Firstly, weeds and trash from previous sowings need to be removed and disposed of.
- Secondly, soil needs to be cultivated to get an even and suitable tilth for planting.
- Small seeds need a very fine soil texture and need only shallow holes, maybe half an inch deep, or scattered on the surface and covered with very fine soil.
- Larger seeds required a deeper hole of about one inch depth and can tolerate a coarser soil.

[Your trainer will give you specific examples and help you to prepare appropriate seedbeds.]

You need to look at the conditions that encourage the seed to germinate. For seeds to germinate (start growing), they need both oxygen and moisture in the soil. However, if the soil is too wet, seeds won’t germinate.

If there is not enough moisture in the soil, the seed will again not germinate, so it is important that the soil is kept well aerated and moist.
Site selection

Select an area with a reliable water source. It should be:

- Good, well–drained and fertile soil.
- Fairly level land with no steep slopes.
- Sunny and open, not shaded by large trees.
- Protected from pigs, chickens, and so on.

Steps in preparing the ground for a seedbed:

1. Remove logs, roots, stones and weeds.
2. Turn the ground over to a depth of 15 –30 cm. Work backwards, using a spade for turning the soil and a hoe for breaking up clods of earth.
3. Dig compost or other recommend fertilizers into the soil.
4. Use a rake and a hoe to make the soil as fine and even as you can get it.

Choosing seeds

To know what kind of seedbed you need to prepare, you need to know what kind of seeds you are going to grow. Will you be planting tiny seeds, such as carrots, or large seeds, such as pumpkins?

What to do when selecting seeds:

- Read the seed packet labels carefully.
- Make sure that you do not have seeds that are past their ‘use by’ date.
- Choose seeds that are disease resistant and that have a high germination rate. The seed resistance to disease and the germination percentage are usually printed on the seed packet.
- Check whether the seeds are a bush variety, which are usually ground cultivated, or a staked variety, which need to be grown on stakes.

Aerating, watering and mounding seedbeds

To grow well, most seeds need access to air. This is provided by preparing the soil so that it is light, open, and soft. A soil that is hard and solid will not let air in. you may need to dig around your seed rows to keep the soil from going solid.

Seeds also need water. However, you must be careful how much water you give.

- Too little water, and the seedlings will dry out and die.
- Too much water, and the seedlings will drown and the soil will go hard and soggy.
Your trainer will tell you how much water to give and when to water.

Some plants, such as pumpkins, grow best when planted in mounds. A mound for pumpkins will usually consist of

- a rich layer of compost, which the plant roots will access, covered by soil, into which you plant the seeds.
- Water quantity: mound plants require more water than plants sown in a flat-bed.
**Practical Activity**

Your next task requires you to prepare a seedbed for planting and report on how you maintain your seedbed.

**What you will need**

- A selected area for your seedbed
- Selected crop and seed
- Appropriate tools and equipment

**Practice**

Gain experience at clearing ground ready for further seedbed preparation.

**Your task: Preparing a seedbed**

*Complete this task for your trainer to check.*

(*These questions can be answered in writing or in conversation with your trainer.*)

Start work on your seedbed by removing all weeds and surface trash, and then disposing of them correctly.

Now complete the following:

Name the crop you intend to grow in your seedbed.

.................................................................

What size is your seed? Give the approximate measurements or dimensions.

.................................................................

.................................................................

Based on the size of your seed, outline what sort of soil that this seed will need for planting.

.................................................................

.................................................................

Describe how you prepared the seedbed to create an even and suitable time for sowing your seeds.

.................................................................

.................................................................
Activity: Moisture, aeration and mounding

Complete this task for your trainer to check.

Continue work on your individual seedbed, and make sure that you use techniques that ensure good aeration and appropriate moisture levels in your seedbed.

(These questions can be answered in writing or in conversation with your trainer.)

1. Describe the germination conditions required by your seed.
   ..............................................................................................................
   ..............................................................................................................
   ..............................................................................................................

2. Outline how you prepared the seedbed to ensure that these germination requirements were met.
   ..............................................................................................................
   ..............................................................................................................
   ..............................................................................................................
   ..............................................................................................................

3. What do we mean by mounding a seedbed?
   ..............................................................................................................
   ..............................................................................................................
   ..............................................................................................................
   ..............................................................................................................

4. Why might your seedbed need mounding?
   ..............................................................................................................
   ..............................................................................................................
   ..............................................................................................................
   ..............................................................................................................
TOPIC 4: Sowing seeds in a Nursery

When you finish this topic you should be able to:

- Prepare seed trays using the correct soil mix
- Plant in seed trays
- Care for young trees and plants in seed trays

What is a Nursery?

A nursery is also known as a greenhouse.
A nursery is a place where young trees and plants are grown.
These are grown in seed trays inside the nursery.
A nursery controls the climate/environment to allow the young trees and plants to grow to a certain height before transplanting.

SEED TRAYS

A seed tray is where the young trees and plants are planted.
Using the right soil mix

It is important to have the right soil mix for planting young trees and plants in seed trays. Commonly used soil mix:

- 3:2:1 (3 black soil/loam soil: 2 organic matter: 1 sand)

*Note:* sometimes you can leave out the sand. It depends on the nature of the soil.

**Organic**

**Planting in seed trays**

Drill sowing seeds evenly on the beds
Cover the seeds by levelling out the hand lightly over the soil.
Caring for the seedlings

Seed trays must be kept inside the nursery at all times. Watering of the young plants should be done twice a day, in the morning and in the afternoon.

Activity

For this task you are required to discuss how you sowed your seeds.

What you will need:

For this task you will need

- Seed tray
- Crop seed

Appropriate tools and equipment
Labeling materials.

Seedlings growing in seed trays ready for transplanting
Task: Sowing seeds

Your trainer will assist you in completing this task correctly.

Seed sowing

Describe the method of sowing seeds, describing all the steps involved.

........................................................................................................

Explain the reasons for sowing seeds

........................................................................................................

........................................................................................................

Keeping the workplace tidy after sowing

Explain how you tidied the area around the nursery after you had finished sowing your seeds.

........................................................................................................

........................................................................................................

Describe in detail how and where you stored all the tools, equipment and unused seeds.

........................................................................................................

........................................................................................................
TOPIC 5: Maintain seedbed to seedling stage of growth

At the end of this topic you should be able to

- recognize and apply fertilizers and lime
- prepare a seedbed by hand for sowing
- maintain seedbed to seedling stage of growth

You need to maintain your seedbed and ensure good germination and seedling.

In this section you will be working with the following:

- Seedbed
- Your chosen crop
- Weeding
- Watering
- Controlling pests and diseases.

Maintaining seedbeds.

Different crops have different pests, and there are different ways of controlling each of these pests. Ask your trainer what to look out for and how to control pests on the crops you have chosen to grow.

<table>
<thead>
<tr>
<th>Types of crops</th>
<th>Type of pest</th>
<th>How to control pest</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Cabbage</td>
<td>White cabbage butterfly caterpillar</td>
<td></td>
</tr>
<tr>
<td>Tomato</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pepper</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Activity

In this activity you need to report on the work that you did in maintaining your seedbed until the seeds began to grow.

In the table below, record all the work that you did in maintaining your seedbed. Read the Chinese Cabbage example underneath the table to get an idea of what you need to make sure your vegetables are healthy and grow well.

<table>
<thead>
<tr>
<th>STUDENT NAME: ________________</th>
<th>SEED NAMES: ________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAY/SEEDBED: ________</td>
<td></td>
</tr>
<tr>
<td>TOOLS NEEDED</td>
<td></td>
</tr>
<tr>
<td>SOW DATE</td>
<td></td>
</tr>
<tr>
<td>GERMINATING DATE</td>
<td></td>
</tr>
<tr>
<td>SEEDLING GROWTH RATES (mm, cm)</td>
<td></td>
</tr>
<tr>
<td>watering</td>
<td></td>
</tr>
<tr>
<td>weeding</td>
<td></td>
</tr>
<tr>
<td>fertilizer</td>
<td></td>
</tr>
<tr>
<td>controlling pests</td>
<td></td>
</tr>
<tr>
<td>thinning</td>
<td></td>
</tr>
<tr>
<td>REMARKS</td>
<td></td>
</tr>
</tbody>
</table>
Example Growing Report

Crop: Chinese cabbage

Botanical name: 
*Brassica chinensis*

Site location:
- Land should not be excessive drained.
- Chinese cabbage can be grown on land with elevation less than 1500m.
- Can tolerate a wide range of soil conditions.

Seed bed Preparation:
- Clear the area to be used. Remove big stones and plant roots.
- Mark the seed bed 3m x 1m is an easy size to prepare.
- Dig out the soil 15cm deep. Put the top soil on one side and sub soil on the other side.
- Put back the top soil into the seed bed until only 7.5 cm of depth is left.
- Put small stones on the top soil to help in drainage.
- Mix with 1 bucket of sand and 1 bucket of manure.
- Construct a wood frame around seed bed to prevent soil mixture from slipping off.

Land Preparation:
- Clear the area to be used and remove big stones and plant roots.
- Mark a plot size of 3m x 1m.
- Dig the soil to fine tilth.
- Mix some poultry manure thoroughly.
- Level the garden plot, which should be 15cm above ground.

Recommended Varieties:
- Tropicana
- Saladeer
- Wong bok
- Pak-choi-kwang-moon
- Pe-tsai

Seed Selection:
- Only viable seeds should be used for sowing
- Seed must be able to germinate, emerge from the soil and produce a healthy plant.

Seed Germination:
- To germination seed needs the right amount of heat (temperature) – optimum temperature of soil for germination is 29°C.
- Water – soil moisture should be above 50%.
- Oxygen – good drainage is required to remove excess water and proper aeration is maintained.

Raising Seedlings:
- Mix seeds with sand for even distribution of seeds.
- Sprinkle the seeds (with sand) on the prepared seed bed and cover it with fine soil.
The seed bed should be watered and covered with coconut leaves, banana leaves or other similar materials to keep the beds moist.
- When the seedlings appear, the covering should be removed immediately to prevent elongated, weak and bent seedlings.
- To prevent overcrowding, thinning should be done. Seedlings should be thinned to about 10cm apart.

**Transporting Seedlings:**
- In 3-4 weeks’ time the seedlings reach 3 leaf stage and are ready for transplanting.
- Use only healthy and vigorous seedlings.
- The seed bed should be watered ½ an hour before lifting the seedlings. Transplant into plots immediately after removing or from the seed bed.
- It is best transplanted during the afternoon or on a cloudy day to avoid transplanting stress.

**Planting Distance:**
- Seedlings are planted in rows 18 – 20 cm between plants and 35 – 40 cm between rows.

**Management Practices:**
- Organic manure such as compost or poultry manure is mixed with soil before transplanting.
- Urea is applied around each plant 1 – 2 weeks after planting.
- A hand fork or a hoe may be used for inter-row cultivation to control weeds and to hill the soil around the plants.
- Water the plants in dry spells.
- Mulch the crops to retain moisture.
- Fence the area to keep out animals.

**Pest and Disease Control:**
**Pests:**
- Cluster caterpillars feed on the young leaves and destroy the growing tips.

**Control:**
- Spray with any of the following chemicals:
  - Ambush 5g in 14 litres of water or
  - Orthene 20g in 14 litres of water.

**Diseases:**
- Soft rot

**Controls:**
- Practice crop rotation
- Provide good drainage

**Harvest and Marketing:**
- Chinese cabbage is ready for harvesting in 6 – 8 weeks after transplanting.
- Plants are tied into bundles and sold in the local markets.
- The yield is about 500 – 700kg per 50 square meters (sqm or m²)

**Post-Harvest Management:**
- Cut the root system of the plants and remove the old lower leaves of the plants.
- Clean the plants and store in a cool place.
- Avoid physical damage while handling the crop produce.
- Store in cool place if intended for later use or marketing.

**REVIEW QUESTIONS**

*(These questions can be answered in writing or in conversation with your trainer.)*

1. What should you do when preparing a seedbed?
   - ______________________________________
   - ______________________________________
   - ______________________________________

2. Why is site selection important
   - ______________________________________
   - ______________________________________
   - ______________________________________

3. Why are the best seeds used in seed selection
   - ______________________________________
   - ______________________________________

4. Name 3 things you need to do to look after/care for your chosen crop
   - ______________________________________
   - ______________________________________
   - ______________________________________

Congratulations!

You have now finished this Introduction to Horticulture in Tuvalu.
**ASSESSMENT:**

Ask your trainer to assess your learning and comment below on how well you have done in this topic.

<table>
<thead>
<tr>
<th>Task Description</th>
<th>YES</th>
<th>NO</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tools selected are suitable for the task and used safely</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultivation depth and tilth are consistent over the cultivated area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil is aerated suitable for the soil characteristics and seeds to be used</td>
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<td></td>
</tr>
<tr>
<td>Surface is even over the cultivated area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Added material is incorporated uniformly throughout the total area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tools are cleaned and stored after use</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

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Glossary

1. **Aerated soil**: Loosening or puncturing the soil to allow water and air penetration into the soil.

2. **Broadcasting of fertilizers**: A method of fertilization that is used before planting, this is a process by which synthetic fertilizers are thrown onto the prepared beds or given area.

3. **Bush Knife**: A tool that is used for cutting, slashing and weeding off unwanted weeds or plants.

4. **Compost**: Organic soil materials made from decayed plants that can be dug into the soil to improve fertility.

5. **Contouring**: Ridges that are constructed horizontally across slopes.

6. **Cultivate**: The process of breaking up the soil surface, the removing of weeds.

7. **Debris**: Scattered pieces of cut or leftovers plants that are left on the field after harvesting.

8. **Digging**: Preparing the soil by inserting a spade to break up the soil. A well-dug garden will have been dug to a depth of two shovel blades.

9. **Draining**: The removing of excess water from the soil surface and upper subsoil, using ditches or other means.

10. **Drilling**: Dropping of the seed into holes in the soil made with your finger and then covering the seeds using your hands or a wooden plank.

11. **Fertilizers**: A mineral plant food. A complete fertilizer will contain the main elements used by growing plants; Nitrogen (N), Phosphorus (P) and Potassium (K).

12. **Fork**: A tool used for turning manure or loosening the soil before transplanting and for uprooting stumps. A fork breaks the soil up more finely than a spade.

13. **Germination**: The process that transforms the embryo in a seed to grow into a seedling.

14. **Hoe**: A tool mainly used for making heaps, loosening the surface soil in order to promote plant growth and to destroying weeds.

15. **Hydroscopic**: The ability to attract moisture from the air and make the substance wet.
16. **Lime:** Also known as limestone, a mineral that can neutralize soil acidity and release other nutrients for plants to use.

17. **Maintaining tools:** Farm tools should be cleaned after use and kept in store for a long time.

18. **Manure:** Organic matter, excreted by animals, which is used as a soil conditioner and fertilizers.

19. **Mounding:** The raising of soil into piles or mounds to help plants grow.

20. **Mulching:** Green or dried grasses that are used to cover the top soil around the growing seedlings. Their purpose is to help prevent the evaporation of water to the atmosphere and control the growth of weeds.

21. **Nitrogen:** An essential nutrient for plant growth and reproduction. It helps promote leafy growth.

22. **Nutrients:** “Plant food”. Mineral elements with quantities.

23. **Organic gardening:** The method of gardening using only materials derived from living things. (that is, composts and manures)

24. **Organic fertilizer:** Any material which originated as a living organism. (i.e. composts and manures)

25. **Pest and diseases:** Organisms that reduce the quantity and quality of any farm produce.

26. **Pick axe:** A tool mostly used to dig trenches and drains, when the soil surface are made up of igneous rocks or the soil surface are rocky.

27. **Planting:** The art of cultivating certain plants to grow for consumption. It involves both placement in suitable soil and maintenance of growing conditions.

28. **Potassium:** A nutrient required by plants in large amounts because it helps form carbohydrate and translocation of starch to all parts of the plants.

29. **Rake:** A tool used for leveling the soil surface, breaking large crumbs into small ones, removing stones and weeds from seedbeds.

30. **Records:** Individual daily farm activities that are written and kept for future evaluations.

31. **Seedbeds:** An elevated garden bed offering better drainage, aeration and warmer soil.
32. **Seedling:** A plant that has just emerged from its seed with its first root, stem and leaves.

33. **Single spit digging:** Digging the soil to a one spade width (one spit) at a time in order to improve soil drainage and soil fertility.

34. **Soil structure:** The physical appearance of the soil. It may be sandy, stony, organic and so on.

35. **Soil texture:** The measurement of the coarseness or fineness of the soil particles.

36. **Sow seeds:** Is the direct planting of seeds on a prepared seed box or trays and also on a given seedbed.

37. **Spade:** A tool used for lifting the soil and completely turning it over, also used for leveling and for digging holes.

38. **Staking:** A practice that is used to drive a stick/stake into the ground, for plant support.

39. **Storing tools:** The placing of tools and equipment in their secure and proper place in a room to minimize injuries and theft.

40. **Synthetic fertilizer:** A mix of mineral nutrients such as NPK to help sustain the growth of the plant.

41. **Thinning:** Removing excess seedlings, to allow sufficient rooms for the remaining plants to grow.

42. **Tilling:** The shallow cultivation of the top soil that will cover up large cracks and pore spaces.

43. **Tilth:** cultivation of land, tillage.

44. **Varieties:** Different breeds of the same plant. For example, ‘Money-maker’ and ‘Russian Red’ are varieties of tomato.

45. **Water source:** The sources of water channels that can be used to water the plants.

46. **Weeds:** Any plant or group of plants that are growing where it is not wanted.
Student Checklist

- Cultivate soil using hand tools
  - Cultivate soil with a hand tool
  - Provide organic matter for soil organisms to live on
  - Identify relevant hand tools
  - Demonstrate the safe use of hand tools
- Recognise fertilizer applications
  - Identify when to use the following fertilizers:
    - Lime, nitrogen, phosphorous, potassium

has completed the course “Introduction to Horticulture in Tuvalu”.

I have worked with them through the course and I have seen them complete the exercises and activities I have marked on this checklist.

Trainer’s Name

Signed

…………………………………………………………………………………………
Know the difference between compost and mulch

Explain the value of using organic fertilizers

Make compost

**Prepare a seedbed by hand for sowing**

Prepare a seedbed for planting

Identify a suitable site for growing vegetables

Select the best seeds for planting

**Sewing seeds in a nursery**

Prepare seed trays using the correct soil mix

Plant in seed trays

Care for young trees and plants in seed trays

**Maintain seedbed to seedling stage**

recognize and apply fertilizers and lime

prepare a seedbed by hand for sowing

maintain seedbed to seedling stage of growth