

**LEAD FARMER EXTENSION AND
TRAINING GUIDE ON SUSTAINABLE
AGRICULTURE**

Foreword

Malawi, like any other country in the world, is faced with challenges of climate change and land degradation which are negatively impacting on the nation's efforts to improve food and nutrition security. For the country to continue reaping from its efforts in achieving food security, it is imperative to implement sustainable agriculture farming systems which include climate change adaptation measures.

In light of the country's vulnerability to climate change challenges affecting food security, investing in Sustainable Agriculture technologies has become a necessity. The Development Fund of Norway through its partners has developed the Lead Farmer Extension and Training Guide on Sustainable Agriculture to assist in the implementation and promotion of Sustainable Agriculture technologies in a more harmonised manner and help reinforce the confidence of Lead Farmers in addressing questions and concerns raised by follower farmers. The guide includes modules on the following interventions:

- a. Soil and Water Conservation
- b. Manure
- c. Agroforestry
- d. Conservation Agriculture
- e. Intercropping and Crop Rotation
- f. Integrated Weed Management
- g. Pest and Disease Control
- h. Farmer-to-Farmer Extension and Leadership Skills

The Lead Farmer Extension and Sustainable Agriculture Guide, apart from containing technical information, takes into consideration lessons learnt from field experiences. It incorporates step-by-step construction procedures which are easier to follow, simplified to the level of an extension worker and Lead Farmer. The guide promotes low cost but more sustainable approaches that will assist the farmers to use land-based natural resources in a sustainable manner.



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Acronyms

ADC	Area Development Committee
AEDC	Agriculture Extension Development Coordinator
AEDO	Agriculture Extension Development Officer
ASHP	Area Stakeholder Panel
CAEO	Chief Agricultural Extension Officer
CLRCO	Chief Land Resource Conservation Officer
DAO	District Agriculture Office
DAESS	Department of Agricultural Extension Services System
DF	Development Fund of Norway
EPA	Extension Planning Area
FF	Follower Farmer
LF	Lead farmer
MoAFS	Ministry of Agriculture and Food Security
MoU	Memorandum of Understanding
MZADD	Mzuzu Agriculture Development Division
NGO	Non-Governmental Organisation
SA	Sustainable Agriculture
SALRCO	Senior Assistant Land Resource Conservation Officer
SALFP	Sustainable Agriculture Lead Farmer Programme
VDC	Village Development Committee

Introduction

The majority of farmers in Malawi are smallholders experiencing chronic food shortages especially during the critical months from January to March. One of the reasons for food shortage is low yield which is caused by poor soils, lack of quality seeds, inappropriate planting time and lack of knowledge about simple techniques that will improve productivity of farming systems.

The Sustainable Agriculture Lead Farmer Programme (SALFP) addresses food insecurity in a two-step programme of extension and training. The main goal is to increase productivity at small-holder farmer level in Malawi by introducing sustainable farming techniques that are simple, effective and do not require expensive inputs. The approach treats farmers as change agents who are empowered to spread the knowledge and share their skills with communities. The Lead Farmer (LF) is the cornerstone and the main change agents in the SALFP. Next to the LF a group of Follower Farmers (FF) is trained by lead farmers through adoption of the recommended sustainable agriculture (SA) techniques and practices.

Overview of the Sustainable Agriculture Lead Farmer Program

SALFP is managed by the Development Fund (DF) of Norway. SALFP operates in a given community for four years. The program is planned to include one year of mobilization, enrolment and intensive training of LFs; two years of extension work where the training is followed up and finally one year of winding up the program and handing-over activities to the local development and governance structures or farmer groups.

DF is implementing SALFP through local partners. Partners' field officers carry out training and follow up on the LFs in accordance with the Lead Farmer Training and Extension Guidebook. Each field staff works according to a plan which is in concurrence with the agriculture calendar of the particular area. The plan also includes a schedule of the visits to LFs or follower farmers. This plan is shared with DF and is responsible for overseeing and coordinating the activities of all partners.

The responsibility of partners' field staff is to guide the LFs to extend the knowledge and skills effectively to FFs. Field staff will also regularly assess and monitor the progress of adoption of recommended SA techniques and practices by follower farmers.

LFs have diverse backgrounds including age, gender, literacy levels and practical farming experiences. Therefore, facilitation of the trainings and extension needs to recognize this diversity. Common among farmers are the practical and economical interest in how to develop smallholder farming into a viable and life-long farming enterprise and a general interest in the

development of their community. This interest in farming and development is the foundation of SALFP.

Farmer Training and Extension System

A taskforce involving partners' technical staff has been formed. The taskforce monitors the practical implementation of the Lead Farmer Extension and Training in the field and report biannually to programme management.

Besides utilizing the decentralized structures, it is planned that during the implementation of the farmer-to-farmer extension, a deliberate effort is made to work with the District Agricultural Extension Services System (DAESS) for enhanced coordination and sustainability.

The District Agricultural Extension Services System (DAESS) aims to empower farmers to demand high quality services from those that are best able to provide them. Specifically the DAESS aims to:

- a. Organise farmers' agricultural needs
- b. Pool service providers and related resources in order to address prioritized farmers agricultural needs
- c. Instil a sense of ownership and self-reliance in agricultural programmes among farmers
- d. Foster coordination among stakeholders in service provision

The following committees are established and/or strengthened at the district level in line with the DAESS system:

- a. District Agricultural Committee
- b. District Agricultural Extension Coordination Committee and
- c. District Stakeholder Panel

At a lower level, the latter committee is called Area Stakeholder Panel (ASHP). These institutions form a platform for the various stakeholders to meet and discuss agricultural related issues at different levels so that stakeholders' participation is promoted in the district.

Main Focal Areas of DAESS

The District Agricultural Extension Services System has four main areas of focus as follows:

- a. **Organisation of farmers' demands:** This is a process of enabling farmers according to their socio-economic status to identify their agricultural felt-needs.
- b. **Organising service providers' response to farmers' needs:** This is a process of identifying and engaging service providers that would respond to farmers' needs.
- c. **Stakeholders Coordination:** All the stakeholders will have to cooperate, coordinate and plan together at the district level for the system to be effective.
- d. **Funding acquisition:** The district assembly finds ways of financing agricultural extension services from a diverse base of sources. The assemblies have to explore sources of finances (see section on Financing of Services).

PART I

LEAD FARMER EXTENSION



A. The Cropping Season

The Sustainable Agriculture Lead Farmer Program’s Extension System has been designed to follow the agricultural cropping seasons. However, it is recommended to conduct most training during the off peak agricultural period (July—November).

The extension schedule should correspond to the agricultural calendar below.

Table 1: Agricultural calendar that guides extension schedule

Month	Activity happening
July—October	Land Preparation
	Minimum tillage
	Selected SA practices (compost making and application, establishment of agroforestry tree nurseries, digging pits)
	Choosing of SA technologies to be implemented by LFs
October—December	Compost application
	Planting of agroforestry tree seedlings
	Planting of maize and other crops
	Implementing SA technologies
December—February	Weeding
	Liquid manure application
March—June	Harvesting
July—September	Marketing

B. SALFP and the community in the local governance setting

SALFP implementation ensures full participation of existing local development and governance structures (be it formal government structures, traditional structures or informal structures). In other words, the program, from the day it enters the community until it phases out, consults and collaborates with relevant democratic structures at village, area, and district levels. Experience suggests that, for example, where the Area Development Committees (ADCs) and the Village Development Committees (VDCs) have been suitably involved, the program impact is greater.

C. Working with Lead Farmers

In this chapter, we will explain how to identify and choose Lead Farmers. It should be emphasised that a successful LF program begins with the care with which LFs are selected.

The SALFP endeavours to ensure that there is gender equality by offering both men and women equal opportunities to participate in the programme. Therefore, critical in the implementation of the project are the diverse cultural and social set ups that exist. This can potentially affect the gender equality during identification, selection and implementation of SALFP. To be able to address the gender challenge and effectively implement the lead farmer initiative in a sustainable fashion, the initial SALFP sensitization meeting with local authorities includes a comprehensive gender main streaming training and awareness creation. The capacity of the local leaders

(traditional and religious) as custodians of culture has to be built, as they help in initiating the change in attitude and conduct of the community members. The training clearly highlights the importance of gender equality and its implications if not properly handled. The briefing defines the role local leaders play in ensuring that gender equality is achieved. If not handled cautiously, gender can hinder development activities including the successful implementation of SALFP.

D. The Lead Farmers

i. Who they are?

LFs are self-motivated individuals who are willing to share knowledge and skills with other farmers, *have specialized in SA technologies and are implementing at least three of them of which one is on a 0.2 to 0.4 ha of land.* Identification and subsequent selection of LFs is a critical stage to ensure success of the farmer- to-farmer extension. It is worth mentioning that the LF model has been practised in Malawi for a long period of time by different Non-Governmental Organizations (NGOs) and the Ministry of Agriculture and Food Security (MoAFS).

To get the best out of the LFs, it is recommended that the identification and selection processes be participatory and inclusive to ensure that the local leadership i.e. chiefs, Area Development Committees (ADCs) and the Village Development Committees (VDCs) are fully involved. It is recommended that the following steps be followed in identification and selection (**for details refer to annex 3**):

- Step one:** Extension Worker facilitates a meeting with local leaders to identify technologies requiring dissemination and reinforcement and potential LFs according to technologies.
- Step two:** Local leaders identify and shortlist the potential lead farmers by technology.
- Step three:** Local leaders discuss with the community on who should be the LF according to the shortlist.
- Step four:** Community endorses the lead farmers by technology and the person accepts the responsibility.

ii. Qualities of a Lead Farmer

Characteristics of the Lead Farmer are as follows:

- a. Be willing to share the information with others
- b. Be able to lead others
- c. Be an early adopter of SA technology
- d. A communicator with good facilitation skills
- e. Should be literate
- f. Be gender sensitive

- g. Should be honest, trustworthy and humble
- h. Should be development conscious
- i. Should be tolerant
- j. Should originate from the village and socially accepted by the community
- k. Should be able to sacrifice for others
- l. Should be cooperative
- m. Should be approachable

E. Description of SALFP

At country level, SALFP has three management levels: DF Malawi office; partner office and the field level where farmers/households organize the daily activities. The overarching framework for the SALFP is the Malawi Government through the Ministry of Agriculture and Food Security.

For an extension system to be effective it is important that roles and responsibilities for all stakeholders are clearly defined. To reduce the practical challenges, we have in this chapter attempted to define these roles and responsibilities. It should be appreciated that all stakeholders at all levels are responsible to ensure gender equality within their roles and responsibilities.

i. Roles and responsibilities of different stakeholders

I. Development Fund of Norway Staff

- a. To ensure that every partner carries out activities as specified in the extension guide
- b. To carry out periodic field support and monitoring visits
- c. To consolidate reports on the SALFP extension program
- d. To develop a monitoring and evaluation system for extension and training
- e. To monitor the implementation of the SALFP extension and training programme
- f. To update the SALFP partners on any emerging developments

III. Partner organizations

- a. To implement the extension program according to contract
- b. To ensure field extension staff have relevant competences
- c. To carry out extension planning and follow up of field staff
- d. To regularly send consolidated extension reports to DF

IV. Frontline staff (field officers)

- a. To provide advice to LFs on leadership and facilitation
- b. To provide guidelines to lead farmers on technical issues
- c. To advise and mobilize communities into clubs/groups
- d. Guide communities in the selection of lead farmers
- e. To backstop lead farmers on their day-to-day technical work
- f. To link LFs up with other service providers

- g. To initiate and facilitate implementation of appropriate technologies
- h. To support lead farmers and communities in organizing field days, manure launches and seed fairs
- i. To receive technical work plans and reports from the lead farmers
- j. To report regularly from extension visits
- k. To conduct review meetings with the LFs

V. Roles of Lead Farmers.

- a. To assist frontline staff to mobilize communities into groups/clubs
- b. To facilitate adoption of various improved agricultural technologies by the communities through farmer trainings, field days, extension meetings, adoption of the technologies, etc.
- c. To assist in compilation of agricultural report for the VDCs
- d. To monitor agricultural projects in the VDC
- e. To facilitate monitoring of project capital items in the VDCs
- f. To coordinate frontline staff activities with the VDCs
- g. To provide technical data to the frontline staff as necessary
- h. To implement various technologies
- i. To mobilize and train follower farmers
- j. To give feedback on challenges faced during adoption of extension technologies through reports

VI. Follower Farmers

- a. To attend trainings, field days and any other activities organised by the field officers, lead farmers and the group
- b. To practice sustainable agriculture principles as outlined in the farmer handbook and the handbook for data collection.

VII. Village Development Committees (VDCs)

- a. To overall owner of all activities in the VDC
- b. To initiate VDC review meetings
- c. To appoint/withdraw LFs
- d. To be responsible to the ADC

VIII. Area Development Committees (ADCs)

- a. To supervise and monitor the VDCs
- b. To approve VDCs work plans
- c. To coordinate inter-ADC development activities
- d. To be responsible to the district council

IX. District Council

- a. To supervise ADCs and implementing partners

- b. To ensure quality implementation of projects
- c. To ensure that what is implemented is suitable for the district
- d. To support partners in the implementation of activities as outlined in the Extension Guide
- e. To approve ADCs plans and fit them into district plans
- f. To coordinate the LF approach with other similar projects/programs

When a contract is signed between a partner organisation and DF Malawi office, it is the obligation of the partner organisation's management to plan for and carry out of all activities. The partner organisation would most of the times have an agriculture extension supervisor, who plans and schedules the activities for the field extension officers.

The detailed planning of extension visits is done in collaboration with LFs and should be condensed in a work plan for the season. The condensed work plan will be shared with DF Malawi office. All LFs should also have a copy of the work plan including the schedules for visits. In this way, all LFs will know in advance when they will be visited.

ii. Advantages of the Lead Farmer Model

The LF model has a lot of advantages. Some of these are as follows:

- a. Easy and faster dissemination of technical information since the lead farmer lives within the community
- b. Easy communication as the lead farmer shares the same cultural beliefs and language as the community
- c. Enhanced adoption of agricultural technologies because the learning is from fellow farmers
- d. Farmer's problems are easily identified, understood and addressed since the lead farmer stays in the same village
- e. The LFs significantly reduce the work load of the extension worker because the lead farmers cover some technologies and areas which would have been the responsibility of the extension worker

iii. Ratios and numbers

SALFP and its stakeholders have agreed on the following extension ratios and numbers:

- a. Each LF works with up to 30 follower farmers
- b. 48 core extension visits to LFs are carried out over a four-year period by field staff
- c. Each LF should be visited at least monthly
- d. The LF should endeavour to visit FFs at least once a month.

iv. Follow up protocol

SALFP has a monitoring and evaluation system to ensure that the programme objectives are on track. Follow up visits are done at various levels (follower farmer, lead farmer, extension worker).

v. Follower Farmers

It has been planned that each LF will work with up to 25 to 30 FFs in SALFP and s/he will train them in a group. Preferably, the LF should visit each of his/her FFs once a month for follow up. It should be noted that the lead farmer can visit up to five farmers a day. These are core visits aimed at consolidating what SA activities FFs are conducting.

vi. Lead Farmers

As a rule of thumb, the extension worker will ensure that each LF is visited at least once in a month. These are core visits over and above the visits and support lead farmers may request from extension workers any time.

vii. Field Extension staff

DF Malawi office may together with the SALFP taskforce conduct joint supervision to the extension worker once a quarter.

viii. Other Tasks

a) Implementation of SA technologies

Implementation of SA technologies by the Lead Farmers shows the follower farmers how a technology and/or a practice is done e.g. results of two plots one with manure only and the other without.

To ensure successful implementation of SA technologies in year 1, each LF receives relevant inputs in the appropriate quantity and on time on pass-on basis (**refer to annex 6**).

b) Field days

In SALFP LFs are supported to host field days to showcase SA best practices. All LFs are encouraged to conduct field days on various technologies being implemented. Besides backstopping LFs on technical messages, SALFP through its implementing partners support Lead Farmers with materials such as posters, fliers and relevant literature to enhance learning.

c) Visibility materials

Incentives play a critical role in motivating human beings whenever they are asked to conduct specific tasks. In SALFP, a provision is made to support Lead Farmers with t-shirts, caps branded with SA technical messages and a bicycle. Besides conveying the SA messages, the t-shirts will act as motivation to Lead Farmers as they get recognised in the communities.

d) Lead farmer tours

Experience suggests that farmers learn better from their peers. SALFP endeavours to support Lead Farmer exchange visits so that they share best practices and learn from one another.

e) Support to Lead Farmers

For SALFP to be effective, LFs should be adequately supported in their work. The support aims at increasing the Lead farmers' mobility and visibility as they train follower farmers. Once Lead Farmers have been selected they sign a contract with the DF partner organisation. The contract stipulates the obligations of the Lead Farmers to the programme as well as those of the partner organisation. In addition, the benefits and other accompanying support to enable Lead Farmers effectively work are stipulated. SALFP supports LFs with a bicycle and with basic cultivation inputs, such as seeds and fertilizer on pass-on basis.

F. Core extension visits and expected outcomes

This part outlines the delivery of SA techniques and practices as extension visits over the planned four-year period. Over the four-year period, this guide has defined 18 core extension visits. However, the number may vary according to local circumstances. What is important is that all techniques and practices are delivered.

The SALFP key stakeholders have contributed to and decided on selected SALFP techniques and practices. These are defined in the SALFP document, they are detailed in the SALFP Training Modules and have all been presented to the LFs during the five days initial training.

The SA techniques and practices are:

- a. Manure
- b. Soil and water conservation
- c. Conservation agriculture
- d. Agroforestry
- e. Crop rotation and intercropping
- f. Weed control
- g. Pest and diseases and
- h. Leadership and facilitation skills.

Over and above these technical messages, a training module on leadership and facilitation skills has been developed. The module is aimed at equipping the cadre of Lead Farmers with facilitation skills, something which is a vital element in SALFP. It should be emphasized that the protocol presented in the table below of year 1—4 year is calculated at ensuring that Lead Farmers get uniform training and support. Extension staff may use it as a checklist and guide.

Table 2: Key tasks to be carried out during visits to the communities over the course of the program

Core activities through for the duration of the program

Year 1
Conduct mobilization of the community Conduct consultation with local authorities Identify and select LFs Organize a 5 day residential training for new LFs in SA Facilitate recruitment of follower farmers Facilitate adoption of SA technologies by LFs on selected SA technologies based on LF interests' Establishing LF farm records.
Year 2
Continue facilitating LF implementation of SA technologies Facilitate adoption of selected technologies by follower farmers Facilitate establishment of farm records by follower farmers Facilitate management of appropriate LF's implementation plots and Field Days Facilitate review meetings to discuss best practices and plans
Year 3
Facilitate follow up and continued adoption of the selected SA technologies and practices Facilitate appropriate implementation of SA technologies and field days.
Year 4
Start winding up the SALFP program work with the LFs and the groups Initiate handing over to local institutions (ADCs & VDCs) and Ministry of Agriculture Finally hand over to local institutions (ADCs & VDCs) and Ministry of Agriculture Graduate lead farmers that are doing their work well in line with annex 5

In the following text each extension visit will be introduced in a paragraph called “About the visit” and further specified in a paragraph called “Expected results”. Extension staff should, as far as possible, make sure that all techniques and practices are delivered at lead farmers' level and that results can be seen in the follower farmers' fields. However, timing and mode of delivery may vary from one field staff to the other. It is mandatory that all SALFP extension work is carried out according to a plan shared with the lead farmers.

As a guide, a total of 18 core extension visits are made by the extension worker to the Lead Farmers over a period of 4 years. These core visits are aimed at setting the motion of mobilization of the communities, training of Lead farmers, facilitating adoption of SA technologies and initiating hand over processes of the program to local institutions and Government structures for sustainability (for detailed SA technologies see training curriculum).



NOTE: Choice of SA technologies and practices follow the local farming situation and lead/follower farmers' interest.

Detailed generic extension topics and expected results

The individual field extension staff and partner organizations work out an extension visit plan and share this with the LFs.

While all extension visits will be reported on by the lead farmers and the extension staff, the end results shall be visible in the follower farmers' fields.

Below is the generic guide, in which key extension visits are further detailed. However, and for simplicity purposes, some of the visits and the topics are grouped together.

Year 1

Purpose of visit

To conduct mobilization of the community. This will be done in line with **annex 3**.

About this visit: In each new community SALFP ensures that community members and leaders (Area Development Committees and Village Development Committees) are appropriately contacted, involved and mobilized. The outcomes of this mobilization and involvement generally determine the success of SALFP.

Expected results

After community mobilization the leaders and community members will be able to:

- a. Explain the intention and limitations of the planned SALFP activities
- b. Explain the roles and responsibilities of both the community and SALFP
- c. Explain how the lead farmer and the follower farmers will be selected
- d. Define the timeframe of SALFP

Purpose of visit

To conduct consultation with local authorities

About this visit: The local authorities consist of traditional leaders who formally and otherwise make decisions for and over their subordinates. Local authorities are in defined ways part of the formal Malawian governance set up. Land tenure rights on customary land are primarily controlled by the local authorities.

Expected results

After consultation, representatives of the local authority will be able to:

- a. Explain the intention and limitations of the planned SALFP activities
- b. Explain the roles and responsibilities of the community, the local authorities and the SALFP
- c. Define the timeframe of SALFP

Purpose of visit

To identify and select Lead Farmers

About this visit: A lead farmer is a respected and competent farmer elected by the community. She or he will be the focal person for SALFP and is expected, in various ways, to pass on the SA techniques and practices to the follower farmers.

Expected results

After identification and selection of the LF the community members and the LF will be able to:

- a. Explain who the LF is and how and why she or he was selected
- b. Explain the envisaged mutual collaboration between follower farmers and the LF including the expected outcomes
- c. Explain in brief terms how the SA techniques and practices will be introduced to the follower farmers
- d. Explain in brief terms about the LF's residential training and the subsequent extension visits.

Purpose of visit

To recruit follower farmers

About this visit: Each LF works together with and train a group of follower farmers .The FFs are the actual target group of SALFP and the LF and the program staff are the means to reach out to the FFs and the community in general.

Expected results

After recruitment of the follower farmers the FFs and the LFs will be able to:

- a. Explain why group formation is done
- b. Explain how the selection of the FFs was done
- c. Explain the roles and responsibilities of the FFs and the LFs
- d. Explain the expected results
- e. Explain the timeframe of the SALFP

Purpose of visit

To facilitate implementation of SA technologies by LFs on selected SA technologies based on LFs' interest

About this visit: Each LF implements SA technologies in line with SALFP. Adoption and implementation of SA technologies should be seen as a training method used to show farmers how a task or an activity is performed. It can show the participants results of a technology or how to perform a task. Typical examples are that a LF implements SA in a plot in which the

effects of compost manure and fertilizer are shown during and after the cropping season. Implementation of SA technologies by the Lead Farmer serves as a model for other farmers.

Expected results

After this the LF will be able to:

- a. Establish and implement the technology in question
- b. Explain the role and responsibility of both the LF and the field extension staff
- c. Explain to FFs what is done and what the expected results are

Purpose of visit

To establish LF farm records

About this visit: A farm record is a simple and easy-to-use tool for the LFs. Each LF will have a farm record.

Expected results

After this visit the LF will be able to use the farm record book.

Year 2

Purpose of visit

To continue to facilitate implementation of SA technologies

About this extension task: Each LF will manage implementation of SA as agreed with SALFP. Each implementation site is designed to be a model for other farmers and will be located strategically so that many farmers are able to see it. Some inputs, which often OPV maize seed, are provided by SALFP on pass-on basis.

Expected results

Neighbouring FFs will have:

- a. Asked the LF questions regarding implementation of SA
- b. Practiced similar techniques in their own farm
- c. Discussed the implemented techniques with other farmers
- d. Requested SALFP field extension staff to get support

Purpose of visit

To facilitate adoption of selected technologies by follower farmers

About this extension task: This task is the essential part and also the bulk of the SALFP extension. Interaction with the LFs and the FFs involves all SA techniques and practices. The extension visits must go well with farmers' needs and be aligned to the practicalities of the

cropping season. Many visits are required to cover all aspects of the SALFP techniques and practices. A reasonable fulfilment of farmers needs shall be met during the lifespan (4 years) of the SALFP.

Expected results

After an initial year of extension work the LF is able to;

- a. Assist FFs in learning about and practicing relevant SA techniques and practices.
- b. Communicate technical issues, relevant to SALFP, effectively to FFs.

Purpose of visit

To facilitate establishment of farm records by follower farmers

About this extension task: A farm record is a simple and easy-to-use tool for the FFs. In year two each FF will maintain a farm record book.

Expected results

After explaining the farm record book the FF will be able to;

- a. Use the farm record book to the benefit of the farm work
- b. Explain to the field extension staff the most interesting information in the farm book

Year 3

Purpose of visit

To facilitate follow up and continued adoption of the selected SA key messages (technologies and practices)

About this visit: During year 3 all SA techniques and practices shall be followed up and be completed. Any extra or special request for facilitation from the LFs and the FFs shall be fulfilled as far as practicable.

Purpose of visit

At the end of year 3 the FFs are practicing minimum 3 of the following soil fertility techniques:

- a. Use of compost/manure
- b. Fertility crops/fertilizer trees/agroforestry
- c. Crop rotation with a legume crop (3 years rotation)
- d. Contour ridging
- e. Conservation tillage/practicing pot-holes/ripping

And minimum 1 of the following practices:

- f. No burning of crop residues
- g. Intercropping
- h. Biological/natural pest control.

Purpose of visit

To facilitate the management of appropriate implementation of SA

About this visit: Same as year 2

Expected results

Same as year 2

Year 4

Purpose of visit

To wind up the SA program work with the LF and the group

About this visit: It is anticipated that during the 3 first three years of SALFP the training on all generic SA techniques and practices are completed. However some need may still arise and should be met if at all possible. At the same time it should clearly be communicated to the FFs and the LFs when the SALFP will terminate (after 4 years). A winding-up plan is developed with the LF and the group and agreed upon. For easy understanding the winding up plan shall be in writing and be shared widely.

Expected results

After the facilitation of winding up processes, the LF and the group will be able to:

- a. Explain the results and outcomes of SALFP so far
- b. Explain the winding up plan in brief terms and the consequences for the individual farmers
- c. Explain in brief terms how the individual farmer will continue working with SA in the years to come

Purpose of visit

To initiate handing-over to local institutions (ADCs & VDCs) and Ministry of Agriculture

About this visit: It is anticipated that during the first three years of SALFP, all training will be generic SA techniques and practices are completed and collaboration with local institutions is enhanced. It should now be clearly communicated to all formal and traditional structures when SALFP will phase out (after 4 years). Furthermore, in tandem with similar processes at FFs' and LF's level, a winding-up plan is developed and agreed upon. For easy understanding the winding up plan shall be in writing and distributed to relevant actors.

Expected results

After the handing over has been initiated the local institutions will be able to:

- a. Refer to the handing-over document and explain the details
- b. Explain the consequences of the winding up plan for themselves and for the community
- c. Explain how the local institutions and MoAFS will continue working with the farmers on SA in the years to come

Purpose of visit

To finally hand over to local institutions (ADCs & VDCs) and Ministry of Agriculture

About this visit: The final hand-over is done according to the winding-up plan

Expected results

A year after hand-over a field trip to follower farmers will reveal that farmers are practicing a minimum of two soil fertility techniques and minimum of 1 SA practice, according to the SALFP LFA.

PART II

LEAD FARMER TRAINING IN SUSTAINABLE AGRICULTURE

In this section of the LF Guide, we will take you through selected SA Modules based on the technologies that DF promotes through the LF Model in Malawi.

The modules are as follows:

1. Soil and Water Conservation
2. Manure
3. Agroforestry
4. Conservation Agriculture
5. Intercropping and Crop Rotation
6. Integrated Weed Management
7. Pest and Disease Control
8. Farmer-to Farmer Extension, Facilitation and Leadership Skills



Module 1

SOIL AND WATER CONSERVATION



1.1 About this Module

Soil and water conservation entails a number of technologies. Some of these technologies include marker ridges, vetiver planting/establishment, gully reclamation and rain water harvesting techniques such as, raised footpaths, swales, infiltration pits.

Soil erosion and declining of soil fertility under continuous cultivation are increasingly becoming serious land degradation problems in the country. There is widespread evidence that the use of land in some areas is improper as evidenced by continuous growing of crops on the same piece of land, cultivation of unsuitable areas such as steep slopes and river banks. This also includes *deforestation* and all these account for soil degradation. These have contributed to soil erosion, loss of rainwater and destruction of catchment areas eventually, leading to low crop production per unit area and food insecurity.

This module will look at how soil and water can be conserved in farming lands with emphasis on marker ridges and gully reclamation.

1.2 Objectives

By the end of this module participants should be able to:

- a. Understand how to conserve soil and water through construction of marker ridges and planting of vetiver
- b. Understand the importance of conserving soil and water.

1.3 Expected Results

After learning this module, the LF will be able to:

- a. Define Soil and Water Conservation;
- b. Know benefits of soil and water conservation practices at farm level;
- c. Know how to construct and use instruments in constructing marker ridges;
- d. Mark and construct marker ridges;
- e. Know how to reclaim gullies;
- f. Know how to harvest rainwater;
- g. Know how to use vetiver grass in soil and water conservation.



Time-frame: 3 hours 45 minutes

1.4 Activities

1.4.1 Introduction (10 minutes)

The facilitators will ask participants to be in 3 groups. Facilitator will give groups, 20 minutes to discuss the land as regards to its physical, biological and chemical characteristics as well as other

environmental factors comparing with 15-20 years ago, their understanding of land degradation and its causes, how they think they can conserve soil and water for efficient crop use and why they feel it is important to conserve soil and water.

Flip charts will be posted in front and one person from each group will be asked to write answers. After the group discussion one member from the group will present in plenary.

1.4.2 Plenary—Teaching about Soil and Water Conservation: 1 hour 55 Minutes

I. Definition of Soil and Water Conservation

The facilitator will give meaning of Soil Conservation as the protection, maintenance, rehabilitation, restoration and enhancement of soil resources and includes the management and use of soil resources to ensure the sustainability of such use. Water conservation is ensuring there is increased infiltration of water in the soil so as to reduce erosion caused by runoff.

II. Benefits of Soil and Water Conservation

The following will be given as benefits of Soil and Water conservation:

- a. Reduces water runoff and soil erosion;
- b. Conserves soil moisture for plant growth;
- c. Increases ground water supplies;
- d. Reduces siltation and flooding.

Figure 1: Aligned ridges as one measure of soil and water conservation

1.4.3 How to Conserve Soil and Water

The following activities will be explained that will lead to conservation of soil and water.

I. Construction of a Marker Ridge

In order to control runoff and soil loss, a marker ridge should be constructed across the contour starting from the top of any cultivated land.

The facilitator should explain that most crops in Malawi are cultivated on fields with a certain degree of slope. And that many farmers do not conserve their land through use of marker ridges. As a result, there is a lot of surface water runoff down the slopes causing soil erosion. This is one of the major causes of land degradation in Malawi.

The facilitator should explain that construction of marker ridges is a simple practice to reduce the above impacts.

II. Instruments for Marking Contour Lines

The facilitator will explain that there are different instruments used in making contour lines. The low cost instruments will be used. The facilitator will have parts used to make the instruments and explain them one by one as he illustrates on flip charts as follows:

i) The A-frame

The facilitator will explain that an A-frame is shaped like letter A. Will explain each of the following materials used in making an A-frame:

- a. 2m of string
- b. 1 stone
- c. 3 nails or string to tie the frame together
- d. 1 panga knife
- e. Pegs to mark contour
- f. 1 hammer or rock or anything for driving pegs into the ground
- g. Three 1.6—2m poles

Thereafter, the facilitator will explain how to make and use an A-frame.

ii) The Line Level

The facilitator will explain that a Line Level consists of a miniature spirit level that hangs from a taut string between two poles. Then will explain each of the following construction materials.

- a. 1 line level
- b. 5m of string
- c. 2 wooden poles, 1.6—2m long with flat ends
- d. A knife
- e. Pegs to mark contour lines
- f. A hammer or rock or anything for driving pegs into the ground

Thereafter, the facilitator will illustrate how it is made.

iii) The PhiriLino Frame

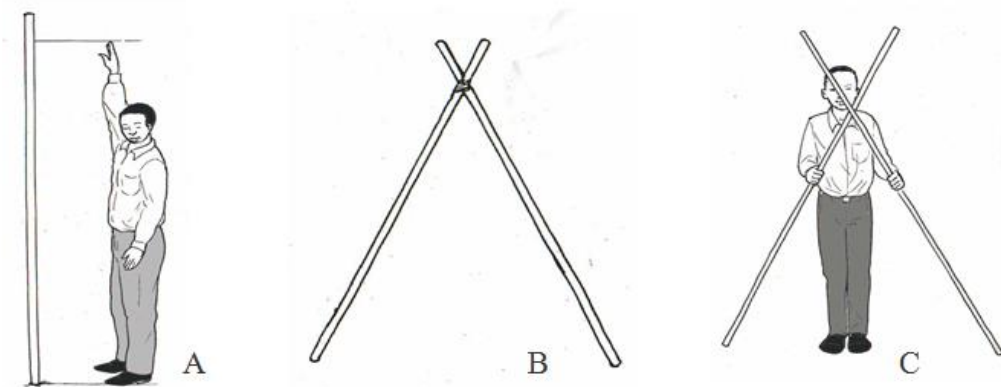


Figure 2: Constructing an A-Frame

The facilitator will explain that PhiriLino frame is similar to an A-frame except that it uses a line level superimposed on a string tied to both legs of the frame instead of a pendulum. Therefore, it combines the advantages of a line level and A-frame which makes it simpler and faster to use.



Figure 3: The PhiriLino Frame

The facilitator will explain that most materials used are as explained under A- frame and line level and mention them yet the following specifically for PhiriLino will be explained:

- a. Line Level
- b. 2.5m of string
- c. 4 wooden poles with flat ends (two 3m long, one 2.5m long and the other one 2m long)

Thereafter, the facilitator will illustrate how to make and use the PhiriLino frame.

Making/setting up of instrument: For each of the instruments, the facilitator will explain and demonstrate the following:

- a. Cutting/preparation of poles
- b. Tying of poles

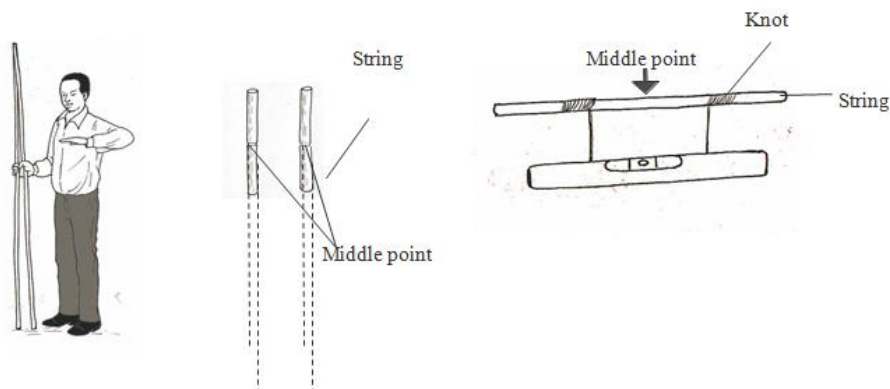


Figure 4: Material for constructing the PhiriLino frame

- c. Test the operation of the equipment

III. Pegging Contour Lines

Use of A-frame and the PhiriLino frame

The facilitator will explain that an A-frame and a PhiriLino frame are used in the same way. The only difference is that readings from a PhiriLino are made on the spirit level on the string fixed on the frame. The facilitator will also mention that two people are required to do the exercise. The facilitator will explain the following and demonstrate by establishing one contour together with participants.

Step 1: Insert a peg at the starting point of the line, and positioning of one leg of A- frame next to it. Depressions or stones, ridges and humps should be avoided.

Step 2: Hold this leg in place, move the other one up or down slope until the string hangs precisely over the mark on the cross pole A- frame) or bubble is precisely centred (PhiriLino). Insert a peg at this point of the leg.



Step 3: While holding the second leg in place; pivot the first one round and move it up or downslope until the string hangs exactly over the mark again or bubble is precisely centred. Drive another peg at this point.

Step 4: Continue pivoting across the slope until you reach the end of the field, pegging the position of the legs as you go.

Step 5: Moving down the slope to the next contour line. The interval depends on the slope of the field i.e. 20m apart for on a gentle slope, 15m for medium slopes and 10m for steep slopes.

Use of Line Level

The facilitator will mention that three people will be needed for this exercise and will be referred to as **A**, **B**, **C**. The following steps will be followed:

Step 1: Pegging will start at the top of the field about 10 - 20m below the upper corner.

Step 2: **C** instructs **A** to insert a peg by his stick to locate the starting point.

Step 3: **C** then instructs **B** to move 5m along estimated contour line with the string tight.

Step 4: **C** reads position of the bulb. He/she instructs **B** to move up or down the slope until the bubble is precisely centred. **B** inserts another peg at the



Figure 6: Pegging contour lines using Line Level

precisely location of his or her stick.

Step 5: Leaving **B** in place, **A** moves past **B** to locate the next peg. **C** instructs **A** to move up or down the slope while reading line level.

Step 6: Follow step 4. When the bubble is perfectly centred, insert another peg on **A**'s stick.

Step 7: Repeat steps 2-6 above till the end of the field is reached.

IV. Smoothing Contour Lines

The facilitator will state that pegged contour lines need to be smoothed in order to reduce sharp angles between them. This simplifies building marker ridges.

Move pegs only on uniform terrain as follows:

- a. 3 people each stand by the first 3 pegs in the line. Move the middle peg (No 2) so that all 3 pegs are in straight line.
- b. All 3 people then move two pegs forward, i.e. pegs 3, 4 and 5. Move the middle peg (No 4) so that pegs 3, 4 and 5 are in a straight line. Repeat this till the line is finished. The line now will follow the gradual curve.

Practical Session: 2 hours 55 Minutes

Participants will be divided into groups. Each group will have 3 lead farmers. The facilitator will state that the practical session be as follows:

- a. Making/ setting up equipment
- b. Pegging contour lines
- c. Smoothing contour lines
- d. Constructing marker ridges
- e.

He/she should point out that contour lines on irregular terrain should not be smoothed as it would cause runoff problems.

V. Constructing Marker Ridges

The facilitator will state that once pegging of contour lines is over, they should be built into a marker ridge.. The facilitator will explain that vetiver grass will be planted along the marker ridge which will be demonstrated.

VIII. Gully Reclamation

A gully is a large ditch formed as a result of the erosion process. It indicates an advanced or severe stage of rill erosion. A gully can only be reclaimed since it cannot be cleared within a season. Before undertaking any gully reclamation, it is important to first identify the source and cause of the problem and try to conserve the whole catchment where the problem originates.

The key issue is to reduce the speed of water and increase the amount of water that seeps into the soil. This could be done either by planting trees or vetiver in dense hedges or use of contour ridging. The most common and cheapest method of gully reclamation is by laying out stones across a rill or gully forming check dams.



Figure 7: A gully at an advanced stage

IX. Check dams

Check dams are simple structures that can check gully erosion by slowing down water flow or runoff in the drainage system as well trap sediments. Three types of check dams which are widely used include: stone check dams, brushwood check dams and live check dams. They also serve as one method of harvesting rain-water.

X. Rainwater Harvesting

Rainwater harvesting is a method of collecting, storing and conserving rain-water in order to curb runoff. Infiltration pits, box ridges and contour marker ridges are some technologies commonly used to harvest rain-water in the field. Ponds of various sizes according to the size of the land and the needs of the farmer can also be used as a low-cost field technology to harvest rain-water. The construction of water tanks is another way through which the farmer can harvest rain-water.



Figure 8: A newly constructed swale that has been planted with vetiver

XI. Vetiver Planting and Establishment

Vetiver zizanoides is a widely adaptable, fast growing, deep-rooted and perennial plant that is unpalatable to livestock. Vetiver forms a living barrier which arrests soil movement. Where slopes are in excess of 3%, vetiver strips planted on the contour are the most effective way of controlling erosion. The tillers (or slips) of vetiver are planted at 45 x 45 cm spacing.

1.5 Plenary—Summary of Practical Work

Participants will go back in class. The

facilitator will indicate that this is the end of training on this module and all of them together will go through the answers given by participants during introduction. This is also to check if their expectations have been met.

1.6 Frequently Encountered Problems

- a. **Washing away of conserved land:** There are various reasons why the conserved land can be affected. One of these is strong runoff from neighbouring un-conserved gardens getting into a particular garden. This problem can be minimized by involving the entire community to ensure that the whole catchment is conserved. Other practices such as planting vetiver grass, pigeon peas and fruit trees can be incorporated on the contour to enhance the effectiveness of contour ridging while offering additional benefits.

1.7 Task Checklist

The facilitator will now provide the following questions to see if participants have understood the training.

- a. How do we come up with a contour line?
- b. Give three instruments used in making a contour line?
- c. What is the difference between an A-frame and PhiriLino frame?
- d. What are the three benefits of conserving soil and Water?
- e. What is a marker ridge?



NOTE: It is recommended that all soil and water conservation practices be done on a catchment basis for effectiveness.



Module 2

MANURE



2.1 About this Module

Manure is decomposed organic matter from both plants and animals. It contributes to the fertility of the soil by adding organic matter and nutrients such as nitrogen. There are three types of manure. These are:

- a. Animal manure;
- b. Compost manure; and,
- c. Green/ Plant manure.

2.1.1 Livestock in Sustainable Agriculture

Animals are important in a number of ways including provision of manure for crop production hence very important under Sustainable Agriculture.

2.1.2 Benefits of Livestock Manure

Animal manure has been used for centuries as fertilizer for farming because it improves soil structure (aggregation) and holds nutrients and water. This improves soil fertility. Animal manure also encourages soil microbial activity, which promotes the soil's trace mineral supply, improving plant nutrition. It also contains some nitrogen and other nutrients that assist the growth of plants. Unlike chemical fertilizers, compost manure have proven useful in sustainable agriculture as a means of climate change adaptation.

Manure improves soil structure of the top soil through the supply of organic matter. This in turn:

- a. Improves root penetration
- b. Improves permeability
- c. Improves water retention capacity
- d. Improves resistance to erosion
- e. Improves aeration
- f. Reduces leaching of soil nutrients
- g. Improves soil microbial activity

2.1.3 Deliberate Efforts to Improve Synergy

It is important that there is a proper integration of crop and livestock by farmers so that either can benefit from the other in a sustainable way. DF and its partners consider livestock as an important component in the farming system hence its support in provision of livestock under pass-on scheme. In this set up, when a beneficiary receives one form of livestock s/he will have to repay by giving an equivalent number of livestock that she received to another household. Pass-on has three major objectives and one of them is to allow beneficiaries have access to manure.

All livestock beneficiaries are farmers who implement SA technologies in their gardens where they can use manure for crop production. There is proper arrangement in the use of crop residues depending on the number of livestock and farm size. Part of the residues is used as animal feed and part of it towards achieving some SA technologies such as CA.



The other important factor with compost manure is that they are low cost inputs in comparison to inorganic fertilizers and they supply nutrients even in subsequent years after application. As opposed to compost manure, chemical fertilizers only contribute to raising the total amount of nutrients in the soil without maintaining the organic matter content of the soil and eventually this leads to soil structure deterioration.

NOTE: While integration of livestock is paramount for successful implementation of SA, its effectiveness is hampered by ineffective and unattended free-range grazing systems. Therefore, there is a need to ensure restricted movement of livestock throughout the year.

2.2 Objectives

In this module Lead Farmers are going to learn about manure and compost manures focusing on the following topics: Collection and usage of manure, different types of compost manures that can be made on the farm, methodology in making compost manures, ideal sites where compost manure should be made, materials required in making various types of manures and their application rates.

2.3 Expected Results

By the end of this module the Lead Farmers should be able to:

- a. Know the importance of composts and manures in sustainable agriculture
- b. Different kinds of composts and manures
- c. Know the raw materials used in making different types manures
- d. Know how to make different kinds of composts and manures



Time Frame: 5 hours 30 minutes

- e. Know the application rates for different kinds of manure

2.4 Activities

2.4.1 Introduction (30 minutes)

The facilitator will ask participants to be in three groups. The facilitator will then give each group a flip chart, marker and different kinds of manure (bokash, liquid and animal manure). The facilitator will then ask the participants to name the type of manure they have been given and outline the importance of applying composts and manure in sustainable agriculture.

2.4.2 Plenary – Teaching about different types of manure and how they are made (1 hour 30 minutes)

Compost

The facilitator will define compost as organic matter that has been decomposed and recycled as a fertiliser.

The facilitator should explain that availability of the raw materials will largely determine the type of compost manure a farmer wants to make. For instance, compost manure may be made by using pit method, changu (Chinese method) and chimato (heap method).

a. Making compost using pit method

The facilitator should explain that in this technique a pit is used for making the manure. However, this method is not recommended during the rainy season because excessive rain water may drain into the pit.

b. Making compost using the changu (Chinese) method

The Facilitator should explain that Changu a relatively faster way of making compost and can be prepared anywhere including wetlands.

c. Making Compost Using Bokashi Method

The facilitator will explain that Bokash manure is the type of manure made by mixing different plant/ animal materials. Ash is also added hence the name Bokash. The manure is used for basal dressing and is of higher nutrient value than other types of manure.

2.4.3 Group work—demonstrating how various manures are made (3 hours 30 minutes)

The facilitator will ask the Lead Farmers to be in three groups and walk to the nearby field where prior arrangements were made for a practical session. The facilitator will explain to the Lead Farmers that each of the groups will have a chance to practice making all the categories of composts as listed above.

The facilitator should explain that it is ideal that the site where composts are made be near the garden intended for manure application for ease of transportation. It is also recommended that the pits used for manure making and the heaps be under a shade to reduce evaporation (the shade could either be constructed using poles and thatched with grass or under a tree).The facilitator should also emphasize that the pit/heaps should be on a fairly flat ground and near to a water source and material.

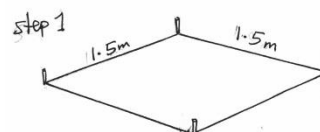
The facilitator should explain that in order to make compost manure in pits, they will require the following materials:

- Preferably green vegetative matter (crop residues e.g. maize stover, ground nut haulms)
- Khola manure, previously made manure or rich top soil. These are required because they contain high microbes necessary for the decomposition process
- Water
- Tools and farm implements such as hoes, shovels, watering cane, panga knife, sickle and a bucket
- Measuring tape

2.4.4 Construction Method for Pit Manure

The facilitator will demonstrate making composts in the pits by asking one Lead farmer to do this step by step process:

- Clear and level the ground where the compost will be made
- Mark the pit 1.5m by 1.5m



- c. Dig to a depth of 1m where there are more microbial activities
- d. While digging separate top soil from sub-soil
- e. After finishing digging the pit, put manure to a depth of 3 to 5 cm at the bottom of the pit
- f. Saturate the manure with water
- g. Fill the composting material 20-30 cm layer
- h. Apply adequate water
- i. Put manure 3-5 cm and add water
- j. Add green material
- k. Add virgin or anthill soil and add water
- l. Repeat the above process till the pit is full
- m. Cover the pit with 8 cm layer of top soil (if on open space, cover with a thick layer of grass to reduce evaporation)

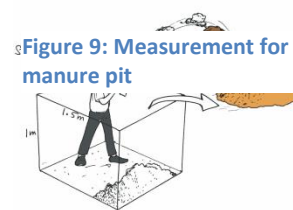


Figure 10: Digging to a depth of 1 m

The facilitator will explain that after one week, the LF needs to check the decomposition process by inserting a stick into the pit, the warmth of the stick indicates that decomposition is taking place and that after 2-3 months the manure will be ready for use.

2.5 Construction Method for Changu Compost Manure

The facilitator will demonstrate the process of making the Changu manure by asking one Lead Farmer to do the following step by step process:

- a. Clear the surface on the ground at least 2 m diameter for easy marking
- b. Measure a 1.5 to 2m diameter circle (Figure 9) by using a peg and the string
- c. Heap 20-30 cm thick layer of composting material over the area marked. This will form the base of the heap
- d. Water the heap adequately until it just oozes out when the materials are squeezed to induce decomposition
- e. Add manure to a height of 3 to 5cm thick
- f. Water the booster layer until the water oozes out
- g. Add green material
- h. Add virgin or ant-hill soil (5 cm layer) and again water until water oozes out
- i. Repeat the above process with the diameter of each subsequent layer reducing until the heap is 1.5m high, thereby attaining a conical shape
- j. Cover the heap with grass to reduce evaporation

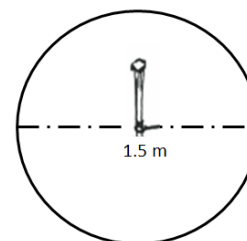


Figure 11: Diameter for manure base in metres (b)

The facilitator needs to explain to Lead Farmers that it is essential to turn the heap to include the rest of the material in the decomposition process and that if the stick that is placed in the middle of the heap is not warm then something must be wrong. The facilitator needs to explain that if this happens one needs to check on two basic things: Moisture content i.e. too little or too much and the booster used did not start the decomposition process.

Whatever the reason is it is necessary to dismantle the heap and repeat the compost-making process. The facilitator will tell the Lead Farmers that it is ideal that the heaps be turned after 3-4 days and thereafter every 4-5 days to speed up decomposition. Normally, the heap will mature within 30-40 days depending upon the nature of composting materials used. The softer and greener the material the faster it will decompose.

2.6 How to Make Bokash Manure

The facilitator will explain that unlike pit, changu and chimato manures, bokash has different kinds of raw materials and ingredients. He or she will explain that any unit can be used to measure quantities of materials used to make Bokash. In the demonstration below, a pail has been used.

2.6.1 Material for making Bokash Manure

The facilitator will need to outline the following required ingredients and explain their role:

- a. 4 parts of crop residues (mostly fresh materials, leaves from fertilizers trees preferable)
- b. Three parts virgin soil (soil from an anthill can also be used)
- c. ½ pail maize bran soaked in water over night
- d. Rotten fruits/local beer wastes made from millet or ½ teaspoon full of yeast in 500 ml of water
- e. ½ pail ash with small particles of charcoal to host micro-organisms
- f. Watering cane
- g. Water
- h. Three parts fresh dung
- i. 4 parts crop residues
- j. 3 parts virgin soil
- k. 3 parts fresh dung
- l. 1 part maize bran
- m. 1 part ash
- n. 1 part rotten fruit

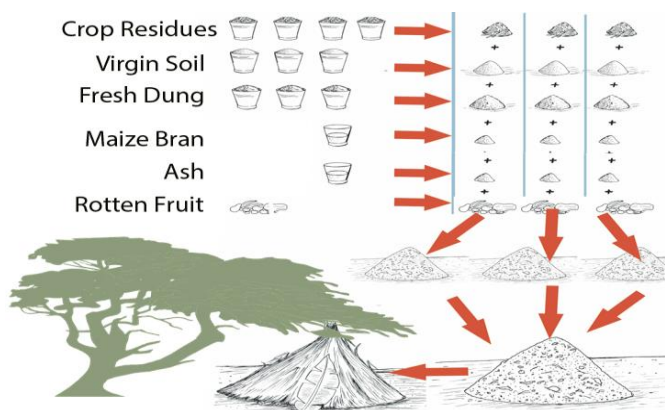


Figure 12: Material for making Bokash manure

2.6.2 Methodology for making Bokash manure

- a. Mix small proportions of all the ingredients listed earlier
- b. Mix all heaps to come up with one heap
- c. Sprinkle the heap with 500 ml yeast liquid or ½ pail maize bran or rotten fruits
- d. Cover the heap with either banana leaves or plastic in order to maintain temperature
- e. The heap is fully decomposed after 21 days. If not used immediately, the manure should be stored under shade

2.7 Liquid Manure

The facilitator should explain that liquid manure is made either from green vegetative material or animal manure e.g. goat and chicken droppings and cow dung. The facilitator will also tell Lead Farmers that for them to make liquid manure the following materials are required:

- a. Herbaceous vegetative material such as triphonia, belekete, kabata, jelejele (mtetegza), etc.
- b. Droppings from animals and poultry
- c. Water
- d. Hessian sacks or drum
- e. Locally made pots and strings
- f. Three supporting poles

2.7.1 Steps for making liquid manure from green vegetative matter

- a. Crush the vegetative matter
- b. Soak in water (200 litres per 50 kg green matter)
- c. Keep the container air tight iv. Stir after seven days
- d. After 14 days, sieve the solution from the residue
- e. Use within 7 days



2.7.2 Liquid from animal manure

- a. Fill any size of a container with $\frac{3}{4}$ full of fresh animal dung of any type
- b. Add water to the container with animal dung until it is above the dung
- c. Keep shaking/ stirring the mixture for 21 days until the dung dissolves in a solution. You should cover after every stirring
- d. Dilute the solution in the ratio of 1:5 if liquid manure is made from chicken droppings. One part being manure and 5 parts being water. No dilution is needed if made from dung of other four-legged animals
- e. Animal liquid manure is ready after 21 days hence if to be used in maize, make liquid on the day of planting.

Figure 13: Liquid from animal manure

NOTE: Dilution ratio of liquid manure to water is 1 to 1 for cow dung and 1 to 3 for chicken droppings.

2.7 Curing Animal Waste into Manure

The facilitator will explain that animal waste is dung and urine from livestock. The facilitator should explain that there is a need to cure the animal dung before applying the same to the fields. Curing is the process where the waste is collected from the khola and heaped to heat and to allow thorough decomposition to take place before its application in the farm. The facilitator should explain that this process is essential because it will:

- a. Reduce the heat of the manure when applied to the fields
- b. Kills the pests, diseases and weed seeds

2.7.1 Materials required

- a. Ready supply of khola animal wastes.
- b. Water
- c. Grass
- d. Tools, i.e. hoe, pail, measuring tape

2.7.2 Curing Procedure

The facilitator will demonstrate curing of animal wastes into manure by asking one Lead farmer to do this step by step process:

- a. Clear the ground for easy marking
- b. Dig a pit of minimum size of 1.0 m deep and 1.0 m wide. Width and length will depend on the availability of fresh animal wastes. The objective is to construct a pit that has the capacity to take the available manure
- c. Take out the animal wastes from the khola and mix it with water just to a friable condition but not too watery.
- d. Put the mixture in the pit until it is full. The top of the heap should be conical in shape so any water may accumulate on top will drain away. The water will suppress decomposition.
- e. Cover the pit with top soil and grass to avoid moisture loss and evaporation (preferably grass without any viable seed). The facilitator should tell the Lead Farmers that they should check the decomposition after 2-3 days by inserting a stick in the heap. The stick should be warm if decomposition is taking place. The fully cured manure will be ready for storage or application to the fields after 30-40 days.

2.8 Application Rates for Different Types of Manure

Table 3: Rates at which different types of manure will be applied to fields

Manure Type	Application Rate
Pit	15 pits / Acre
Changu	15 heaps / Acre
Bokash	32-40 heaps / Acre
Liquid manure should be applied at the rate of 20 litres per 8 metre or for every ten paces	

2.9 Plenary—Teaching about Mode and Rates of Manure Application (30 minutes)

The facilitator will explain that different kinds of compost manures have different rates of application. Application rates of manure also vary with the type of soil and the quantity of manure available. The facilitator will explain that light soils such as sand requires larger quantities of manure compared to heavy soils such as clay.



2.10 Liquid manure application



- a. Apply on both sides of the crop just as fertilizer is applied under Sasakawa in maize
- b. Apply 50ml on each side of the crop
- c. Apply to maize 21 days after planting
- d. On vegetables, application can be after 14 days
- e. The residues can also be applied into the field or used as composting material

NOTE: To speed up decomposition of manures, humic acid solution can be used in place of pure water. In the absence of humic acid, locally available maize samp can be applied for the same purpose. Beer sediments, if added to the manure have also proved to speed up decomposition.

2.11 Frequently Encountered Problems and Possible Solutions



- a. **Applying the compost manure in the garden but the crop not responding well:** The compost made may not be of high quality. Remember that for you to make high quality composts you need high quality raw materials. Another reason is that the manure might have been applied below the recommended application rates.
- b. **Applying khola manure and experiencing an increase in incidence of pests and having the crops scorched:** The khola manure may have been applied before it was properly cured. Manure curing is essential because it helps to reduce the heat of the manure when applied to the fields and kill the pests, diseases and weed seeds.

2.12 Task Checklist

- a. Why is it important to make your compost manure near the garden?
- b. Why is it important to make composts under a shade?
- c. Why would it be important to use humic acid in manure making?

Module 3

AGROFORESTRY



3.1 About this Module

Agroforestry is any farming system in which trees/shrubs are deliberately integrated with crops and /or animals on the same unit of land. Besides contributing to increase in soil fertility, agroforestry is key to mitigating climate change risks as they act as a carbon sink. Agroforestry benefits both the environment and the farmers' economy in ways such as;

- a. Improved soil fertility mainly through increased organic matter which is added through
 - i. Leaf drops;
 - ii. Roots bringing up nutrients from sub soil;
 - iii. Reduced leaching because of the canopy;
 - iv. Improved micro-climate because of the shade provided by the canopy cover; and
 - v. Reduced soil temperature through the canopy.
- b. Reduced soil erosion through
 - i. Reduced raindrop impact as raindrops hit the canopy first;
 - ii. The soil being bound by the roots of the trees
- c. Improved soil structure through:
 - i. Increased organic matter;
 - ii. Hard soils being broken by roots.
- d. Source of raw materials for different household purposes like:
 - i. Fuel wood;
 - ii. Housing/ Fencing materials.
- e. Improved food security through increased cash crop yield
- f. Source of fruits and nuts
- g. Source of animal fodder
- h. Source of medicinal products

3.2 Objectives

The objective of this module will be to train lead farmers on agroforestry practices, nursery and field management for improved soil fertility and crop production.

3.3 Expected Results

By the end of this module, the Lead Farmers should be able to:

- a. Explain techniques used in nursery establishment
- b. Explain seed rates for different agroforestry species
- c. Explain the benefits of practicing agroforestry in sustainable agriculture
- d. Explain different kinds of agroforestry species and their benefits



Time Frame: 4 hours 15 minutes

3.4 Activities

3.4.1 Introduction (10 minutes)

The facilitator will ask participants to be in 2-3 equal groups and give each group a flip chart, pen and marker and different types of seeds for agroforestry species. The facilitator will then ask the group to name the seeds, give seed rates for the different kinds of agroforestry seeds and outline the importance of agroforestry in sustainable agriculture.

3.4.2 Plenary - Teaching of Nursery Establishment (1 hour 30 Minutes)

The facilitator should explain the importance of nursery establishment in agroforestry and the various stages in raising nurseries.

Nursery establishment is one of the most important stages in agroforestry technology and every effort should be put in place to have a well-established and permanent agroforestry nursery. Some of the critical stages in the development of an agroforestry nursery include the following:

- a. Seed collection, selection and storage;
- b. Nursery site identification;
- c. Fencing
- d. Organization of nursery management;
- e. Planting containers and media;
- f. Seed treatment and sowing; and,
- g. Post germination treatment.

3.5 Plenary—Teaching about Principles of Seed Collection and Seed Rates

The facilitator will explain why local seed collection and selection is important in agroforestry technology. She should also explain why it is important to store seeds in a cool shade.

Good plants, to a very large extent, depend on the quality of the seed used. Although preparation of the soil may be excellent good results will not follow unless the seed is of good quality. This is where seed selection comes in. Farmers should select seed that is:

- a. free from dirt, weed seeds and any other impurity
- b. free from diseases

Local seed collection is important for sustainability of the tree planting programme. When projects reach their conclusion and donors pull out of the area, the communities will have to buy seed or collect for themselves, the latter is more dependable. It is important that you collect seed from the type of trees that you see growing well i.e. healthy and mature trees that show the characteristics of the species. Only collect when the seeds are dry and are falling down on their own. However, make sure that the falling of the seed is not premature and due to pest or disease attack. It is also important to follow good seed storage practices so as to maintain seed viability.

Immediately after collecting the seeds you need to dry, thresh and winnow the seed and then store it in the shade at ambient temperature spread out on reed mats to allow free air circulation.

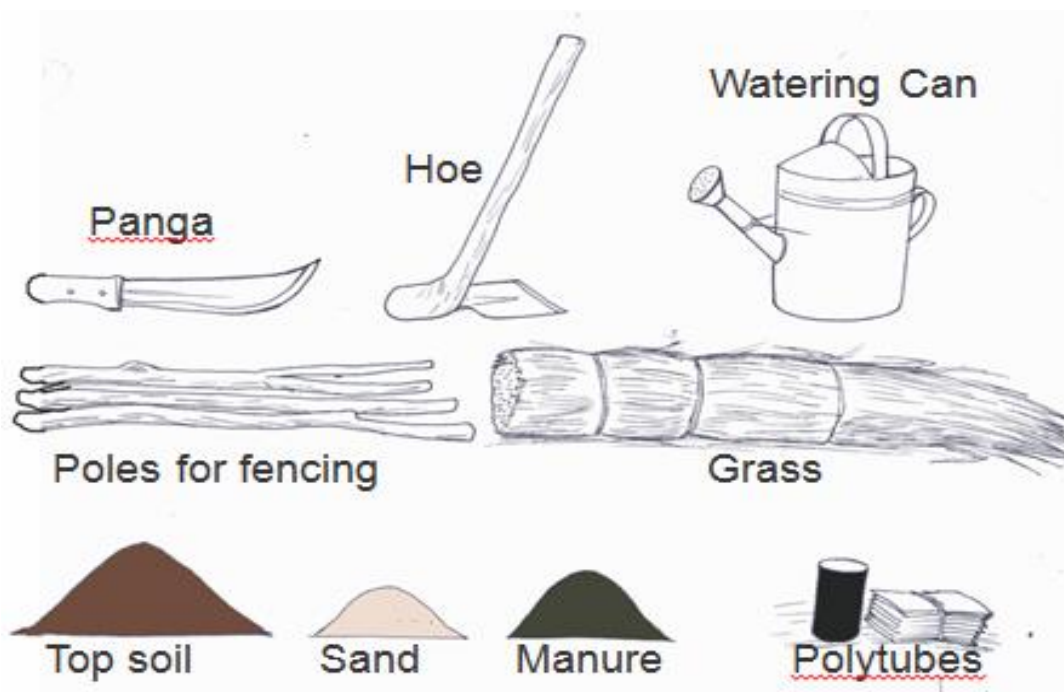
The amount of seed (either weight or number of seeds) required to raise between 100 and 5,000 seedlings for a variety of different tree species is detailed in annex 1. This quantifies the number of seeds per kg for each of the tree types, and provides a recommended seed rate per tube and calculated weight of seed needed to raise different numbers of seedlings.

Agroforestry seed can be sown either through use of polythene tubes or direct sowing in the garden.

3.6 Group work – Nursery Site Selection (2 hours 25 minutes)

The facilitator should divide the participants into 2 or 3 groups. The facilitator will then give each group flip charts and pental markers. The participants will then answer the following questions in their designated groups and write them down on the flip chart:

- Why should nurseries be established near the farmer's home?
- Why should nurseries be established near a water source?
- Why should nurseries be set on a flat ground?
- Why should nurseries not be established on clay or waterlogged soils?



- Why should nurseries be fenced?

Figure 14: Material to collect for tube filling

After the participants have answered the questions in groups the facilitator will organize a plenary for 15 minutes where the groups will present their findings.

Practical session—filling polythene tubes

The facilitator will ask the lead farmers to go back to their groups and walk to the nearby field where prior arrangements were made for the practical session. The facilitator will make sure that the following materials are available for the practical session: hoe, panga, watering can, grass and poles for fencing, top soil, sand, manure, tree seed, nail cutter for breaking the seed coat and polythene tubes or alternative pots like Chibuku cartons, masters, gin sachets.

The facilitator will then demonstrate soil preparation by collecting fertile top soil, sand and manure. The ingredients should be mixed in the ratio: parts top soil to supply nutrients and microbes: one part manure to improve fertility: one part river sand to improve drainage of the media.

After soil preparation, the facilitator will then demonstrate filling of polythene tubes by wetting soil mixture until it is sticky. With open – ended tube, the facilitator will fill the bottom 2 cm first and press against the ground to plug the bottom so that the soil does not fall through the tube. Then the facilitator will fill the tubes right to the top and water them. The facilitator will top up the tubes with nursery soil if needed. The facilitator will then let the LFs fill the remaining tubes exactly following how it was done.

After the Lead Farmers have filled the tubes, the facilitator will ask the Lead Farmers to arrange tubes in blocks of 50 x 10, or 100 x 10 for easy counting and management. The facilitator will also ask the Lead Farmers to bank soil around each block to keep them upright and avoid heat from the sun on the outer most tubes.

3.7 Plenary –Teaching about Seed Treatment and Sowing

The facilitator will explain to the Lead Farmers why they need to treat seed. The facilitator will also explain why it is not recommended to use hot water in treating the seeds.

Some seeds do not germinate easily because the thick outer coat does not let the water in. If water cannot get in the seed cannot start to grow. Therefore, there is a need to make this outer seed coat permeable to water. The seed treatment methods used consist of physically breaking the seed coat to allow water to enter and initiate the germination sequence. The correct procedure

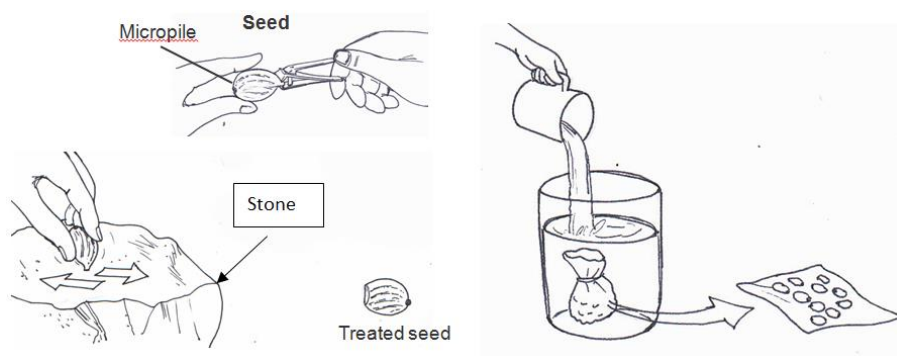


Figure 15: Seed treatment for different kinds of agroforestry tree seeds

needs to ensure that the micro pile is not damaged. The technical term for this process is scarification. The other term for this process is *nicking*.

3.9 Seed Treatment and Planting Depth Recommendations for Common Tree Species

3.9.1 Plenary—Teaching about Seed Sowing in Tubes

The facilitator will explain that the seed need to be sown the same day of pre-treatment. Cover the seed with soil after sowing. S/he should explain that soil cover should not be too much as doing so may lead to most seed failing to germinate.

Table 4: Summary of sowing treatment and methods for different kinds of agroforestry seeds

Botanical Name	Local Name	Seed Treatment	Planting Depth (cm)	Nursery Time
<i>Acacia galpinii</i>	Nkhungu	Nick	1.5-2.0	8—12 weeks
<i>Acacia polyacantha</i>	Mthete	Nick	1.5-2.0	8—12 weeks
<i>Azelia quanzensis</i>	Msambamfumu	Remove aril	4.0	8—12 weeks
<i>Albizia lebbek</i>	Mtangatanga	Nick	1.5-2.0	8—12 weeks
<i>Bauhinia thoninji</i>	Chitimbe	Nick	1.5-2.0	8—12 weeks
<i>Faidherbia albida</i>	Msangu	Nick	1.5-2.0	5—8 weeks
<i>Khaya nyasica</i>	Mbawa	Soak 48 hrs	3.0	10—16 weeks
<i>Sena siamea</i>	Khesya wa milimo	Nick	1.5-2.0	8—12 weeks
<i>Senna spectabilis</i>	Khesya wa maluwa	Nick	1.0	8—12 weeks
<i>Toona ciliate</i>	Sendrella	None	0.5	10—16 weeks

The facilitator will explain that once sown, the tubes will have to be covered lightly with dry grass in order to provide some shade.

3.9.2 Group work –Teaching about post germination treatment

The facilitator will ask the Lead Farmers to go into their respective groups again. The facilitator will then distribute flip charts and markers and ask the Lead Farmers to list the post germination procedures they will undertake. The Lead Farmers should be able to list the following procedures: watering, re- sowing, weeding, thinning and root pruning.

Watering: After sowing, water tubes every morning and afternoon. Continue until the seedlings are 3 weeks old. Thereafter reduce watering to early morning hours only but do not let plants wilt. As a general guideline remember to avoid under or over watering.

Re-sowing: Empty pots are wasted pots so when there is no germination in some pots it will have to be investigated. If the seed appears dead then re-sow.

Weeding: it is fundamental to weed both in the pots and around the site to have a healthy nursery.

Thinning: Thin tubes to one seedling per pot after germination. However, do it gently so that you do not disturb the plant that is left.

Root pruning: Prune small roots growing through the bottom of the tubes by regularly lifting tubes off the ground. Prune larger roots by sliding a sharp panga under the tubes. Root prune every 2 weeks with the final pruning 3 – 4 days before out planting to allow recovery. Shifting of tubes every 2 weeks to avoid roots sticking to the ground should be emphasized. Cutting of roots with Panga disturbs fast growth of seedlings when out planted.

3.9.3 Plenary—Teaching about Under Sowing

The facilitator should explain that under sowing of legumes into maize can be achieved within both the traditional and Sasakawa planting systems. He/she should also indicate the three agroforestry species that can be planted: *Tephrosia vogelii*, *Sesbania sesban* and *Cajanus cajan*. The facilitator should also give examples of the benefits of under sowing. These include:

- Improve soil fertility and crop yields
- Control run off and erosion
- Suppress weeds to reduce loss of soil moisture and nutrients
- Reduce crop damage from pests (stalk borers, aphids, leaf-eaters, termites, weevils and fleas) and striga
- Produce fuel wood for domestic use.

It is important for the facilitator to explain the importance of the legume intercrop at the same time as maize. Failure to plant early limits growth and so less biomass is produced and makes the intercrop less tolerant to pests and diseases.

Table 5: Seed rates for different agroforestry trees

Species Name	Seeds/Kg	Seeds/Tube	Grams required to raise the following seedlings			
			100	1,000	2,000	5,000
<i>Acacia gaipini</i>	4,800	2	40	400	800	2,000
<i>Acacia polyacantha</i>	9,900	3	30	300	600	1,500
<i>Azadirachta indica</i>	11,000	2	20	200	400	1,000
<i>Bauhinia thoninii</i>	6,100	3	50	500	1,000	2,500
<i>Faidherbia albida</i>	6,900	3	40	400	800	2,200
<i>Gliricidia sepium</i>	7,000	2	30	300	600	1,400
<i>Khaya nyasica</i>	2980	3	100	1,000	2,000	5,000
<i>Senna siamea</i>	33000	2	6	60	120	300
<i>Senna spectabilis</i>	82,305	6	7	70	140	360
<i>Tephrosia vogelii</i>	17,500	5	6	60	120	280
<i>Toona cilita</i>	300,000	5	1	10	30	80
<i>Ziziphus mauritiana</i>	1,500	3	200	2,000	4,000	10,000

Table 6: Tree species and agronomical practice

Species	Practice	Spacing	No of trees/ plants per ha
Gliricidia	Green manure banks	90 cm by 150 cm	16,666
Tephrosia	Annual under-sowing	75 cm by 75 cm	33, 000 (3 plants)
Cajanus cajan	Annual under-sowing	75 cm by 75 cm	33,000 (3 plants)

Dispersed systematic tree inter planting

The following tree species are recommended for dispersal tree planting practices. They can initially be planted at closer spacing and thinned as they grow. The trees include:

- a. *Faidherbia albida* (Msangu)—mostly recommended for this practice
- b. *Acacia polycanta* (Mthethe)
- c. *Acacia galpinii* (Nkunkhu)

Table 7: Canopy size and number of trees per hectare

Tree Canopy	Recommended spacing	Recommended density
3 meters	10 x 5m	200 trees/ ha
5 meters	10 x 10 m	100 trees/ ha
8 meters	10 x 20 m	50 trees/ ha
10 metres	20 x 20 m	25 tree/ ha

The facilitator should also explain various methods of under sowing in the traditional maize system with 75 to 90 cm between plants in the rows and the Sasakawa planting system with the maize planted at 25 cm in a row.

The facilitator should explain that in the traditional system farmers need to sow 3 seeds per station on the top of the ridge, with two stations 30 cm apart between every two maize plants/stations while in Sasakawa planting system farmers need to sow 3 seeds per station on the top of the ridge with one station midpoint between two stations. In both cases the seeds need to be sown at the depth of 1-5cm.If the seeds are too deep they will not germinate

3.10 Plenary – Teaching about Weeding, Year and Time of Harvesting

3.10.1 Introduction (15 minutes)

In this section the facilitator should explain why it is important to keep fields planted with Tephrosia free of weeds. At the end of this plenary discussion the facilitator should clearly outline the harvesting procedure and biomass usage.

3.10.2 Plenary – Teaching about Dispersed Systematic Tree Inter-planting

In this section the facilitator will explain that dispersed systematic tree inter-planting involves planting trees with crops at wide spacing to improve soil fertility and crop yields. S/he should also explain that if properly managed this practice sustains farm productivity over a long term and provides other useful tree products. This practice is popular with smallholder farmers

because it builds on traditional agroforestry practices offering a range of tree species to meet different farmer needs.

The facilitator should also indicate the common species recommended: *Leucaena* and *Sesbania* at 0.9m X 0.9m. *Gliricidia* and *Senna* may be planted wider apart at 1.8m X 1.8m because of their large size. *Tephrosia* is best spaced at 0.9m X 0.45m.

This practice involves planting trees with crops at wide spacing to improve soil fertility and crop yields. If properly managed this practice sustains farm productivity over a long term and provides other useful tree products. This practice is popular with smallholder farmers because it builds on traditional agroforestry practices offering a range of tree species to meet different

Practical session—learning how to dig planting pits

The facilitator should ask the participants to go into their respective groups for this practical session. For this session you will need a hoe, soil and manure. The facilitator should demonstrate by digging a pit (60 by 60 cm). After digging the pit loosely replace the soil in the pits.

The facilitator should also tell the Lead Farmers different pit dimensions for out-planted nursery seedlings and direct sowing (10 x 10 cm and 5 x 10 cm respectively).



farmer needs.

NOTE: It is a standard practice to start with top soil and then manure in filling the pits.

Remember to create a basin around the tree to allow collection of water. After planting, the need for putting pressure on soil to chase away air circulating in the soil should also be emphasized



3.11 Frequently Encountered Problems and Possible Solutions

- Seeds failing to grow after they have been sown in poly tubes:** This might be due to seeds not having been treated (nicked).
- Tree nursery eaten by goats and other livestock:** Nursery may have been established far away from houses and probably not well fenced.
- Shortage of water in most rivers and streams especially during Nov and Dec.



3.12 Task Checklist (15minutes)

- Why is it important to sow the legume intercrop at the same time as maize?
- Why is it important to create a basin around the tree?
- Why should farmers not sow seeds too deep?
- Why is it important to test the viability of the seed after it has been nicked?



NOTE: Experience suggests that farmers raise and out-plant good seedlings in the first year. However, there is little effort to manage these trees during subsequent years leading to reduced survival rate. Therefore, it is emphasized that farmers take care of their trees e.

g. by protecting them from bush fires and livestock.



Module 4

**CONSERVATION
AGRICULTURE**



4.1 About this Module

The common method of land preparation among farmers in Malawi is characterized by turning the soils every season, clearing and burning weed and crop residues and intensive hoeing or ploughing. Most of these practices lead to lack of organic matter resulting into soil degradation. Soil degradation is when soil deteriorates because of human activity and loses its quality and productivity. The yields get lower every year because the soils have been worked over and over without enough fertility replenishment.

Conservation Agriculture has proven to benefit farmers in many countries. It aims to empower farmers to make more sustainable use of their land in ways that improve food security and their incomes. It enables farmers to acquire the knowledge and skills to operate systems that within a year or two save labour, promote soil water retention, enhance soil fertility and improve crop yields.

Since both crop rotation and weed control are included in other modules, these topics will briefly be explained in this module.

4.2 Objectives

In this module you are going to learn the crucial techniques in conservation agriculture that will include why we need conservation agriculture, principles of conservation agriculture, and steps to follow during the transition period from conventional farming to conservation agriculture.

4.3 Expected Results

By the end of this module, participants should be able to:

- a. Explain why common methods of land preparation will result in soil degradation and low soil fertility
- b. Explain the benefits of no till and soil cover
- c. Explain practically the principles of Conservation agriculture and steps to follow to achieve when making the switch from Conventional Agriculture



Time Frame: 5 hours 30 minutes

4.4 Activities

4.4.1 Introduction (30 min)

The facilitator should introduce the module to the participants by asking different questions like what they understand by conservation agriculture, what the difference is between conservation agriculture and conventional farming and why we need conservation agriculture.

1. What is Conservation agriculture?

Conservation Agriculture is a farming system aimed at producing high crop yields while reducing production costs, maintaining soil fertility and conserving water. It is a way to achieving sustainable agriculture and improving livelihoods.

Conservation agriculture has three basic principles namely:

- a. Minimum soil disturbance;
- b. Maximum soil cover; and
- c. Crop rotation/association.

It is based on enhancing natural biological processes above and below the ground. It aims at minimizing soil and water loss and having an operation threshold of leaving a minimum of 30% crop residue cover on the surface throughout the year.

II. Why Conservation Agriculture?

Yields in many areas are actually failing. A major cause of this is declining soil fertility often caused by the way of farming. The rising population has forced farmers to abandon traditional practices that left the land fallow for several years, and to cultivate ever-smaller plots. Intensive tilling and hoeing year after year can produce a hard pan in the soil that restricts root growth and stunts plants. Rain water pounds the bare soil, forming a surface crust that the water cannot penetrate. It runs off taking the valuable top soil with it. Erosion in some places is so severe that little soil is left.

To get as good yield farmers often apply more and more fertilizer. With less moisture in the soil plants are more vulnerable to drought. They start to wilt after a few days without rain. Conservation agriculture enables farmers to reverse this trend. It prevents hard pans from forming, protects the soil, increases soil moisture and restores soil fertility, thereby stabilizing yields and improving production over the long term. There are many reasons why farmers should practice conservation agriculture:

a. To improve yields

The current trend in Malawi suggests that crop production is not keeping up with population growth. Yields in many areas are actually declining due to:

- i. The rising population has forced most farmers to abandon traditional practices that left the land fallow for several years, and now cultivate on smaller plots
- ii. Declining soil fertility, and many other forms of land degradation
- iii. Unreliable rainfall patterns characterized by frequent occurrence of extreme conditions such as droughts and floods

b. To maintain the productivity of the land

The conventional farming practices are very much centred on immediate crop production, without any concerns for the future. This has led to the loss of huge expanse of arable lands. Conservation agriculture aims to empower the farmer with the techniques that will ensure that the resource base is sustained and improved.

c. To reduce the cost of production

Tilling the soil is expensive. Due to the high cost of labour and other farm inputs, many farmers cannot recoup their production costs by selling what they produce, so they end up making a loss. Conservation agriculture techniques help farmers to improve soil fertility leading to reduced requirement of external inputs like expensive inorganic fertilizers and therefore these farmers cut costs while increasing yields.

d. To overcome shortages of labour and farm power

Many households suffer from severe lack of labour and farm power. Hunger, malnutrition and diseases such as malaria and AIDS, have left many households with very little labour. Conservation agriculture, with reduced labour for land preparation, enables such households to grow more food with less work.

e. To easily adapt to effects of climate change and global warming.

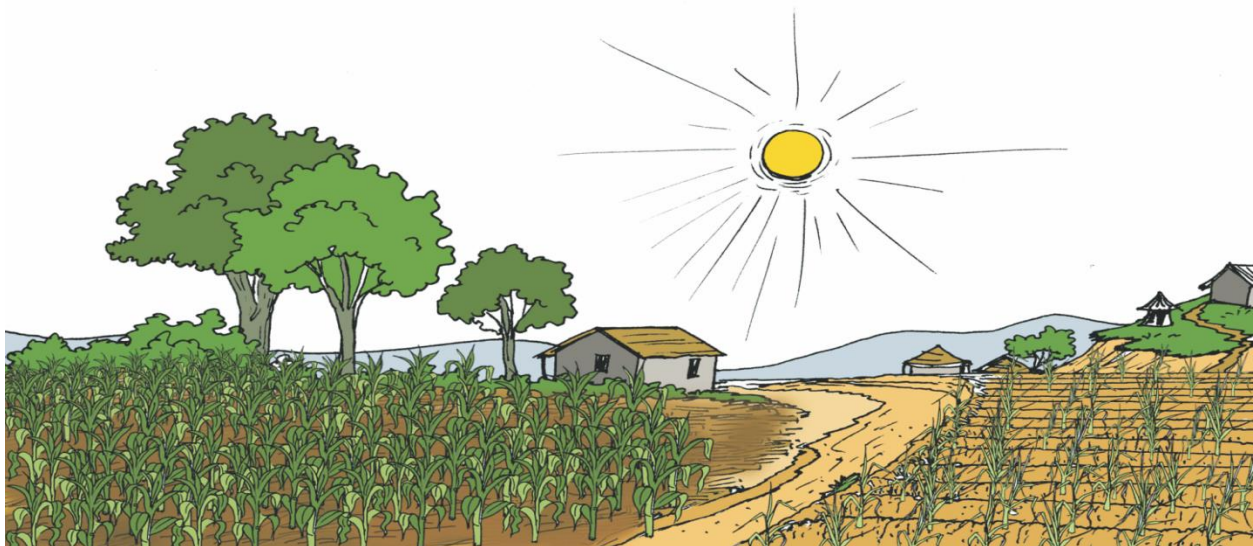
The different techniques promoted in conservation agriculture such as mulching, minimum tillage and crop rotation do not only enable the farmer to easily adapt to effects of climate change, but also ensure that farmers also contribute to the fight against global warming by minimizing carbon emissions.

4.5 Plenary — Teaching about the Principles of Conservation Agriculture (1 hour 15 minutes)

The facilitator should explain the three principles of conservation agriculture to the participants and should emphasize that these three principles should be followed concurrently.

There are three principles of Conservation Agriculture (CA) namely:

- a. Minimum soil disturbance and weed control



- b. Permanent soil cover; and,
- c. Crop rotation/associations.

Figure 16: Moisture stress contrast in maize under CA (left side) and that is under conventional agriculture (right side)

4.5.1 Minimum Soil Disturbance

CA involves minimum soil disturbance from practices such as tillage, ridging, weeding, and banking with hand-hoes. Although soil disturbance has been associated with good performance of crops in the short term it has negatively been associated with diminishing of soil fertility in the long term. The high performance in the short term is the result of mineralization as soils are turned to and forth. Further to the above, the process of chemical soil disturbance deteriorates soil “life” through formation of crusts and compaction eventually leading to soil erosion resulting from failure of water to infiltrate the soil.

Eroded soil pollutes rivers and is deposited as sediments behind dams. Conservation agriculture avoids these problems; it reduces the amount of tillage and can eliminate it altogether if seeds are planted directly into the soil.

Table 8: Effects from synergies between minimum soil disturbance and other practices related to Conservation Agriculture

Minimum Disturbance and Soil Cover	Minimum Disturbance and Rotation	Minimum Disturbance and Organic Matter
Protects soil from erosion,	Nutrient balance	Stabilizes/holds soil particles together
Regulates soil temperature and evaporation	Stores nutrients	Source of carbon and energy for soil microbes
Reduces soil compaction		Improves soil aeration
Source of organic matter		Improved water infiltration
Control weeds		
Nitrogen fixation (e.g. pigeon peas)		
Physical root effects		
Disease / pest control		

I. The options for minimum soil disturbance

There are various technologies that in combination, would allow minimum soil disturbance. The choice of the technology may be based on: soil resistance to erosion (erodibility), land management and topography. Hereunder two main technologies are explained; a) ridges and b) pits.

II. Use of Old Planting Ridges

In the first year crops are planted on old ridges, i.e. ridges are not split and reformed in furrows. Within two years the old ridges effectively disappear.

NOTE: It is recommended that since these ridges will be permanent, they must be made right in the first year and on contour. Ensure that the hard pan is broken in the process.



Construction of ridges has to start immediately after harvest. This spreads the labour and allows the farmer to plant with first rains.

Make the ridges following established marker ridges. The ridge spacing will depend on the crops to be grown and the desired plant populations. In addition to using old planting ridges, the other options are: use of rippers and chaka hoes.

4.5.2 Maximum Soil Cover

Soil degradation is always faster and most serious where the soils are left without cover and result into formation of hard pans and pulverization of top soil. The maintenance of a permanent soil cover of dead or living plant material is the heart of conservation agriculture. The sources of soil cover include *living or dead plant material applied as mulch, green manure, cover and forage crops, crop residues and fallow vegetation, e. g. Tephrosia.*



I. Benefits of soil cover

- a. Protects against impact of rain drops – less surface sealing and crusting and therefore less runoff
- b. Improves water infiltration due to protection of soil surface structure by the residues
- c. Maintains continuous pores for aeration in the absence of tillage.
- d. Reduces water evaporation from the soil surface as the residues protect the surface from solar radiation.
- e. Enhances moisture conservation because of the increased infiltration and reduced evaporation.
- f. Source of organic matter build up resulting in better soil structure,
- g. Controls the multiplication of weeds

II. The Options for Maximum Soil Cover

- a. Prevent burning and uncontrolled bush fires.

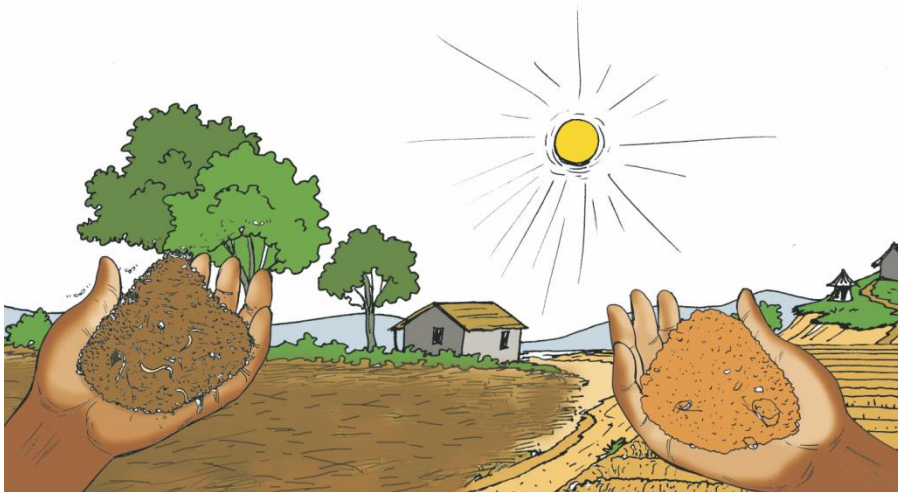


Figure 18: Soil colour contrast between a covered field (darker soil, left) and a field that is

- b. Figure 17: Differences in colour between soil from a bare field and that from a residue-covered field

otect

- from free range roaming livestock
- c. Crop rotations
- d. Growing of green manure and cover crops

NOTE: A minimum of 30% soil cover has been widely recommended.

4.5.3 Crop Rotation/Associations

Crop rotation is the growing of different crops in a sequence (one season after another) in one field to avoid mono-cropping. A good rotation includes a cash crop, a staple food crop, a legume and an improved fallow. Crops in a rotation should be suited to the area and manageable by the farmer. Crop rotation and associations enhance nutrient uptake and replenishment. It is one of the core principles of conservation agriculture. (Refer to Module on Intercropping and Crop Rotation for details about crop rotation).

When planning a crop rotation in conservation agriculture always adhere to the following:

- a. Alternate a grain crop with a legume or oil crop; and,
- b. Alternate a crop that produces a lot of residues with one that produces fewer and determine whether the crop is commercial and cost effective.

Independent of tillage systems, rotation of crops is always a good practice. In the absence of tillage, it is even more important to break pest cycles. Crop rotation can either be in space (e.g. a four year rotational cycle of alternating a legume, grain, and a grass crop) or through crop mixtures such as under-sowing and Inter-planting.

4.6 Plenary—Teaching about Transition from Conventional Farming to Conservation Agriculture (1 hour 30 minutes)

The facilitator should explain to the participants where Conservation Agriculture can be applied and steps to be followed when one is moving from Conventional Farming to Conservation Agriculture

4.7 Where to Apply Conservation Agriculture

Conservation Agriculture can be applied under almost all soil-climate-crop combinations, but is perhaps most effective in increasing and stabilizing yields where low or uneven rainfall limits crop production. It is also suitable for areas with highly degraded unproductive soils as a mechanism for recovering the soils.

4.8 Crops that can be grown under CA

Crops like maize, wheat, soya beans, cotton, and sunflower can be grown successfully under CA. Even root crops including potatoes and cassava can be grown although harvesting of these crops causes considerable soil movement.

4.9 Requirements to start CA

4.9.1 Information

It is advisable to get information about the system from experienced farmers and technicians and stay informed. The farmer should start with a small area of land (about 10% of the property) and first learn how to manage the system.

4.9.2 Preparation

- a. Prepare the field beforehand (get rid of compaction, perennial weeds and acidity problems).
- b. Obtain the right equipment for seeding (and for weed control).
- c. Produce sufficient ground cover

4.9.3 Implementation

- a. It is important to achieve good weed control;
- b. Start with a good crop rotation to provide nutrients, additional residues and weed control;



Practical session—learning how to Pit Making and Laying of Crop Residues (3 hours 35 minutes)

The facilitator should sub-divide the participants into smaller groups of about ten participants each and should go out to a field where the participants will have hands-on practice on pit making and laying of crop residues in a conservation agriculture field.

- c. Prevent weeds from setting seed.

4.10 Frequently Encountered Problems and Possible Solutions

4.10.1 Mind Set

Many farmers, extension agents and researchers find it difficult to understand that crop production is possible without ridging/breaking the soil. LFs need to implement SA technologies so that people learn from the results.

4.10.2 Residue retention

CA, generally, does not work well without residues as many benefits come from surface mulch. However, most smallholder farmers manage well mixed crop-livestock systems and depend on the residues for fodder during dry season. Therefore, often, there is a conflict concerning use of residues. To reduce this conflict, CA needs to be started on a small part of the farm with adequate supply of residue. Once the farmer can manage the system well and yields have increased, then s/he can use part of the residues for fodder while at the same time leaving enough on the land as ground cover on another small plot with CA.



4.10.3 Weed Control

Weed infestation can be a problem under CA. In the first seasons of CA, much attention needs to be paid to weed control as this is, traditionally, the principle reason for tillage. Weed control in CA can be effectively managed through use of cover crops, maintaining crop residue on the ground and integrated weed management. Weeds should not set seed, so year-round weed control is very important. If controlled effectively, the weed populations decrease after the first two or three seasons.

4.11 Task Checklist

- a. What is Conservation Agriculture?
- b. Mention three principles of Conservation Agriculture
- c. Name three sources of soil cover that can be used in CA
- d. What is the best way of controlling weeds under CA?

4.12 Complementary CA Practices

Conservation agriculture includes complementary practices that enhance the ability of the farmer to become more self-sufficient with reduced vulnerability to climate change. Options that complement these practices include use of planting pits, organic manure, vetiver hedge rows to control runoff and erosion, agroforestry to improve soil fertility and reduce fertilizer costs and selected herbicides to control weeds with less labour.

4.12.1 Use of Permanent Planting Pits

Planting pits require considerable labour, especially in the first dry season when soils are very hard. Planting pits are dug manually with a hoe from the month of May or soon after harvest so that labour is distributed over a long period and that the crop can be planted with the first rains. The pits are recommended particularly for dry areas, with soils not too hard to work on.

Basic construction procedure follows the following steps:

- a. In a field that was previously cropped, leave up to 30% crop residue. The residue will decompose, add organic matter and improve soil structure.
- b. If it is virgin land, it should be stumped, wood and roots removed. The stump holes should be covered by hand and levelled off. Do not plough.
- c. Mark pit position using the rope following a contour line i.e. The basins should be dug across the slope.

Table 9: Pit dimensions and spacing

Pit Specifications	Recommended Spacing
Spacing between basin/pit	70cm
Spacing between rows	90cm
Depth	20cm
Length	30cm
Width	30cm
Plants/basin	4 plants

4.12.2 Increasing the efficiency of the pits

It is important to realize that the use of these pits alone will not produce the highest yields. For best results:

- a. Always incorporate crop residues (leave a minimum of 30% crop residue on the field).
- b. Agro forestry trees and cover crops can also be integrated in pits.
- c. Protect crops from weeds, pests and diseases.
- d. Always plant with first rains.

- e. Grow crops in rotation, at least 30% of cropped land should be planted to legumes.
- f. Apply fertilizers and manure.

It is recommended to apply two shovels of manure in a basin with the dimension specified in the table above. If basal dressing fertilizer is available, it can be applied at the same time. When manure has been applied, it should be covered with soil. A shallow depression should still remain on top. If manure is used for top dressing use liquid manure at the rate of 50ml per maize plant or by using a feeding cup.

4.12.3 Weed Control

The pits have to be kept free of weeds at all times. Remove the weed as soon as they appear and just before harvesting to reduce the amount of weeds in the next season (Refer to Weed Control Module).

NOTE: When using the planting pits remember that the pits are permanent and can be used for three successive seasons so it is important to take good care of them.

4.12.4 Harvesting

It is advisable to harvest the crop when the field is free of weeds as this reduces weed infestation in the next season. Remove the main crop from the field. Cut the stems up to a height of

30cm. The stem should be left to rot together with the roots. Remove the crop and cut plants at base. Leave stems and leaves on the soil. The roots should not be uprooted but should be left to decompose within the pit.

It is advisable to fill planting pits with soil almost to the very top to avoid bogging the plants during watering.

Make planting pits during the dry season as hard pans are best dealt with at this time.

4.12.5 Management of crop residues During the Dry Season

Crop residues must be spread along the ridges. If there is need for livestock fodder, take away 70% for the livestock and other uses. The residues must be protected from fire at all times.

4.12.6 Agroforestry

Agroforestry practices greatly complement CA by enhancing crop yields and soil fertility, suppressing weeds, pests and diseases; conserving soil and water and providing for other uses such as fuel wood and fodder from the same piece of land. Soil fertility improvement trees can be planted in the ridges. The most commonly used tree species include *Faidherbia albida*, *Gliricidia*, *Senna siamea*, *Tephrosia vogelii*. These trees can be planted under relay cropping or mixed/intercropping.

4.12.7 Planting in the Following Season

Planting in the next season can use the same planting stations.

Module 5

INTERCROPPING AND CROP ROTATION



Unit 1

INTERCROPPING

5.1 About this Unit

Intercropping is the growing of two or more different crops on the same field at the same time. In many parts of Malawi intercropping is an old traditional practice. Frequently, Maize was grown with crops such as beans and pumpkins. Intercropping is beneficial in the sense that it reduces the occurrence of insect pests, diseases and weeds. In brief, the advantage of this method is that it will allow one crop to grow together with another.

For instance, when maize is inter-planted with beans and pumpkins, the maize will benefit from nitrogen fixed by the beans and the ground cover provided by the pumpkin will suppress weeds and conserve moisture. The shade from maize plants will protect the pumpkins and beans below it from the strong rays of the sun and the impact of heavy rains. In organic farming, intercropping is one of the measures recommended for pest management.

5.2 Objectives

The objective of this module will be to train Lead Farmers about inter-cropping and bring them to an understanding of the best crop combinations in this practice. Benefits of intercropping, including improved food security and soil fertility; and as an insect and /or disease control measure will also be understood.

5.3 Expected Results

At the end of this module the Lead Farmers should be able to:

- a. Explain different types of intercropping practices



Time Frame: 45 minutes

- b. Explain benefits of intercropping on the farm

5.4 Activities

5.4.1 Introduction (15 minutes)

The facilitator will ask participants to be in groups of 10 people. The facilitator will then give each group a flip chart and a marker. The facilitator will then ask the participants to:

- a. List different types of cereals and legumes.
- b. Give beneficial effects of planting legumes to the soil.



Figure 19: Maize intercropped with beans in mixed intercropping

the crops that may be grown in this system. This would make it difficult for pests to locate their target crop. In addition, this ensures that the ground is covered and therefore, it will reduce the water loss through evaporation and suppress weeds.

II. Row intercropping

This is the growing of two or more crops simultaneously when one or more crops are planted in rows, for example, maize intercropped with beans.



Figure 21: Multi-storey intercropping

This is the growing of two or more crops simultaneously during part of the lifecycle of each species. A second crop is planted after the first crop has reached its physiological maturity but before it is ready for harvest.

V. Multi-storey intercropping

This is the association of tall perennials with shorter biannual and annual crops. Maize can be interplanted with trees like Sesbania and Gliricidia.

5.4.2 Plenary—Teaching about different types of Intercropping (45 minutes)

The facilitator should explain different types of intercropping clearly highlighting the agronomic advantages of each of the system. The facilitator should also explain why it is important to adjust below the seed rate of each crop that will be planted. The following intercropping systems are explained to the Lead Farmers:

I. Mixed inter-cropping

This is the growing of two or more crops simultaneously with no distinct row management. Pumpkins, okra, cowpeas and cucumbers are some of the crops that may be grown in this system. This would make it difficult for pests to locate their target crop. In addition, this ensures that the ground is covered and therefore, it will reduce the water loss



Figure 20: Row intercropping

III. Strip intercropping

This is the growing of two or more crops simultaneously in different strips wide enough to permit independent cultivation but narrow enough for agronomical interaction of the crops. This is ideal for vegetables. It is easier to control pest outbreak in one strip as this in method, crops from the same family are not too near to each other.

IV. Relay intercropping

This is the growing of two or more crops simultaneously during part of the lifecycle of each species. A second crop is planted after the first crop has reached its physiological maturity but before it is ready for harvest.

VI. Sequential intercropping

This is also an aspect of multiple cropping involving the growing of two more crops in sequence on the same field in the same year. The succeeding crop is planted after the preceding crop has been harvested. There is no intercrop competition and farmers have to manage only one crop at a time.

5.5 Group work—Teaching about Different Crop Combinations Farmers can Intercrop (30 minutes)

The facilitator should divide the participants into groups and give each group flip charts and markers. The groups will then discuss and answer in writing the following questions:

- a. What crops can best be intercropped with Cereals: (maize, sorghum and millet)?
- b. What crops can best be intercropped with legumes (ground nuts and beans)?
- c. What crops can best be intercropped with cash crops (cotton)?

Unit 2

CROP ROTATION

5.6 About this Unit

Crop rotation is the practice of growing a series of dissimilar types of crops in the same field in sequential seasons.

Crop rotation gives various benefits to the soil. A well-known effect of crop rotation is the replenishment of nitrogen through the use of green manure in sequence with cereals and other crops. Crop rotation also benefits the farmer in other ways; it mitigates the build-up of diseases and pests that often occurs when one species is continuously cropped; it can improve soil structure; and increase soil fertility by alternating deep-rooted and shallow-rooted plants and altering crops with different nutrient requirement - for example, maize followed by groundnuts.

5.7 Objectives

The objective of this module will be to enable the trainer to:

- a. Train Lead Farmers in crop rotation and bring them to understanding of best crop combinations in this practice,
- b. Explain the shortcomings and risks of growing the same crop in the same field for many years; And,
- c. State the benefits of crop rotation and what crops to follow each other in a rotation are understood.

5.8 Expected Results

At the end of this module the Lead Farmers should be able to:

- Explain the importance of practicing crop rotation in their fields



Time Frame: 45 minutes

- Choose crops that can follow each other when practicing crop rotation.

5.9 Activities

5.9.1 Plenary—Teaching about principles of crop rotation and choice of crops (30 minutes)

After explaining the shortcomings and risks associated with mono-cropping the facilitator should explain the principle of crop rotation. Dissimilar crops need to follow each other. For instance a crop that depletes the soil of one kind of nutrient is followed during the next growing season by a

crop that returns that nutrient to the soil. Similarly deep-rooted crops should be followed by shallow-rooted crops in the next season.

The facilitator should also explain to Lead Farmers that the choice and sequence of rotation crops depends on the nature of the soil, the climate, and precipitation which together determine the type of plants that may be cultivated. The facilitator should also explain that other important aspects of farming such as crop marketing and economic variables must also be considered when deciding crop rotations so that farmers get the best of the rotation.

5.9.2 Group-work—Benefits of Crop Rotation (30 minutes)

The facilitator should divide the participants into groups and give each group flip charts and markers. The participants will then answer the following questions in their groups and write them down on the flip chart:

- a. What are some of the advantages of practicing crop rotation in sustainable agriculture?
- b. Why should farmers not plant crops belonging to same family in the subsequent years in crop rotation?

5.9.3 Plenary - Teaching about how crop rotation helps in control of pests and soil erosion (30 minutes)

The facilitator will explain to the Lead Farmers why plants within the same taxonomic family tend to have similar pests and pathogens agronomically. The facilitator will also explain why by regularly changing the planting location, the pest cycles can be broken or limited.

To help Lead Farmers understand this concept the facilitator needs to give an example of how the root-knot nematode can be controlled by growing a crop that is not its host in the subsequent year. This in turn makes it possible to grow a susceptible crop the following season without needing soil fumigation as is the case in tobacco nurseries, or other external control practices.

The facilitator should also explain how careful choice of crops to be rotated helps reduce soil erosion by reducing raindrop impact and sediment detachment.

A four-crop rotation will be planned by dividing the garden into 4 subplots.









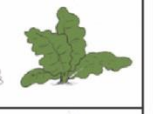




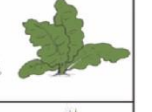




	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Plot 1				
Plot 2				
Plot 3				
Plot 4				

Figure 22: A sample crop rotation cycle with Maize, G/Nuts, Sweet Potato and Tobacco



5.10 Frequently Encountered Problems and Possible Solutions

a. **Overcrowded plants in an intercropped field:** This may be encountered if different types of seeds have been planted at their full seed rate. To correct this, the farmer needs to reduce the seed rate for each selected crop to be used in a mixture. By reducing the seed rate of each, the crops have a chance to yield well within the mixture.

b. **Intense build-up of pests and diseases in the fields where crop rotation is practiced:** The farmer may have planted crops belonging to the same family in the subsequent years. The changing of crops in a sequence tends to decrease the population level of pests as plants within the same taxonomic family tend to have similar pests and pathogens. Therefore, by regularly changing the planting location, the pest cycles can be broken or limited.

5.11 Task checklist

- When practicing intercropping, why is it important that the seed rate of each crop in the mixture be adjusted below its full rate?
- Why is intercropping important in sustainable agriculture?
- In the choice of crops to be used in rotation, why is it important that we consider crop marketing and economic viability of the crops?
- Why is it important that leguminous crops should follow cereals in rotation?
- Why should crops in the solanaceous family (the facilitator will have to give examples of such plants like tobacco, potatoes, tomatoes, eggplants, pepper) not follow each other in crop rotation?



Module 6

INTEGRATED WEED MANAGEMENT



6.1 About this Module

A weed can be described as a plant considered undesirable within a certain context. It commonly applies to unwanted plants in human-controlled settings, such as farm fields, gardens, lawns, and parks. Weeds compete with crops for nutrients, moisture and sunlight. They can also harbour pests and diseases causing reduction in yields. To effectively manage weeds in the field, it is recommended to use an integrated approach. This involves a combination of different weed management methods, for example timely planting, crop rotation, intercropping, soil cover, timely weeding and use of herbicides.

While this module is about controlling weeds, it should be noted that sustainable agriculture involves cultivation of a diversity of plants which also benefits from a biological rich nature.

6.2 Objectives

The objective of this module will be to build an understanding of participants on weeds and different methods of weed management.

6.3 Expected Results

By the end of this module the Lead Farmers should be able to:

- a. Explain different weed control methods;
- b. Explain why the use of herbicide is the last choice;
- c. Recognize local weeds and differentiate between the grass family, creeping and broad leaf weeds;
- d. Know the effects of weeds on crop production;
- e. Know the correct use, names and effects of locally available herbicides;
- f. Know types of herbicides;
- g. Read and understand the labels and other reading material following the product;
- h. Know correct and safe ways of using herbicides and the risk by not doing so.
- i. Know advantages and disadvantages of using herbicides in weed control; and,



Time frame: 1 hours 15 minutes

- j. Know correct and safe ways of using herbicides and the risk by not doing so.

6.4 Activities

6.4.1 Introduction (10 minutes)

Brainstorming exercise: Ask participants the following questions and write answers on a flip chart:

- a. What do you understand by the word “weed”?

- b. What is the commonest way of weed management in our gardens?

6.4.2 Farm walks (10 minutes)

Participants will be divided into two groups and be asked to walk in two different crop fields and pick different plants that they consider weeds. In case of dry season, participants should be able to list most common weeds affecting their fields. If possible, they should interview owners of the fields. The groups should do the following:

- a. Classify the weeds into categories based on their similarities or species; the grass family, creeping or broad leaf weeds, for example;
- b. Indicate how each of the weed species group affects the crops (it would be in the same way in other instances); and
- c. List how best to control each of the weed groups.

6.4.3 Farmers' presentations (15 minutes)

One participant from each group will make a presentation and explain the findings listed on a flip chart. The groups will then discuss their different findings. In this way, a common picture of common weeds in the area is provided. During a discussion the following questions should be answered: What are common weeds in project areas? What are different ways of managing the weeds?

6.4.4 Facilitator's Summary (35 minutes)

The facilitator summarises the module by defining what a weed is, how weeds affect crop production i.e. by competing for space, nutrients, water and light with the preferred plants. The facilitator will also state that there are different ways of managing weeds and decisions on management method to use vary according to plant life cycles, infestation size, environmental parameters and management objectives.

The facilitator will explain the following weed management methods:

I. Preventative Weed Management

Preventative weed management refers to any management method that aims to prevent weeds from producing seed in a cultivated field, a pasture, or a greenhouse. Examples of preventative weed management would be using weed free seed, only transporting animal feed that is weed free, making sure farm equipment is cleaned before moving from one location to another, and screening irrigation water to prevent weed seeds from traveling along irrigation ditches.



II. Cultural Weed Management

Cultural weed management refers to any technique that involves maintaining field conditions such that weeds are less likely to become established and/or increase in number. Examples of cultural weed management would be crop rotation, avoiding

Figure 23: Some cultural weed control methods



Figure 24: Mechanical weeding using a hand hoe

overgrazing of pastures, and maintaining good soil fertility.

III. Manual/Mechanical Weed Management

Mechanical weed management is described as any physical activity that removes, injures, kills or makes the growing conditions unfavourable for unwanted plants. Such methods include weed pulling, mowing, mulching and tillage.

IV. Biological Weed Management

Biological weed Management refers to any technique that involves the use of natural enemies of weed plants to manage the germination of the weed seeds or the spread of established plants, for example, grazing goats under macadamia trees or in an orchard.

V. Chemical Weed Management

Chemical weed management refers to any technique that involves the application of a chemical (herbicide) to weeds or soil to manage the germination or growth of the weed species.



Figure 25: A farmer spraying his crop without protective clothing

The facilitator will indicate that weed management by using chemicals should be the last option. This is because chemicals can have serious side-effects such as resistance and, if not properly

used they can be dangerous to humans and the environment. The facilitator will indicate that it is, therefore, important that use of herbicides is discussed a little further.

6.5 Plenary: Teaching about Herbicides

The facilitator will ask the following questions at the beginning of this session:

- a. Who has ever used herbicides?
- b. Can you explain how you have used herbicides in your gardens?
- c. What are the advantages and disadvantages of using herbicides in weed control?
- d. How do you ensure correct and safe use of Herbicides?

The facilitator will define a herbicide as a chemical used to kill or inhibit the growth of weeds and other pests. Herbicides can be classified as:

- a. Non-selective, and
- b. Selective herbicides.

A non-selective herbicide kills all actively growing vegetation by contact or by a systemic mode of action (chemical transported throughout the plant). An example is Round Up (Glyphosate) commonly used to kill all vegetation. A selective herbicide kills only certain target plants (as specified on product label) and leaves behind all other plants virtually unhurt (dosage and timing of application dependent). Most selective herbicides used on intended weeds are systemic in nature (chemical transported throughout plant).

6.5.1 Advantages of using herbicides

- a. They kill unwanted plants;
- b. They can be used as a second or last option for example when manually removing weeds can destroy the crop;
- c. They can remove all plants when used as pre-germination weed control;
- d. Herbicides can be used on closely planted crops where other methods cannot be used;
- e. When other strategies fail they save time and labour;
- f. They work fast; and,
- g. Use of herbicides can be cheaper than manual weeding;
- h. They help the crops grow by destroying the weed that is robbing the crops of water, nutrients and sunlight.

6.5.2 Disadvantages of using herbicides

While herbicides can be an effective way to manage weeds, these poisonous chemicals for plants can also be extremely dangerous to humans, animals and the environment. For these reasons, it is extremely important to know how to apply herbicides safely.

The following are some of the disadvantages of using herbicide:

- a. Some herbicides are non-biodegradable and are harmful for a long period of time;

- b. They are all slightly toxic to the environment.

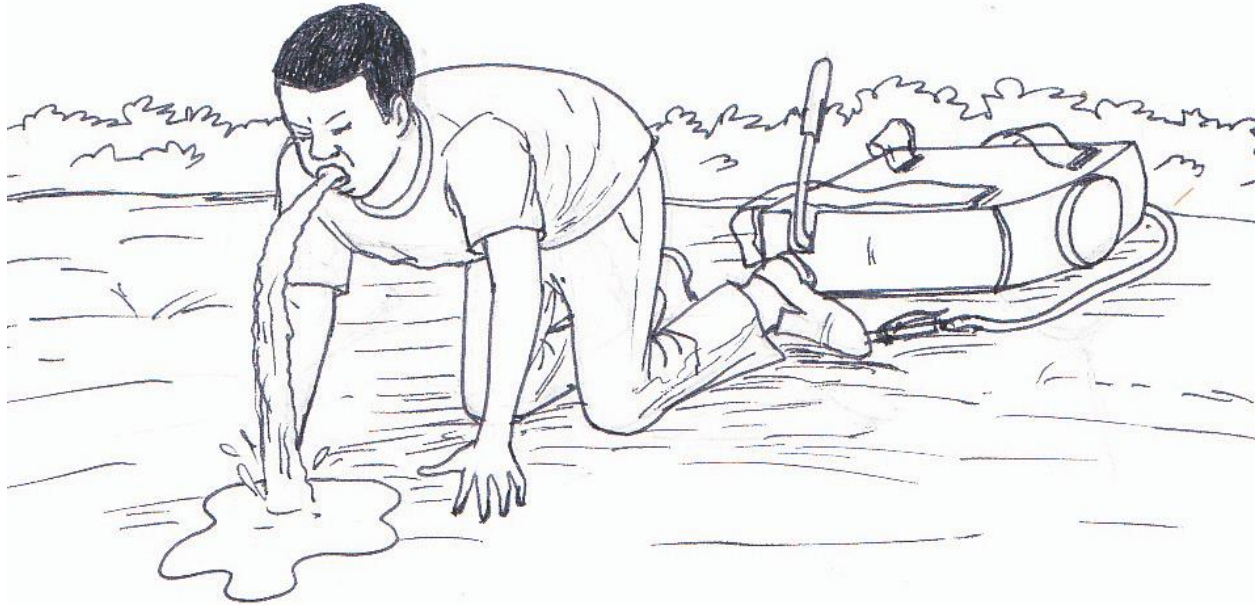


Figure 26: Herbicides can be harmful to human beings

- c. The herbicide will pollute the environment e.g. when carried into streams by runoff rainwater or leached into underground water supplies; and,
- d. Herbivores may be affected when eating the plants treated with herbicides. The toxic herbicide would be passed up the food chain increasing in concentration each time resulting in cancers and even deaths.

6.5 Facilitator's Summary on Herbicides

- a. The facilitator will state that use of herbicides can be useful but can also have negative effects both on man, animals and environment if not used properly. She/he will indicate that this being the case, there is a need to use them correctly and safely.
- b. Herbicides in weed management should only be used in the first 2-3 years when starting SA farming. It is expected that by this time weed infestation will have decreased drastically.
- c. Indicate that good cultivation practices will minimize the weed problem. Following those different methods of weed management should be used in combination. For example, after 2-3 years of herbicide use farmers should be encouraged to keep enough crop residues to use as mulch such as in CA technology which will eventually suppresses weeds.
- d. Use safety rules during application of herbicides.

6.6 Frequently Encountered Problems and Possible Solutions

- a. **Burning of crop residues:** Burning of crop residues is a common problem. If residues were left to decompose or used as mulch in the field they would improve soil fertility. Sometimes, people burn residues as a way of preparing land for planting and sometimes as they are hunting e.g. mice. It is recommended that communities come up with regulations against unnecessary burning. Those using crop residues for CA could also safely keep their crop residues where they cannot be destroyed e.g. by fire or grazing animals Training of communities on the disadvantages of burning crop residues should continue (to be moved to CA).
- b. **High infestation rate of weeds:** Farmers should be encouraged not to allow weeds to mature. Farmers should be slashing weeds down towards the end of the season. In so doing, there will be reduction of weed population over years.
- c. **Infestation rate of weeds is high year to year:** This happens when weeding is done only once. The weeds that grow later are allowed to flower and mature; as a result, the seed from such weeds is carried over to the next season.



6.7 Task Check list (5 Minutes)

- a. What is a weed?
- b. Mention 5 methods of controlling weeds
- c. What is the best way of controlling weeds?
- d. Name two types of Herbicides?
- e. What are the advantages and disadvantages of Herbicides?
- f. How best should we use herbicides in order to avoid side effects?





Module 7

**PEST AND DISEASE
CONTROL**



7.1 About this Module

Pests like insects and organisms that cause diseases are part of the natural environmental system. In this system there is a balance between predators, parasites and pests. This is nature's way of managing populations. The creatures that we call pests and the organisms that cause diseases only become pests and diseases when their activities affect yields economically. If the natural environmental system is imbalanced then one population can become dominant: because it is not being preyed upon. However, both pest and diseases can in unpredictable ways seriously attack and destroy a crop.

7.2 Objectives

In this module you are going to learn how farmers can manage to keep balance of predators, parasites and pest on the farm and also how to use the locally available herbs to manage pest and diseases on the farm.

7.3 Expected Results

By the end of this module the Lead Farmers should be able to:

- a. Identify common pest and diseases and explain in which ways they could be harmful to the crop;
- b. explain how to manage pests and diseases in sustainable agriculture;
- c. Explain how to avoid economic losses in crop production; and,
- d. Explain how to prepare natural remedies in their respective areas and how to use them as



Time frame: 2 hours

natural pesticides.

7.4 Activities

7.4.1 Introduction (25 minutes)

The facilitator will ask participants to be in groups of 10 people. The facilitator will then ask each group to go out in the field and observe the presence of predators, pests and diseases in the field and record them on flip chart. The facilitator will also ask the groups to indicate the role of each organism in the field.

7.4.2 Plenary—Teaching about Natural Pest and Disease Control (2 hours)

The facilitator should explain the aim of natural pest and disease control and the advantages of natural control versus the use of chemical control.

The aim of natural pests and disease control is:

- a. To restore a balance between pest and predator; and,

- b. To keep pests and diseases down to an acceptable level.

NOTE: The aim is not to eradicate the pests altogether as they also have a role to play in the ecosystem. Once a pest or disease has started to attack a crop, the damage cannot be repaired and control becomes increasingly difficult. Where possible, use techniques that help to avoid or prevent pests and diseases.

Chemical pesticides do not solve the pest problem. In the past 50 years, insecticide use has increased tenfold, while crop losses from pest damage have doubled. Here are some advantages and preventive measures of natural pest control.

I. Advantages of Natural Pest Control

a. Monetary cost

Using natural pest and disease management is often cheaper than applying chemical pesticides because natural methods do not require buying expensive materials from the outside. Products and materials which are already in the home and around the farm are most often used.

b. Safety for people

Using natural pest and disease management technique is safe to humans. There is much concern over the dangers of chemical products. They may be misused because, sometimes, the instructions are not written in the language spoken by the person using the product. There have been many reports of people suffering from severe skin rashes and headaches as a result of using chemical pesticides. There are an estimated one million cases of poisoning by pesticides each year around the world. Up to 20,000 of these result in death. Most of the deaths occur in developing countries where chemical pesticides, which are banned in Europe or the USA, are still available.

c. Safety for the environment

Sustainable agriculture works with nature, not against it and that is why natural pest and disease management is environmental friendly. In most cases pests are often controlled with man-made chemicals which have many negative effects. For example, artificial chemicals kill useful insects which eat pests or parasites. Artificial chemicals can stay in the environment and in the bodies of animals causing problems for many years. Some pest and disease organisms become resistant to artificial chemicals and can no longer be controlled.

II. Knowing the problem

Before taking action to control pests and diseases it is very important to make sure that the problem is correctly identified. Only then you can hope to succeed. Knowledge of pests and diseases will help you decide whether the problem is caused by a pest, a disease, a mineral deficiency in the soil or an environmental factor.

Proper identification should be the first step in controlling the problem and, more importantly, in preventing it from happening again.



7.4.2 Preventive Measures

The following is a general approach to natural pest and disease control with specific examples.

a. A Healthy Soil

A soil managed by using organic methods will give plants a balanced food supply. Plants which are fed well, like people, will be much more resistant to pests and diseases. The soil should be managed in ways that develop and protect its structure, its fertility and also the millions of creatures for which it is a home.

Caring for the soil involves providing a regular input and recycling of organic residues in the form of animal manures and plant remains. The aim is to maintain levels of humus (organic material) that give desired structure to the soil, feed organisms which live in the soil and provide nutrients for growing crops. Whilst chemical fertilizers appear to improve plant growth, their use can also have negative effects. A plant may look healthy but, because of the high content of nitrogen given by the chemical fertilizer, causing fast sappy growth, it is very attractive to pests. It has been observed that aphids lay double the number of eggs on plant grown with chemical fertilizers compared to organically grown plants.

b. A Healthy crop

By giving plants the right growing conditions they will be more able to resist pests and diseases. In addition, the right choice of a crop will help to deter pests and diseases. A crop growing in an area where it is not suited is more likely to be attacked. You should take account of the soil type, the climate, the altitude, the available nutrients and the amount of water needed when selecting your crops. Plants grown under the most suitable conditions will resist/tolerate pests and diseases better and therefore yield well. To help ensure a healthy crop, weeding should be done early and regularly to stop weeds from taking nutrients which should be used by the crop the crop.

c. Tolerant varieties and genetic diversity

Within a single crop there can be many differences among plants. Some may be able to tolerate particular diseases and these plants are mostly in the traditional crops grown by farmers. These have been grown and selected over many centuries to meet the requirements of the farmer. Although many of these are being replaced by modern varieties, seeds are often still saved locally.

Crops which have been bred by modern breeding methods tend to be very similar and if one plant is susceptible to a disease, all the other plants are as well. Although some new modern varieties may be very tolerant to specific pest and diseases, they are often less suited to the local climate and soil conditions than traditional varieties. It can, therefore, be dangerous to rely too much on them. A wide variety or “genetic diversity” between the plants within a single crop is important. This helps the crop to tolerate pests and diseases and acts as an insurance against crop failure in an unusual weather such as drought or flood.

d. Crop rotation

Growing the same crops in the same site year after year can build up pests and diseases in the soil. These will transfer from one crop to the next. Crops should be planted in a different piece of land each year, and not return to the original site for several years. For vegetables a 3 to 4 year rotation is usually recommended as a minimum. Crop rotation also helps a variety of natural predators to survive on the farm. A typical four year rotation would include a cycle as follows; year one maize and beans; year two a cereal; year three a root crop and; year four either green manure or improved fallow (**Refer:** Intercropping and Crop rotation Modules for details).

e. Good hygiene

If infected plant material, live or dead, is left lying around, pests and diseases can be passed on to future crops. Debris should be cleared up and disposed of. This can be done by composting the debris. The composting process will kill some pests and diseases and produce compost which is a good soil improver and fertilizer. However, some diseases may survive after being composted. If in doubt, the infected material should be burnt.

g. Companion planting

Companion planting means growing certain plants to protect other plants from pest or diseases. This may be because the pest is deterred by the companion plant, or because the pest is attracted to the companion plant rather than the crop. For example, onions planted either side of a row of carrots help to deter carrot flies. You need to sow 4 rows of onions for 1 row of carrots. This effect will only last as long as the onions have growing leaves. Many pests avoid garlic, so this can be used very effectively for companion planting with most crops.

In a similar way farmers have found that placing mint leaves near spinach plants will deter insect pests. By planting milkweed among vegetables, some African farmers have effectively reduced the number of aphids on their crops. This is because aphids are more attracted to the milkweed than to the vegetables. Companion planting can also mean that one plant acts as a barrier for another. In Columbia, jassid infestation in beans is reduced when beans are sown 20 to 30 days after maize. The maize acts as a shelter for the beans.

h. Plants to attract predators, parasitoids and parasites

Similar to companion planting which seeks to deter pests from the main crop, attractant plants can be grown to attract predatory insects. For example, provision of areas resembling the pests' natural habitat like bushes and trees provide resting areas, shelter and food. Areas of natural habitat can be left around the edges of fields where crops are grown. If these areas are destroyed then there is likely to be an imbalance between the populations of predators and pests.

There are many plants that can be grown to attract natural predators and parasites which will help to keep down pests and diseases. Flowers such as marigolds (*tagetes*), mint (*Mentha*), sunflower (*Helianthus annuus*), sunhemp (*Crotalaria spp*) as well as local legumes are useful attractant plants.

Hoverflies, whose larvae feed on green flies are attracted to the flowers of herbs and vegetables such as fennel, celery, coriander, dill, carrot, and parsnips (Umbelliferae family), the nectar and pollen that these flowers provide will help to increase the number of eggs that these beneficial insects lay. Umbellifers will also provide food to various parasitic wasps whose young live on aphids and some caterpillars. Redhood pokers (*Kniphofia uvaria*) are used in parts of Africa to attract birds that eat aphids and other pests.

7.4.3 Curative crop protection methods

If all preventive crop protection practices fail to sufficiently prevent economic losses to the farmer, it may be necessary to take curative action. Curative action means controlling the pest or disease once it has already infected the crop. Several options exist in sustainable agriculture, such as biological control with natural predators or antagonistic microbes, the use of natural pesticides based on herbal preparations or other natural products and mechanical control with traps including hand picking.

I. Traps

Traps can help to reduce the population of certain pests. If used at an early stage, mass multiplication can be prevented. There are several types of traps:

- Light traps attract nocturnal flying pest insects;
- Pitfalls catch creeping insects and slugs;
- Sticky traps, e.g. of a colour attracting a certain pest insect;
- Pheromone traps release a sex-hormone of the female insect, thus attracting the males which get stuck in the trap. If a large number of small pheromone containers are distributed in an area, the male insects get confused and will not manage to find the females to mate and reproduce with.



Figure 27: Examples of traps

I. Social prevention

It may be necessary to work with surrounding farmers to destroy a pest. For example, the variegated grasshopper (*Zonocerus variegates*), usually has 1 or 2 nests per hectare. These can be destroyed by raking out the eggs from the nest and leaving them in the sun to dry out and die. The nest could be on another farmer's farm but it could affect your crops. Joint action and cooperation between all farmers could considerably reduce infestation.

7.4.4 Plenary—Teaching about Recipes of Natural Remedies (55 minutes)

The facilitator should ask the participants of any recipes of natural remedies they know or use in their respective areas and how those recipes were being prepared. The facilitator should ask on what pests and diseases are those recipes used. Natural recipes may have one or more pests or diseases to control. Some recipes are used in powdered form while other sprayed in liquid form. Natural recipes should be handled with care and kept away from children.

If pests and diseases cannot be prevented or controlled by cultural and physical means, it may be necessary to use natural pesticide made using local recipes. Many growers have developed ways of making their own sprays from plants such as garlic, chillies, marigolds and many others.

Table 10: Recipes for different organic sprays

Ingredient	Preparation	Indication
<i>Azadirachta indica</i> (Neem) Water Cloth	Mix 80g of pounded neem seed with one litre of water and allow to stand for 12 hours. Strain with a cloth and use as a spray	Effective against bollworms and stalk borers
<i>Tephrosia vogelii</i> Water Cloth	Pound 1 bucket(20 l) of fresh loosely packed leaves and mix with 20 litres of water. Allow to stand for 12 hours. Strain through cloth and dilute 1 part of liquid to 4 parts water then use as spray	Effective against aphids, cutworms and termites. Apply as preventive once a week
<i>Swartsia madagascariensis</i> (Ndale)	Pound 50g of leaves and mix with 1 litre of water. Allow to stand for 24 hours and strain through cloth. Apply as a spray	Effective against termites, jassids and aphids
<i>Carica papaya</i> (pawpaw)	Pound 1kg chopped leaves and add 1 litre of water. Allow to stand for 6 hours, strain through cloth, and add 50g soft soap. Dilute 1 part to 4 parts water and spray during cool periods.	Effective against rust
<i>Capsicum annum</i> (Chilli)	Pound 100g ripe fresh chillies and add 1 liter of water and cover. Shake well and allow to stand for 12 hours. Strain and dilute with 5 liters soapy water, use as spray during cool periods.	Effective against ants, aphids, beetles, weevils, mosaic virus and cabbage worm. Caution: May scorch plants.
<i>Allium sativum</i> (Garlic)	Grind 3 to 4 bulbs and mix with 1 liter water. Allow to stand for 24 hours strain and dilute with 5 liters of soapy water.	Effective against aphids, wireworm and bean rust
Wood ash	Apply around plants or sprinkle on leaves	Effective against termites and aphids
<i>Euphorbia ttirucalli</i> (Ulunsonga)	Chop stem -like leaves and apply in planting holes	Effective against cutworm
<i>Chrysanthemum cinerariifolium</i> (pyrethrum)	Soak 500g dry pyrethrum flowers in 4 liters water. Allow to stand for 24 hours. Strain and use as spray in equal parts with garlic spray	Effective against aphids, beetles, bugs, hoppers, caterpillars, worms, locusts, thrips, bean fly, fruit fly.

A solution can be made from marigold using water and soap. The liquid acts as a crop strengthener to help potatoes, beans, tomatoes and peas resist blight, mildew and other fungal diseases. It also repels aphids, caterpillars and flies. Garlic spray is particularly good against worms, Colorado Beetle, False codling moth, fungal diseases. It also repels aphids, caterpillars and flies. Garlic can also kill nematodes if soil or batches of soil are drenched with garlic liquid.

7.4.5 Plenary—Teaching about Traps and Setting of Traps (30 minutes)



The facilitator will ask participants to be in groups of 10 people. The facilitator will then ask each group to go out and set up the traps in the field and check if they can catch any pest. Whatever is captured should be recorded on the flip chart.

7.5 Frequently Encountered Problems and Possible Solutions

- a. **Most farmers and other extension agencies think that use of chemicals is the only solution to pest and disease control and underrate the effectiveness of natural pest control:** There should be continued awareness on sustainable pest and disease control.

Farmers should also be made to understand the various benefits economically, health-wise and environmentally.

- b. Pest and disease identification is a challenge faced by many farmers hence applying the correct control measure becomes a problem.
- c. It is important that farmers are reminded of the most important pests and diseases and how crops are mainly affected. Pictures should support practical work for better understanding. This should not be only a single session but in any other convenient time they meet.



7.6 Task Checklist (10 minutes)

- a. What is natural pest control?
- b. Mention three advantages of natural pest control.
- c. What are the preventive measures one can follow in natural pest control? Give examples of companion crop planting.
- d. Name two recipes for natural remedies used in natural pest control and outline how they are made.

Module 8

FARMER TO FARMER EXTENSION, FACILITATION AND LEADERSHIP SKILLS



8.1 About this Module

Once Lead Farmers have been trained, they will train other farmers. These trainees are referred to as follower farmers. The approach in training Lead Farmers has been both theoretical and practical. Lead Farmers will also follow the same approach in training their follower farmers. This module will equip Lead Farmers with skills on how they can effectively transfer acquired knowledge and skills to their follower farmers. It will also look at how to handle follower farmers as being fellow adults.

8.2 Objective

The major objective of this module is to equip Lead Farmers with facilitation skills so that they are able to effectively transfer knowledge and skills to follower farmers.

8.3 Expected Results

By the end of this module the Lead Farmers should be able to:

- a. Conduct a training session for follower farmers;
- b. Know what farmer-to-farmer extension is;
- c. The advantages of farmer-to-farmer Extension; and
- d. Disadvantages of farmer-to-farmer extension.



3 Hours

- e. Know types of leadership and attributes of good leadership.

8.4 Activities

8.4.1 Plenary—Teaching about Facilitation Skills (30 Minutes)

The facilitator will explain that as trained LFs now, they will train other farmers. This type of training is called *Farmer-to-Farmer Extension*. The facilitator will continue to say that it has been noted that these farmers help to increase adoption of SA technologies if they themselves are also practicing what they are training follower farmers in. The facilitator will explain the advantages and disadvantages of farmer-to-farmer extension as follows:

I. Advantages of farmer-to-farmer extension

- a. Adoption of good farming practices is faster and done at low cost;
- b. Farmer-to-farmer extension helps farmers to be settled in the same area. Firstly as a requirement for choosing a LF and secondly because of the need to have their gardens established;
- c. It helps the lead farmers to be proud of their knowledge, good work and may want to continue doing better;

- d. Farmer-to-farmer extension helps many farmers to be reached with recommended messages at the right time;
- e. Encourages ownership of programs by the community since Lead Farmers are from within the context of the community;
- f. Reduces the workload of the extension worker and the problems related to the shortage of staff are eased; and,
- g. It also helps famers work as a group hence they encourage each other.

II. Disadvantages of farmer-to-farmer extension

- a. Some Lead Farmers may take themselves as being very knowledgeable or as if they are equal to government extension staff, which is not true;
- b. Some follower farmers may underrate the Lead Farmers; and,
- c. Some Lead Farmers do not work well due to the perceived lack of incentives

8.4.2 Plenary—Teaching about Qualities of Good Lead Farmers (30 minutes)

The facilitator will explain that for follower farmers to believe what we will train them, a LF should have some good qualities. Then s/he will task the participants to list qualities of a good Lead Farmer. Later she will summarize these as follows:

- a. Should have good behaviour so that follower farmers should never have any fear to approach him or her;
- b. Should have audible voice or should be able talk so that everybody can hear;
- c. Should have confidence and self-control;
- d. Should be able to speak the language of the area.

8.4.3 Plenary—Teaching about Facilitation Skills (1 hour 30 minutes)

The facilitator will explain that the following steps will be followed in training follower farmers:

- a. Opening of the training session;
- b. Should greet the follower farmers;
- c. Opening prayer;
- d. Introductions;
- e. Objectives of the training;
- f. Should ensure that the training is well divided so others can easily follow; and
- g. In closing, summarize properly followed by a word of prayer.

8.5 Core Facilitation Skills

The facilitator will continue to explain that the LFs will also take note of the following in the course of training:

- a. S/he should be able to see every follower farmer while training them;
- b. S/he should be training others while standing;
- c. S/he should be seen by FFs and maintain eye contact;
- d. S/he should respect FFs views;

- e. S/he should be audible enough;
- f. S/he should be knowledgeable of the content;
- g. S/he should be able to identify a conducive venue for the training and time;
- h. S/he should be free to be moving around the training room; and,
- i. S/he should have ways of ensuring that participants are actively engaged in the training.

The facilitator will summarize this area by saying that adult learning is different from the way

Practical session—learning how to dig planting pits

The facilitator will divide the participants into two groups. He will also advise that each group will choose one person who will act as a LF and others will be like follower farmers. The facilitator should explain the following about the assignment:

- a. Group 1 will discuss and choose one person to teach about one type of manure.
- b. Group 2 will discuss and choose a person to teach about conservation agriculture.

After discussions the facilitator will explain before presentations that once presentations are made members of the other group will act as judges. They will judge others basing on the following areas and each area has two points.

children are taught.

Table 11: Rating Criteria

Item	Group 1	Group 2
Dressing (use of protective wear)		
Introduction		
Explaining the subject matter		
Use of teaching and learning aids		
Closing		
Total Marks		

8.6 Plenary: Teaching About Leadership—1Hour

The facilitator will explain that a Lead Farmer is a leader. He will explain that it is very important that as one leading others, s/he will be expected to be exemplary. S/he will explain that every group will be successful if it has a leader elected and accepted by the majority. S/he will explain that the responsibility of a leader is to lead the group towards achieving the goal. Therefore, as LFs they will be leading and guiding follower farmers to increase the adoption of SA technologies.

8.6.1 Who is a Leader?

A leader is a person who is able to guide or make others follow what s/he does, or a person who is able to influence others towards a particular action or goal.

8.6.2 Types of Leadership

- a. Democratic/participatory;
- b. Authoritarian/dictatorial; and,
- c. Passive/permissive/laissez faire.

I. Democratic Type of Leadership

- a. If other members take part in decision making they become encouraged and work hard;
- b. There is sharing of ideas in regards to how the group should be carrying out its activities;
- c. People work hard; and,
- d. People understand their group or activities and their roles.

II. Authoritarian/Dictatorial type of leadership

- a. The leader makes decisions on her/his own;
- b. Decisions are made from above and they are just followed without asking questions;
- c. The leader has wields a lot of power even when things are not going on well.

III. Laissez faire Leadership

- a. Little guidance from leaders;
- b. There is complete freedom for followers to make decisions;
- c. Leaders provide the tools and resources needed and,;
- d. Group members are expected to solve problems on their own;

Laissez faire leadership can be effective in situations where group members are highly skilled and motivated. In cases where group members lack knowledge, however, it may not be ideal.

8.6.3 Qualities of a Good Leader

- a. Should be hard working;
- b. Should be able to accept his position/role;
- c. Should not easily get angry;
- d. Should strive to meet the objectives of the group while ensuring that every member is involved;
- e. Should be able to be thinking of others; and,
- f. Should be able to mix freely with group members.

NOTE: It is always important to consider gender and youths when choosing leaders.



REFERENCES

Better Land Husbandry Manual, PROSCARP (EU) and Land Resources Conservation Department, 2003

Conservation Agriculture, "*A manual For Farmers and Extension Workers in Africa*"

ACT, 2005

Guide to Agricultural Production and Natural Resources Management, revised 2012

Annex I

FACILITATION METHODS FOR THE LEAD FARMER-A CATALOGUE OF EXTENSION METHODOLOGIES

1. Result demonstrations

A result demonstration is a method designed to show, by example the practical application of an established fact or group of facts. "The result demonstration," is one which shows after a period of time what happened after a practice is adopted. As an example, compost is put on a certain field. Good seed potatoes are planted and cared for. In the next field, no compost is used and poor seed potatoes are used. At harvest time, the potatoes are dug in each field at the same time. The villagers have watched everything from the time of planting and growing to harvesting. In an effort to assist the LFs in planning the demonstration and keeping track on what happened, the farmer is encouraged to use the farm record book.

2. Household visits

These are visits made by the extension staff to individual farmers' farms to help with particular issues. During the visit, the extension staff makes observations and discusses with the farmer on possible solutions, strategies and plans.

3. Farmer-to-farmer extension

The farmer-to-farmer extension is an extension method or approach where a farmer who has undergone training in one agricultural practice or technology or more passes over the knowledge and skills to other farmers. The trained farmer, therefore, becomes the change agent within his/her community especially after adopting the practice and/or technology.

4. Group methods

Group methods take into account the inclination of the individual to respond to the pressures and opinions of groups in which he/she participates and to listen to the views of others before arriving at a decision about making changes in his farming operations. Group methods include: *general meetings, group discussions, exhibits, tours etc.*

5. Motivational tours

A motivational tour is a primary visit to a practicing farmer or an institution in another area. This involves a group of up to 30 participants. A motivational tour exposes farmers to developments and new technologies which are being used by farmers in another area or being developed at a research station or activities being implemented by other organizations such as NGOs. Tours act as a vehicle for exchanging ideas and insights among farmers.

6. Diversity/Seed fairs

A diversity fair is a unique approach to increase public awareness on the value of traditional knowledge of local crop diversity. The method has been found popular not only in Nepal and Vietnam but also in Africa and Latin America. In the fair, farmers participate by displaying different plant genetic materials for assessing the status of genetic diversity in the area. The community organized diversity fair exclusively focuses on indigenous landraces and has been found useful to locate rare diversity. This kind of participatory event also helps to enhance social interactions and unifies communities and local organizations.

7. Field days

A field day is a group extension event conducted at the site of any type of results demonstration. Field days provide the opportunity for 25 or more farmers to visit a demonstration site, learn about what is being demonstrated, ask questions and be encouraged to try new ideas on their farms.

8. On-farm/field training

This is a training conducted in the field by the trainers of trainers to a group of up to 30 farmers. Training is usually practical in nature and can go up to several days. The training is held for a maximum of 3hrs per day and in some cases can last the whole day. Where the training is organized for the whole day, the group organizes food to eat during lunch, to avoid people going back to their homes for lunch.

9. Farmer field schools

A farmer field school is a learning approach that is field oriented and participatory emphasizing on learning by doing. The training takes place over an extended period such as a growing season and involves classroom and field work. The training is holistic; it follows the farming systems

adopted by participants. It means the training starts from an understanding of existing farmer's practices e.g. inputs used, resources available, market prices etc.

Annex 2

LEAD FARMER TRAINING SCHEDULE

1. Summary of Time Allocation by Module

Module	Time
Opening- day 1	1 Hour
Soil and Water Conservation	3 Hours 30 minutes
Manure	5 Hours 30 Minutes
Agroforestry	4 Hours 15 Minutes
Conservation Agriculture	5 Hours 30 Minutes
Intercropping and Crop Rotation	1 Hour 30 Minutes
Weed Control	1 Hour 15 Minutes
Pest and disease control	2 Hours
Leadership and Facilitation skills	3 Hours
Action Planning	3 Hours

2. Timetable for 5 Day Lead Farmer Training—SALFP Curriculum

DAY	TIME	TOPIC	RESOURCE PERSON
DAY 0	12:00- 6:00	Arrival of participants	
Sunday			
DAY 1	8:00-8:05	Opening Prayer	Volunteer
Monday	8:05-8:15	Introductions	
	8:15-8:25	Welcome Remarks	
	8:25-8:35	Opening Remarks	
	8:35-8:45	A brief on SALP	
	8:45-9:00	An overview of SA	
	9:00-10:00	Soil and water conservation (theory)	
	10:00-10:15 AM	Tea Break	TIME KEEPER
	10:15-10:45	Soil and water conservation (theory)	
	10:45-12:00	Soil and water conservation (practical session)	
	12:00-1:30 PM	LUNCH	TIME KEEPER
	01:30-03:00	Soil and water conservation (practical session)	
	03:00-03:15 PM	Tea Break	TIME KEEPER
	03:15-04:00	Soil and water conservation (practical session)	
	04:00-05:00	Manure (theory)	
	5:00 PM	END OF DAY 2	President
DAY 2	08:00-08:30 AM	RECAP ON DAY 2 WORK	
Tuesday	08:30-10:00 AM	Compost manure making /use (theory)	
		<i>Chinese, bokash, Liquid, changu, curing, pit.</i>	
	04:00- 05:00	Intercropping & Crop Rotation	
	5:00PM	END OF DAY 3	President
DAY 3	08:00-08:30 AM	RECAP DAY 3 WORK	
Wednesday	08:30-10:00 AM	Agroforestry (theory)	
	10:00-10:15 AM	Tea Break	TIME KEEPER
	10:15- 12:00	Agroforestry (practical session)	
	12:00-01:30 PM	Lunch	TIME KEEPER

	01:30-02:30	Agroforestry (practical session)	
	02:30- 03:00	Weed Control	
	03:00-03:15	Tea Break	TIME KEEPER
	03:15-04:00	Weed Control	
	04:00- 05:00	Pest and disease control	
	5:00 PM	END OF DAY 4	President
DAY 4	08:00-08:30 AM	Recap of Day 4 Work	
Thursday	08:30- 09:30	Pest and disease control	
	09:30-10:00 AM	Conservation Agriculture (theory)	
	10:00-10:15 AM	Tea Break	TIME KEEPER
	10:15-11:00 AM	Conservation Agriculture (theory)	
	11:00- 12:00	Conservation Agriculture (practical session)	
	12:00-1:30 PM	LUNCH	TIME KEEPER
	01:30- 03:00	Conservation Agriculture (practical session)	
	03:00-03:15	Tea Break	TIME KEEPER
	03:15- 05:00	Conservation Agriculture (practical session)	
	5:00 PM	END OF DAY 5	President
DAY 5	08:00-08:30	Recap of Day 5 Work	
Friday	08:30-10:00	Facilitation skills	
	10:00-10:15 AM	Tea Break	TIME KEEPER
	10:15-11:15	Facilitation skills	
	11:15-01:00	Action planning	
		Closing remarks	
			TIME KEEPER

Annex 3

THE LEAD FARMER IDENTIFICATION AND SELECTION PROCESS

1. The Process

Identification and subsequent selection of Lead Farmers is a critical process to ensure the success of the farmer-to-farmer extension.

Before the actual selection of Lead Farmers, a community-based training on gender targeting local leadership and members of the community is conducted in order to raise awareness on the importance of gender equality in SALFP. This is followed by two meetings which are conducted at the community level. The first meeting will be to introduce SALFP and the LF approach to the local leadership, VDC, ADC and religious leaders. This will be followed by the second meeting where LFs will be selected as described in section 3.2 below. The gender training and subsequent meetings will be **facilitated by project/extension staff** assigned by the management of the implementing partner.

2. Gender Awareness Training

The participants of this training should include Local leadership including, chiefs, ADC/VDC members, religious leaders and community members. The extension staff and field officers will help in mobilizing relevant community members to attend the training.

3. Sensitization Meeting of the SALFP

Partner organizations organize a sensitization meeting with the local leaders to introduce the SALFP program. The meeting aims at bringing understanding on the following:

- a. SALFP and the implementing partners' approach and interventions under SALFP;
- b. The Lead Farmer Approach and the selection process; and
- c. Importance of gender equality in regards to the SALFP and other programs.

Action from this meeting is that the local leaders will explain to their community members where LFs will be selected. The objective is to ensure that all members understand SALFP and the LF approach before LFs are selected. The community will select people that have the needed qualities as LFs.

Date and time of the LF selection meeting is agreed at the end of this first meeting. Not less than **2 weeks** will be given to allow for proper dissemination of the messages to community members.

The community leaders should be informed about who **should be present** at the second meeting i.e. community members (**equal representation of male and female**), community leaders including and other relevant stakeholders in the area (MoAFS extension staff, other local NGOs etc.).

4. Selection of Lead Farmers

A meeting is convened as scheduled. The partner organizations should ensure that the meeting has equal representation of male and female community members, community leaders including village heads, religious leaders, VDC members, ADC members, ministry of agriculture officials and representatives from other organizations.

Steps: The following steps are followed at this meeting:

a. Welcoming Remarks by Local Leadership

A Local Leader will give welcoming remarks and briefly introduce the purpose of the meeting. He or she will then hand over to the facilitators from the partner organisations.

b. Facilitation

The facilitator (a representative from the implementing partner that knows and understands both SALFP and the LF approach) introduces the SALFP program to the community and its purpose *which is to ensure sustainable food security and improve the livelihoods of rural communities within the context that increases their adaptive capacity to the impacts of climate change*. After this, the facilitator explains the following steps before the actual selection of the LFs:

i. Gender

This step gives a clear understanding of gender:

- a) What gender is
- b) Importance of gender equality in developmental projects
- c) Role of local leadership in ensuring gender equality
- d) Partners' commitment towards achieving gender equality
- e) At the end, equal numbers of males and females will be selected in case more than one LF is needed.

ii. Characteristics of a lead farmer

- a) Willing to share the information with others
- b) Able to lead others
- c) Early adopter of technology
- d) A communicator with good facilitation skills
- e) Should be literate (Special consideration may be given in case all supposed female LFs are unable to read and write to avoid being gender inequality).
- f) Should be honest, trustworthy and humble
- g) Should be development conscious
- h) Should be tolerant
- i) Should originate from the village and socially accepted by the community
- j) Should be able to sacrifice for others
- k) Should be cooperative

- l) Should be approachable

iii. The Role of a Lead Farmer

- a) To teach others and mount promotion plots
- b) To implement all new technologies introduced by the AEDOs in line with DF promoted activities
- c) To facilitate formation and implementation of action plans with farmers
- d) To write and submit reports to Extension Workers
- e) To conduct follow ups on farmers' action plans
- f) To promote extension technologies through farmer training, field days, extension meetings, promotion plots and local tours
- g) To give feedback on problems faced during adoption of extension technologies through reports
- h) To conduct demonstrations on improved technologies
- i) To liaise with extension workers on farmers' needs
- j) To lead communities in community-based monitoring and evaluation.

iv. Support from Community members

- a) Attending meetings organised by LFs
- b) Adopting technologies being promoted
- c) Giving them time to take care of their personal affairs
- d) Communicating problems to lead farmers depending on their specialty

v. Follower Farmers (FFs)

The facilitator will explain that the selected lead farmers will be trained and will also have **to train** others after their training. Those that will practise what they have been trained in by LF will be called follower farmers. These steps are followed to recruit FFs:

- a) LFs attend the training. This will either be residential or day training. A **residential training** will apply where selected LF are coming from far distances hence cannot walk to and fro the training every day. A **day's training** will apply where the selected LFs forming a class are not far from the venue. They will go home after the training and come back the next morning to continue with the training till the end
- b) The LF reports to local leadership once he or she is back and arranges for a community training
- c) LF conducts training to all interested village members
- d) LF monitors those that implement what they have been trained in
- e) A FF will be the one that implements at least 3 different SA technologies of which one should be in the range of 0.2-04 ha.
- f) Each LF will have 25-30 FFs.

vi. Technologies

The facilitator will explain that a LF will perform a number of Sustainable Agriculture technologies including:

- a) Soil & water conservation, manure making and use, agro forestry, conservation agriculture, inter-cropping, crop rotation, weed control and pest & disease control.

- b) LF should be willing to implement at least 3 different SA technologies of which one should be in the range of 0.2- 04 ha in area.

vii. Number of LFs per community/village

The number of LFs per community will be determined by the number of farm families as follows:

- a) A village of not more than 20 farm families will have one LF;
- b) If a family has already a lead farmer e.g. by other organizations should never be considered for selecting another LF; and,
- c) Local leaders e.g. a village headman should not be elected as LF.

viii. Feedback

The facilitator will give members room for questions.

c. Selection of LFs

After explaining the LF approach, the selection process will begin by voting. **Include spouses and immediate relatives, where possible.** The meeting will conclude with a consultation session between partner staff and the newly elected LFs and their spouses and immediate relatives.

d. Verification exercise

After the selection, the extension staff will ask all new LFs, their spouses and local leaders to remain behind for a brief verification exercise. He or she will once again go through the attributes/ characteristics and the expected roles of the LF. The spouses and local leaders, having full knowledge of the selected LF will comment on each one of the attributes until a common agreement is reached. Expected level of support from the spouse and local leaders to the lead farmers will also form part of the agenda.

e. Conclusion

In conclusion the LF section process will follow these steps:

- i. Call traditional leaders, religious leaders, VDC and ADC members for a gender training to enforce a common and shared understanding on gender equality. After this a sensitization meeting on the SALF program with the community leaders will also be convened. It is important that senior partner staff is present at this meeting. The LF approach should be explained in detail and the gender aspect will be included in this explanation.
- ii. After this meeting the community leaders are given a few weeks to discuss and explain to their communities about the project and the LF approach

A new meeting will be called by the local leaders for the actual selection of LFs where all community members should participate. This meeting will follow the steps listed in this document. The participants should already have some understanding of the project, the LF approach and the importance of gender equality.

Annex 4

LEAD FARMER TECHNOLOGY TRANSFER

1. Background

Development Fund of Norway (DF) has for more than 10 years, been using the farmer-to-farmer extension approach through the Lead Farmer (LF) model.

2. Objective of LF approach

There are two objectives for this approach:

- a. To ensure timely dissemination of technical messages as this has not been possible due to reduced numbers of government extension workers;
- b. To scale-up Sustainable Agriculture (SA) technologies. Each lead farmer is supposed to practise what s/he is trained in and have 25-30 Follower Farmers (FFs) that also practise what they are trained in by the LF. Some follower farmers graduate into lead farmers and have their own follower farmers.

3. Factors that Discourage Follower Farmers

Experience suggests that much emphasis is given to selecting and training LFs and not much is done concerning follower farmers as detailed below:

- a. No formal training is provided to the FFs;
- b. Not much recognition is given to FF in terms of support; and,
- c. Follower farmers are visited less and their progress is not monitored by programme staff

Not enough emphasis is made on targets that the lead farmers are supposed to achieve during the implementation of the techniques they were trained in, for example the hectares under different SA technologies.

4. Knowledge Transfer from Lead to Follower Farmer

A lead farmer is the focal point for dissemination of SALFP supported interventions. The lead farmer and his/her follower farmers form a group through which DF funded programs are implemented in different areas. Sustaining the momentum in this group is one factor that is very important for the successful implementation of SA activities.

An action plan is developed at the end of the lead farmer training. This action plan includes the following:

- a. Training of follower farmers after undergoing the Lead Farmer training. The FFs are expected to adopt sustainable agriculture technologies being promoted by the LF;
- b. Documentation of the technologies being implemented by the follower farmers; and,
- c. Joint planning between the lead farmer and his/her follower farmers on the technologies to be implemented in subsequent seasons. This will help build rapport and bring more cohesion into the group.

The cohesion of the group of a lead farmer and follower farmers should be used as a factor to consider when the implementing partner would like to bring additional project interventions like goats to be passed-on, exchange visits, Village Saving and Loan Associations and irrigation. Any pass-on activity should trickle down from the lead farmer to her follower farmers.

NOTE: Where possible technology transfer should start at village level. It works well if village members are hard-working and many have become follower farmers. The village headman is usually at the center and facilitates SA implementation plans together with the LF.



5. Moving Away from the 10X10 Demonstration Plot

During the lead farmer selection process—and at the lead farmer training—it should be emphasized that a lead farmer will be an implementer at least three different SA technologies one of which should be implemented on an area of not less than 0.2 hectares.

a. Target Setting

In order to optimize the area under sustainable agriculture practices the plans should include the following targets:

- i. Number of LF to be selected; and,
- ii. Area (ha) under individual SA practices (Soil and Water Conservation, Manure, agroforestry, Conservation agriculture).

b. Action planning after training

At the end of any lead farmer training, a clear action plan is developed for each Lead Farmer. The action plan should show at least 3 SA technologies that each LF has chosen to start with. This should include:

- i. Choice by each LF of one SA technology that he or she will implement on land that is at least 0.2 ha; and,
- ii. Technologies that will be put under promotion plots.

Annex 5

GRADUATION OF LEAD FARMERS

1. Background

Development Fund of Norway (DF) and its partners have used the Farmer-to-Farmer Extension through the Lead Farmer Approach for over 10 years. The first Lead Farmers (LFs) were selected by Mzuzu ADD, DF's partner who pioneered the Lead Farmer approach.

There are no nationally acceptable guidelines on how long a partner will work with the same LF. This has resulted in working with some of the LFs for close to 9 years and some LFs becoming too advanced in age to continue working effectively. This document is a guide as to when and how a LF could be graduated.

2. Lead Farmer Extension and Training Guide on Sustainable Agriculture

The LF graduation is in line with what has been specified in Part 1 (Lead Farmer Extension) of this Guide, **table 2** as indicated below.

Core activities through for the duration of the program
Year 1
<ul style="list-style-type: none"> a. Conduct mobilization of the community b. Conduct consultation with local authorities c. Identify and select LFs d. Organize a 5- day residential training for new LFs in SA e. Facilitate recruitment of follower farmers f. Facilitate mounting of demonstrations by LFs on selected SA technologies based on LF interests' g. Establish LF farm records
Year 2

<ul style="list-style-type: none"> a. Continue facilitating LF demonstrations b. Facilitate adoption of selected technologies by follower farmers c. Facilitate establishment of farm records by follower farmers d. Facilitate management of appropriate LF's demonstration plots and field days e. Facilitate review meetings to discuss best practices and plans
Year 3
<ul style="list-style-type: none"> a. Facilitate follow up and continued adoption of the selected SA technologies and practices b. Facilitate management of appropriate LF's demonstration plots and field days
Year 4
<ul style="list-style-type: none"> a. Start winding up the SALFP program work with the LFs and the groups b. Initiate handing over to local institutions (ADCs & VDCs) and Ministry of Agriculture c. Finally hand over to local institutions (ADCs & VDCs) and Ministry of Agriculture

Summary

In year 1 the Lead Farmer will be selected, trained and start implementation of SA activities. They will identify Follower Farmers (FFs) in the same year who will also start implementing activities.

Years 2 and 3 will be full years of implementation and adoption of SA technologies by both lead farmers and their follower farmers.

In year 4 the beneficiaries will have gained full knowledge of project implementation from both theoretical and practical experiences. In this year, LFs will be prepared for graduation. This will be discussed with leadership of local institutions in closer collaboration with the ministry of agriculture officials so that they are all aware of and understand this arrangement.

During the first three years, the programme will focus on building the capacity of farmers through trainings, exchange visits, monitoring and follow up among others. The idea is to ensure that knowledge and skills remain within the context of the community after the programme phases out. All trainings conducted by the programme are aimed at ensuring that the farmers have confidence and technical know-how to stand on their own without and/or with little external support. Throughout the different phases of the programme, implementing partners will be working in close collaboration with the local development structures and MOAFS.

By the end of the fourth year, SALFP's leader farmer related activities will be **"handed over"** to local institutions like Area Development Committees (ADCs) and Village Development Committees (VDCs). The MOAFS staff at District and EPA levels will be fully involved in the transition to ensure successful handover of responsibilities from the programme to local development structures.

3. Preparation for the graduation ceremony

Project staff and government extension workers will ensure that before graduation, the following will have been put in place:

- a. An inventory of SA technologies being implemented;
- b. Record keeping is reviewed and encouraged for easy monitoring of activities by ADCs, VDCs, project and agriculture staff;
- c. Empower group/village committees to support the LFs; and,
- d. LFs are linked with other local developmental institutions.

4. Qualities of a Lead Farmer to be graduated

The local leadership and project staff will assess every LF and recommend for graduation those that have fulfilled the following as specified in the LF selection process document:

- a. The LF is implementing at least three different SA technologies of which one should be in the range of 0.2-04 ha;
- b. The LF has effectively trained FFs who are also implementing at least 3 different SA technologies of which one ranges from 0.2-04 ha. They are also active in other project activities;
- c. Conducts demonstrations effectively on newly released technologies as introduced by the AEDOs or project staff in line with DF promoted activities;
- d. Facilitates formation and implementation of action plans with follower farmers;
- e. Writes and submits reports to Extension Workers as agreed;
- f. Conducts follow up on follower farmers' action plans;
- g. S/he is involved in the promotion of technologies through farmer training, field days, extension meetings, demonstrations, and local tours;
- h. Gives feedback on problems faced during adoption of extension technologies through reports;
- i. Liaises with extension workers on farmers' needs; and,
- j. Takes lead in community-based monitoring and evaluation.

5. On Graduation Day

The following is explained at the graduation ceremony so that there is a clear understanding by all people present and community members:

- a. That graduating LFs does not mean that they will be left out but rather they are being recognised for the good work they have been doing;
- b. That they have performed well as adopters or innovators and managed their groups well;
- c. They will still be responsible for the group or follower farmers. Ensuring that activities e.g. pass on programmes continue to run effectively;
- d. They will still be supported in the implementation of their activities by following them up on a quarterly basis or twice in a year. They will still be invited to major events e.g. Seed fairs;
- e. They will be at the centre of organising events such as field days together with agriculture extension staff.

6. Recognition of Graduating LF

- a. The programme arranges a graduation ceremony;
- b. A clear programme of events is developed;
- c. Local leadership, project staff, donor representative and media are invited to the graduation ceremony;
- d. Certificates and badges are presented to all graduating LFs;
- e. They are henceforth called Master Lead Farmers; and,
- f. A sign-post bearing their names and titles is placed in their gardens.

Annex 6

GUIDELINE ON MANAGEMENT OF PASS-ON SYSTEMS

1. Background

The Development Fund of Norway and its implementing partners have used the pass-on system for livestock, seed and other materials that have been supplied to project beneficiaries. All of these have been passed-on to either groups or individuals. This document seeks to harmonize the pass-on system and bring a common understanding of the same among DF partners and other collaborators.

2. What is pass-on?

Pass-on is a form/system of credit/loan provided to an individual or a group in form of material with an agreement that it will be paid back in form of the similar material, in agreed amounts, to another individual or group. The recipient will also pay back to another individual or group and the process continues until all beneficiaries in the catchment receive the material(s).

3. Objectives of pass-on

The major objectives of the pass-on are:

- a. To ensure that project resources like seed and livestock reach out to many or all beneficiaries in the catchment;
- b. To ensure that no such materials as livestock or seed are issued for free in order to avoid beneficiaries from developing a dependency syndrome; and,
- c. To instil a spirit of commitment, hard work and ownership amongst beneficiaries for sustainability of the project.

4. Materials under pass-on

Any material support provided to beneficiaries is considered for pass-on. The material support includes but is not limited to:

a. Livestock

The objectives of provision of livestock under pass-on are to enable beneficiaries to access manure and improve their economic and nutritional status. When an individual or a group is given livestock they will pay back to another group the same in terms of number and sex, i.e. as was issued to them. The livestock being passed-on will have been weaned and in good health so they can survive on other foodstuffs apart from milk. If only males are born and it is a female that is to be passed-on, an arrangement has to be made either to sell the male and acquire the female or it has to be exchanged elsewhere for the a female.

b. Seed

The objectives of providing seed under pass-on are to encourage multiplication, diversification or introduction of a new variety.

OPV maize is used whenever beneficiaries are supplied with maize seed. OPVs can be recycled for 3 growing seasons.

The seed under pass-on will be paid back in the ratio of 1:2, i.e. if an individual or group received 1 kg of any form of seed, 2 kg will be paid back. The seed to be provided/passed on should be of good quality and approved viability.

Cassava cuttings and Sweet Potato vines are also supplied under pass-on. These are issued in bundles. They will also be paid back in the ratio of 1:2 bundles.

c. Business Capital

The objective of providing financial or other resources is to help beneficiaries to increase their capital base for a particular business or to improve their production.

This would be in form of material to support business or any other production. It may also be in form of cash to start a specified business. The benefiting group will pay back equal quantities in terms of numbers and quality. If paying back will be in form of money (for non-cash items), an amount will be agreed upon e.g. by putting some interest on the principle so that the amount still buys equal quantities as issued to the initial group.

5. Beneficiary Selection

a. Characteristics:

- i. The beneficiary or the group should be committed to the values of the programme; and
- ii. The beneficiary or the group should be responsible enough to ably care for the materials until they are passed on to others.

b. Twinning of individuals/ groups

Two sets of beneficiaries should be identified at the same time, the one that will initially receive the materials and the other to whom the materials will be passed on. The first individual/group will receive in the presence of the second one. The second group will also help in monitoring the care of materials issued to the first group.

6. Agreement form

Once members receive the material, they will sign an *agreement form* (annex 7) with the Lending Organization. This will be witnessed by the local leadership.

7. Provision of materials

Provision of the material under pass-on should be done at a public function that is witnessed by the local leadership including, chiefs, ADC/VDC members and religious leaders. All members targeted to benefit from the system should be present.

The meaning and objectives of the pass-on should be explained to all members in detail. It should be emphasized that the intention is to ensure that everybody in the programme in the area benefits from the provided items.

When issuing the materials, the second group will be told that once the materials are ready, they will be the ones that will receive next so they should be ardent in monitoring the first group.

Once materials are issued, members that have received the materials will sign an agreement stating that they have received materials in good condition and agree to the whole pass-on arrangement.



Annex 7

PASS-ON AGREEMENT FORM

BETWEEN

_____ *[Name of Lending Organization]*

AND

_____ *[Name of Recipient(s)]*

1. Responsibilities of Lending Organization

The lending organization agrees to:

- a. Ensure that beneficiaries are fully sensitized and trained before they receive the materials. This will allow beneficiaries to have enough knowledge to avoid unnecessary loss of materials, for example through death or reduced productivity;
- b. Ensure that the right material is procured/provided by involving a specialist in the procurement of particular material; and,
- c. Make frequent follow up to ensure that beneficiaries get required technical advice in a timely manner until every member of the group benefits from the scheme.

2. Responsibilities of Recipient(s)

The recipient agrees to do the following:

- a. Ensure that they have mobilized themselves into functional groups with strong committees
Know in advance the next group to benefit from the first lot of pass-on. This group will also be empowered to closely monitor how the first group manages the materials;
- b. Construct a standard khola before being issued with livestock;
- c. Ensure that the materials are well managed and carefully keep records such as births, deaths and other development; and,
- d. Replace livestock that dies in their care within one (1) month after the occurrence of the death.

NOTE: The Lending Organization and the recipient(s) will meet biannually to review progress of the initiative.

3. Reasons to Withdraw Material/Stock

The following will lead to termination of this agreement and the withdrawal of the materials lent out:

- a. Deaths of more than 40% within a year in case of issued (in this case the recipient will still have to replace the dead livestock);
- b. A lack of respect for the group's constitution leading to confusion (for example, fighting over positions, irregular meetings, unilateral decisions made by influential members) in the group; and,
- c. No pass-on takes place within the expected time.

Agreement

FOR LENDING ORGANIZATION

Name: _____

Position: _____

Signature: _____

Date: _____

FOR RECIPIENT

Name: _____

Position: _____

Signature: _____

Date: _____