

Climate Smart Agriculture

Training Manual



Rural Development Programme

Implemented by

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH



As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

Published by

Deutsche Gesellschaft für Internationale Zusammenarbeit
(GIZ) GmbH

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FOREWORD

Climate change is a fundamental concern for Uganda and Northern Uganda in particular because of its effects on the agriculture sector which is a mainstay for rural households. The most frequent climate risk that has affected farmers across northern Uganda has been prolonged dry spells with consequences of heat and water stress leading to reduced yields. Shifting onset of rains is also posing challenges to farmers with unpredictable rainy seasons making it difficult to plant in time. This puts farmers in a vulnerable position, jeopardizing food security for many.

Climate Smart Agriculture (CSA) is an approach to overcome existing barriers in achieving food security, adaptation of agriculture to climate change and mitigation of greenhouse gas (GHG) emissions. Climate Smart Agriculture is a key aspect for Uganda in achieving its national commitments summarized in the Nationally Determined Contribution (NDC) towards achieving the goals of the Paris Climate Change Agreement.

To address some of these challenges, the GIZ - Rural Development Programme (PRUDEV) as a bilateral programme of the Ugandan government and the German Federal Ministry for Economic Cooperation and Development supports the agriculture-based development of the rural economy in selected regions of Northern Uganda. Part of the PRUDEV programme is the European Union co-funded “Promotion of Climate Smart Agriculture” (ProCSA) that focuses on strengthening the rural population against the effects of climate change through climate-smart agriculture (CSA).

This training manual serves as a reference and guiding document for farmer cooperatives and community-based trainers (CBTs) when teaching farmer groups and applying CSA practices.

Many have contributed to the development of this Manual. We extend our gratitude to the Ministry of Local Government, the District Local Governments in the districts of Agago, Amolatar, Dokolo, Kitgum, Lira, Oyam and Napak, the over 200 Community-based Trainers, individual farmers and all other stakeholders that have given their feedback and are using the manual. Appreciation for the technical input to the Manual goes to the Agency for Sustainable Rural Transformation (AFSRT), International Institute for Rural Reconstruction (IIRR), Uganda Landcare Network (ULN) and UNIQUE forestry and land use GmbH.

PRUDEV looks forward to continuing the collaborative engagement with all our partners as we work towards empowering smallholder farmers in strengthening their resilience against negative effects of climate change.

Thank you,



Luigina Blaich

Head of Rural Development Programme



INTRODUCTION

Why this manual?

Climate Smart Agriculture (CSA) is an approach to overcome existing barriers in achieving food security, adaptation of agriculture to climate change and mitigation of greenhouse gas (GHG) emissions. Climate Smart Agriculture is a key aspect for Uganda in achieving its national commitments summarized in the National Determined Contribution (NDC) towards achieving the goals of the Paris Climate Change Agreement.

This reference manual aims to address these challenges by providing community-based trainers and farmer cooperatives with a comprehensive set of tools to empower farmers to make climate smart production decisions, adopt CSA practices and install demonstration plots.

It should be noted that CSA approaches are site and context specific. Agricultural production systems vary between regions, and climate change affects each area and each farm in different ways. While there is no one-size-fits-all solution, some general principles should be followed, and specific examples presented can be adapted by trainers and farmers to suit their particular circumstances.

Structure and outline of the manual

The training manual is modular, giving options to trainers and farmers to select depending on their knowledge, interest, and local agroecological conditions.

This training manual opens with an extensive list of facilitation and training methods that can be used to implement the course. This is followed by training chapters – each consisting of various training module options – that present CSA and resilience enhancing measures suitable for farmers in Uganda.

Each module clearly sets out the aims and methods of the learning component (that is, the learning objectives of the module and the required time and materials), followed by the stepwise training content, including its link to climate change and CSA. A summary of key messages is presented at the end of each module to help participants recap learning.





ABBREVIATIONS AND ACRONYMS

GHG GreenHouse gases

LSB Local Seed Businesses

CSA Climate Smart Agriculture

FAO Food and Agriculture Organization

IPM Integrated Pest Management

GALS Gender Action Learning System





MODULE 1:

Training Methods and Approaches

INTRODUCTION

The challenge of climate changes is multifaceted and therefore offers opportunities for continued community learning for smallholder farmers. Community based learning is therefore crucial and should be conducted in a free and conducive environment. Community based trainers must therefore set an environment to facilitate this learning that happens in an out-of-class informal setting. The trainer must therefore understand the participatory nature of learning and employ flexible methods to actively engage and maintain the interest of men and women participants. The trainer should further appreciate the importance of appropriate people skills to manage and deliver gender-sensitive training in the context of Climate Smart Agriculture (CSA).





MODULE OBJECTIVES

At the end of this module, the men and women Community-based Trainers and community facilitators will;

- Learn and practice various participatory farmer training methods.
- Understand which methods to apply flexibly in different contexts.
- Develop increased knowledge and skills in organizing, planning, and conducting gender-sensitive training and meetings on CSA practices.
- Support the active engagement of both men and women farmers in CSA and help increase their training participation and their adoption of CSA practices.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Brief warm-up and introduction session

Session 2: Understanding the role of a facilitator and facilitation skills

Session 3: Planning and implementation of gender-sensitive training



Estimated time

Approximately 7.5 hours



Location

Classroom and fields



Training materials

Flip charts, cards, chalk, marker pens, overhead projector, and stationery. Require training tools for learning, demonstrating, or practicing

SESSION 1

Brief warm-up and introduction session



FACILITATOR'S GUIDELINES



ACTIVITY 1: 'THREE WORDS' ICEBREAKER

- Ask participants to say their names and come up with three words they associate with the topic of teaching methods or community facilitation.
- Mention your expectations for the session and anything else that may be relevant.

Establish participants' understanding and expectations of facilitation

- After the group introductions, have everyone seated in a circle or in any way that allows them to see and hear each other freely. You should stand in a position where you have a clear view of all the participants.
- Have a dialogue on facilitation with both male and female trainer participants making sure to record key points on a flip chart. Use a different flip chart to note down open questions and open points of discussion and make sure to come back to them at the right moment.

SESSION 2

Understanding the Role of a Facilitator and Facilitation skills



FACILITATOR'S NOTES

What is the role of a facilitator?

A “Facilitator” helps participants learn from the activity and makes things easy. A facilitator:

- Serves as a coordinator and organizer of small groups and ensures everyone participates and stays on task.
- Supports mobilization of farmers, coordinates and organizes group meetings, and facilitates group training.
- Guides participants through a learning process, recording ideas and reading them back.
- Encourages group members to learn together and implement what is learned.
- Ensures men, women, and youths access training services equally.





The Basic Facilitation Do's and Don'ts

Things an effective facilitator should do;

- **Be confident.** Be conversant with the facilitation material before starting the training. Speak clearly and show enthusiasm while facilitating.
- **Use humor, stories, and examples** directly related to the training session.
- **Select appropriate methods and techniques** that meet the needs of the group. Use numerous fun energizers and icebreakers.



Provide breaks. Provide 10 minutes for settlement after arrival at the training venue and short breaks and “energizers” during training will allow time for internalization and appreciation of new ideas, knowledge, skills, practices, and innovations.

- **Observe individual participation** and involvement during exercises and evaluate the group's needs. Ensuring active participation, particularly from the more reserved members, women, youth, and minorities. Motivate participants to open up.
- **Use of attentive body language** such as nodding, smiling to be supportive of participants, and encouraging their responses with positive comments.

Things facilitators should not do:

- Facilitating while **reading from a smartphone** or manuscript.



Going off-topic, such as telling inappropriate, irrelevant, or offensive stories or talking too much about your personal life and experiences.

Being too dominating. Do not push personal agendas and opinions as the “right” answer or generally talk too much and dominate the process with your views.

- **Downplaying people's ideas** or allowing people to bully others in the group.





Enhancing trainers' moderation skills

The outcome of any meeting will largely depend on how a facilitator leads and moderates group discussions. Below are some tips on how you can effectively moderate a group meeting:

- **Ask open questions** to engage participants, draw from their own experiences, and examine new ideas.
- **Wait at least 8 seconds** for an answer after asking an open question.
- **Listen carefully** to all responses and ask for further clarification or an example.
- **Affirm all answers.** Learners need to know that every response, regardless of how strange or different, is heard and even appreciated for what it is.
- **Encourage cross-group-talk.** The facilitator needs to encourage participants to answer and re-respond to each other's ideas and questions.



SESSION 3

Planning and implementation of gender-sensitive training



FACILITATOR'S NOTES

Key considerations for implementing CSA training sessions with the increased active participation of women and men

1. Awareness creation on CSA meetings/training/learning demonstrations among women and men.
2. Mobilization/invitation of women/men/youth to attend CSA meetings/training/ demonstrations Ideas: make specific invitations by word of mouth at the household and individual level.
3. Preparations for meetings/training/demonstration to enable all the gender categories to attend.
4. Prepare interactive training materials, for example, visual charts, audio, and videos

Evaluating the overall training session

Make sure to carry out a short evaluation by the participants. This will help you to see which training content and method were well received and which one was not. A suitable method is to list the topics you covered in the module and ask participants to evaluate using the '5 smiley' matrix (see example in the following table). This is done relatively quickly and gives you an idea about participants' perceptions.

Ask participants to mark each topic in their assessment. Do not watch participants while they do it to guarantee anonymity.

					
Topic					
Venue					
Facilitator					
Topic 1					
Topic 2					
Topic 3					



MODULE 2:

Climate Change, Causes and Effects

INTRODUCTION

Climate change is happening right now in Uganda. The onset and duration of rains are more unpredictable during the rainy season, which is supposed to last from March to June, resulting in drought and decreased rainfall has been reported to come in more intense and destructive downpours, resulting in floods, landslides, and soil erosion, particularly near the end of the year. This module aims to help rural farmers in Northern Uganda and the Karamoja region understand the role of climate in their lives and the impact of climate change on their livelihoods and food security.



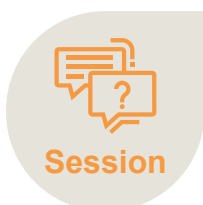


MODULE OBJECTIVES

At the end of this module, the men and women participants will,

- Gain an understanding of the basic climate related terminologies.
- Appreciate the causes and effects of climate change on Agriculture and Food security.
- Understand the relevant strategies for climate change adaptation and mitigation.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session 1: Definition of Basic Climate Related Terminologies

Session 2: Causes and Effects of Climate Change on Agriculture and Food Security

Session 3: Relevant Strategies for Climate change Adaptation and Mitigation

Session 4: Hazard mapping and identifying coping strategies



Approximately 7.5 hours



Lead Farmer's Home



Training flip charts on climate change, manila papers, stones, sticks, pens and pencils

SESSION 1

Selected Agronomic practices and their contribution to Climate-Smart Agriculture



ACTIVITY 1 INTERACTIVE SESSION: GROUP ACTIVITY

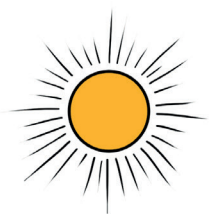
Divide the participants in four groups (two for men and two for women). In a general group discussion, explore the kind of gender differentiated changes they have observed over time within their farming systems in terms of seasonality, rainfall patterns, prevalence of climatic risks. In a plenary, share the answers and from the group responses generate the basic terminologies that relate to climate change.



FACILITATOR'S NOTES

What is weather?

Weather is the state of the atmosphere at a specific location and time. Weather can change within a very short period, even within the same day. The following are some weather elements;



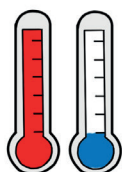
Sunshine



Rain



Cloudiness



Temperature



Humidity



Wind



What is Climate?

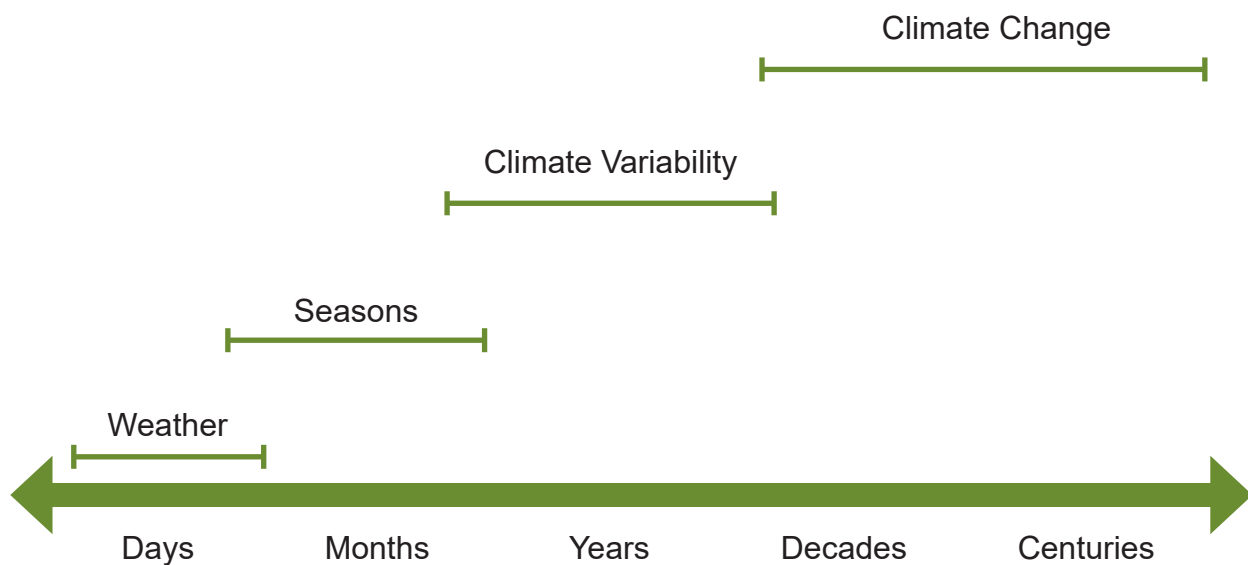
When weather elements are observed at a specific location over several years, they constitute a pattern that determines the climate of that location. Climate not only constitutes long-term average temperatures and precipitation, but also other weather events (heat waves, cold spells, storms, floods and droughts) that occur, how frequently they occur, how long they last, and their intensity.

What is Climate Variability?

Climate variability refers to the degree to which various elements of climate (such as temperature and rainfall) deviate from the average. It includes natural fluctuations and changes in the climate that last longer than a single weather event and may include the occurrence of extreme events. It reflects

What is Climate Change?

Climate change refers to changes in long-term shift in the average climate conditions over time (at least 30 years); this means the long-term changes in the typical rainfall, temperature, and wind conditions at a given time of the year, as depicted in the figure below. These changes begin with days, months and through to centuries.



Climate Scale - Weather, Seasons, Climate Variability and Climate Change



Causes and Effects of Climate Change on Agriculture and Food Security

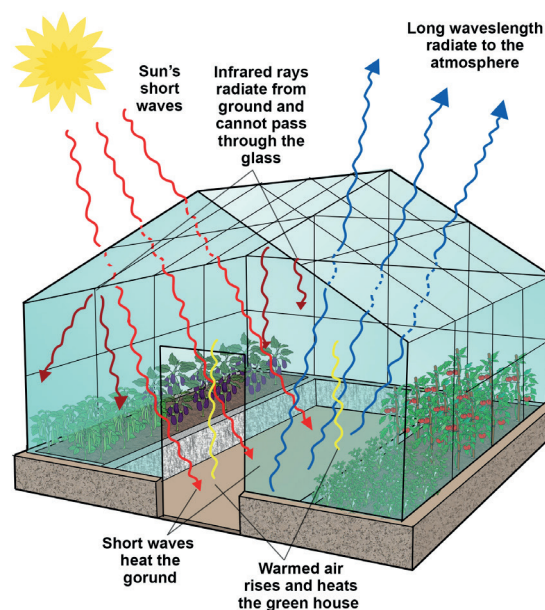
ACTIVITY 2 INTERACTIVE SESSION: PEER TO PEER

- Take a walk with the person next to you and have a conversation on your past experience with long-term changes in rainfall and temperature over the past five years? Ten years? Since you have lived in this village?
- On individual flash cards, write down the two most important changes that have you observed and hand these over to the facilitator
- In a plenary session, the facilitator reads out some of the flashes and clusters them in them on the wall



FACILITATOR'S NOTES

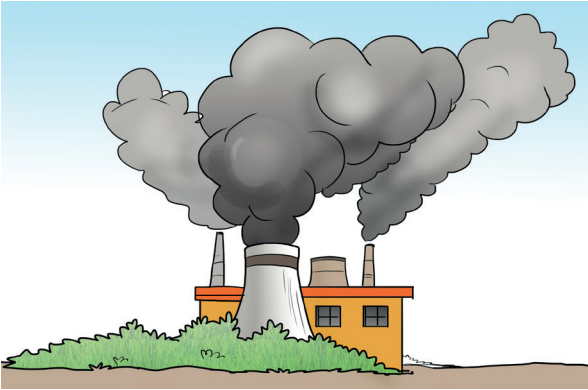
Many of the changes that you have discussed with your peer are climate change related. Climate change is primarily produced by natural processes (volcanic eruptions, wind movements, oceanic waves, etc.) and human actions that result in the accumulation of greenhouse gases (GHGs) in the atmosphere. These gases are in different kinds and exist in the atmosphere, can trap heat from the sunshine and therefore make the earth warmer than it is supposed to be as shown in the figure.



Greenhouse Effect



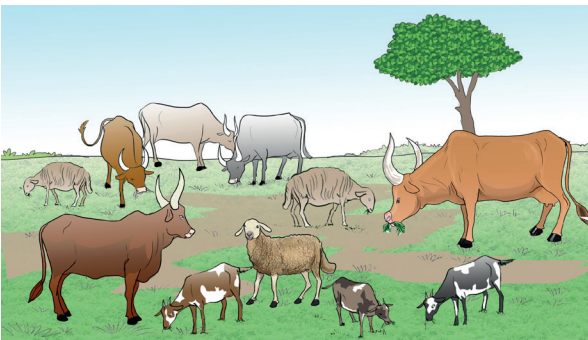
The different human activities that contribute to climate change



Burning coal and gas



Deforestation



Increase livestock farming



Fertilizer use



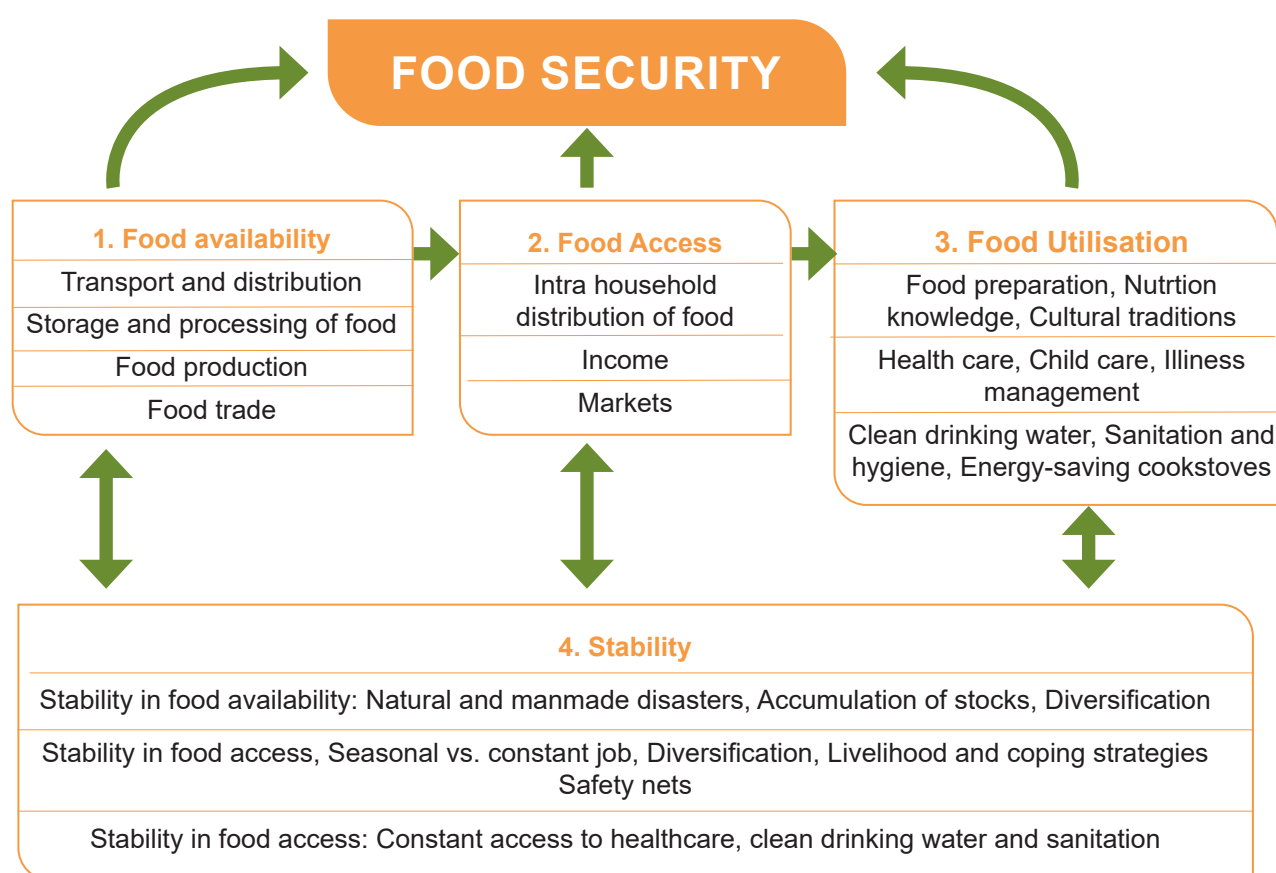
Climate Change's Impact on Agriculture and Food Security

To meet the challenge of feeding an ever-increasing population, agriculture must contend with the dangers and risks posed by climate change that have detrimental impact on agricultural production and productivity.

Some of the climate change risks include;

- Increased frequency of dry spells and drought
- Rising temperatures
- Increased intensity of extreme weather events for example floods

These risks are associated with negative impacts on the productivity of crops, livestock and forestry. With these climate risks also comes bigger impacts on food security. A well-functioning food system benefits all four pillars of food security: availability, access, utilization, and stability. Each of these four dimensions is impacted by climate change.



Source: Adapted from Burchi et al 2011 and FAO, 2014



Joint exercises: Hazard mapping and identifying coping strategies

Step 1

Divide the participants into four groups (2 groups for men and 2 groups for women). Each group should have its own spot where all the hazard mapping exercises will be aggregated. Ask the men and women participants the kind of long-term changes in rainfall and temperature that they have experienced and how these changes have impacted crop and livestock production in their villages. The groups summarize their findings on a flip chart and make a discussion in a plenary on the gender specific experiences from the men and women groups.

Step 2

Let the participants indicate the time of sowing and harvesting for enterprise 1 and other significant activities and events, such as soil preparation and weeding, calving, etc. Then, let the participants discuss what time of the year they have observed changes in rainfall and temperature. Let them indicate these changes in the respective months of the seasonal calendar. Each group then presents in seasonal calendar activities in a plenary.

Step 3

In same groups, ask the participants to discuss the severity of the climate change impacts and how this has affected their wellbeing on a rating scale of 1-5 (where 1 is minimal impact and 5 very severe impact). On a flip chart, each group make a summary of their findings and makes a presentation in a plenary.

Hazard	Impact	Coping Strategies	Effectiveness	Sustainability
Drought	- crop dies - Garden become dry - Low animal production	- Planting tolerant crops - Use of farm activities - Intercropping - Planting in wetland - Buying...	2 2 2 3	3 2 2

PROBLEMS	CAUSES OF PROBLEMS	WHO IS AFFECTED	WHAT DO THEY DO IF AFFECTED
Floods	Digging of wetland Human settlement in the wetland	Farmers near wetland Animals	Digging of water channels Re-settlement Use of sand bank
Low rainfall	Deforestation ester charcoal burning brick making cultivation etc	farmers Destruction of aquatic lives Animals	Simple irrigation Use of zero grazing (fodder) Construction of dam water harvest
Soil erosion	Cutting of trees Sand mining bricks making digging along the	farmers near travellers	Planting trees Use of cover crop Use of grass bank mulching

Step 4

In a plenary, the groups discuss what could be done to reduce the impact of climate change, focusing on the most problematic effects that the group has identified. Let the participants brainstorm about possible measures that could be taken. On a flip chart, let each group list the 5 most important measures. As a wrap up, let the facilitator introduce the different measures that will be discussed in the subsequent modules.



MODULE KEY MESSAGES

- ✓ Weather is the daily changes in a day for example rainy or sunny conditions while climate change are the long term changes in weather for a long period of time; over 30 years. Climate change is primarily produced by natural processes and human actions that result in the accumulation of greenhouse gases (GHGs) in the atmosphere. These gases trap heat from the sunshine and therefore make the earth warmer than it is supposed to be.
- ✓ Climate change has a detrimental impact on agricultural production and productivity and this ultimately affects the food status of a given household. Many climatic risks include; increased droughts, increased occurrence of floods, increased incidences of pests and diseases, increased storms, increased heat stress and humidity. These extreme weather events have several negative impacts on biodiversity and general human livelihoods.
- ✓ Climate change adaptation and mitigation are two critical measures to curb the effects of climate change. Adaptation is adjusting to climate change's current and future impacts through changes in farming practices, enhancement of knowledge and information, reduction and management of climate variability and improvement in policies and planning. Mitigation refers to lessening the severity of the effects of climate change by preventing or reducing the destructive human activities within the farming system to reduce, avoid and remove greenhouse gases.



REFLECTION EXERCISE FOR PARTICIPANTS

Now that you have an idea about climate change, its adverse effect on agriculture and food security and the strategies on how to curb the effect; develop one key message that will make a difference in your life. The men and women participants write out the key message on flash card and hang it up on the wall. As a plenary, a gallery walk is instituted so that all participants read the messages of other participants.





MODULE 3:

Climate Smart Agriculture

INTRODUCTION

Climate-Smart Agriculture is one of the advanced responsive options to climate change used Globally and in Northern Uganda. Climate-smart agriculture (CSA) is an integrated approach of managing landscapes that address the interlinked challenges of food security and accelerating climate change at the same time. It has three goals in mind: Increasing agricultural productivity to support equitable increases in farm income, food security, and development; Adapting and strengthening agricultural and food security systems to climate change on multiple levels; and reducing greenhouse gas emissions from agriculture (including crops, livestock, and fisheries).



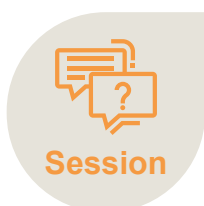


MODULE OBJECTIVES

At the end of this module, the men and women participants will,

- Gain a basic understanding of climate Smart Agriculture.
- Understand of some of the gender dimensions around Climate-Smart Agriculture.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Understanding Climate Smart Agriculture

Session 2: Gender and Climate-Smart Agriculture

Session 3: Gender-sensitive CSA planning and strategy development



Estimated time

Approximately 7 hours



Location

Farm Field



Training materials

Flip charts, markers, notebooks, teaching aids with pictorial illustrations of practices

SESSION 1

What is Climate Smart Agriculture?

ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING

Brainstorm with the participants the meaning of the term Climate-Smart Agriculture. Make sure that both men and women participants agree on a single definition and then ask them to translate it into their language.



FACILITATOR'S NOTES

Climate-smart agriculture (CSA) may be defined as an approach to transforming and reorienting agricultural development under the new realities of climate change (Lipper et al., 2014). The most used definition is provided by the Food and Agricultural Organisation of the United Nations (FAO), which defines CSA as “agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces or removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals.” In this definition, the principal goal of CSA is identified as food security and development (FAO 2013a; Lipper et al. 2014), while productivity, adaptation, and mitigation are recognized as the three interlinked pillars necessary for achieving this goal. Climate-smart agriculture is anchored on three pillars.



Productivity: Climate-smart technologies and practices can help maintain or sustain agricultural productivity amidst a changing climate. Maintenance and sustenance of agricultural productivity ensure food and nutritional security of households, making it one of the pillars of CSA.

Source: FAO, 2019

Adaptation: Technologies and practices used to adjust to actual or expected climate change and its effects help enhance the resilience of households, communities, and landscapes to climate change, thus making adaptation another pillar of CSA.

Mitigation: CSA can help reduce agriculture's contribution to climate change by reducing GHG emissions or completely removing them. Any action that helps to reduce GHG emissions is dubbed mitigation.

It is important to note that CSA systems include different elements, as shown in the following illustration:



Note that climate smart agriculture systems are very different from conventional agricultural intensification systems.

ACTIVITY 2 INTERACTIVE SESSION: BRAINSTORMING

Discuss the differences and similarities between CSA systems and conventional agriculture intensification systems with both men and women participants



SESSION 2

Gender and Climate-Smart Agriculture



ACTIVITY 3 INTERACTIVE SESSION: BRAINSTORMING

Ask the men and women participants the roles that men and women perform in farming and the specific challenges the community faces in adopting CSA practices. Summarize the answers on a flip chart and introduce the concept of gender and gender equality. Explain the significance of the two concepts in the adoption of climate smart agriculture.



FACILITATOR'S NOTES

Gender is critical to adoption of CSA practices that help both female and male farmers increase their agricultural production and productivity and contribute to better incomes and livelihoods while also contributing to climate change mitigation and adaptation. Two terms, gender and gender equality therefore become very pertinent.

Gender refers to 'masculine and feminine – that is, to qualities or characteristics that society ascribes to each sex. People are born female or male, but they learn to be women and men. Perceptions of gender are deeply rooted, and generally, in all cultures, gender determines power and resources for females and males.

Gender equality is understood as “a state in which women and men enjoy equal rights, opportunities, and entitlements in civil and political life.

It implies equal participation of women and men in decision-making, equal ability to exercise their human rights, equal access to and control over resources, and the benefits of development, and equal opportunities in employment and in all other aspects of their livelihoods.”

Taking a gender-responsive approach to CSA means that the needs, priorities, and realities of men and women must be recognized and adequately addressed in the design and application of CSA so that both men and women can equally benefit. This will contribute to increased incomes, adaptation, and nutritional outcomes for the entire household.



SESSION 3

Gender-sensitive CSA planning and strategy development

ACTIVITY 4 INTERACTIVE SESSION: BRAINSTORMING

Ask participants to discuss how gender determines their responsibilities both within the household and in farming. How this affects decision-making processes, ownership and resource utilization, benefits sharing, and access to inputs and information in their own lives. Be deliberate to ask men and women respondents. Summarize the answers on flip chart and bring out the unique strengths, interests and challenges that shape the above processes.

Step 1

Introduce the idea of developing a gender-sensitive strategy and action plan using the **'Vision Road Journey'** following the Gender Action Learning System (GALS) methodology.



Farmers displaying their Vision Road Journey developed basing on the GALS methodology

Step 2

Divide the participants in 4 groups (two for men and two for women) allow participants to verbalize their thoughts and understanding of household planning dynamics from a gender lens. These thoughts should be summarized on a flip chart and present in a plenary. Your role as the trainer will drive home the point that the opinion or vision of each community member, regardless of gender, is of importance and that a shared vision toward prosperity and agricultural productivity within the community, irrespective of household or gender differences, is the best way towards success. The community must jointly develop a shared vision, phrased as an action

Step 3

In the same group, request the participants to develop a gender sensitive CSA strategies using the following key questions

1. Who in your household would be involved in implementing the steps under these CSA practices? As much as possible, consider each step of the process (i.e., acquiring seeds/material, planting, maintenance, harvest, storage, sales, etc.), not the practice as a whole.
2. Would the additional workload be distributed evenly among men and women?
3. If not, what could be done to make the adoption of the CSA practices manageable for all household members involved?
4. What do you need to make this happen?
5. If you lack specific resources, are you able to borrow or secure these through your spouse/family/farming group/community?
6. What will be the outcome of these activities, and what impact will this have on your life and your household?

Step 4

In a plenary, Invite participants, particularly women, to present highlights from their strategy, e.g., what challenges they focused on, their proposed solutions for overcoming them, and what kind of cooperative efforts were agreed upon. Allow sufficient time for questions and answers to encourage knowledge exchange. Ask participants how they plan to ensure “social resources” such as farmer groups and public extension services.



MODULE KEY MESSAGES

- ✓ Climate smart agriculture is a way of managing landscapes that helps farmers, livestock and crops adapt to the effects of climate change and, where possible fight it by reducing greenhouse emissions from agriculture. At the same time, it takes into account the growing world population to ensure food security
- ✓ Adopting gender-responsive CSA practices and technologies will enhance productivity (food security), adaptation (resilience), mitigation (reduction of GHGs) among both men and women farmers. Men and women need work together within their households and at the community level to reap benefits from CSA.



REFLECTION EXERCISE FOR PARTICIPANTS

Ask participants to reflect on their farming activities and experiences at individuals, household and community level. Using the Vision Road Journey under the GALS methods, develop your individual level gender strategy to adopt the CSA practices



MODULE 4:

Agronomic Management Practices

INTRODUCTION

Agronomic management practices are agricultural practices that are generally associated with field crop production, such as soil management, cultivation, and row cropping, among others. When men and women farmers attempt to increase agricultural productivity, factors such as climate, roots, moisture, weeds, pests, fungi, and erosion can all pose significant challenges. This module will teach you about several agronomic practices.



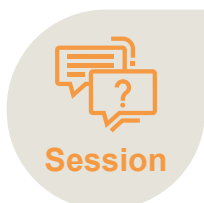


MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- Learn about and appreciate various agronomic practices and their contributions to Climate-Smart Agriculture.
- Learn about and demonstrate an intercropping strategy that, among other things, can tackle the Striga weed and cereal stem borer moth problem in the area.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Selected recommended agronomic practices and their contribution to Climate-Smart Agriculture.



Estimated time

Approximately 3 hours



Location

Farmer Home



Training materials

Flip charts, marker pens, notebooks, teaching aids with pictorial illustrations of practices, a nearby field, maize or sorghum seed, Bracharia grass or Napier grass, desmodium silver leaf, compost, farm yard manure, triple superphosphate.

SESSION 1

Selected Agronomic practices and their contribution to Climate-Smart Agriculture



ACTIVITY 1 INTERACTIVE SESSION: GROUP ACTIVITY

Divide the farmers in two groups of men and women farmers. In the groups, the men and women discuss the crop production practices that they use to ensure healthy crops, increased yields, and adaptation to climate changes. On a flip chart in plenary, summarize a few practices together with the men and women groups, evaluate whether they are climate smart.



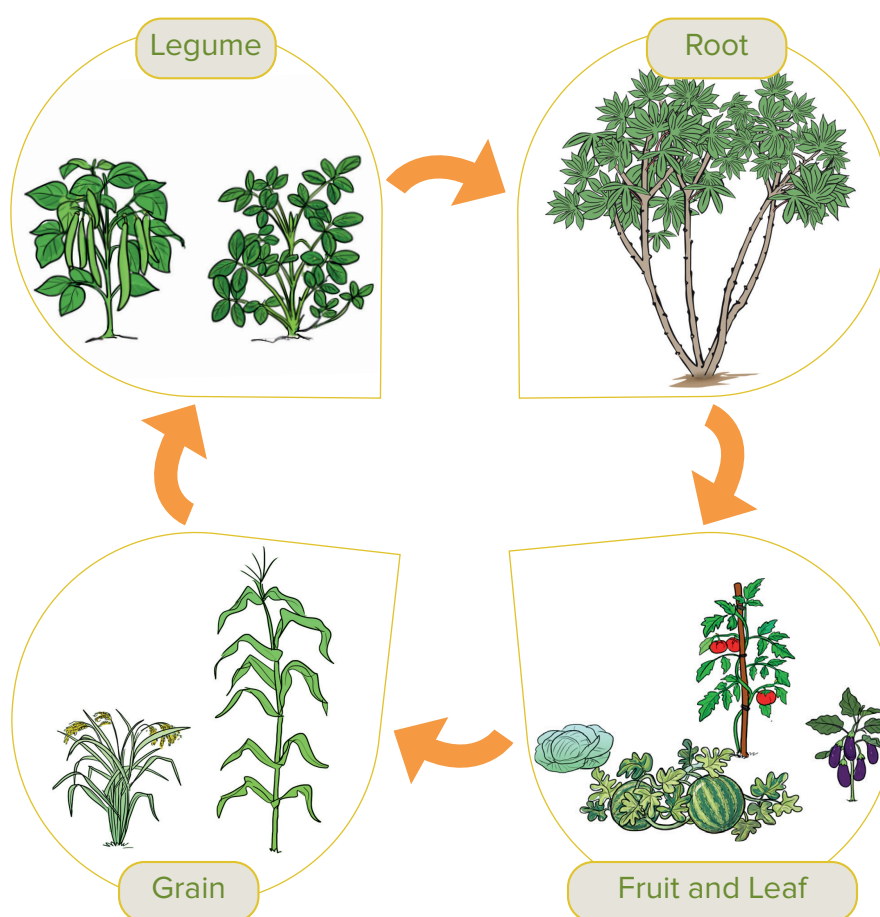
FACILITATOR'S NOTES

Some Agronomic Practices	Benefits
Improved land clearance	Reduces the amount of greenhouse gases released into the air and retain or build up the organic matter in the soil, thus boosting its fertility and water holding capacity
Early cultivation and planting	Increases the chances of a crop reaching maturity before the rains end, and enables more water to become available which increases yields.
Improved crop varieties	Improves fast maturity, high yielding, and generally more tolerance of crops to pests and diseases.
Crop rotation	Controls the build-up of pests, weeds, and diseases and ensure that root systems explore the soil to different depths—recycling nutrients.
Intercropping	Enhances nitrogen-fixation, intensification, and increased yields of two crops

Common Agronomic Practices and their Benefits

Crop Rotation

Crop rotation is the repeated planting of a sequence of crops in the same field in a set order throughout a cropping season or years of cropping. It can be done once or many times per year. This activity is essential to prevent the accumulation of pests, weeds, diseases, and pesticides and guarantee that the root system explores the soil to various depths. Suitable crops for use in rotations are summarized in the figure.



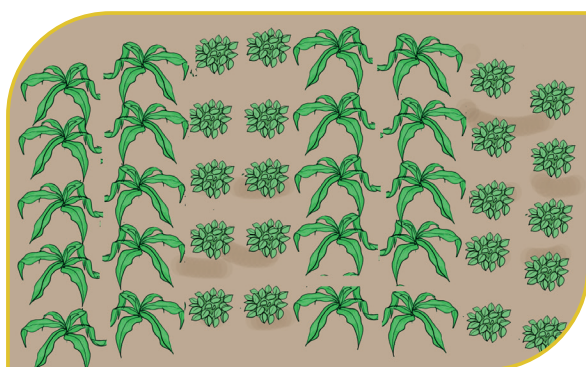
Benefits of Crop Rotation

- **It improves the soil structure and reduces depletion or erosion:** Some crops have solid and deep roots. They can break up hardpans and tap moisture and nutrients deep in the soil. Others have many fine, shallow roots. They tap nutrients near the surface and bind the soil.
- **It increases soil fertility:** Legumes (such as groundnuts and beans) fix nitrogen in the soil. When their green parts and roots rot, this nitrogen can be used by other crops such as maize.

- **It helps control weeds, pests, and diseases hence reducing reliance on synthetic chemicals:** Planting the same crop season after season encourages certain weeds, insects, and diseases. Planting different crops break their life cycle and prevent them from multiplying.
- **It produces different types of output:** Growing a mix of grain, beans, vegetables, and fodder means a more varied diet and more types of products to sell.
- **It reduces risk:** A single crop may fail because of drought. Pests may attack it. Or its market price may be low when the time comes to sell it. Producing several different crops reduces these risks.

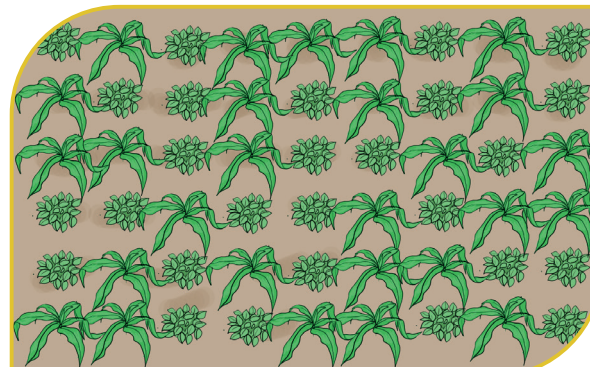
Intercropping

Intercropping is the simultaneous planting of two or more crops in the same field, such as maize and beans, maize and groundnuts, or maize and potatoes. Intercropping, also known as interplanting, generates additional income, food, and shade, fixing nitrogen and controlling weeds and soil erosion. It also provides a lot of biomass to form residues that can be returned to the soil as organic inputs. Intercropping comes in different categories as illustrated in figure.



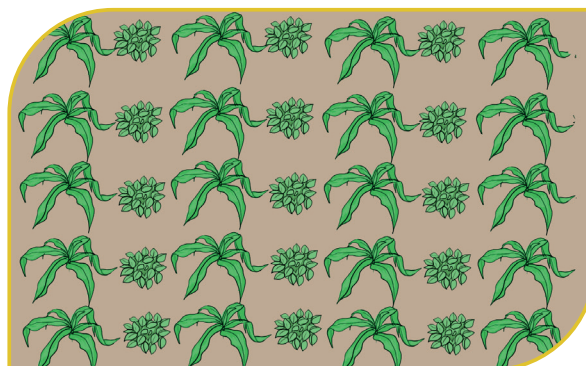
Contour Strip Cropping

Alternate strips of grasses or grain with other crops along contour on gentle slopes



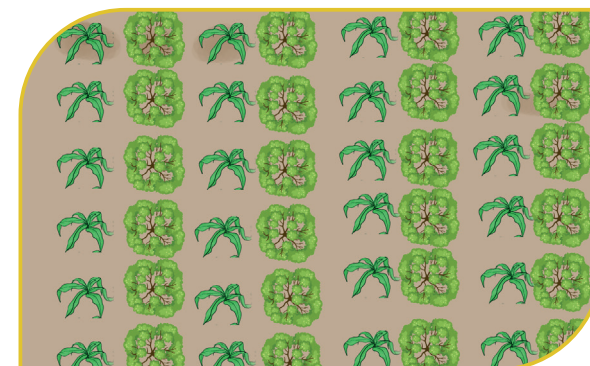
Mixed Intercropping

Basic form in which the component crops are mixed.



Row Intercropping

Component crops are arranged in alternate rows



Relay Intercropping

Practice of growing annual crops or forage between rows of trees or shrubs



The Push-Pull – An example of an effective intercropping strategy

Push-Pull is a simple cropping strategy whereby farmers use Napier grass or Bracharia grass and desmodium legume (Silverleaf or Greenleaf desmodium) as intercrops in maize or sorghum.

Desmodium is planted in between the rows of maize. It produces a smell or odor that stemborer moths do not like. The scent ‘pushes’ the stemborer moths away from the maize crop. On the other hand, Napier grass (Pennisetum purpureum) or Bracharia grass (Brachiaria cv Mulato) is planted around the maize crop as a trap plant.

Napier grass or Bracharia grass is more attractive to stemborer moths than maize, and it ‘pulls’ the moths to lay their eggs on it. But Napier grass or Bracharia grass does not allow stemborer larvae to develop. When the eggs hatch and the tiny larvae bore into Napier grass or Bracharia grass stems, the plant produces a sticky substance like glue which traps them, and they die.

So, very few stemborer larvae survive, and the maize is saved because of the ‘push-pull’ strategy. Other benefits of the practice include; nitrogen fixation, provision of fodder, soil erosion reduction, and suppression of the striga weed by the ground cover of desmodium.



Push-pull plot during 2nd season, maize and desmodium with Striga border crop. The plot is bordered by Napier grass.



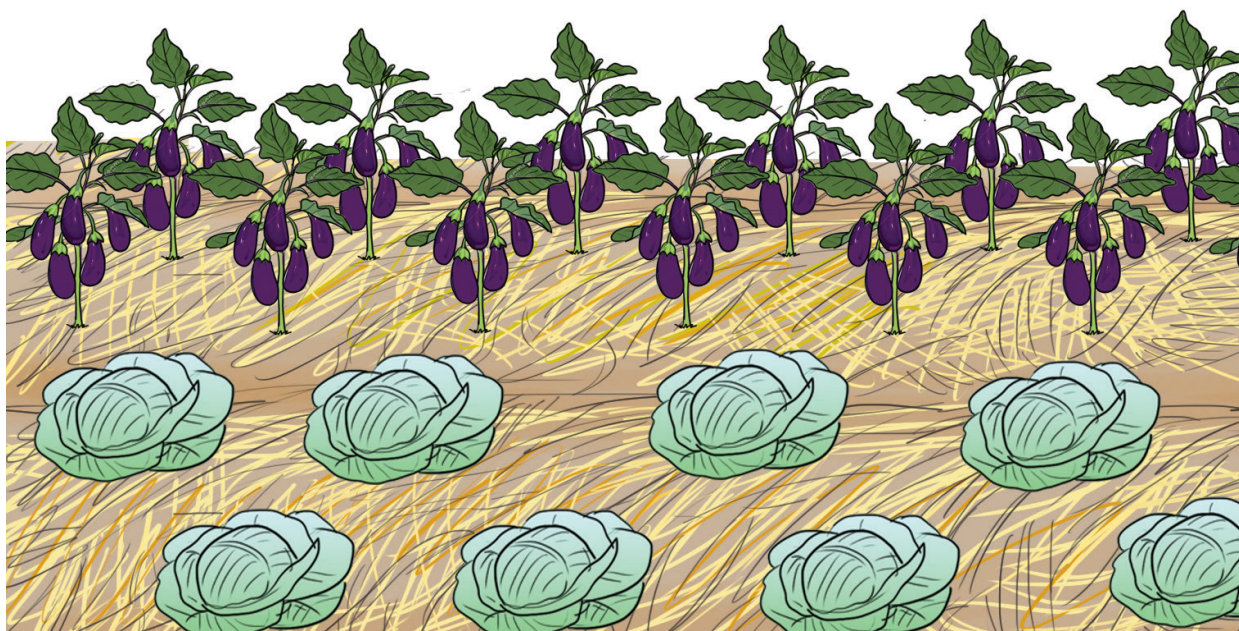


Benefits of adopting a push-pull strategy

- Increase maize yield by 25 - 30% in the areas where stemborers are the only problem. Where both stemborers and Striga are problems, you can double your maize yields.
- Increase the supply of cattle feed from harvesting Napier grass or Bracharia grass and desmodium.
- Fix nitrogen into your farm soil by desmodium legume, so you save on fertilizer costs.
- Protect your soil from erosion, as desmodium acts as a cover crop.
- Retain soil moisture, as desmodium acts as mulch.

Mulching

Mulching uses plant material such as straw, leaves, crop residues, green manure crops, saw-dust, etc., that is spread upon the soil's surface.



Mulch applied in a vegetable field





Benefits of Mulching

- **Protecting the soil from wind and water erosion:** soil particles cannot be washed or blown away.
- **Improving the infiltration of rain and irrigation water by maintaining a good soil structure:** no crust is formed; the pores are kept open
- **Keeping the soil moist by reducing evaporation:** plants need less irrigation or can use the available rain more efficiently in dry areas or seasons
- **Feeding and protecting soil organisms:** organic mulch material is an excellent food for soil organisms and provides suitable conditions for their growth
- **Suppressing weed growth:** with a sufficient mulch layer, weeds will find it difficult to grow through it
- **Preventing the soil from heating up too much:** mulch provides shade to the ground, and the retained moisture keeps it cool
- **Providing nutrients to the crops:** while decomposing, organic mulch material continuously releases its nutrients, thus fertilizing the soil
- **Increasing the content of soil organic matter:** part of the mulch material will be transformed to humus





MODULE KEY MESSAGES

- ✓ A wide range of agronomic practices exist to increase agricultural productivity and so contributes to income and food security. Crop rotation is a practice where a repeated sequence of crops is planted in the same field in a set order throughout a cropping season or years of cropping. This activity largely prevents the accumulation of pests, weeds, diseases, and pesticides, improves soil structure and enhances soil fertility. A farmer may also intercrop with two or more compatible crops for greater income, food and soil health.
- ✓ A farmer needs to be conscious about the simultaneous crops in the intercrop to curb competition for nutrients. Compatible crops in the intercrop are usually legumes, cereals, tubers and other root crops. The intercrops may be arranged as alternating strips, rows, mixed or in relay allies.
- ✓ The push and pull is an intercropping strategy where different fodder crops are intercropped with cereals. The fodder crops are used as trap plants of the stem borer which is an important pest in most cereals. Other benefits of the practice include; nitrogen fixation, provision of fodder, soil erosion reduction, and suppression of the noxious weeds.
- ✓ Mulching uses naturally available plant to cover the soil surface and protect the soil from erosion and evaporation, nourishes soil life, increases soil organic matter content, and provides nutrients to the crop. Mulching also improves the water infiltration and if used in sufficient amounts can suppress weed grow. Mulching should be applied with caution for it is a habitat for many dangerous pests and diseases. Though mulching uses readily available materials, it is labour intensive and may increase drudgery for the already busy time schedules of women farmers.



REFLECTION EXERCISE FOR PARTICIPANTS

Divide the participants in four groups (two for men and two for women). In a group discussion come up with a feasible household plan on how to equitably allocate labour to enhance the use of mulching in their fields. Each group presents its plan and both men and women participants use the plans to develop their own plan for equitable labour allocation during mulching in their own field.





MODULE 5:

Use of Quality Seed and Planting Materials

INTRODUCTION

It is impossible to grow good crops from bad seeds. As a result, quality seeds and planting materials of well-adapted varieties are essential inputs for climate-smart crop production. Under changing climate conditions, quality seeds and planting materials of locally adapted and improved varieties are critical to overall crop production. Improved varieties have been studied and tested for unique qualities such as increased yields, reduced fertilizer requirements, resistance to climate change, and increased soil carbon. Local types are genetically more diverse, making them more resistant to climatic variation, pests, diseases, and other moisture and temperature stresses.





MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- Understand and appreciate the importance of using quality, stress-tolerant seed types and planting materials as a driver for Climate Smart Agriculture in their communities.
- Learn about the operations of local seed businesses and community seed banks in their neighborhoods and come to appreciate the opportunities these businesses and seed banks provide.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Stress tolerant local and improved seed varieties.

Session 2: Local Seed Businesses and Community Seed Banks



**Estimated
time**

Approximately 9 hours



Location

Under a tree, or a classroom setting



**Training
materials**

Flip charts, marker pens, Variety of seeds, Community seed bank, teaching aids with pictorials

SESSION 1

Stress tolerant local and improved seed varieties

ACTIVITY 1 INTERACTIVE SESSION: GROUP ACTIVITY

Divide the participants in four groups according constituting of 2 men and 2 women groups. Ask the group members to make a list of the crops that they commonly grow and why the crops are important and write them on a flip chart. Provide specimens of some of the commonly grown crop and ask the participants to identify these varieties. In a plenary, share the answers.

ACTIVITY 2 INTERACTIVE SESSION: GALLERY WALK

Ask the men and women participants to walk around the “classroom” and see if any of the crops that has been listed and the seed they have observed can withstand harsh conditions. Let them write the name of the crop/seed and their note books and include any other crop/seed that they know is tolerant to harsh conditions.





FACILITATOR'S NOTES

Introduction to stress-tolerant seed varieties

Stress-tolerant varieties are an essential adaptation strategy to climate change and are thus climate-smart. Stress tolerant varieties can be traditional varieties that are well adapted to local conditions (but are sometimes “forgotten”) or new or improved varieties resulting from plant breeding or even genetic modification.

Enhanced varieties have undergone extensive research and testing to ensure unique characteristics. You could, for example, switch to stress-tolerant varieties, which are (more) resistant to drought, heat, flooding, wind, or diseases, thereby improving your adaptive capacity. They can increase yields, use less fertilizer, withstand the effects of climate change, and increase soil carbon. Local varieties are more genetically diverse, making them more resistant to climatic variation, pests, diseases, and other stresses.

Understanding some important terms

Stress tolerant varieties have proven to better cope with stresses such as drought, diseases, pests, salt or pH sensitivity, winds, or any other external factor than different varieties. This does not mean that they are resistant to this kind of stress, but they are less affected than other varieties. Specific examples include:

- **Locally adapted or traditional varieties** are crops that farmers usually grow that are suitable for local conditions (proven successful in their area) and are more resistant to drought or diseases. They are generally cheaper than improved varieties, require fewer fertilizer inputs and a good strategy to cope with climate change.
- **Drought-tolerant varieties** are crops that survive under dry conditions better than other varieties. Farmers have tested these crops and varieties and report good production even during periods of drought.
- **Short-season varieties** can mature and produce a decent yield in a shorter period than others. Under climate change conditions, this has an advantage when rainfall patterns become less predictable.
- **Early maturing varieties** allow you to take advantage of the short rain season, during the first rains or second rains and secure a crop.
- **High-yielding varieties** are crops that have been developed through professional breeding programs on research stations or through genetic modification. Usually, the seeds are expensive and need fertilizers and careful treatment. This may be a good option if you can invest in these seeds and the required inputs. Otherwise, test different varieties and select those that can produce a high yield on your farm.



SESSION 2

Local Seed Businesses and Community Seed Banks

ACTIVITY 3 INTERACTIVE SESSION: PLENARY

Ask the men and women participants if they know of any farmers or farmers' groups producing seeds for sale in their community. Using a flip chart, ask group to list the advantages of having an LSB in their community.



FACILITATOR'S NOTES

What is a Local Seed Business?

A local seed business (LSB) is a group of farmers who can produce and market quality seeds of varieties preferred by other farmers and sustain the business through reinvesting capital and effort in the industry. Individual farmers get together in an LSB to produce and market high-quality seeds to their fellow community members. Through this, a small-scale farmer can achieve economic success by being a member of a group business, which includes the opportunity to pool resources such as labor. Furthermore, bulking seed for sale has a more significant market potential because farmers can obtain a higher price for their seeds when they sell in bulk. In addition, local seed businesses make quality seeds readily available and at a much lower cost to the communities in which they are based.



What does it take to have a successful Local Seed Business?

An LSB must be commercially oriented and capable of making investments to be sustainable. The success of local businesses are premised on four building blocks as indicated in the figure below.



The four LSB building blocks and respective success factors, ISSD Uganda 2015

What are Community Seed Banks?

Community seed banks collect, store, and manage seeds to provide seeds to community members for usage. Seeds are collected from farmers in the community and are selected and stored in accordance with the storage system that has been agreed upon. Different types of communal seed banks can be established; for example, seeds can be stored in pots in a shed or community building, in clay pots on the floor, in a family granary, or on a kitchen shelf, among other places. Farmers provide the seeds, which are then collected and kept in a community seed bank until they are needed.





ACTIVITY 4 INTERACTIVE SESSION: FIELD EXERCISE

Organize a trip to a nearby community seed bank. At the seed bank, let each individual farmer take a random walk and note the different kind of seed and storage facilities within the bank. In a plenary request a community seed bank representative to describe the key steps of setting up a community seed bank. As a wrap, ask the men and women participants to list some advantages of a community seed bank.

Importance of Community Seed Banks

- Serve as an emergency seed supply when farmers experience a shortage of seeds due to failure or destruction of crops because of floods, droughts, pests, and diseases.
- promote and sustain genetic diversity which enhance the cultivation of various crops.
- Preserve and promote agro-biodiversity, especially for women, who traditionally play a vital role in selecting and conserving seeds and increasing knowledge of traditional varieties among all community members.
- Ensure farmer seed security and improve the availability and accessibility of seeds by offering seeds at lower costs.





MODULE KEY MESSAGES

- ✓ Improved and locally adapted and stress tolerant varieties of all crops are available. Both men and women farmers need to use a variety of improved and locally adapted seeds to cope with climate change and ensure good yield and income diversification. Diversifying your farm with different crops and varieties will also enhance your resilience to climate change effects
- ✓ The use of stress tolerant cultivars offers labor saving benefits to both women and men especially during dry spells thus contributing to reduced drudgery for women. Stress-tolerant varieties can easily be obtained from groups of men and women farmers who produce and market quality seeds through viable local seed businesses. Local seed businesses must be commercially oriented and capable of making investments to be sustainable.
- ✓ Community seed banks are communal storage facilities including clay pots in a shed, floor or community building, a family granary, or a kitchen shelf, that are used to store seed that has been collected from men and women community members. Seeds within the community are collected, selected and stored by the farmers until such a time when they are required for use.



REFLECTION EXERCISE FOR PARTICIPANTS

Ask the men and women participants to list actions that can support them to establish Community Seed Banks. What kind of support do men and women require to strengthen their capacity to establish their own community seed bank? What benefits of home or communal owned seed banks for men and women farmers?





MODULE 6:

Integrated Pest Management

INTRODUCTION

As a result of climate change, an increasing number of pests, diseases, and weeds can spread and establish themselves, causing substantial agricultural damage and, as a result, cause food loss for a rapidly growing population around the world. Integrated Pest Management (IPM) is a big part of the answer. More and more people in both developed and developing countries are using IPM for long-term, sustainable farming that makes sure there is enough food to go around and doesn't use up resources that can't be replaced.





MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- Gain a basic understanding of IPM and its Principles.
- Learn about and appreciate cultural, physical, chemical, and biological pest control strategies.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Introduction to IPM and its principles

Session 2: Cultural Pest Control

Session 3: Physical Pest Control

Session 4: Biological Pest Control

Session 5: Chemical Pest Control



Estimated time

Approximately 10 hours



Location

Farmer Field



Training materials

Flip charts, marker pens, note books, training aids with visuals, nearby field

Introduction to Integrated Pest Management and its principles



ACTIVITY 1 INTERACTIVE SESSION: MINI FIELD WALK

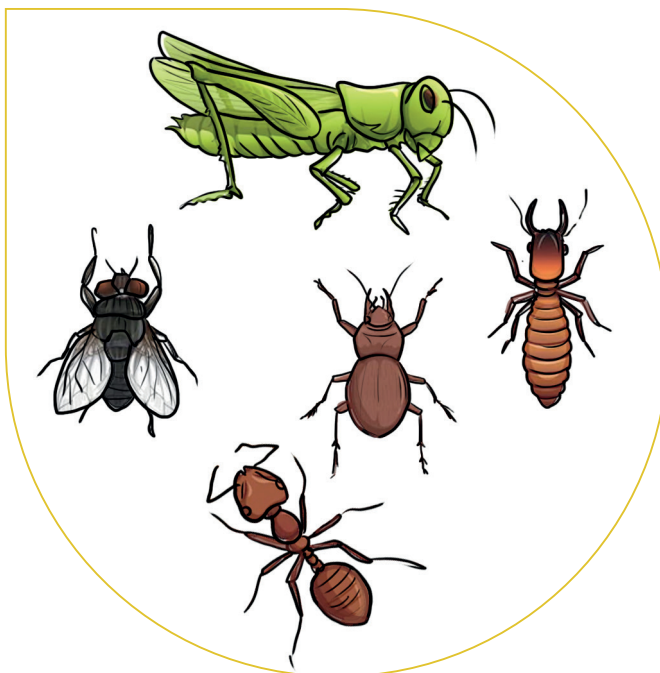
Organize a field trip to the farmer garden and identify the different insects and any other damages or symptoms of damages on the different crops. In a brainstorming plenary, ask individual men and women to share their field experiences on the insects and symptoms of damage that they have observed in the field. Ask the men and women participants what other insects and or crop damages that they have observed in their own fields. Make a summary to indicate that some of the insects and the other damages seen could have been caused by pests.



FACILITATOR'S NOTES

What is a Pest?

The term “pest” refers to an organism that lives and grows in an area where it is not wanted and causes harm to plants, humans, structures, and other organisms, especially crops that are farmed for human use. Pests can be mainly insects, fungi, plants, bacteria, and viruses.





What is Integrated Pest Management?

Integrated Pest Management (IPM) means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to economically justified levels and reduce or minimize risks to human health and the environment. IPM combines cultural, biological, and chemical measures to manage diseases, insects, weeds, and other pests for farmers. IPM is a site-specific strategy for managing pests in the most cost-effective, environmentally sound, and socially acceptable way.

Principles of Integrated Pest Management

1. **Prevention and Suppression:** Prevention is the adoption of measures to reduce the chance of the occurrence of pests. Suppression is reducing the impact of pests.
2. **Monitoring:** Methods and tools must monitor harmful organisms. Monitoring can be done through observations, a scientifically sound warning, forecasting, early diagnosis systems, advice from professionally qualified advisers, etc.
3. **Decision Making:** This is done based on the results of the monitoring. IPM focuses on threshold-based intervention in most cases. A threshold is the defined pest density, or population level, which, when exceeded, management should occur.
4. **Non-Chemical Methods:** These methods are prioritized over chemical methods to produce satisfactory results. They include biological, physical, and ecological methods.
5. **Pesticide Selection:** When the alternative methods are not adequately used, pesticides are used for pest control. The pesticides used, however, needs to be as specific as possible for the target.
6. **Reduced Pesticide Use:** Reduced pesticides use refers to the reduction in the frequency and doses of the pesticides. This method needs to be supported by other means of intervention.
7. **Anti-resistant Strategies:** IPM focuses on the anti-resistance activities as: Unmanaged and haphazard use of pesticides has created the problem of resistance and Pests have developed resistance, and the use of pesticides has a more negligible effect on them
8. **Evaluation:** Evaluation is done based on the records of the use of the pesticides, their effects, and many more. Evaluation is necessary to study further the effectiveness of the plan protective measures and plan.





Advantages of IPM

- **Lower cost intervention:** The application of IPM lessens the financial burden. Moreover, different techniques involved in IPM are more sustainable with long-lasting benefits.
- **Benefits to the environment:** IPM uses less pesticides and is therefore an eco-friendly approach which considers the effect on the environment before the application of any interventions.
- **Minimizes residue hazards of pesticides:** It is evident that in an IPM schedule, the use of pesticides will be considerably reduced; hence, pesticide residue hazards will also get automatically minimized.
- **Anti-Resistance:** The IPM model in itself is the anti-resistant mode for pest control and discourages the use of chemicals. Pesticides are used only when the other alternatives are not satisfying.

Limitations of IPM

- More involvement in the technicalities of the method: IPM needs to be planned, demands more attention and expertise in the various fields of pest control.
- Time and energy-consuming: Application of IPM is time-intensive for IPM strategies differ from region to region, a different plan is required for each region.





SESSION 2

Cultural Pest Control



ACTIVITY 2 INTERACTIVE SESSION: MINI FIELD WALK

Open the session by asking the participants the on the different cultural pest control methods they know about. Be deliberate to select men and women participants. Summarize the answers on a flip chart and the logically lead into the definition of cultural pest control.



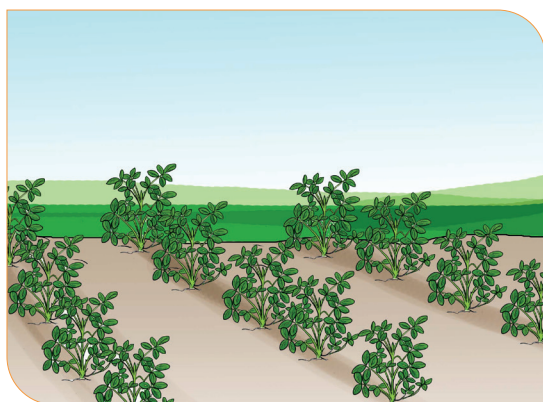
FACILITATOR'S NOTES

What is Cultural Pest Control?

In agriculture, cultural pest control is a term that refers to techniques of altering the growth environment to limit the predominance of undesirable pests. Cultural controls are practices that reduce pest establishment, reproduction, dispersal, and survival. For example, crop rotation - replacing a susceptible crop with a less sensitive crop; and changing irrigation practices - less watering can reduce root disease and weeds. Thus, we can say cultural pest control is based on the following strategies:

- Make the crop or habitat unacceptable to pests by interfering with their oviposition (lay eggs) preferences, host plant discrimination, or location by both adults and immature.
- Make the crop unavailable to the pest in space and time by utilizing knowledge of the pest's life history, especially its dispersal and overwintering habits.
- Reduce pest survival on the crop by enhancing its natural enemies or altering the crop's susceptibility to the pest.

Examples of Cultural Pest Control measures



Planting density and spacing - maximizes yield per unit area to reduce pest incidences



Mixed cropping - more than one crop is grown on the same piece of land to reduce pest population



Fertilization - promotes rapid growth and shortens the susceptible stages of plants



Pruning, defoliation, and topping - removing and destroying dead, diseased, or infested wood can significantly reduce pest populations



Mulches - natural or synthetic soil coverings may encourage or discourage pests

SESSION 3

Physical or Mechanical Pest Control

ACTIVITY 3 INTERACTIVE SESSION: BRAINSTORMING

Open the session by asking the participants on the different physical pest control methods they know about. Be deliberate to select men and women participants. Summarize the answers on a flip chart and the logically lead into the definition of physical pest control.



FACILITATOR'S NOTES

What is Physical or mechanical Pest Control?

Physical pest control is a method of getting rid of insects and small rodents by killing, removing, or setting up barriers that will prevent further destruction of one's plants.

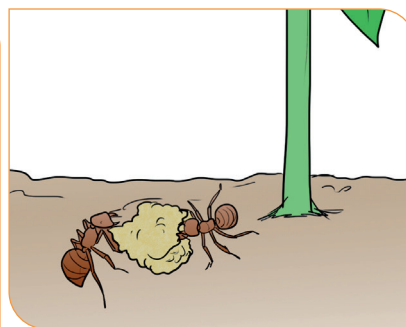
Examples of Physical or mechanical Pest Control measures



Handpicking



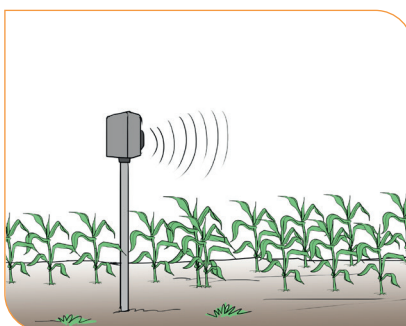
Use of hand nets and bags



Beating and Hooking



Sieving and Winnowing



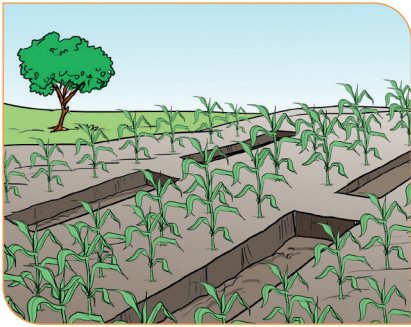
Sound Production



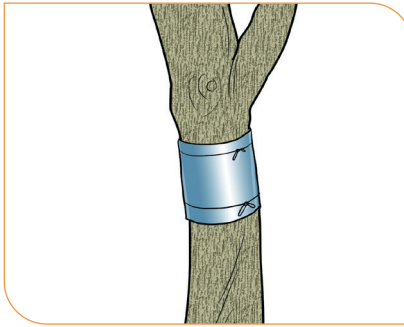
Shaking and Gnarring



Examples of Physical or mechanical Pest Control measures



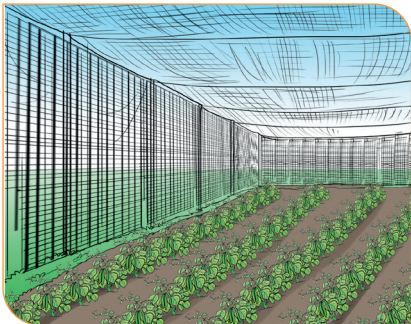
Trenching the field



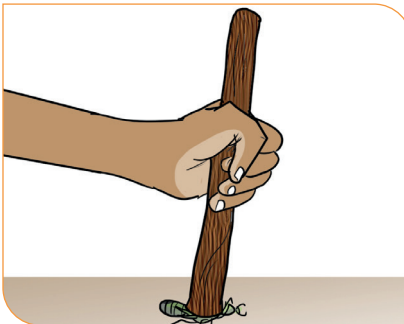
Banding the trees



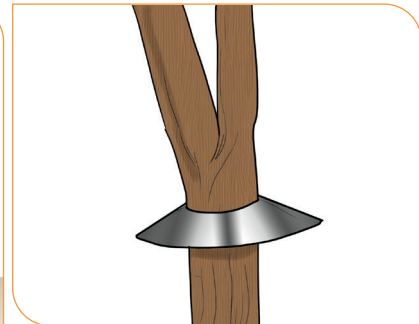
Rope dragging



Mechanical Exclusion



Crushing and Grinding



Tin collars on stems



ACTIVITY 4 INTERACTIVE SESSION: BRAINSTORMING

Open the session by asking the participants on the different biological pest control methods they know about. Be deliberate to select men and women participants. Summarize the answers on a flip chart and the logically lead into the definition of biological pest control.

What is Biological Pest Control?

Biological control or biocontrol controls pests such as insects, mites, weeds, and plant diseases using other organisms. It relies on predation, parasitism, herbivory, or other natural mechanisms but typically involves an active human management role. Recognize and distinguish beneficial insects from harmful ones, as shown in the photos below:



Lacewing larva attacking
aphid



Ladybird beetle feeding
on aphids.



Assassin attacking a lygus
bug

Source: UC IPM, 2014

Three types of Biological Pest Control measures

Importation: This involves the introduction of a pest's natural enemies to a new locale where they do not occur naturally. Early instances were often unofficial and not based on research, and some introduced species became serious pests themselves.



Augmentation

Augmentation involves the supplemental release of natural enemies in a particular area, boosting the naturally occurring populations there. In an inoculative release, small numbers of the control agents are released at intervals to allow them to reproduce an inundative release, in contrast, large numbers are released in the hope of rapidly reducing a damaging pest population.

Conservation

Natural enemies are already adapted to the habitat and the target pest. Their conservation can be cost-effective and straightforward, as when nectar-producing crop plants are grown on the borders of rice fields. Cropping systems can be modified to favor natural enemies; a practice sometimes referred to as habitat manipulation.



ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING

Open the session by asking the participants on the different chemical pest control methods they know about. Be deliberate to select men and women participants. Summarize the answers on a flip chart and the logically lead into the definition of chemical pest control.

What is Chemical Pest Control?

Chemical control refers to the application of pesticides that are chemical in nature. These chemical pesticides are used only when necessary and in conjunction with other measures to provide more effective, long-term control in integrated pest management. These pesticides are chosen and used in a manner that minimizes the potential harm they may cause to people, nontarget creatures, and the surrounding environment. As part of an integrated pest management program, you will use the most selective pesticide that will accomplish the task while also being the safest for other organisms and the environment's air, soil, and water quality; you will use pesticides in bait stations rather than sprays, and you will spot-treat a few weeds rather than spray an entire field.

Classification of Chemical Pesticides

No	Common Categories	Harms Or Kills
1	Insecticides	Insects
2	Acaricides	Ticks
3	Herbicides	Weeds
4	Fungicides	Fungi
5	Rodenticides	Rodents (rats, moles, squirrels, and porcupines)
6	Molluscicides	Snails (aquatic or water pests in the fishpond)
7	Bactericides	Bacteria
8	Nematicides	Nematodes
9	Virocides	Virus
10	Algicides	Algae
11	Miticides	Mites

Safety precautions in the use of Chemical Pesticides

Pesticides are not only toxic for pests, but pesticides are also toxic for you, your family, and your animals. Hence, there are some fundamental rules:



Wear protective gear when handling pesticides.



Store the chemicals in a safe and cool place, away from any food or fodder, and out of reach of children.



Ask your input dealer about the proper pesticide and the right way to use it.



Use the right dose and mix the product well with water.



Spray chemicals only in the early morning or late afternoon.



MODULE KEY MESSAGES

- ✓ IPM is the best combination of cultural, biological, and chemical measures to manage diseases, insects, weeds, and other pests for farmers. It considers all relevant control tactics and locally available methods, evaluating their potential cost-effectiveness.
- ✓ Cultural pest control involves alteration of the growth environment to limit the predominance of undesirable pests. The alteration may be manifested in the manipulation of plant design and management, maintenance of field sites and harvesting procedures.
- ✓ Several physical pest control methods including hand picking, use of traps, nets, sieving and winnowing, burning, sounding, crushing and grinding, amongst others, are useful for monitoring and mass trapping of pest populations such as insects, birds and rodents.
- ✓ Biological control or bio-control is a method of controlling pests and plant diseases using other living organisms or natural products coming from plants or minerals. Biological control can be done through importation, augmentation and conservation.
- ✓ Chemical pest control methods should only be used when other non-chemical methods have not been effective, but with the right safety precautions. So chemicals must be used in their right doses and stored safely to avoid potential harm to people, non-target creatures, and the surrounding environment.



REFLECTION EXERCISE FOR PARTICIPANTS

If a man or woman farmer is given unlimited integrated pest management practices, which of these would be the most appropriate given time constraints and differential access to resource by men and women farmers? Each participants should also write their answer on a flash card and pin it up on classroom surface. Be deliberate to separate the cards for men and women.





MODULE 7:

Soil Fertility Management

INTRODUCTION

Fertile soil is vital for plant growth and the production of nutritious food that meets all human nutritional requirements. Additionally, soil fertility influences some economic activities, making it a factor in economic growth and poverty reduction. Finally, effective soil fertility management can reduce soil, water, and air pollution, regulate water availability, support a diverse and active biotic community, expand plant cover, and establish a carbon-neutral footprint. On this basis, soil fertility management is a critical Climate Smart Agriculture intervention.



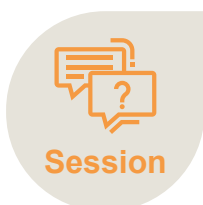


MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- Gain a basic understanding of soil fertility and soil nutrient management.
- Learn about and appreciate different soil fertility management practices and technologies relevant to enhancing soil fertility and the promotion of climate-smart agriculture.
- Understand how to practically apply the different soil fertility management practices and technologies.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Understanding some basics of soil fertility

Session 2: Use of Cover Crops and Green Manure

Session 3: Use of Animal Manure and Liquid fertilizer

Session 4: Use of Composting and the application of agricultural Lime

Session 5: Proper use of Mineral or Chemical Fertilizers



Estimated time

Approximately 13 hours



Location

Farmer Field



Training materials

Flipcharts, marker pens, teaching aids, animal manure, wood ash, greens vegetative materials, Canavalia ensiformis, Mucuna pruriens, Crotalaria juncea, Calliandra, Leucaena and Sesbania, tithonia, grasses, broadleaved weeds or any green sappy vegetation, agricultural lime, chemical fertilizers

SESSION 1

Understanding some basics of soil fertility



ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING

Ask the participants to discuss and share their understanding of the term soil fertility and later ask them what a fertile soils looks like. Be deliberate to select men and women farmers. Summarize the answers on a flip chart and the introduce the concept of soil fertility.



FACILITATOR'S NOTES

What is Soil Fertility?

Soil fertility refers to a soil's ability to support plant growth by providing required plant nutrients and desirable chemical, physical, and biological properties as a habitat for plant growth. Plant nutrients include the macronutrients nitrogen, phosphorus, and potassium and the micronutrients sulfur, calcium, and magnesium. The most common micronutrients are boron, chlorine, copper, iron, manganese, molybdenum, and zinc.

Soil Nutrient Management?

Soil nutrient management is the process of maintaining or enhancing soil fertility. It is done using the nutrients already in the soil or by adding nutrients from external sources, both organic and inorganic. A common framework for approaching nutrient management is known as the “**Four Rs**”:

- Right amount - the proper rate of application
- Right source - applying the proper type
- Right placement - using the appropriate method for application
- Right timing - applying at the correct time in the lifecycle of the system

Nutrient deficiency or hunger signs in crops

If plants do not get enough of a particular nutrient they need, the plants can grow stunted, unable to blossom or bear fruit, discolored, or even die. Symptoms show in the general appearance as well as in the colour of the plants.

**ACTIVITY 2 INTERACTIVE SESSION: BRAINSTORMING**

Ask the participants to discuss and share their understanding of the terms cover crop and green manure. Be deliberate to select men and women farmers. Show the participants photographs of cover crops and green manure and then discuss the benefits of cover crops and green manure and how they can relate to climate-smart agriculture.

**FACILITATOR'S NOTES****What is Green Manure?**

Green manure refers to plants planted to improve or protect the earth thereby increasing the level of nutrients and organic matter in the soil. They can also be used to break disease cycles since they cover the ground and contain helpful microorganisms. These plants also limit the growth or spread of weeds by covering the ground. It is also possible to clip the plants and set them on the compost heap.

Cover Crops

Cover crops, also known as nitrogen-fixing crops, are either leguminous or non-leguminous crops that have green manure capabilities and can absorb atmospheric nitrogen and incorporate it naturally into the soil to improve soil nutrients and conserve soil.



General benefits of Green Manure and Cover Crops

- Keeps the soil covered and improves soil moisture – reduced evaporation (water loss).
- Reduces weeds through shade and covered soil.
- Reduces labor because weeding intensity requirements will decrease.
- Breaks disease cycles; some have beneficial microbes.
- Softens the soil and make it easier to be worked
- Maintains soil fertility through additional biomass
- Intercrops well with your regular crops like maize or cassava.
- Brings to the surface nutrients that the plants with the deep roots system
- Acts as feed to animals, e.g., calliandra fodder banks for cattle.
- Easy to produce (no need to buy seeds or fertilizer once you have introduced them to your farm).

Examples of Cover crops and Green Manure



Illustration: Mucuna Seed

Mucuna pruriens, commonly called bean velvet, is a tropical legume used as an important forage, fallow and green manure. It can be intercropped with maize and serves perfectly for planting cotton in the next season after mucuna.





Illustration: Cassava with Canavalia ensiformis (Photo credit: Paul Borsy, UNIQUE)

Canavalia ensiformis, known as “Jack bean,” is a legume and a cover crop used by farmers for increasing nitrogen levels and shade provision for the soil. It is also used for animal fodder and human nutrition.. It can be intercropped with cassava, bananas and sweet potatoes.



Illustration – Crotalaria juncea (Photo credit: Paul Borsy)

Crotalaria juncea, commonly known as brown hemp or sunn hemp, is essential for green manure, fodder, and lignified fiber obtained from its stem. It can be intercropped with maize or other crops like cassava, pineapple, banana,



ACTIVITY 3 INTERACTIVE SESSION: BRAINSTORMING

*Visit three fields that have already established cover crops and green manure intercrops. Divide the participants into three groups (one for men and two for women). Let each group visit a field (*Canavalia ensiformis*, *Mucuna pruriens*, *Crotalaria juncea*) and observe the planting, spacing of the different cover crops. After the exercise, ask participants what they observed, and how easy it is to put into practice.*



**ACTIVITY 4 INTERACTIVE SESSION: BRAINSTORMING**

- Ask the men and women participants whether they have used manure in their farming.
- Find out about their positive and negative experiences with their use of animal manure.
- Be deliberate to select men and women farmers. Summarize the answers on a flip chart and then introduce the concept of animal and liquid fertilizer.

**FACILITATOR'S NOTES****What is Animal Manure?**

Animal manure is obtained from various farm animals, but it can also be purchased from other farmers or at the market. Animal dung is applied as an organic fertilizer to multiple crops and trees. A few sources of animal excreta include Chicken excreta, cow dung, and goat excreta. Animal manure can be collected and stored using a manure pit for proper usage. It can be applied directly to the soil (then it should be covered and mixed with soil) or collected and turned into compost.

Management of Animal Manure

- The quality of manure differs because of type of livestock, number of livestock, grazing or stall management, feeding (diet), collection methods, composting and storage (to avoid evaporation of nutrients or volatilization and nutrient leaching).
- Until the manure is used on the field, manure needs to be collected and stored, especially for farmers who keep (a part of) their livestock in a stable or paddock.
- By storing the manure properly, the nutrients remain in the manure and do not runoff into the environment (soil and or water).



- A manure pit can be made to store the manure. Covering the manure with leaves or branches, leaching nutrients by the air, and other side-effects such as foul odor can be prevented.
- Animal manure should always be covered (with soil, other organic material, or plastic sheets). This will allow proper composting (turning it into fertile soil).
- Do not leave the manure exposed to sun or rain since it will lose nutrients. Ideally, a proper floor and roof are created to ensure nutrients remain in the manure.



ACTIVITY 5 INTERACTIVE SESSION: BRAINSTORMING

Visit a farm which has animal manure. Demonstrate how the manure is applied in a field crop and ask each participants to do the same. Make sure that women participate actively in the exercise. In a plenary discuss the crops where animal manure can be used for both men and women participants.

What is Liquid fertilizer?

Liquid fertilizer is a fertilizer made from slurry or fermented materials of nitrogen rich green plants, compost, wood ash and fresh animal manure that protects crops, prevents pests and diseases, provides nutrients (nitrogen, phosphorous, potassium), and irrigates crops. It is also an alternative to harmful chemicals. Liquid fertilizer is categorized into; (i) plant teas (made from green plant materials) and (ii) manure tea (which is made fermenting fresh animal manure in water). It can be directly sprayed on the soil or crops.

How to prepare liquid fertilizer

1. Collect and chop green sappy leaves.



2. Immerse the plant material into fresh water and cover the drum. Stir every three days.



4. Apply 250 ml- 500 ml around the crop base (roots)- early morning or evening.



3. Collect and chop green sappy leaves.



1. Fill a bag with fresh manure



2. Immerse the bag into a drum with fresh water and cover it. Stir the mixture every 3 to 5 days.



- 4..Apply 250ml-500ml (1/4 to 1/2 litres) of the dilutex manure tea around the crop base (roots)- early morning or evening.



3. After 2 to 3 weeks dilute the mixture with 2 to 3 parts of water



How to prepare plant tea



ACTIVITY 6 INTERACTIVE SESSION: FIELD EXERCISE

Visit a farm which where plant tea has already been prepared. Demonstrate how plant tea is applied in a field crop and ask each participants to do the same. Make sure that women participate actively in the exercise. In a plenary discuss the crops where animal manure can be used for both men and women participants.



SESSION 4

Use of compost and the application of agricultural lime



ACTIVITY 7 INTERACTIVE SESSION: BRAINSTORMING

Ask the participants their understanding of the word compost or the process called composting. Be deliberate to select men and women participants.

Summarize the answers on a flip chart and then introduce the concept of composting and agricultural lime



FACILITATOR'S NOTES

What is Compost and Compositing?

Compost is used as an organic fertilizer that can be added to the soil. Composting means piling up crops and other farm wastes in layers to make them decompose quickly. It is a biochemical process in which micro-organisms decompose organic waste matter (crop residue, kitchen wastes, cow dung, urine) into a soil-improving product. The final product is a uniform, black mass of rotten, nutrient-rich manure. Composting is done to produce an organic fertilizer balanced in plant nutrients. This organic fertilizer, called humus, improves soil fertility, moisture retention, and soil aeration.

Advantages of Composting

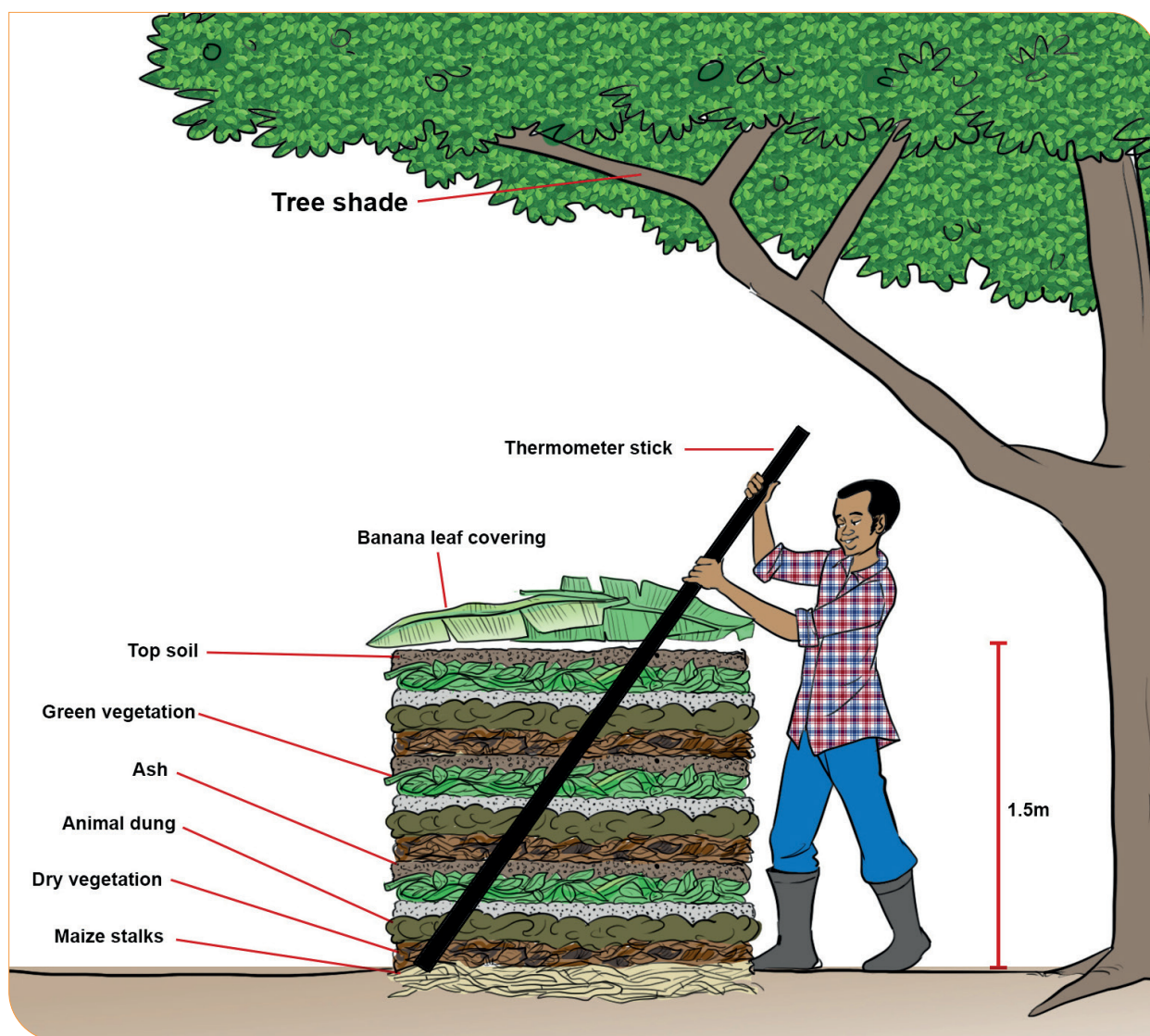
- Large amounts of vegetation, such as crop remains, garden weeds, kitchen, household wastes, hedge cuttings, garbage, etc., are used.
- When adequately made, compost becomes immediately available as plant food without the need to be first broken down by soil microorganisms.
- Compost does not cause excessive weed growth, as with ordinary farm manure.
- Good crops can be obtained without the need for extra chemical inputs.
- All farmers can make and use compost regardless of their financial abilities.



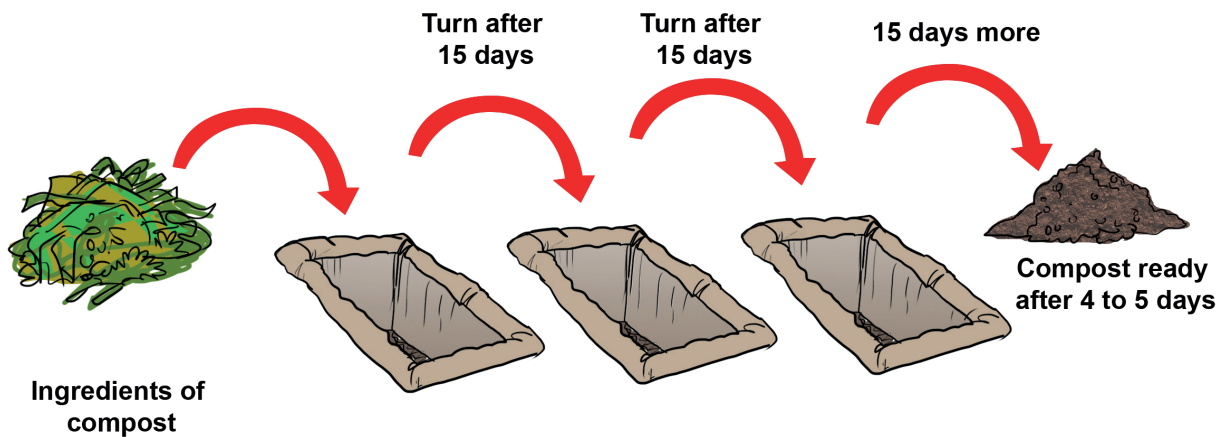
Disadvantages of composting

- Compost requires a lot of labor and time to prepare and spread over the farm.
- The nutrient composition of the compost varies a great deal. It depends on the materials used and the preparation methods (see using organic matter).
- Low availability of vegetation to make compost in drier areas.

Types of Compositing



Composting pile method



Pit composting



ACTIVITY 8 INTERACTIVE SESSION: FIELD EXERCISE

Visit a farm which where all the materials necessary have been assembled. Together with the participants, following the steps in the illustrations above to carry out pile and pit composting Make sure that women participate actively in the exercise. In a plenary discuss the pros and cons of each of the composting methods.

What is Agricultural Lime

Sometimes soils become acidic due to overuse of fertilizers, mono-cropping, and depletion of soil organic matter stocks through over cultivation. One of the most common ways to neutralize soil acidity to achieve the required pH for crop productivity is lime application. Different crops have different pH requirements.



ACTIVITY 9 INTERACTIVE SESSION: FIELD EXERCISE

Visit a farm which has an acidic soil. Together with the participants, follow the steps in the illustrations to carry out Liming. Make sure that women participate actively in the exercise. In a plenary discuss the pros and cons of each of the composting methods.



SESSION 5

The proper use of Mineral or Chemical Fertilizers



ACTIVITY 10 INTERACTIVE SESSION: BRAINSTORMING

Divide the participants in four groups (two for men and two for women). In their groups, ask the participants if they have ever used mineral fertilizers and for what purposes. Ask them to list the advantages and disadvantages of mineral fertilizers. In a plenary, ask each group to make a small presentation.



FACILITATOR'S NOTES

What are mineral fertilizers?

Mineral fertilizers also called inorganic fertilizers have concentrated nutrients that can be use to replenish the soil in case the soil nutrients are insufficient. Four principles (the '4Rs') help us to apply mineral fertilizer effectively and keep losses as small as possible:

The "4Rs" of the effective use of mineral fertilizers

Right mineral fertilizer product

The fertilizer should match the needs of the crop and the properties of your soil. There are straight fertilizers that provide one nutrient (most notably, nitrogen, phosphorus, or potassium) and compound fertilizers that offer more than one nutrient; for example, 'NPK' fertilizer provides nitrogen (N), phosphorus (P), and potassium (K). These are the essential plant nutrients.

Right fertilizer rate

The correct fertilizer rate means matching the amount of fertilizer to the crop's needs. This depends on the kind of soil you have, whether you're also applying organic manure, and the number of nutrients you applied to previous crops in the same field.



Right time of fertilizer application

The right time means making nutrients available when the crop needs them. Ideally, mineral fertilizers should be applied two times in the crop growing season:

Right placement of mineral fertilizer

Right placement means applying the nutrients where it is easy for the crop to access them. However, mineral fertilizer is a strong chemical; it mustn't directly touch the seed or plant, or else it will burn it.

Therefore, make sure that mineral fertilizer is placed 10 cm below the seed into the soil; this is the length of your index finger.

Examples of Mineral Fertilizers

FERTILIZER	COMPOSITION	RECOMMENDED APPLICATION
Di-Ammonium Phosphate (DAP)	18% Nitrogen (NH ₄ – nitrate), 46% Phosphorous (P ₂ O ₅)	During planting.
Nitrogen, Phosphorous, Potassium (NPK)	17 parts of Nitrogen 17 parts of Phosphorous 17 parts of Potassium	During planting and as a top dressing.
Calcium of Ammonium Nitrate (CAN), UREA	26% Nitrogen (NH ₄ + NO ₃) Urea (45 – 46% Nitrogen (NH ₄).	As top dressing.

* These fertilizers are water-soluble and are best applied when the soil is moist





ACTIVITY 11 INTERACTIVE SESSION: FIELD EXERCISE

Visit a farm which where all the materials necessary for mineral fertilizer application have been assembled. Together with the participants, following the steps in the illustrations above to apply the mineral fertilizers as in the illustration. Make sure that women participate actively in the exercise.

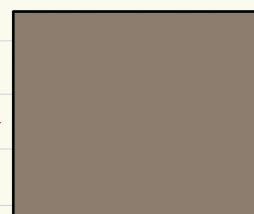
1. Apply DAP during planting



One maize plant = 2.9 gms of DAP
One hectare = 44.444 maize plants
One kg = 1,000 gms
One acre = One 50 kg bag of DAP



One 50kg bag
of DAP



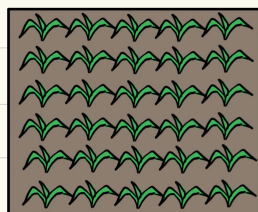
One acre

When maize is 3 or 8 weeks, nitrogen in the DAP would be either leached or used by plants and plants require Nitrogen for top dressing. One acre needs 2 bags of 50 kgs of CAN for top dressing.

2. Apply 1 bag of CAN after 3-4 weeks of planting.



One 50kg bag
of CAN

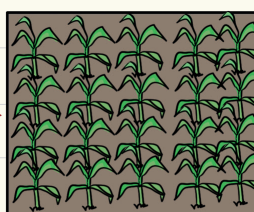


One acre

3. Apply the second bag of CAN after 8 weeks of planting



One 50kg bag
of CAN



One acre





MODULE KEY MESSAGES

- ✓ A fertile soil contains a balanced amount of macro and micro nutrients to sustainably feed the plant. Good plant growth can only occur if soil are replenished with the right food nutrients to feed the crop. While some nutrients are required in large amounts (nitrogen, phosphorus, and potassium), others are required in small amounts (sulfur, calcium, and magnesium micronutrients are boron, chlorine, copper, iron, manganese, molybdenum, and zinc).
- ✓ A wide range of soil fertility management technologies exists. While some technologies use naturally available materials, other technologies are derived from inorganic materials. Technologies that use naturally available materials include the use of green manure, cover crops animal manure, liquid fertilizer, compost while mineral fertilizers are obtained from inorganic materials. The decision to select which soil fertility management practice to use is gender neutral and is largely informed by the ease of use of the technology, its affordability and resource intensiveness.
- ✓ Most organic materials contain only small amounts of nutrients and many times it is not easy for the farmer to get adequate amount to apply to large fields. In this case, men and women farmers may opt for mineral fertilizers that contain concentrated nutrients that are easy to carry and apply. However, the farmer ought to apply the right mineral fertilizer in the right amount, at the right time and using the right method of placement for a selected crop.



REFLECTION EXERCISE FOR PARTICIPANTS

Get two different colors of flash cards (one color for men and the other for women). Ask each participant to select one soil fertility management option that will be the most appropriate in his/her farm. Each participant should also write one reason for the choice. Write your choice on a flash card and pin it up on classroom surface. Be deliberate to separate the cards for men and women





MODULE 8:

Soil and Water Conservation

INTRODUCTION

Adequate soil and water management practices can improve soil quality and increase yields in a long-term and safe manner. This module will teach you how to keep soil and water safe, maintain good soil moisture levels, and drain water in a way that does not cause soil erosion, land sliding, or soil nutrient loss. It will also demonstrate various rainwater harvesting options and water storage techniques for impervious surfaces. Through soil and water conservation, sustainable soil management contributes to increased food production, improved food nutrient content, combating land degradation, and adaptation and mitigation of climate change.





MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- understand soil erosion, its impact, and control.
- identify and describe the soil moisture conservation options that can be practiced locally.
- understand the different types of rainwater harvesting options and water storage techniques.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Understanding Soil Erosion

Session 2: Soil Moisture Conservation Techniques

Session 3: Rainwater harvesting options and water storage techniques



**Estimated
time**

Approximately 4 hours



Location

Farmer Field



**Training
materials**

Flip charts, marker pens, notebooks, teaching aids with pictorial illustrations of practices of different types of soil Erosion, SWC techniques and practices, and illustrations of common rainwater harvesting and storage technologies.

SESSION 1

Understanding Soil Erosion



ACTIVITY 1 INTERACTIVE SESSION: FIELD EXERCISE

Pre-select two areas around the training site that have been affected by soil erosion. Divide your participants into men and women groups and request them to discuss the status of the site visited. On a flip chart, each group summarizes their findings. If soil erosion is one of the findings, then the facilitator poses a general question on what the definition of soil erosion is.



FACILITATOR'S NOTES

What is Soil Erosion?

Soil erosion is a progressive process in which the upper layer of soil (topsoil) is moved and transported by many factors – most notably water, wind, and mass movement – resulting in its degradation over time. Soil erosion is responsible for significant and extensive environmental damage because of removing a field's original top and so causing loss of soil organic matter and soil moisture. There are six types of soil erosion; including wind, floodplain, gulley, splash, sheet and rill.

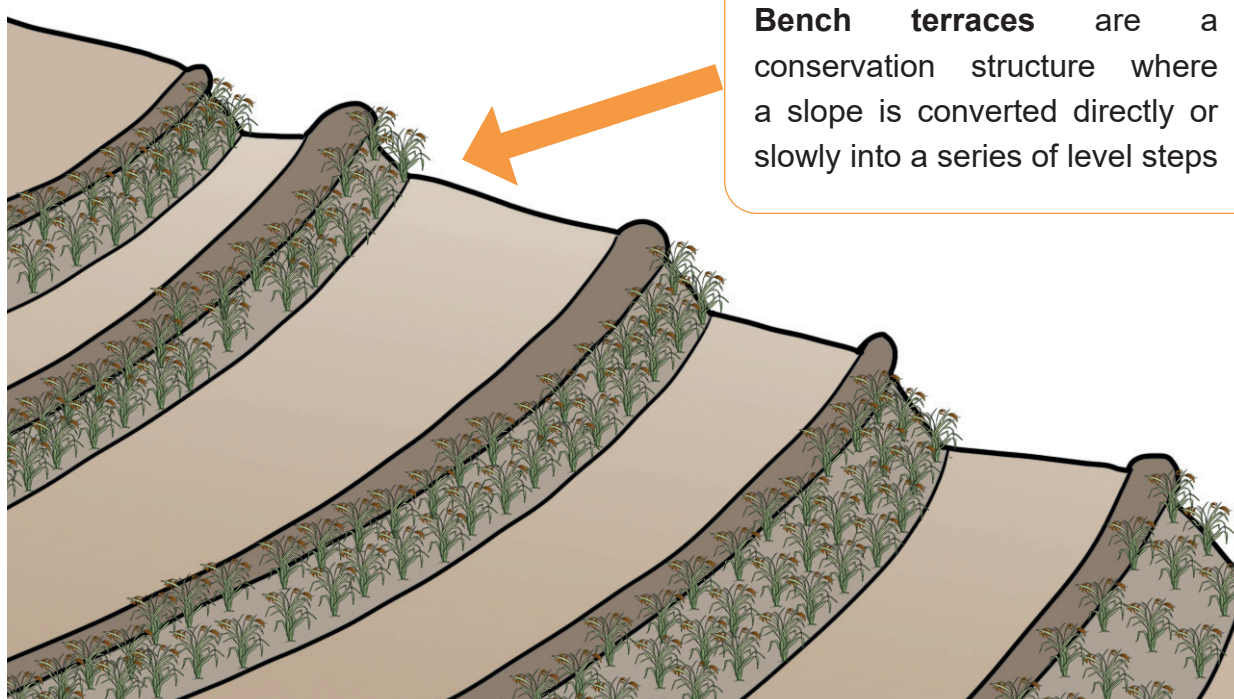
Soil erosion can be controlled through; (i) planting trees and shrubs; (ii) using no till or minimum tillage; (c) building up organic matter in the soil; and; (d) using appropriate grazing techniques.

**ACTIVITY 2 INTERACTIVE SESSION: FIELD EXERCISE**

Prepare a training site with some soil moisture conservation techniques (e.g. terracing; contour bunds etc) In a peer to peer random walk, request the male and female participants to identify how moisture is being conserved with the different techniques, the advantages and disadvantages associated with the techniques given the other roles that men and women play in society. In a plenary, request volunteers to narrate a small story of their experiences.

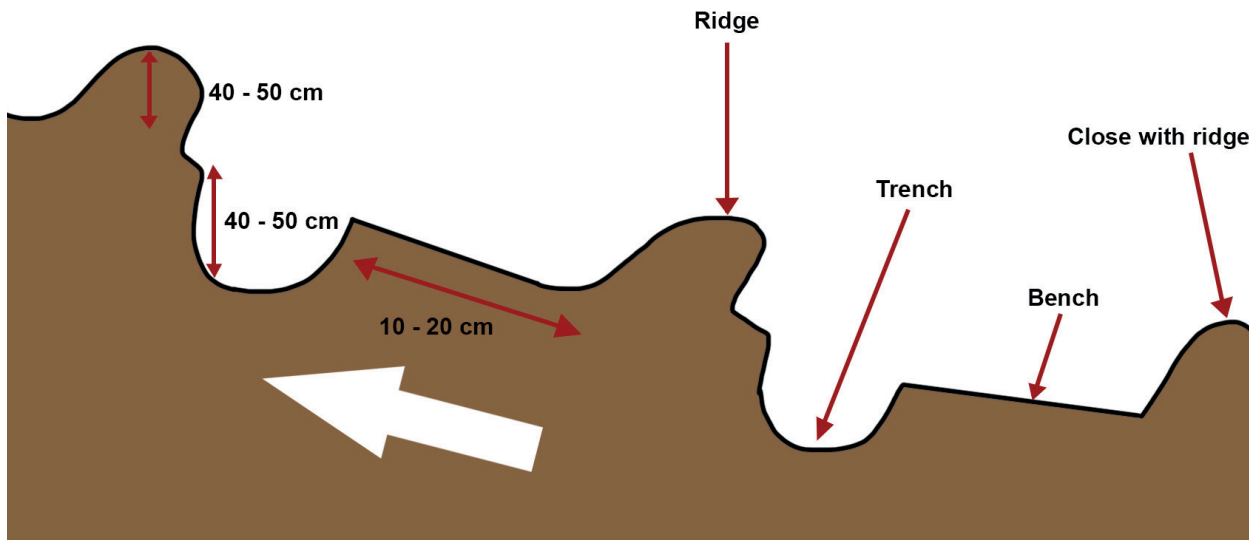
**FACILITATOR'S NOTES****Technique 1 – Terracing:**

The technique uses soil embankments and channels change the slope profile and as a result slow down water runoff, especially in areas prone to soil erosion.

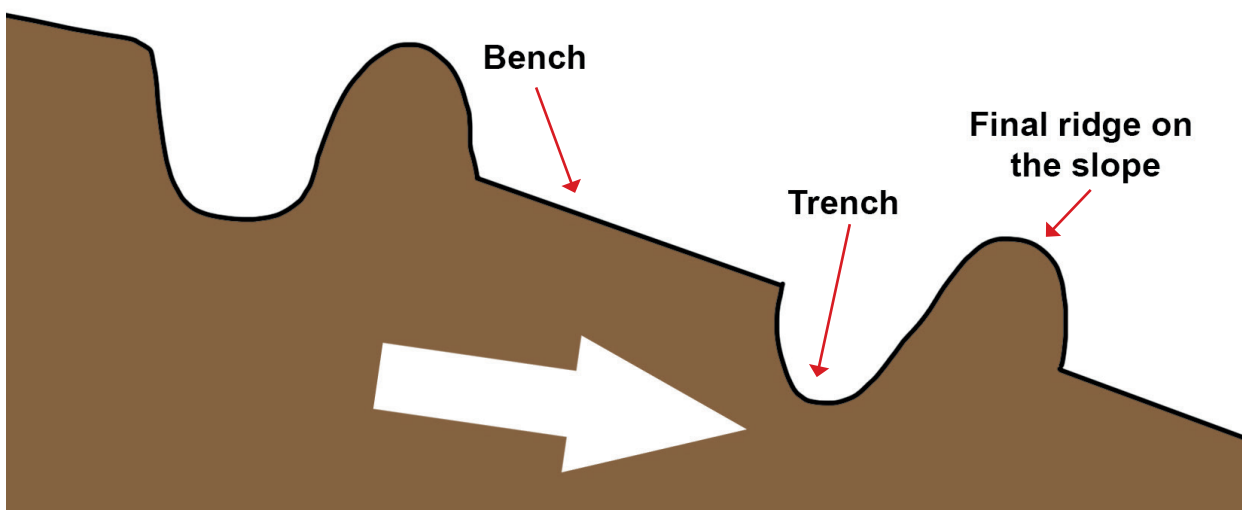




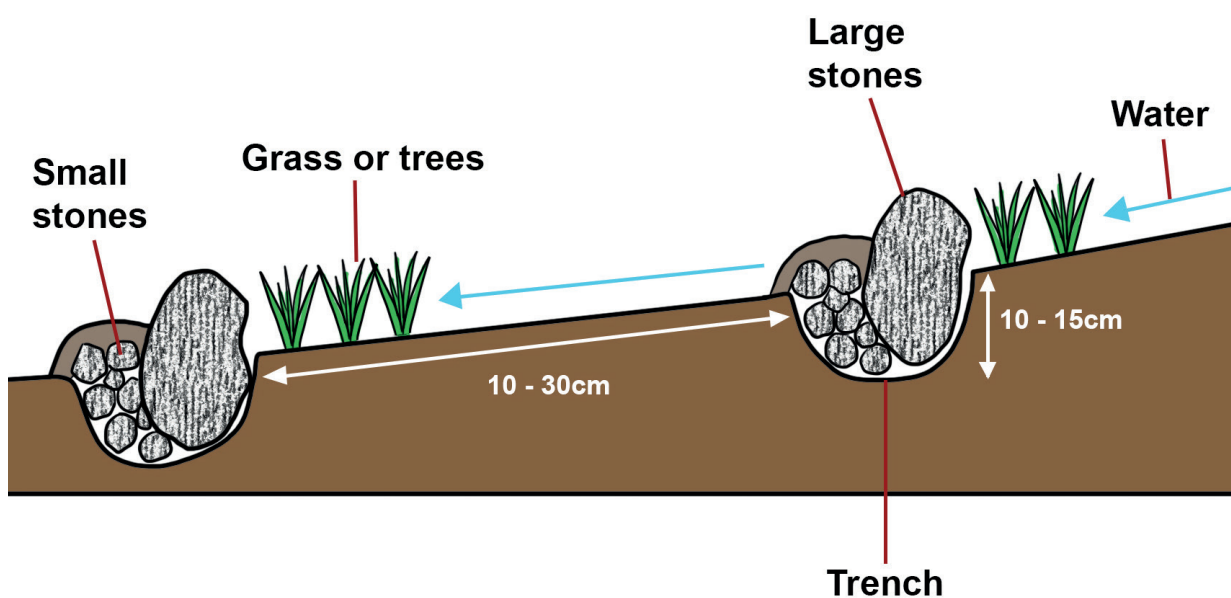
Fanya Juu: translates as “throw the soil skyward.” Dig a trench and throw the earth uphill to form a ridge to construct this type of terrace.



Fanya Fanja chini: translates as “throw the soil downhill.” To construct this type of terrace, start by digging a ditch and dumping the soil down to form a ridge



Stone terraces: use stones create strong embankments on steep slopes. The stone slow down runoff and increase water infiltration



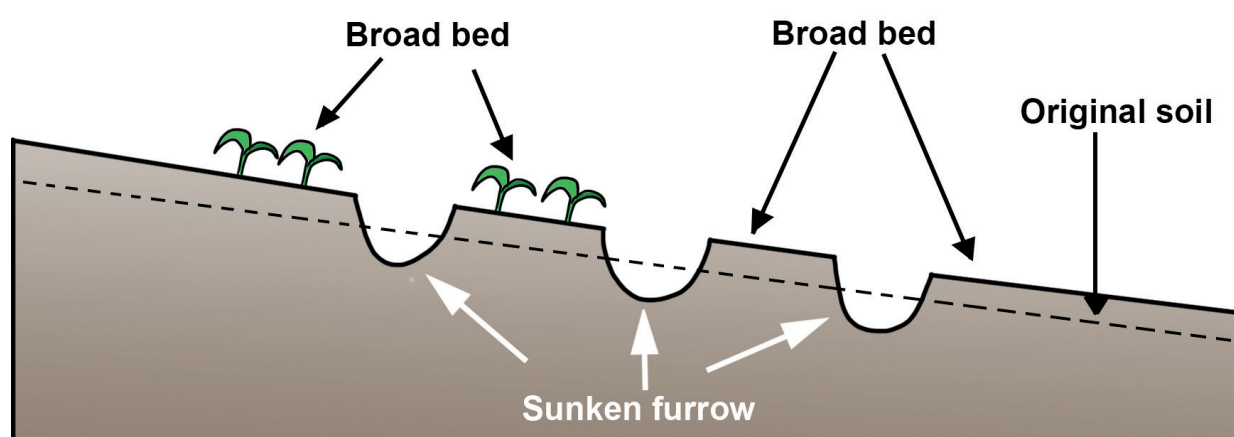
Technique 2 – Contour bunds or Contour Farming

Contour farming involves ploughing, planting, and weeding along the contour. Contour lines travel closely across steeper hillside and therefore trap water from running downstream.



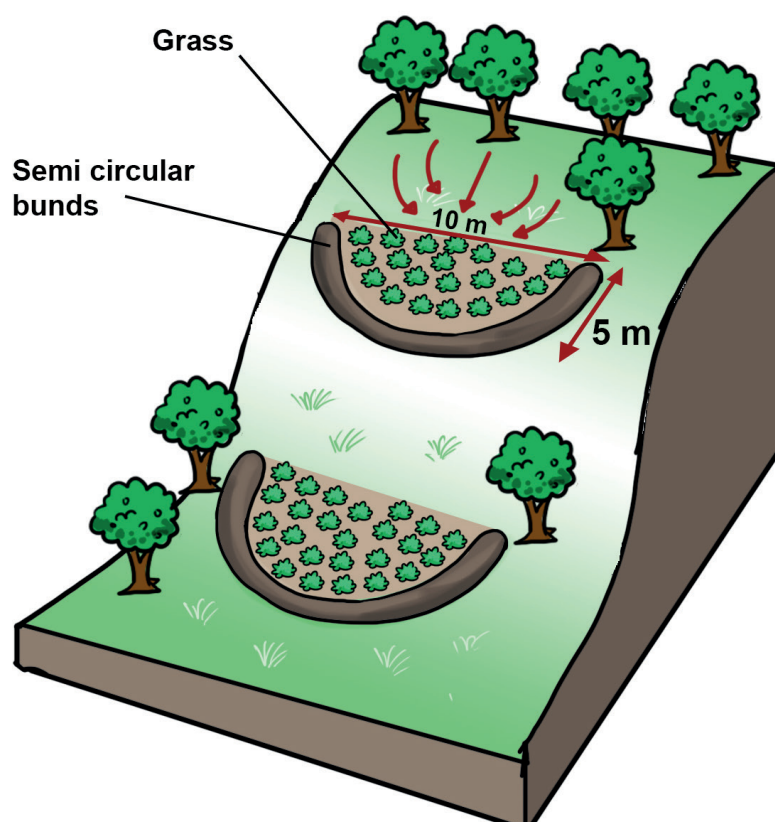
Technique 3 – Broad beds and furrows

Furrows are narrow ditches dug in the field between crops. Runoff water is diverted into furrows. The furrows are blocked in the lower end. When one furrow is complete, the water backs up into the head furrow and flows into the next furrow. Between the furrows are broad beds where crops are grown.



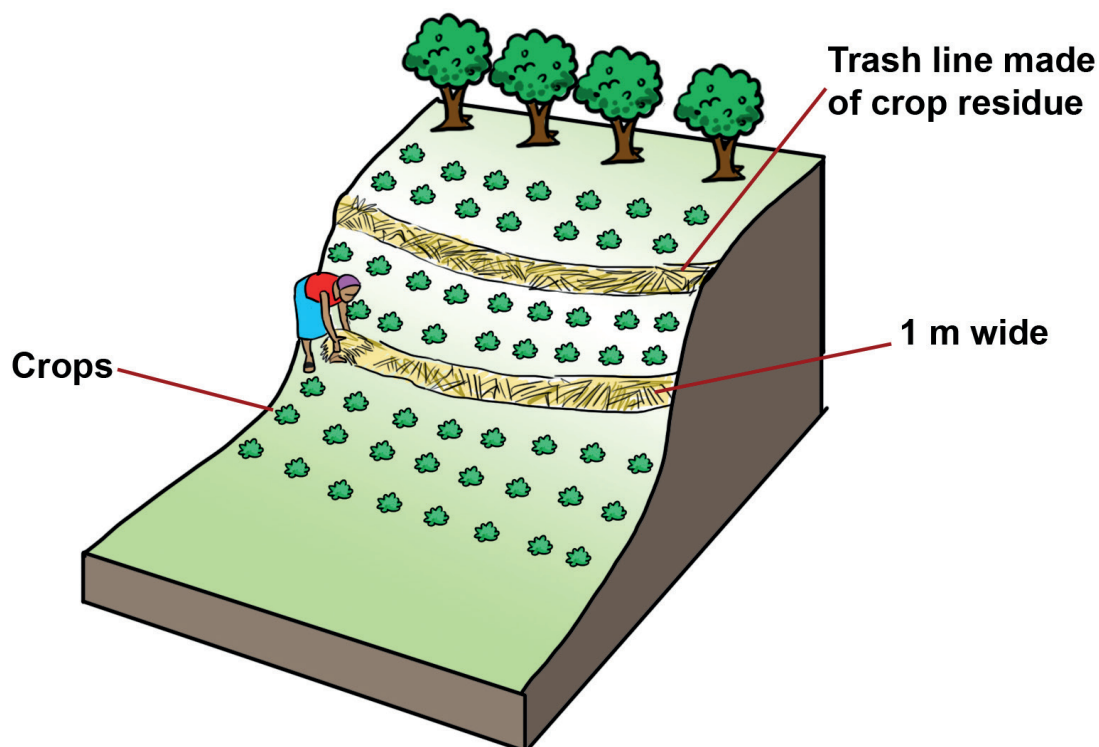
Technique 4 – Semi-circular bunds

Semi-circular bunds are made by digging holes on the tips of the contours in the form of half-circles. Semi-circular bunds are used to harvest water, conserve soil and water.

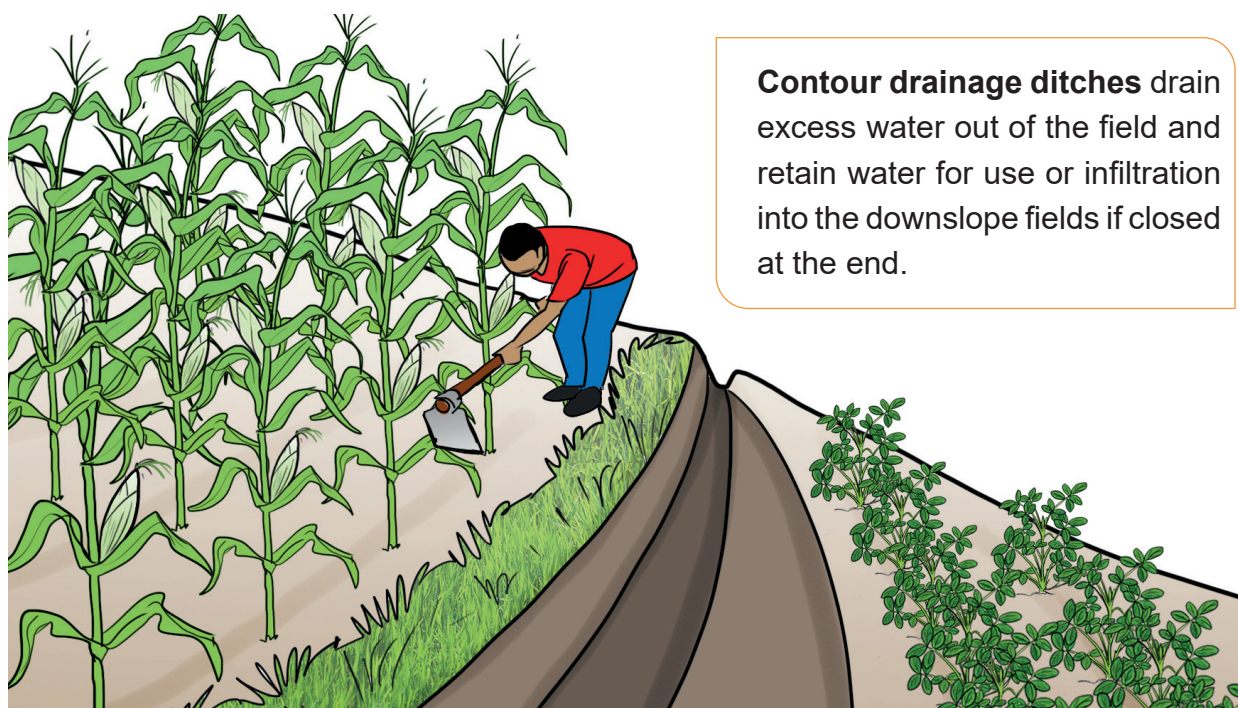


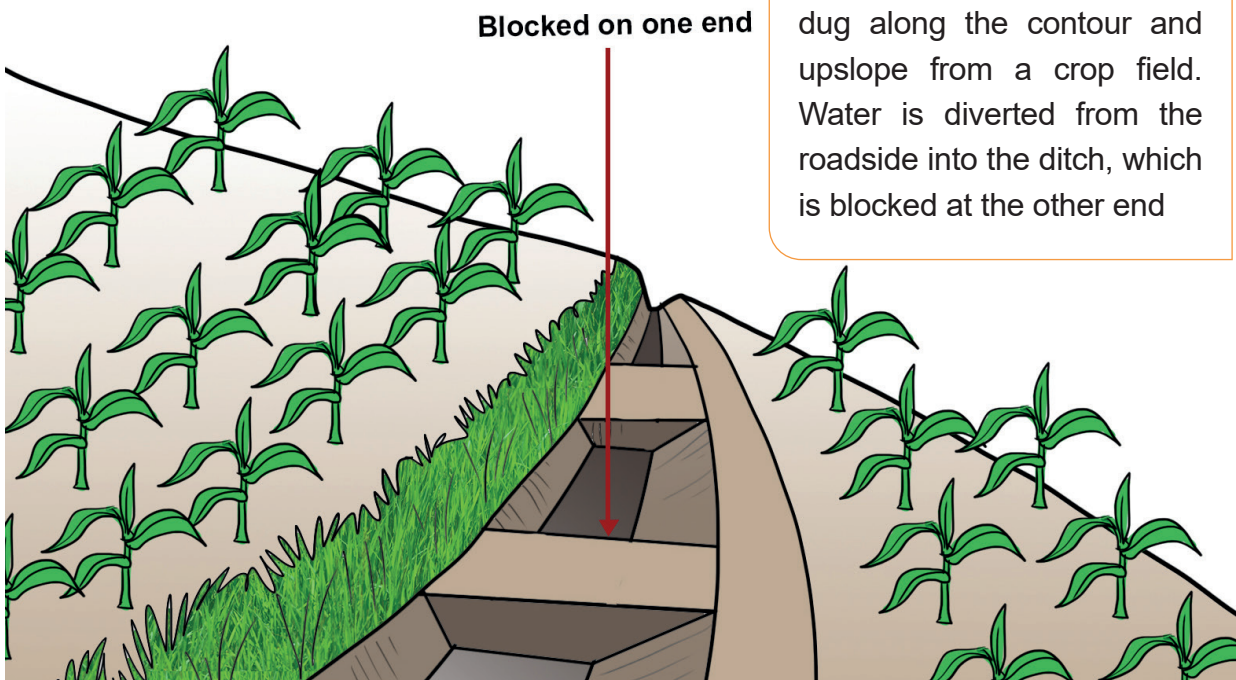
Technique 5 – Trash lines

Trash lines are created across the slope along the contour using previous seasons' crop residues (millet, maize, and sorghum stalks), grasses, litter, and other dead vegetative organic materials.



Technique 6 – Retention ditches

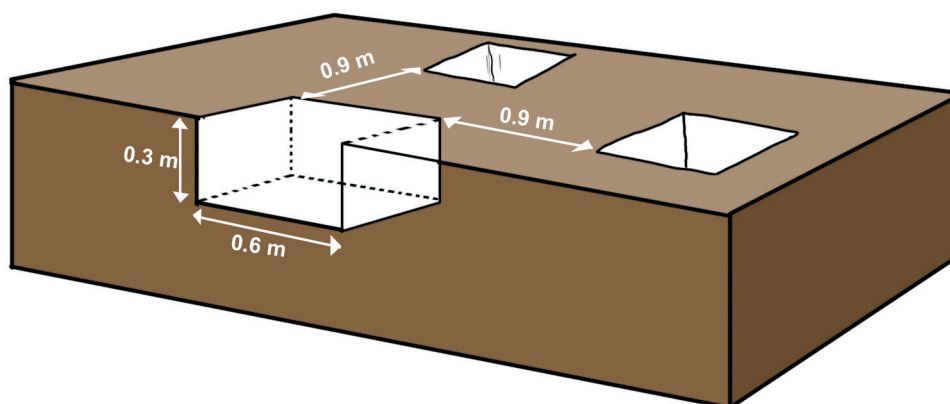




Technique 7 – Pitting

Pitting is digging holes of various sizes to grow crops such as bananas, coffee, tea, and grains (maize, millet, and beans). The pit acts as a water harvester and a conserver of both moisture and fertility. Manure is added to increase fertility in the pit for a long time. You can plant crops repeatedly in the same place.

Zai pits are shallow, vast pits in which cereal crops such as maize are planted. Topsoil from the excavation or compost is mixed with manure and put back in the pit, where a few cereal seeds are then produced.

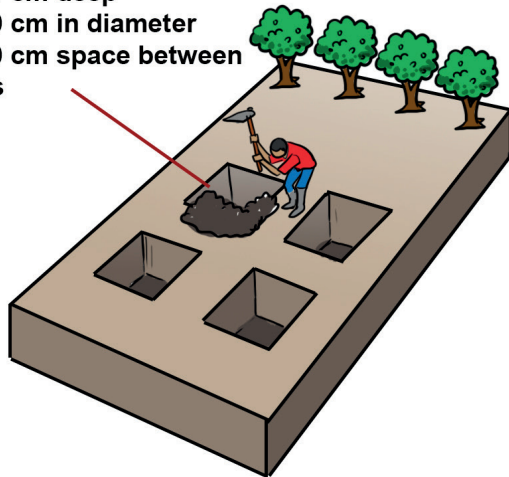




Tumbukiza pits: This pitting system involves digging huge pits and filling the holes with trash and vegetative material, including farmyard manure and topsoil. Tumbukiza means “throw all in.”

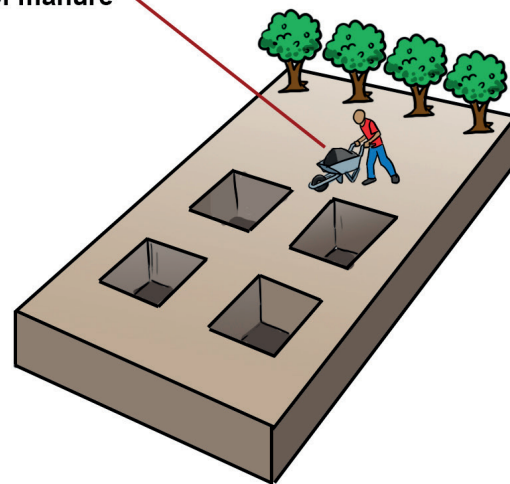
Three months before planting season

Pit measurement
- 60 cm deep
- 60 cm in diameter
- 90 cm space between pits



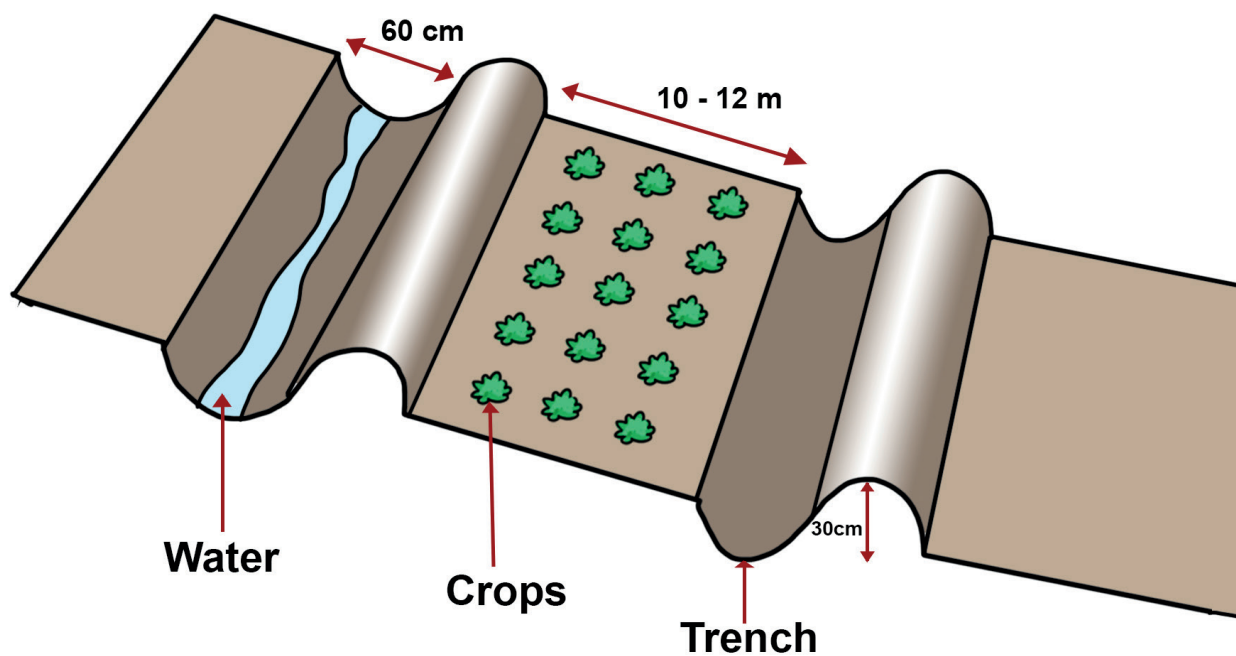
One month to the onset of rainfall

2 - 3 wheelbarrows of manure



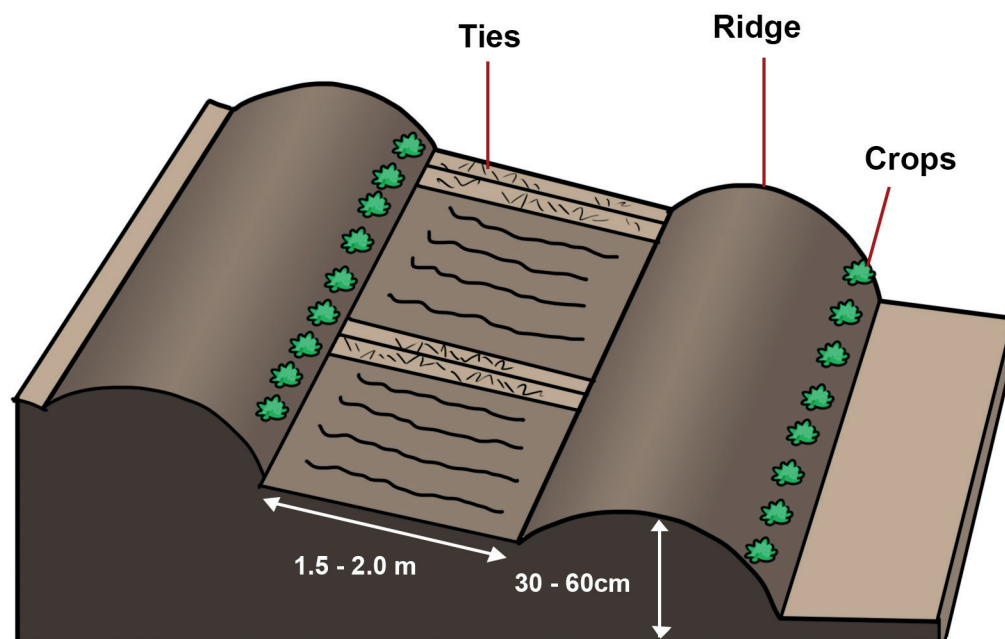
Technique 8 – Trenches

Trenches are small ditches or pits constructed over a slope to collect water and keep it from running off. Trench embankments are planted with grasses, legumes, and trees to stabilize soils.



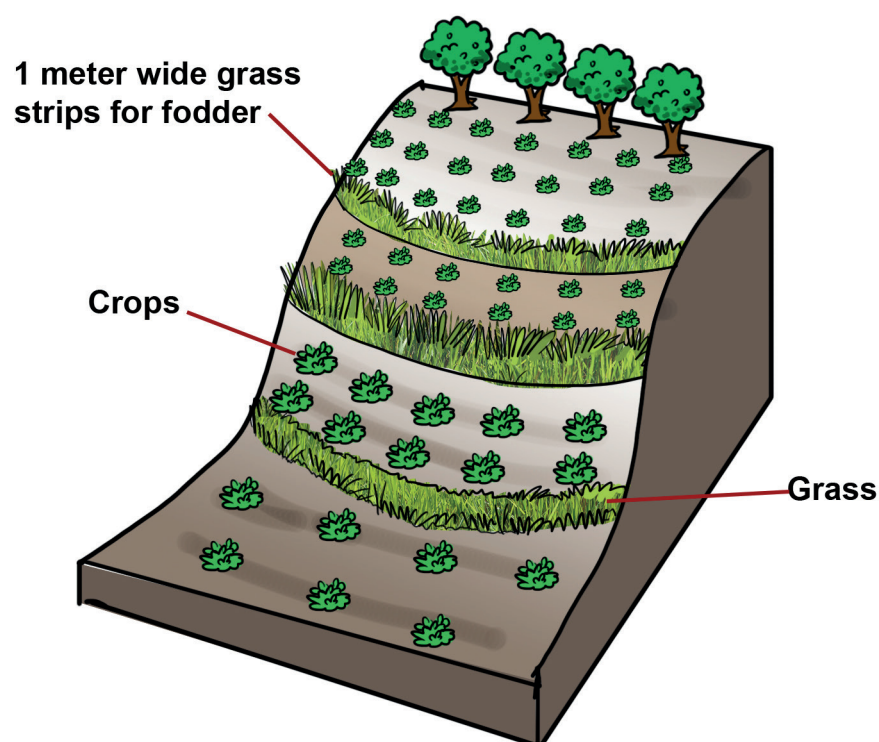
Technique 9 – Tied ridges

A succession of cross-ridges that interrupt or block the furrows in dry soils, preventing water from flowing through the furrows, are referred to as tied ridges. This allows the water that has been trapped between the ridges to seep into the ground.



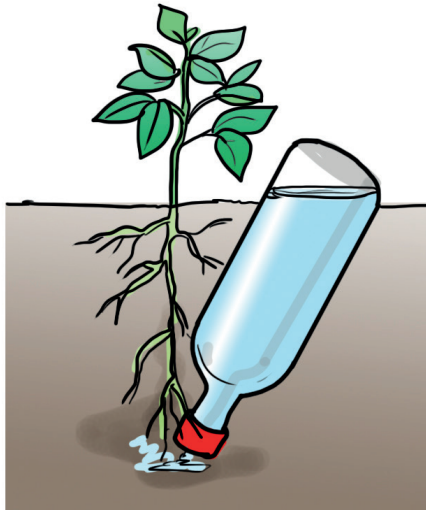
Technique 10 – Grass strips

Grass strips are 1 m wide grass planted on terraces along contours to retain soil and minimize the amount of water running down the slope. Grass strips are either planted with fodder grass such as Napier or left unplanted, providing food for livestock (cut and carry).



Technique 11 – Irrigation

Supplemental irrigation has become imperative to avert this scenario because an adequate water supply is essential for plant growth. When rainfall is insufficient, the plants must receive additional water from irrigation. Various methods can be used to supply irrigation water to different type of plants. Below are a few examples. Please note each method has its advantages and disadvantages. These should be considered when choosing the best suited.



Bottle irrigation works by filling an empty bottle with water, turning it upside down, and sticking the open end about 8 cm into the soil close to the plant.

Bucket Drip Irrigation: A simple gravity drip irrigation system uses low-cost plastic hoses, cut to the appropriate lengths and laid out on the ground to irrigate vegetable plots or orchards. Small holes in the hose let water drip out to keep the base of the plants wet without wasting water; the perforated plastic hoses are called “drip lines.”



Source: Geo-Hydro Supply



Sprinkler Irrigation : This is like natural rainfall. Water is pumped through a pipe system and then sprayed onto the crops through rotating sprinkler heads.



Source: Agripro focus





SESSION 3

Rainwater harvesting and water storage options



ACTIVITY 3 INTERACTIVE SESSION: PLENARY

In plenary (with deliberate choices of men and women participants) discuss the locally used rainwater harvesting options and water storage techniques. Discuss the kind of options that men and or women are likely to use and why?



FACILITATOR'S NOTES

What is Rainwater Harvesting?

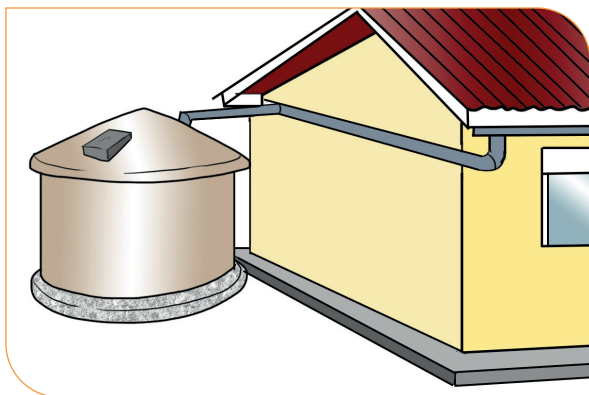
Rainwater harvesting is the process of slowing down, collecting, and concentrating runoff water for productive purposes such as producing crops, fodder, pasture, or trees, and supplying livestock and or residential water, most commonly in arid and semi-arid environments. The objective is to alleviate the effects of temporary rain shortages, some of which result from climate change.

What are Water Storage Approaches?

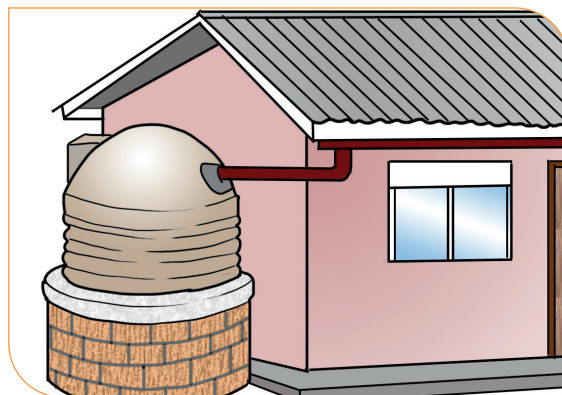
Water storage approaches are practical ways of storing and conserving water, especially during the dry season. The water is mainly used for household consumption, but can also be used for agricultural purposes, e.g., water harvesting tanks can provide water for drip irrigation. There are different approaches, such as tanks, ponds, and dams.

1. Tanks

Water harvesting tanks, which can be placed above ground (surface tanks) or below ground (sub-surface tanks), can be used to collect rainwater from large rock catchments and rooftops (clay tiles and galvanized iron roofs). Tanks come in many forms



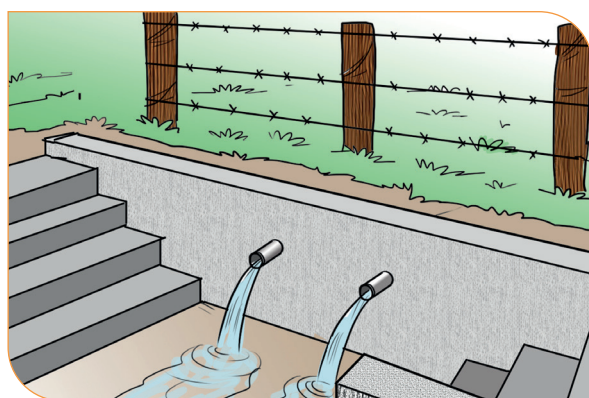
A ferro-cement tank



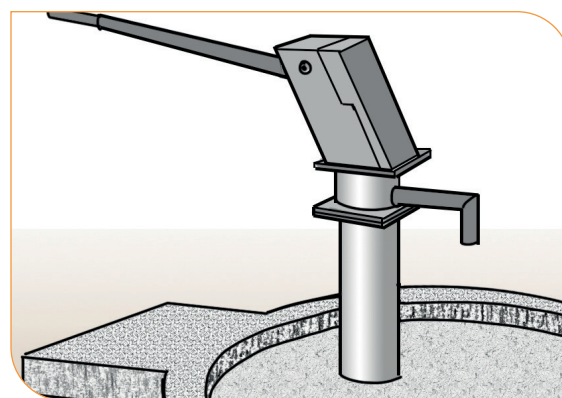
A dome-cap tank

2. Wells and boreholes

It is vital to collect water from underground sources in areas with few or no surface water supplies to draw from (groundwater near the surface or deep geological layers). When a borehole is connected to a well (which is often modern), the borehole serves as a water reservoir while also providing water to other farm areas.



Well



Borehole



3. Excavated pans and ponds

Ponds are reservoirs with a water volume of less than 5,000 m³. Excavated pans are shallow depressions (1 m to 3 m deep) constructed to collect and hold runoff water from various surfaces, including hillsides, roads, rocky areas, and open rangelands.



4. Water Dams

Charco dams: These are excavated pits or ponds about 3 m deep and built at carefully selected locations as water collection points

Earthen dams: These are channel flows with wall of up 2–5 m tall. They are built with a clay core, stone aprons, and spillways to discharge excess runoff.

Sand dams: A sand dam is a wall constructed across the stream to restrict surface flow. The height of the dam wall is increased by 0.3 m after floods have deposited sand to the spillway level.

Subsurface dams: A subsurface dam is where the wall barrier, sometimes made of compacted clay, is below the ground.



MODULE KEY MESSAGES

- ✓ Soil and water conservation is a combination of agricultural practices including terracing, contouring, furrows, bunds, ditches, strips, pitting, trenches, ridges adapted as physical barriers to enhance water availability, reduces heat and drought stress in order to promote soil health. These physical barriers nevertheless have complex designs which in turn introduce engendered drudgery to the already labour constrained small-holder households.
- ✓ Water harvesting and storages are important practices in arid and semi-arid environments to alleviate water scarcity. Water can be harvested from ground surfaces and rocks, irregular surfaces and roof catchment. A wide range of storage structures including tanks, wells, boreholes, water dams, excavated pans and ponds, water. These structures conserve the water resources and therefore provide a reliable water supply that empowers men and women farmers to ensure animal and domestic consumption throughout the year. This then reduces on the amount of time that women invest in search of water for livestock and domestic consumption.
- ✓ Stored water can be used efficiently for irrigation purposes in order to increase crop production and productivity. A wide range of irrigation techniques including bottle, bucket, furrow, flooding and sprinkler exist and offer cost effective options that can be used by both men and women farmers.



REFLECTION EXERCISE FOR PARTICIPANTS

Ask the men and women participants to write down in their notebooks any particular soil and water conservation technique that they can immediately use on their farm after the training. As they think through this action point, let them also write down any gender related challenges they may encounter in adopting a soil and water conservation techniques of their choice.





MODULE 9:

Conservation Agriculture

INTRODUCTION

Sustainable agricultural approaches can boost climate change resistance, biodiversity protection, and natural resource sustainability. It promotes soil water availability, reduces heat and drought stress, and improves soil health over time. Conservation agriculture contributes to all three pillars of Climate-Smart Agriculture, thereby establishing it as an essential CSA practice.





MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- understand Conservation Agriculture and its three founding principles.
- put the Conservation Agriculture principles into action with examples from maize and pigeon peas.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Underst the meaning of Conservation Agriculture

Session 2: Put the principles into action – Planting pigeon peas

Session 3: Put the principles into action - Cutting down pigeon peas and maize



Estimated time

Approximately 7.5 hours



Location

Farmer Home



Training materials

Flip charts, markers, notebooks, teaching aids with pictorial illustrations of practices cover crop seeds (Mucuna, velvet beans, Pigeon peas, Canavalia, Crotalaria and Lablab), maize seed, Pigeon peas seeds, hand hoes, planting string

SESSION 1

Understanding the meaning of Conservation Agriculture



ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING

Ask the men and women participants how a health soil looks like. List the answers on a flip chart and later ask the participants to propose way in which this soil can be kept health.



In a plenary, show an image of how a healthy soil should look like.



FACILITATOR'S NOTES

What is Soil Health?

Soil health is the ability of a specific kind of soil to work in a natural or artificial ecosystem to sustain plant and animal productivity, protect water and air quality, and support human health and habitation.



Some Characteristics of Healthy Soil

- **Good soil tilth** - soil tilth refers to the overall physical characteristics of the soil in the context of its suitability for crop production.
- **Sufficient depth** - Sufficient depth refers to the extent of the soil profile to which roots can grow and function. A soil with a shallow depth because of a compaction layer of past erosion is more susceptible to extreme fluctuations in the weather, thus predisposing the crop to drought or flooding stress.
- **Sufficient but not excessive nutrient supply** - An adequate and accessible supply of nutrients is necessary for optimal plant growth and for maintaining balanced cycling of nutrients within the system. Excess nutrients can lead to leaching and potential groundwater pollution, high nutrient run-off and greenhouse gas losses, and toxicity to plants and microbial communities.
- **Good soil drainage** - Even after heavy rain, healthy soil will drain more rapidly because of good soil structure, adequate distribution of different pore spaces, and sufficient water for plant uptake.
- **Large population of beneficial organisms** - Healthy soil will have a high and diverse population of beneficial organisms to carry out these functions and thus help maintain a nutritional soil status. The organisms help nutrient cycling, decomposition of organic matter, maintenance of soil structure, biological suppression of plant pests,
- **Low weed pressure** - Weed pressure is a significant constraint in crop production. Weeds compete with crops for water and essential nutrients for plant growth. Weeds can interfere with stand establishment, block sunlight, interfere with harvest and cultivation operations, and harbor disease-causing pathogens and pests.
- **Free of chemicals or toxins that may harm the crop** - Healthy soils are either devoid of harmful chemicals and toxins or can detoxify and bind such chemicals, making them unavailable for plant uptake due to their richness in stable organic matter and diverse microbial communities.

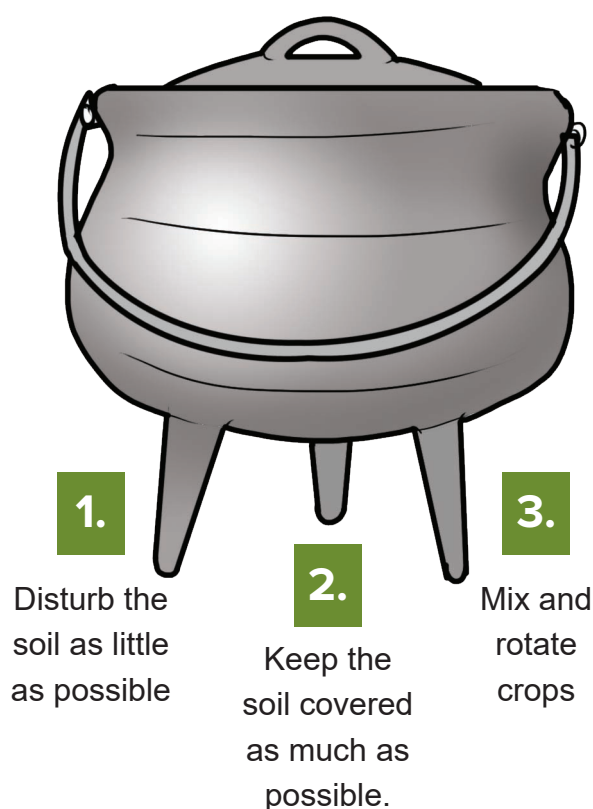




What is Conservation Agriculture?

Conservation agriculture aims to increase crop yields while lowering production costs, preserving soil fertility, and conserving water. It is a method of achieving sustainable agriculture while also improving livelihoods. It is based on the following three principles.

1. Disturb the soil as little as possible
2. Keep the soil covered as much as possible.
3. Mix and rotate crops



Like a cooking pot

The three principles of conservation agriculture are like a three - legged cooking pot. It works best if it has all three legs!

Principle 1 - Disturb the soil as little as possible - Conservation Tillage

Conservation tillage is a planting method that uses as little soil disturbance as possible. After planting, it leaves at least 30 – 50 percent of the field surface covered with crop residues such as mulch and stubble. The process does not mix the top and subsoils.

1. **Zero tillage:** It is often referred to as no-tillage farming or direct drilling farming. It is a method in which all the leftovers from the previous crop are left in the soil following harvest. The fresh produce is then planted directly into the tilled ground, with the seeds being inserted into the soil through small apertures or holes in the tilled earth.





- 2. Reduced or Minimum tillage:** It involves preparing the soil only to the extent that renders the ground ready for seed germination, seed emergence, water infiltration, aeration, soil temperature regulation, and weed control. It is achieved by opening a planting line or a hole without disturbing the areas between the rows where crops are planted. Examples include;

Three techniques can be used for direct planting with little disturbance to the soil

**Technique number 1 –
Dibble Stick Planting**



Use a planting stick (sharpened at one end) or machete to make holes to plant the seed.

**Technique number 2 –
Planting Basins**



Planting basins are small pits in the ground that can be used for planting different crops.

**Technique number 3 –
Hand-jab Planter**



Hand-jab planters are used for sowing and for filling in gaps after crop germination.



ACTIVITY 2 INTERACTIVE SESSION: FIELD EXERCISE

Direct seeding using the planting stick

Go to the chosen demo field. The field should NOT have been tilled but be ready for planting. Start demonstrating the direct seeding of maize with the stick. Make pairs of men and women and request them to direct seed at least ten maize seeds. Observe and correct the participants as needed.





Principle 2 - Keep the soil covered as much as possible

There are three methods to keep the soil covered.

1. Leaving plant material

- After harvest, leave your crop residues in the field (for example, maize or sorghum stalks). Don't burn them!
- Spread residues all over the ground. At least 30% of the soil should be covered.

2. Adding plant and other organic material

- If your residue is insufficient to obtain good soil cover, you can add plant material outside your field. For example, you can cut grass close by or use leaves or prunings from trees and shrubs. You can also use animal manure or compost
- A cover crop can be planted during the cropping season (to cover the soil in between the crop rows, or as a standalone plantation to cover the whole field and produce the maximum amount of biomass possible.

Principle 3 – Mix and Rotate

Mixed cropping and crop rotation embrace one of the principles of conservation agriculture. Planting the same crop each season - as sometimes practiced in conventional farming, is minimized by planting the right mix of crops in the same field and rotating crops from season to season. This allows a breakdown of survival and multiplication cycles of pests, diseases, and weeds resulting in higher yields and maintenance of soil fertility.

Based on the three principles, conservation agriculture can help improve yield, reduce production costs, and overcome labor and farm power shortages. It can be practiced at different scales or levels of farming as shown in the figure

SESSION 2

Putting the principles into action – Introducing Pigeon Peas as a Cover Crop in Conservation Agriculture



ACTIVITY 3 INTERACTIVE SESSION: PLENARY

Ask the men and women participants if they know what cover crops and green manure are. For those who know these terms, ask them to share their experiences with the use of the techniques in conservation agriculture. Be deliberate to select men and women participants. Summarize the answers on a flip chart and then introduce the terms cover crops and green manure using pigeon pea plant as an example.



FACILITATOR'S NOTES

Pigeon pea is a drought-tolerant crop that thrives in nutrient depleted soils. It is cultivated primarily by smallholder farmers mostly for cash and food. Its seeds have high protein (>20%) making it vital for preventing malnutrition commonly associated with starch-based diets of vulnerable rural communities. It can be intercropped with maize or sown in the pure stand (meaning alone) separately from maize or any other crop. If planted in pure air, the planting density should be high. It can then recover degraded soil by adding organic material and nitrogen.

Advantages of Pigeon Pea Plant

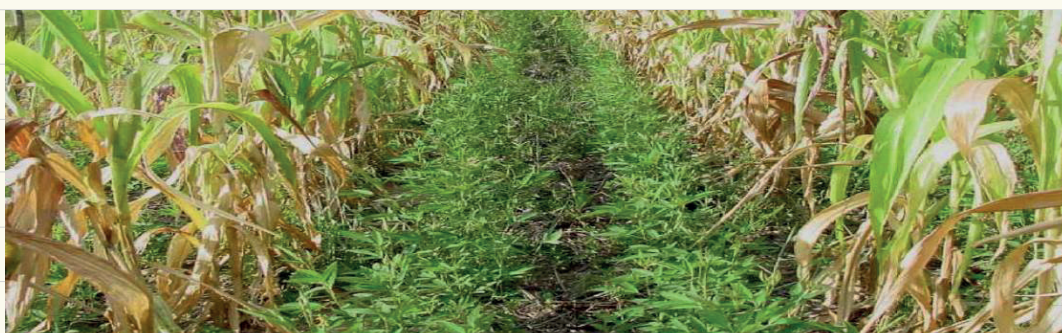
- provides soil cover and also improve soil fertility and produce food and feed.
- adds to organic material and helps to improve the soil by maintaining moisture and avoiding soil erosion.
- acts like a fertilizer by fetching nitrogen from the air and giving it to the soil.
- discourages the growth of weeds.



ACTIVITY 4 INTERACTIVE SESSION: FIELD EXERCISE

Planting Pigeon Pea as Intercrop

Go back (after 60 days) to the chosen demonstration field where maize was planted using direct seeding. Demonstrate the intercropping of pigeon peas within the maize crop. Ask the men and women participants to plant the pigeon pea. Observe and correct the participants as needed.



- *Plant the pigeon pea seeds in double rows between the maize rows as in the illustration*
- *Use a 25 x 25 cm spacing in pure stand and a wider spacing if you intercrop with maize*
- *Use a 50 x 50 cm spacing if pigeon peas are for seed production*
- *Plant 2 – 4 seeds per hole.*

Field Management

The farmers should keep the rows free from weeds without destroying the pigeon pea, which will grow but not compete with the maize. In turn, pigeon pea will suppress weed, maintain moisture, and produce biomass, increasing overall yields, and mitigating climate change.



Illustration: After the maize harvest, the field should look like residues of maize and rows of pigeon pea.

When the maize is grown, farmers should harvest the maize in the usual way but let the pigeon pea continue growing. The pigeon pea will then cover the whole field of maize. This is what we want: to produce biomass



SESSION 3

Putting the principles into action - cutting down pigeon peas and maize

ACTIVITY 5 INTERACTIVE SESSION: PLENARY

Recap with the men and women participants the importance of pigeon peas and the various ways it can be planted. Ask the participants the advantages and disadvantages of using pigeon peas as a cover crop. Summarize the answers and then introduce the practice of cutting down the pigeon peas and maize.

ACTIVITY 6 INTERACTIVE SESSION: FIELD EXERCISE

Go to the field and demonstrate how to cut maize stalks and pigeon pea. Cut with the machete and lay it down on the field. The material should touch the ground and be laid down in the same direction (not crisscross). Demonstrate one row and then ask each the men and women farmer to practice the same. A clean field should appear like the illustration below





MODULE KEY MESSAGES

- ✓ Conservation agriculture begins with a health soil that has the capacity to support human health and habitation. Conservation agriculture is built on three principles viz (i) conservation tillage (ii) soil coverage and (c) mix and crop rotations
- ✓ Conservation tillage is an option where there is little disturbance of the soil during direct planting and can either be zero or minimum tillage. Various gender differentiated techniques such as using the dibble stick, the planting basin and the hand-jab planter can be very effective depending on technical skills and financial status of the farmer.
- ✓ Soil cover is key in conservation agriculture as soils should never be left bare if they are to retain their health. Crop residues and cover crops serve as good ingredients to protect the soil especially during the cropping season and can be readily available for men and women to use in their fields. While these covers protect the soil with their large biomasses, they also enhance soil organic matter and offer other ecosystem services for food and income security.
- ✓ Mix and rotate right crops in the same field from season to season. This allows a breakdown of survival and multiplication cycles of pests, diseases, and weeds resulting in higher yields and maintenance of soil fertility. Remember that you should never mix crops that compete for the same soil nutrients. Good crop mixes and rotation usually comprise of legumes, cereals, tubers and other root crops



REFLECTION EXERCISE FOR PARTICIPANTS

Take an individual walk for 10 minutes. As a man and or woman farmer, think about the natural resources that you have available on your farm. Given the resources that you have access to and control over, what conservation options will you adopt? Write the option in your note book and in plenary share it with a peer.





MODULE 10:

Homestead Gardening

INTRODUCTION

Smallholder farmers need to grow their food in their own homes to get more nutritious and healthy vegetables, fruits, and animal source foods into their diets. These can also bring in extra money, making households more resilient to short-term and long-term stress. Numerous homestead gardening options exist to meet the basic needs food requirement and offer the first defence line especially for women farmers who responsible for day to day nutrition of the entire household





MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- Learn about homestead gardening as a viable climate-smart agriculture option.
- Learn about the different homestead gardening options.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Introduction to the concept of homestead gardening.

Session 2: Establishment and management of nursery beds for homestead gardens.

Session 3: Homestead Gardening Options



Estimated time

Approximately 4 hours



Location

Lead Farmer Garden



Training materials

Stationary, flip charts, mark pens, pangas, sacks, sticks, plenty of rope, bark, banana leaves or some other material for tying, broad leaves, fertile soil, compost manure, organic waste, mix of greens and browns, vegetable seeds and seedlings



SESSION 1

Introduction to the concept of homestead gardening



ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING

Ask the men and women participants what they understand by the term home gardening. Have a discussion with the groups about the benefits and barriers of using home garden among men and women farmers.



FACILITATOR'S NOTES

What is a Homestead Garden?

Homestead Gardening is a term that refers to the growing of a variety of foods, vegetables, and fruits on a small plot of land that is usually located behind the grower's own house or in their backyard.

Some benefits of homestead Gardens

- Off-season planting is possible and so women and men can produce health and nutritious vegetables, fruits, and herbs throughout the year, thus ensuring household income, food security and family resilience to shortfalls due to climate variability.
- Homestead gardening contributes to conservation efforts by recycling waste from the kitchen, crops, poultry, and livestock in the gardens.
- Homestead garden are resource efficient and use less labor, water and land for production purposes. In addition, other resources such as Garden produce ash, compost, wastewater, kitchen scraps, and mulch used to raise the garden are easily available.



SESSION 2

Establishment and management of nursery beds for homestead gardens.

ACTIVITY 2 INTERACTIVE SESSION: FIELD EXERCISE

Organize men and women participants in groups of 5-7 to demonstrate the process of establishing nursery beds, planting beds, transplanting seedlings, and direct sowing of seeds in the home gardens. Following the summarized steps below.



FACILITATOR'S NOTES

1.



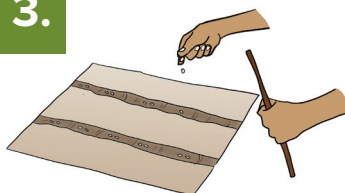
Prepare a plot of land for raising seedlings.

2.



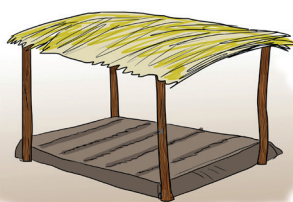
Prepare raised beds to prevent waterlogging.

3.



Sow seeds in the raised beds.

4.



Protect your nursery from the hot sun or heavy rains.

5.



Transplant the seedling into a bigger field

A: Sack Gardens**ACTIVITY 3 INTERACTIVE SESSION: BRAINSTORMING**

Start the session by discussing what they know about the sack garden technique and how many have tried it. Brainstorm with the group about the advantages and disadvantages of a sack garden. Discuss with the group strategies that should be used for encouraging the adoption of sack garden technologies by men, women, and youth. Guided by the following steps, work with them to set up a sack garden as a demonstration they can base on to set up there at their own homes.

**FACILITATOR'S NOTES****What is a sack garden?**

Sack gardens are tall sacks filled with soil from which plant life grows. This concept for a small, portable garden is suitable for areas where the gardener may have to relocate continually and areas where there is little or no healthy soil (as the soil in the bag is contained).

**ACTIVITY 4 INTERACTIVE SESSION: BRAINSTORMING**

Divide the participants into four groups (two for men and two for women) and establish sack gardens by following the steps listed below. After the practical experience, ask the men and women farmers to share their experience in setting up these gardens in a plenary



Necessary Materials



Fill the base with soil



Cut sides for growth



Transplant seedlings





Advantages of sack gardens

The main advantages of sack gardens are their portability, small size, low cost, efficiency, productivity, and contributions to food security. These traits make them ideal in situations such as:

- Where investing in a traditional garden is too risky due to fear of expropriation or individuals having no legal right to land.
- Where population density and scarcity of arable prevent traditional gardening.
- Where contaminated soil is present.
- Where there is a high chance of natural disasters such as floods or mudslides.
- Where there is not enough ground-level sunlight to grow vegetables.
- Where drought is common or water very limited.
- Where there is a food crisis. Small-scale homestead vegetable growing can greatly alleviate pressure from relief efforts.
- Where community development initiatives and programs aim to address community vulnerabilities.

B: Keyhole Gardens



ACTIVITY 5 INTERACTIVE SESSION: BRAINSTORMING

Start the session by discussing what they know about the keyhole garden technique and how many have tried it. Brainstorm with the group about the advantages and disadvantages of a keyhole garden. Discuss with the group strategies that should be used for encouraging the adoption of keyhole garden technologies by men, women, and youth.





FACILITATOR'S NOTES

What is a keyhole garden?

A keyhole garden is a circular raised garden bed with a compost basket at the center and a keyhole-shaped path that allows access to the entire park. The composting basket can be fed throughout the season. It will continually break down and deliver nutrients to the bed for the duration, as will the chunky bits of organic matter you add to the layers of the bed as you build it. Keyhole garden come in many types as indicated in figure

Types of keyhole gardens



Key-hole garden



C: Trench Gardens



ACTIVITY 6 INTERACTIVE SESSION: BRAINSTORMING

Start the session by discussing what they know about the Trench Garden technique and finding out how many have tried it. Brainstorm with the group about the advantages and disadvantages of a keyhole garden. Discuss with the group strategies that should be used for encouraging the adoption of Trench Garden techniques by men, women, and youth. Guided by the following steps, work with them to set up a Trench Garden as a demonstration they can base on to set up there at their own homes .





FACILITATOR'S NOTES

What is a Trench Garden?

Trench Gardens are also commonly known as raised beds. They look like conventional garden plots, but the difference is that they contain fertilizing and moisture-retaining layers dug into the ground. The layers of the trench garden retain moisture and nourish the soil, making it more productive than a conventional garden. Rows should be spaced approximately 50 cm apart.



Benefits of Trench Gardens

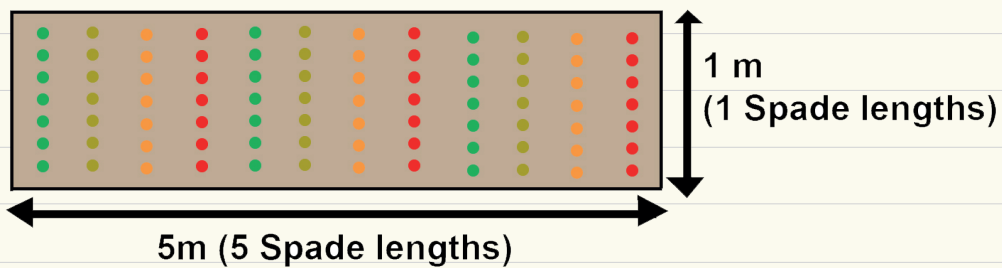
- Soil enrichment. Layers of organic materials break down over time to become hummus, adding nutrients to the soil. In addition, the use of natural fertilizers, such as manure and compost, helps feed the plants with vital nutrients.
- Moisture retention in arid or semi-arid climates. Layers of organic material soak up and retain moisture, acting as a sponge. More excellent retention means that the garden requires water less frequently and in smaller quantities
- Reducing dependence on external inputs. One of the keys to success is using locally available resources for construction and maintenance. All the materials used in construction should be sourced from the community or surrounding area.





ACTIVITY 7 INTERACTIVE SESSION

Visit an already established trench garden with several types of vegetables and let the participants take a gallery walk. Divide the participants into four groups (two for men and two for women). With the plan below, request each group to establish a trench garden



D: Planting Basins



ACTIVITY 8 INTERACTIVE SESSION: BRAINSTORMING

Start the session by discussing what they know about the plant basin technique and finding out how many have tried it. Brainstorm with the group about the advantages and disadvantages of plant basins. Discuss with the group strategies that should be used for encouraging the adoption of plant basin techniques by men, women, and youth. .

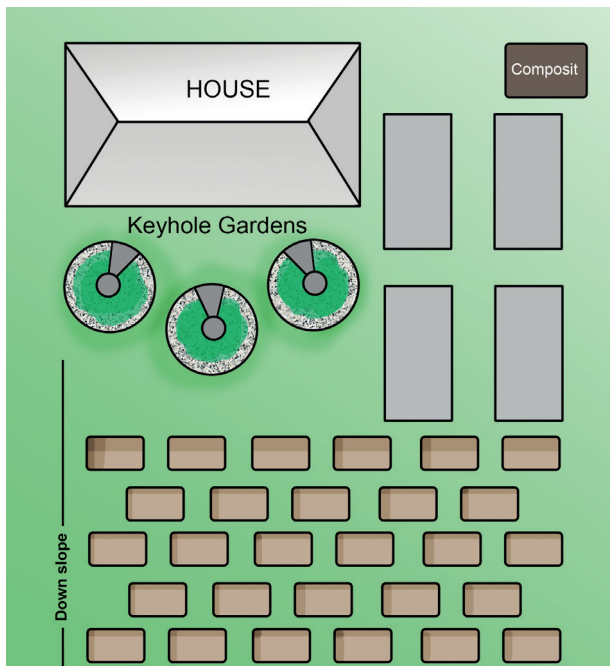


FACILITATOR'S NOTES

What is a planting basin?

Planting basins are small pits in the ground used for planting many types of crops. They are about 15 cm wide, 30–35 cm long, and 15 cm deep – about the size of a man's foot. Planting basins can be used for various crops, including maize, beans, sorghum, and wheat, in multiple ways. These can be intercropped or crop rotated at some point





Typical Homestead Garden Layout with Planting Basins

Benefits of Planting Basins

- Concentrates inputs in the potholes rather than spreading them throughout the plot.
- Adds nutrients to the soil by increasing the amount of organic material present.
- Planting basins can be reused for up to three years without applying new inputs.
- Traps water runoff, improving moisture retention and preventing soil erosion.
- Uses locally available resources.



ACTIVITY 9 INTERACTIVE SESSION: FIELD EXERCISE

*Divide the participants into two groups (one for men and one for women).
With the typical homestead garden lay out, establish some planting basin
in a specified field.*





Maintenance of Planting Basin

- **Mulching.** After harvest or weeding, crop stocks and weeds can be left in the field as mulch. Mulching helps to keep soil moist moisture by slowing evaporation while creating a protective shield against wind and water runoff.
- **Weeding.** Weeds growing between the rows compete with crops for nutrients and water. Weeds should be removed after planting and periodically throughout the growing season, leaving the dead weeds in the field as mulch. This is especially important during a drought or dry season.
- **Ridges.** These are essential to the design of the planting basin and need to be maintained. Creating ridges around the potholes on the slope's downhill side helps trap water in the pothole and channel runoff into other potholes.
- **Reuse.** Planting basins can be reused from season to season. After the first harvest, crop stocks can be left in the field as mulch. Replant potholes by loosening the topsoil and breaking up clumps to allow the new seed to grow.



MODULE KEY MESSAGES

- ✓ Various home garden options including sack gardens, key hole gardens, trench gardens and planting basin can be used to utilize the small space around a homestead. The choice of the home is largely informed by the amount of space around a house and how many vegetables can be produced. With careful planning and maintenance of the gardens, women can feed their household members on fresh fruits and vegetables all year around.
- ✓ Home gardens as mixed cropping systems that can produce vegetables, fruits, plantation crops, spices, herbs, ornamentals and medicinal plants throughout the year need regular maintenance. Building and maintaining (mulching, weeding) a homestead garden is labour intensive especially for women farmers who have to perform other production and reproduction roles within the household. Thus a rational choice of the garden is paramount and may call for garden designs and structures that can be re-used overtime.



REFLECTION EXERCISE FOR PARTICIPANTS

Ask the men and women farmers to visualize the amount of redundant space that they have around their homestead. Given the wide variety of home gardens learned in this modules, which of them would be most feasible in their homestead? Indicate two types of crops of your choice that you will grow in the home garden.





MODULE 11:

Post-Harvest Handling

INTRODUCTION

An estimated 30 percent of total crop production is lost each year in Sub-Saharan Africa because of post-harvest losses, a figure increasing because of climate change, which poses challenges to agricultural production and exacerbates the problem of post-harvest loss. In Uganda, smallholder farmers in the northern region are more susceptible to these and even higher losses during harvest and postharvest operations because of a lack of appropriate technologies and management skills.



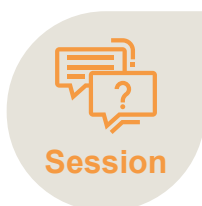


MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- understand the meaning of post-harvest handling and its role in climate-smart agriculture.
- learn about and adopt different effective post-harvest handling practices and technologies

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Introducing post-harvest handling and post-harvest losses

Session 2: Reducing post-harvest losses in grains

Session 3: Reducing post-harvest losses in cassava

Session 4: Reducing post-harvest losses in fruits and vegetables



Estimated time

Approximately 8 hours



Location

Farm Field



Training materials

Posters, flip chart, marker pens, note book, maize or sorghum seed, salt, tin, moisture meter, bottle, samples of storage facilities, illustrations of post-harvest handling of grains, cassava, fruits and vegetables.

SESSION 1

Introducing post-harvest handling and losses



ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING

Ask participants to list the common crops grown in their area. Write them down on a flip chart. Ask the participants to list the losses and challenges they face after harvesting these crops. Be deliberate to select both men and women participants. On a flip chart, summarize the types of crops with their associated losses for men and women participants



FACILITATOR'S NOTES

Introduction to post-harvest handling

Post-harvest handling is the stage of crop production immediately following harvest, including drying, threshing, cleaning, cooling, sorting, processing, value addition, packing, and storage. Good postharvest handling is critical to reducing postharvest losses between harvest and consumption, maintaining the quality of products, and ensuring good food safety. Currently, Post-harvest losses are being exacerbated by climate change, thus introducing climate-smart solutions to help smallholder farmers improve their production, decrease post-harvest losses, and increase their incomes.

Precautions during harvesting

- During harvesting, care should be taken to ensure that the product is not affected in quality or quantity.
- The crop should be harvested at the right stage, depending on the intended use.
- The timing should also be correct, and weather conditions should be dry to maintain the quality and quantity available for consumption and sale.



Types of post-harvest losses to be avoided

- Qualitative losses. This is damage or contamination of the grain because it is mixed with sand, dirt, or contaminated other seed types.
- Quantitative losses. This is the reduction in the weight of the grain because rodents eat up either portion of the seed, spillage through threshing or drying and transportation.
- Nutritional losses. This is a reduction in the nutritional or food value of the grain because of poor quality. For example, poor drying and storage mixing of sesame with sand and stones harms human health (causes appendicitis).
- Germination losses. This is a reduction in the ability of the seed to germinate or sprout after planting due to failure in viability or dormancy.

Primary Sources and causes of post-harvest losses

Source of Loss	Causes
Mechanical damage	<ul style="list-style-type: none">• Poor handling, shelling, or threshing, cleaning, sorting, drying• Poor transport and loading practice
Heat	<ul style="list-style-type: none">• Unsuitable storage structures (insufficient shade, water leakage on roofs and ventilation facilities, lack of heat insulation)
Moisture	<ul style="list-style-type: none">• Unsuitable storage structures (insufficient shade, water leakage on roofs and ventilation facilities, lack of heat insulation)• Insufficient drying before storage (high moisture content)• Water leakage and seepage through the roof and floor.
Insect Pests	<ul style="list-style-type: none">• Introduction of infested maize into the storage facility• Cross infestation from neighboring stores• Entry of insects and pests from wastes and rubbish around the store• Use of infested bags
Microbes	<ul style="list-style-type: none">• High moisture content in farms and stores.• High relative humidity
Rodents	<ul style="list-style-type: none">• Lack of barriers or guards to the storage facility• Open spaces indoors, windows, and the presence of holes
Birds	<ul style="list-style-type: none">• Openings like windows, ventilation openings, and roof openings





SESSION 2

Reducing post-harvest losses in grains



ACTIVITY 2 INTERACTIVE SESSION: FIELD EXERCISE

Visit a site where grain is being handled. In a peer to peer random walk, request the men and women participants to identify the post-harvest losses around the site. Ask the men and women participants to note the similarities between these losses and what they experience in their own farm. In a plenary, request volunteers to narrate a small story of their experiences and together discuss way in which these losses could have been reduced.



FACILITATOR'S NOTES

Checking Moisture Content: The first line of defence to curb post-harvest losses is reduce the moisture content. Moisture content can be checked through;

Traditional Method

- **Pour grain into a tin and listen carefully to the sound.** Grain with high moisture content gives a dull sound compared to the sharp sound made by dry grain.
- **Push your hand into grain bulk:** Wet grain offers more resistance to penetration than dry grain. In addition, grain with high moisture content is warm due to increased metabolic rate, while grain with optimum moisture content is excellent in the middle.
- **Bite with your teeth:** dry maize grain is hard and cracks when you bite with your teeth, while grain with high moisture content is soft, the teeth penetrate when you try to bite.
- **Salt method:** Take a small sample of the maize grain mixed with dry salt, put it in a clean, dry jar, shake it vigorously for several minutes and allow it to settle. If salt becomes wet and sticks on the wall of the pot, then the grain has a high moisture content above 15%, and therefore, it needs to be dried further.





Modern or Scientific Method

A moisture meter is used for measuring grain moisture content. It measures the percentage moisture content in each sample. You could use the results of the moisture meter to compare your estimations based on the traditional methods approach



Strategies to reduce post-harvest losses in maize and other cereals



ACTIVITY 3 INTERACTIVE SESSION: BRAINSTORMING

Discuss with the participants the strategies they use or know about reducing post-harvest losses in maize and other cereals. Be deliberate to select men and women participants. Summarise the answers on a flip chart

Practice






Drying

How to reduce post-harvest losses

- Dry shelled maize to safe levels of moisture content for storage (12 – 13%).
- Sun drying is the common method.





Practice	How to reduce post-harvest losses
 <p>Threshing & Winnowing</p>	<ul style="list-style-type: none">• Threshing is the removal of grain from the panicles.• It is usually done by women who manually beat the well-dried sorghum panicles with a stick or pound it in a mortar with a pestle to release the grain.
 <p>Cleaning</p>	<ul style="list-style-type: none">• Remove any foreign material and non-conforming grains from the normal ones.
 <p>Storage & Packing</p>	<ul style="list-style-type: none">• Store your grains until an appropriate time of use. The primary aim for grain storage is for quality maintenance, security and better prices.

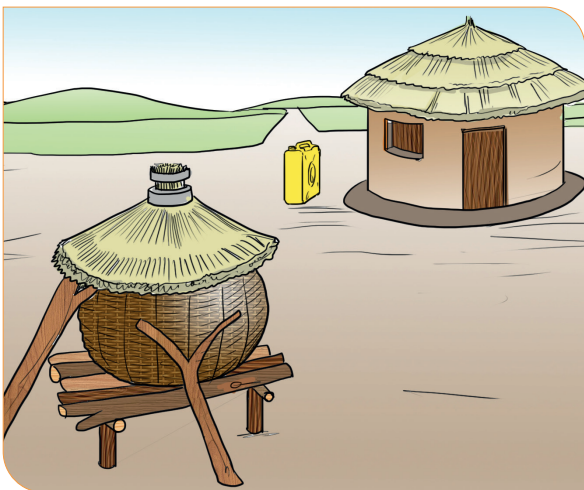




ACTIVITY 4 INTERACTIVE SESSION: BRAINSTORMING SESSION

Discuss with the participants the traditional and modern grain storage techniques that they have personally used, seen without use, or heard about and their advantages and disadvantages. Be deliberate to select men and women participants. Summarize the answers on a flip chart.

Storage options for grains



Grain storage cribs: This is a storage structure used to store grains temporarily. It is usually rectangular with ventilated sides and is raised about a meter from the ground with rodent guards.



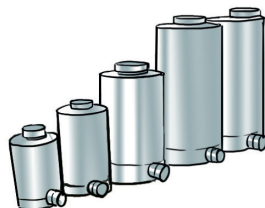
Traditinal bags jute



Hermetic plastic bag



Air tight plastic containers



Metal silos

Hermetic Storage: Dried and cleaned grains is stored in plastic or metal silos or packed in airtight bags or containers and stored in clean and well-ventilated rooms. Hermetic storage does not allow oxygen and water from the atmosphere to reach the internally stored grain.





Grain storage Pests

Pests can cause crop losses of up to 100%. The main pest categories are insects, rodents, molds, birds, and humans who steal and contaminate the grain. The common primary pests in East Africa are larger grain borer, lesser grain borer, maize weevil, and rodents.

Grain storage Hygiene

- Keep store surroundings clean, clear vegetation or rubbish which may hinder inspection or provide breeding grounds for insects and rodents.
- Clear the ground around the store. This will make it easy to spot termite trails.
- Keep livestock away from the store and droppings should be cleaned up.
- Clean the storage containers when they are empty.
- Dip secondhand sacks into boiling water to kill any insects. Then dry in the sun.
- Remove grain residues from sacks by turning them inside out and brushing them.
- Burn grass inside solid-walled bins and mud-plastered baskets to kill insects and mold.
- Sprinkle the inside walls and floor of the structure with insecticide to kill insect pests.
- Store old grain separately from the new crop. It should be used first.
- Separate any chemicals, fuels, paint, and toxins from your grain storage room.



SESSION 3

Reducing post-harvest losses in cassava

ACTIVITY 4 INTERACTIVE SESSION: BRAINSTORMING

Discuss with the participants how they handle their cassava roots after they have been harvested. Discuss with the group any other practices or technologies or good or bad experiences in their cassava post-harvest handling experience they may have or have heard about. Summarize the answers on a flip chart.



FACILITATOR'S NOTES

Guidelines on cassava post-harvest handling

1.



Harvest cassava with care

2.



Transport and store under shade

3.



Peel the cassava wholly

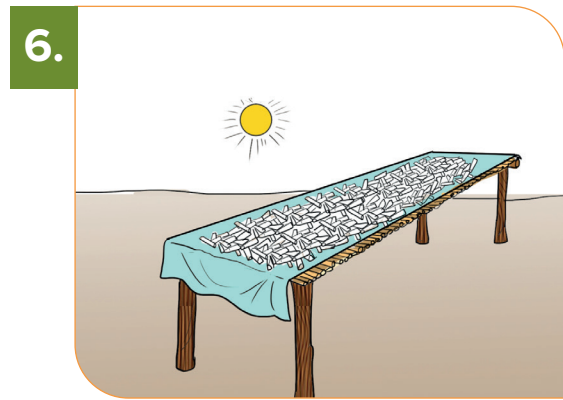
4.



Wash the peeled cassava tubers with clean water



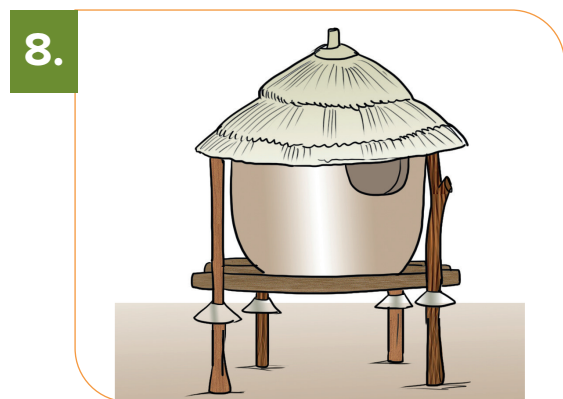
Slice the cassava into thin pieces to facilitate fast drying



Thoroughly sundry the cassava chips for 3 to 5 days



Check for dryness by breaking or pounding



Packaging and Storage of Cassava chips



SESSION 4

Reducing post-harvest losses in fruits and vegetables

ACTIVITY 5 INTERACTIVE SESSION: BRAINSTORMING SESSION

Discuss with the participants the guidelines on fruit and vegetable post-harvest handling presented in the facilitator's notes. Be deliberate to select men and women participants. Summarize the answers on a flip chart.



FACILITATOR'S NOTES

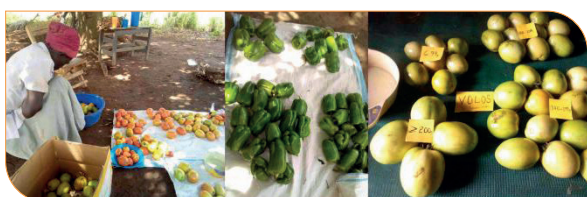
Guidelines on fruits and vegetable post-harvest handling



Harvesting: Do the harvesting as carefully more so in the mornings as to minimize mechanical injury.



Handling: Pick and carry vegetables and fruits with care, using appropriate containers.



Cleaning, sorting, and grading Clean the fruits while sorting them to remove any damaged or diseased fruits.



Packaging: Use clean, smooth, and well-ventilated containers.



Transporting: Load and unload with caution. In the case of long-distance transportation, use clean, well-ventilated vehicles.



Storage: Store only high-quality products.



Processing: Solar drying, salting, fermenting, and pickling are some of the processing and value addition technologies and practices to go for.





MODULE KEY MESSAGES

- ✓ Major causes of post-harvest losses are mechanical damage, heat, moisture, microbes, insect and animal pests. During harvesting therefore care should be taken to ensure that the product is at the right stage and with the right weather conditions.
- ✓ To curb losses for grain and root crops, several procedures including drying, cleaning, package and storage should be done. Storage can be done using storage cribs, stores, or other hermetic materials. In the store keep out insect pests, birds and humans.
- ✓ Fruits or vegetables should be harvested, cleaned, sorted and transported with care to avoid mechanical damage. Women become very important in the above processes because they are more careful. Packaging, storage and processing are auxiliary activities that increase the shelf life of the product.



REFLECTION EXERCISE FOR PARTICIPANTS

Ask the men and women participants to think about one major crop that they grow on your farms. What are the main causes of post-harvest losses? Given the resources that you have access to and control over, what strategies will they embrace to curb the post-harvest losses?





MODULE 12:

Integrated Livestock Management

INTRODUCTION

In smallholder settings, as is the case in the majority of Northern Uganda, livestock management is inextricably linked to other farming systems to maximize available resources and to capitalize on potential benefits that the various systems may receive from one another, resulting in a concept we refer to as integrated livestock management. The latter is a strategic Climate Smart Agriculture intervention, which is why this module will be dedicated to it, with topics ranging from its fundamentals to its applications in relation to relevant practices and technologies, especially as the livestock industry accounts for a significant portion of greenhouse gas emissions.





MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- gain a basic understanding of integrated livestock management and appreciate its benefits in relation to climate-smart agriculture.
- gain a basic understanding of different integrated livestock management practices.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Introduction to integrated livestock management

Session 2: Some integrated livestock management practices



**Estimated
time**

Approximately 12 hours



Location

Livestock Farm



**Training
materials**

Flip charts/ News print papers, marker pens, masking tape, flash cards of various colours; sheets of manila papers, teaching aids, materials and tools

SESSION 1

Introduction to integrated livestock management



ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING SESSION

Start the session by finding out how many men and women keep livestock.

Let those who do make a list of the livestock they own. Ask the men and women participants to mention the systems that they use to keep their livestock. Summarize the answers on a flip chart to show the difference between the livestock that men and women own or keep



FACILITATOR'S NOTES

Integrated livestock management

An integrated livestock system is typically made up of various mixed components, such as livestock with crops, livestock with bees and crops, or livestock with crops and fish. These elements collaborate in a natural cycle to maximize resource use. The products or by-products of one component (for example, livestock manure) are used as a resource for another (e.g., crops). Several elements: land or soil, water, crops or vegetation, feeds, livestock, manure, and waste are considered to achieve efficient livestock production.

Benefits of integrated livestock management

- Increased livestock productivity.
- Resources are used efficiently (land, water, soil).
- Sustainable intensification.
- No land-use change because of land expansion.
- Reduced Green House Gas emissions and pollution.
- Reduced land degradation.
- Restoration and rehabilitation of degraded or eroded land.
- Adaptation to climate risks and hazards.
- Reduced cases of pests and diseases.
- Conservation of biodiversity.

SESSION 2

Some integrated livestock management practices



ACTIVITY 2 INTERACTIVE SESSION: BRAINSTORMING

Ask participants to list the common sustainable integrated livestock management practices in their community. Be deliberate to select men and women participants. Note the responses on the flip chart. Take participants through the integrated livestock management practices in the facilitators' notes, highlighting how they contribute to some or all the three pillars of Climate-Smart Agriculture.



FACILITATOR'S NOTES

Common Integrated Livestock Management Practices

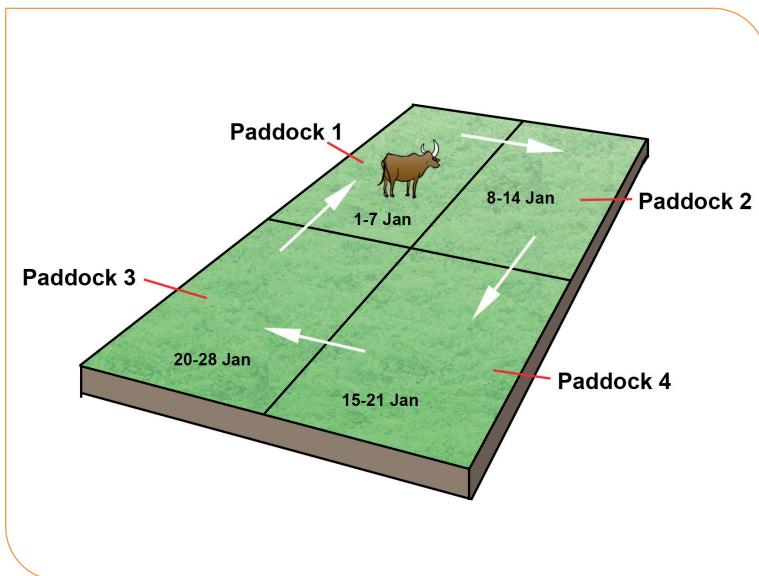
1. Improved feeding and Watering

1.1 Feeding

Livestock mainly feed on pasture (perennial fodders, pastures, and legumes) found on grazing land or bought from specialist outlets (shops or distributors). Efficient pasture management is therefore necessary for improving livestock nutrition. Pasture management involves selective sowing of improved pasture varieties to enhance livestock grazing.

Livestock Production systems

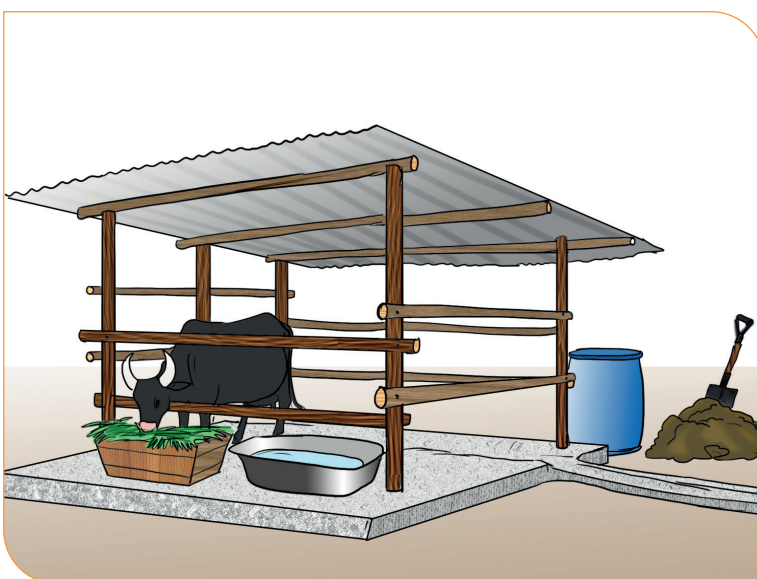
There are three main livestock production systems: (i) Land base grazing system, (ii) mixed system (iii) landless system. The integrated livestock management approach can be applied to these three systems in the following ways.



Land based:
Livestock is grazed



Mixed: Both crops and livestock are raised on same farm for complementary benefits



Landless systems:
The system involves managing waste or manure especially in pigs, dairy, and feedlots



1.2 Livestock nutrition (diet)

Animals need appropriate food to provide essential nutrients for overall health and productivity. For example, a well-fed cow provides more milk than a cow fed on low-protein crops. The main food groups important for livestock are listed below:

1. **Carbohydrates:** Essential for energy provision. Sources include green grass, roughage, pasture, and hay
2. **Proteins:** Essential for body-building. Sources include crushed maize, cereal grains, various silages plant-sourced meals made from sunflower, soybean, maize, wheat,
3. **Vitamins:** Essential for controlling diseases, increasing livestock productivity and performance, increasing growth and development, and increasing reproduction and fertility.

VITAMIN	FUNCTION	SOURCE
A	Reduces blindness and eye problems, rough skin, swollen legs, incoordination in pigs, reduced egg production and hatchability, skeletal malformations, growth, and reproductive failure	Lucerne mill, carrots, dried crushed amaranthus leaves
B2	Essential for starch or glucose and protein metabolism	Lucerne meal, green plants, fish meal, milk products
B12	Essential for the maturation, energy production, and synthesis of haemoglobin.	Soya meal, fish meal feed, milk
D	Essential for bone formation, growth, and starch/ glucose	Sunlight
E	Essential for potent antioxidants boost the immune system, muscle structure, and reproduction	Fresh green grass, soybeans wheat meal
K	Essential for blood clotting and activation of plasma protein	Sesbania, desmodium and calliandra leaves, sweet cloversm, green forage (Napier), well-cured hays, and fishmeal

4. Minerals: There are two main minerals: macrominerals (required in large amounts) and micro (needed in small quantities) minerals. The following table summarizes the most common macronutrients and the sources, functions, and health conditions associated with the lack of minerals.

MINERAL	FUNCTION	SOURCE
Calcium	Strengthening bones, teeth.	Agriculture lime, fish meal, milk, crushed shells, marble dust, seaweed, green leafy forage, and legumes.
Phosphorous	Growth, tissue building, milk, bones.	Bone meal, salt licks, cereal grains, hay, and straw.
Magnesium	Fastening of the nervous system, enzyme, carbohydrates breakdown.	Legumes, peas, and lentils.
Sulfur	Synthesis of proteins, active enzyme reactions, yolk formation, insulin, and bile formation strengthens wool, fur, and feathers and supports cellular respiration.	Kales and cabbage, amaranth leaves, Sesbania, Calliandra, soymeal, fish meal.

1.3 Water

Water, considered the source of life, is essential for a healthy animal's diet. An animal can die faster from lack of water (dehydration) than from the absence of any other feeding. An animal need 1 liter of water per 10 kgs bodyweight. The water should be fresh and safe for consumption, so watering points should be shielded from treading and other sources of contaminants.

Importance of water for Animal life

- Water is vital to body fluid regulates the processes such as digestion, transport of nutrients, and excretion. Water dissolves ionic and large numbers of polar organic compounds. Thus, it transports the products of digestion to the place of the body's requirement.
- Water regulates the body temperature by the process of sweating and evaporation.

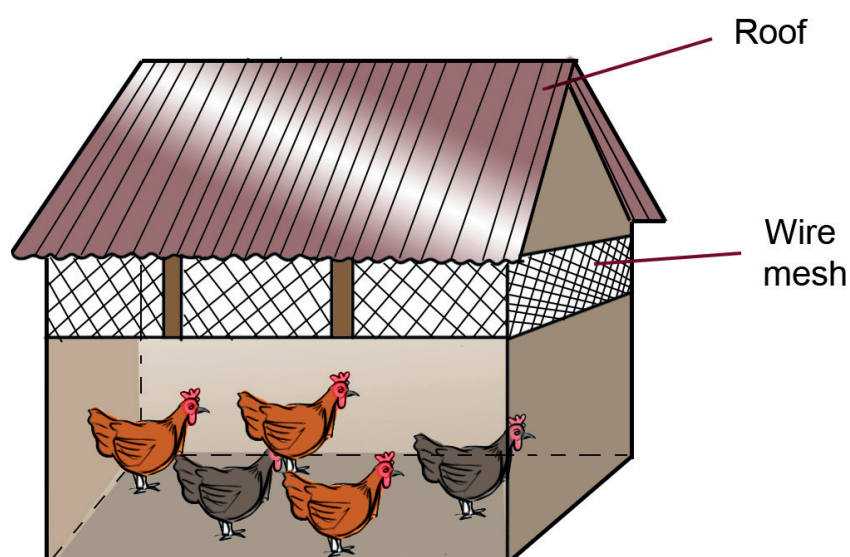
2. Housing and stall management systems

Poor animal housing stalls expose animals to pests and diseases, restricts movement, are uncomfortable, and reduce productivity and resilience to the adverse effects of climate change. It is also essential for animals to have access to shade to avoid exposure to sunlight during the day.

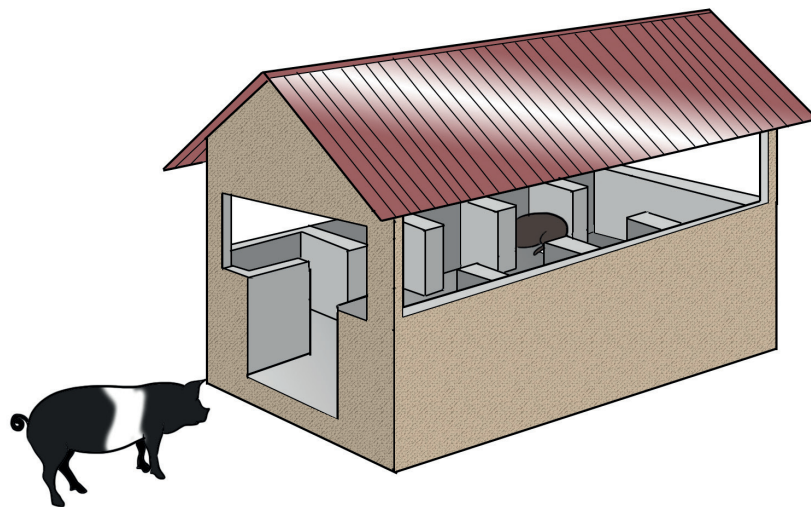
Factors to consider when constructing Animal houses

- **Type of livestock:** Different animals need different housing and structures or housing conditions.
- **Feeding behavior:** Different animals have different feeding behavior. The structures should be adapted to minimize feed loss and contamination.
- **Drinking:** Housing should accommodate water containers and drinking habits. It should also allow for the drainage of spilled water.
- **Breeding:** Housing should be favorable for mating, birthing and free of unnecessary disturbance..
- **Climatic factors:** Housing in areas prone to strong winds, for example, should be steady and built near windbreaks such as trees. Those in flood-prone areas should be raised away from the path of runoff water.

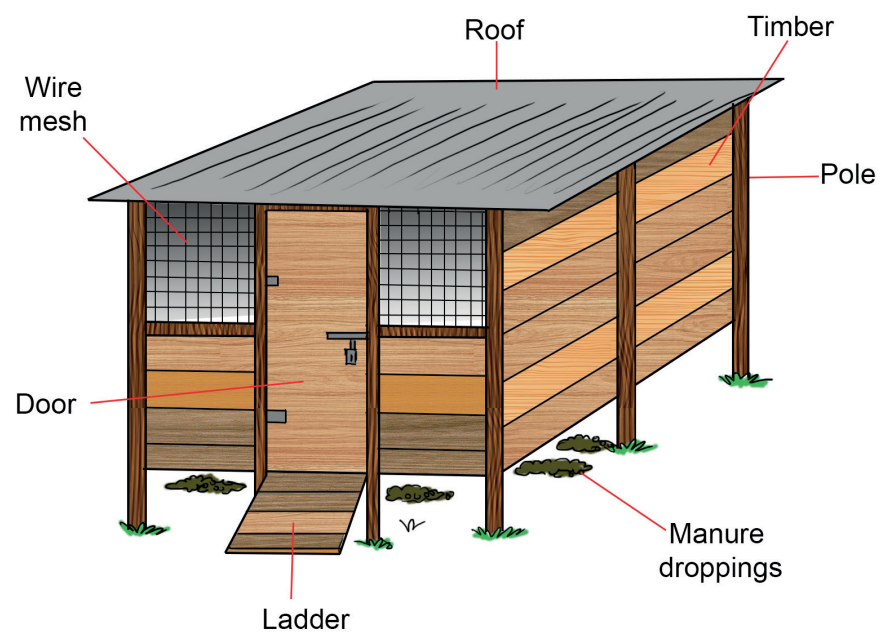
Forms of Housing



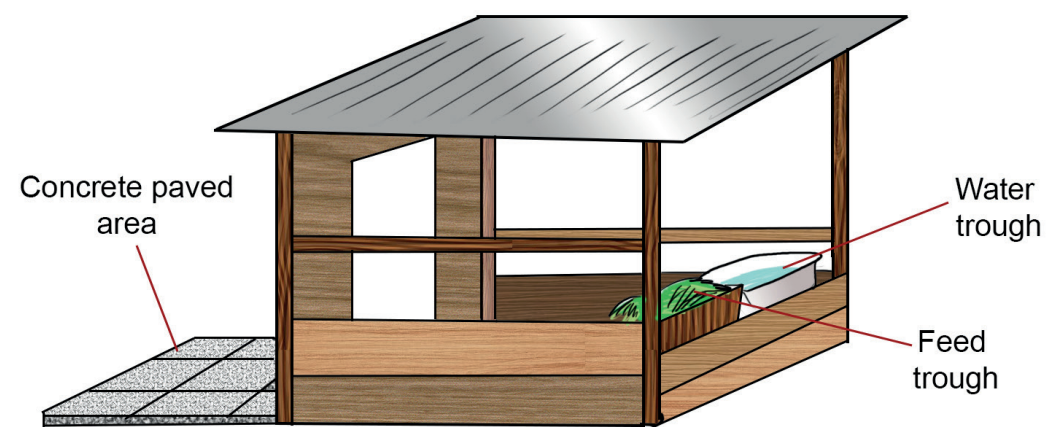
Chicken house



Pig house



Goats house



Cattle house



3. Improved breeding

Improved breeds improve livestock through selective mating and hybridization. Cross-breeding strategies develop composite cattle breeds with heat tolerance, parasite and disease resistance, fitness, reproductive traits, and resistance to poor nutrition. Cross-breeding methods should involve locally adapted breeds and improved breeds to make livestock species more resilient to climate changes.

4. Improved Waste Management

In the integrated livestock management system, waste – including livestock dung and urine, crop residues, and feedlots manure – is managed in the following ways:

- **Covering manure:** Chicken droppings and cow dung can be added to soil as manure (in the form of slurry or farmyard manure) or to non-porous soil to improve the soil texture and composition.
- **Biogas gas generation (bio-digestion):** Farmers can also use livestock manure to produce biogas. Biogas can also be used for cooking, lighting, and powering small electronic gadgets.

5. Pest and Disease Control

Climate change can cause conditions for the prevalence and proliferation of pests and diseases to mutate (adapt) or increase, lowering livestock production, causing the death of animals, and exposing the farmer to health risks.

NOTIFIABLE DISEASES		NON-NOTIFIABLE DISEASES
<ul style="list-style-type: none">• Foot and Mouth Disease (FMD)• Anthrax• Contagious Bovine Pleuropneumonia (CBPP)• Rabies• Lump Skin disease	<ul style="list-style-type: none">• Contagious Caprine Pleuropneumonia (CCPP)• New Castle Disease• East Coast Fever (ECF)• Rift Valley Fever• Trypanosomosis• Avian Influenza	<ul style="list-style-type: none">• Worms• Reproductive disorders• Mastitis• Scours

Illustration: Common diseases in East Africa



Diseases can be controlled through feeding and supply of good nutrition, water supply, improved housing, vaccination, deworming or drenching, spraying, pasture management, and improved breeding. Other practices to control diseases include avoiding congestion and overcrowding, maintaining grazing and accessing information, and extension advisory services.

The main challenges facing the control of animal diseases and pests are:

- Absence of adequate capacity for disease control and clinical services.
- Little public awareness on disease and pest confirmation.
- Inadequate epidemic surveillance.
- Poor tick control.
- Weak inspectorate and quality assurance.
- Lack of enforcement of existing rules and regulations on the movement of livestock.
- Products both within the country and across the national borders.
- Inadequate human, financial and physical capacity to enhance the performance of the Department of Veterinary Services.





MODULE KEY MESSAGES

- ✓ An integrated livestock system is typically made up of various mixed components, such as livestock with crops, livestock with bees and crops, or livestock with crops and fish. The integration is purposed for resource use efficiency and to ultimately to increase livestock productivity.
- ✓ Animal housing is an important aspect for both animal health and hygiene. Animal houses should be appropriately constructed to accommodate the different livestock types and their feeding behaviour. Houses should also provide a conducive environment for animals to drink, breed and also withstand extreme weather events.
- ✓ Nutrition is part and parcel of integrated livestock management. Livestock diet should constitute of carbohydrates for energy giving, proteins for body building, vitamins and mineral supplements. A wide varieties of natural feeds exist to enable men, women and low-resource farmers provide a balanced diet to their livestock. Water is also an integral part of livestock nutrition and should be fresh and safe for consumption and should be provided all the time at specific watering points within the farm.
- ✓ Other complementary aspects including proper breed selection, animal and herd management, disease control and waste management are important parts of an integrated livestock management system for increased livestock productivity, feed conversion efficiency and adaptability.



REFLECTION EXERCISE FOR PARTICIPANTS

Divide the participants in four groups (two for men and two for women). In a group discussion come up with a feasible household plan to fit livestock feeding and nutrition into the 24 hour clockwork role of a typical small holder farmer household. What are the gender related challenges as roles are distributed between men and women household members?





MODULE 13:

Beekeeping

INTRODUCTION

Bees are necessary not only to produce honey, but also for plant pollination. Over one-third of the food we eat is dependent on bee pollination, either directly or indirectly. Many fruit trees, nut plants, and vegetables require pollination by bees to bear fruit, and without pollinators, these crops may become extinct (a potentially colossal biodiversity loss). Thus, food production would be jeopardized without bees' natural role, as bees pollinate approximately 35% of food crops used by humans. Beekeeping, directly and indirectly, contributes to all three pillars of Climate-Smart Agriculture, making it an essential CSA practice.





MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- obtain a basic understanding of beekeeping and its benefits, especially in relation to CSA.
- gain an understanding of three of the most common beekeeping systems used in Uganda.
- understand how to set up and maintain a good apiary.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: A brief introduction to beekeeping and its benefits

Session 2: Common beekeeping systems in Uganda

Session 3: How to set up and maintain a good apiary



Estimated time

Approximately 9 hours



Location

Farm with bee keeping systems



Training materials

Flip charts, marker pens, masking tape, and visual aid, apiaries

SESSION 1

A brief introduction to beekeeping and its benefits



ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING SESSION

Start the session by finding out how many of the participants are keeping or have ever owned bees. If there are some, let them share a few of their experiences, both negatives, and positives. Be deliberate to select men and women participants. In a plenary, discuss with the group the benefits of beekeeping.



FACILITATOR'S NOTES

What is Beekeeping?

Beekeeping is the active rearing of bees. Historically, bees were not “kept” but rather hunted, smoked, and killed for honey and, occasionally, brood (larvae and pupae).

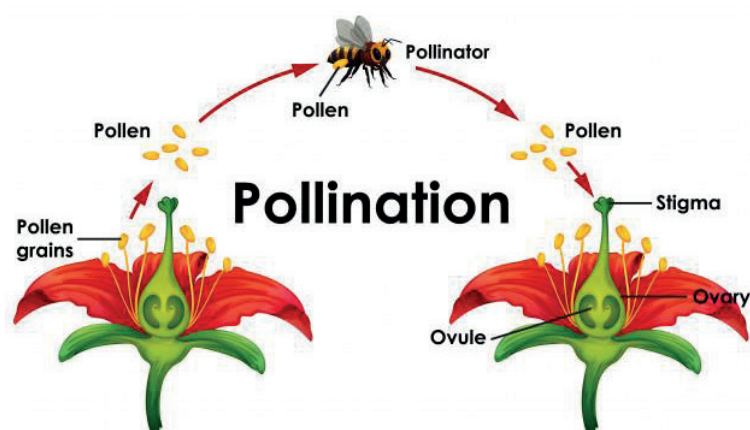
A bee colony is made up of three types of bees: a queen (which is the only bee capable of egg-laying and is therefore responsible for it), drones (male bees), and worker bees (sterile females, whose function changes according to their age).

Benefits of Beekeeping

- Bees are essential pollinators of plants, thus playing a significant role in biodiversity and improvements in crop yields. This is particularly valued in organic farming
- Requires limited resources in terms of cost, labour and land
- Produces hive products with therapeutic or medicinal value. The most known product from beekeeping is honey: it is consumed as a whole, added, and mixed with other ingredients and is considered an essential foodstuff in Uganda.
- Products from beekeeping and the colonies can be marketed and thus serve as an essential source of household income.
- Conservation of natural resources: Beekeeping is a non-destructive activity that could be employed to conserve biodiversity in protected areas.

Relevance of bees for pollination

- As mentioned, bees are essential pollinators and contribute to crop production worldwide. Pollination is considered the most important “management practice” for ensuring agricultural production worldwide. It is, therefore, an essential contribution to climate change adaptation.



- Trees and crops flower at different times throughout the year. A beekeeper should thus identify which trees and crops are in the area to ensure the bees have sufficient forages to feed on. A flowering calendar (listing flowers available each month) can help.
- Trees and crops suitable for beekeeping found in the forest and planted in and around the farm are listed below.

Tree species	Crops or forages
Acacia	Blackberry
Shea tree - Vitellaria paradoxa nilotica	Calliandra
Combretum	Citrus
Diospyros	Clover
Dombeya	Sunflower
Julbernardia globiflora	Cotton
Pentaclethra macrophylla	Mango
Vernonia amygdalina	Cashew
Calliandra calothyrsus	Neem
Eucalyptus	Bottlebrush
Musa spp, Coffee	Passion fruit

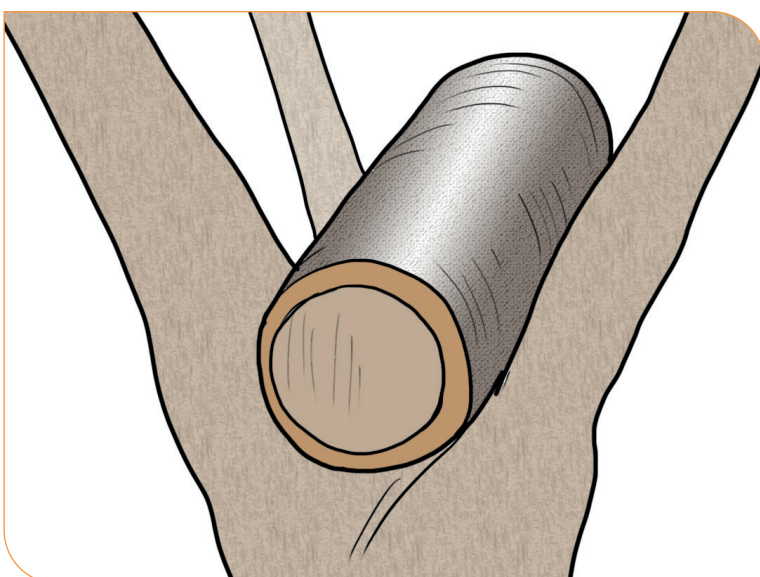
Source: adapted from the Republic of Uganda: Ministry of Agriculture, Animal industry and fisheries (2012)

**ACTIVITY 2 INTERACTIVE SESSION: BRAINSTORMING**

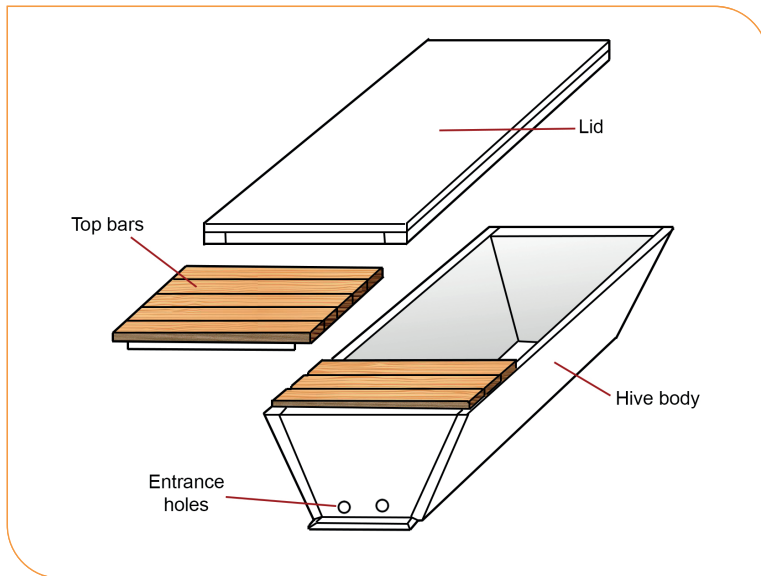
Ask the participants which beekeeping systems they already know. What advantages and disadvantages can the participants mention about the different beekeeping systems they have said? Be deliberate to select men and women participants. Summarize the answers on a flip chart as way to introduce the beekeeping system.

**FACILITATOR'S NOTES****Standard beekeeping systems in Uganda**

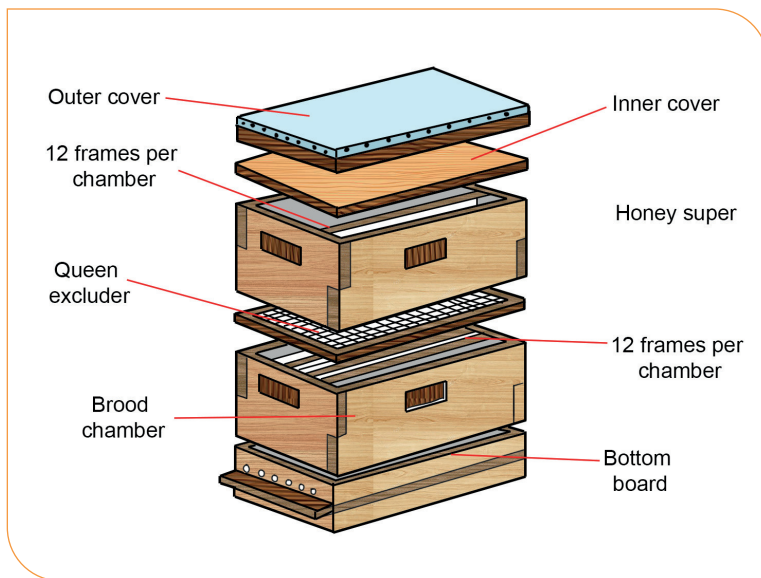
There are three standard beekeeping systems in Uganda. The traditional log hive system, the top bar hive, and the modern hive. The traditional and top bar hive systems are most relevant (i.e., available and affordable) for farmers in Northern Uganda and are thus explained in detail.



A traditional beekeeping system



The top bar beekeeping system The top bar hive is a box with a series of bars arranged side by side along the top, at which the bees are encouraged to construct their combs.



Modern frame system A modern hive consists of a bottom, 1-2 brood chambers, 1-2 honey chambers, and an inner and outer cover. Depending on the type and size of the frame system, 9 – 12 frames per chamber can be used.

Choosing the right beekeeping system

- Select the most suitable beekeeping system based on your objectives (hobby, income generation etc...)
- Available of resource time, funding (for investments in equipment), location, and materials can help select the most suitable beekeeping system.
- Overall, for the bees, the system should be dry, have a correct size, odorless, and the system should protect the bees from pests and predators.





SESSION 3

How to set up and maintain a good apiary



ACTIVITY 3 INTERACTIVE SESSION: BRAINSTORMING

Make a pre-arrangement to visit a farmer/farm that owns bees. Let the men and women participants take a random walk to see the different apiaries.

Using the step below guide the men and women participants how to set up and maintain a good apiary.



FACILITATOR'S NOTES

Steps in setting up and maintaining a good Apiary

Step 1: Site selection:

- Easy to access.
- Away from human activity and noise.
- Safe from thieves.
- Near a place where bees can find water.
- Near flowers and trees that produce flowers.
- Protected from intense sun and winds.
- Usually, a place that is not useful for other activities such as crop farming.

Step 2: Site preparation

- Clear obstacles and vegetation around hives to allow easy movement
- Protect against unwanted visitors such as thieves and large animals
- Plant nectar-producing plants to provide forage





Step 3: Placing the hives - Things to observe

- If you decide to use stands, they should be at least 1 meter high. They must be made of robust and termite-resistant wood to last.
- Use suspension wires if honey badgers are a danger. The wires need to be well greased to keep ants away.
- Hang hives at least 1 meter from the ground.
- Leave enough space (10-20 m for scutellata bees) between hives to make it easy to work without disturbing bees in other hives.
- Make sure the hive entrances face away from footpaths.

Step 4: Hive Preparation and Maintenance

- The hives need to be clean and contain good bait to attract honeybee swarms to live there.
 - Use plenty of beeswaxes around the inside of the hive and at the entrance. A top bar with a fresh beeswax starter strip is excellent for attracting bees. Bees are also attracted by a comb containing brood
 - If possible, use a wax starter strip on each top bar. This will force the bees to build in the desired direction
 - The bees like the odor of some leaves, which are always known locally and are sometimes used as extra baits
 - Inspect hives regularly to check if bees have moved into them.
 - If there are no bees, check hives are clean and dry and that no pests, such as ants and spiders, or snakes, have moved in
 - Add more wax bait if needed. The best time to colonize hives is when bees are swarming or migrating
 - Discuss with experienced local beekeepers when the best colonizing times will be.





Step 5: Inspection (only for Langstroth and Top Bar-Hives)

- Hive inspection should be done at least once a month to get acquainted with your bees. This will enable you to know:
 - When the colony needs a new queen
 - The colonies with docile bees
 - Productive colonies
 - Colonies with less tendency of swarming
 - Performance of the queen
 - Presence of pests, predators, and diseases
 - Whether the honeybee colonies need supplementary feeding
 - When to divide to form a new colony
 - When to harvest the honey
 - This is usually done by keeping a work-plan

Step 6: Inspect inside the hives to see if:

- The bees are building combs correctly (one comb on one top bar).
- The queen is laying enough eggs.
- The brood nest has a closed brood area without too many empty cells in between.
- There are any leakages of water.
- There are intruders like ants, beetles, or spiders.
- Diseases are harming the bees.





MODULE KEY MESSAGES

- ✓ Beekeeping is a common practice either as a hobby or as an income and food security investment. Other uses of bees and their products include; pollination and medicine. Bee keeping is a low cost investment and use natural resources and protected areas to house the apiaries.
- ✓ There are three standard beekeeping systems in Uganda. The traditional log hive system, the top bar hive, and the modern hive. These bees systems should be dry, have a correct size, odourless and protected from pests and predators.
- ✓ When bees are grown for commercial honey production, it is important that the farmer pays attention to the site where the apiary will be set, placing of the hives, their preparation and maintenance. The hives should also be inspected routinely and proper harvesting and post-harvesting procedures should be keenly observed.



REFLECTION EXERCISE FOR PARTICIPANTS

If you have been given unlimited resources to set up an apiary, what bee keeping system would be most suitable for you as a man or woman farmer? Given the amount of available space in your homestead, draw a simple plan of how this bee keeping system would be set up.





MODULE 14:

Agroforestry

INTRODUCTION

Agroforestry is becoming more recognized as a land management system that can serve as a response option for climate change adaptation and mitigation while also addressing many of the issues that smallholder farmers face. Agroforestry has the potential to create a wide range of livelihood benefits, including economic and environmental ones, since it can aid in the mitigation of climate change and the adaptation of farmers to intense and changeable weather. Agroforestry contributes to all three pillars of Climate-Smart Agriculture, thereby establishing it as an essential CSA practice.



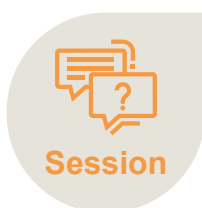


MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- Gain a basic understanding and appreciation of Agroforestry and its benefits.
- Understand different agroforestry systems.
- Gain a basic understanding of Tree nursery establishment and Tree seedlings management.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Understanding the basics of agroforestry and its benefits

Session 2: Understanding agroforestry systems and related land-use practices

Session 3: Tree nursery establishment and seed management



Estimated time

Approximately 7.5 hours



Location

Farmer Home



Training materials

Flip chart, chalk, marker pens, posters, cards, overhead projector, writing materials. Other materials will depend on the specific agroforestry method applied



SESSION 1

Understanding the basics of Agroforestry



ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING

Ask the participants about the benefits of agroforestry. Be deliberate to target men and women participants. Summarize the answers on a flip chart and discuss with the participants how agroforestry can contribute to the three pillars of Climate-Smart Agriculture.



FACILITATOR'S NOTES

What is Agroforestry?

Agroforestry is a collective name for land-use systems and practices in which trees and shrubs are deliberately integrated with crops and animals on the same land management unit. The integration can be in a spatial (in space) mixture or a temporal (time) sequence. The integration must be ecological, economically viable, and socially responsive.





ACTIVITY 2 INTERACTIVE SESSION: BRAINSTORMING

Organize men and women participants in groups of 5-7 and discuss with the participants the different agroforestry systems and related land-use practices. In a plenary, summarize the answers on a flip chart and get an idea of which systems men and women are already familiar with and those they would love to try out immediately.



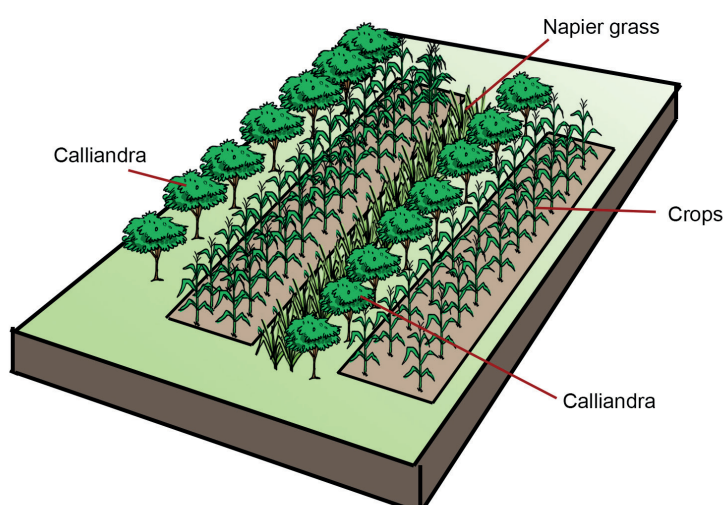
FACILITATOR'S NOTES

What is Agroforestry System?

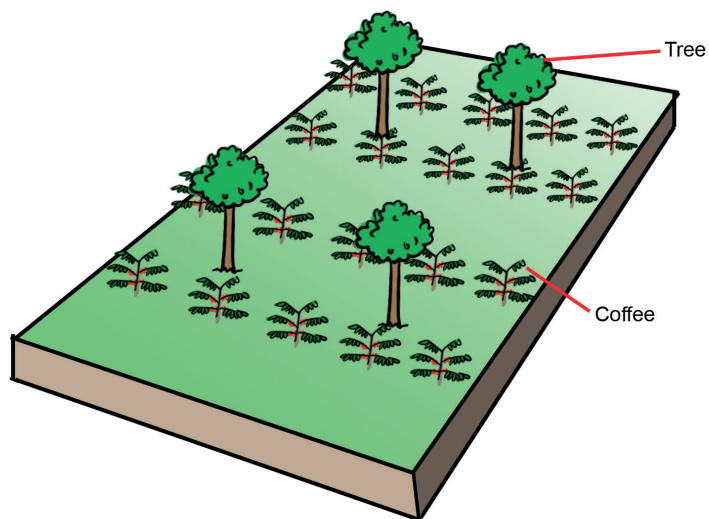
An agroforestry system is a distinct use of different agroforestry practices in different locations and over a certain period. The most common systems are discussed below.

Types of Agroforestry System

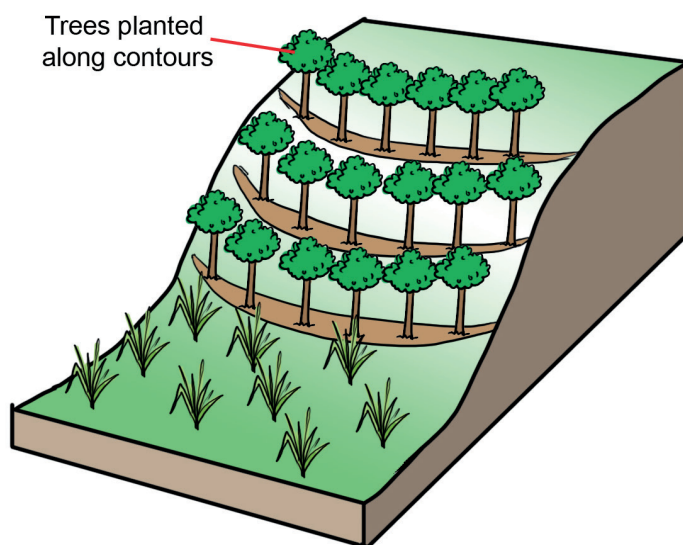
1. **Agri-silviculture – Planting trees among crops** It is defined as the growth of trees and crops on the same land. Agri-silviculture comes in many types as shown in figure
2. **Silvopasture – Trees with pastures or livestock**



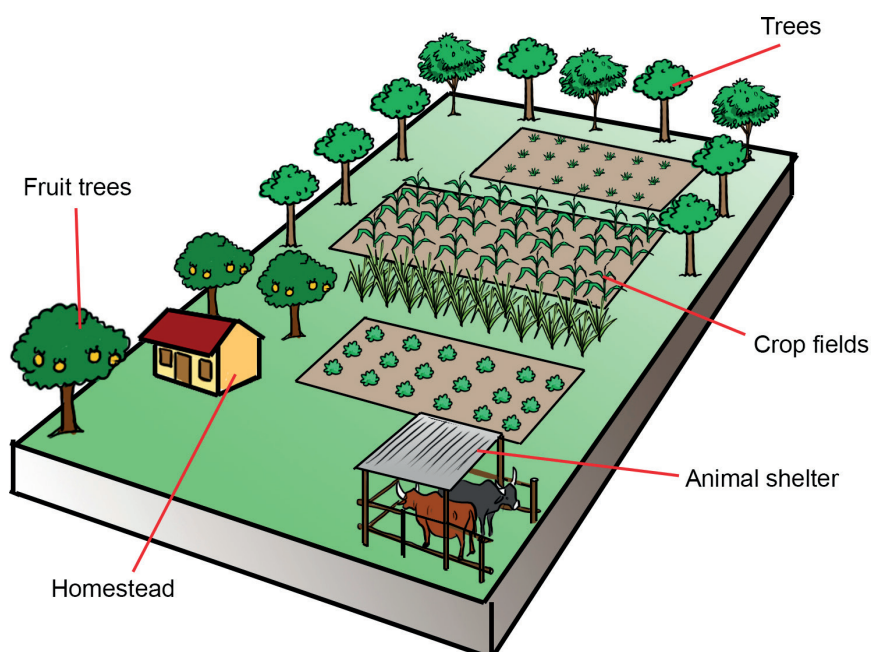
Alley cropping: This is the practice of growing annual crops or forage between rows of trees or shrubs to create hedgerows in a landscape



Trees with Perennial crops:
Trees can be grown with other plants that live for a long time, like coffee, sugar cane, and tea.



Contour Trees: Contour trees are planted on sloping ground to preserve soil and water quality and aesthetic purposes

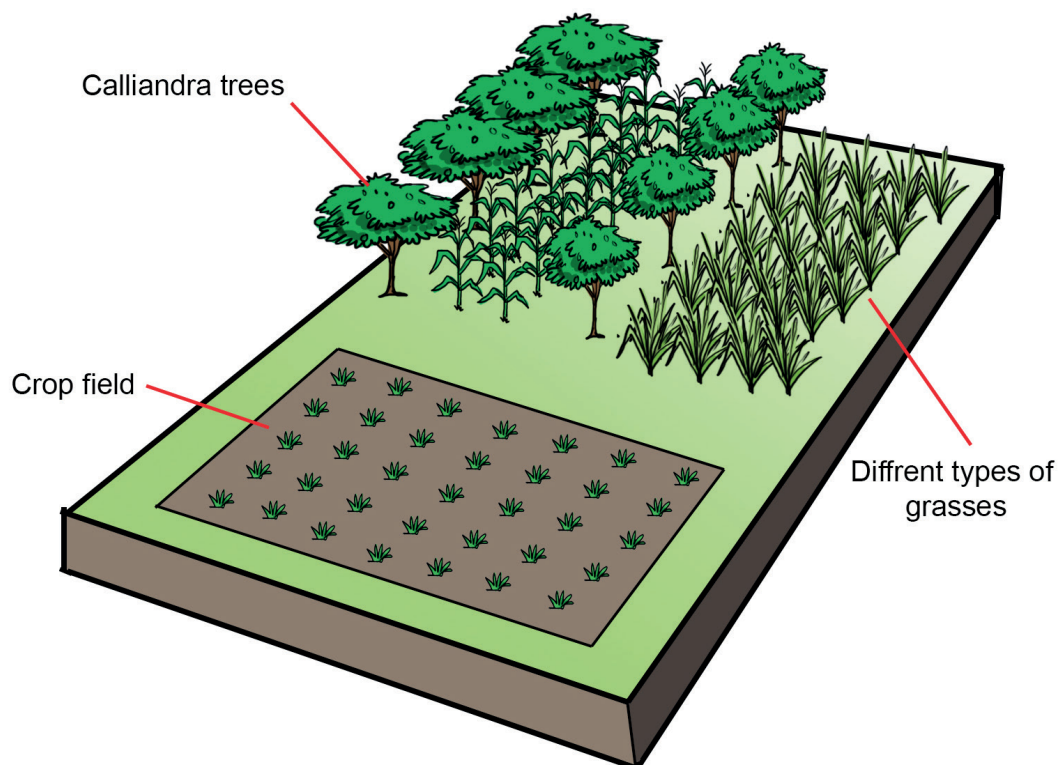


Homestead Garden Trees. A homestead garden can be tree-filled with various trees (fruit, fodder, timber, and medicinal trees) and crops planted together.

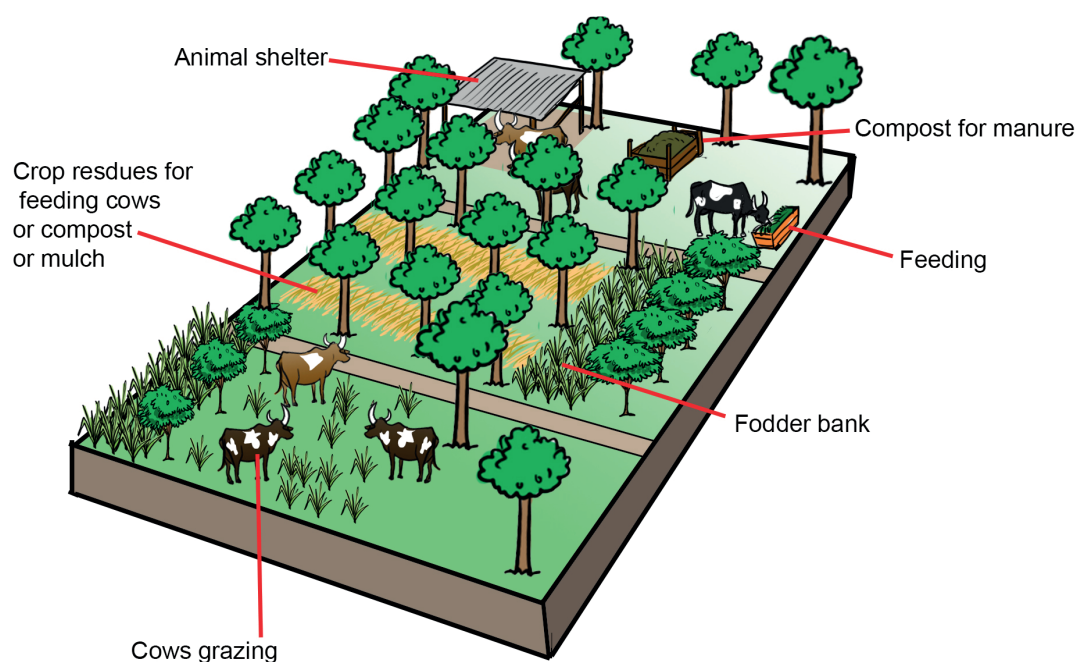


Silvopastoral systems are agroforestry arrangements that purposely combine fodder plants, such as grasses and leguminous herbs, with shrubs and trees for animal nutrition and complementary uses.

3. Agrisilvopastoral – Trees with pastures or livestock



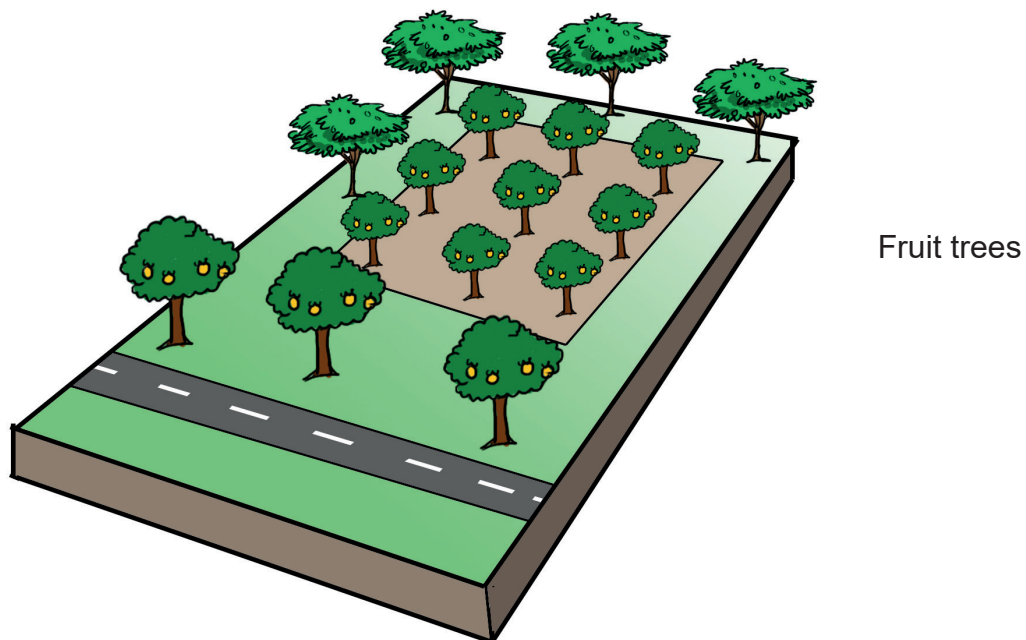
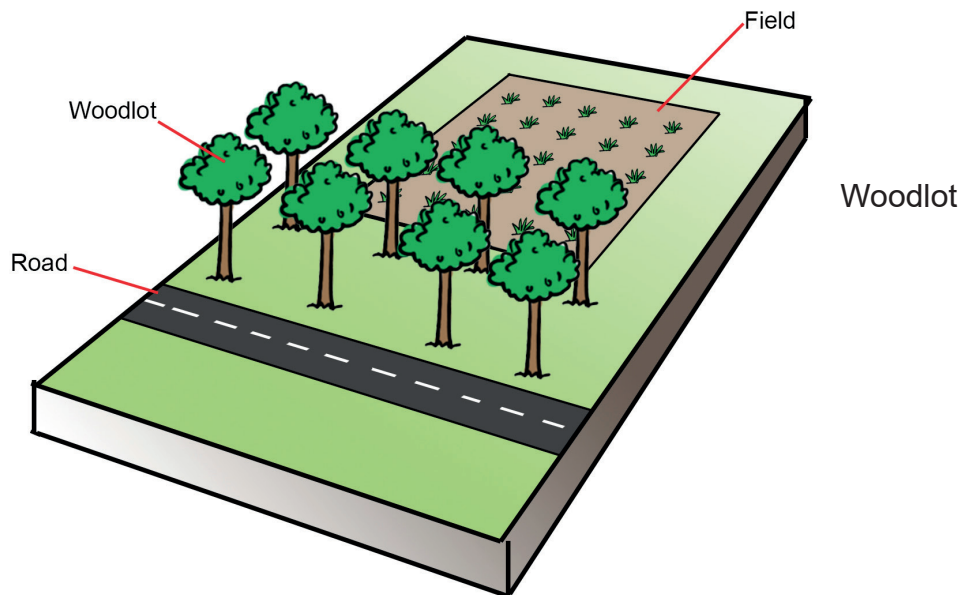
Agro-silvopastoral systems are land-use practices that integrate trees and crops into livestock production. They play an essential role in reducing vulnerability and increasing crop resilience, thus helping communities better tackle climate risks.

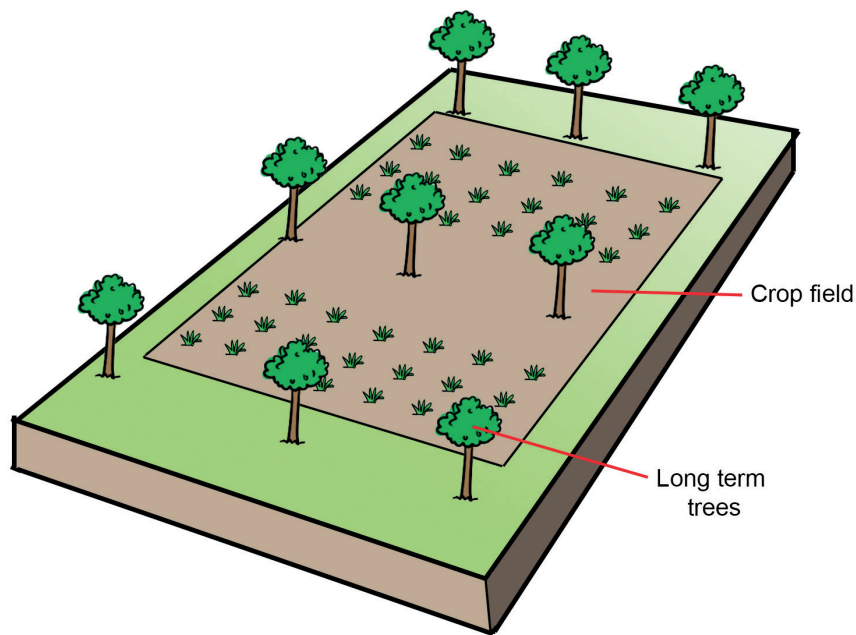




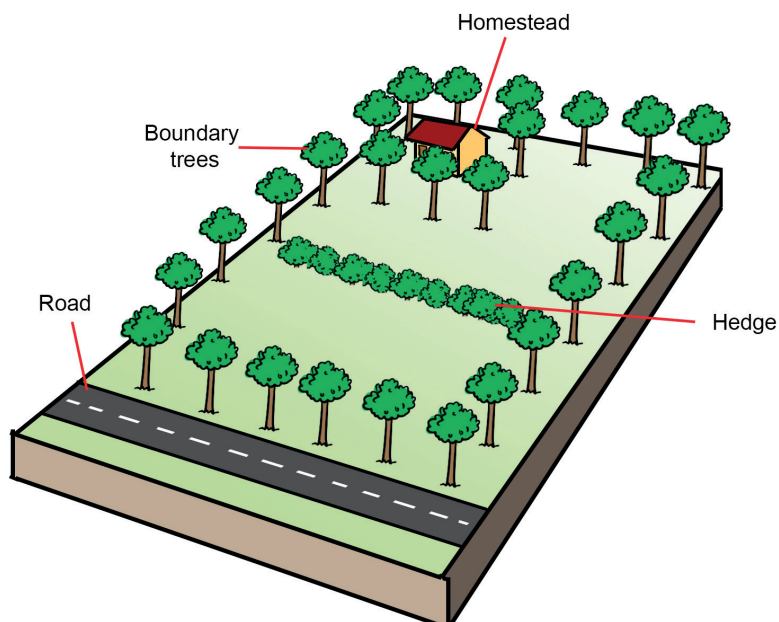
Common Agroforestry Land-use Systems

There are four major land-use practices within agroforestry. In this context, land use refers to how you choose to plant the trees and how they interact with the crops.





Intercropping



Boundary planting



Tree species

The following table summarises the main tree species in various major land-use agroforestry systems in East Africa.

WOODLOTS	FRUIT ORCHARD	DISPERSED PLANTING	BOUNDARY PLANTING
<i>Casuarina equisetifolia</i>	<i>Mangifera indica</i>	<i>Grevillea Robusta</i>	<i>Markhamia lutea</i>
<i>Albizia lebbeck</i>	<i>Citrus limon</i>	<i>Albizia coriara</i>	<i>Casuarina equisetifolia</i>
<i>Markhamia lutea</i>	<i>Persea Americana</i>	<i>Albizia lebbeck</i>	<i>Acacia xanthophloea</i>
<i>Cedrela odorata</i>	<i>Artocarpus heterophyllus</i>	<i>Acrocarpus fraxinifolius</i>	<i>Maesopsis emnii</i>
<i>Acacia nilotica</i>	<i>Psidium quajava</i>	<i>Podocarpus falcatus</i>	<i>Grevillea Robusta</i>
<i>Acacia xanthophloea</i>	<i>Syzygium cumnii</i>	<i>Prunus Africana</i>	<i>Leucaena leucocephala/ Calliandra calothyrsus</i>
<i>Acacia polyacantha</i>	<i>Pasiflora edulis</i>	<i>Cordia Africana</i>	<i>Senna siamea</i>
<i>Maesopsis emnii</i>	<i>Eriobotrya japonica</i>		

Factors to consider when choosing trees for agroforestry

CHARACTERISTICS	BENEFITS
Multi-purpose	Provide products such as firewood, fodder, poles, green leaf manure, medicine.
Growing	Fast growing, increased production of biomass.
Rooting system	Deep-rooted so that they do not affect other crops.
Competition	Non-competitive for plant space, nutrients, air, light and water.
Re-growth	Grows back after cutting.
Nutritious and tasty	Fodder for livestock, non-poisonous, soft leaves.
Canopy	Light can penetrate but still give shade.
Nitrogen	Nitrogen-fixing, improve soil fertility.
Economic	Produce saleable products (fruits, timber, firewood).
Environmental	Do not overtake other species, indigenous, promote biodiversity, adaptable, compatible with the landscape.

SESSION 3

Tree nursery establishment and Tree seed management



ACTIVITY 3 INTERACTIVE SESSION: PLENARY

In a plenary, discuss the experiences of men and women participants in tree planting. Summarize the experiences on a flip chart and discuss with the participants the steps and techniques involved in tree nursery establishment, tree seed management, including how to successfully plant trees.



FACILITATOR'S NOTES

What is a Tree Nursery?

A tree nursery is a location, either on or off the farm, where tree seedlings are raised and developed to a desired, useable size before being planted. The plants can be used on your farm or sold to others, resulting in additional money for the family because of their production. Nurseries provide easy access to young tree seedlings at an affordable price. Seedlings produced in a nursery have a higher chance of surviving than seeds dropped straight into the ground. This is because the seedlings have already established themselves.

Benefits of on-farm tree nurseries

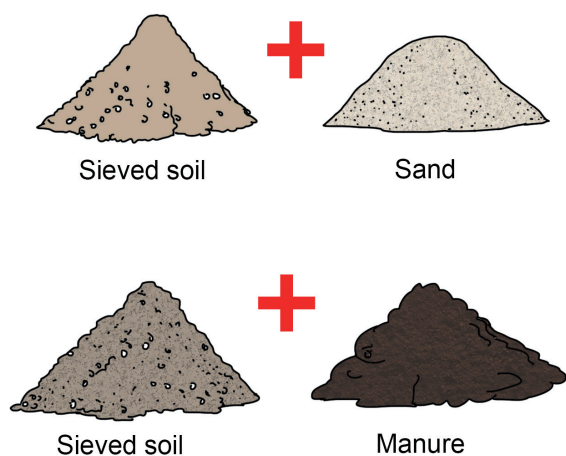
- You can grow the desired tree species and the number of seedlings.
- Income generation opportunities from selling seedlings.
- Cost-efficient – cheap to establish and manage.
- Availability of seedlings throughout the year.
- Possibility of using locally available materials for planting.
- Nurseries can be used as teaching material for schools and groups



ACTIVITY 4 INTERACTIVE SESSION: FIELD EXERCISE

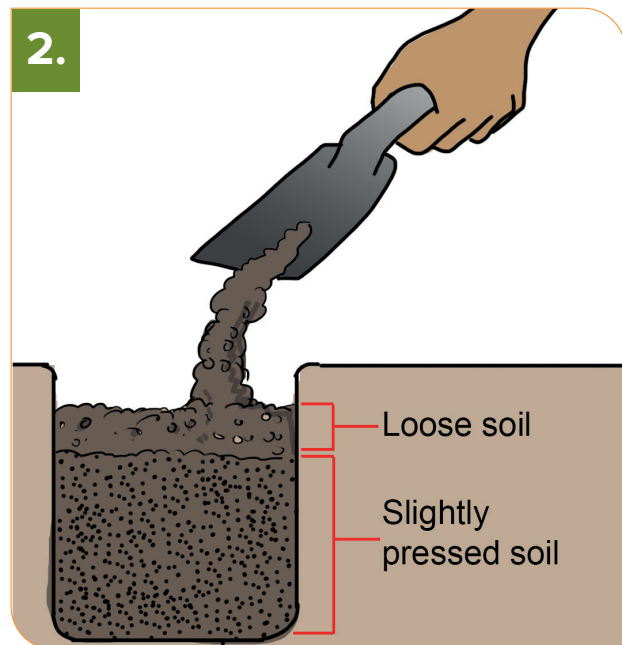
Divide the participants of two groups (one for men and one for women) and carry out the following steps in seed bed preparation.

1.



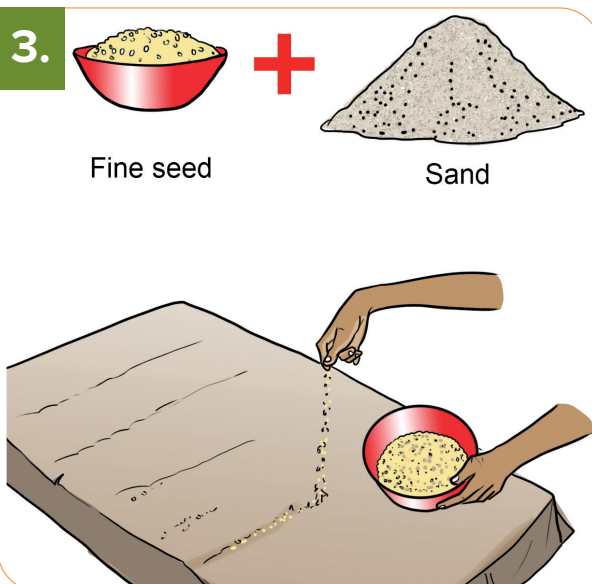
Soil Preparation

2.



Potting

3.



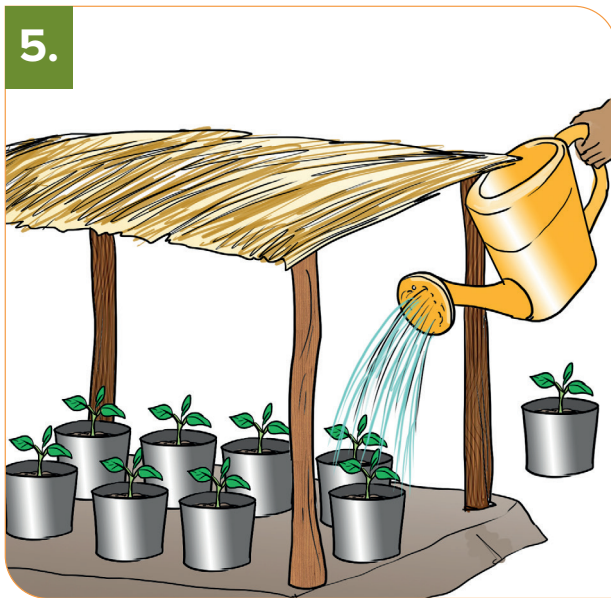
Sowing

4.



Pricking out





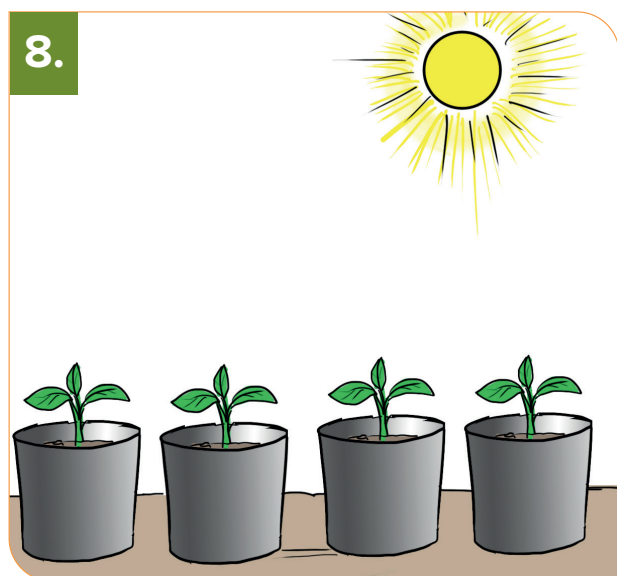
Shading and watering



Weeding



Root Pruning



Hardening Off



How to Plant a Tree

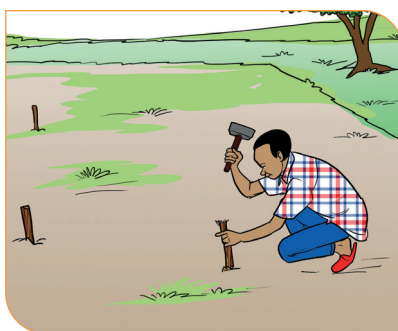


ACTIVITY 5 INTERACTIVE SESSION: FIELD EXERCISE

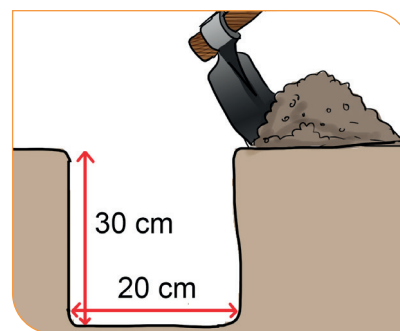
Divide the participants of two groups (one for men and one for women) and carry out the following steps in planting a tree.



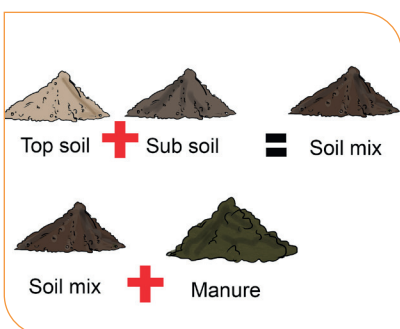
Choose a suitable species



Choose the agroforestry system/practice



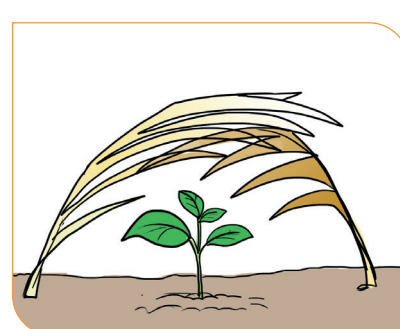
Prepare the hole



Plant the seedling



Prepare the soil and manure



Managing the growing planted tree



MODULE KEY MESSAGES

- ✓ Agroforestry is a collective name for land-use systems and practices in which trees and shrubs are deliberately integrated with crops and animals on the same land management unit. The choice of an agroforestry tree is gender differentiated largely due to the purpose and type of products the farmer desires, the growth habits of the trees as well as its environmental friendliness.
- ✓ Trees can be grown in different arrangements as woodlots, orchards, intercropped or on the boundary of the farm. These trees enhance food supply, improve soil fertility, regulate soil moisture content, control erosion, and promote pollination by bees.
- ✓ Tree seedlings are raised in nurseries before they are eventually planted in a proposed site. Various practices including; watering, hardening off, root pruning should be undertaken to ensure a good quality seedling.



REFLECTION EXERCISE FOR PARTICIPANTS

Ask the men and women participants to list three things that drive their choice of a given agroforestry tree. Given the differential gender access and control over land, what agroforestry system would the men and women participants use to establish the trees on their farm?





MODULE 15:

Sustainable Energy

INTRODUCTION

Improving access to reliable and sustainable energy sources holds the promise and potential to transform the lives of entire populations across the African continent, whether it is through the reduction of the drudgery associated with farm work, the generation of higher incomes, or the improvement of the health and well-being of hundreds of thousands of people. Sound energy management for and from the agri-food system can make a significant contribution to the transition to climate-smart agriculture and the achievement of food, climate, and energy security. This transformation will only be achieved if current examples of energy-efficient food systems are copied on a large scale.



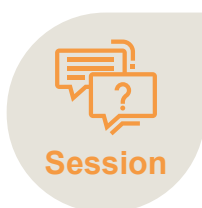


MODULE OBJECTIVES

At the end of this session, the men and women participants will,

- gain a basic understanding of sustainable energy.
- gain a basic understanding of some CSA suitable Sustainable energy technology options they can use in their areas and beyond.

MODULE TIMING, LOCATION, AND MATERIALS REQUIRED



Session

Session 1: Understanding the meaning of Sustainable Energy

Session 2: Some CSA relevant Sustainable Energy application options



**Estimated
time**

Approximately 5.5 hours



Location

Farmer Home



**Training
materials**

Marker Pens, flip charts, example of energy saving stove and if possible visit of a kiln, biogas crop residues

SESSION 1

Understanding the meaning of Sustainable Energy



ACTIVITY 1 INTERACTIVE SESSION: BRAINSTORMING

Ask the participants about the sources of energy that they use. Ask if there are other sources they know of that they could use. Guide the discussion with some of the examples highlighted in the facilitator's notes. Guided by the facilitator's notes, explain the meaning of the term sustainable energy, and make sure that they understand its three components, especially the one on renewable energy.



FACILITATOR'S NOTES

What is Sustainable Energy?

Sustainable energy is the provision of energy such that it meets the needs of today without compromising the ability of future generations to meet their own needs. It has the following three key components:

- 1. Renewable Energy** - Applies to those energy resources that are non-depletable or naturally replenishable. Examples include; wood and wood waste, solid waste, biogas, ethanol, biodiesel, hydropower, geothermal, wind, and solar.
- 2. Energy Efficiency** – Applies to those energy source that reduce the amount of energy required to provide products and services. An excellent example is a house that incorporates as much natural lighting as possible while relying less on electricity.
- 3. Energy use Avoidance** – Relates to energy use only when needed, such as switching off lights when nobody is in the room or putting out a fire to save the firewood for future use.

SESSION 2

Some CSA relevant Sustainable Energy application options



ACTIVITY 2 INTERACTIVE SESSION: GROUP ACTIVITY

Divide the participants into four groups (two for men and two for women) and let each group discuss the sources of energy they use. In a plenary, each group makes a small presentation to enable you to distil the energy option for both men and women. Using the different examples present, explain the meaning of sustainable energy.



FACILITATOR'S NOTES

Renewable Energy

It is the kind of energy that comes from sources that can be reused or replenished. Examples of renewable energy include;

- 1. Biomass Energy:** This comes from living and recently dead biological material including trees, plants, firewood, manure, sewage, crop residues, and biofuels.
- 2. Biogas:** This is a flammable or combustible gas produced when organic plant matter is digested inside airtight containers known as digesters. Dung from cattle, sheep, goats, pigs, poultry is the most affordable and widely available organic material for biogas production on small-holder farms.

Advantages of Biogas use:

- It is a cheap source of alternative fuel for cooking and lighting.
- It provides an integrated way for sustainable use of nutrients
- It improves sanitary conditions, reducing the spread of parasites and bacteria since these are killed in the digester.
- It reduces respiratory problems since very little smoke is produced.
- It improves the environment by reducing cutting down trees for firewood and charcoal.

3. Farm residues

You can use farm residues and agricultural waste to produce energy. The significant benefits of using agricultural waste include:

a. Biomass biochar

Crop residues such as straw, stalks, leaves, twigs, litter, and other agricultural waste can be burned indirectly with less oxygen to produce biochar. Biochar can be used as an organic fertilizer in the soil to improve soil functions while simultaneously lowering greenhouse gas emissions.

b. Briquettes

These are a type of compressed biomass manufactured from leftovers of charcoal, sawdust, paper, husks (rice, coffee), cobs, bagasse, groundnut shells, and any other agricultural biomass waste that can be combusted through decomposition without oxygen). Briquettes are more efficient, renewable and offer other business opportunities.



4. Sustainable Charcoal Production

Sustainable charcoal production refers to all sustainable biomass production, processing, and packaging practices, improved utilization with improved cooking stoves, and safe disposal without negatively impacting the environment and people in the present and future generations.

Key insights before going into Sustainable Charcoal Production

- As a farmer, you must follow a legal and institutional framework that outlines rules, standards, and guidelines for producing and transporting sustainable charcoal.
- You should obtain a license from the forest authority to start the charcoal enterprise.
- Farmers can start sustainable charcoal production associations.
- The quantity and quality of charcoal must ensure that the promoted tree species are fast-growing, yielding high-quality charcoal (fruit, medicinal, riverine, and indigenous trees of importance must not be used to produce charcoal).
- Ensure that charcoal produced through sustainable means is more profitable and attractive, and the impact on the environment is not harmful.
- Charcoal producers must address inefficiencies during harvesting and conversion during charcoal production to minimize GHG emissions.

Sustainable Energy Technologies

Small-scale farmers can take advantage of renewable energy resources by employing various technologies. Improved cooking stoves, solar systems (such as solar dryers, water purifiers, and milling machines), wind turbines, improved charcoal-making kilns, and biogas systems are only a few examples.

1. More efficient Charcoal making Kilns

There are different types of kilns: traditional and modern ones. Here, we overview some types of kilns and some recommendations for efficiency. Men are generally well-positioned to get involved in constructing and managing these kilns. The benefits can be enjoyed by the entire household and even the community. For the BK, a kiln efficiency of up to 29.6% is reported. The coating shall seal all cracks. between 16% to 21% in case studies.



Basic Earth Mould Kiln (BEK)



Improved Basic Earth Mould Kiln (IBEK)



Half Orange brick klin



Improved Earth Klin



Portable Klin



Metal Drum Klin



https://www.researchgate.net/figure/Improved-earth-kiln-A-portable-kiln-B-and-metal-drum-kilns-C_fig5_339168017 + Rocío Díaz-Chavez

2. Cooking Stoves



ACTIVITY 3 INTERACTIVE SESSION: FARM VISIT

Visit a farm that has some cooking stoves in their homestead. Ask the farmer to explain how the stove is constructed, the advantages and disadvantages of these cooking stoves. In a plenary discuss other kind of stoves that the men and women participants have seen being used in the area.





Traditional Stove Three Stones are commonly used to construct the traditional cooking stove. It is inefficient in energy efficiency since it makes extensive use of fuelwood



Wood Saving Stove The wood-saving stove it uses less fuelwood (firewood, charcoal).



The fireless cooker uses solar energy and is used to keep food warm and allow the cooking of food with less fuelwood



Charcoal stove





MODULE KEY MESSAGES

- ✓ Sustainable energy is the provision of energy such that it meets the needs of today without compromising the ability of future generations to meet their own needs.
- ✓ It has three key components including renewable energy, energy efficiency and energy use avoidance. Renewable energy constitutes biomass, biogas, crop residues and sustainable charcoal production
- ✓ Sustainable Energy Technologies for renewable energy include improved cooking stoves, solar systems (such as solar dryers, water purifiers, and milling machines), wind turbines, improved charcoal-making kilns, and biogas systems.



REFLECTION EXERCISE FOR PARTICIPANTS

Ask the men and women participants the kind of renewable energy sources that are available in their household. Discuss the best options of technologies that will be efficient as well as labor saving for women participants who are usually charged with the cooking of food items for other family members.

REFERENCES

Burchi, F., Fanzo, J., & Frison, E. (2011). The role of food and nutrition system approaches in tackling hidden hunger. *International journal of environmental research and public health*, 8(2), 358-373. <https://doi.org/10.3390/ijerph8020358>

FAO. (2018). *Climate-smart agriculture training manual – A reference manual for agricultural extension agents*. Rome. 106 pp. Licence: CC BY-NC-SA 3.0 IGO.

Food and Agriculture Organization of the United Nations (2013). *Climate-Smart Agriculture Sourcebook*

Food and Agriculture Organization of the United Nations (2014). *Agricultural Learning Materials*

Food and Agriculture Organization of the United Nations [FAO]. (2019). *Climate Smart Agriculture Learning Material*

Integrated Seed and Sector Development Uganda (ISSD) Uganda, 2015

Lipper, L., Thornton, P., Campbell, B.M., Baedeker, T., Braimoh, A., Bwalya, M., Caron, P., Cattaneo, A., Garrity, D., Henry, K. and Hottle, R. (2014). Climate-smart agriculture for food security. *Nature climate change*, 4(12), 1068-1072.

DOI: <https://doi.org/10.1038/nclimate2437>

UC IPM Highlights. (2014). University of California statewide Integrated Pest Management Program Annual Report.

https://ipm.ucanr.edu/legacy_assets/pdf/misc/annual_report2014.pdf



This manual was developed with the financial support of the European Union. Its contents do not necessarily reflect the views of the European Union.





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