MODULE 01

Garden Design and Establishment

FACILITATOR GUIDE 1

Identifying Resources

Identifying resources necessary to achieve a home gardener's goals

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Home Garden Toolbox

World Vegetable Center

OVERVIEW

LEARNING OBJECTIVE

Gardeners will be able to critically evaluate the resources available to them and how these resources can help them achieve their gardening goals.

DURATION

MATERIALS NEEDED

- A shaded discussion area close to where gardeners can conduct a group walk to identify resources around their community
- Flipchart and markers
- Pencils and notebooks for all gardeners

KEY CONCEPTS

Let's start talking about the resources gardeners already have rather than what they lack!

NATURAL
Soil, chicken manure, plants and seeds, water sources, air, light

PHYSICAL
Tools and buildings

HUMAN
Labor, knowledge, technical capacity

SOCIAL
Support from family and community, labor sharing

FINANCIAL
Money, bartering, work-trades

- Gardeners have untapped resources all around them. Let's help them identify new ways of using these resources.
- We find that there is immense wealth around us when we go around our community and think about new ways to use the resources available to us.
- When gardeners share their knowledge about local resources, it helps them build confidence in their own knowledge and ability and allows them to learn from each other.

TRAINING AGENDA

1	Introduction and warm-up	DISCUSSION	10 min
2	Setting our gardening goals	DISCUSSION	30 min
3	How to build our ideal garden	DISCUSSION	1 hour
4	Identifying the resources around us	PRACTICAL ACTIVITY	1.5 hour
5	Closing discussion	DISCUSSION	10 min

10 min

1. Introduction and warm-up

Welcome gardeners to the training. Do a brief introduction to today's topic and review the training agenda. You may want to outline the training agenda on your flipchart or board so gardeners can see it when they arrive.

Conduct a warm-up exercise or ice-breaker to make sure all gardeners feel welcome and are ready to fully participate. Suggested warm-up and ice-breaker activities can be found in the Facilitator's Guide: Encouraging Learning through Participant Engagement.

Participant Engagement Guide

30 min

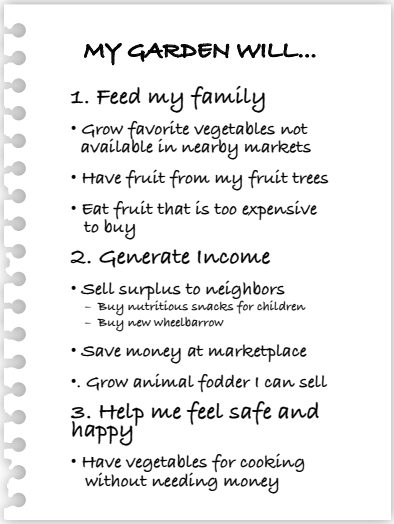
2. Setting our gardening goals

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners envision their future gardens and identify their garden goals.

MATERIALS NEEDED:
- Flipchart and markers
- Pencils and notebooks for all gardeners

1. Engage gardeners in a visioning exercise of what their ideal garden would look like. Start by asking them to think in their heads or write in their notebooks what their garden goals are: "My garden goals are..."
2. Ask gardeners to share these goals and discuss some of the following questions as a group:
   - What are some examples of successful gardens they have seen and why were they successful?
   - Will their gardens look different after several seasons of gardening? Better? Worse? Why is this important?
   - Is it possible for their garden to serve multiple purposes? How will they make sure their gardens best serve them and their households?
3. Ask gardeners to review the garden goals that were mentioned during the discussion. List these goals on your flipchart for all to see.
4. Ask gardeners to revisit the original goals they thought about or wrote in their notebooks and revise them as necessary.



1 hour

3. How to build our ideal garden

INTERACTIVE DISCUSSION

GOAL OF ACTIVITY: Gardeners identify the different resources needed to build a successful garden.

FACILITATOR PREPARATION: A flipchart divided into five columns

MATERIALS NEEDED: Flipchart and markers

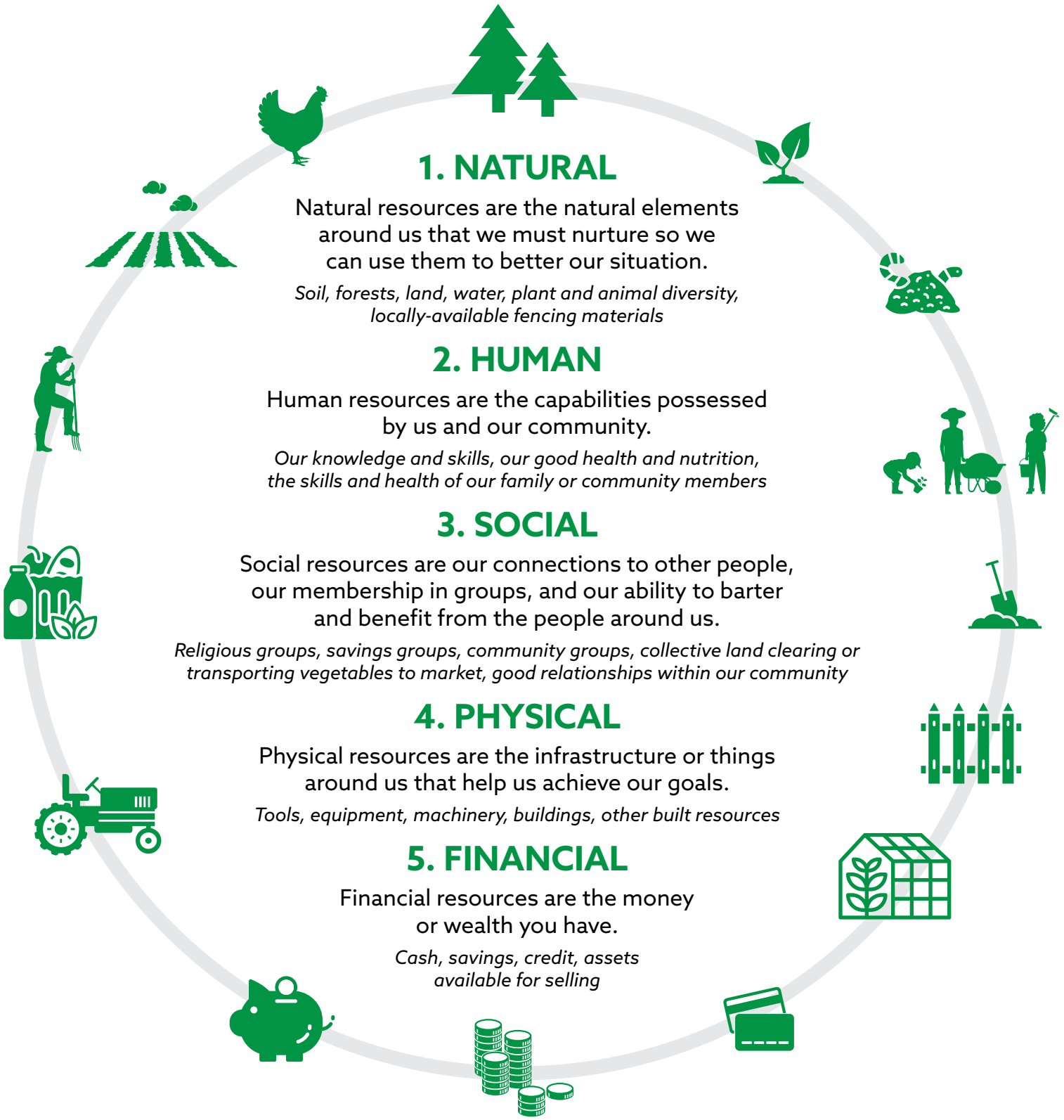
1. Engage gardeners in a discussion around the resources needed to build a successful garden:
   - What do we mean by 'resource'?
   - What are some local examples of resources?
   - What resources do we need to build a successful garden?
2. As gardeners name resources, write them in the different columns so they are grouped into the 5 Resources categories. When they have finished, write the name of the category at the top of each column and explain the concept of the 5 Resources.
3. Ask gardeners if they can think of any additional resources that can be added to the list.
4. Discuss which resources can be found locally.

5 RESOURCES BACKGROUND INFORMATION

It is easy to get discouraged if we think we are not capable of achieving success or achieving good results from our actions. If we focus our energy on finding deficits in our current situation, we will most likely find them. We start thinking it will be too difficult to change our current situation, so we end up not trying or not trying very hard. But if we change our mindset and instead focus on finding new resources or strengths that we can apply to our situation, we will find that little changes over time end up helping us achieve our goals. Building a positive mindset is especially important for gardeners who may have experimented with gardening in the past and gotten discouraged when they had poor yields, suffered from pest infestations, or been asked to grow something by a well-meaning extension agent or NGO that they did not know how to use when it came time to harvest. These gardeners will be skeptical that they should try any new practices that YOU introduce to them!

To encourage gardeners to build a garden that best suits them and their household's needs, we will help them think about how they can use the resources that are already all around them – rather than asking them to invest time and money into a garden that is not right for them. When we think about resources as belonging to one of five categories, we see that many helpful things already exist around us. The five categories of resources are: Natural, Physical, Human, Social, and Financial. Resources can be owned by individuals or households – or they can be collectively owned or available to the entire community. For example, a wheelbarrow (Physical resource) may be individually owned, but a nearby forest (Natural resource) may be owned or used by the entire community or surrounding communities. Sometimes, a resource can fall into two categories, such as a stream that is used by many community members for irrigation water. The stream is a Natural resource for a gardener who wishes to use it to water their garden, but it may also takes Social resources for that gardener to have the rights or social status to access the stream if not all community members have equal access to this water. We might also see that increasing one resource leads to an increase in another resource, such as when we sell livestock (Natural resource) to gain money (Financial resource). The opposite may also be true, for example if we invest money in our garden (Financial resource) but we do not see good yields (lower Natural resources). Our goal is to build our stock of resources in all categories so that we have a rich toolkit to draw from when we embark on a new project, such as growing a garden.

Examples of 5 Resources



1. NATURAL

Natural resources are the natural elements around us that we must nurture so we can use them to better our situation.

Soil, forests, land, water, plant and animal diversity, locally-available fencing materials

2. HUMAN

Human resources are the capabilities possessed by us and our community.

Our knowledge and skills, our good health and nutrition, the skills and health of our family or community members

3. SOCIAL

Social resources are our connections to other people, our membership in groups, and our ability to barter and benefit from the people around us.

Religious groups, savings groups, community groups, collective land clearing or transporting vegetables to market, good relationships within our community

4. PHYSICAL

Physical resources are the infrastructure or things around us that help us achieve our goals.

Tools, equipment, machinery, buildings, other built resources

5. FINANCIAL

Financial resources are the money or wealth you have.

Cash, savings, credit, assets available for selling

1.5 hours

4. Identifying the resources around us

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Gardeners are encouraged to become observers of their own environment, identifying the richness of resources that they have around them that can help them meet their garden goals.

STEP 1. Organize gardeners to go on a group walk to identify natural resources in their local area that are useful for home gardens. Many of these resources are freely available, for example, animal manures, plants that can be used for mulching, or ashes from cooking fires. **Ask gardeners to each pick up at least one resource on their walk to bring back with them.**

STEP 2. After the walk, gather gardeners in a circle and ask them to show their resource to the group. They should **explain what their resource is and what it is used for.** Encourage gardeners to explain how the resource will help their garden.

STEP 3. At the end, ask gardeners to think about how the resources they saw will further their gardening goals. Ask gardeners, **"what new resources did you see that you are excited about? How will you use this resource to further your gardening goals?"** Have as many gardeners share their thoughts as possible.

Photos by Elin Duby

10 min

5. Closing discussion

Ask gardeners to share with the group:

1. Something they learned in the session
2. How they are going to use this in their own homestead

Additional resources are available at toolbox.avrdc.org

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QUESTIONS & COMMENTS: homegardens@worldveg.org | Please let us know if you are using the toolbox.

NEXT GUIDE: Site Evaluation

MODULE 01

Garden Design and Establishment

FACILITATOR GUIDE 2

Site Evaluation

Evaluating your landscape and selecting a garden site

toolbox.avrdc.org

Home Garden Toolbox
World Vegetable Center

OVERVIEW

LEARNING OBJECTIVE

Gardeners will be able to assess their landscape and climate and understand how to most efficiently grow food in this environment.

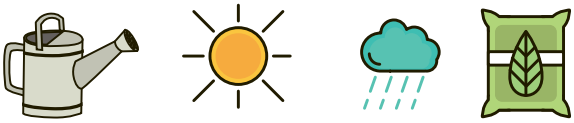
DURATION

MATERIALS NEEDED

- A shaded area for gathering together to discuss

KEY CONCEPTS

Plants, just like people, have some basic needs that need to be taken care of in order for them to thrive.



- They need water, nutrients, air, light, and protection from damage.
- The basic needs of plants tell us the key criteria for selecting a good site for our home garden. We need a site with good soil, easy access to water and nutrients, enough sunshine and with protection from animals, strong winds, and rain.
- By carefully considering these criteria and observing our land, we can select a good site for our home garden. This will allow plants to thrive while we spend as little energy as possible maintaining them.

TRAINING AGENDA

1	Introduction	DISCUSSION	10 min
2	Basic needs of plants	DISCUSSION	30 min
3	Identify the best site for a home garden	PRACTICAL ACTIVITY	1 hour
4	Closing discussion	DISCUSSION	10 min

FACILITATOR NOTES

Encourage gardeners to engage and discuss as much as possible. They are the ones with the local knowledge of the landscape so their input is essential.

10 min

1. Introduction and warm-up

Welcome gardeners to the training. Do a brief introduction to today's topic and review the training agenda. You may want to outline the training agenda on your flipchart or board so gardeners can see it when they arrive.

Conduct a warm-up exercise or ice-breaker to make sure all gardeners feel welcome and are ready to fully participate. Suggested warm-up and ice-breaker activities can be found in the Facilitator's Guide: Encouraging Learning through Participant Engagement.

Participant Engagement Guide

30 min

2. Basic needs of plants

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners learn that plants, just like people, have basic needs that need to be taken care of in order for them to thrive. Gardeners can successfully select a site for their gardens by thinking first about these basic needs and how to satisfy them.

1. Engage gardeners in an interactive discussion around:
   - The basic needs of plants
   - How these needs compare with the needs of humans
   - What these needs tell us about the key criteria for selecting a site for a home garden

KEY MESSAGES

Plants have very similar needs as humans and livestock. They all need adequate water, food, air, protection, and care to thrive.

We can ensure that our gardens are set up for success by taking care where we place our gardens.

Given these basic needs, the key criteria for selecting our garden sites should be spaces that provide:

- **Accessibility to all household members** for easy maintenance and harvesting
- **Good quality soil** that is free of stones
- Easy **access to water**
- Easy **access to nutrients** – can a compost be placed near?
  How else will nutrients enter the garden soil?
- At least **five hours of direct sunlight** a day, but also not too exposed to strong sun.
  If strong sun, then partial shading is desired.
- **Protection from livestock and theft** – is there room for a fence?
- **Protection from strong winds and potential flooding**

1 hour

3. Identifying the best site for a home garden

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Encourage gardeners to stop and observe their landscape before selecting a garden site. If we take time to observe and evaluate our site and understand the flow of water, how the sun moves across the land, and the quality of the soil and access to water, then we can choose a site for our garden that will be provide a good home for our plants and allow them to thrive. In addition, by carefully choosing a site for our garden, we will ultimately reduce the time, energy and cost required to set it up and maintain it.

STEP 1. Walk with gardeners around the homestead to identify the best site for a home garden. Ask them to keep the key criteria for a home garden in mind.

STEP 2. During the walk, probe gardeners with questions to help their critical evaluation of the landscape:

1. How does rainwater naturally move across the landscape?
   How can the rainwater be stopped, slowed and spread effectively?
2. Is there any place on the land that tends to flood during the rainy season?
3. Is there a water point such as a well, a river or a rainwater tank?
4. Is there a slope? Does the site need terracing?
5. Is there easy access to manure and/or compost?
6. Is there a flow of nutrients we can make use of?
7. Is there easy access to mulch material?
8. What is the soil quality?
   - Is the soil soft and worked already or hard?
   - Is there evidence of soil life in the soil?
   - Is the soil sandy and dry or moist and full or organic matter?
   - Are there signs of soil erosion?

STEP 3. Split gardeners up into groups of 2 or 3 and discuss where the best site for a home garden would be while considering the key criteria. Encourage them to walk around if they feel it necessary.

STEP 4. Gather with gardeners again and ask each group to give their suggestion for the best site. Ask them to explain why they feel that site is the best. Agree with gardeners on a site for the garden.

CONSIDERATIONS FOR SELECTING A GARDEN SITE

RAINWATER: Water moves from the highest point to the lowest point in a landscape. If there is a slope on the land, water will move to the lowest point and cause erosion of precious topsoil. By digging a ditch perpendicular to the slope ("on contour"), water running down the slope can be slowed, sunk into the soil, and spread across the land. If we dig this ditch above where we put our garden we will protect the garden from flooding and 'bank' water in the soil for the plants to use.

FLOODING: If there are places on the land that tends to flood we should not put our gardens there. Diversion drains can help divert some of the water from the area that tends to flood.

TERRACING: The garden needs to be on as flat land as possible, otherwise the soil will wash away. If the land is on a steep slope there may be a need to terrace the land in order to have a home garden.

EASY ACCESS TO MANURE AND COMPOST: If we place the garden near the compost or manure heap it will reduce the energy spent getting the compost to the garden.

EASY ACCESS TO MULCH MATERIAL: Mulch such as dried leaves or grasses help reduce evaporation and adds organic matter to the soil. Identifying sources of mulch is important for our garden.

FLOW OF NUTRIENTS: A compost heap or a heap of manure contains nutrients for the soil. When it rains some of those nutrients will flow away with the rain water. By placing a garden site down slope from a chicken coop or a compost heap, the nutrients will flow down with rainwater into our gardens so we can use them effortlessly.

SOIL QUALITY: We need good quality soil for our home garden. If the soil is degraded, very compacted, sandy, or very dry then it will require a lot of work to build a garden. If there is a site on the land where the soil is good this may be a good place to start the garden.

You may find that there is a site with good soil but it tends to flood or is far away from the house. Likewise, there may be a site near the compost heap, but it is very steep and requires a lot of work to terrace it and the soil is degraded. Selecting a site is about balancing all the considerations and finding the site that works best for you. Our goal is to meet the basic needs of plants with as little additional effort on our parts as possible.

10 min

5. Closing discussion

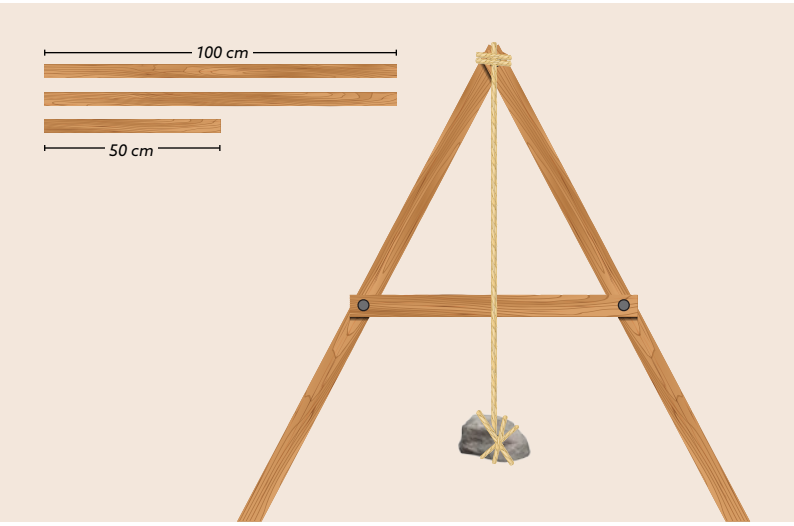
Ask gardeners to share with the group:

1. Something they learned in the session
2. How they are going to use this in their own homestead

NEXT GUIDE: Establishing Your Garden

Establishing Your Garden

Photo by Elin Duby



OVERVIEW

LEARNING OBJECTIVE

Gardeners will be able to prepare a garden bed with the appropriate soil tilth, nutrient additions, and protective mulch. They will understand how to store water and nutrients in their garden beds by first analyzing how these elements flow across a landscape and then stopping, spreading, and sinking them where they want them.

DURATION

MATERIALS NEEDED

- A flipchart or board with markers
- A site where gardeners can construct garden beds with swales and berms
- Hoes, rakes, and other tools for the group to use
- At least 20 liters of water
- Mulching materials
- Compost, green manures, cooking ash, and other organic material to enrich beds
- Two pieces of wood exactly the same size for every A-frame created (recommended 1m)
- One piece of wood half the size of the longer two pieces for every A-frame created (recommended 50 cm)
- String
- Nails
- Hammer
- Pen or pencil
- Fist-sized rocks

KEY CONCEPTS

- Well prepared garden beds contain lots of added nutrients, are deeply dug to reduce compaction, and store water from the landscape in them.
- When garden soils are double dug, plants can easily access the water, nutrients, and air they need to thrive.

TRAINING AGENDA

1	Introduction and warm-up	DISCUSSION	10 min
2	Key elements of a well-prepared garden bed	DISCUSSION	30 min
3	Water storing	PRACTICAL ACTIVITY	15 min
4	Orienting garden beds, pathways, and berms	PRACTICAL ACTIVITY	30 min
5	Making an A-frame	PRACTICAL ACTIVITY	30 min
6	Using an A-frame to identify contours	PRACTICAL ACTIVITY	30 min
7	Dig a double dug garden bed	PRACTICAL ACTIVITY	45 min
8	Closing discussion: the benefits of fixed beds	DISCUSSION	20 min

10 min

1. Introduction and warm-up

Welcome gardeners to the training. Do a brief introduction to today's topic and review the training agenda. You may want to outline the training agenda on your flipchart or board so gardeners can see it when they arrive.

Conduct a warm-up exercise or ice-breaker to make sure all gardeners feel welcome and are ready to fully participate. Suggested warm-up and ice-breaker activities can be found in the Facilitator's Guide: Encouraging Learning through Participant Engagement.

Participant Engagement Guide

30 min

2. Key elements of a well-prepared garden bed

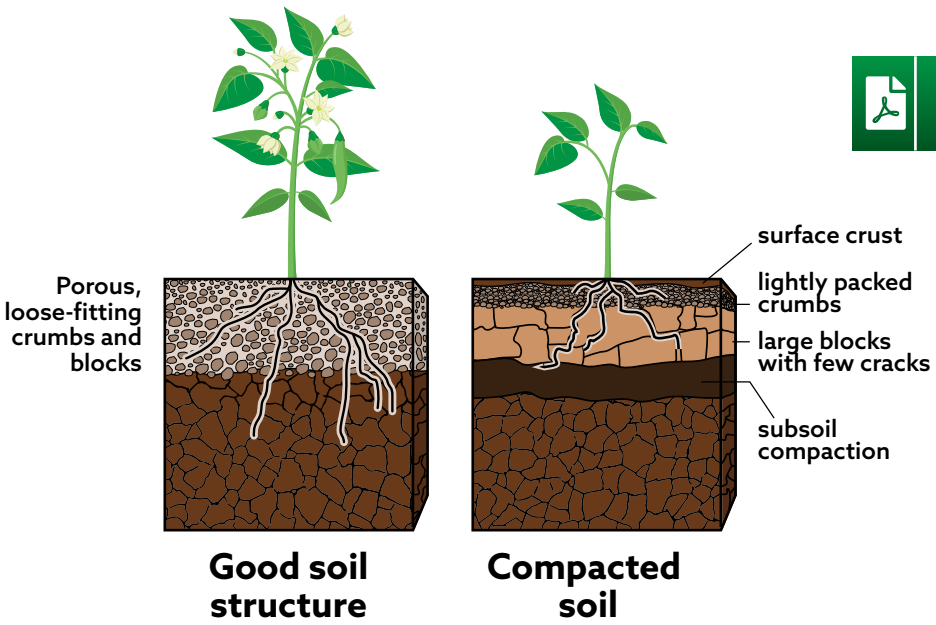
INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Help gardeners recognize important elements of a well-prepared garden bed and motivate them to invest time in this activity.

MATERIALS NEEDED: Flipchart and markers

1. Split gardeners up into small groups to discuss the key elements of a well-prepared garden bed. Have them write down the elements they feel are most important.
2. Bring gardeners back together and lead a discussion where they share their ideas. Write down all their suggestions on a flipchart, plus any additional key elements they did not list.
3. Ask gardeners to share why they think each element is important to have in a garden bed. Write down their reasons to the right of each element. Discuss each reason why and answer questions as they arise.
4. Show gardeners the **illustration of compacted soil** to help them visualize what is happening within the soil. Explain that many of the key elements listed on the flipchart work together to reduce compaction and help plants access water and nutrients.

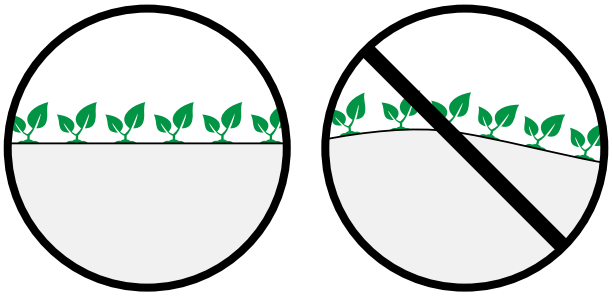
Download Poster Size Soil Compaction



Elements of a well-prepared garden bed

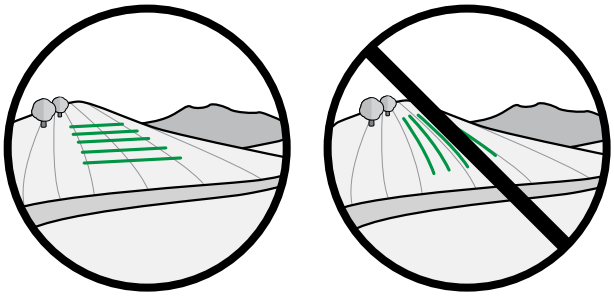
Flat surface

Having a flat bed reduces runoff and soil erosion from the bed during heavy rains.



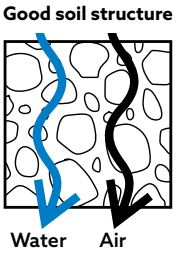
Oriented perpendicular to slope

Beds that are oriented perpendicular to the slope can stop rainfall from running down the slope, but beds that follow the slope risk having rainfall run straight through them. Heavy rains will erode the beds' topsoil and can wash newly planted seeds away.



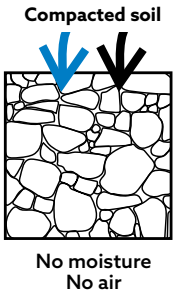
Fine soil tilth

Fine soil tilth reduces stress on plant roots as they are growing and allows roots to have good contact with the soil so they can easily absorb nutrients, air, and water.



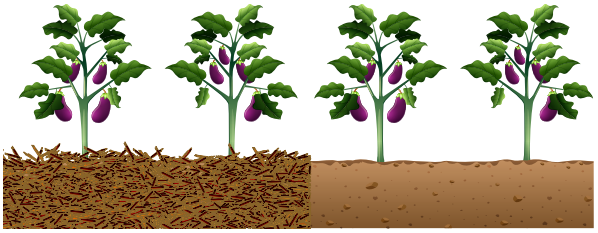
Reduced compaction

Air and water pores remain intact throughout soil profile.



Reduced bare soil by using mulches

Bare soil is prone to erosion and water evaporation during sunny days. Give gardeners examples of how to cover soil here with either living or 'dead' mulch. 'Living mulch' are plants that will cover the soil, while 'dead' mulch is dried leaves, grass, or other parts of dried plants. Soil can also be covered with rocks or bark from a dead tree.

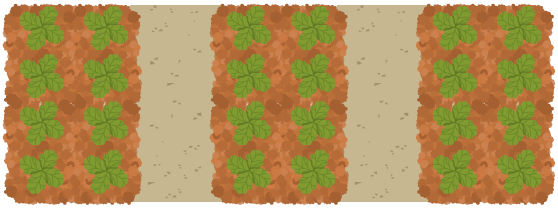


Free from weed seeds as much as possible

Less work throughout the season to remove weeds. Weeds compete with crops for water and nutrients.

Has designated pathways

Pathways allow us to tend to our gardens without stepping on our beds. When we step on our garden beds, we destroy the air and water pores our plants need to access nutrients and water.



Width allows weeding the center of the bed without stepping in it

A bed with the appropriate width allows us to tend to our garden without stepping in our beds and compacting our soil.

15 min

3. Demonstration of water storing

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Demonstrate to gardeners that soils can store large amounts of water when garden beds are prepared using swales, mulch, and deep digging.

FACILITATOR PREPARATION: Do some preliminary scoping to find a sloped piece of land where all the gardeners can gather and observe the demonstration.

MATERIALS NEEDED:

- Hoes
- Mulching materials
- At least 20 liters of water

STEP 1. Find a slightly sloped, completely bare piece of land and draw two squares, each about 0.5m x 0.5m, in the soil using a stick. One square is left completely bare. For the other square, dig down a few centimeters to make mini contour lines and place stones as needed along the contour. The contour lines do not need to be perfect.

STEP 2. Ask gardeners to collect mulch materials and water. Place all the mulch on the deeply dug square. Explain that this square is the field of a gardener who understands how to stop and spread water so that it can help them with their gardening. While slightly scratching with the hoe at the surface of the bare square, explain that this is the field of a gardener who plowed their field quickly and did not want to leave any unsightly material on their field after plowing.

STEP 3. Ask gardeners to come up close to observe what happens. Mimic a rainstorm by pouring water equally over the two squares. Make sure it is enough water to fully saturate the squares. Ask them to observe what happens with the water and with the soil. Which square has stored their water? What happened to the water of the other square?

STEP 4. Ask gardeners to come and feel under the mulch and see how much moisture is retained. Dig into both squares if necessary to investigate where the water has gone.

STEP 5. Ask gardeners to share their observations.

KEY MESSAGES

- Water moves from the highest point to the lowest point. When water moves across the landscape, it takes nutrient-rich topsoil with it.
- A bare piece of land where no efforts are made to store the water will have water running off the land together with topsoil.
- By digging a ditch and berm on contour upslope from a garden bed and orienting our garden beds to be perpendicular to the slope, we will help slow the flow of the water, sink it into the soil and spread it more evenly throughout the landscape. By placing a ditch on contour just above our garden bed, we can store water in the soil for our plants and also protect our garden from the effects of a heavy rainfall. These steps can be taken in combination with using mulch and continuously keeping the soil covered to minimize evaporation and water runoff.

30 min

4. Orienting garden beds, pathways, and berms

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Gardeners will learn how to orient and mark out their garden beds, pathways and berms after evaluating rainwater flows across a landscape.

FACILITATOR PREPARATION: Identify a suitable garden site where farmers can gather and establish some double-dug garden beds with swales and berms. Farmers will be working here for the duration of the training session.

STEP 1. Gather participants at the garden site.

STEP 2. Ask participants to look at the site and consider the key elements of a well-prepared garden bed and the results of the previous activity. Ask them to discuss in pairs where they think the garden beds should best be located.

STEP 3. Ask participants to share their thoughts and explain why.

STEP 4. Identify the highest point of the garden space and talk about how water moves through the space. Have gardeners provide their insights and identify any areas where they see existing erosion or wet areas where water is pooling. Ask participants where they would place berms and beds given the flow of water.

STEP 5. Mark out areas for garden beds and pathways together with participants. All beds should run perpendicular to the slope and all gardeners should be able to reach the center of each bed while standing in the pathway. A suggested size for garden beds is 1m wide and 3–4 m long.

STEP 6. Identify locations for berms with participants. Berms should go perpendicular to the slope and should be located upslope from the garden bed. Remind participants of the previous activity.

KEY MESSAGES

- A contour line is an outline of a natural feature such as a hill. Every point of a contour line is on the same elevation. This means that the contour line never runs upslope or downslope. Contour lines can be drawn as close together or as far apart from each other as is needed for your situation. For garden beds, they can be drawn 1–4 m apart, as is necessary.
- Each garden design will be different depending on your situation and the landscape. The key is to choose a location that works for your situation and that helps to reduce the cost of maintenance and enhance garden productivity.
- The berms should be dug on contour, perpendicular to the slope. These are designed to protect the garden beds from heavy rainfall by diverting an overflow of water away from the beds. They can also help capture water and sink it in the ground to store it for future use.

30 min

5. Making an A-frame

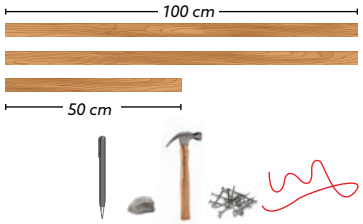
PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Demonstrate the construction and use of an A-frame to identify contours in the landscape.

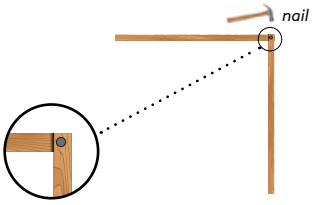
MATERIALS NEEDED:

- Two pieces of wood exactly the same size for every A-frame created (recommended 1 m)
- One piece of wood half the size of the longer two pieces for every A-frame created (recommended 50 cm)
- String
- Nails
- Hammer
- Pen or pencil
- Fist-sized rocks

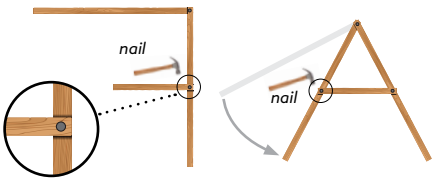
STEP 1. Lay the pieces of wood, the string, nails, and hammer on the ground. Explain to participants that you are going to make a frame that will help dig a berm that runs with the contour of the land. Ask participants if they remember why we want to dig berms on the contour of the land and why the berms should be perpendicular to the slope. Berms help stop and spread water evenly throughout the landscape.



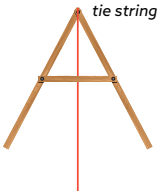
STEP 2. If only one A-frame is being made, select two participants to help with the process. If several A-frames are being made, split participants up into groups to have each group making A-frames at the same time.



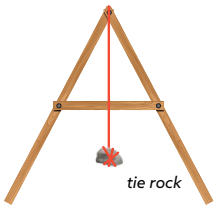
1. Instruct participants to nail the two long pieces of wood together at the top, ensuring that they are equally long on each side.



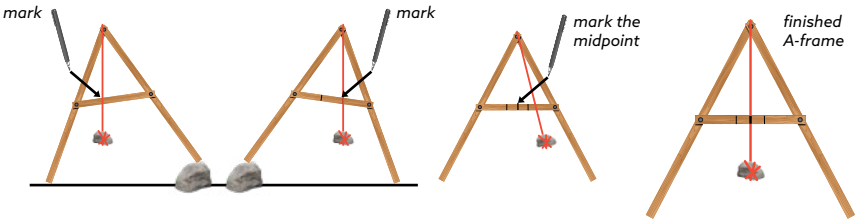
2. Take the smaller piece of wood and fit it halfway down the longer pieces as a crossbar (to form an 'A')



3. Tie the string at the top of the A-frame where the two longer pieces of wood meet. The string should be long enough to reach well below the crossbar.



4. Find a small rock and tie it to the end of the string. The string should move freely.



5. Calibrate the A-frame by finding a step or a flat rock about 15–20 cm high. Place one leg of the A-frame on level ground and the other up on the step or rock and mark the spot where the string hangs on the crossbar. Then switch and put the other leg up the rock or step, making sure to put the legs in exactly the same spot. Mark where the string falls on the cross bar. Then measure the distance between the two marks and find the mid-point. If you do not have access to a measuring tape, then measure this distance with a piece of string and fold the string in half to mark the mid-point.

KEY MESSAGES

- An A-frame helps us find contours on the land.
- An A-frame can easily be constructed with locally-available materials and used by anyone.

30 min

6. Using an A-frame to identify contours

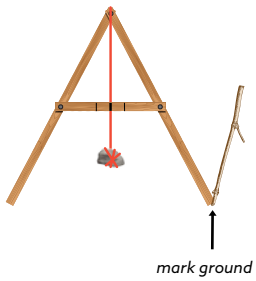
PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Demonstrate to gardeners how to build swales and berms at their garden sites.

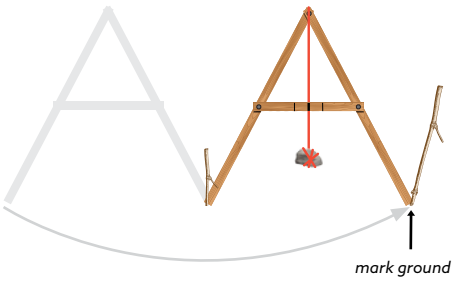
FACILITATOR PREPARATION: Walk the land before the training to get a sense of a good place to start digging the ditch on contour.

STEP 1. Ask participants to collect sticks about 20–30 cm long. The sticks will be used to mark out the contour lines found by the A-frame. Show participants the first couple of steps of how to measure the contour:

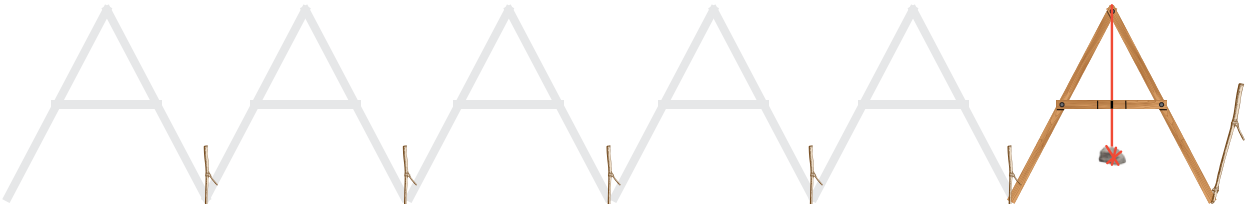
1. Mark your starting point with a stick in the ground and put one leg of the A-frame by the stick. Then find the spot where the string hangs exactly in the middle by moving the other leg. Keep the leg by the starting point fixed and move around to find the spot where the string hangs exactly in the middle. Mark this spot in the ground with a stick.



2. Keep the leg by the stick fixed in the ground while swinging the A-frame around 180 degrees to find the next point where the string hangs at the marked mid-point. Mark this point with a stick.



3. Repeat.



STEP 2. When you have marked a decent enough distance with your sticks, dig or trace a very shallow line along the sticks to mark the contour line. Once you have the line marked, you can dig down a bit deeper, placing the soil on the lower side of the slope to create your berm. It is helpful if the end of the swale is directed towards a place that would benefit from excess water, such as a fruit tree or bananas.

STEP 3. Once you have dug the swale, pass the A-frame inside the ditch also to ensure it is level inside.

STEP 4. Explain to participants that the berm is another productive opportunity, for example for planting beans or sweet potatoes. Berms should be protected from erosion.

45 min

7. Dig a double dug garden bed

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Have gardeners practice digging a bed using the double-dug technique and understand how this practice can help their plants.

FACILITATOR PREPARATION: Identify a suitable garden site where gardeners can gather and establish some double-dug garden beds. They will be working here for the duration of the training session. Ask them to collect local soil amendments, such as manure and ash, before beginning the exercise.

MATERIALS NEEDED:

- Soil amendments such as manure and ash
- Local tools, such as fork hoe, shovel, and rake

STEP 1. Explain to gardeners what double digging is and how it helps plants grow. Ask them to recall the elements of a well-prepared garden bed discussed earlier. If possible, show them the flipchart paper to refresh their memory before starting to dig.

STEP 2. Begin by marking with string or simply drawing a line in the dirt where your garden bed will be located. Make sure that all the beds, pathways, swales, berms, and holes are measured and marked before beginning to double dig. Divide the garden bed into "trenches" that are the width of the spade you are using.

STEP 3. In the first trench, take out the top 20 cm of topsoil and place it at the end of the bed.

STEP 4. Identify a couple of volunteers from the group and ask them to dig the next 20 cm of subsoil from the same section of the trench. They should just loosen and aerate the soil by rocking the spade back and forth but not removing the soil from the trench. Keep loosening the whole section until most of the larger soil clods have been broken up.

STEP 5. Start to add any available soil amendments such as compost, manure, ash, and charcoal dust to the loosened subsoil. One shovel or several handfuls of each amendment is enough.

STEP 6. Using a shovel, mix these amendments into the subsoil.

STEP 7. Ask another volunteer from the group to dig 20–30 cm of topsoil in the next 40 cm section. As it is dug up and loosened, place this topsoil on top of the subsoil section that was just amended. Make sure that all the topsoil gets removed.

STEP 8. Ask a new person in the group to further loosen and aerate the subsoil, as in Step 4.

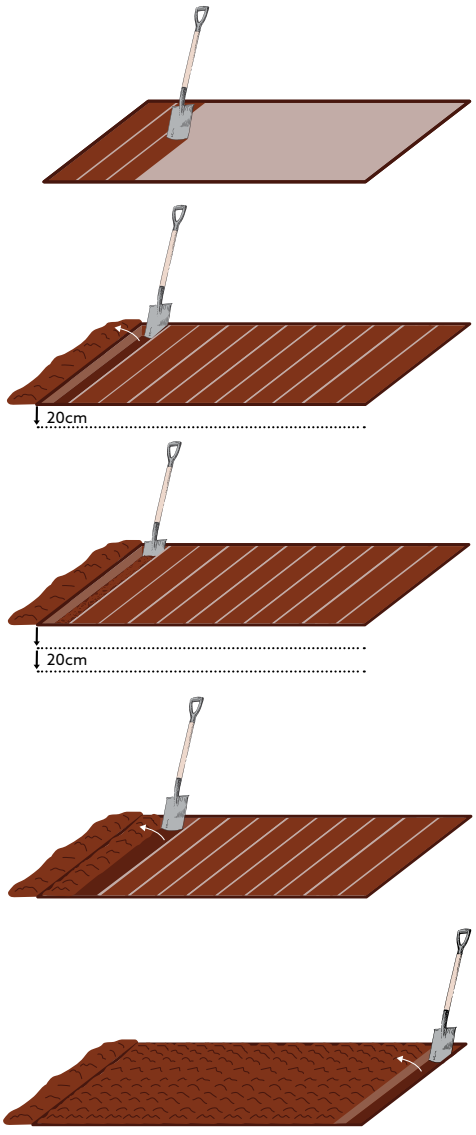
STEP 9. Amend the soil again, as in Step 5. (You may need to ask participants to keep collecting soil amendments)

STEP 10. Repeat Steps 3–6 until bed is complete. The saved topsoil from the start of the bed should be used to build up the bed in the last 40 cm section.

STEP 11. Once the double digging process has been completed, add more manure, compost, and soil amendments to the finished bed, mixed well into the loosened soil at the bottom of the hole. The idea is to have a good organic matter-soil mix that is as deep as the root systems of the garden plants.

STEP 12. Smooth out the top with a rake or hoe or by hand, creating a flat planting space. The garden is now ready for planting or seeding.

STEP 13. Ask gardeners to share what they have observed and how this method differs from their current practices.



KEY MESSAGES

- Double digging involves the loosening of two layers of soil, and the addition of organic matter.
- Deeply dug soil reduces stress on plant roots.
- When soil has good tilth, plants can be spaced closer together since they can more effectively use the space below them.
- Double-dug beds are long lasting, so gardeners do not have to use as much energy in following seasons.
- All plants require air around the roots for good root health and function. Double-dug beds aerate the soil deep in the soil profile.
- Soil amendments such as compost, manure, wood ash, and charcoal dust can be sourced locally to improve soil organic matter.

KEY DEFINITIONS

Aeration

The process of creating openings in the soil to help air, water, and nutrients move into the soil to plant roots, alleviating soil compaction.

Topsoil

This is the upper, outermost layer of soil, usually the top 5–10 inches. It has the highest concentration of organic matter and microorganisms and is where most of the soil's biological activity occurs.

Subsoil

This is the soil lying immediately under the topsoil. It is typically more compacted than the topsoil and has greater nutrient imbalances.

20 min

8. Closing discussion: the benefits of fixed beds

INTERACTIVE DISCUSSION

GOAL OF ACTIVITY: Gardeners think about the benefits of fixed garden beds and what can be done if they need to shift their beds around season to season.

1. Engage gardeners in a discussion around the pros and cons of having fixed garden beds.
2. Discuss reasons why you would need to shift sites season to season and what gardeners can do in these situations.

KEY MESSAGES

- Fixed garden beds allow gardeners to build soil fertility year after year and actually improve the health of the soil in these plots. After many seasons of adding compost, manure, and other organic material to the same soil, gardeners will notice more soil life, more water holding capacity, a more loamy texture, and a darker color. Gardeners may have never seen soil actually improve over time; they may have only noticed it become depleted. This is because they have been spreading their energy around, rather than investing a lot of time and attention into a single plot.
- Fixed garden beds allow gardeners to maintain soil tilth year and year if they avoid walking on beds and use permanent pathways around beds.
- Fixed garden beds allow gardeners to take advantage of the work they did building swales along contours and berms to capture water. Gardeners may also notice improvements they can make for next year as they observe how rainfall moves across their beds throughout the season.
- Some gardeners may have difficulties accessing the same garden sites year after year however. Moving beds from site to site gives gardeners flexibility when they need it.

NEXT GUIDE: Fence Making

Fence Making





OVERVIEW

LEARNING OBJECTIVE

Gardeners will understand the importance of a fence and the multiple uses of a fence to help improve production. Gardeners will also be able to identify suitable local fence materials.

DURATION

MATERIALS NEEDED

- A shaded area for gathering together to discuss
- Locally available fencing material
- Tools required to build a fence

KEY CONCEPTS

- Chickens, goats and other small animals can quickly destroy a home garden unless it has a fence.
- Fences can benefit a gardener beyond providing garden protection: living fences can provide mulching materials, timbers, poles, stakes, and even fruit and nutritious leaves. The fence can also be used as a trellis for vining fruits, such as passion fruit.
- A sturdy fence can be made completely with locally-sourced materials. Termite resistant wood is preferable for the corners of the fence that bear the majority of the weight of the fence.

TRAINING AGENDA

1	Introduction and warm-up	DISCUSSION	10 min
2	The multiple purposes of a fence	DISCUSSION	5 min
3	Fencing options	DISCUSSION	15 min
4	Fencing the garden	PRACTICAL ACTIVITY	1 hour
5	Closing discussion	DISCUSSION	10 min

FACILITATOR NOTES

Engage gardener in a discussion that brings out local knowledge on good fencing practices and good local fencing materials before suggesting materials to use.

10 min

1. Introduction and warm-up

Welcome gardeners to the training. Do a brief introduction to today's topic and review the training agenda. You may want to outline the training agenda on your flipchart or board so gardeners can see it when they arrive.

Conduct a warm-up exercise or ice-breaker to make sure all gardeners feel welcome and are ready to fully participate. Suggested warm-up and ice-breaker activities can be found in the Facilitator's Guide: Encouraging Learning through Participant Engagement.

Participant Engagement Guide

5 min

2. The multiple purposes of a fence

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners understand the importance of having a fence to protect their home gardens and can identify some additional benefits of a fence that can increase their garden's overall productivity.

1. Discuss with gardeners why a fence is necessary and other purposes a fence can serve.

KEY MESSAGES

Protecting the home garden with a fence is important if we want to ensure we have a good crop. Chickens, goats and other small animals can quickly destroy a home garden if it is not fenced. If small animals are let into the home garden, they can not only eat the crops very quickly but also compact the soil by stepping on it. A good fence will also help protect the garden from harsh winds that can dry the soil.

A fence can also provide vertical growing space, for example by growing a climbing plant such as passion fruit or grenadilla across it. It is also possible to grow a living fence that can bear fruit and provide staking, mulching, and composting material.

15 min

3. Discussing fencing options

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners are able to identify locally available examples of a 'dead' fence and a 'living' fence and the pros and cons of each of them.

1. Ask gardeners to describe and give locally-available examples of:
   - A 'dead' fence
   - A 'living' fence
2. Ask gardeners to discuss in pairs some local options for fencing of the demonstration garden.
3. Discuss the suggested options as a group, examining the pros and cons of each and deciding on an option for the demonstration garden.

KEY MESSAGES

One example of a **'dead' fence** is thorny branches piled together around the garden. While this fence does a good job of protecting the garden from livestock, it cannot produce any material that can be useful for the gardener or their household.

Living fences can be made from trees found in the area by taking cuttings to use as living fence poles. When watered and cared for, these poles will eventually produce leaves and branches that can be used as mulching materials or stakes.

If **fruit trees** are incorporated into the fence, gardeners will eventually be able to harvest fruit from their fence.

Sisal is a living fence option that eventually creates a thick impenetrable fence around the garden and produces fibrous material that could be useful to gardeners and their households.

1 hour

4. Fencing the garden

PRACTICAL ACTIVITY

GOAL OF DISCUSSION: Gardeners learn how to make a fence around their home garden using locally-available materials.

MATERIALS NEEDED:

- Locally available fencing material
- Tools required to build a fence

STEP 1. Discuss the size of the fence with gardeners and outline in the garden where the fence will be erected. Instruct gardeners to collect the types of fencing materials agreed to during the group discussion.

STEP 2. Build the fence with gardeners.

Note: If the activity is not finished within the allocated time of the training, the gardeners can finish the fencing on their own. But insist the fence is finished before the next module begins!

KEY MESSAGES

Good fences...

... Have adequate thorn bush or thick material at the bottom to ensure chickens cannot enter.

... Use termite resistant wood when needed. This is especially true if dead wood is used as stakes to build the corners of the fence.

... Have a well-planned entrance or gate. Ensure the bottom of the entrance is also chicken proof.

10 min

5. Closing discussion

Ask gardeners to share with the group:

1. Something they learned in the session
2. How they are going to use this in their own homestead

NEXT GUIDE: Specialized Garden Designs

Specialized Garden Designs

Unconventional spaces and urban gardening

Photo by Sheena Shah


Photo by Sheena Shah

Unconventional spaces and urban gardening

LEARNING OBJECTIVE

Gardeners will learn techniques for growing gardens in small, unconventional spaces.

DURATION

MATERIALS NEEDED

Bring with you:

- Flipchart and pens
- Container types for all three kinds of gardens (horizontal sack gardens, vertical sack gardens, and container gardens)
- A cylindrical tube (such as downpipes for rainwater harvesting or a bucket or tin that has been opened on both ends) that can be used to add a column of rocks into the center of the vertical sack garden. The diameter of the tube should be smaller than the diameter of the sack.
- Multiple seed options
- Seedlings for demonstration
- A knife for cutting holes in containers and sacks

Prepare at the training site:

- Water
- Rocks
- Mulching material
- Compost, composted manure, and/or high-quality soil

KEY CONCEPTS

- Not every household has a backyard or field where they can build a garden. But that's ok! Plants can grow almost anywhere if they have a bit of soil, sunlight, and water.
- Just a few well-chosen plants can help families access more vegetables that can be incorporated into their daily meals.
- If space is an issue for your area, consider if container or sack gardens are appropriate for your participants.

TRAINING AGENDA

1	Introduction to container or sack gardening	DISCUSSION	30 min
2	Identifying container or sack garden resources around us	PRACTICAL ACTIVITY	1 hour
3	Building container and sack garden	PRACTICAL ACTIVITY	1.5 hour

30 min

1. Introduction to container or sack gardening

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners learn how to identify new resources and spaces that can help them grow vegetables in containers or sacks to improve their daily diets.

MATERIALS NEEDED: Flipchart and markers

1. Introduce the concept of container or sack gardening to gardeners.
2. Ask gardeners to brainstorm vegetables that are well suited to grow in a container or sack and list these vegetables and their benefits for all to see. Have gardeners think about what they like to eat and discuss if it can be grown in a container.
3. Remind gardeners of the 5 Resources categories introduced in Identifying Resources. Ask gardeners to name resources that could be used in container or sack gardening. Encourage gardeners to think creatively about the resources around them.
4. Discuss with gardeners the best places to put a container or sack garden. The key characteristics of a good site for a container or sack garden are similar to those of a good garden site, as introduced in Site Evaluation.

KEY MESSAGES

WHAT IS A CONTAINER OR SACK GARDEN?

- Container gardens use different kinds of buckets, pots, barrels, baskets, tins, boxes or other containers to produce vegetables. The container must be large enough to hold the plant(s) you want to grow, and have drainage holes so excess water can escape. Care should be taken with dark-colored containers that might retain too much heat in hot months.
- Sack or bag gardens use sacks with drainage holes in them to produce vegetables. Sacks can be placed either upright or on their sides.
- Container or sack gardens can be used by gardeners who are limited in the planting space available to them, experience a lot of crop theft in their area, or are limited in their personal mobility to fields because of cultural norms or safety conditions in their area.
- Gardeners can place either individual plants or a small assortment into a vessel that is then are placed in well-thought out areas around a household.

WHAT VEGETABLES SHOULD I GROW IN MY CONTAINER OR SACK GARDEN?

- The depth of the container will determine the type of root structure that will fair best. Shallow containers, such as a jerrycan cut in half, will be best suited for shallow or fibrous rooted vegetables, such as leeks. Large containers, such as rice sacks, can grow vegetables with more extensive root systems, such as tomatoes.
- Local indigenous vegetables are hardy species that may grow well in container or sack gardens.
- What vegetables will provide ample yields that can easily be incorporated into family meals? For example, chard leaves can be harvested regularly and used in cooking daily for many months while taking up very little space. Bushy plants, like eggplants, may take up a lot of space while only yielding a few fruits.

1 hour

2. Identifying container or sack garden resources around us

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Gardeners are encouraged to become observers of their own environment, identifying the richness of resources that they do have around them that can help them build a container or sack garden.

FACILITATOR PREPARATION: Select a training site where gardeners can walk around their community freely to find resources that can be used for container gardening. They will need to end at a homestead or other suitable place where they can identify locations to place garden containers.

STEP 1. Organize gardeners to go on a group walk to identify natural resources in their local area that are useful for container or sack gardening. Many of the resources needed for container or sack gardening are freely available: discarded containers/sacks, rocks, animal manures, or plants that can be used for mulching. Ask gardeners to each pick up at least one resource on their walk to bring back with them.

STEP 2. After the walk, gather gardeners in a circle and ask them to show their resource to the group. They should explain what their resource is and what it is used for. Encourage gardeners to explain how the resource will help them grow plants in unconventional spaces.

STEP 3. Ask gardeners to look around and identify sites where garden containers or sacks can be placed. In addition to spaces on the ground, have gardeners think about vertical or above-ground options.

KEY MESSAGES

- Useful resources for sack or container gardens are all around us, such as manure, ash and fertiliser plants such as *Tithonia diversifolia*.
- Containers or sacks can be placed on window sills, rooftops if they are accessible and partially shaded, low walls, or in places where vining plants, such as squashes or climbing beans, can fill vertical spaces.

1.5 hours

3. Building container and sack gardens

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Gardeners participate in building three types of gardens (horizontal sack gardens, vertical sack gardens, and container gardens) and learn the skills required to repeat the exercise on their own.

MATERIALS NEEDED:

Bring with you:

- Flipchart and pens
- Container types for all three kinds of gardens (horizontal sack gardens, vertical sack gardens, and container gardens)
- A cylindrical tube (such as downpipes for rainwater harvesting or a bucket or tin that has been opened on both ends) that can be used to add a column of rocks into the center of the vertical sack garden. The diameter of the tube should be smaller than the diameter of the sack.
- Multiple seed options
- Seedlings for demonstration
- A knife for cutting holes in containers and sacks

Prepare at the training site:

- Water
- Rocks
- Mulching material
- Compost, composted manure, and/or high-quality soil

STEP 1. Set up three stations around the training site, one for building a horizontal sack garden, one for a vertical sack garden, and one for a container garden. Assemble the necessary equipment at each site, such as soil, compost, and rocks, or put it in a centralized location where all can easily access it.

STEP 2. Do each station with gardeners gathered around and explain the steps as you go.

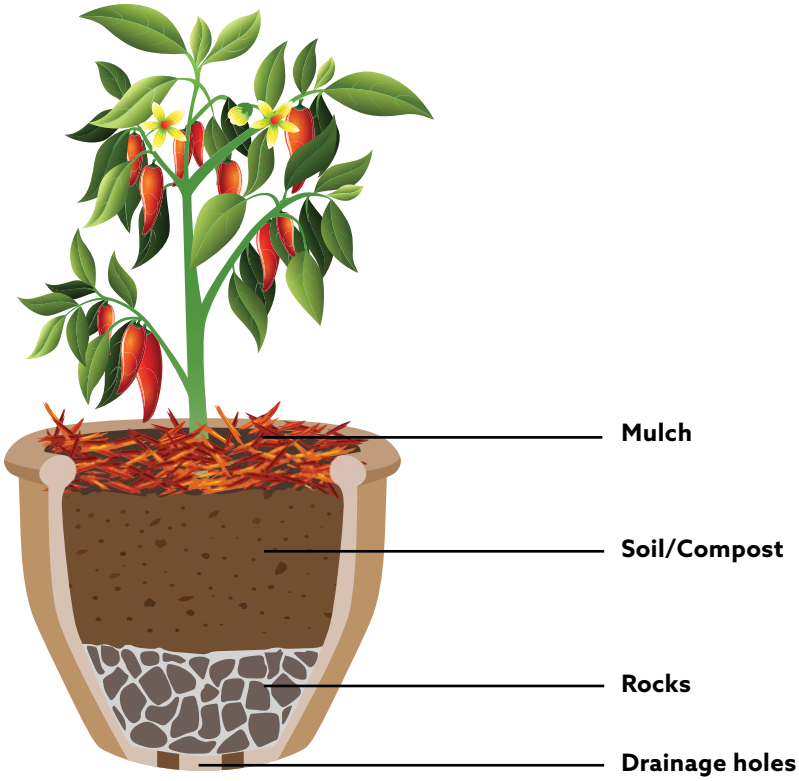
STEP 3. Discuss with gardeners the benefits of each style of container garden and how each might be used for different crops and spaces.

KEY MESSAGES

- Container and sack gardens are beneficial for small spaces and places with no arable land, such as in urban spaces. When you add high-quality soil and compost to the container it will stay loose and fluffy for longer, but poor quality soil will easily become compacted. Container gardens will need to be watered more frequently than plants in the ground as water easily evaporates out.
- All manner of sacks and containers can be used for gardening. Encourage gardeners to be creative!

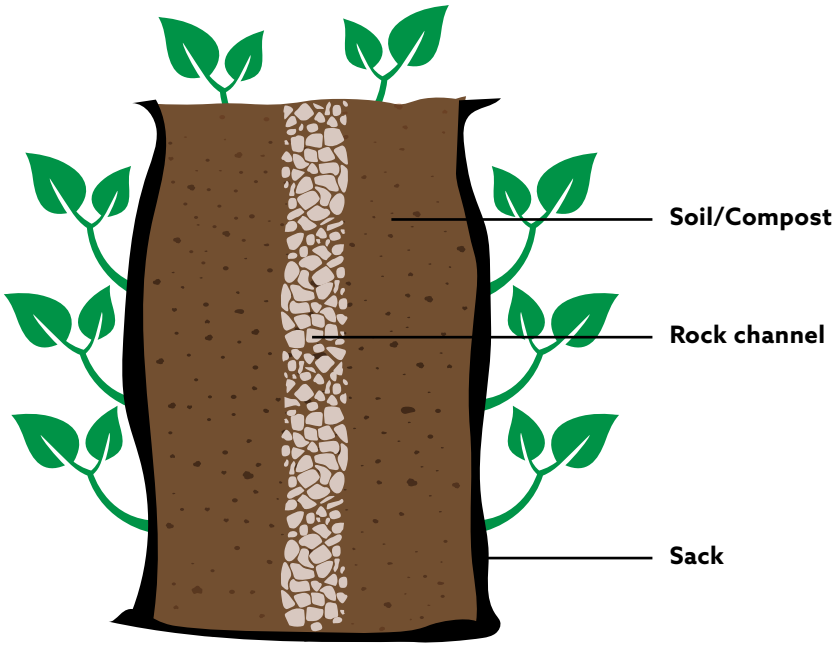
HOW TO BUILD A CONTAINER GARDEN

1. You can use many different kinds of buckets, pots, barrels, baskets, tins, or boxes to produce vegetables. Look for containers that are at least 25 cm (10 in) wide and 30 cm (12 in) deep. Bigger containers hold more soil and retain moisture longer, so you do not have to water as much.
2. On the side, mix soil and compost together in a 50/50 ratio.
3. Poke several holes in the bottom of the container for drainage.
4. Add a layer of rocks at the bottom of the container about 3 cm (1 in) deep.
5. Fill the container with the soil/compost mixture plus manure if available. Leave about 8 cm (3 in) space at the top so there is room to water.
6. Thoroughly water the soil in the container before adding seeds or seedlings. Soak the soil completely, then allow it to sit for a few hours to drain excess water. This time can be reduced during a demonstration but stress to gardeners that the soil should not be waterlogged when seeds are introduced.
7. Sow seeds directly into container or use seedlings. If using seedlings, leave 8–10 cm (3–4 in) of space in between each plant, or according to the seed spacing recommendations. Set seedlings in the soil at the same level they were growing in their pot.
8. Cover the soil in the container garden with a layer of straw, old leaves, or other mulching material to prevent it from drying out.
9. Check plants daily and water when necessary to keep them healthy and productive.
10. Starting about a month after planting, vegetables should be fed about once a week with botanical manure tea.
11. Plants that grow tall or produce vines, like tomatoes and cucumbers, will need support in a container, such as poles or a wire mesh cage.



HOW TO BUILD A VERTICAL SACK GARDEN

1. Carefully choose the location for the sack garden as it is challenging to move when full of soil.
2. On the side, mix soil and compost together in a 50/50 ratio.
3. Place about 12 cm (5 in) of the soil/compost mixture at the bottom of the sack. Set the cylindrical tube in the center of the sack and fill with rocks.
4. Surround the tube with soil until you reach the upper rim of the tube. Then slowly lift up the tube so that the rocks remain in the center. Again set the tube in the middle of the sack and fill it with rocks. Surround the tube with more soil. Lift the tube up when this layer of rocks and soil are in place. Repeat until the sack is full. This "rock channel" will make it easy to water your sack garden. Alternatively, you can use some wire mesh, make a cylinder, and set it in the middle of the bag. Fill it with rocks, and then add the soil all around to the top of the sack. The cylinder will stay in the center of the sack.
5. Poke holes into the side of the sack at an even distance about 20 cm (8 in) apart.
6. Transplant seedlings into the holes and tamp soil lightly around the roots.
7. Beets, carrots, lettuce or other vegetables or herbs can be direct-seeded on the top of the sack.
8. Water your sack garden from the top: Pour water into the rock channel until it comes out of the bottom holes.



HOW TO BUILD A HORIZONTAL SACK GARDEN

1. Carefully choose the location for the sack garden as it is challenging to move when full of soil.
2. On the side, mix soil and compost together in a 50/50 ratio.
3. Fill the sack with the soil/compost mixture.
4. Sew up or secure the opening of the sack. Lay the full sack flat on the ground or surface.
5. Poke 1 cm (0.5 in) wide drainage holes into the bottom side of the sack at an even distance about 10 cm (4 in) apart. If the sack is made from loosely woven material that will allow water to drain, you do not need to do this step.
6. On the top side of the sack, cut hole openings for seedlings, or cut row openings for seeds.
7. Transplant seedlings into the holes and tamp soil lightly around the roots OR sow seed in rows at the appropriate depth.
8. Water your sack garden gently from the top.

Additional resources are available at toolbox.avrdc.org

Specialized Garden Designs

Arid and drought-prone environments




Arid and drought-prone environments

LEARNING OBJECTIVE

Gardeners will learn sustainable gardening techniques for arid and drought-prone environments.

DURATION

MATERIALS NEEDED

Bring with you:

- Flipchart and markers
- Multiple seed options
- Seedlings for demonstration

Prepare at the training site:

- Compost or composted manure
- Local tools such as hoes, axes, and spades
- Mulching materials

KEY CONCEPTS

- Some gardeners live in environments that have very little or erratic rainfall and soils that do not have good water holding capacity. This makes it challenging to grow vegetables as vegetables can quickly become water stressed.
- In areas where gardeners grow gardens in hot, water-stressed climates, it is especially important to store water in the soil for future use. This can be done by using sunken beds and zaï pits that trap water and funnel it to where plant roots will find it.

TRAINING AGENDA

1	Why is watering so important for home gardens?	DISCUSSION	45 min
2	Different bed designs for arid and drought-prone environments	DISCUSSION	30 min
3	Building sunken beds and zaï pits	PRACTICAL ACTIVITY	1.5 hour

45 min

1. Why is watering so important for home gardens?

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners will understand the importance of reducing water stress on vegetable plants.

MATERIALS NEEDED: Flipchart and markers

1. Ask gardeners why they think vegetables require constant access to water, but other crops may survive without irrigation.
2. Write the key stages of a plant's life on the board. Ask gardeners to describe what is happening at each stage and how water is needed to do this work.

KEY MESSAGES

WHY DO VEGETABLES REQUIRE REGULAR WATERING?

- Vegetables have **short roots** compared to other crops.
- Vegetables are **rapidly growing** and need water at every stage so their growth is not stunted.
- Vegetables grow much quicker than many other plants. They need water constantly to quickly **establish their root structures** and **grow above ground structures** (stems and leaves).
- Vegetables contain a lot of water in their **stems, leaves, and fruits.** They need to pull water from the soil in order to build these parts.
- Compared to trees and shrubs, vegetables have very short roots. Trees and shrubs can reach deep into the soil to access water, but **vegetables have to rely on what is near the surface,** which can quickly get dried out. Even maize has much deeper roots (1.8 m or 6 ft) when mature than most vegetable plants. Tomato roots are some of the deepest vegetable roots (0.9 m or 3 ft) whereas onions have some of the shallowest roots (0.4 m or 1.5 ft).
- **Fruiting crops** (eggplants, tomatoes, maize) cannot develop flowers or set fruit well if they are water stressed. It is especially important to make sure these crops have adequate water during their flowering and fruiting stages.
- **Leafy vegetables** need water at every stage of growth to make sure they are continuously growing the leaves that we eat.
- **Root crops** (carrots, beets, onions, potatoes) do not have very deep roots and therefore cannot access water deep in the ground.

The life cycle of plants

GROWTH STAGE	WHAT IS HAPPENING?	WHY IS WATER IMPORTANT?
Germination: when a seed starts to grow	Seed is taking in water from soil, the seed coat is softening, and the young plant is emerging from the seed coat.	Water is needed to start this process and ensure the young seedling does not dry out.
Establishment: true leaves have emerged and plants are starting to grow	Early shoots are growing and roots are elongating in the soil.	Water is needed to fuel this growth and make sure root structures are fully formed. Stunted roots can lead to poor water and nutrient absorption later on.
Vegetative growth: plants are putting their energy into growing roots, stems, and leaves	Root masses are increasing and roots are getting deeper. Plants are growing the stems and leaves they need to capture energy from the sun through photosynthesis. The more green leaves they have, the more energy they can capture.	Lots of water is needed to fuel this rapid growth.
Reproductive growth: plants start putting their energy into flowering	Plants start to produce flowers. Flowers are fertilized and start to grow fruit. Leaves may die as plants focus on fruit growth.	Water stress during this stage can cause flowers to die and fruit to become withered.
Ripening and dying: Fruits are maturing and vegetative parts of plant may die	All the plant's energy is put towards ripening its fruits and the seeds within these fruits.	For many vegetables, water is less critical during this stage. Too much water may actually cause fruits to crack because they take up too much water.

30 min

2. Different bed designs for arid and drought-prone environments

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners will understand how sunken beds and zaï pits can help them store water and nutrients so that they are more readily available to plants growing in arid conditions.

1. Describe sunken beds and zaï pits and discuss how they trap water and retain it longer than other bed designs.
2. Review the key criteria of selecting a site for your garden beds and explain how these same principles are used for sunken beds and zaï pits.

KEY MESSAGES

SUNKEN GARDEN BEDS ARE BETTER THAN RAISED GARDEN BEDS IN ARID CONDITIONS FOR SEVERAL REASONS:

- They are easier to water efficiently by flood irrigation.
- The raised pathways give the moist soil and young seedlings some protection from drying winds and sun.
- Young plants can easily be protected by laying palm fronds or other material across the beds.
- When wet season rains are intense, garden soil is not eroded and rainwater is funneled into the beds.

ZAÏ PITS ARE ALSO BENEFICIAL IN ARID CONDITIONS. THEY GROW FEWER VEGETABLES THAN SUNKEN BEDS, BUT ARE ALSO LESS WORK.

- Zaï pits are a farming technique that store water and soil nutrients in "pits" before the planting season. The pits are typically 20–30 cm in diameter and 20–30 cm deep.
- Pits are spaced 90 cm apart in each direction if the gardener wants to cover a field, but pits can also be strategically placed where vegetables are desired.
- Zaï pits protect vegetables and store water and nutrients in the same way as sunken beds, but require less space and labor.

1 hour

3. Building sunken beds and zaï pits

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Demonstrate to gardeners how to build sunken garden beds and zaï pits that trap water and nutrients in environments where water and nutrients are scarce.

MATERIALS NEEDED:

Bring with you:
- Multiple seed options
- Seedlings for demonstration

Prepare at the training site:
- Compost or composted manure
- Local tools such as hoes, axes, and spades
- Mulching materials

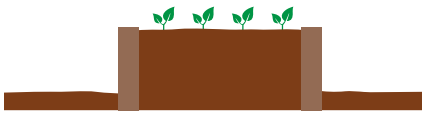
STEP 1. Build a sunken bed with gardeners

STEP 2. Construct 4–5 zaï pits to plant a few select vegetable plants, like squashes, tomatoes, or watermelon. Put 2–3 seeds per hole, instructing gardeners to thin down to only one plant per hole when seedlings have developed a few true leaves. Gardeners should select the healthiest seedling to keep. Alternatively, plant one transplant in each zaï pit and apply much around it.

HOW TO CONSTRUCT A SUNKEN BED

1. Determine the appropriate site for your sunken beds. Consider proximity to a water source, nutrients, sunlight, and other key elements of a garden bed when determining where to place your sunken beds.
2. Use an A-frame to mark out the contours found within the landscape. Even with sunken beds, it is important to build your garden beds along the contours of the landscape to minimize erosion from the beds and most effectively capture rainwater.

Sunken bed



Raised bed

3. Mark out beds so they run perpendicular to your slope and each bed is on the same contour line, i.e. does not go down or up slope. Bed widths should be slightly narrower than normal so that gardeners can continue to access the center of the beds without stepping in them. Alternatively, add some stepping stones to the bed.
4. Remove the richer topsoil from the bed and set it aside. Stop digging when it is clear that another soil horizon has been reached. Topsoil is typically found in the first 1–10 cm of the soil.
5. Continue digging 30–45 cm (1–1.5 feet) to remove the subsoil from the pit.
6. Use the subsoil to raise the pathways around the bed. By raising the pathways, you can make the pit as deep as 60 cm (2 feet).
7. If the bottom of the pit is severely compacted soil, use local tools to loosen it.
8. Create a level surface in the bottom of the pit before adding the topsoil back into the pit.
9. Fill the pit with enough compost or composted manure to plant into.
10. Sow seeds or plant seedlings directly into the compost.
11. Apply mulch to the bed as appropriate.
12. Palm fronds or large branches can be laid over the bed to provide shade and extra protection for young seedlings.

HOW TO CONSTRUCT A ZAÏ PIT

1. Look at your landscape and find the slope. Even land that appears flat will have a slight slope that will determine which way water will flow. This is very important in arid environments where we want to trap any water that flows across the landscape.
2. Using a hoe, dig zaï pits in orderly lines. Each pit should be spaced 90 cm apart from each other in every direction.
3. Dig each pit so it is around 20–30 cm in diameter and 20–30 cm deep.
4. Excavated soil is placed down slope of the hole to form a berm.
5. A spade of compost or composted manure is placed in each hole. Fresh manure should not be used since seeds are sown directly into this material.
6. Sow seeds or place seedlings directly into compost or composted manure.
7. Mulch should be placed on top of pits to slow down water evaporation from pits.
8. Evaluate if other measures, such as stone barriers placed upslope from the zaï pits, can slow and spread water so that it can be more easily captured within the pits.

Additional resources are available at toolbox.avrdc.org

Specialized Garden Designs

Garden designs for heavy rains and flood-prone environments

Garden designs for heavy rains and flood-prone environments

DURATION

LEARNING OBJECTIVE

Gardeners will problem solve how to protect home gardens from heavy rains and flooding and will learn gardening techniques for flood prone areas.

MATERIALS NEEDED

• Flipchart and markers

KEY CONCEPTS

- Too much water can wash away topsoil and seeds. Heavy rains can damage plants and create waterlogged conditions that suffocate plant roots.
- Gardeners can help each other develop solutions to protecting their home gardens when flooding and heavy rains create challenging conditions.
- Raised beds and elevated container and sack gardens can help gardeners direct excess water away from plant roots. Flat garden beds help protect topsoil from erosion.

TRAINING AGENDA

1	Protecting our gardens from heavy rains and flooding	DISCUSSION	1 hour

1 hour

Protecting our gardens from heavy rains and flooding

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners think through how to protect their gardens from heavy rains and/or floods.

FACILITATOR PREPARATION: A flipchart with two columns

MATERIALS NEEDED: Flipchart and markers

1. Ask gardeners to brainstorm some challenges to gardening when heavy rains and/or floods are a problem. Write the challenges gardeners say on the left side of the paper. Add any challenges that they missed.
2. As a group, discuss possible solutions to these challenges. Ask gardeners what they can do to prepare for heavy rains or floods when they are preparing their garden. Ask them to share examples of gardeners who have successfully protected their crops from heavy rains or floods.
3. For areas with heavy rains, discuss the importance of a flat garden bed to reduce erosion and stop, spread, and sink water before it reaches garden beds.
4. Draw a picture of a raised bed and show how rainwater can quickly percolate downwards away from plant roots when loosened soil is piled up on the garden bed surface.

KEY MESSAGES

Many gardeners are experiencing heavier rains or more frequent flooding than normal due to climatic changes.

TOO MUCH WATER CAN BE DAMAGING TO GARDEN BEDS:

- Garden bed soil can be eroded. When topsoil is eroded away, many nutrients are lost, including any nutrients from fertilizer that was added.
- Seeds can be washed away.
- Small seedlings can be washed away or damaged in the rain.
- Even large plants can be damaged from heavy rains. Delicate flowers and fruits can also be damaged.
- Plant roots can be sitting in water for long periods of time. This means they cannot access any air and plants can suffocate as a result.

PROPER USE OF RAISED BEDS:

- Raised beds drain water out of them quicker than if plants were planted at the original soil level. This is important so that plant roots are not sitting in flooded soil.
- It is possible to create a very deep garden bed by digging down below the bed and then creating the raised garden bed on top of where you just dug. This gives the roots extra space to explore without compaction.
- Raised beds can be very prone to erosion, especially during heavy rain storms. It is important to reinforce the sides of the beds with locally-available materials, such as stones, banana stems, timbers, or wood panels so that topsoil does not get washed away.
- Raised garden beds should be aligned perpendicular to the slope to reduce erosion. Rainwater should be stopped and slowed with berms located upslope from the garden beds. Garden beds should be flat to avoid runoff and always mulched.

Note: Horizontal and vertical sack gardens strategically placed on high areas such as walls, flat lying roofs, or hills can also help gardeners grow vegetables in areas with seasonal flooding.

Specialized Garden Designs

Gardening on steep slopes

Gardening on steep slopes

LEARNING OBJECTIVE

Gardeners will observe how water can remove topsoil from steep slopes and discuss how terracing can help.

DURATION

MATERIALS NEEDED

- Flipchart and markers
- A jug or jerry can of water for the demonstration
- Local tools such as hoes, axes, and spades
- Two pieces of wood exactly the same size for every A-frame created (recommended 1 m)
- One piece of wood half the size of the longer two pieces for every A-frame created (recommended 50 cm)
- String
- Nails
- Hammer
- Pen or pencil
- Fist-sized rocks

KEY CONCEPTS

- Gardeners who plant on steep slopes face problems with severe erosion. Erosion carries away nutrient-rich topsoil through rain and wind, leaving behind poorer quality subsoil.
- Gardeners have used terracing for centuries, but terracing can be made more effective by placing the terrace along the contours of a landscape and by reinforcing the outer wall of a terrace with thick grasses.

TRAINING AGENDA

1	Understanding terracing	PRACTICAL ACTIVITY	1 hour
2	Using contours to build effective terraces	PRACTICAL ACTIVITY	1.5 hours

1 hour

1. Understanding terracing

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Gardeners share knowledge of terracing techniques using a soil mound that helps them visually understand.

FACILITATOR PREPARATION: In advance, prepare a soil mound. The soil mound should be at least 50 cm high and wide.

MATERIALS NEEDED: A jug or jerry can of water for the demonstration

STEP 1. Explain to gardeners that the session is about sharing knowledge around terracing techniques. Gather gardeners around the soil mound and ask them to gather sticks and put them on the mound to represent plants.

STEP 2. Ask gardeners what happens to soil on slopes when it rains. After gardeners give their answers, pour a jug or jerry can of water over the mound and observe what happens. Ask gardeners to share their observations.

STEP 3. Ask gardeners how they would address this problem. If they live in an area with steep slopes they are likely to have knowledge of terracing techniques. Ask gardeners to demonstrate terrace building on the soil mound and explain what they are doing and why.

STEP 4. Pour water over the terraced soil mound and ask gardeners to observe what happens and share their observations.

STEP 5. Ask gardeners to summarise key points about terracing and write them on a flipchart. Elicit any key points that gardeners may have missed.

STEP 6. Demonstrate step by step how to build a terrace by building a mini terrace on the soil mound. Point out key points as you go along.


Photo by Elin Duby

1.5 hours

2. Using contours to build effective terraces

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Gardeners learn how to use contours to improve their terrace building.

FACILITATOR PREPARATION: Identify a slope on which to mark out contour lines. Review the Key Messages about contour lines in Establishing Your Garden before the session.

MATERIALS NEEDED:

- Two pieces of wood exactly the same size for every A-frame created (recommended 1 m)
- One piece of wood half the size of the longer two pieces for every A-frame created (recommended 50 cm)
- String
- Nails
- Hammer
- Pen or pencil
- Fist-sized rocks

STEP 1. Gather gardeners at a site with a steep slope where they may practice marking out contour lines.

STEP 2. Demonstrate to gardeners how to build an A-frame.

STEP 3. Have gardeners mark out a few contour lines where they may start digging a terrace. Contour lines should be marked out 10–12 meters upslope or downslope from each other to allow enough space for each terrace.

STEP 4. Gardeners do not have to dig each terrace to completion, but make sure participants understand how terrace building would proceed after marking out contour lines.

HOW TO BUILD A TERRACE

1. Use an A-frame to mark out the contours of a slope.
2. One meter deep trenches are formed along the contours of a slope. Soil from these trenches is thrown upward to form banks along the edge of the upper terrace.
3. Terraces should be made level as much as possible.
4. Trenches can be dug every 10–20 m to form a new terrace.
5. Over time, the banks on the outer edges of the terrace will even out. They can be planted with grasses to prevent downward erosion. It is best to plant thick grasses that can be used as animal fodder. One example is vetiver grass, which has very deep roots. Bananas or yams can be planted in the trenches of the terraces where water will collect. Trees along the sides of the terrace will further prevent erosion.
6. Terraces must be maintained by throwing soil back onto the uphill terrace as necessary.

Specialized Garden Designs

Keyhole gardens

Keyhole gardens

LEARNING OBJECTIVE

Gardeners will understand the concept of a key hole garden and when it is useful. They and will also practice building a keyhole garden.

DURATION

MATERIALS NEEDED

- Flipchart and markers
- Lots of high quality soil and compost
- Brick, stone or metal for the outer walls
- A sheet of wire mesh to create a cylinder about 30 cm in diameter or wood poles if wire mesh is not available
- Pegs and a string
- Stones, branches, twigs for the bottom of the garden
- Water
- Mulching materials
- Vegetable seeds and/or transplants
- Local tools such as spades, axes, and hoes

KEY CONCEPTS

- Keyhole gardens require upfront time, labor, and materials and are best used when gardeners do not have arable land, so must create it.
- The plants in a keyhole garden are elevated, which makes them suitable for people with disabilities.
- Keyhole gardens should be used when gardeners can identify a challenge that can be solved by using the keyhole garden design.

TRAINING AGENDA

1	Is a keyhole garden right for you?	DISCUSSION	1 hour
2	Building a keyhole garden	PRACTICAL ACTIVITY	2.5 hours

1 hour

1. Is a keyhole garden right for you?

INTERACTIVE DISCUSSION

GOAL OF DISCUSSION: Gardeners will learn what a keyhole garden is and if it is a suitable solution for their gardening problems.

MATERIALS NEEDED: Flipchart and markers

1. Discuss with gardeners the key characteristics of a garden bed.
2. Draw a picture of a keyhole garden and discuss each individual component of the garden design with gardeners. Ask gardeners to brainstorm how each component helps create a suitable environment for plants to grow.
3. Discuss with gardeners what materials and labor are needed to construct a keyhole garden and what maintenance they might need to be done the following season and each subsequent year.
4. Ask gardeners if the keyhole garden helps them solve any problems they may currently have with growing vegetables.
5. Finish the discussion by brainstorming a list of locally available materials that would be suitable for building each component of a keyhole garden.

KEY MESSAGES

ARE KEYHOLE GARDENS RIGHT FOR YOU?

Keyhole gardens require a lot of upfront time, labor, and building material. They are best used in situations where gardeners do not have arable land in which to grow vegetables. The plants in a keyhole garden are elevated above the ground, which also makes them suitable for people with disabilities. If keyhole gardens are built to the right height and contain a lot of rich soil and compost, they can produce an abundance of vegetables in a very small space. However they require yearly maintenance to repair broken walls and replace soil nutrients that were harvested. The central "compost pit" must be maintained and soil amendments added to counteract the soil settling over time. Prior to building a keyhole garden, evaluate gardeners' resources and access to land to ensure that other garden bed designs are not more appropriate. Check in with gardeners to confirm their interest in maintaining the keyhole garden structure throughout the course of its lifetime.

2.5 hours

2. Building a keyhole garden

PRACTICAL ACTIVITY

GOAL OF ACTIVITY: Gardeners will gain practical experience of building a keyhole garden.

FACILITATOR PREPARATION: Identify a piece of land where the keyhole garden can be placed and gather gardeners there. Ensure that all building materials have been collected in advance. It is essential that soil used in the keyhole garden is of the best quality, therefore make sure enough organic material is available to properly fill the central circle and the inner layer of the keyhole garden. This might mean you need to start locating good soil or building compost piles many months in advance to prepare for building the keyhole garden.

MATERIALS NEEDED:

- Brick, stone or metal for the outer walls
- A sheet of wire mesh to create a cylinder about 30 cm in diameter or wood poles if wire mesh is not available
- Pegs and a string
- Stones, branches, twigs for the bottom of the garden
- Water
- Mulching materials
- Vegetable seeds and/or transplants
- Local tools such as spades, axes, and hoes

STEP 1. Gather gardeners at the site where the keyhole garden will be constructed.

STEP 2. Explain the materials gathered to the gardeners and what they will be used for.

STEP 3. Assign gardeners to different tasks and construct the keyhole garden.

STEP 4. Discuss with gardeners what should be planted where to make the best use of planting space in the keyhole garden. Plants that are more frequently harvested or are harvested quickly can be planted on the outer rim of the garden, whereas plants that require longer to mature can be placed towards the inner circle of the garden.

HOW TO BUILD A KEYHOLE GARDEN

1. Determine a suitable place for your keyhole garden, taking into account hours of sunlight, access to water, and security of the garden structure.
2. Using pegs and string, mark two nesting circles: One 2 m (6 ft) in diameter and one 30 cm (l ft) in diameter.
3. Mark out where the entrance of your garden should be, by leaving a wedge shape or "keyhole" that goes from the outside edge of the widest circle to the center. This allows gardeners to access the middle of the structure.
4. Create your outer structure by building a wall out of brick, stone or metal. Build up the wall until it is about 1 m (3 ft) high.
5. Use the sheet of wire mesh to create a cylinder about 30 cm in diameter, or make a rough basket cylinder from wood poles and dried grasses.
6. Set the cylinder in the center of the circle and put a layer of stones and twigs on the bottom for drainage.
7. Add a layer of wood ash to provide potassium to the soil and an extra layer of grass retains the moisture.
8. Add soil on top of the wood ash. Fill nearly to the top, making sure the soil slopes down from the center to the garden edges.
9. Fill the compost basket with raw vegetable scraps, coffee grounds, eggshells, grass, leaves.
10. Vegetables and herbs that will be picked often should be planted around the edges of the garden.
11. Plants that are harvested once, such as carrots and beets, should be planted toward the center.
12. Water the garden by pouring water into the composting cylinder.

Additional resources are available at toolbox.avrdc.org