# Push-pull Curriculum for Farmer Field Schools

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# Contents



## Preseason

# Season 1

# Off season



# Season 2

# List of illustrations

# Foreword

This push-pull curriculum for farmer field schools (FFS) is a major step towards getting the push-pull technology into the national extension systems in eastern and southern Africa. The FFS approach aims at supporting farmers by improving the quality of disseminating technology to ensure that majority of the farmers benefit from innovative technologies.

While research institutions have developed a range of technologies to solve local production problems in most smallholder farming systems, agricultural productivity has continued to decline. Many of the technologies have not been effectively disseminated to majority of the farmers and hence remain largely unknown except in few pilot areas. Still, others have not been tested on-farm by the farmers to allow adjustment to local conditions. Inappropriate management practices and increased pressures on resources, especially natural and economic resources, worsen the situation.

The push-pull strategy is a platform technology that has potential to improve livelihoods of smallholder farmers and rural families, to increase agricultural productivity and to improve environmental sustainability. These outcomes can be achieved by addressing problems of striga weed, stemborers, and low soil fertility. These are major problems that constrain cereal production in sub-Saharan Africa in general and Eastern Africa region in particular. Research conducted by icipe in collaboration with its partners, particularly KARI, Ministry of Agriculture, Ministry of Livestock and Fisheries in Kenya, and Rothamsted Research in UK, has shown that planting Napier grass (especially Bana variety) around a maize field intercropped with a fodder legume, desmodium (Silverleaf or Greenleaf), significantly reduces the problems of striga and stemborers.

The Push-pull technology is now practiced by more than 7000 farmers in 19 districts in Kenya, 5 districts in Uganda, and training and demonstrations have started in Tanzania. Our aim is to expand this technology to as many farmers as possible in different agro ecological zones, districts, and regions. To do so, the use of the Farmer Field School (FFS) approach is appropriate. Push-pull is a knowledge-intensive technology and requires a well-designed curriculum to enable farmers to understand and apply it on their farms. The curriculum is a roadmap for providing a range of learning opportunities for the various entry points of the technology for the smallholder farmers. It is also an important resource for the national extension system, the NGOs and the community-based organizations.

icipe hopes that this curriculum will enhance farmers' understanding of their agro-ecosystems, cereal production constraints and the potential of Push-pull technology to address them. It is also hoped that it shall strengthen local decision-making and technology development capacities for more productive and sustainable agriculture.

*Prof. Christian Borgemeister*

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# Preface

Smallholder farmers in Africa face many problems. Their plots are too small to be economically productive; they have little or no money to invest in farm equipment; crop pests and diseases destroy most of their crops. The list is endless. The result is a vicious cycle of poverty and malnutrition.

Many efforts are being put into addressing the problems of smallholder farmers. This curriculum addresses the major problems that affect cereal production in Africa: Stemborers and Striga weed, and low soil fertility. Where these have not been addressed, agricultural production has been severely affected. In some instances, crop failure of up to 100% has been recorded.

By combating the twin problem of stemborers and striga weed through the use of the Push-pull technology, the smallholder farmer can maximize production and improve household health and income.

### Purpose of the curriculum

The purpose of this curriculum is to guide farmers in learning the principles and practices of the Push-pull technology so that they can apply them on their farms. Push-pull is a knowledge-intensive technology, and there is a need to have a curriculum to guide the process of acquiring knowledge and skills in the use of the technology.

### Target of the curriculum

The curriculum is aimed at the farmer, the extension staff, NGOs, collaborators and all others who are interested in the Push-pull technology. It has been written in a simple language to enable farmers and others to read and understand it with ease.

### Parts of the curriculum

The curriculum is divided into four main parts.

1. The pre-season weeks: This part covers activities that prepare the ground for an effective Push-pull Farmer Field School.
2. Season 1: This corresponds with the first maize cropping season. All activities follow the growth of the maize crop.
3. The first off-season: This is the period after the first maize crop season. Relevant learning activities are incorporated for the farmers to do before the next season.
4. Season 2: This corresponds to the second maize cropping season, and like Season 1, activities follow the growth of maize.

### How the curriculum was developed

This curriculum is a product of several people from the three Eastern Africa countries: Kenya, Uganda and Tanzania. They includ farmers, research scientists, agricultural extension officers from the Ministry of Agriculture and Ministry of Livestock and Fisheries, practitioners from NGOs, and donors. It was developed at *icipe* Thomas Odhiambo Campus in Mbita, Kenya. Later, a small group of experts fine-tuned the material from the workshop to

enable easy facilitation and learning.  A full list of the workshop participants is included in this curriculum.

### Implementation

Push-pull is a knowledge-intensive technology that needs a curriculum designed to guide learning at various entry points of the technology for the smallholder farmers. This curriculum covers the key components of the Push-pull technology written for direct implementation by farmer groups and individual farmers. It will be covered and applied by majority of small-scale farmers in the region through Farmer Field Schools (FFS).

The FFS offers farmers opportunities aimed at enhancing learning by doing, getting involved in experimentation, problem solving, discussion and decision-making. The school aims to educate farmers to understand their environment and farming practices, thus enabling them to make rational decisions in the use of resources and to identify appropriate practices and technologies that are relevant to their farming systems.

### Assessment of the curriculum coverage

Participants in the Push-pull Farmer Field School will evaluate the curriculum through active involvement. Lessons will involve a participatory approach in making field observations, experimentation, developing indicators/parameters, recording and analyzing information. The curriculum includes Participatory Monitoring and Evaluation (PM&E) activities and tools to help the farmers, researchers and extensions agents to monitor and evaluate the technology.

Zeyaur R. Khan

Principal Scientist / Programme Leader, *icipe*

Mbita, Kenya

# Acronyms

| | |
|---|---|
| AESA | Agroecosystem Analysis |
| CAN | Calcium Ammonium Nitrate |
| CBO | Community Based Organization |
| CREADIS | Community Research in Environmental and Development Initiatives |
| CYMMIT | International Maize and Wheat Improvement Centre, Nairobi, Kenya |
| DERLTO | District Extension Research Liaison and Training Officer |
| FAO | Food and Agriculture Organization of the United Nations |
| FFS | Farmer Field School |
| GM | Gross Margin |
| HIV | Human immunodeficiency virus |
| icipe | International Centre of Insect Physiology and Ecology |
| IR-Maize | Imazapyr-Resistant Maize |
| KARI | Kenya Agricultural Research Institute |
| NAADS | National Agricultural Advisory Services (Uganda) |
| NAARI | Namulonge Agricultural and Animal Research Institute |
| NARO | National Agricultural Research Organization |
| NGO | Nongovernmental Organization |
| PDA | Provincial Director of Agriculture |
| PM&E | Participatory monitoring and evaluation |
| TVC | Total Variable Costs |

# Preseason

# Introduction

## Pest problems of maize

Stemborers and striga weeds are the most destructive pests of cereal crops and can greatly reduce yields of maize on small-holder farms. You can get yield losses of 30 to 100% if stemborers and striga are not controlled. Control of stemborers by insecticides and control of striga weeds by herbicides is very expensive for resource-poor farmers. It is also not good for the environment.

### Stemborers

Stemborers are important pests of maize in Africa, but they also attack other crops such as sorghum, millet and sugarcane. Damage is caused by larvae which first feed on young leaves, but soon enter into the stems. During the early stage of crop growth the larvae may kill the growing points resulting in deadhearts (Fig 1).

**Fig 1. Deadheart caused by stemborer larvae**

At a later stage of larva growth, extensive tunneling (Fig 2) inside the stem weakens the stalk so that it breaks and then lodges. Damage caused by stemborers could result into 20% to 40% reduction in grain yields.

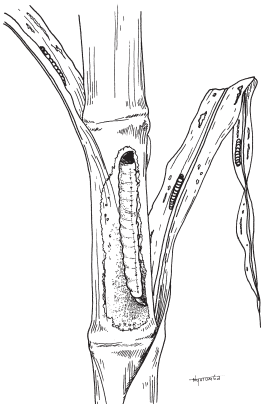

**Fig 2. Tunnelling of maize stalk by stemborer larva**

Adult moths of stemborers are seldom seen in farmers' fields as they are inactive during the day. They become active after sunset and lay their eggs during the night.

In eastern Africa there are two species of stemborers which cause heavy damage to cereal crops –*Busseola fusca* (Fig 3) and *Chilo partellus* (Fig 4).

*Busseola fusca* is an African stemborer and is present in high and mid altitude areas (3500 ft and above*)* like Kitale*. Chilo partellus* accidentally came to Africa from Asia in 1930s. *Chilo partellus* is present on low and mid altitude areas (below 4000 ft) like Kenyan coast.

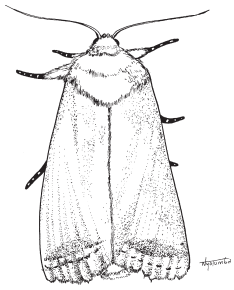

**Fig 3. *Busseola fusca***

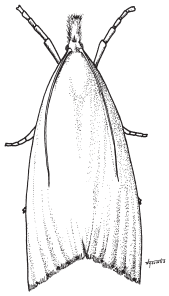

**Fig 4. *Chilo partellus***

Adult moths lay eggs on maize plants (Figs 5 and 6). The eggs then hatch into larvae which, after feeding on leaves for two to three days, enter inside maize stems. *Busseola fusca* lays its eggs between stem and leafsheaths (Fig 5), whereas *Chilo partellus* lays its eggs on plant surface in form of egg batches (Fig 6).

Fig 5. ***Busseola fusca*** **laying eggs**

Fig 6. ***Chilo partellus*** **laying eggs**

After larvae bore into maize stems, they feed and grow within the stems for 2-3 weeks.

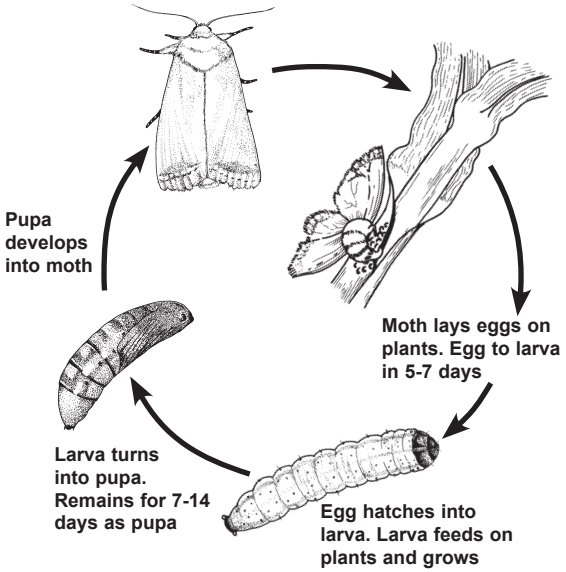


**Fig 7. Life cycle of** *Busseola fusca* **stemborer**

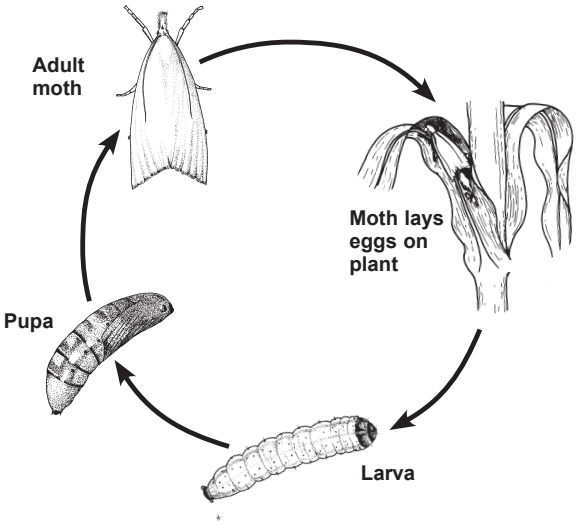


**Fig 8. Life cycle of** *Chilo partellus* **stemborer**

When larvae are fully grown, they pupate and remain inside the maize stem for 7-14 days. Adults emerge from pupae and come out of the stem. They mate and lay eggs on maize plants again and continue damaging the crop.

## Striga weeds

Striga or witchweeds are parasitic weeds that affect maize in many parts of Africa reducing production by 30% to 100%. When a farm is infested with striga, the affected maize hardly grows more than one foot tall. The weed does not grow on its own but grows by attaching itself onto the host plants (Fig 9). Each striga plant can produce 20,000-80,000 seeds, which lie dormant in the soil until a maize crop is planted again. This dormancy can last for over 15 years. As striga germinates, its roots grow towards the maize crop, penetrate the roots of the maize and start to draw nutrients from there. This causes severe stunting of the maize and yield loss.

**Fig 9. Striga weed attached to maize roots**

In east Africa, there are two common species of the witchweed, *Striga hermonthica* and *Striga asiatica. Striga hermonthica* is common around the Lake Victoria basin while *Striga asiatica* is mainly found in the coastal areas. The most affected crops include maize, sorghum, rice and sugarcane.

Farmers should control striga before it emerges from the ground because by the time it emerges, much damage will have been caused. Although various control methods have been proposed, few farmers are able to avoid yield loss by these means. For example, though manual removal reduces re-infestation, it is uneconomical since most damage is done even before the weed emerges. Therefore, any control strategy has to begin within the soil.

# Control of stemborers and striga weed using the Push-pull strategy

## What is the "Push-pull" strategy?

ICIPE and its partners have developed an effective, cheap and environmentally friendly technology known as “Push-pull” for the control of stemborers and suppression of striga weeds in maize.

It is a simple cropping strategy, where the farmers use Napier grass and desmodium legume (Silverleaf or Greenleaf) for control of stemborer and striga weed in maize fields.

Desmodium is planted between the rows of maize. It produces a smell that stemborer moths do not like. The smell “pushes” away the moths from the maize crop.

Napier grass is planted around the maize crop as a trap plant. Napier grass is more attractive to female moths and it pulls the moths to lay their eggs on it. But Napier grass does not allow stemborer larvae to develop on it. When the eggs hatch and the small larvae bore into Napier grass stem, the plant produces a sticky substance like glue, which traps them and they die. So, very few stemborer larvae survive and maize is saved.

In addition, desmodium, interplanted among the maize, reduces striga weed. It has been shown that nitrogen fixed by desmodium and chemicals produced by the roots of desmodium are responsible for suppressing the striga weed. Therefore, striga does not grow in the maize-desmodium intercrop.

## Benefits of adopting the Push-pull strategy

When you adopt the Push-pull strategy you will:

- Increase maize yields by 25–30% in the areas where only stemborers are a problem but more than 100% where both stemborer and striga are problems
- Increase supply of cattle feed from Napier grass and desmodium
- Fix nitrogen into your farm by desmodium legume, so you save on fertilizer costs
- Protect soil from erosion as desmodium acts as a cover crop
- Retain soil moisture in your plot because desmodium acts as a mulch
- Get money from sale of desmodium seed at an attractive price
- Make more money from increased milk production and sales
- Save on farm labour as you do not have to manually remove striga weed from the farm
- Protect maize from strong winds when surrounded by Napier grass

In this curriculum you will learn how to establish and maintain Push-pull plots and increase your maize yield by controlling stemborers and striga and improving soil health.

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- ***District Agricultural Officers near you***

# Week 1

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Initial ground working | 2 weeks | Meeting place |

## Preparing to launch a Farmer Field School (FFS) in a community

A Farmer Field School is a process, not a goal. It aims to increase the capacity of farmers to test new technologies in their own fields and assess results and their relevance to particular circumstances. Farmers interact with researchers and extension workers on a demand driven basis, only asking for help where they are unable to solve a problem themselves.

FFS is a dynamic process that is practised, controlled and owned by farmers to help them transform their observations to create a better understanding of their crops and livestock.

The initial step in formation of a Farmer Field School involves what we call ground working.

## Topic: Initial ground working

### Learning objective

On completion of this topic participants will:

- Become aware of FFS
- Understand the importance of FFS

### Learning activities

The Ministry of Agriculture and partners can conduct a series of formal or informal meetings with interested farmers and community members, local government officers and non-governmental organisations before starting the FFS. The first meeting should be reasonably informal to introduce the FFS idea and to raise interest among potential participants.

Ground working is important because of the following reasons:

- It introduces the FFS idea and to creates interest among potential participants
- It assesses the level of interest in the community
- It creates a basis for ownership in the FFS to be formed

FFSs are likely to be effective if the participants reside in the same village. This enhances the chances of community members establishing an FFS in the village and encourages the participants to continue with group activities after the FFS season ends. Such groups provide good entry points for other development efforts in the community.

Ideally, a request for a field school should come from the community itself. People who request training are likely to be motivated and responsible than those forced into a programme by some authority. Field days arranged by existing FFS can trigger such requests. In areas where the idea of FFS is not known, interest can be created by working through active local leaders or exchange visits to an area where a FFS exists.

The timing of initial ground working is important. It should not be held at a time when potential participants, be it men or women, are engaged in other activities that might exclude them from participating. Through these initial meetings it will be possible to confirm or identify the farming community's main interest areas or problems, and to check whether the community members are sufficiently interested to attend a season-long course on the subject. The groups are responsible for the care and maintenance of the study enterprise covering all aspects of the cropping cycle, from soil preparation, through planting,

weed control, pest and disease control, harvesting, processing, post harvest storage, to marketing of produce. The approach is a season-long training following the seasonal activities of a crop. Issues related to financing of the FFS should be openly discussed, to make all arrangements transparent and to build trust.

It is important to spend time discussing potential participants' expectations, and getting the group to decide whether any of these are unrealistic to avoid problems later. The potential adult learners should be given enough opportunity to ask questions, get clarifications, and make suggestions.

# Week 2

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Introduction of Farmer Field Schools | 1 hour | Pieces of paper/ flip – charts, pens/ markers, a tick or more than one (or any other insect that is common), a board to display |
| 2 | Levelling expectations | 1 hour | |
| 3 | Setting of learning norms | 1 hour | |

## Introduction

Farmer Field Schools (FFSs) are informal hands-on schools for adults who come together on a regular basis to learn the "*how and why*" of a particular topic. The FFS uses participatory methods to help farmers develop their analytical skills, critical thinking, and creativity, and to help them learn to make better decisions.

This lesson will introduce the community to what a field school is, the number of people involved, setting of norms and levelling of expectations in an FFS.

## Topic 1: Introduction to Farmer Field Schools

### Learning objectives

This topic serves to:

- Introduce the FFS methodology to the community and FFS members
- Establish the interest of the community in using the FFS to learn about Push-pull
- Outline the principles and objectives of FFS

### Learning activities

- Facilitator-led introduction to FFS
- Facilitator-led discussion on the need for FFS
- Facilitator-led discussion on objectives and principles of FFS

### Facilitation procedure

- The facilitator initiates the activity by asking the farmers to draw a maize plant
- Everybody knows how a maize plant looks like. Each person in the crowd can carry out this exercise or a few volunteers can make a drawing of a maize plant
- The facilitator collects the drawings and displays them on a board or a place where all the participants present can clearly see them
- The facilitator asks participants to name the parts of the maize plant on the drawing and indicate the role of the different parts. The participants look, name and discuss whether the plant parts are labelled correctly and what role the parts do
- If the parts on the drawing are not labelled correctly, the facilitator asks the participants to explain the reason for the difference in observation
- Then the facilitator brings out a maize plant and shows it to the farmers, asking them to have a look and confirm the labelling and the role the different parts play
- Participants discuss the different parts of the maize plant and the role each part plays

### Principles of FFS

- What the farmer wants rules
- The field is the learning ground
- Learning by doing
- Extension workers are facilitators and not teachers
- participatory learning out of mistakes

- Systematic training process
- Learn how to learn
- Unity is strength
- Problem-posing/problem-solving
- Every FFS is unique

## Topic 2: Levelling of expectations

To avoid disappointing FFS participants and making some even drop out, it is important that the participants become aware of what they expect. At this very early stage participants can level out unrealistic expectations before committing themselves to participate in the FFS.

### Learning objectives

On completion of this topic participants will be able to:

- Indicate what they expect from the FFS course
- Understand that not all their expectations are achievable through the FFS course

### Learning activity

- Facilitator-led introduction: Why would you like to join an FFS? What do you hope to gain? What do you expect from the facilitator?
- Group exercise – participants divide into smaller groups discuss questions and present to the whole group their ideas
- Facilitator-led discussion on unrealistic and realistic expectations

### How to level expectations

- Level expectations after the participants have introduced themselves. You can do this exercise with the whole group or with smaller groups
- Ask the following questions.
  - Why have you joined the FFS?
  - What do you hope to gain?
  - What do you expect from the facilitator?
  - What do you think the facilitator expects from you?
- Divide the group into sub-groups of at most 5 participants and give them time to discuss the questions
- One participant in the sub-group can write the answers on a flip-chart
- Invite a representative of each sub-group to present their responses to the whole group/class
- Summarize the group expectations
- Guide the discussions and respond to each expectation. Ask the group members what they think about each expectation and whether it is realistic and achievable within the FFS cycle

It is the responsibility of the facilitator to make sure that unrealistic expectations are levelled out and realistic expectations are made part of the FFS programme.

## Topic 3: Setting of learning norms

For the smooth running of the FFS, it is important to set ground rules and norms to ensure a suitable learning environment. Interruptions such as people coming late or under influence of alcohol, mobile phones, absenteeism, domineering people, cases of non- participation, are not good for a learning environment.

### Learning objectives

On completion of this topic participants will be able to:

- Create a climate that enhances the learning process
- Prevent negative influences that would interfere with the success of the FFS
- Enhance members' accountability to the group
- Train other participants how to organize and better manage themselves

### Learning activities

- Divide the class into groups of 4-6 members to discuss and list norms to guide good conduct in an FFS
- Facilitator-led discussion on norms and reinforcements of the FFS programme
- Listing of acceptable norms and reinforcements of the FFS

### How to set norms

- Find out from the group what learning norms are
- Ask group members to list the learning norms
- Guide the group to come up with more norms and suggestions on what should be done when a member does not respect the norms. For example, what should be done in the following instances?
    - Late comers: member has to pay a fine; member has to dance, etc.
    - Absenteeism: group can decide on how many sessions a participant needs to attend to be able to graduate (e.g. an attendance of 75% will be required)
    - Dominant people or lack of order in the group (you can use the stick, only the person holding the stick is allowed to speak. A person who would like to speak must raise his/her hand and be given the stick. Or use a slogan to get the group's attention)
    - People not contributing to group work: should pay for a day's labour.
    - Members who do not respect other people's opinions should be reprimanded
- The learning norms should be pinned on the wall for everybody to see

# Week 3

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Introduction to Farmer Field School Implementation | 2 hours | Facility to visualise the main points of the discussion e.g., flip charts/chalkboards, markers, masking tapes; list of 1-2 names of successful projects and 1-2 names of failed projects introduced into the village or in the neighbouring village. |
| 2 | Introduction to Participatory Monitoring and Evaluation | 2 hours | |

## Introduction

Adult learners volunteer to participate in a field school. To make the decision to participate they need enough information on how the school will meet their needs and interests. This lesson will introduce participants to the importance of a field school.

## Topic 1: Introduction to Farmer Field School implementation

### Learning objectives

On completing this topic participants will:

- Understand the objectives of the FFS
- Identify where to locate the FFS
- Identify activities to learn through FFS
- Plan for official opening of the field school

### Learning activities

- Facilitator-led introduction on the objectives of FFS
- Brainstorming and group discussion on appropriate location of FFS, learning activities, and the appropriate time to open the school officially
- Facilitator-led discussion on importance of having a productive and effective FFS

### Objectives of FFS

- Empower farmers with knowledge and skills
- Sharpen the farmers' ability to make critical and informed decisions that make their farming profitable and sustainable
- Sensitise farmers in new ways of thinking and problem solving
- Help farmers learn how to organise themselves and their communities
- Enhance relationship between farmers, extensionists and researchers to work together in testing, assessing and adapting a variety of options within their specific local conditions

### Identifying the suitable time for the FFS

Participants should be involved in scheduling the day of the week and time of the day and the frequency with which to hold the FFS meetings. Women may not have the same availability as men. It is also usually easier to gather farmers together for a meeting early in the day, before they start their routine activities. Meetings of about 4 hours may suit the majority of farmers, but the timing needs to be discussed with all the participants. The sessions of the initial phase of the school can commence before the start of the cropping season/cycle, when farmers are less busy with farm work. During the cropping season/cycle, sessions should be held regularly every one to two weeks.

### Identifying the location of the school

Ensure that all participants' opinions regarding the proposed location are heard. The school should be located at a place that is:

- Accessible and acceptable to all the farmers
- Suitable for the proposed enterprise and within or next to the community
- Near a shade and in a comfortable, secure area for the group to draw, analyse the data and discuss findings.

### Identifying the FFS activities

In order to start to identify initial topics that the FFS participants might like to learn, the participants can carry out a problem analysis for maize crop in the village. 3-4 volunteers from the group can do this. These volunteers can talk about their experiences with maize production, and the problems and successes they have had. The group can brainstorm on key cross cutting points from the different farmers' presentations which will help define the initial activities the group will learn about.

In order to develop skills needed to design and implement their experiments it is important that a session on experimentation is conducted very early in the FFS season. Participants can return to the topic of experimentation later during the season as they build their own skills and ideas.

### Opening the FFS officially

For the development of the school and to ensure community support and replication of similar activities it is important to start the school with a proper opening ceremony. This will give the local authorities, including farmer leaders, the opportunity to express to the participants their support and interest in the school.

## Topic 2: Introduction to Participatory Monitoring & Evaluation (PM&E)

# Introduction

Participatory monitoring & evaluation (PM&E) is a process through which stakeholders at various levels are involved in monitoring or evaluating the process and results of a particular project or programme. The stakeholders may include local people, researchers, NGOs, and policy makers. Evaluation is a process of determining whether the design and delivery of a programme were effective and whether the proposed outcomes were met. It begins in the initial planning phase and continues throughout the life of the programme. Evaluation done to improve or change the program is called formative evaluation. The evaluation that focuses on the results or outcomes of a programme while it is in progress is called summative evaluation. Good programme evaluation provides useful feedback to all those concerned with a certain programme

PM&E aims at measuring the effectiveness of a project, building ownership and empowering you, building accountability and transparency; and enabling you take corrective actions to improve achievement of better outcomes.

In this lesson, you will learn why you should monitor and evaluate the farm activities you undertake in your farm or in a FFS.

### Learning objectives

On completion of this topic participants will be able to:

- Understand and explain the importance of PM&E
- Discuss the principles of PM&E

## Learning Activities

- Facilitator-led introduction on importance of participatory monitoring and evaluation
- Divide participants into groups of 4-6 and let them brainstorm the on need for PM&E and write on flip charts (Lead questions: Why should you be involved in monitoring and evaluating what group activities you are doing? What guidelines would you follow in doing PM&E?)
- Groups make presentations to the bigger group
- Facilitator-led discussion on importance and principles of PM&E

## Notes

### *(1) Purposes of PM&E*

- Assess what has been achieved
- Measure progress in line with the set objectives
- Improve monitoring for better management
- Identify strengths and weaknesses
- Check on the effectiveness of effort - is there a difference
- Do cost benefit  analysis- were the costs reasonable
- Collect information to plan
- Share experience with others

### *(2) Principles of PM&E*

PM&E seeks to involve programme participants in reflecting and assessing the progress of their project. Core principles of PM&E:

- It involves you as active participants – you actively participate in making decisions about your project/program activities
- It builds your capacity to analyze, reflect and take action
- It encourages joint learning of stakeholders at various levels.
- It promotes commitment to taking corrective actions. Facilitators are catalysts
- Emphasizes people-centeredness - relies on your creativity and knowledge about your environment
- It draws on your local resources and capacities (abilities)
- It is gender-sensitive – considers both men and women as important players.
- It promotes empowerment in which you and the community are encouraged to take ownership, management and control of your own choices and decisions.
- It encourages partnership and sustainability.

| HOW? | | WHO? | WHERE? | WITH WHAT? | WHEN? |
|---|---|---|---|---|---|
| Indicators | Tools | | | | |
| | | | | | |
| | | | | | |

# Week 4

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Field observations | 30 Minutes | Records showing inputs and costs; crops and livestock information; record sheets; and flip charts/chalkboards, markers, exercise books, pens. |
| 2 | Attending FFS regularly | 30 Minutes | |
| 3 | Keeping farm records | 1 hour 30 minutes | |
| 4 | Enterprise budgets | 1 hour 30 minutes | |

## Introduction

Observing and keeping records are two important things on your farm. You learn a lot from the observations you make and the records you keep about what is happening on your crops and livestock. This in turn enables you to make good decisions. Records are essential for good planning and use of your limited resources. Without proper understanding of record keeping, you may not succeed in today's business world.

In this lesson, you will learn about:

- Field observations
- Farm records
- Enterprise budgets

## Topic 1: Field observations

### Learning objectives

On completion of this topic participants will be able to explain the importance of making field observations.

### Learning activities

- Facilitator-led discussion on the importance of field observations
- Facilitator-led discussion on how to make field observations and how to record observations
- Field walk to observe, identify and discuss the kinds of insects in a farm and the damage/benefits of such insects

## Topic 2: Attending FFS regularly

The success of an FFS depends on all members attending all the learning activities regularly and being involved in all group activities. Participants are expected to apply directly what they learn in the FFS. Therefore, it is important that every participant attends all the field school sessions.

### Learning objective

On completion of this topic participants will be able to understand the importance of attending FFS sessions regularly.

### Learning activities

- Facilitator-led introduction on the importance of attending all sessions regularly
- Brainstorm on rules to guide attendance of meetings
- Learn how to use the attendance roll

## Topic 3: Keeping farm records

### Learning objectives

On completion of this topic participants will be able to:

- Explain the importance of farm record keeping
- Prepare and explain the different types of farm records

### Learning activities

- Facilitator-led introduction: importance of keeping farm records
- Facilitator-led discussion on types of farm records and their preparation

**Note**

- *If you keep records properly, they will provide you with answers that lead to better farm management decisions*
- *Record keeping should be simple to make it easy for you to use and to avoid making mistakes*
- *For you to get maximum value out of your records make sure you update them regularly and timely*

## Topic 4: Enterprise budgets

A budget provides the answer to the question: what will be the profit or loss of doing a certain enterprise? Budgeting relates to the future. It tells us what the profitability of an enterprise or activity will be if we decide to use a certain production technology. Budgeting is a planning tool used by several kinds of people including farmers, managers, extension specialists, and policy makers.

### Learning objectives

On completion of this topic participants will be able to:

- Understand the importance of budgets as a tool in management of farm business
- Develop budgets to compare the inputs used in various enterprises and eventually their net profits

### Learning activities

- Facilitator-led introduction on meaning of enterprise budgets (What is an enterprise budget?)
- Facilitator-led discussion of format for enterprise budgets
- Brainstorm on the uses of enterprise budgets (Are enterprise budgets necessary?)
- Give examples for group exercise

### Enterprise budgets

- Single budgets are easier to use, monitor and evaluate
- Single enterprise budgeting has several uses:
  - Helps in *considering the profitability of a single enterprise* – Using the budgeting method helps one to investigate the profitability of a particular enterprise regardless of other farm enterprises
  - Helps in *monitoring and control* – Budgeting can be used for comparing actual implementation with planning, in order to identify and solve problems during the production season
  - Helps in *whole farm planning* – The most important component of any planning method is the list of enterprise budgets and their gross margins. The single enterprise budget also enables the planner to 'grade' enterprises, and classify them according to their characteristics and profitability with regard to the production factors
  - Helps in *preparing normative budgets* – Budgets of single enterprises are compiled by government agencies for planning and policy implementation for providing 'know-how' and information to the farmers and advising them on what to grow

# Week 5

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Tools of Participatory Monitoring & Evaluation | 4 hours | Facility to visualise the main points of the discussion e.g., Flip charts/chalkboards, markers, masking tapes; list of 1-2 names of successful projects and 1-2 names of failed projects introduced into the village or in the neighbouring village. |

## Introduction

Any activity, project or programme requires resources in developing and implementing it. It is therefore important that you check on how you begin. You need to choose and use the appropriate method or tool that will provide quality feedback. This will help to show whether the resources you are investing in the project are producing benefits or making profits

PM&E tools help you to observe and analyse situations and performance and to understand what you are observing. Participatory monitoring and evaluation (PM&E) is management tools to enhance your learning and enable you take correct actions. In this lesson, you will also learn how to use relevant (PM&E) tools.

## Topic: Tools of Participatory Monitoring & Evaluation

### Learning objectives

On completion of this topic participants will be able to:

- Carry out evaluation using different PM&E tools
- Reflect on what to monitor to measure success, and identify appropriate indicators to measure the identified parameters
- Decide how to monitor parameters, who should do it, where, with what and when

### Learning activities

- Facilitator-led introduction to tools of PM&E
- Identify practical cases of community projects that were successful or unsuccessful (failed) and brainstorm why they succeeded or failed
- Identify and discuss the indicators of project success or failure

### Notes

**(1) Examples of PM&E Tools**

**■ Sketches and maps**

Sketches and maps can be used at the beginning of the programme (for planning purposes), during the process (for monitoring purposes) and at the end of the programme (for evaluation purposes) in order to locate the changes in the programme.

**■ Semi-structured interviews**

Informal dialogue and interviewing is generally one of the first steps in participatory planning activities. Taking time to talk to people will set the right atmosphere.

**■ Focus-group discussion**

A focus group consists of 4–8 people who collect information, clarify details or gather opinions about an issue. It facilitates the exchange of experiences. The group usually records its discussion and shares with rest of the group.

**■ Daily activity analysis/diaries**

A diary keeps a record of events over time and can used to collect information regarding changes in the field, lives of individuals or groups, etc. Diaries are simple records of facts, such as the attendance of participants in the FFS.

■ **Change or success stories**

The change or success story of an individual or group identifies significant changes – positive and negative – relating to an activity. This highlights a project's impact and people's perception of it. Stories document a sequence of events over time related to a person, location, household or organisation and help you to understand the history of a community or the impact of a programme. Stories also help the group to learn about people's experiences and expectations and can help highlight obstacles to plans.

■ **Transect walk**

The transect walk helps in mapping information collected and monitoring. The participants take a structured walk (for example, in a zigzag) through a selected area, making observations using chosen indicators.

■ **Direct observation**

This includes any approach, which relies on directly observing objects, events, or relationships in the field, and keeping a record of the observations. Counting the number of stemborers or other insects and their predators, for example, helps farmers and outsiders to understand how the stemborers spread and endanger the crop.

■ **Evaluation wheel**

This uses indicators such as attendance, appreciation of the specific content of the session, performance of the facilitator, level of overall satisfaction, participation by all members, etc. The FFS group ranks these aspects on an agreed scale, say a ranking of 1-5. The reasons behind each score are discussed and solutions suggested for improvement.

(2) Procedure for sharing success stories

**Step 1:** Ask one participant to describe one important enterprise introduced in the area that was a success. All participants should listen carefully to the story.

**Step 2:** In groups of 4 – 6, participants discuss. (Lead question: what do you need to monitor to be able to measure success both on the group activities and among individual members?) Write the parameters on cards.

**Step 3:** Let each group present its results. Fix the list of measurements and respective indicators on a chart for everyone to see.

**Step 4:** Look at the indicators and identify the ones that are suitable and easy to measure, i.e. most SMART: specific, measurable, attainable, relevant and timely.

**Step 5:** Divide the things discussed with the defined indicators among the groups.

**Step 6**: Each group discusses which tools to use to measure the indicator (HOW), WHO should be responsible, WITH WHAT and WHEN and document their decisions in a table as below. The group can use the format of the table below

**Step 7:** Repeat Step 1-6 with another participant for an enterprise or project that was not successful. Get consensus from the others (if they come from the same village).

**Step 8:** In the larger group go over the presentations of the group works with especial emphasis on how realistic the monitoring plan is, the costs involved and where will the funds come from, level of knowledge the participants have in monitoring the tasks, whether they have resource persons, what training they require, etc.

| How | | Who | Where | With what | When |
|---|---|---|---|---|---|
| Indicators | Tools | | | | |
| | | | | | |

# Season 1

# Week 1

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Preparing and laying out the Push-pull plot | 2 hours | Ruler/tape measure, string, pegs, sticks for measurement, mallet hammer, polyethylene tags or marker pens, push-pull manual |
| 2 | Planting the Push-pull and the Check plots | 2 hours | Jembes/hoes, pangas, pegs, sticks, fertilizer, seed materials, napier grass cane cuttings or root splits, dry sand, small bucket, small container (pot, tin, etc) of good soil |

## Introduction

Two things are necessary when establishing a good and easy to manage Push-pull plot: proper land preparation and careful layout of the field. Proper land preparation has the following advantages:

- It helps control weeds
- It facilitates easy sowing and helps to establish good seed and soil contact
- It helps the seeds to absorb moisture easily
- It provides sufficient aeration
- It helps improve the water holding capacity of the soil

If you follow good management practices the Napier grass and desmodium you will establish this year will benefit your Push-pull plot for 5 or more years.

This week's lesson is about these two important activities. Participants will learn how to prepare and lay out the Push-pull plot and the Check plots.

## Topic 1: Preparing and laying out the Push-pull plot

### Learning objective

On completion of this topic the participants will be able to demonstrate how to prepare and lay out land for the first season.

### Learning activities

- Facilitator-led introduction on preparation and laying out of Push-pull plot and Check plots
- Practical preparation of the two plots
- Facilitator-led discussion on requirements for preparing and laying out Push-pull plots

### How to prepare the Push-pull plot

**Note**

*If your land is slopping, the desmodium and maize rows must run across the slope to avoid surface runoff and to reduce soil erosion.*

**Step 1**: Mark out a plot measuring 21m by 21m using a tape measure, pegs and strings (To make sure it is a square, use a string to ensure the two diagonals have the same length).


**Fig 10. Measuring a Push-pull plot**

**Step 2:** Put a peg at each corner of the measured area. Starting from a peg at one corner, put more pegs all around the plot at intervals of 75 cm.

**Step 3:** Run a string from the first peg in one corner to the first peg on the opposite side of the field.

**Step 4:** Run the second string from the second peg to the second peg on the opposite side.

**Step 5**: Run the third string from the third peg to the third peg on the opposite side.

**Step 6:** Repeat Steps 3, 4 and 5 for all the other sides, until you have a plot looking like Fig 11 below.

The Push-pull plot is now ready for planting.

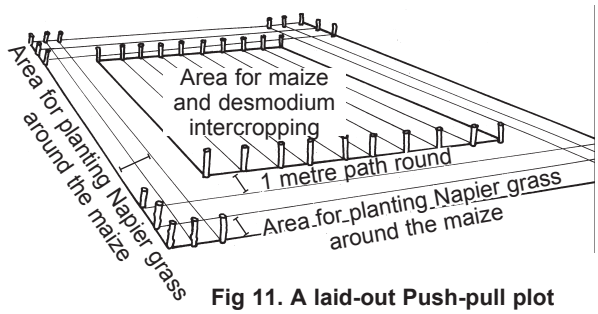


**Fig 11. A laid-out Push-pull plot**

### How to prepare the Check plot

**Step 1:** Demarcate a plot measuring 21m by 21m.

**Step 2:** Starting from one corner put pegs along two opposite sides of the square at 75 cm intervals.

**Step 3:** Run a string across from the first peg from a corner to the first peg on the opposite side and do the same up to the last pegs.

### What NOT to do

- Do not remove the pegs until your plot is fully planted
- Do not plant Push-pull in less than 21m by 21m plots as Napier grass tends to grow tall and therefore creating a shading effect on the maize crop

## Topic 2: Planting the Push-pull and the Check plots

This topic covers:

- Planting of Napier grass canes or root splits
- Planting the desmodium
- Planting the maize

### Learning objective

On completion of this topic participants will be able to demonstrate how to plant on both Push-pull and Check plots.

### Learning activities

- Facilitator-led introduction on planting the Push-pull plot
- Practical activities on planting of Push-pull (maize, desmodium and Napier grass) and the Check plots
- Discussions on planting all plots

### Planting order

### (1) Planting Napier grass

Bana is the best variety of Napier grass for use in Push-pull.

Follow these steps when planting Napier grass in your Push-pull plot.

**Step 1:** Dig a hole at each peg on the border of the marked plot.

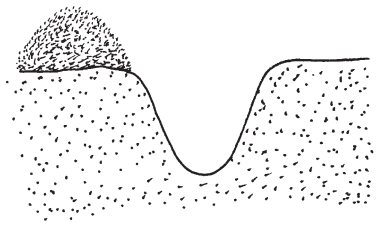

**Fig 12. Hole for planting cane or root split**

**Step 2:** Apply one tea spoonful of triple super phosphate fertilizer or 2 hand-fulls of well decomposed farmyard manure in each hole (Fig 13).

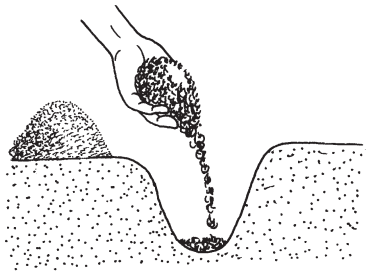

**Fig 13. Applying fertiliser or manure**

**Step 3:** Place a three node cane into each hole at an angle of 30º-45º all facing one direction (Fig 14).

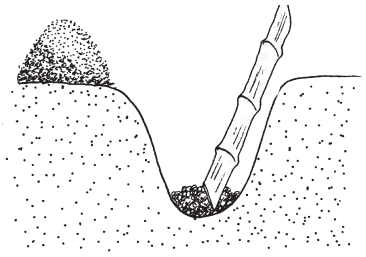

**Fig 14. Two nodes of cane in a hole**

**Step 4:** Cover with soil ensuring that two nodes of the cane are well covered (Fig 15).

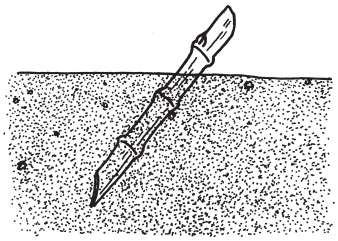

**Fig 15. Cane covered with soil**

**Step 5:** Repeat Steps 1 to 4 for the second and third rows, ensuring that the rows are 75 cm apart and 75 cm between the plants within the rows.

When complete, you will have three rows of Napier grass all round the maize field.

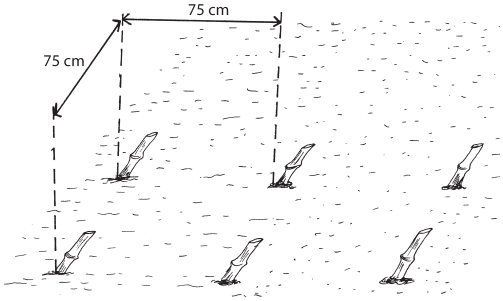


**Fig 16. Rows and plants at 75 cm apart**

If you are using root splits, place them upright into the planting holes and cover with soil (Fig 17 below).

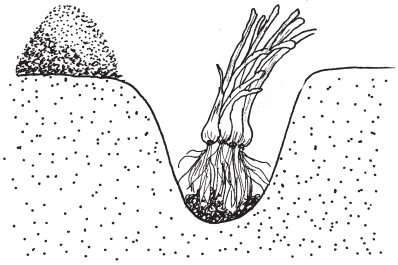

**Fig 17. Planting splits**

**Note**

*Some farmers prefer to establish Napier grass in the short rains. The desmodium and maize intercrop are established in the subsequent season. This helps to control stemborer in the first season of Push-pull establishment.*

## (2) Planting desmodium

**Step 1:** Start from the fourth peg at the corner of the marked plot and run a string to the fourth peg on the opposite side. Do the same for all the sides (Fig 18).

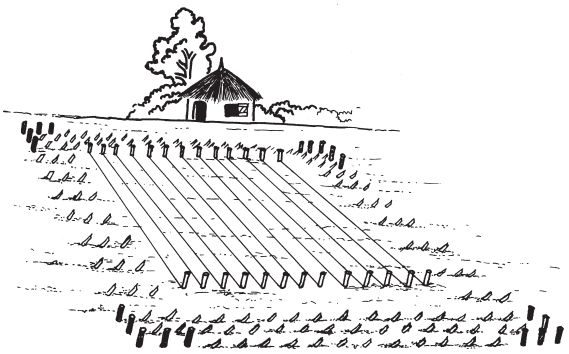

**Fig 18. Strings running across the plot**

**Step 2:** Mix thoroughly desmodium with fine sand in the ratio of one part desmodium seed to two parts dry sand (Fig 19).

- To plant a 21m by 21m plot you need 250g to 300g of desmodium seed

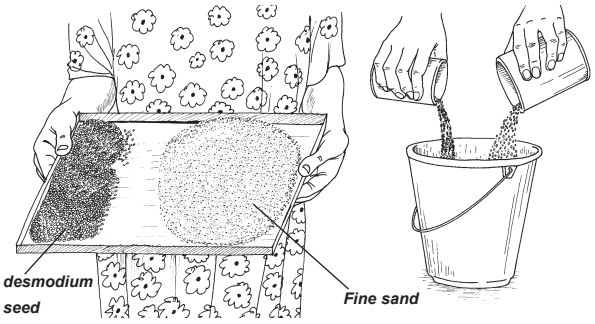


**Fig 19. Mixing desmodium with fine sand**

**Step 3:** Using a sharp pointed stick, make a furrow 1-2 cm deep along the string lines. Leave a 75 cm space at the end of each row between the end of the desmodium row and the inner row of Napier grass (Fig 20).

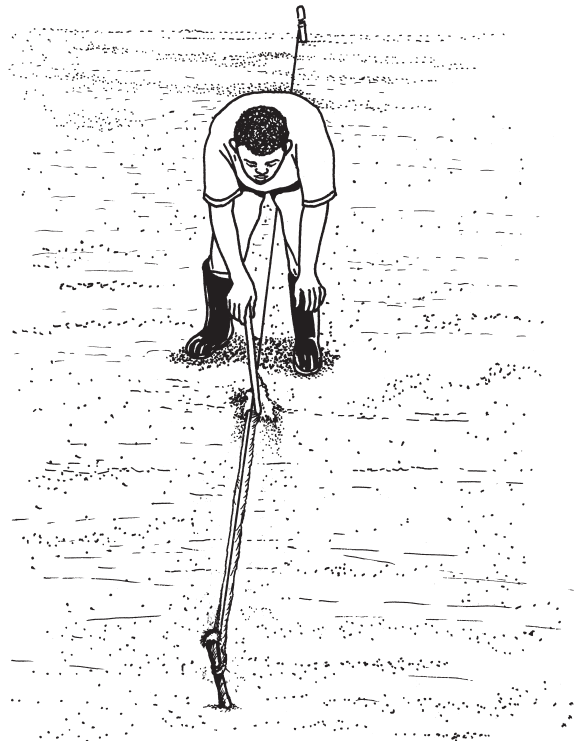

**Fig 20. Making a furrow for drilling desmodium**

**Step 4:** Drill fertilizer or farmyard manure along the furrows, and mix with soil, using a stick, without covering or disturbing the furrow.

**Step 5:** Drill the desmodium/sand mixture prepared in Step 2 into the furrow and cover with a light amount of soil (Fig 21).

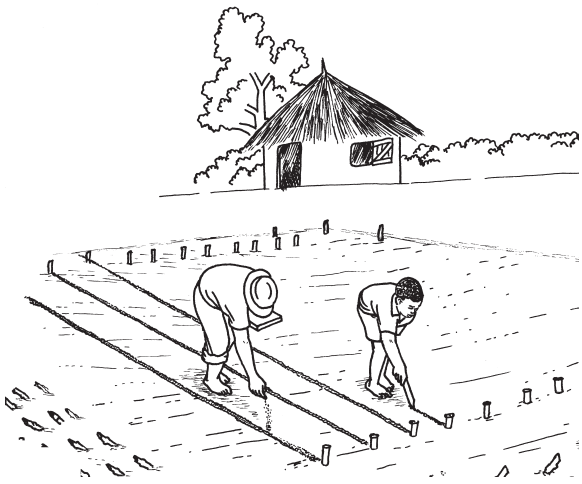

**Fig 21. Drilling desmodium into furrows**

- Desmodium is drilled in the furrows at 75 cm row to row distance

**Note**

- *Plant desmodium with the rains for maximum germination*
- *Planting desmodium in a straight line will save you a lot of time when you come for the first weeding after 3 weeks. It will also help you to distinguish desmodium seedlings from weeds*
- *If you do not have desmodium seeds, you can use desmodium vines from any neighbouring farm. This should be done when there is adequate soil moisture to ensure good establishment. (See **Season 2 Week 1** on desmodium vine propagation)*

**Step 6:** Plant desmodium in a small container (pot, tin, etc.) and keep it in a shade and watered. These seedlings will help you to identify desmodium seedlings in the field.

## (3) Planting maize

### (a) Push-pull plot

**Step 1:** Maize is planted in straight lines ***between the rows of desmodium***

- Ensure that the first row of maize is at least 1 m away from the inner row of Napier grass
- The recommended spacing for maize is 75 cm between rows and 30 cm between hills in a row

**Step 2:** Apply one tea spoonful or soda bottle top of triple super phosphate or two spoonfuls of single super phosphate per hole. You may also use a handful of good quality manure per hole. Cover with a small amount of soil.

**Step 3:** Plant two maize seeds per hole and then thin to one plant per hill after first weeding (see **Season 1**, **Week 5**).

**Note**

*Planting in this way ensures that maize rows alternate with Napier grass rows (i.e. they should not be on the same row with Napier). This helps make ploughing easier in the next season.*

### (b) Check plot

In the Check plot, the same maize variety is planted in the entire 21 m by 21 m plot.

**Step 1:** Dig holes at 75 cm between rows and 30 cm within the rows.

**Step 2**: Apply one tea spoonful or soda bottle top of triple super phosphate or two spoonfuls of single super phosphate in each hole. You may also use a handful of good quality manure per hole. Cover with a small amount of light soil.

**Step 3:** Plant two maize seeds per hole. When the maize germinates you will thin to one plant per hill after the first weeding (see **Season 1, Week 5**).

### What NOT to do

Do not do any planting if moisture is not enough or if the field is too dry.

### Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Push-pull Plot** | Field layout | | | | |
| | Planting Napier | | | | |
| | Planting Desmodium | | | | |
| | Planting maize | | | | |
| | Fertilizer application | | | | |
| | Manure application | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| **Check Plot** | Field layout | | | | |
| | Planting maize | | | | |
| | Fertilizer application | | | | |
| | Manure application | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |

## Input costs

| | Input used | Quantity used | Cost |
|---|---|---|---|
| **Push-pull Plot** | Maize seed | | |
| | Desmodium seed | | |
| | Napier | | |
| | Fertilizer | | |
| | Manure | | |
| | Other | | |
| **Total** | | | |
| **Check Plot** | Maize seed | | |
| | Fertilizer | | |
| | Manure | | |
| | Other | | |
| **Total** | | | |

## Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Variety of maize planted | | | | |
| Date of planting: | | Fertilizer applied: | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| **Soils** | | | | |
| • Soil colour: | | | | |
| • Soil moisture: | | | | |
| • Soil depth: | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 2

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Gapping maize | 30 Minutes | Maize seeds, pen, jembes/hoes, pegs, sticks, strings, tape measure, ruler, desmodium seeds (100 grams) and TSP fertilizer. |
| 2 | Land preparation for planting of desmodium for seed production | 1 hour | |
| 3 | Planting desmodium | 30 Minutes | |
| 4 | Introduction to Ecosystems | 1 hour | Pieces of paper/ flip – charts, pens/ markers and a board to display. |

## Introduction

It takes about 4 – 5 days for the maize to germinate. At times some of the maize seeds do not germinate. This leaves gaps in the field that need to be filled. This is called **gapping**. Gapping should be done at this stage so that the new maize can catch up with the rest of the crop.

## Topic 1: Gapping maize

### Learning objectives

On completion of this topic participants will understand and explain the importance and timing of gapping.

### Learning activities

- Facilitator-led introduction on the importance and time of gapping
- Practical activities on gapping of maize
- Discussion

### How to gap maize (both in Push-pull and Check plot)

**Step 1:** Walk along the rows, identify gaps where maize seeds have failed to germinate and dig holes.

**Step 2:** Plant two maize seeds per hole and then thin to one plant per hill after first weeding (in Week 5).

**Note**

- *You do not have to apply fertilizer at this stage since you had applied earlier.*
- *Be careful not to step on the germinating desmodium seedlings in the Push-pull plot*

## Topic 2: Preparing land to plant desmodium for seeds

Desmodium is expensive to buy and the demand for planting material by farmers is high. This lesson will enable the farmer to produce desmodium from seed or vines for their own use or for sale.

### Learning objectives

On completion of this topic participants will demonstrate how to prepare a plot for desmodium seed production.

### Learning activities

- Facilitator-led introduction on desmodium seed bed preparation
- Practical activities on seed bed preparation
- Discussion

### How to prepare land for planting desmodium

**Step 1:** Mark out a 10 m by 10m plot

**Step 2:** Before the onset of rains, you will have ploughed or dug your land by hand and broken the soil into fine particles. Desmodium has very small seeds.

Therefore, the soil should be carefully prepared so that it is as fine and clean as possible.

**Step 3:** Starting from one corner of the plot, put pegs along two opposite sides of the square at 75 cm intervals (Fig 10).

**Step 4**: Run a string across from the first peg to the first peg on the opposite side. Do the same for all the pegs (Fig 11).

**Note**

*A 10 m by 10 m desmodium plot can produce 3-4 kg of seed for sale and vines to establish your next Push-pull plot.*

## Topic 3: Planting desmodium

### Learning objectives

On completion of this topic participants will plant desmodium for seed production.

### Learning activities

- Facilitator-led introduction on planting of desmodium seeds
- Practical activities on seed planting
- Discussion

**Step 1:** For a 10 m by 10 m plot, mix thoroughly 100 g of desmodium seed with 200g fine sand, or a ratio of one part desmodium to two parts sand (Fig 19).

**Step 2:** Using a strong pointed stick, make a furrow 1-2 cm deep along the string lines (Fig 20).

**Step 3:** Drill TSP fertilizer or farmyard manure along the furrows, and mix with soil, using a stick, without covering or disturbing the furrow.

**Step 4:** Drill the desmodium/sand mixture prepared in Step 1 into the furrow and cover with a light amount of soil.

**Step 5:** Plant desmodium in a small container (pot, tin, etc.) and keep it in a shade and watered. These seedlings will help you to identify desmodium seedlings in the field.

**Note**

- *Plant desmodium with the rains for maximum germination.*
- *Planting desmodium in a straight line will save you a lot of time when you come for the first weeding after 3 weeks. It will also help you to distinguish desmodium seedlings from weeds.*

## Topic 4: Introduction to Ecosystems

# Introduction

An ecosystem (short for ecological system) consists of both living and non-living things and the physical environment (habitat). A habitat is the place where a population lives. A population is a group of living organisms of the same kind living in the same place at the same time. All of the populations interact and form a community. The community of living things interacts with the non-living world around it to form the ecosystem. Ecosystem consists of many smaller complete ecosystems in a habitat. The habitat supplies organisms with food, water, warmth, air and minerals. Some interactions of the components result in higher benefits while others lead to losses.For crops and livestock, positive interactions result in higher productivity while negative interactions lead to lower yields.

Farmers need to understand these interactions so as to maximize the positive ones for higher production and minimize the negative ones through better management. It is important for them to understand the functions and interactions of the various components, the living, the non-living and the physical environment.

### Learning objectives

On completion of this topic, participants will be able to:

- Understand different types of ecosystems
- Build awareness of the relationships that exist between living and non-living things found in their environment
- Appreciate that if one thing in the network of interaction is changed, it can influence all of the components of the ecosystem

### Learning activities

- Facilitator-led introduction on meaning and importance of ecosystem
- Through focus groups, farmers critically observe, analyze and make decisions on their field problems (Lead question: What relationships exist between living and non-living things in the farm?)
- Facilitator-led discussion on elements of an ecosystem

**Step 1**: Divide the group into small groups of 4-6 members. Each group will go to the field and do the following:

- Look around and as far as they can see
- List all the living and non-living things they can see
- Discuss how the things observed are connected or how they affect each other

**Step 2**: After 20 minutes of observation, discussion and note-taking return to the meeting place. Each group will do the following:

- Draw a picture showing all the things that they observed and draw lines to show which things are connected or affect each other
- Make a presentation to the big group to explain what they have drawn

### Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Push-pull plot** | Gapping maize | | | | |
| **Check plot** | Gapping maize | | | | |
| **Seed multiplication plot** | Preparing land | | | | |
| | Planting desmodium | | | | |

### Input Costs for desmodium multiplication plot

| | Input used | Quantity used | Cost |
|---|---|---|---|
| | Desmodium seed | | |
| | Fertilizer | | |
| | Manure | | |
| | Other | | |
| **Total** | | | |

## Farmer's fields

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Age of maize in weeks | | | | |
| **Germination** | **Poor** | **Average** | **Good** | |
| • Maize | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | Low | Medium | High | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

| Indicator | Observation | |
|---|---|---|
| | Push-pull field | Check plot |
| Emergence count | | |
| Maize germination | | |
| Seedling damage observations | | |

# Week 3

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Gapping Napier | 30 MInutes | Napier grass cuttings/root splits, hoe/stick, Push-pull manual, pen and paper, markers, flip charts |
| 2 | Agro Ecosystem Analysis (AESA) | 1 hour | |
| 3 | Group Assessment | 2 hours 3 minutes | |

## Introduction

Napier grass stem cuttings take two weeks to sprout while the root splits can start sprouting in one week. Sometimes some of the planted Napier grass cuttings or root splits fail to sprout. Therefore, you need to gap at this stage so that later in the season there is enough Napier grass to protect your maize crop against stemborers, and to produce more fodder for your livestock.

## Topic 1: Gapping Napier

### Learning objectives

On completion of this topic, participants will be able to understand and explain the importance and timing of gapping Napier grass.

### Learning activities

- Facilitator-led introduction on the importance and time of gapping
- Practical activities on gapping of Napier grass
- Discussion

### Gapping Napier grass

**Step 1:** Walk along the rows and mark the gaps where Napier grass has not sprouted.

**Step 2**: Place a three node cane ensuring two nodes are well covered with soil. The new canes should all face the same direction as those planted earlier.

If you are using root splits, place them into the holes and cover with soil.

## Topic 2: Introduction to Agroecosystem Analysis (AESA)

The AESA is a field-based analysis of the relationships of components observed in the field such as soil, water, pests and their relationships. Participants learn to make regular field observations, analyze problems and opportunities encountered in the field and learn to improve decision-making skills regarding farm management. Participants thus develop the ability to assess and analyze problems, adopting a scientific procedure that consists of observation and analysis, followed by recommendations.

In this topic participants will learn how to conduct AESA by visiting the experimental plots/farms by observing the ecosystem, including interactions and ecological processes. They do so by sampling, observing, recording and making comparison and analysis of information.This helps them to take actions based on sound information.

### Learning objectives

On completion of this topic participants will be able to:

- Become more aware of the things and interactions that make up the ecosystem of their fields- the “agro-ecosystem”
- Develop indicators for monitoring interactions and processes in the ecosystem
- Use their understanding and observations of the agro-ecosystem as a basis for decision making about crop/ livestock management

**Learning activities**

- Facilitator-led introduction on meaning and importance of AESA
- Group observations and discussions of the components of an agroecosystem (Lead question: What relationships exist between humans, crops, livestock and the physical environment?)
- Facilitator-led discussion on indicators of monitoring elements of an agro-ecosystem

**Procedure**

**Step 1**: Divide the group into small groups of 4-6 members. Each group will go to the field and do the following:

- Look around the host farm and list all the living (crops and livestock, insects) and non-living things they can see
- Discuss how they are connected or how they affect each other

**Step 2**: After 20 minutes of observation, recording and discussion return to the meeting place. Each group will do the following:

- Draw a picture showing all the things that they observed and draw lines to show which things are connected or affect each other
- Make a presentation to explain what they have drawn to the big group

**Fig 22. An AESA session**

Examples of Indicators for monitoring interactions and processes through AESA

**Examples of Indicators for monitoring interactions and processes through AESA**

| Frequency of monitoring | Indicators |
|---|---|
| At start of experiment | Initial land use, soil type, soil moisture, land area, date of planting, germination rate, etc |
| Periodically | Signs of stemborer and striga infestation, other pests, soil cover, soil life, soil moisture, etc |
| Frequently | Rainfall, plant growth, pest and diseases, soil moisture, moisture stress, management practices carried out, labor input, benefits obtained |
| At end of experiment | Crop height, grain yield, biomass yield, soil nutritional level, total labour input, total benefits, cost/benefit analysis |

## Topic 3: Group assessment

# Introduction

There is a lot to learn and this can be very challenging. People learn at different rates. Some find it easy, while others may find it difficult. The aim of group learning lesson is to maximize the resource of the fast learners for the benefit of the whole group, through sharing of experiences and challenges. If you achieve all the above you will have a very effective FFS experience.

**Do not use negative criticism, be objective and positive in your comments.**

Now you have been working together as a group for 6-7 weeks, and you have had time to apply on your farm what you have learnt in the field school. It is time to go out and see how you and your colleagues have laid out your Push-pull and the Check plots. The purposes of this are:

- To maximize your group learning (social learning)
- To learn from each other's experiences
- To correct any errors that may have been made

### Learning objective

The objective of this assessment is to maximize interactive learning through group discussion and evaluation.

### What to do in the assessment

**Step 1:** Form groups of 4-6 members.

**Step 2:** Each group visits each farm represented by the members in the group.

**Step 3:** Use the table below to assess the Push-pull and the Check plots, and discuss with the farmer. Rate each farm using this scale:

1 = Poor 2 = Average 3 = Good

| | Push-pull plot | | Check plot | |
|---|---|---|---|---|
| **What to check** | **Rating** | **Comments** | **Rating** | **Comments** |
| Field preparation | | | | |
| Layout of the field | | | | |
| Cleanliness of the plots | | | | |
| Germination of maize | | | | |
| Napier grass establishment | | | | |
| Germination of desmodium | | | | |
| Germination of desmodium in the pots | | | | |
| Record-keeping | | | | |
| **Total rates** | | | | |

Other comments _____

_____

_____

_____

_____

_____

### Labour cost

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Push-pull Plot | Gapping Napier | | | | |
| | Other | | | | |

### Farmer's field

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Variety of maize planted | | | | |
| Date of planting: | | Fertilizer applied: | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| **Soils** | | | | |
| • Soil colour: | | | | |
| • Soil moisture: | | | | |
| • Soil depth: | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 4

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Sources of stemborer infestation | 1 hour 30 Minutes | Pictures and samples of grasses, hand lens (if available), sharp knives or blades, vials, petri dishes, small containers e.g., shoe polish containers; plastic buckets (5 litres) |

## Introduction

Many types of wild grasses grow in Africa. Stemborers live and feed on some of these grasses. Similarly, many types of useful insects that attack and destroy stemborers also live on these grasses. This lesson will show the farmers how wild grasses contribute to the overall management of stemborers in the Push-pull strategy.

## Topic: Sources of stemborer infestation

### Learning objective

On completion of this topic, participants will be able to identify grasses on which stemborers prefer to live.

### Learning activities

- Facilitator-led introduction on the various type of grasses on which stemborers prefer to live.
- Field visits to observe the presence of stemborers on various grasses.
- Discussion (Lead question: Which grasses have the highest stemborer presence?)

### Duration: 1 hour 30 minutes

### Identifying host grasses

Form groups of 4 to 6 members.

**Step 1:** Facilitator leads groups in a field walk collecting 5 different types of grasses and dissecting 10 stems of each.

**Step 2:** Groups use the pictures provided to try and find out their names. Figs 23 -25 are examples of common grasses.

**Step 3:** Groups give the local names of the grasses they have collected.

**Step 4:** The participants count and record the number of larvae present on each dissected grass type.

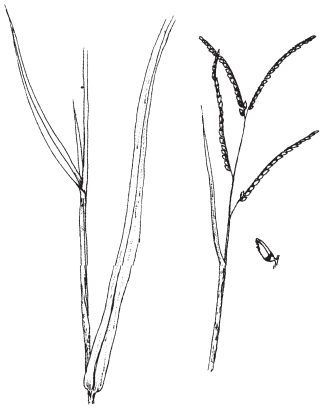

**Fig 23. Signal grass**

**Fig 24. Wild Sorghum**

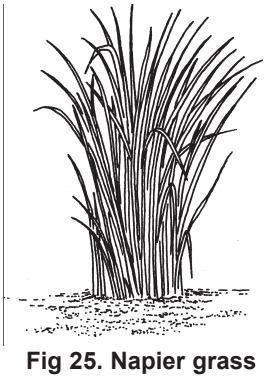

**Fig 25. Napier grass**

**Step 5:** The participants place this in 20 plastic pots.

| Grass name | Local name | Total no of stems dissected | Total no of stemborer larvae | Number of larvae per stem |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |
| 6. | | | | |
| 7. | | | | |

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| **Crop Health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull Plot | | | | |
| • Maize Check Plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

Farmers' comments after the lesson:

_____
_____
_____
_____

# Week 5

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | 1st weeding, thinning and top dressing maize in both Push-pull and Check plots | 2 hours | Jembe, CAN fertiliser, teaspoon/soda bottle top, desmodium seedling planted in a pot/ tin in Week 1, small amounts of desmodium seeds; fine dry sand. |
| 2 | Weeding (and top dressing) of Napier grass | 1 hour | |
| 3 | Identifying desmodium seedlings | 30 Minutes | |
| 4 | Hand weeding and gapping desmodium | 1 hour | |

## Introduction

Weeds compete with your crops (maize, desmodium and Napier grass) for water, soil nutrients, light and space. Therefore, early weeding of crops is very important. It is essential to carry out the first weeding when maize is three weeks old. If you delay the weeding your crops will not be healthy.

Thinning of maize to one plant per hill is essential. If there are too many maize plants per hill they will compete with each other for food and light, and not grow well.

Top dressing is particularly important in the poor soils associated with striga, and for growing hybrid maize. At the time of top-dressing maize should be free of weeds. The need for top dressing is less after the third season in the Push-pull plot.

## Topic 1: 1st weeding, thinning and top dressing maize in both Push-pull and Check plots

### Learning objectives

On completion of this topic, participants will:

- Understand and explain the importance and proper timing, weeding, thinning and top-dressing maize
- Demonstrate proper weeding, thinning and top dressing maize

### Learning activities

- Facilitator-led introduction on importance and proper timing of weeding, thinning and top dressing maize
- Practical activities on weeding, thinning and top dressing maize
- Discussion

The growth of maize plants in the first week is rather slow and it is during this period that weeds establish rapidly and become competitive.

- Weed competition is highest during the period of 2 to 6 weeks after sowing. This time is critical for weed control
- It is important to keep your plot free of weeds during this critical period of weed competition

**Step 1:** Carefully weed your maize using a Jembe or hoe (Fig 26).

**Fig 26. Weeding maize with a hoe**

**Step 2:** Thin the maize to one plant per hill, leaving the healthiest plant.

**Step 3:** Top dress the maize with CAN at the rate of one teaspoon or soda bottle top per plant. Scoop the fertilizer and sprinkle it around the base of the maize plants leaving a space of 1 inch around the base. If the fertilizer is sprinkled on the stem it can burn the maize.

**Note**

*In places where striga is a problem, farmers apply half rates of fertilizer: one half during the first weeding and the other half during the second weeding.*

Be careful not to step on the desmodium seedlings planted in between the maize rows.

## Topic 2: Weeding and top dressing Napier grass

### Learning objectives

On completion of this topic, participants will:

- Understand and explain the importance and the timing of weeding and top-dressing Napier grass
- Demonstrate weeding and top dressing Napier grass

### Learning activities

- Facilitator-led introduction on importance and time of weeding and top dressing Napier grass
- Practically weed and top dress Napier grass
- Discussions

### 1st Weeding Napier grass in Push-pull plot

**Step 1:** Carefully weed your Napier grass using a jembe or hoe.

**Step 2:** ***(Optional step if your Napier is not growing well)*** Top dress the Napier grass with CAN at the rate of one teaspoon or soda bottle top per plant. Scoop the CAN fertilizer and sprinkle it around the base of the Napier grass. Leave a space of 1 inch around the base. If the fertilizer is sprinkled on the stem it can burn the Napier grass.

## Topic 3: Identifying desmodium seedlings

### Learning objectives

On completion of this topic participants will recognise desmodium seedlings and differentiate them from weeds.

### Learning activities

- Facilitator-led introduction on identifying desmodium seedlings
- Practical observation of desmodium seedlings and weeds of the same age
- Discussion

### Identifying desmodium seedlings

**Step 1:** Walk around and pick the weeds growing around the plot.

**Step 2:** Compare the weeds you have picked with the desmodium seedlings in the pot/tins planted in **Season 1 Week 1** and identify the differences.

**Step 3:** Walk through the field and see whether you can tell the difference between the desmodium seedlings and the weeds growing on the plot.

# Topic 4: Hand weeding and gapping desmodium

## Learning objectives

On completion of this topic participants will:

- Understand the importance of timing of hand weeding and gapping of desmodium seedlings
- Hand weed, gap and top dress desmodium seedlings

## Learning activities

- Facilitator-led introduction on the importance and proper timing for hand weeding and gapping of desmodium
- Hand weeding and gapping of desmodium seedlings
- Discussion

## Hand weeding and gapping desmodium

Once you can tell the difference between the desmodium seedlings and weeds, it will be easier for you to weed the desmodium seedling rows.

## Weeding

**Step 1:** Carefully walk down the desmodium rows and look for weeds.

**Step 2:** Pull the weeds out gently by hand using a small sharp stick (Fig 27). Continue till the whole plot is weeded.

**Fig 27. Weeding desmodium by hand**

## Gapping

**Step 1:** Walk down the desmodium rows and identify the gaps.

**Step 2:** Mix thoroughly desmodium seeds with fine sand in the ratio of one part desmodium to two parts sand (**Week 1, Fig 19**).

**Step 3:** Using a strong pointed stick, make a furrow 1-2 cm deep along the desmodium lines where they need gapping.

**Step 4:** Drill the desmodium/sand mixture prepared in Step 2 into the furrow and cover with a light amount of soil.

**Note**

- *If the soil is light and there is heavy rain just after planting, farmers may find the desmodium rows have slightly moved. Therefore they should make the rows straight after the first weeding. If you do this immediately after rains you may straighten the rows by gently pushing the soil and the seedlings with your hands.*
- *Weeding should only be done when the soil is moist. Weeding when the soil is dry disturbs the roots of desmodium seedlings and can kill the young seedlings.*

## Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Push-pull Plot** | Maize: Weeding, thinning and top-dressing | | | | |
| | Weeding and gapping desmodium | | | | |
| | Weeding (and top dressing) Napier | | | | |
| | Any other Activity | | | | |
| **Total** | | | | | |
| **Check Plot** | Maize: Weeding, thinning and top-dressing | | | | |
| | Any other Activity | | | | |
| **Total** | | | | | |

## Input costs

| | Input used | Quantity used | Cost |
|---|---|---|---|
| **Push-pull plot** | Fertilizer | | |
| | Other | | |
| **Total** | | | |
| **Check plot** | Fertilizer | | |
| | Other | | |
| **Total** | | | |

## General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 6

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Identifying stemborers | 1 hour 30 minutes | Stemborers: Picture of moths and real moths; stemborer eggs |
| | Understanding striga | 1 hour 30 minutes | • Samples of striga at various stages of growth<br>• Knives, pictures of damaged plants, hoe, flip charts, posters, marker pens, masking tapes |
| 2 | Gapping of desmodium (seed plot) | 40 minutes | Small amounts of desmodium seeds, fine sand to gap the desmodium seedling rows |

## Introduction

Stemborers are a big threat to maize and cereal production in Africa. The Push-pull technology aims to eliminate this problem and hence improve the agricultural productivity of the small-scale farmer. This topic is designed to help you to identify and understand stemborers.

## Topic 1: Identifying stemborers

### Learning objectives

On completion of this topic farmers will:

- Identify the stemborer egg, larva, pupa and adult moth
- Describe the life cycle of stemborers

### Learning activities

- Facilitator-led introduction on identification of stemborers
- Field walks to identify stemborers
- Facilitator-led discussion on description of life cycle of stemborers

**Step 1:** The facilitator shows the farmers pictures of the two types of stemborers: *Busseola fusca* (Fig 28) and *Chilo partellus* (Fig 29).

**Step 2:** Farmers walk around the plots and collect stemborers from grasses by dissecting the plants.

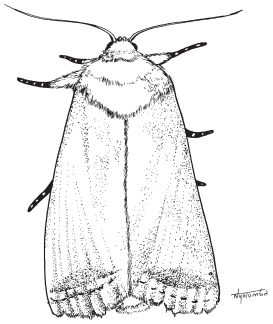

**Fig 28. *Busseola fusca***

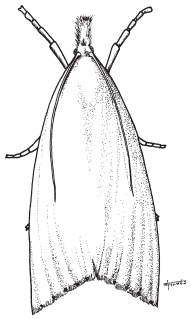

**Fig 29. *Chilo partellus***

**Step 3:** Farmers note the type of grass where the stemborers are most present.

**Step 4:** Farmers come together and try to identify which of the stemborers are *Chilo partellus* and which are *Busseola fusca.*

**Step 5:** Farmers walk into the Check plot and identify the eggs of stemborers in maize.

**Note**

Busseola fusca *lays its eggs between stem and leafsheaths (Fig 30) and* Chilo partellus *lays its eggs on plant surface in form of egg batches (Fig 31).*

**Fig 30. *Busseola fusca* laying eggs on maize**

**Fig 31. *Chilo partellus* laying eggs on maize leaf**

**Step 6:** Farmers infest the potted plants (planted in **Season 1 Week 4**) with stem-borer eggs.

## Topic 2: Identifying Striga

# Introduction

Striga or witchweeds are parasitic weeds that affect cereal crops in many parts of Africa, causing up to total loss of the crop. The weed does not grow on its own. It grows by attaching itself onto a host plant. As striga seed germinates, its roots grow and penetrate and attach to the host crop's roots to get food. This makes the crops stop growing normally (severe stunting) leading to huge yield loss. The most affected crops include maize, sorghum, rice and millet.

Many farmers cannot identify different types of striga and some do not know what a dangerous weed it is. This topic will help you to understand striga and identify the damage it causes to your maize.

### Learning objectives

On completion of this topic farmers will:

- Identify different types of striga weed
- Describe striga biology and the damage it causes to maize plants

### Learning activities

- Facilitator-led introduction on identification of striga
- Field walks to identify striga
- Facilitator-led discussion on description of striga biology and damage

**Fig 32.** ***Striga hermonthica: pinkish flowers***

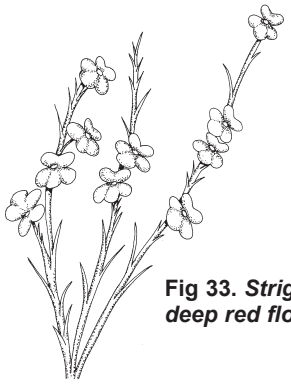

**Fig 33.** ***Striga asiatica: deep red flowers***

**Step 1:** Farmers are shown samples of striga weed S*triga hermonthica* (Fig 32) and S*triga asiatica (*Fig 33*).*

**Step 2**: Farmers observe and discuss features of striga.

**Step 3**: Farmers are shown samples of striga-infested maize (Fig 34).

**Step 4:** Farmers walk in the fields around the plots and see whether they can identify striga.

**Fig 34. Striga weed attached to maize roots**

**Step 5:** Mark 10 striga-infested plants for observation in week 10.

## Topic 3: Gapping of desmodium on the seed production plot

# Introduction

Some of the desmodium seeds that were drilled into the soils may not germinate. This is easy to tell from the gaps between the growing seedlings. Gapping or filling the spaces where desmodium did not grow, needs to be done early so that the whole crop can grow together.

### Learning objectives

On completion ot this topic participants will

demonstrate proper gapping of desmodium seedlings on the seed production plot.

### Learning activities

- Facilitator-led discussion on importance and the proper ways of gapping of desmodium
- Actual gapping of the desmodium

**Step 1:** Walk along the rows of desmodium and mark the gaps where desmodium has not grown. Take care not to step on the young seedlings

**Step 2:** Mix thoroughly desmodium with fine sand in the ratio of one part desmodium seed to two parts sand (Fig 19).

**Step 3:** Using a strong pointed stick, make a furrow 1-2 cm deep along the desmodium lines where they need gapping.

**Step 4:** Drill the desmodium/sand mixture prepared in Step 2 into the furrow and cover with a light amount of soil.

**Note**

- *You do not need fertilizer during gapping because the fertilizer you applied during planting is still in the soil*
- *You should gap when the soil is moist so that the seeds can germinate and catch up with the already growing crop*

### Labour cost

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Seed multiplication plot** | Gapping Desmodium | | | | |
| | Other | | | | |

### General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| striga | | | | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

Farmers' comments after the lesson: _____

_____

_____

_____

# Week 7

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | 2nd weeding of maize | 45 minutes | Jembe, hoe, sharp stick. |
| 2 | 2nd weeding of Napier grass | 30 minutes | |
| 3 | 2nd hand weeding of desmodium | 1 hour | |
| 4 | 1st hand weeding of desmodium seed production plot | 1 hour | |

## Introduction

By now your maize is five weeks old and new weeds have grown which you will need to remove otherwise they will affect the growth of your maize crop. Similarly, new weeds have grown in your Napier and desmodium. This time desmodium has grown and you can easily recognize it.

## Topic 1: 2nd weeding of maize

### Learning objective

On completion of this topic participants will be able to:

- Understand the importance of 2nd weeding of maize
- Demonstrate proper weeding of maize

### Learning activities

- Facilitator-led introduction on the importance of 2nd weeding of maize
- Actual weeding on both Push-pull and the Check plots
- Discussions on weeding maize fields

Carefully weed your maize using a Jembe or a hoe.

- Make sure you cover the bottom part of the maize plants with ample soil
- If you are in areas where striga weed is a problem, you may have applied the first half of fertilizer on your maize plot. Now you can apply the second half

## Topic 2: 2nd weeding of Napier grass

### Learning objectives

On completion of this topic participants will:

- Understand and explain the importance and the timing of 2nd weeding of Napier grass
- Demonstrate proper weeding of Napier grass

### Learning activities

- Facilitator-led introduction on the importance and time of 2nd weeding of Napier grass
- Practically weed Napier grass
- Discussions on weeding Napier grass

### How to weed Napier grass

Carefully weed your Napier grass using a Jembe or hoe.

- Take care not to weed very close to the base of the growing canes and the young root splits otherwise you will interfere with the roots. The weeds close to the base can be pulled out by hand
- There is no need to add fertilizer to your Napier grass at this stage

## Topic 3: 2nd hand weeding desmodium

### Learning objectives

On completion of this topic participants will:

- Understand the importance and timing of 2nd hand weeding of desmodium
- Practically demonstrate the 2nd hand weeding of the desmodium

### Learning activities

- Facilitator-led introduction on importance and the proper time for 2nd hand weeding
- Actual hand weeding
- Discussions on weeding desmodium

### Hand weeding and gapping of desmodium

At this time you can easily tell the difference between the desmodium seedlings and weeds but remember that the gapped plants will be much smaller than the original crop.

Walk down the rows of desmodium seedlings and look for the weeds. Carefully pull them out by hand using a small sharp stick (Fig 35). Continue till the whole plot is weeded.

**Fig 35. Weeding the desmodium plot**

**Note**

*It is not necessary to apply fertilizer at this stage.*

## Topic 4: 1st hand weeding desmodium seed production plot

### Learning objectives

On completion of this topic participants will be able to:

- Understand the importance of hand weeding desmodium in the multiplication plot
- Hand weed the desmodium seed production plot

### Learning activities

- Facilitator-led introduction on importance and the proper time for hand weeding and gapping of desmodium
- Hand weeding and gapping of desmodium seedlings
- Discussions

Now that you can easily tell the difference between the desmodium seedlings and weeds, it is easy for you to weed the desmodium seedlings.

Walk down the rows of desmodium seedlings in the seed production plot and look for the weeds. Carefully pull them out by hand using a small sharp stick (Fig 35). Continue till the whole plot is weeded.

**Note**

*Weeding should only be done when the soil is moist. Weeding when the soil is dry disturbs the roots of desmodium seedlings. This can kill the young seedlings.*

## Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Push-pull Plot** | Weeding maize | | | | |
| | Weeding desmodium | | | | |
| | Weeding Napier | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| **Check Plot** | Maize: Weeding | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| Seed Multiplication Plot | Desmodium weeding | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |

## General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| Crop health | **Poor** | **Average** | **Good** | |
| • **Maize Push-pull plot** | | | | |
| • **Napier grass** | | | | |
| • **Desmodium** | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| **Stemborers** | | | | |
| **Striga** | | | | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 8

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Stemborer damage and symptoms | 1 hour | Samples of striga at various stages of growth, knives, pictures of damaged plants, hoe, flip charts, posters, marker pens, masking tapes |
| 2 | Topic 2 Identifying striga | 30 minutes | |

## Introduction

Now that you already know what stemborers are, it is important that you are also able to identify the damage they cause to your crop, and the damage symptoms.

## Topic 1: Stemborer damage and symptoms

### Learning objective

On completion of this topic participants will be able to recognize damage caused by stemborers in maize and their symptoms.

### Learning activities

- Facilitator-led introduction on stemborer damage and the effects on maize plants
- Identifying damages caused by stemborers
- Field walks to observe stemborer infestation and damage level
- Observing the plants in pots (from Week 6) for stemborer damage
- Discussions

***Note***

- *Stemborers are most destructive at larvae stage. The larvae first feed on young leaves but soon enter into the stems where they feed and grow for 2-3 weeks (Fig 36).*
- *During early stage of the crop growth larvae may kill the growing points resulting in deadhearts (Fig 37).*
- *At a later stage of growth, extensive tunneling inside the stem weakens the stalk so that the plant breaks or lodges. (Fig 38)*

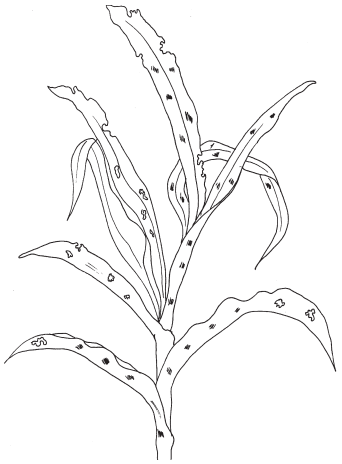

**Fig 36. Maize leaves showing damage caused by stemborer**

**Fig 37. Deadheart caused by stemborer larvae feeding inside maize plants**

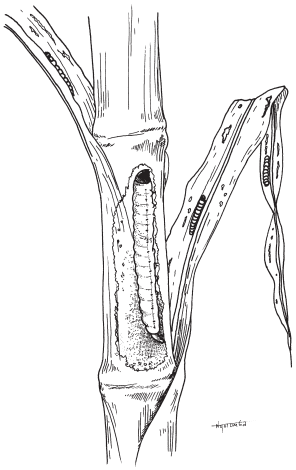

**Fig 38. A stemborer larva feeding inside maize stem**

## Topic 2 Identifying striga

This is a continuation of Week 6 Topic 2. By this stage some of the striga plants have emerged above the ground. Some level of damage is also obvious.

### Learning objectives

On completion of this topic participants will be able to:

- Identify emerging striga weed
- Identify symptoms of damage on crops that are infested with striga

### Learning activities

- Facilitator-led introduction on how to identify striga weed
- Observation of striga plants in the field
- Measure the height of healthy and striga infested maize plants marked in **Week 6**
- Discussions on observations made

### General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| **Stemborers** | | | | |
| **Striga** | | | | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

| **Indicator** | **Observation** | |
|---|---|---|
| | Push-pull field | Check plot |
| Height of maize (in cm or ft) | | |
| Natural weeds | | |
| No. of striga plants | | |
| Stemborer infestation on maize (Y/N) | | |
| Stemborer infestation on Napier (Y/N) | | |
| Number of larvae on 5 damaged plants | | |
| Number of larvae on 5 potted plants from Week 6 | | |

# Week 9

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | The Biology of Stemborer | 1 hour | Petri-dishes/Shoe polish containers, Sharp knives |
| 2 | 2nd weeding of desmodium seed multiplication plot | 30 minutes | |

## Introduction

This week is a continuation of topics on stemborer and striga covered in Weeks 6 and 8.

## Topic 1: The biology of stemborers

### Learning objectives

On completion of this topic participants will understand and describe the life cycle of stemborers from egg to larval/caterpillar stages.

### Learning activities

- Facilitator-led introduction on the stemborer life cycle from eggs to larvae
- Field walks to identify and collect stemborer damaged plants
- Observe the potted plants from Week 6 for stemborer damage
- Discussion

**Step 1:** Collect 5 damaged plants from the field and 5 potted plants which were infested with eggs in Week 6.

**Step 2:** Dissect carefully the plants and observe and count the stemborer larvae inside the stem and in the whorl/funnel.

**Step 3:** Record the damage and the number and size of stemborer larvae.

## Topic 2: 2nd weeding of desmodium seed multiplication plot

### Learning objectives

On completion of this topic participants will be able to:

- Understand and explain the importance of hand weeding of desmodium
- Carry out hand weeding of the desmodium seed production plot

### Learning activities

- Facilitator-led discussion on importance and the proper time for hand weeding and gapping of desmodium
- Carry out hand weeding and gapping of desmodium seedlings

Now that you are able to tell the difference between desmodium seedlings and weeds, it is easy for you to weed the desmodium seedlings.

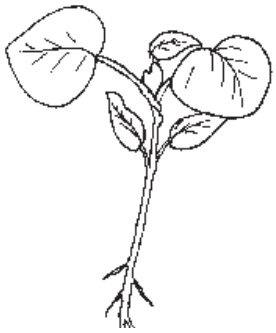

**Fig 39. Desmodium plant at an early stage (3 weeks old)**

Just walk down the rows of desmodium seedlings and look for the weeds. Carefully pull them out by hand using a small sharp stick as in Fig 35. Continue till the whole plot is weeded.

**Note**

- *Weeding should only be done when the soil is moist. Weeding when the soil is dry disturbs the roots of desmodium seedlings. This can kill the young seedlings.*
- *Care must be taken not to dig so close to the base of the desmodium as this can weaken the root.*

## Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Seed multiplication plot | Weeding desmodium | | | | |
| | Any other Activity | | | | |
| **Total** | | | | | |

## General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

## Stemborer infestation

| **Indicator** | **Observation** | | |
|---|---|---|---|
| | **Push-pull** | **Check plot** | **Potted plants** |
| Number of stemborer larvae on 5 damaged plants | | | |
| Average size of stemborer larvae on 5 damaged plants | | | |
| Number of stemborer larvae on 5 potted plants | | | |
| Average size of stemborer larvae on 5 potted plants | | | |

# Week 10

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Biology of striga | 1 hour | Jembe, Basin, Water (to wash the roots), Tape measure to measure the height |

## Introduction

By now you can identify the striga weed and explain how it affects your crops. Our topic this week will help you understand how it grows and multiplies.

## Topic: Biology of striga

### Learning objectives

On completion of this topic participants will be able to understand and describe striga growth and multiplication.

### Learning activities

- Facilitator-led introduction on striga biology
- Observations on striga growth
- Discussions

### Procedure

**Step 1:** Measure the height of 10 striga infested plants that were marked in Week 6 and compare with 10 healthy plants.

**Step 2:** Observe and count the number of striga above the ground 15cm around the maize plant.

**Step 3:** Dig carefully 15 cm around the 5 smallest striga infested maize plants and lift them out with the soil around their roots.

**Step 4:** Wash the soil carefully from the roots and observe:

- How the striga roots are attached to the maize plant roots
- The number of striga plants that have come above the ground and those that have not emerged

**Step 5:** Record the number of striga per maize plant.

| Indicator | Observation | |
|---|---|---|
| | Push-pull plot | Check plot |
| Average Height of 10 healthy maize plants (in cm) | | |
| Average Height of 10 marked striga infested maize plants (in cm) | | |
| Average No. of striga plants around 10 marked maize plants | | |
| Average No. of striga plants below ground | | |

**General observations (AESA): Farmer's fields**

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • **Maize Push-pull plot** | | | | |
| • **Napier grass** | | | | |
| • **Desmodium** | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

Farmers' comments after the lesson: _____

_____

_____

_____

# Week 11

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Introduction to Profitability Analysis | 2 hours | All records, calculator, flip charts, marker pens; Record samples of receipts and expenses on crops and livestock enterprises; record sheets; and flip charts/chalkboards, markers, exercise books, pens. |

## Introduction

This lesson aims to familiarize participants with the basic methods of checking whether a farming enterprise is making or losing money.

This is what you would put in any activity on your farm (Costs):

- Money to buy inputs and pay hired workers
- The time your family and you spend on that enterprise

This is what you get out of the enterprise (income):

- Use it yourself and not have to buy it from the shop/market. You can then save the money you could have spent and use it for another enterprise
- Sell produce from that enterprise

You need to keep proper records of what you put in (cost) and what you get from any farming enterprise (income or benefit) so that you can know whether that enterprise is making money, or making a loss for you.

This lesson will introduce you to two main types of records called the **costs** and **benefits** records. You will learn why you need to keep them and how to use them.

## Topic: Introduction to Profitability Analysis

### Learning objectives

On completion of this topic participants will be able to:

- Explain the importance of recording costs incurred and benefits received
- Compare the costs and the benefits of two enterprises (Push-pull and Check plots)

### Learning activities

- Facilitator-led introduction on the importance of keeping receipts and expense records
- Exercise on provided examples of receipts (revenues) and expenses (costs)
- Calculating total expenses and total income
- Discussion on record keeping

### Recording expenses and receipts for push-pull and Check plots

**Step 1:** Facilitate discussion on costs related to farmers' own practices and Push-pull plots (seed, Napier, fertilizer, labour for land preparation, planting, weeding, etc.)

**Step 2:** List all the possible costs in both the Push-pull and Check plots.

**Step 3:** Facilitate discussion on possible incomes related to farmers' own practices and Push-pull plots (yield, fodder, milk, etc.).

**Step 4:** List all the possible incomes in both the Push-pull and Check plots.

**Step 5:** Facilitate brief discussion on how to keep good income records and how to calculate the total income received.

**Exercise on recording expenses (costs) and receipts (income)**

**Step 1:** Facilitator to explain the general procedure of the activity and participants' role in it.

**Step 2:** Ask one of the participants with experience of recording costs of farm inputs to develop a record sheet for expenses and incomes of a specific farm enterprise (e.g., crop).

**Step 3:** Ask another participant with experience of recording costs of farm inputs to develop a record sheet for expenses and income of another farm enterprise (e.g., livestock).

**Step 4:** Ask participants to calculate the total costs and the income received on both enterprises.

**Procedure for calculating expenses and income**

**Cost analysis of Push-pull and Check plot expenses**

| Activity | Input | Push-pull | | | Check plot | | |
|---|---|---|---|---|---|---|---|
| | | Qty | Unit price | Total value | Qty | Unit price | Total value |
| | | a | b | c = a x b | d | e | f = d x e |
| Land preparation | Labour<br>Equipment | | | | | | |
| Planting Desmodium, maize, Napier | Labour<br>Seed<br>Fertilizer | | | | | | |
| Weeding<br>Gapping | Labour | | | | | | |
| Top dressing | Fertilizer<br>Labour | | | | | | |
| Harvesting | Labour<br>Transport | | | | | | |
| Processing | Labour | | | | | | |
| | **Total Costs (T)** | | | | | | |

**Benefits Analysis of revenues from Push-pull and Check plot (After compiling benefits in each season)**

| Enterprise | Push-pull | | | Check plot | | |
|---|---|---|---|---|---|---|
| | Qty | Unit | Gross value | Qty | Unit | Gross value |
| Maize - (bags) | | | | | | |
| Napier- 10 kg (bundles/wheelbarrows) | | | | | | |
| Desmodium- (3 kgs) | | | | | | |
| (Other produce) | | | | | | |
| **Total Gross value** | | | | | | |

## General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 12

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Group assessment | 4 hours | All records, calculator, flip chart, marker pens; record samples of receipts and expenses on crops and livestock enterprises; record sheets; and flip charts/ chalkboards, markers, exercise books, pens. |

## Introduction

Now you have been working together as a group for 16-17 weeks, and you have had time to apply on your farm what you have learnt in the field school. It is time to go out and see what you and your colleagues have done so that you can all learn from each other's experiences.

This is the second group learning activity since you started the Push-pull farmer field school. At this stage you have mature Push-pull fields.

## Topic: Group assessment

### Learning objective

The objective of this group learning activity is to maximize interactive learning through group evaluation of individual farm activities related to the FFS experiment.

### Learning activities

- Facilitator-led introduction on the procedure of doing group evaluations
- Farm visits in groups formed in Week 3
- Discussion of group results

### What to do in the assessment

**Step 1:** Join the groups that you formed in Week 3. Each group can be made up of 4-6 members.

**Step 2:** Visit each farm represented by the members in the group.

**Step 3:** Use the table below to assess the Push-pull and the Check plots, and discuss with the host farmer. Rate each farmer using this scale:

1 = Poor 2 = Average 3 = Good

| | Push-pull plot | | Check plot | |
|---|---|---|---|---|
| | Rating | Comments | Rating | Comments |
| **What to check** | | | | |
| Establishment of maize | | | | |
| Weeding of maize | | | | |
| Establishment of Napier | | | | |
| Weeding of Napier | | | | |
| Establishment of desmodium | | | | |
| Weeding of desmodium | | | | |
| Record keeping | | | | |
| Total rates | | | | |

Comment on Desmodium seed multiplication plot (Rate 1 – 3) _____

(1 = Poor 2 = Average 3 = Good)

Other comments _____
_____
_____

**General observations (AESA): Farmer's fields**

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop Health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 13

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Harvesting Napier and desmodium from Push-pull | 1 hour | A panga, ruler or tape measure, jembe, chopping log, gunny bags, polythene sheets |
| 2 | Utilization of Napier and desmodium from Push-pull | 1 hour | |

## Introduction

One of the benefits of Push-pull is the rich fodder that can be used to improve the productivity of your livestock. As long as you practice Push-pull, you will have fodder to feed your livestock. This lesson will show you how to use fresh Napier grass and desmodium to feed your livestock and provide you with your first benefit from your Push-pull plot.

## Topic 1: Harvesting Napier and desmodium from Push-pull

### Learning objective

On completion of this topic participants will demonstrate how to correctly and systematically harvest Napier from a Push-pull plot.

### Learning activities

- Facilitator–led introduction on importance of harvesting Napier and desmodium at correct stage and in a systematic manner
- Practical activities on Napier grass harvesting
- Practical activities on desmodium harvesting
- Facilitator-led discussion on fodder production from Push-pull. (Lead question: What are the advantages and disadvantages of weeding and applying slurry daily or after harvesting an entire row?)

**Note**

*The best time to harvest Napier grass to feed your livestock is when the grass is 3 to 4 ft (1 to 1.5 metres) high. Do not let your Napier to get too old (to form canes) because it becomes poor quality livestock feed.*

**Step 1:** Start harvesting the inner row nearest the maize and harvest this row around the field first, **as much as your livestock needs each day (see ration tables at the end of this lesson)**. Always leave a stem height of 2 to 4 inches (5 to 10cm) from the ground at harvesting.

**Fig 40. Harvesting Napier grass**

**Step 2:** After you have completed harvesting the inner row, start harvesting the middle row. As you cut the grass weed, apply manure, slurry or CAN between the cut lines.

### How to correctly harvest desmodium for fodder

The best stage for harvesting desmodium is when it has covered the ground and is starting to flower. For the first season, desmodium can be ready for harvesting when maize is physiologically mature.

Start harvesting desmodium from one side of the plot as per the daily utilization needs. Collect and take it to the feeding place. See topic on feed utilization below. Always leave a stem height of 2 to 4 inches (5 to 10cm) from the ground at harvesting. See Fig 41.

**Fig 41. Harvesting desmodium**

### What NOT to do

- Do not cut or harvest the Napier grass across the Napier rows so as to leave an opening into the Push-pull maize plot.
- During the first season do not harvest the desmodium until it has established well, or if it has not covered the ground.

## Topic 2: Utilization of Napier and desmodium from Push-pull

### Learning objective

On completion of this topic, the participants will demonstrate how to prepare and mix Napier grass and desmodium to feed livestock.

### Learning activities

- Facilitator–led introduction on the importance of a balanced animal ration
- Facilitator–led discussion on importance of Napier and desmodium as feed
- Practical activities on Napier grass and desmodium chopping
- Practical activities on desmodium and Napier ration mixture making
- Discussion on utilization of Push-pull products

### How to correctly utilize fodder from Push-pull

During the wet season cut Napier and leave it in the open for at least 30 minutes before chopping. This allows the Napier to lose some water (wilt) and increases the roughage eaten by the livestock.

**Step 1**: Carry the harvested fodder to the chopping area, preferably near the feeding area.

**Step 2**: Chop the harvested Napier grass and desmodium separately into small pieces of about 1 inch (2 cm).

**Fig 42. Chopping desmodium and Napier grass and feeding to livestock**

**Step 3**: Mix three parts of chopped Napier with one part of chopped desmodium.

**Note**

- *To avoid wastage the chopped forage should be fed to livestock in a feed trough.*
- *During the dry season, chop the maize stover (see utilization of Maize stover in Week 17) into small pieces and mix with the chopped Napier grass and desmodium.*

■ Always remember to give your livestock the recommended mineral supplements.

### What NOT to do

Never allow livestock to graze in the Push-pull plot as they will destroy the desmodium and the Napier grass.

### Napier grass and desmodium requirements for various breeds of livestock during the rainy season

| BREED | Napier grass | | desmodium | | Total forage | |
|---|---|---|---|---|---|---|
| | Kg/day | Gunny bags/day | Kg/day | Gunny bags/day | Kg/day | Gunny bags/day |
| Friesian/Ayshire | 68 - 82 | 1.47-1.78 | 22 - 28 | 0.47-0.60 | 90 - 110 | 1.94- 2.38 |
| Guernsey/Jersey | 49 – 64 | 1.06- 1.39 | 16 - 21 | 0.34-0.45 | 65 - 85 | 1.40- 1.84 |
| Zebu cattle | 49 | 1.06 | 16 | 0.34 | 65 | 1.11 |
| Dairy bull | 34 – 49 | 0.74 -1.06 | 11 - 16 | 0.24 - 0.34 | 45 - 65 | 0.98- 1.40 |
| Dairy goat | 7.5 - 11 | 0.16- 0.24 | 2.5 - 4 | 0.05-0.08 | 10 - 15 | 0.21- 0.32 |

### Napier grass and desmodium requirements for various breeds of livestock during the dry season

| BREED | Napier grass | | desmodium | | Total forage | |
|---|---|---|---|---|---|---|
| | Kg/day | Gunny bags/ day | Kg/day | Gunny bags/ day | Kg/day | Gunny bags/ day |
| Friesian/Ayrshire | 53 - 60 | 1.15 – 1.30 | 17 - 20 | 0.36 – 0.4 | 70 - 80 | 1.51 - 1.70 |
| Guernsey/Jersey | 41 – 49 | 0.89 – 1.06 | 14 - 16 | 0.30 – 0.35 | 55 - 65 | 1.19 - 1.21 |
| Zebu cattle | 39 | 0.84 | 14 | 0.30 | 55 | 1.14 |
| Dairy bull | 26 - 39 | 0.56 – 0.84 | 9 - 14 | 0.2 – 0.3 | 35 - 55 | 0.76 - 1.14 |
| Dairy goat | 6 – 10 | 0.13 - 0.21 | 2 - 3 | 0.04-0.06 | 8.5–13.5 | 0.17 - 0.27 |

**Note**

*One gunny bag of chopped material weighs approximately 46 kg*

## Labour Costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Push-pull plot | Harvesting 10 kg of Napier grass * | | | | |
| | Harvesting 3 kg of desmodium* | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |

**These amounts can feed one dairy goat per day.*

**Note**

*Now that you have calculated the cost of cutting fresh fodder you do not have to do this again. All you have to do is enter in the table below the amount of fodder you use each week.*

## Benefits

| | Type of benefit | Quantity | Amount (market price) |
|---|---|---|---|
| Push-pull plot | 10 kg Napier grass | | |
| | 3 kg Desmodium | | |
| | Other benefit | | |

## General Observations (AESA): Farmer's Fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop Health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 14

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Conserving Napier and desmodium from push-pull | 3 hours | A panga, chopping log, gunny bags, polythene sheets, molasses, water, buckets, sprinkler [sample of silage and hay (optional)], a hoe and a 120 litre drum full of water. This is for pressing down the fodder. |

## Introduction

One of the benefits of Push-pull is the rich fodder that can be used to improve the productivity of your livestock. In a good rainy season farmers may have surplus forage beyond what the animals can eat. The excess fodder can be conserved for dry season feeding. This lesson will show you how to conserve the excess or surplus Napier grass and desmodium for use when needed.

## Topic: Conserving Napier and desmodium from Push-pull

### Learning objectives

On completion of this topic, participants will be able to demonstrate how to correctly conserve and utilize surplus fodder and crop residue from the Push-pull plot.

### Learning activities

- Facilitator-led introduction on the importance of dry season feeding and forage conservation
- Practical activities on silage making
  - pit silage
  - gunny bag silage
- Discussion on conserving Push-pull products

### How to make silage from surplus Push-pull fodder

Making silage is a way of conserving fodder without losing much of its quality. In this way fodder can be preserved for several years. The method used in silage making is determined by available materials and the farmers' needs. Small scale farmers can use either the gunny bag or small pits system.

### Making silage in a gunny bag

**Step 1**: Cut and wilt the Napier and desmodium, before chopping (30 minutes to 1 hour).

**Step 2**: Chop the grass and desmodium separately into pieces of about 1- 4 inches (2 -8 cm)

**Fig 43. Chopping desmodium and Napier grass**

**Step 3**: Mix 3 parts of chopped Napier with 1 part of chopped desmodium.

**Step 4**: Spread 50 to 70 kg of the chopped Napier and desmodium mixture on a polythene sheet or a gunny bag on flat ground.

**Step 5**: Dilute 1 litre of molasses with 3 litres of water.


**Fig 44. Diluting molasses with water**

**Step 6**: Sprinkle the mollases-water mixture on the chopped Napier and desmodium mixture as evenly as possible. Turn and mix the forage repeatedly to ensure an even spread of the molasses on the material.

**Step 7**: Put the material into a polythene lined gunny bag and compact it thoroughly using a pestle or heavy stick until the bag is almost full. Leave enough space to tie the top of the bag.

**Fig 45. Putting the mixture of desmodium and Napier grass in the gunny bag**

**Step 8**: Tightly tie the end of the bag with a string ensuring that no air remains in the bag. Air in the bag ruins the silage.

Store the silage filled bag upright, away from sunlight or rain. Place a weight like a heavy stone, on the tied end of the bag to maintain the compacting.

### Making silage in a pit

**Step 1:** Make a shallow pit, preferably on a slightly sloping ground. The depth of the pit should decrease from the higher ground to the lower ground giving a wedge-like shape.

For small scale production a pit of 8ft x 4ft x 3ft deep is enough to produce about 1000 kg of silage. If you do not have enough material you can dig a smaller pit.

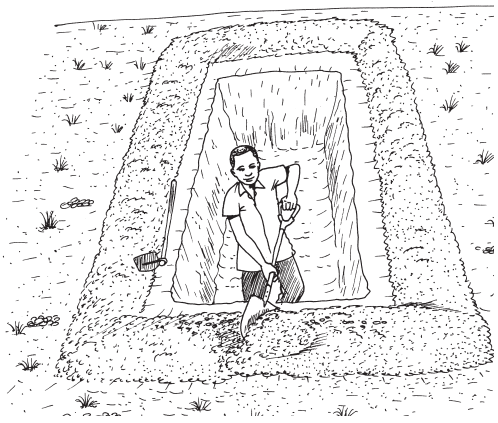

**Fig 46. Digging shallow pit for silage**

**Step 2**: Prepare a mixture of molasses and water: You need 20 litres of molasses with 60 litres of water. This is enough for the whole pit.

**Step 3:** Chop the forage to lengths of about 1- 4 inches long using a panga or a chaff cutter.

**Step 4:** Spread polythene sheeting over the sides and floor of the pit so that the chopped materials do not come into contact with soil.

**Step 5:** Pour the chopped material into the polythene lined pit. Spread evenly until the pit is one third ($^1/_3$) full. Use the drum of water to compact the mixture (Fig 47).

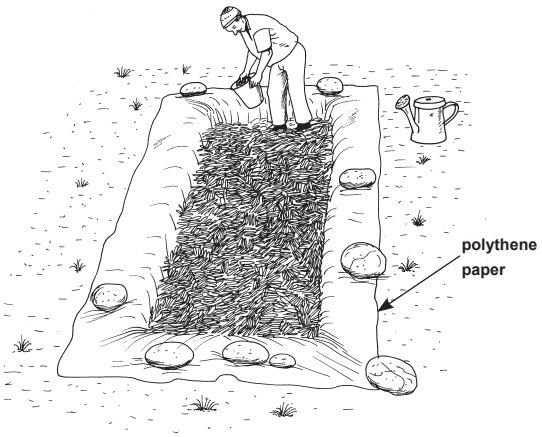


**Fig 47. Filling the silage pit**

**Step 6:** Stir the mixture prepared in Step 2. Take out 40 litres and sprinkle evenly over the chopped forage in the silo. (You can also use a garden sprayer).

**Step 7:** For subsequent additions add and spread 2 bags of chopped material, sprinkle with the molasses mixture evenly and compact with the drum (Fig 48). You can also use a log of wood to compact the mixture.

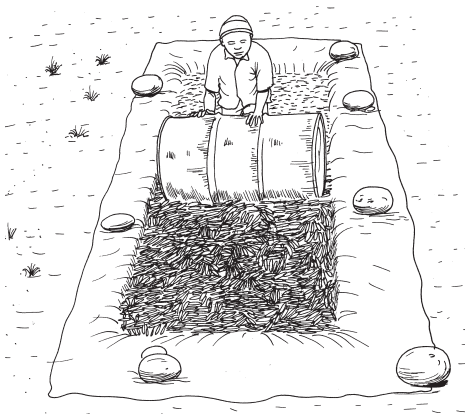

**Fig 48. Compacting silage with a drum**

**Step 8:** Repeat Step **7** until the pit is full. Remember to stir molasses mixture each time before drawing.

**Step 9:** Repeat Step 6 and 7 until the pit is full and dome shaped.

**Step 10:** Cover the pit after a final pressing with a polythene sheet and dig a small trench around the sides of the pit. Then cover with a soil layer of at least 1ft (30cm) thickness to keep the air out, prevent poly thene damage (by rain, birds and rodents) and to further compress the material.

**Note**

*The silage made should be ready for use in one month (30 days). Under proper storage conditions i.e., not allowing air and water into the silage, silage can be kept for up to 3 years.*

## Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Silage making | Digging pit | | | | |
| | Harvesting and chopping Napier grass | | | | |
| | Harvesting and chopping desmodium | | | | |
| | Filling and compressing pit | | | | |
| | Other activities | | | | |
| **Total** | | | | | |

## Costs

| | Input used | Quantity used | Cost |
|---|---|---|---|
| **Silage making** | Molasses | | |
| | Gunny bags | | |
| | Polythene sheets | | |
| | Other items | | |
| **Total** | | | |

## Benefits ( Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg desmodium (1 Unit) | | | |
| | Milk | | | |
| | Other benefit | | | |

## General Observations (AESA): Farmer's Fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 15

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Using gross margins in profitability analysis | 2 hourss | Record of receipts and expenses (optional); record sheets; calculator, and flip charts/chalkboards, markers, exercise books, pens. |

## Introduction

When establishing a new enterprise, it is important to consider the economic value it will contribute to your whole farm business. There are three ways of calculating this: the **gross margin**, **return to land** and **return to labour.** Gross margin is the simplest and the most commonly used.

Gross margin is difference between the gross income earned from an enterprise and the variable costs (see the table) incurred in the enterprise for a given period of time (usually per year or per cropping season). A gross margin enables you to evaluate the performance of enterprises that have similar requirements for capital and labour.

Gross margins provide a useful tool in terms of farm management, budgeting and estimating the likely **returns or losses** of a particular enterprise (say, crop). They can therefore help you to improve your management or streamline your production.

This week's lesson will show you how to calculate gross margins of Push-pull and Check plot enterprises on your farm. The same approach can be used in determining gross margins of any other enterprises on your farm.

## Topic: Using gross margins in profitability analysis

### Learning objectives

On completion of this topic participants will be able to:

- Explain the importance of gross margins and how to use it
- Calculate gross margins for the two farm enterprises: Push-pull and Check plots

### Learning activities

- Facilitator-led introduction on the importance of gross margins and how to use it (Provide examples of receipts and expenses from growing a given crop in a given season)
- Calculate total revenues (income) received and total expenditures (all the input costs and the cost of all hired services) incurred to get gross margins.
- Facilitator-led discussion on importance of gross margins

### Procedure of calculating gross margins

**Step 1:** Facilitator to explain the general procedure of the activity and the participants' role in it.

**Step 2:** Using the previous records of costs incurred on the Push-pull and Check plots, the participants add up all the variable costs incurred, e.g., costs of seed, Napier, fertilizer, labour costs.

**Step 3:** Similarly, using the records of incomes from the Push-pull plot and Check plot the participants add up all the income received, if any from maize, fodder, milk etc. If no income has been received, reaonable imaginary numbers can be used to learn how to calculate gross margins.

**Step 4:** Subtract the total expenses from the total income to get the gross margin.

**Step 5:** Compare the gross margins from the Push-pull and the Check plots per unit area

(per-acre/hectare basis). This is a useful means of comparing the enterprises against each other.

**Note**

**Variable costs***: These are costs that vary directly with the level of output of an activity. For example, if the area under maize is increased by 50% then seed, fertilizer, and labour will also increase (though not necessarily by about 50%). Variable costs may determine the yield (level of output) of that activity.*

**Fixed costs***: These are costs that do not vary with the level of output of an activity. Example: If you own land that is your fixed cost.*

**Total variable costs** (TVC) = Inputs + Operational + Equipment costs

**Total revenue** (TR) = Revenue from Maize + Desmodium + Napier +…

**Gross Margin** = **TR - TVC**

## Cost analysis of Push-pull and Check plots

| Activity | Input | Push-pull | | | Check plot | | |
|---|---|---|---|---|---|---|---|
| | | Qty | Unit price | Total value | Qty | Unit price | Total value |
| | | a | b | c = a x b | d | e | f = d x e |
| Land preparation | Labour<br>Equipment | | | | | | |
| Planting Desmodium, maize, Napier | Labour<br>Seed<br>Fertilizer | | | | | | |
| Weeding/ Gapping | Labour | | | | | | |
| Top dressing | Fertilizer<br>Labour | | | | | | |
| Harvesting maize | Labour<br>Transport | | | | | | |
| Harvesting fodder | Labour | | | | | | |
| Making silage | Labour<br>Inputs | | | | | | |
| Processing | Labour | | | | | | |
| | Total costs (T) | | | | | | |

**Benefit analysis of Push-pull and Check plot** (After compiling benefits in each season)

| Enterprise | Push-pull | | | Check plot | | |
|---|---|---|---|---|---|---|
| | Qty | Unit | Gross value | Qty | Unit | Gross value |
| Maize - (bags) | | | | | | |
| Napier- Units of 10 Kg | | | | | | |
| Milk | | | | | | |
| Other produce | | | | | | |
| Total Gross value | | | | | | |

**Benefits** ***( Please keep filling the number of units each week as you cut)***

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | Milk | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's fields**

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop Health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 16

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Animal manure collection, storage and application to Napier grass | 1 hour | Shovels, jembes, wheelbarrows, basins, drum, zero grazing unit with slurry pit, well decomposed manure, panga or a sickle, string, gunny bag, rake. |
| 2 | Collecting, storing and applying slurry to Napier grass | 30 minutes | |
| 3 | Making and utilizing desmodium hay | 2 hours | |

## Introduction

Push-pull has many by-products. Some of them are useful in improving the soil health on the Push-pull and on other parts of the farm. This lesson will show you how to use compost, manure and slurry from animals to improve your land. The lesson will also show you how to conserve some of the by-products of Push-pull to feed your animal.

## Topic 1: Collecting, storing and applying animal manure on Napier grass

Napier grass is a heavy feeder of soil nutrients, and the soil needs to be replenished regularly. Farm yard manure is a good and cheap way of doing this. The best results can be achieved during the rainy season.

Farm yard manure is a decomposed mixture of livestock dung and urine with straw and litter used as bedding material and residue from the fodder fed to the livestock. Manure improves soil fertility where fodder and crops are grown. Manure also improves the soil texture and the capacity the soil to absorb and hold water.

### Learning objective

On completion of this topic participants will:

- Understand the importance of farm yard manure
- Collect and store manure
- Apply manure to Napier grass

### Learning activities

- Facilitator–led introduction to importance of farm yard manure and handling to apply it to Napier grass
- Practical activities on collection, storage and manure application to Napier grass
- Facilitator–led discussions (lead question: what makes good quality manure?)

### Procedures

#### (1) How to collect and store manure

**Note**

*Manure quality will be good if the cows are fed with high quality feed such as legumes and Napier grass.*

**Step 1:** Collect manure from the animal boma regularly and heap in a pit or above the ground under a shade.

**Step 2:** Turn the manure using a shovel or a jembe at most twice a month to ensure all the material is well decomposed.

- Leave the well decomposed manure under the shade until you are ready to use it

#### (2) How to apply manure to Napier grass

**Step 1:** After cutting the Napier grass, first apply manure and then weed. This allows the manure to mix well with the soil.

**Step 2:** Spread two handfuls of well decomposed manure on and around the base of cut Napier and weed.

### What NOT to do

Do not heap soil and manure on Napier grass during weeding. This will expose the shallow roots and reduce the plant growth.

## Topic 2: Collecting, storing and applying slurry to Napier grass

Cattle slurry is a mixture of cow dung, urine, and feed left over, available from the zero-grazing stable.

### Learning objective

On completion of this topic participants will demonstrate how to collect, store and apply slurry to Napier grass.

### Learning activities

- Facilitator–led introduction to the importance and use of slurry
- Practical activities on slurry application to Napier grass
- Facilitator-led discussion

### How to collect and apply slurry to Napier grass

**Step 1:** Collect fresh slurry in a pit or drum and allow to 'mature' by keeping it covered for at least 2 weeks.

**Step 2:** Pour mature slurry in furrows dug between Napier grass rows and cover with soil. This will reduce loss of Nitrogen. Best results can be achieved if this is done after harvest during the rainy season.

**Note**

*600 to 700kg of liquid slurry is enough for Napier grass in a 21 m by 21 m Push-pull plot for a year.*

### What NOT to do

- Do not spread the fresh slurry directly on Napier grass or you will burn it.
- Never leave the slurry pit or drum uncovered because it will lose nitrogen.

## Topic 3: Making and utilizing desmodium hay

# Introduction

You can use the desmodium you trim from your plot to feed your livestock. The surplus can then be conserved in the form of hay for use later.

### Learning objective

On completion of this topic participants will demonstrate how to make and utilize desmodium hay.

### Learning activities

- Facilitator–led introduction to the importance of and the procedures for making quality hay from desmodium
- Practical activities on desmodium hay making and utilization
- Facilitator-led discussion on importance and procedures of desmodium hay making

### Source of material for making hay

- The trimmed desmodium during (**Season 2**, **Week 6** and **8**)
- When you cut back desmodium after the seed has been harvested (**Season 2, Week 21**)

**Note**

*For the first season, desmodium can be ready for harvesting when maize is physiologically mature.*

### Procedure

**Step 1:** Cut half a row of desmodium, transfer immediately to a shade. Spread to dry. Always leave a stem of 2 to 4 inches (5 to 10cm) high from the ground at harvesting.

**Note**

*You will need the desmodium vines from the Push-pull plot to establish your new Push-pull plot in the second season. Once you have the vines from the new plot you can harvest all the desmodium and make hay. You can make desmodium hay from any amount of desmodium.*

**Step 2:** Use a rake to turn the cut desmodium once a day to allow for quick wilting. Avoid over-drying the hay. 2 to 4 days drying is sufficient depending on the moisture content of the plant. Well dried hay should not break easily on handling.

**Step 3:** Collect and store the hay in a dry place away from rain and any form of moisture. If you leave it outside, cover with tarpaulin or polythene sheet. For small amounts put in bundles or gunny bags and keep in a store.

## How to make bales

For large amounts you can reduce the space needed for storage by making bales.

**Step 1.** Make a bottomless wooden baling box 3 feet by 2.5 feet by 2.5 feet. Arrange strings across the box as shown in Fig 49.

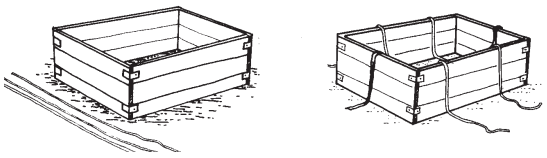

**Fig 49. Bottomless wooden boxes**

**Step 2:** Put the hay in the box in layers.

**Step 3:** Compress by trampling on the material in the box (Fig 50).

**Fig 50. Putting and compressing hay**

**Step 4:** Once the box is full and compacted, tie the strings from the opposite sides of the box very tightly (Fig 51). Properly compressed hay should weigh 15-20 kg.

**Fig 51. Tying the box**

**Step 5:** Remove the bale from the box and store in a raised place free of moisture (Fig 52). Allow plenty of air circulation to prevent mould from forming.

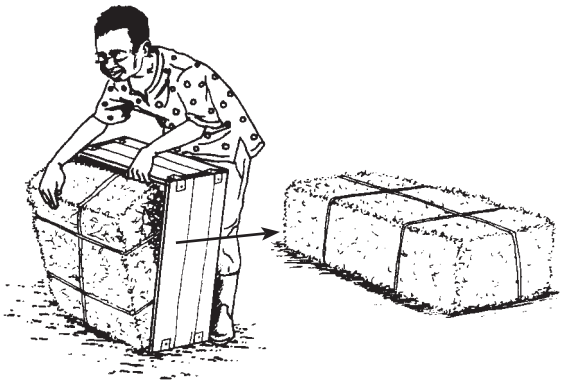

**Fig 52. Removing the bales from the box**

Use the desmodium hay to improve the nutritive value of Napier grass. Mix one part of desmodium hay to five parts of chopped fresh Napier grass (1:5).

**Refer to desmodium feeding table in week 13.**

## What NOT to do

- Do not dry the cut desmodium directly in the sun
- The desmodium hay should not be exposed to rain

**Labour Costs**

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Push-pull plot | Harvesting desmodium | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |

**Benefits** ( Please keep filling the number of units each week as you cut).

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (1 unit) | | | |
| | Milk | | | |
| | Other benefit | | | |

**General Observations (AESA): Farmer's Fields**

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 17

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Recording desmodium pests | 2 hours | Plastic jars or clear bottles, clear plastic bags for handling the beetles |

## Introduction

Blister beetles are the most common pests of desmodium. They are brightly coloured beautiful insects. They have orange/yellow or red bands (spots) on their backs often with coloured antenna. However, some types of Blister beetles have uniform metallic black colour. Blister beetles are also major pests of other crops such as okra, cowpeas, beans and sweet potatoes.

Adult beetles eat up the flowers of desmodium so that you do not get any seeds from the affected plant. The larvae do not feed on desmodium; they feed on grasshopper eggs.

Blister beetles appear on desmodium around October/November just after the rains.

They are called Blister beetles because if you touch them they produce a chemical that can cause blisters on your skin.

## Topic: Recording desmodium pests

### Learning objectives

On completion of this topic participants will identify and record some common types of Blister beetles found in desmodium crops

### Learning activities

- Facilitator led introduction on importance of recording desmodium pests
- Practical exercise (Field walks to collect Blister beetles)
- Discussion (Lead question: How important are blister beetles and other flower pests to farmers?)

**Step 1:** Walk in the desmodium plot and collect samples of Blister beetles. Use plastics bags or gloves. Do not handle them with your bare hands. Use the drawings to identify the Beetles.

**Step 2:** Walk around the farm and record the number of Blister beetles on different crops.

**Step 3:** Destroy the beetles.

At the moment there is no affordable method to control Blister beetles for small scale farmers. The record you are making now will help scientists to develop affordable control measures.

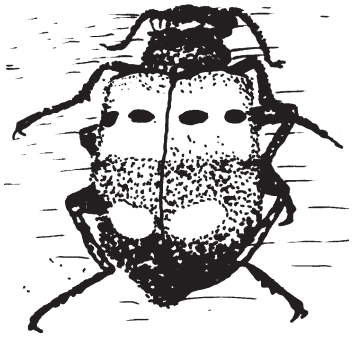

**Fig 53. Blister beetle**

| Plot | Type 1 | Type 2 | Type 3 | Type 4 | Grasshoppers |
|---|---|---|---|---|---|
| Established Push-pull plot | | | | | |
| Desmodium multiplication plot | | | | | |
| Check plot | | | | | |
| Other crops | | | | | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |

*Please write the name of the crops*

### Benefits (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (1 unit) | | | |
| | Milk | | | |
| | Other benefit | | | |

### General observations (AESA): Farmer's fields

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 18

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Harvesting maize | 2 hours | Tape measure, weighing balance, panga, wheelbarrows or sacks for carrying the maize cobs, poles, string. |
| 2 | Storing maize stover | 45 minutes | |

## Introduction

This is the time you have been waiting for. Your maize is now ready for harvesting and storing. This lesson discusses when and how to harvest and store maize.

You have two plots: The Push-pull and the Check plot. Make sure that you harvest each plot separately and keep the maize from each plot separately. This will help you to know the difference in yields between the two plots.

## Topic 1: Harvesting maize

### Learning objective

On completion of this topic participants will be able to:

- Explain the right time to harvest maize
- Demonstrate how to harvest maize

### Learning activities

- Facilitator-led introduction on timing of maize harvesting
- Practical exercise:
  - Measuring the height of the maize
  - Harvesting
  - Dissecting some stalks to check for stemborers
- Discussions (Lead questions: What is the relationship between maize height and yield? What happens to the stemborers that are in the stover?)

### When to harvest maize

- The grain crop can be harvested when cob-sheath turns brownish and grains become hard and shiny
- In high altitude areas, maize may take up to a month longer to mature
- The difference in length of growing season between early and late hybrids is more in the number of days from planting to silking than in the days from silking to maturity

### How to harvest maize

There are two methods of maize harvesting:

1. **Plucking of cobs**: The maize cobs are removed from the standing plants and placed in the open to dry in the sun. The maize stalks are later cut and fed to animals.
2. **Stalk cutting**: The plants are cut and piled up in the field and the cobs are removed when they are dry. The dried stalks are fed to animals.

### Sorting and drying of maize cobs

- After harvest, sort out all off-type maize cobs, particularly those showing different colours and texture, and the diseased cobs, before placing them in bins to dry
- A good sorting at this time considerably reduces the task of sorting after the maize cobs have been dried to the desired extent (10 to 15 percent moisture content)

**Step 1:** Starting from one corner of a plot walk to the opposite corner (diagonally). As you walk stop at **every fifth plant**, measure and record its height and then cut it at the base. Carry all the plants you have cut out of the plot and dissect them. Observe and record the number of stemborer larvae and pupae.

**Step 2: Harvest the maize**

- **Cob plucking method**: Harvest and take the weight of the cobs in both the Push-pull and the Check plots and leave them in the open to dry.
- **Stalk cutting method**: Leave stalks from Push-pull and Check plots in separate piles until they are dry. Then take the weight of cobs. Keep the records from the two plots separately.

**Step 3:** Walk through the plot and randomly select 30 stalks from the Push-pull plot and 30 stalks from the Check plot and dissect them. Count the number of stemborer larvae and pupae in each stem.

## Topic 2. Storing maize stover

### Introduction

Maize stover from your last crop can be used to feed your livestock. Apart from providing feed during the dry season when other materials are in short supply, this also helps remove stemborer larvae and pupae from the field.

#### Learning objective

On completion of this topic participants will demonstrate how to store and utilize maize stover.

#### Learning activities

- Facilitator–led introduction on the importance of maize stover as a dry season livestock feed
- Practical activities on maize stover storage and utilization
- Discussion

#### How to store maize stover

Maize stover can be stored either loose or baled. Loose storage is easier for the small scale farmer.

**Step 1:** Cut and assemble stover into bundles that are easy to carry.

**Step 2:** Identify the place for storage. This can be against a tree or three poles tied together at the top. This should be placed under a shade.

**Step 3:** Carry the stover to the selected storage place. Stack it in a slanting position to allow the rain water to run off (Fig 54). This will ensure that only the stover on the surface will be spoiled while the inner ones retain their good quality.

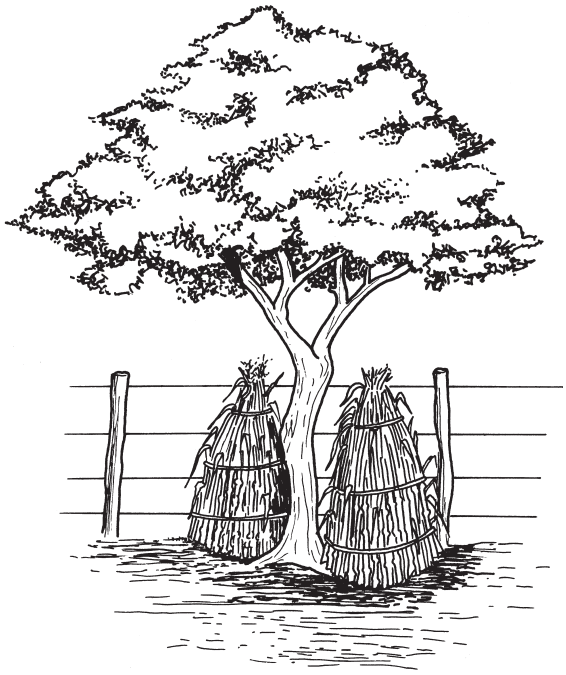

**Fig 54. Storing maize stover in a shade**

**Step 4:** To feed stover to your animals cut it into small pieces (2 to 4 inches) as per your daily need. Stover is not very good quality feed and protein rich materials like desmodium hay and fodder should be added to it.

**Note**

*Make sure you have used up all the stover before the start of the next season or the stemborers that are in the stover will go to your new crop.*

#### What NOT to do

Do not leave stover intended for livestock feed on the ground in the Push-pull farm.

**Labour costs**

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Push-pull plot | Harvesting maize | | | | |
| | Collecting and stacking stover | | | | |
| | Other activity | | | | |
| **Total** | | | | | |
| Check plot | Harvesting maize | | | | |
| | Collecting and stacking stover | | | | |
| | Other activity | | | | |
| **Total** | | | | | |

**Estimated benefits**

| | Estimated quantity | Value |
|---|---|---|
| Stover from Push-pull | | |
| Stover from Check Plot | | |

**Benefits** (Please keep filling the number of units each day as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (1 unit) | | | |
| | Milk | | | |
| | Other benefit | | | |

### General Observations (AESA): Farmer's Fields

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Observations** | | | | **Farmer's comments** |
| | Low | Medium | High | |
| Rainfall | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

### Stemborer assessment at harvest

| Indicator | Observation | |
|---|---|---|
| | Push-pull | Check Plot |
| Number of stemborer larvae on 5 damaged plants | | |
| Average size of stemborer larvae on 5 damaged plants | | |

# Week 19

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Shelling and storage of maize | 1 hour | Gunny bags, balance, 2kg tins (gorogoro), maize sheller (optional) |
| 2 | Harvesting desmodium pods | 45 minutes | |

## Introduction

This week has two topics:

- Shelling and storage of maize
- Harvesting desmodium pods

## Topic 1: Shelling and storage of maize

Last week you discussed when and how to harvest maize. You then harvested the maize. This week you will look at how to shell and store the maize.

**Note**

*It is important to select only healthy and clean cobs for shelling. The diseased and rotten cobs must be destroyed because they may contain aflatoxin that is poisonous to you and to your livestock.*

***Do not eat or feed them to your livestock.***

- After harvest, cobs must be dried in the sun for 4 to 5 days and shelled when completely dry (at 10 to 15 per cent moisture). If you do not dry the maize well, it can attract storage pests which may bring aflatoxin
- Shelling can be done by hand or power sheller
- After shelling, the grain should be dried for 3 or more days, cleaned and stored in a dry place protected from rats
- After removing the grains, the cobs can be used as livestock feed particularly during the dry season

### Learning objectives

On completion of this topic participants will be able to:

- Explain the appropriate methods of shelling and storing maize
- Demonstrate how to shell and store maize

### Learning activities

- Facilitator-led introduction on maize shelling and storage
- Practical exercise:
  - Shelling the maize cobs
  - Cleaning and weighing, shelled maize
  - Recording weights of shelled maize
- Discussions

### Things to do

**Step 1:** Shell the cobs that you harvested and left to dry last week.

**Step 2:** Clean and weigh them. Keep separate records for Push-pull and for Check plots.

## Topic 2: Harvesting desmodium pods

After you have harvested maize you can start harvesting desmodium pods. You can continue harvesting the pods for another 2-3 weeks. As not all the pods will be ready at the same time, today we will discuss when and how to harvest mature pods.

### Learning objective

On completion of this topic participants will be able to:

- Explain the appropriate method of harvesting desmodium pods
- Demonstrate how to harvest desmodium pods

## Learning activities

- Facilitator-led introduction on desmodium harvesting
- Practical exercise:
  - Harvesting desmodium pods
- Discussions

## Things to do

**Step 1:** Walk around the edge of the Push-pull plot and pick pods that are either green, yellow or brown.

**Step 2:** Break open the pods and observe the seeds inside.

- The seeds inside the green pods are soft and green and not ready for harvesting
- In the yellowish or brownish pods the seeds are brownish green and hard. These are ready for harvesting

**Note**

*If you delay harvesting when the pods are brownish, you will lose the seeds as the pods may fall due to rain and wind.*

**Step 3:** How to harvest the pods

- Harvest the pods every 3 – 4 days when the pods have turned yellow and brown
- Put on an apron made of polythene material. This stops the pods from sticking to your clothes
- Walk through the plot and hand-strip the ripe pods and place them in an open tin (Fig 55)

**Fig 55. Harvesting desmodium pods**

- Keep the open tin in a shaded but secure place for 3 days. This will allow them to ferment
- After the 3 days dry them in the sun for another 4 days

**Note**

*One acre of well managed and properly harvested desmodium seed crop can give 50 to 60 kg of seed. In Kenya, this can earn a farmer between Ksh 30,000/= and 50,000/= when sold at the current market price of Ksh 600/= to 800/= per kg of seed.*

## Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Push-pull plot | Harvesting desmodium pods | | | | |
| | Shelling maize | | | | |
| | Other activity | | | | |
| **Check plot** | Shelling maize | | | | |
| | Other activity | | | | |

**Benefits** (Please keep filling the number of units each day as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (1 Unit) | | | |
| | Milk | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 20

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Processing and marketing desmodium seeds | 2 hours | Weighing balance, containers (2 Kg tins), a flat grinding stone, rubber sole of an old shoe, wire mesh (30cm by 30 cm), polythene clothing, Jembe, Panga, clear polythene bags. |
| 2 | Improving soil fertility | 45 minutes | |

## Introduction

Desmodium seed is very valuable either for expanding your push-pull or for sale. In this topic we discuss the processing of the pods harvested in Week 19. We also discuss how you can market your seeds.

## Topic 1: Processing and marketing desmodium seeds

### Lesson objective

On completion of this topic participants will learn how to process and discuss how to market their desmodium seeds.

### Learning activities

- Facilitator-led introduction on processing and marketing desmodium
- Practical work on seed processing
- Discussions (Questions to guide discussions: e.g., How can we create market for desmodium seeds?)

### Processing desmodium seeds

**Step 1:** After the pods have been sun-dried thresh them using a stone and an old rubber shoe sole (Fig 56).

**Fig 56. Threshing of desmodium pods**

You can also put the pods in a gunny bag and thresh them, but this can damage some of the seed and they will not germinate when planted.

**Step 2:** After threshing, winnow the seeds to remove husks and dust (Fig 57).

**Fig 57. Winnowing desmodium seed**

**Step 3:** Sieve the seeds using a 30 cm by 30 cm wire mesh (the type used for mosquito screen on windows). This will give you clean seed. Weigh the seeds.

**Step 4:** Store the seeds in a dry, clean tin or an airtight container.

**Step 5:** The husks can be used to feed your animals.

### Marketing desmodium seeds

Desmodium seeds are expensive and the farmer can sell them for extra income. Many farmers are taking up Push-pull and so they need the seeds. The seed companies are also looking for seeds to sell to more farmers.

The ready market for desmodium seeds comes with challenges. If you want to sell to seed companies, you need to be organized into a group so that you can be certified. In Kenya the recognized authority is the Kenya Plant Health Inspectorate Service (KEPHIS).

## Topic 2: Improving soil fertility

Taking good care of your soil will keep it healthy. Soils need enough moisture, air and supplies of food (soil nutrients). These help plants to grow better and sustain good living things in the soil, such as earthworms.

Push-pull plays an important role in conserving and improving the health of the soil.

The Napier grass that is grown around the maize crop helps conserve and improve soil fertility in many ways by:

- Stopping soil erosion through run-off
- Binding the soil and acting as a wind breaker

Desmodium helps improve soil health by:

- Providing good ground cover, thus preventing erosion and helping retain soil moisture during dry season
- Fixing nitrogen, thus enriching the soil with nutrients for growing plants
- Increasing soil fertility with leaves that fall on the ground as it grows

This lesson covers the various aspects of soil conservation and shows how Push-pull helps improve soil health.

### Learning objectives

On completion of this topic particiapnst will understand the important aspects of soil fertility and how Push-pull helps improve soil health.

### Learning activities

- Facilitator-led introduction on how to tell a healthy soil from poor soil
- Observations of soil fertility indicators
- Facilitator-led discussions

### How to tell if your soil is getting healthier

Here are things to observe in the Push-pull and the Check plot

| | | Push-pull plot | | Check Plot | |
|---|---|---|---|---|---|
| **Soil quality indicator** | **Soil quality indicator questions** | **Yes** | **No** | **Yes** | **No** |
| Organic matter | Is the soil getting darker? | | | | |
| Soil structure | Is the soil getting softer underfoot? Is it easier to work on? | | | | |
| Runoff | Does rain soak into the soil quickly? (Rain soaks fast and water does not stay on the surface.) | | | | |
| Soil moisture | Does the soil stay moist for longer period after rains? | | | | |
| Soil life (aeration) | Does the soil have many earthworms? Are there many holes in the soil, and worm casts on the surface? | | | | |
| Crops' health | Do your crops look vigorous and healthy? | | | | |
| Crop yields | Are your yields improving? | | | | |
| Root growth | Do the crop roots grow well? | | | | |
| Presence of Weeds | Do the soils have the type of weeds that like to grow on fertile soils? | | | | |
| If you answered *Yes* to these questions, your soil is getting better! | | | | | |

**Note**

*Improving soil can take several seasons. This is still an early stage to see much improvement.*

### Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (Hours) | Cost of labour per day | Total Cost of this Activity |
|---|---|---|---|---|---|
| Push-pull plot | Processing desmodium seed | | | | |
| | Other activity | | | | |

### Benefits from desmodium seed

| | Type of Benefit | Quantity | Unit Market price | Total Value |
|---|---|---|---|---|
| Push-pull plot | Desmodium seed | | | |
| | Desmodium husks | | | |
| | Other benefit | | | |

**Benefits** (Please keep filling the number of units each day as you cut)

| | Type of Benefit | Quantity | Unit Market price | Total Value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (1 unit) | | | |
| | Milk | | | |
| | Other benefit | | | |

### General observations (AESA): Farmer's fields

| General Information | | | | |
|---|---|---|---|---|
| Date | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 21

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Feeding silage to dairy animals | 30 minutes | Silage, a jembe, shovel, buckets |
| 2 | Harvesting the desmodium multiplication plot | | |

## Introduction

In Week 14 you learnt how to conserve excess fodder as silage that can be used to feed your animals during dry season when fodder is scarce. This week you will learn how to utilize it.

## Topic 1: Feeding silage to dairy animals

### Learning objectives

On completion of this topic participants will be able to recognize good quality silage and how to use it.

### Learning activities

- Facilitator-led introduction on how to recognize good quality silage feed
- Practical exercise: feeding animals
- Discussions (How do you differentiate between good and poor silage?)

**Step 1: How to tell the quality of your silage**

Open the silage pit or gunny bag. Smell the silage and look at the colour. This will tell you the quality of the silage.

- Good silage has a sweet smell and has a shiny yellow brown colour
- Poor silage has a rotten smell and has a dark and mouldy colour. Your animals will not eat poor quality silage

**Step 2: How to use the silage**

- From the gunny bag silage, open the tied end and quickly remove enough for one day's feeding then immediately tie the bag up again. This will be a daily routine until the silage is finished. If you do not tie the bag immediately, air will get in and spoil the silage
- Open the pit silo from the lower side of the slope. Quickly remove enough material for one day's feeding and then immediately cover the open end again. This will be a daily routine until the silage is finished

**Step 3:** Put silage in a trough just like you do with fresh forage.

- Feed after milking or at least 3 hours before to eliminate the silage smell in the milk

**Note**

*A grade cow may eat up to 40 kg and a cross-breed less, about 20 kg of silage per day. The silage given to livestock should not be more than 60% of the total feed consumed by the livestock daily.*

## Topic 2: Harvesting the desmodium multiplication plot

It is now time to harvest seed from your desmodium multiplication plot. You will have learnt how to do this on the Push-pull plot in **Week 19.**

### Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Desmodium multiplication plot | Harvesting desmodium pods | | | | |
| | Other activity | | | | |

**Benefits** (Please keep filling the number of units each day as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (I unit) | | | |
| | Milk | | | |
| | 5 Kg Silage (1 unit)* | | | |
| | Other benefit | | | |

**5 Kg of silage is what a dairy goat consumes in a day.*

### General observations (AESA): Farmer's fields

| General Information | | | | |
|---|---|---|---|---|
| Date | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Off Season

# Week 1

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Land preparation | | Ploughs, jembes/hoes, pegs, sticks, strings, tape measure, ruler, desmodium vines and TSP fertilizer |
| 2 | Processing desmodium seed from multiplication plot | | Weighing balance, containers (2 Kg tins), a flat grinding stone, rubber sole of an old shoe, wire mesh (30cm by 30 cm), clear polythene bags. |
| 3 | Addressing risk and uncertainty | 1 hour | Record of receipts and expenses (optional); record sheets; calculator, and flip charts/chalkboards, markers, exercise books, pens. |

This week you need to prepare the land for planting the Check plot and the new Push-pull plot to be planted with vines.

## Topic 1: Land preparation

- Clear your land during the dry season
- Plough and harrow your land to a fine tilth (until the soil has no large lumps) before the onset of the rains

**Note**

*For the established Push-pull plot the land preparation and planting will be done together after the onset of rain.*

## Topic 2: Processing desmodium seed from multiplication plot

You need to process the desmodium seed which you harvested in multiplication plot. ***Please refer to Week 20 lesson on processing***.

## Topic 3: Addressing risk and uncertainty

Risk and uncertainty are important factors that influence the chances of a farmer adopting a new technology. Decision-making, which involves choosing between possible alternative actions, is one of the most important activities that a farmer has to do to adopt the technology. It is also an act of management that cannot be ignored or postponed. A farmer making a decision with some knowledge of the probability (chance) of making a good decision does so under condition of risk. On the other hand, a farmer making decisions without knowledge of the probability of making a 'good' or 'bad' decision does so under the condition of uncertainty. However, there is no certainty that a 'good' decision will be the 'right' decision. That is, while the farmer may act reasonably well and follow the right procedures, he/she has no control over the outcome. This is because farmers make decisions in a risky and ever-changing environment. Information and experience are important conditions in determining the quality of decisions farmers make.

Changes in technologies, markets, government policies and social factors all contribute to the risky environment that farmers carry out their activities in. For example, households may be willing to take more risks if they receive insurance/support from social networks, governmental and non-governmental organizations.

This lesson will provide an introduction to the terminology, types, and strategies used in addressing risk and uncertainty in day-to-day activities.

### Learning objectives

On completion of this topic participants will be able to:

- Explain the importance of addressing risk and uncertainty

- Identify various types of risks that affect farming decisions
- Suggest strategies of addressing risk and uncertainty

## Learning activities

- Facilitator-led introduction on importance of addressing risk and uncertainty
- Form 3 sub-groups of 6-8 members to brainstorm on the various types of risks they operate in and the strategies they use to address them.
  - Group 1. Common production problems - risks and uncertainties and what action(s) they propose to address these.
  - Group 2. Common marketing problems - risks and uncertainties and what action(s) they propose to address these.
  - Group 3. Common financial problems - risks and uncertainties and what actions (s) they suggest to address these.
- Facilitator-led discussion on options the participants wish to test and to agree on a) what information will be required and from what sources, b) how to record the information and c) how to analyse the information.

**Notes**

***Types of risks***

- *Production and technical risks (drought, insufficient fodder, problems in adapting new technologies to local conditions e.g. appropriate cover crop species, pests and diseases)*
- *Marketing and price risks (price fluctuations of inputs and outputs)*
- *Financial risks (interest payments, changes in interest rates, ability to generate cash)*
- *Institutional risks (breakdown in services supply, management problems in FFS, change in support and subsidies)*
- *Human and personal risks (sickness).*

## Effective risk management may involve:

- Anticipating that an unfavourable event may occur and acting to reduce the chance of it happening; and,
- Taking actions to reduce the adverse consequences of risk should an unfavourable event occur

## Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Multiplication plot | Processing desmodium seed | | | | |
| Check plot | Land preparation | | | | |
| | Other activity | | | | |
| Push-pull vine plot | Land preparation | | | | |
| | Other activity | | | | |

## Benefits from desmodium seed

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Multiplication plot | Desmodium seed | | | |
| | Desmodium husks | | | |
| | Other benefit | | | |

**Benefits o**f livestock feed (Please keep filling the number of units each day as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay | | | |
| | 5 Kg Silage (1 unit)* | | | |
| | Other benefit | | | |

**5 Kg of silage is what a dairy goat eats in a day.*

## General observations (AESA): Farmer's fields

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| Observations | | | | Farmer's comments |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days it rained the week before_____ | | | | |
| Soil moisture | | | | |
| | | | | |
| | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

**Note**

*You need to watch for the rain. If it is raining enough for planting you should plan for planting next week. If not, continue with the Gross Margin Analysis (Season 2, Week 2).*

# Week 2

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Gender in Push-pull | 2 hours | Questionnaires, access and control of resources chart |
| 2 | HIV and Push-pull | | |

## Introduction

Gender refers to how the society looks at the relations between men and women. These relations, and the roles women and men play are determined by culture. The roles differ from one society to another with respect to age, class, race, ethnicity, abilities and disabilities.

## Topic 1: Gender in Push-pull

### Learning objective

On completion of this topic participants will evaluate the gender issues that may affect the adoption of Push-pull technology.

### Learning activities

- Facilitator led discussions on the importance of gender issues in new programmes
- Group discussions

The gender priority areas for Push-pull are:

- How to involve men, women and children in Push-pull.
- The place of rural women as a valuable resource and driver of local livelihoods and how Push-pull can address their specific needs.

### Issues to discuss

Fill in the role played by men and women in the table below.

| Issue | Men | Women | Children |
|---|---|---|---|
| Labour | | | |
| Income | | | |
| Information and Knowledge on new technologies | | | |
| Decision on resources use | | | |
| Decisions on utilization of benefits | | | |
| Land ownership | | | |
| Priority setting | | | |
| Freedom of expression | | | |
| Use of time | | | |

### What you can do

One way of addressing gender issues in Push-pull is to remember that different communities have different cultural and social ways of addressing issues. Try and understand these factors in your community by discussing the following questions.

1. If you want to introduce a new technology in the community, who should you involve first?
2. Find out the relationships that exist between men and women. For instance, are they allowed to attend meetings alone?
3. What time of the day can you involve women and men, or women alone?
4. What activities on the farm are specifically for men?
5. What activities on the farm are specifically for women?
6. Are there crops that should be grown and tended by either the men or the women?
7. Who sells the farm products?
8. Who keeps the money?
9. Who decides what to spend the money on?

10. How do both women and men access information?

11. What roles do children play at home and in the community?

The answers to these questions will help you to design activities that take into account the needs of men, women and children.

## Topic 2: HIV and Push-pull

### Introduction

HIV/AIDS is a serious threat to farming in general and Push-pull is not exempted from its effects. As the technology is being implemented, issues relating to the disease need to be addressed. Remember the following important facts.

- People with HIV/AIDS need additional nutrition to fight the disease. Unproductive land means there less food for everyone. HIV patients may be stigmatized by the community, so are often the first to be left without food
- An unhealthy population is not productive. Ill people cannot look for work on their farms. HIV reduces the number of hands that can be put to work
- The number of orphans increases. This puts an extra burden on the households that take the children in, and on the community as a whole. The orphans do not get enough to eat as parents may feed their own children first
- Women have more work because they care for both AIDS patients and orphans

HIV/AIDS spreads quickly for several reasons: cultural practices, lack of basic health care services, poor information about the disease and sudden increase in income.

#### Learning objectives

On completion of this topic participants will understand issues of HIV that may affect the farmers ability to benefit from Push-pull.

#### Learning activities

- Facilitator-led introduction of HIV and its relationship to household health and Push-pull
- Group Discussions
- Presentations by guest speakers

#### Duration 2 hours

the disease.

#### Why you should openly discuss HIV?

HIV puts a double burden on households: they need extra resources to take care of the sick, but HIV takes away the most productive members of the household thus impoverishing people. The following are some of the consequences of HIV.

- Poverty makes people more vulnerable to HIV. There is little information about the disease in remote areas, and many people cannot read the literature warning them about its dangers. Many believe that the disease is a problem only in the towns. Some assume that people in rural areas cannot be infected
- People engage in various activities that expose them to unprotected sex and multiple partners. In farming communities, men go to towns to sell farm products or to work. They may have girlfriends or use the services of prostitutes there
- Some women and men have multiple partners. Women may engage in commercial sex work to try and make ends meet
- Traditional liquor is brewed in most rural areas. People who drink these brews are at risk because they lack judgment and may practice unsafe sex in their drunken state

The following are some of the traditional practices that facilitate the spread of the disease.

- People living with HIV are commonly stigmatized and so people may be afraid to use testing and counselling centres because they are afraid of being shunned by their own communities
- In most communities it is a taboo to discuss sex related issues. It is therefore difficult to disseminate information about HIV
- Some communities view HIV as a curse, and a result of being bewitched. They do not relate it to human behaviour
- Some people have taken a fatalistic attitude. They believe that death in any form is death and see no need to be careful about their sex life
- Men may go away to urban areas for long periods to work or to look for work. This exposes them and their wives to casual sex partners
- Some communities encourage polygamy. If the husband or one of the wives is infected, the others will contract the HIV virus too
- In some communities, a deceased's brother inherits his widow. If the man died of a HIV related disease, the woman spreads the disease to her new husband
- Most farming communities practice circumcision for boys and girls in groups. The tools used may not be cleaned and sterilized. If one person is infected the whole group is exposed to the disease.
- Most babies are delivered by poorly trained and ill equipped traditional birth attendants. They do not use protective measures, and rarely sterilize the blade they use to cut umbilical cords. If the mother or the attendant is infected, the disease may spread easily

**Risky and No-Risky behaviours**

**Definitely a Risk**
• Having sexual intercourse with multiple partners without a condom
• Sharing a needle for drug use or for injections
• Sharing knives for circumcision
• Sharing needles for ear piercing

**Probably a Risk**
• Being born to a mother who is HIV positive (Mother-to-child transmission)
• Getting blood transfusion
• Sharing a toothbrush
• Kissing

**Definitely NOT a Risk**
• Abstaining from sexual intercourse
• Being close to a person with HIV who is coughing
• Donating blood
• Using a public telephone
• Shaking hands with a person with HIV
• Hugging a person with HIV or AIDS
• Living with a person with AIDS
• Being bitten by a mosquito
• Having a mutually monogamous and faithful relationship with a person who has tested negative for HIV.

From: KARHP, PATH and Population Council

# Season 2

# Week 1

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Preparing the Push-pull plot for 2nd and subsequent season planting | 1 hour | Panga, jembe, sacks to carry the cut material, hoe and 2kg TSP fertilizer, bucket/watering can. |
| 2 | Laying out and establishing a new Push-pull plot using desmodium vines | 1 hour 30 minutes | Ruler/tape measure, string, pegs, sticks for measurement, mallet hammer, polyethylene tags or marker pens, Push-pull manual |
| 3 | Managing desmodium seed multiplication plot | 1 hour | |

**Note**

*This lesson only to be done if there is enough rain for planting. If Not, continue with Gross Margin Analysis in Second Season Week 2, and wait for the rains to come)*

## Introduction

This is the start of the second season. We have three topics to discuss this week:

1. How to prepare the land for the planting 2nd season maize in the Push-pull plot established during the 1st season.
2. We will also learn how to establish a new Push-pull plot using desmodium vines from your already established desmodium seed multiplication plot.
3. Managing desmodium multiplication plot for the second season.

## Topic 1: Preparing the Push-pull plot for 2nd and subsequent season planting

### Learning objective

On completion of this topic participants will prepare a Push-pull plot for the second and subsequent seasons.

### Learning activities

- Facilitator-led introduction on activities of the week
- Field work: land preparation and planting in established Push-pull plots
- Discussion on the exercise

### How to prepare the 2nd season Push-pull plot

**Step 1:** Cut back the desmodium leaving a stubble of 6cm above the ground to encourage regrowth. Keep and feed to livestock.

**Step 2:** Hand weed the desmodium.

**Step 3:** Dig or plough well between the rows of desmodium.

**Step 4:** Weed the Napier grass.

**Step 5:** Plant maize in between desmodium rows at spacing of 30cm. Apply 1 spoonful or soda bottle top of TSP or DAP fertilizer. You may also use a handful of well-decomposed manure per hole.

## Topic 2: Laying out and establishing a new Push-pull plot using desmodium vines

### Learning objective

On completion of this topic participants will be able to demonstrate that they understand how to lay out and establish a new Push-pull plot using desmodium vines.

### Learning activities

- Facilitator-led introduction and discussions on the use of desmodium vines to establish a Push-pull plot
- Practical on the layout and planting of the Push-pull plot
- Discussion (lead question on the economics of using vines as compared to seed)

## How to lay out the Push-pull plot

**Note**

*If your land is sloping, it is essential that the planted rows on your plot run across the slope.*

**Step 1:** Mark out a plot measuring 21 m by 21 m square, using a tape measure, pegs and string.

**Step 2:** Put a peg at each corner of the measured area. Starting from this peg put pegs along all sides of the square at 75 cm intervals.

**Step 3:** Run a string from the first peg to the first peg on the opposite side of the plot.

**Step 4:** Run a second string from the second peg to a second peg on the opposite side.

**Step 5:** Run a third string from the third peg to the third peg on the opposite side.

**Step 6**: Repeat Steps 3, 4 and 5 for all the other sides, until you have a plot looking like (Fig 58).

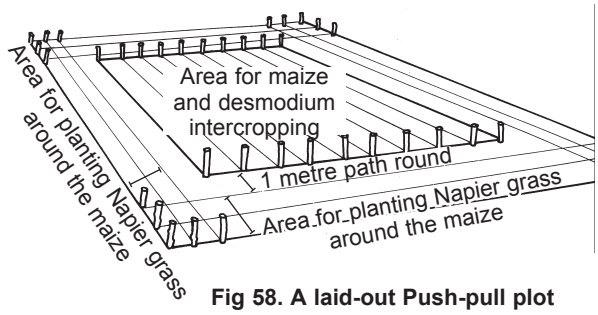


**Fig 58. A laid-out Push-pull plot**

## What NOT to do

- Do not remove the pegs or string until your plot is fully planted (Season 1, Week 1 on planting)
- Do not plant Push-pull in less than 21 m by 21 m plots as Napier grass tends to grow and to have a shading effect on the maize crop

**Note**

*The Push-pull plot should be planted in this order*

## 1. Planting Napier grass

**Step 1:** Dig a hole at each peg on the border of the marked plot.

**Step 2:** Apply one tea spoonful of triple super phosphate fertilizer or 2 hand-fulls of well decomposed farmyard manure in each hole.

**Step 3:** Place a three node cane into each hole at an angle of 30$^{o}$-45$^{o}$ all facing one direction.

**Step 4:** Cover with soil ensuring that two nodes of the cane are well covered.

**Step 5:** If you are using root splits, place them upright in the hole and cover with soil.

(For illustration see **Season 1**, **Week 1**).

## 2. Planting desmodium vines

**Step 1:** Use the vines from the seed multiplication plot and the established Push-pull plot. Use **mature** vines with at least three to four internodes with hair roots to establish desmodium.

**Step 2:** Using a sharp pointed stick make a furrow 1 cm to 2 cm deep along the string lines. Leave 75 cm space between the ends of the desmodium row and inner row of the Napier grass. Place the vines in the furrows with the hair roots facing down.

**Step 3:** Cover the vines, including the leaves with light soil if the moisture level is low. This ensures that the leaves do not lose moisture. Otherwise if it is raining just cover the vines only.

**Note**

*For good establishment of the desmodium, ensure there is enough moisture in the soil. Do Not plant the vines if it is dry.*

## 3. Planting maize in Push-pull plot

Plant maize in between desmodium rows at spacing of 30cm. Apply 1 spoonful or

soda bottle top of TSP or DAP fertilizer. You may also use a handful of well-decomposed manure per hole.

**4. Planting maize in Check plot**

**Step 1:** Plant maize in the entire 21 m by 21 m plot in straight lines at 75 cm between rows and 30 cm between hills in a row.

**Step 2:** Apply one tea spoonful or soda bottle top of triple super phosphate or two spoonfuls of single super phosphate per hole. You may also use a handful of good quality manure (Season 1, Week 2) per hole.

## Topic 3: Managing desmodium seed multiplication plot

Now that you have harvested all the pods and used the mature vines to establish your new Push-pull plot it is time to manage the seed multiplication plot to ensure that you have a healthy crop for the next season. Cutting back the desmodium now allows you to:

- Weed the crop thus encouraging vigorous regrowth in the next season
- Get fodder and hay for your animals in the dry season
- Get vines for establishing a new desmodium multiplication plot (Optional)

**Learning objective**

On completion of this topic farmers will learn how to manage their desmodium seed multiplication plot in the second and subsequent seasons.

**Learning activities**

- Facilitator-led introduction on management of desmodium for the second season, and (Optional) establishment of desmodium vine nursery
- Practical exercise: Cutting back and weeding desmodium, and (Optional) establishing a new nursery
- Facilitator-led discussions on the advantages and disadvantages of establishing a desmodium seed nursery by use of vines (Optional)

**Note**

- *Steps 1 to 5 are optional if you want to establish a new desmodium multiplication plot.*
- *Steps 6 and 7 must be done to maintain your desmodium multiplication plot in good condition for your second season.*

**Step 1:** Identify a suitable site near a water source where you can prepare a 10 metre by 10 metre desmodium vine nursery. Ensure the soil is broken down until it is fine, and ensure the soil has enough moisture for planting vines. If not, water the seed bed.

**Step 2:** Select vines from the seed multiplication plot and the established Push-pull plot. Use **mature** vines with at least three to four internodes with hair roots to establish desmodium in between maize rows.

**Step 3:** Cut the vines close to the main plant and carefully pull it out. Try not to damage the hair roots.

**Step 4:** Using a sharp pointed stick make a furrow 1 cm to 2 cm deep along the line in your new nursery. The lines should be 75 cm apart. Place the vines in the furrows with the hair roots facing down.

**Step 5:** Cover the vines. If there is no rain, water the vines at least twice a week.

**Step 6:** After you have cut the vines and planted them in the nursery, cut the desmodium leaving stubble 4-6 cm above the ground to encourage regrowth. Use the cut material as fodder for your livestock or to make hay.

**Step 7:** Weed the desmodium using a hoe or a jembe and apply half kilogramme (kg) of TSP or 1 kg DAP fertilizer to the whole plot.

**Labour costs**

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Push-pull Vine Plot** | Field layout | | | | |
| | Planting Napier | | | | |
| | Planting Desmodium | | | | |
| | Planting maize | | | | |
| | Fertilizer application | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| **Established Push-pull plot** | Cutting back desmodium | | | | |
| | Land preparation and weeding of desmodium | | | | |
| | Weeding Napier | | | | |
| | Planting maize | | | | |
| | Fertilizer application | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| **Check Plot** | Field layout | | | | |
| | Planting maize | | | | |
| | Fertilizer application | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| Old desmodium seed multiplication plot | Cutting back desmodium | | | | |
| | Weeding desmodium | | | | |
| | Fertilizer application | | | | |
| **Total** | | | | | |

**Input costs**

| | Input Used | Quantity Used | Cost |
|---|---|---|---|
| **Push-pull Vine Plot** | Maize seed | | |
| | Desmodium vines | | |
| | Napier | | |
| | Fertilizer | | |
| | Manure | | |
| | Other | | |
| **Total** | | | |
| **Push-pull plot** | Maize seed | | |
| | Fertilizer | | |
| | Other | | |
| **Total** | | | |
| **Check Plot** | Maize seed | | |
| | Fertilizer | | |
| | Manure | | |
| | Other | | |
| **Total** | | | |
| **Seed Multiplication plot** | Fertilizer | | |
| | Other | | |
| **Total** | | | |

**Benefits of livestock feed** (Please keep filling the number of units each week as you cut)

| | Type of Benefit | Quantity | Unit Market price | Total Value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg desmodium (1 Unit) | | | |
| | Desmodium vines | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| General Information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Planting date | | | | |
| Variety | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 2

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Calculations of Real Gross Margins for Push-pull plot, Check plot and Seed Multiplication plot | | Record of receipts and expenses (optional); record sheets; calculator, and flip charts/chalkboards, markers, exercise books, pens. |

## Topic: Participatory Monitoring & Evaluation (PM&E)

You did this lesson in **Week 1, lesson 15**. Refer to it for this lesson.

Calculations of Real Gross Margins for Push-pull plot, Check plot and Seed Multiplication plot.

**Benefits of livestock feed** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg desmodium (1 Unit) | | | |
| | Desmodium vines | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's fields**

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Planting date | | | | |
| Variety | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 3

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Gapping maize | 30 minutes | Maize seeds, pen, Jembes/hoes, Pegs, Sharp sticks, strings, tape measure, ruler, desmodium seeds (100 grams) and TSP fertilizer. |
| 2 | Weeding and topdressing desmodium seed multiplication plot | 30 minutes | |

## Topic 1: Gapping maize

**Duration: 30 minutes**

You did this lesson in **First Season, Week 2**. Please refer to details in the lesson.

**Note**

*Remember that you do not need to apply fertilizer during gapping because you applied when you planted your maize*

## Topic 2: Weeding and topdressing desmodium seed multiplication plot

You did this lesson in First Season. Please refer to details in **Season 1, Week 7**.

**Labour costs**

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Push-pull Vine Plot** | Gapping maize | | | | |
| | Any other activity | | | | |
| Total | | | | | |
| Established Push-pull plot | Gapping maize | | | | |
| | Any other activity | | | | |
| Total | | | | | |
| **Check Plot** | Gapping maize | | | | |
| | Any other activity | | | | |
| Total | | | | | |
| Seed Multiplication plot | Fertilizer application | | | | |
| Total | | | | | |

**Input costs**

| | Input used | Quantity used | Cost |
|---|---|---|---|
| Seed Multiplication plot | Fertilizer | | |
| | Other | | |
| **Total** | | | |

**Benefits of livestock feed** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | Desmodium vines | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's fields**

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Planting date | | | | |
| Variety | | | | |
| Crop Emergence | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 4

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Gapping Napier in the new plot | 30 minutes | Napier grass cuttings/root splits/vines, hoe/stick, Push-pull manual, pen and paper |
| 2 | Group assessment | 3 hours | All records, Calculator, Flip chart, Marker pens; Record samples of receipts and expenses on crops and livestock enterprises; record sheets; and flip charts/chalk-boards, markers, exercise books, pens. |

## Topic 1: Gapping Napier in the new plot

You did this lesson in Season 1. Please refer to the details in **Season 1, Week 3**.

## Topic 2: Group assessment

### Introduction

Now you have been working together as a group for several months and you have had time to apply on your farm what you have learnt in the field school. It is time to go out and see how you and your colleagues have laid out your new Push-pull and how you are managing your established plot so that you can:

1. Maximise your learning from each other's experiences
2. Correct any mistakes that may have been made.

This is the third group assessment since you started the Push-pull farmer field school. As with the first assessment in **Season 1,Week 3, and second group assessment in Season 1, Week 12** this is a good time to check that everything is being done properly and if not, correct any mistakes.

#### Learning objective

The objective of this assessment is to maximize learning through group evaluation.

#### Learning activities

- Facilitator-led introduction on group evaluation
- Form evaluation groups
- Farm visits, observations and completion of evaluation forms by groups
- Discussion

#### What to do in the assessment

**Step 1:** Make groups of 4-6 members.

**Step 2:** Visit each farm represented by the members in the group.

**Step 3:** Use the table on the next page to assess the Push-pull and the Check plots, and discuss with the host farmer. Rate each farm using this scale:

**1** = Poor **2** = Average **3** = Good

| | 2Nd season push-pull plot | | 2Nd season check plot | | 1St season push-pull with vines | |
|---|---|---|---|---|---|---|
| What to check | Rating | Comments | Rating | Comments | Rating | Comments |
| Field preparation | | | | | | |
| Layout of the field | | | | | | |
| Cleanliness of the plots | | | | | | |
| Germination of maize | | | | | | |
| Napier grass establish-ment | | | | | | |
| Napier grass mainte-nance | | | | | | |
| Napier grass cutting | | | | | | |
| Trimming desmodium | | | | | | |
| Weeding desmodium | | | | | | |
| Sprouting of desmodium vines | | | | | | |
| Record-keeping | | | | | | |
| Total rates | | | | | | |

Other comments on the Seed multiplication plot (Rate 1 to 3):

1 = poor 2 = Average 3 = good

More comments:_____
_____
_____
_____
_____
_____

## Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Push-pull Vine Plot** | Gapping Napier | | | | |
| | Any other Activity | | | | |
| **Total** | | | | | |

**Benefits** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | Desmodium vines | | | |
| | 1 kg Desmodium hay | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| **Crop Health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass sprouting | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 5

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Analysis of household assets | 2 hours | Push-pull manual, pen, markers, flips charts. |
| 2 | Emerging issues of interest | 2 hours | |

## Topic 1: Analysis of household assets

### Learning objectives

On completion of this topic participants will be able to:

- Explain the different types of assets
- Discuss how Push-pull can contribute to household assets

### Learning activities

- Facilitator-led introduction on meaning and importance of doing asset analysis
- Groups of 4-6 members brainstorm on the various types of assets and how Push-pull can contribute to these
- Facilitator-led discussion on asset analysis and how asset growth can be influenced by adoption of Push-pull

### Notes

- ***Financial*** *- This denotes the financial resources that people use to achieve their livelihood objectives. It includes the availability of cash or equivalent that enables people to adopt different livelihood strategies*
- ***Human*** *- This represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives*
- ***Social*** *- This is taken to mean the social resources upon which people draw in pursuit of their livelihood objectives*
- ***Physical*** *- This represents capital that is created by economic production. It includes infrastructure such as roads, irrigation works, electricity, housing, etc.*

  ***Natural*** *- This consists of land, water and biological resources such as trees, pastures and biodiversity*

## Topic 2: Emerging issues of interest

When farmers meet in groups, they discuss the results of their experimentation, learning from one another and devising new ways to solve problems. Training in groups is helpful in many ways: mutual learning is encouraged, solidarity is built, and a base is created for further technological discussion and problem solving. This process brings up new issues of interest to farmers. This session is meant to discuss, clarify, and/or plan for appropriate action.

### Learning objectives

On completion of this topic participants will be able to:

- Discuss some key issues that have emerged after attending the field school so far
- Plan for appropriate action

### Learning activities

- Facilitator-led introduction on the importance of addressing emerging new issues
- Through focus groups, participants brainstorm on new emerging issues (Lead questions: What interesting issue have you observed or felt that requires discussion with the rest of the group? How does it affect you? How does it affect other members? What needs to be done to address the issue?)
- Facilitator-led discussion on key issue summarized from group presentations

**Benefits** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | Desmodium vines | | | |
| | 1 kg Desmodium hay | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop Health** | **Poor** | **Average** | **Good** | |
| • Maize<br>• Napier grass<br>• Desmodium | | | | |
| | | | | |
| | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

Other comments:

_____

_____

_____

_____

# Week 6

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | 1st weeding, thinning and top dressing of maize | 1 hour 30 minutes | Jembe, hoe, Sharp stick., CAN fertiliser, teaspoon/soda bottle top |
| 2 | 1st weeding and top dressing of Napier grass in both push-pull plots | 1 hour | |
| 3 | Desmodium weeding and trimming (established Push-pull crop) | 30 minutes | |
| 4 | 1st weeding desmodium in the vine-established Push-pull plot | 30 minutes | |
| 5 | Weeding and rouging (removing off-types) on the desmodium seed multiplication plot | 30 minutes | |

## Topic 1: 1st weeding, thinning and top dressing of maize

Follow instructions in **Season 1, Week 5**

Topdress after the dew has dried from the leaves; fertilizer falling on the leaves burns them.

## Topic 2: 1st weeding and top dressing Napier grass in both Push-pull plots

Follow the instructions for the lesson in **First Season 1, Week 5**

Topdress after the dew has dried from the leaves. This way, if any fertilizer falls on the leaves, it will not burn the plant.

## Topic 3: Weeding and trimming desmodium (established Push-pull crop)

### Introduction

If you managed your desmodium well in the first season, it is now well established. If let alone it can grow faster than your maize. You must trim it so that it does not compete with your maize for soil nutrients and light. If you delay in trimming, it can suppress the growth of maize and so reduce the yields from your plot.

After you have trimmed the desmodium, you must also weed it otherwise weeds will compete for nutrients and light.

***If managed properly the desmodium will last for more than five years.***

***Refer to Season 1, Weeks 5 and 7.***

## Topic 4: 1st weeding desmodium in the vine-established Push-pull plot

### Introduction

The desmodium plot you established using vines is now ready for weeding. The vines grow faster than seedlings. However, some weeds still grow within the vines and they must be removed.

**Step 1:** Walk between the rows of desmodium vines. Using a sharp stick loosen the soils around the weeds and carefully remove the weeds by hand.

**Note**

*Do not weed if the soil is dry as this can destroy the desmodium roots and kill the plant.*

## Topic 5: Weeding and rouging (removing off-types) on the desmodium seed multiplication plot

# Introduction

If you are maintaining a desmodium seed multiplication plot you must:

- Weed the plot
- Keep the surrounding 2 m clear of all other plants. As the desmodium grows it will spread and cover the 2 m space
- Ensure that there are no off-types present in the plot

**Step 1:** Clear a 2 m strip around the desmodium plot using a panga and a jembe.

**Step 2:** Walk within the vines and using a sharp stick loosen the soils around the weeds and carefully remove weeds and off-types by hand.

### Input costs

| | Input used | Quantity used | Cost |
|---|---|---|---|
| Established Push-pull plot | Fertilizer | | |
| | Other | | |
| Total | | | |
| Vine Push-pull plot | Fertlizer | | |
| | Other | | |
| **Total** | | | |
| Check plot | Fertilizer | | |
| | Other | | |
| **Total** | | | |
| Seed Multiplication plot | Fertilizer | | |
| | Other | | |
| **Total** | | | |

## Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Push-pull Vine Plot** | Weeding and thinning maize | | | | |
| | Top dressing maize | | | | |
| | Weeding and top dressing Napier | | | | |
| | Weeding desmodium | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| Established Push-pull plot | Weeding and thinning maize | | | | |
| | Top dressing maize | | | | |
| | Weeding and top dressing Napier | | | | |
| | Weeding and trimming desmodium | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| **Check plot** | Weeding and thinning maize | | | | |
| | Top dressing maize | | | | |
| **Total** | | | | | |
| Seed Multiplication plot | Weeding and rouging | | | | |
| | Fertilizer application | | | | |
| **Total** | | | | | |

**Benefits** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Dsmodium (1 Unit) | | | |
| | Desmodium vines | | | |
| | 5 kg Silage (1 unit) | | | |
| | 1 kg Desmodium hay (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| | **Maize** | **Napier grass** | **Desmodium** | |
| Planting date | | | | |
| Crop emergence | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 7

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Utilization of fresh desmodium and hay | 1 hour | A panga, ruler or tape measure, jembe, chopping log, gunny bags, polythene sheets |
| 2 | Comparison of stemborer and striga damage between Push-pull and control plots | 2 hours | Samples of striga at various stages of growth, knives, pictures of damaged plants, hoe, flip charts, posters, marker pens, masking tapes |

## Topic 1: Utilization of fresh desmodium and hay

You learnt how to use fresh desmodium and how to prepare desmodium hay in **Season 1**, **Week 13** and **Week 16**. Please follow the same instructions.

### Learning activities

- Facilitator–led introduction on importance of a balanced animal ration
- Practical activities on Napier grass and desmodium chopping
- Practical activities on desmodium and Napier ration mixture
- Facilitator–led discussion on importance of Napier and desmodium as feed

### How to correctly utilize fodder from Push-pull

Note

- *During the wet season cut Napier and leave it in the open for at least 30 minutes before chopping. This allows the Napier to lose some water (wilt) and increases the roughage eaten by the livestock*
- *To avoid wastage the chopped forage should be fed to livestock in a feed trough*
- *During the dry season, chop the maize stover into small pieces and mix with the chopped Napier grass and desmodium*
- *Always remember to give your livestock the recommended mineral supplements*
- *Never allow livestock to graze in the Push-pull plot as they will destroy the desmodium and the Napier grass*

## Topic 2: Comparing stemborer and striga damage between Push-pull and Check plots

By now your maize is 6 weeks old and it will be showing signs of striga and stemborer damage. It is time to start evaluating how your Push-pull plots are performing as compared to your Check plot, as you did in **Season1, Week 8**. The first thing is to check for stemborers and striga attack.

### Learning objectives

On completion of this topic participants will start to evaluate the effectiveness of Push-pull in controlling stemborers and striga.

### Learning activities

- Facilitator-led introduction to stemborer and striga damage
- Field exercises
- Discussions (Are there any differences between the plots?)

**Step 1:** Starting from one corner, walk to the opposite corner (diagonally) of any plot. As you walk stop at **every fifth plant** and look for any sign of stemborer and striga damage. Record what you have noticed.

Look for:

- Signs of stemborer damage
  - Leaf damage
  - Deadheart

- Signs of striga damage
  - Stunted growth
- The number of striga plants within 15 cm around the plant

**Step 2:** Repeat **Step 1** from a different corner and walk diagonally to the opposite corner.

**Step 3:** Repeat Steps 1 and 2 in the other plots.

**Note**

*At the end of the exercise you will have looked at more plants in the Check plot than in the Push-pull plots.*

### 2nd season Push-pull plot

| What to record | Number | *Percent damage |
|---|---|---|
| Total number of plants observed | | |
| Total number of plants with signs of stemborer leaf damage | | |
| Total number of plants with deadheart | | |
| Total number of striga stunted plants | | |
| Total number of striga weeds around maize plants (15 cm) | | |

**The facilitator will work out the percentages and discuss them with the farmers*

### Vine established Push-pull plot

| What to record | Number | *Percent damage |
|---|---|---|
| Total number of plants observed | | |
| Total number of plants with signs of stemborer leaf damage | | |
| Total number of plants with deadheart | | |
| Total number of striga stunted plants | | |
| Total number of striga weeds around maize plants (15 cm) | | |

**The facilitator will work out the percentages and discuss them with the farmers*

### Check plot

| What to record | Number | *Percent damage |
|---|---|---|
| Total number of plants observed | | |
| Total number of plants with signs of stemborer leaf damage | | |
| Total number of plants with deadheart | | |
| Total number of striga stunted plants | | |
| Total number of striga weeds around maize plants (15 cm) | | |

**The facilitator will work out the percentages and discuss them with the farmers*

**Labour costs**

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Established Push-pull plot** | Harvesting 10 kg of Napier grass * | | | | |
| | Harvesting 3 kg of desmo-dium* | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| **Vine Push-pull plot** | Harvesting 10 kg of Napier grass * | | | | |
| | Harvesting 3 kg of desmo-dium* | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |

**Benefits** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg desmodium (1 Unit) | | | |
| | Desmodium vines | | | |
| | 5 kg Silage (1 unit) | | | |
| | 1 Kg Desmodium hay (Unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |
| **Vine Push-pull** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 Kg Desmodium vines (Unit) | | | |
| | 5 kg Silage (1 unit) | | | |
| | 1 Kg hay (Unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Date planted | | | | |
| **Crop Health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | **Low** | **Medium** | **High** | |
| Stemborers | | | | |
| Striga | | | | |
| Rainfall: Number of days it rained the week before: _____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 8

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | 2nd weeding of maize and Napier and 2nd trimming and weeding of desmodium in established Push-pull plot | 1 hour 30 minutes | A panga, ruler or tape measure, jembe, chopping log, gunny bags, polythene sheets<br>Desmodium cuttings |
| 2 | Utilization of trimmed desmodium | 2 hours | |

## Topic 1: 2nd weeding of maize and Napier and 2nd trimming and weeding of desmodium in established Push-pull plot

- It is two weeks since you last weeded your plots and new weeds have now grown. You must weed them to keep your plot free of weeds
- It is also two weeks since you last trimmed the desmodium in your established Push-pull plot. It is now time to trim it again, otherwise it will compete with your maize. It is also time to weed the desmodium
- The desmodium in the vine established Push-pull plot may also need trimming, depending on the amount of rain you have received. It may also need weeding

### Learning activities

- Facilitator-led introduction to the importance of trimming desmodium and weeding all the crops: maize, Napier and desmodium
- Practical activities on trimming and weeding
- Facilitator led discussions

### Desmodium trimming and weeding

**Step 1:** Using a sharp panga, trim the desmodium so that its leaves do not touch the base of the maize. Feed the cut desmodium to your livestock. **See Topic 2 below.**

**Step 2:** Weed the desmodium using a panga or a small narrow hoe.

### Maize and Napier weeding

Carefully weed your maize and Napier grass using a jembe or hoe.

**Note**

*As you learnt in Season 1, some farmers in striga infested areas apply fertilizer when maize is 3 weeks and when it is 5 weeks old.*

## Topic 2: Utilization of trimmed desmodium

### Introduction

When you trim desmodium, especially in the Second Season, you might have more fodder than you need for the day. You can conserve the extra desmodium as hay to use in times of need ( See **Season 1**, **Week 13** and **Week 16**).

The freshly-trimmed desmodium can be used directly as livestock feed (Please see **Season 1**, **Week 13**).

**Labour costs**

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Established Push-pull plot | Weeding maize | | | | |
| | Weeding Napier | | | | |
| | Trimming desmodium | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| Vine-established Push-pull | Weeding maize | | | | |
| | Weeding Napier | | | | |
| | Trimming desmodium | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |
| Check plot | Weeding maize | | | | |
| | Other activity | | | | |
| **Total** | | | | | |

**Benefits** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (1 unit) | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | | | | |
| **Stemborers** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| **Striga** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

**Note**

*Please record stemborer and striga damage as* **Low**, **Medium**, *or* **High**

# Week 9

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Comparng stemborers and striga between Push-pull plots and Check plot | 2 hours | Samples of striga at various stages of growth, knives, pictures of damaged plants, hoe, flip charts, posters, marker pens, masking tapes, sharp sticks |
| 2 | 2nd Weeding and rouging of desmodium seed plot | 1 hour 30 minutes | |

## Topic 1: Comparing stemborers and striga between Push-pull plots and Check plot

By now your maize is 8 weeks old and it will be showing more signs of striga and stemborer damage. You need to continue monitoring how your Push-pull plots are performing as compared to your Check plot.

### Learning objectives

In this lesson participants will continue their evaluation of the effectiveness of Push-pull in controlling stemborers and striga.

### Learning activities

- Facilitator-led introduction on stemborer and striga damage
- Field exercise
- Discussions

**Step 1:** Starting from one corner, walk to the opposite corner (diagonally) of any plot. As you walk stop at **every fifth plant** and look for any sign of stemborer and striga damage. Record what you have noticed.

Look for:

- Signs of stemborer damage
  - Leaf damage
  - Deadheart
- Signs of striga damage
  - Stunted growth
  - The number of striga plants within 15 cm around the plant

**Step 2:** Repeat **Step 1** from a different corner and walk diagonally to the opposite corner.

**Step 3:** Repeat Steps 1 and 2 in the other plots.

**Note**

*At the end of the exercise you will have looked at more plants in the Check plot than in the Push-pull plots.*

### 2nd season Push-pull plot

| What to record | Number | *Percent damage |
|---|---|---|
| Total number of plants observed | | |
| Total number of plants with signs of stemborer leaf damage | | |
| Total number of plants with deadheart | | |
| Total number of striga stunted plants | | |
| Total number of striga weeds around maize plants (15 cm) | | |

**The facilitator will work out the percentages and discuss them with the farmers*

**Vine established Push-pull plot**

| What to record | Number | *Percent damage |
|---|---|---|
| Total number of plants observed | | |
| Total number of plants with signs of stemborer leaf damage | | |
| Total number of plants with deadheart | | |
| Total number of striga stunted plants | | |
| Total number of striga weeds around maize plants (15 cm) | | |

**The facilitator will work out the percentages and discuss them with the farmers*

**Check plot**

| What to record | Number | *Percent damage |
|---|---|---|
| Total number of plants observed | | |
| Total number of plants with signs of stemborer leaf damage | | |
| Total number of plants with deadheart | | |
| Total number of striga stunted plants | | |
| Total number of striga weeds around maize plants (15 cm) | | |

**The facilitator will work out the percentages and discuss them with the farmers*

## Topic 2: 2nd Weeding and rouging of desmodium seed plot

# Introduction

It is three weeks since you last weeded and rogued the desmodium seed multiplication plot. It is now time to do it again.

**Step 1**: Clear a 2 m strip around the desmodium plot using a panga and a jembe.

**Step 2**: Walk within the vines and using a sharp stick loosen the soils around the weeds and carefully remove weeds and off-types by hand (**See Week 28**).

**Labour costs**

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Seed multiplication plot | Weeding and rouging desmodium | | | | |
| | Any other activity | | | | |
| **Total** | | | | | |

**Benefits of livestock feed** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's fields**

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| **Stemborers** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| **Striga** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

Farmers' comments after the lesson: _____
_____
_____
_____

# Week 10

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Improving soil fertility | 45 minutes | Jembe, Panga, Clear polythene bags. Pens, flip chart |

## Topic: Improving soil fertility

In **Season 1, Week 20** we discussed the need to keep your soil healthy. It is now time to see if there are any changes in the soil.

### Learning objectives

On completion of this topic farmers will understand more about the important aspects of soil fertility and how Push-pull helps improve soil health.

### Learning activities

- Facilitator-guided introduction on improving soil fertility
- Observations of soil fertility indicators
- Discussions of any changes in the plots between Season 1, Week 22 and now

### How to tell if your soil is getting healthier

**Step 1**: Go to the established Push-pull plot and pull out 10 mature vines and wash the roots carefully. Observe for nodules.

**Note**

*The nodules have good bacteria (rhizobium) that helps to add nitrogen to your soil that your plants can use (Nitrogen fixation). If the nodules are bigger, there is more nitrogen fixation in your soil.*

**Step 2:** Walk around the Push-pull plots and Check plot, observe and fill the table below.

| | | Established. Push-pull plot | | Push-pull plot with vines | | Check plot | |
|---|---|---|---|---|---|---|---|
| **Soil quality indicator** | **Soil quality indicator questions** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** |
| Organic matter | Is the soil getting darker? | | | | | | |
| Soil structure | Is the soil getting softer underfoot? Is it easier to work on? | | | | | | |
| Runoff | Does rain soak into the soil quickly? (Rain soaks fast and water does not stay on the surface.) | | | | | | |
| Soil moisture | Does the soil stay moist for longer period after rains? | | | | | | |
| Soil life (aeration) | Does the soil have many earthworms? Are there many holes in the soil, and worm casts on the surface? | | | | | | |
| Crop yields | Are your yields improving? | | | | | | |
| Roots | Do the crop roots grow well? | | | | | | |
| Presence of weeds | Do the soils have the type of weeds that like to grow on fertile soils? | | | | | | |
| If you answered *Yes* to these questions, your soil is getting better! If you answered No, discuss the reasons | | | | | | | |

**Benefits of livestock feed** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's fields**

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop Health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| **Stemborers** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| **Striga** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

Farmers' comments after the lesson: _____

_____

_____

_____

# Week 11

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Maize diseases | 4 hours | Pictures of diseased maize, flip charts, pens, marker pens, samples of IR-maize |
| 2 | IR maize | | |
| 3 | Planning Field Day | | |

## Topic 1: Maize diseases

### Introduction

Some of the common diseases that affect maize include: Maize streak, Smut, Grey leaf spot, Leaf rust and Blight. In each area there are maize varieties that are resistant or tolerant to these diseases. In order to maximize maize production from Push-pull, farmers must use the right variety of maize.

#### Learning objective

On completion of this topic farmers will know more about maize diseases and the available disease resistant varieties of maize in their area.

#### Learning activities

- Facilitator-led introduction on maize diseases
- Practical exercise: Participants list maize diseases, their symptoms and disease-resistant maize varieties
- Discussion: (Lead question: What do farmers know about maize diseases, and what resistant varieties are locally available?)

#### Maize diseases and disease-resistant maize varieties

The following are some of the diseases that affect maize, and how to recognize them.

#### 1. Gray Leaf Spot (GLS)

This disease is common in eastern and southern Africa. It is caused by a fungus. The development of the disease is favoured by long periods of leaf wetness and cloudy conditions. This can result in severe leaf death after flowering causing poor grain fill.

**Symptoms:** The disease begins as small, regular, long brown-gray spots growing parallel to the leaf veins. The spots can reach 3 cm in length. Minimum tillage practices have been associated with an increased incidence of GLS.

#### 2. Maize streak virus (MSV)

This disease is caused by a virus transmitted by a leafhopper called *Cicadulina*. It is presently reported in many African countries. Severe infection causes stunting, and plants can die prematurely or if they do not, they may not produce any cob.

**Symptoms:** Early disease symptoms begin within a week after infection and consist of very small, round, scattered spots in the youngest leaves. The number of spots increase with plant growth: they enlarge parallel to the leaf veins. Soon more spots can be seen at leaf bases particularly on the youngest leaves. Fully elongated leaves develop broken yellow streaks along the veins, contrasting with the dark green colour of normal leaf.

#### 3. Blight

Leaf blight (for example northern leaf blight) occurs throughout the world and particularly in areas where high humidity and moderate temperatures occur during

the maize growing season. When infection occurs before and at silking and conditions are humid and warm, the disease may cause significant losses in maize production.

**Symptoms:** Early symptoms are easily recognized; slightly egg-shaped, water-soaked, small spots produced on the leaves. These grow into long, narrow, spindle-shaped disease areas on the leaf. They may appear first on lower leaves and increase in number as the plant develops, and can lead to complete burning of the leaves.

## Topic 2: Imazapyr-Resistant (IR) Maize

CIMMYT and KARI have developed a new approach for striga control in maize. This technology combines low doses of a herbicide (Imazapyr), as a seed coat with herbicide-resistant maize. This prevents striga from attaching itself to the roots of maize plant. The herbicide also kills other surrounding weeds. Extensive on-farm testing in several countries in Africa has shown that the herbicide is highly effective. The treatment leaves a field virtually clear of emerging striga. This allows intercropping with legumes and increases yields by up to three-times. The herbicide does not affect intercrops when they are planted at least 10 cm from maize hills.

Trials have shown that IR maize could be used with the Push-pull system, particularly in the first season, when the desmodium is establishing.

## Topic 3: Field Day planning

Field day is only five weeks away. There is a lot of work to do to make it a success. There are some suggestions in **Season 2**, **Week 15** that you can use as a guide.

To help you select the member's farm to host the field day, we suggest that you use some or all of the criteria in tables referred to above.

**You will have a lot of things to do**. Here are some suggestions:

1. Assign responsibilities for the field day
2. Tell people about it – the farming community, colleagues from other field schools, the provincial administration (DO, Chief, Assistant Chief, etc.), the Ministry of Agriculture, Livestock and Fisheries Extension staff, NGOs and CBOs, Church groups, schools, and the media (posters, radio, newspaper, etc.).
3. Make a programme and agree on the time, what is to be covered, and stick to it.
4. Make a budget.
5. Prepare an evaluation sheet.

**Benefits of livestock feed** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| | | | | |
| **Stemborers** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull Plot | | | | |
| • Check plot | | | | |
| **Striga** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 12

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Napier stunt disease and its management | 2 hours | Samples of a diseased plant (Must be destroyed immediately after use), a jembe |
| 2 | Recording desmodium pests on Push-pull and seed multiplication plots | 1 hours | Plastic jars or clear bottles, clear plastic bags for handling the beetles |

## Topic 1: Napier stunt disease and its management

### Introduction

In eastern Africa (including Ethiopia), the major threat to livestock production and the adoption of Push-pull strategy comes from **Napier stunt disease**. The disease causes severe stunting of the Napier grass and a severe yield reduction creating a shortage of livestock feed. Napier stunt disease is spread by insects.

At present, for small scale farmers, there is no affordable control for Napier stunt disease other than to remove and destroy the affected plants. If you do not remove the affected plants the disease will spread very quickly to the healthy plants.

The symptoms of the disease appear only during the regrowth of harvested Napier. You need to recognize these symptoms so that you can reduce the spread of the disease.

#### Learning objective

On completion of this topic participants will recognize symptoms of Napier stunt disease and how to reduce its spread.

#### Learning activity

- Facilitator-led introduction on:
  - The importance of the disease and how farmers can reduce its spread both on their farms and on the other farms
  - Recognizing the symptoms of the disease
- Practical exercise: Identifying and destroying the affected plants
- Discussions

**Step 1:** Discuss the symptoms

| What to look at | Healthy plant | Diseased plant |
|---|---|---|
| Colour | Green | Yellow |
| Leaves | Wide | Narrow |
| Height | Tall | Stunted |
| Internodes | Long | Short |

**Step 2:** Walk in the field and identify and record the diseased plants in the Push-pull plots and other Napier grass on the farm. Remove and destroy the diseased plants.

**Step 3:** Take a root split from a healthy Napier grass and plant it where you uprooted the diseased plant.

**Note**

*The new plant will not be affected by the disease simply by being planted in the same hole. The disease is spread by insects.*

#### Napier stunt disease incidence

| | Yes | No | Number of infected plants |
|---|---|---|---|
| Established Push-pull | | | |
| Vine established Push-pull | | | |
| Other Napier grass on the farm | | | |

**Note**

*To reduce the spread as much as possible you should walk around the farm and remove and destroy all the affected plants.*

## Topic 2: Recording desmodium pests on Push-pull and seed multiplication plots

# Introduction

In **Season 1, Week 17** you learnt about Blister beetle pests of desmodium. We need to continue observing them and the flowers they are feeding on.

Remember they are called Blister beetles because if you touch them they produce a chemical that can cause blisters on your skin.

### Learning objectives

Participants continue to identify and record the common types of Blister beetles found on desmodium and what other crops they are damaging.

### Learning activities

- Facilitator-led introduction on the common types of Blister beetles found on desmodium and what other crops they damage
- Practical exercise (Field walks to collect Blister beetles)
- Discussions

### Procedure

**Step 1:** Walk in the desmodium plot and collect samples of Blister beetles. Use plastic bags or gloves. Do not handle them with your bare hands. **Use the drawings to identify the Beetles.**

**Step 2:** Walk around the farm and record the number of Blister beetles on different crops.

**Step 3:** Destroy the beetles.

Remember that at the moment there is no affordable method to control Blister beetles for small scale farmers. The record you are making now will help scientists to develop affordable control measures.

| Plot | Type1 | Type2 | Type3 | Type4 | Grasshoppers |
|---|---|---|---|---|---|
| Established Push-pull plot | | | | | |
| Desmodium multiplication plot | | | | | |
| Vine established Push-pull plot | | | | | |
| Check plot | | | | | |
| Other crops | | | | | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |

*Please write the name of the crop.*

**Benefits** (Please keep filling the number of units each week as you cut)

| | Type of Benefit | Quantity | Unit Market price | Total Value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (1 unit) | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| **General Information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop Health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| **Stemborers** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| **Striga** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 13

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Planning Field Day | 3 hours | |

## Topic: Planning for Field Day

Field day is only three weeks away. There is a lot of work to do to make it a success. The suggestions in **Season 2, Week 15** should guide you to prepare for this important day.

To help you select the member's farm, we suggest that you use some or all of the criteria in tables above.

**You will have a lot of things to do as you prepare for the field day**. Take time and use the guidelines given in **Season 2, Week 11** to prepare for it.

**Benefits** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Established Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (unit) | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |
| Vine-established Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (unit) | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| **Stemborers** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| **Striga** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 14

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Comparison of stemborers and striga between Push-pull plots and Check plot | 1 hour 3 minutes | Field records, pens, napier, desmodium, maize grain, minerals, panga, buckets, chopping log, polythene sheet, gunny bags, water wheelbarrows, |
| 2 | Training in fodder preparation from Push-pull and home made ration formulation | 1 hour 30 minutes | |
| 3 | Planning Field Day | 1 hour | |

## Topic 1: Comparing stemborers and striga between Push-pull plots and Check plot

By now your maize is 14 weeks old and it will be showing more signs of striga and stemborer damage. You need to continue evaluating how your Push-pull plots are performing compared to your Check plot.

### Learning objectives

In this lesson, participants will continue their evaluation of the effectiveness of Push-pull in controlling stemborers and striga.

### Learning activities

- Facilitator-led introduction on the effectiveness of Push-pull in controlling stemborers and striga
- Field exercise of checking stemborer and striga damage
- Discussions (Lead question: Which plot is most affected by stemborers and striga weeds?)

**Step 1**: Starting from one corner, walk to the opposite corner (diagonally) of any plot. As you walk stop at **every fifth plant** and look for any sign of stemborer and striga damage. Record what you have noticed.

Look for:

- Signs of stemborer damage
  - Leaf damage
  - Cob damage
- Signs of striga damage
  - Stunted growth
- The number of striga plants within 15 cm around the plant

**Step 2:** Repeat **Step 1** from a different corner and walk diagonally to the opposite corner.

**Step 3:** Repeat Steps 1 and 2 in the other plots.

**Note**

*At the end of the exercise you will have looked at more plants in the Check plot than in the Push-pull plots.*

### 2nd season Push-pull plot

| What to record | Number | *Percent damage |
|---|---|---|
| Total number of plants observed | | |
| Total number of plants with signs of stemborer leaf damage | | |
| Total number of damaged cobs by stemborers | | |
| Total number of striga stunted maize plants | | |
| Total number of striga weeds around maize plants (15 cm) | | |

**The facilitator will assist the farmers to work out the percentages and discuss them.*

**Vine established Push-pull**

| What to record | Number | *Percent damage |
|---|---|---|
| Total number of plants observed | | |
| Total number of plants with signs of stemborer leaf damage | | |
| Total number of cobs damaged by stemborers | | |
| Total number of striga stunted maize plants | | |
| Total number of striga weeds around maize plants (15 cm) | | |

**The facilitator will assist the farmers to work out the percentages and discuss with them.*

**Check plot**

| What to record | Number | *Percent damage |
|---|---|---|
| Total number of plants observed | | |
| Total number of plants with signs of stemborer leaf damage | | |
| Total number of cobs damaged by stemborers | | |
| Total number of striga stunted maize plants | | |
| Total number of striga weeds around maize plants (15 cm) | | |

**The facilitator will assist the farmers to work out the percentages and discuss them.*

## Topic 2: Training on fodder preparation from Push-pull and home made ration formulation

# Introduction

On the farm there are various feed types, including products from the Push-pull plot. Some of these feeds can be used to formulate cheap and balanced concentrate rations at reduced costs.

### Learning objective

At the end of this lesson, participants will be able to identify different feed sources on the farm and make simple concentrate rations that can be utilized by livestock at a reduced cost.

### Learning activities

- Facilitator–led introduction on key issues to consider when formulating a ration for livestock.
- Practical activities on livestock ration formulation
- Discussions (Lead question: How much can you feed to your livestock each day?)

### How to make a ration

**Note**

*When formulating a good ration you should consider the feed requirements for the animal to be fed.*

A good concentrate ration should consist of the following ingredients:

Energy (Maize), Protein (Desmodium) and Minerals (Commercial mineral licks).

### How to mix

Before formulating, the farmer is advised to seek expert opinion from livestock agencies on the nutritive value and mixing levels.

Ensure that maize and desmodium are properly dried. Well dried desmodium hay will make good ingredient if available. It is advisable to make the desmodium hay in advance before formulating your ration. (**See Season 1, Week 16 Topic 3:** Making and utilizing desmodium hay).

**Step 1**: Collect and assemble the ingredients to be used in making the concentrate ration.

**Step 2**: Chop the desmodium hay into small pieces.

**Step 3**: Mix at a ratio of four parts of maize grain with one part of the chopped desmodium hay.

**Step 4**: Mill the mixture into coarse flour, using a hammer mill.

*In situations where desmodium hay and maize mixture is not accepted by the millers, you can mill the maize separately. The desmodium hay can be ground or hand crushed separately. Thereafter thoroughly mix the two ingredients as recommended.*

**Step5**: Your concentrate ration is ready for use or storage. Put it in a gunny bag and store in a dry place. It is advisable to use the concentrate ration within 2 months.

**Step6**: If the ration is used as a substitute to commercial dairy meal, give 4kgs (*2 "goro goro'")* per milking session for a dairy cow or 2kg (1 *"goro goro'")* for a dairy goat.

**What NOT to do:**

Do not use rotten maize or store the ration in a moist place, to avoid aflatoxins.

**Benefits** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| **Established Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1kg Desmodium hay (1 unit) | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |
| **Vine-established Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (Unit) | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's fields**

| **General information** | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| **Stemborers** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| **Striga** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

## Topic 3: Field Day!

Field day is only two weeks away. There is a lot of work to do to make it a success. There are some suggestions in Second Season, Week 15 on what to do. Use them as a guide.

# Week 15

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Final group assessment | 3 hours | Pens, checklist of performance and management of enterprises, farmers' records, flip charts, marker pens, checklist for field day events. |
| 2 | Field day planning | 1 hour | |

## Topic 1: Final group assessment

### Introduction

Now you have been working together as a group for two seasons, and you have had time to apply on your farm what you have learnt in the field school. It is time to go out for the fourth and last time to see what you and your colleagues have done so that you can all learn from each other's experiences, and select the best Push-pull plots so that you can hold the Field Day there next week.

**Learning objective**

The objective of this assessment is to maximize learning through group evaluation of individual plots.

**What to do in the assessment**

**Step 1:** Join the groups that you formed in **Season 1, Week 3**. Each group should have 4-6 members.

**Step 2:** Visit each farm represented by the members in the group.

**Step 3:** Use the table below to assess the Push-pull and the Check plots.

Discuss with the host farmer. Rate each farm using this scale:

1 = Poor 2 = Average 3 = Good

| | 2Nd season push-pull plot | | 2Nd season check plot | | 1St season push-pull with vines | |
|---|---|---|---|---|---|---|
| **What to check** | **Rating** | **Comments** | **Rating** | **Comments** | **Rating** | **Comments** |
| Overall field management | | | | | | |
| Weeding of the plots | | | | | | |
| Maize stand | | | | | | |
| Napier grass management | | | | | | |
| Desmodium management | | | | | | |
| Record-keeping | | | | | | |
| **Total rates** | | | | | | |

| | Desmodium multiplication plot | |
|---|---|---|
| What to check | Rating | Comments |
| Stand of desmodium | | |
| Weeding of the plot | | |
| Off-types | | |
| Quantity of seed produced | | |
| Quality of seed | | |
| Record keeping | | |
| Total rates | | |

## Topic 2: Planning for field day

Field Day is next week. You need to select one of the participant's farm, where you will be able to observe, exchange experiences and show the general farming community the result of your work. This is an excellent opportunity for the community to gain a better understanding of what happens in an FFS and what the benefits and problems of this approach are.

To help you select the member's farm, you should use some or all of the criteria in tables above.

**You will have to check on the things you want to do.** Here are some suggestions discussed earlier:

1. Assign responsibilities for the field day.
2. Tell people about it – the farming community, colleagues from other field schools, the provincial administration (DO, Chief, Asst. Chief, etc.), the Ministry of Agriculture, livestock and fisheries Extension staff, NGOs and CBOs, Church groups, schools, and the media.
3. Make a programme and agree on the time and what is to be covered.
4. Make a budget.
5. Prepare evaluation form.

**Benefits** (Please keep filling the number of units each week as you cut).

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (1 unit) | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's fields**

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| **Stemborers** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull Plot | | | | |
| • Check plot | | | | |
| **Striga** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 16

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Field Day | 4 hours | Chairs, tables, posters, Push-pull brochures, Push-pull FFS curriculum, refreshments, writing material, pens, displays of Push-pull materials and produce, collaborators and guest of honour |

## Field Day

- It will still be necessary to carry out and record the activities you need to do on this day.
- Start on time
- Each participant to do his/her duty
- Ensure everything planned is in place
- Follow the programme

**Benefits** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay (Unit) | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

## General observations (AESA): Farmer's fields

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Crop health** | **Poor** | **Average** | **Good** | |
| • Maize Push-pull plot | | | | |
| • Napier grass | | | | |
| • Desmodium | | | | |
| **Observations** | | | | **Farmer's comments** |
| **Stemborers** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| **Striga** | **Low** | **Medium** | **High** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 17

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Report of the Field Day | 4 hours | Data on field day (list of visitors, new farmers), record of questions asked and responses, record of desmodium sales and orders, formal evaluation questionnaires of field day |

## Report of the Field Day

After your Field Day write a brief report on it. This shall be used as one of the indicators in your final evaluation of he Farmer Field School in **Second Season, Week 23**.

**Things to note**

1. Attendance.
2. Areas of interest from non-group farmers
3. What went on well?
4. What did not go well?
5. Suggestions for improvement.

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's fields**

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Crop age | | | | |
| **Observations** | | | | **Farmer's comments** |
| **Size of cobs** | **Small** | **Medium** | **Large** | |
| • Established Push-pull plot | | | | |
| • Vine Push-pull plot | | | | |
| • Check plot | | | | |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

# Week 18

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Harvesting maize | 2 hours | Tape measure, weighing balance, panga, wheel-barrows or sacks for carrying the maize cobs. |

## Introduction

Your maize is now ready for harvesting. You have three plots: Two Push-pull and one Check plot. As in last season make sure that you harvest each plot separately and keep the maize from each plot separately. This will help you to know the difference in yields between the three plots.

You will also measure the height of the maize plants and dissect them to observe the number of stemborer larvae and pupae.

## Topic: Harvesting maize

### Learning objective

On completion of this topic participants will be able to:

- Explain the right time to harvest maize
- Demonstrate how to harvest maize

### Learning activities

Practical exercise:

- Measuring the height of the maize
- Harvesting
- Dissecting some stalks to check for stemborers
- Facilitator-led discussions on the relationship between maize height, stemborer damage (including larvae and pupae) and maize yield

Remember some key points about sorting and drying maize ears:

- After harvesting, sort out all off-type maize ears, particularly those showing different colours and texture, and the diseased ears, before placing them to dry for 4 to 5 days. Remember, if you do not dry the maize well, it can attract storage pests which will bring aflatoxin
- A good sorting at this time considerably reduces the task of sorting after the maize ears have been dried to the desired extent (10 to 15 percent moisture content)

**Note**

- *Steps 1 to 3 below can be done only on the Farmer-Field school plot*
- *Step 4 should be done on each farmer's plot*

**Step 1:** Starting from one corner of a plot walk to the opposite corner (diagonally). As you walk stop at **every fifth plant**, measure and record its height and then cut it at the base. Carry all the plants you have cut out of the plot and dissect them and record the number of stemborer larvae and pupae.

**Step 2:** Repeat **Step 1** from a different corner and walk diagonally to the opposite corner.

**Step 3:** Repeat Steps 1 and 2 in the other plots.

**Note**

*At the end of the exercise you will have looked at more plants in the Check plot than in the Push-pull plots.*

**Step 4**: Now harvest the crop keeping separate records for each plot.

- **Cob plucking method**: Harvest and take the weight of the cobs in both the push-pull and the Check plots and leave them in the open to dry
- **Stalk cutting method**: Leave stalks from Push-pull and Check plots in separate piles until they are dry. Then take the weight of cobs
- Keep the records from the three plots separately

## Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| **Established Push-pull plot** | Harvesting maize | | | | |
| | Collecting and stacking stover | | | | |
| | Other activity | | | | |
| **Total** | | | | | |
| **Vine-Estab-lished Push-pull** | Harvesting maize | | | | |
| | Collecting and stacking stover | | | | |
| | Other activity | | | | |
| **Total** | | | | | |
| **Check plot** | Harvesting maize | | | | |
| | Collecting and stacking stover | | | | |
| | Other activity | | | | |
| **Total** | | | | | |

## Estimated benefits

| | Product | Estimated quantity | Estimated value |
|---|---|---|---|
| **Established Push-pull** | Maize (50 kg bag) | | |
| | Stover | | |
| **Vine Push-pull** | Maize (50 kg bag) | | |
| | Stover | | |
| **Check plot** | Maize (50 kg bag) | | |
| | Stover | | |

**Benefits of livestock feed** (Please keep filling the number of units each week as you cut)

| | Type of benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg Desmodium (1 Unit) | | | |
| | 1 kg Desmodium hay | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's fields**

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Observations | | | | Farmer's comments |
| Rainfall: Number of days, week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

Farmers' comments after the lesson: _____
_____
_____
_____

# Week 19

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | 2nd Harvesting Desmodium from the two push-pull plots and the desmodium multiplication plot | 2 hours | Gunny bags, balance, 2kg tins (gorogoro) Maize sheller (optional) |
| 2 | Shelling and storage of maize | 2 hours | |

## Topic 1 : 2nd Harvesting Desmodium from the two Push-pull plots and the desmodium multiplication plot

After you have harvested maize you can start harvesting desmodium pods and continue harvesting for another 2-3 weeks. As not all the pods will be ready at the same time, today we will discuss when and how to harvest.

You learned how to harvest desmodium from the Push-pull plots in **Season 1, Week 19**.

Please refer to the lesson details. **Remember:** this is a continuous activity that should continue for the next two to three weeks as the pods mature.

## Topic 2: Shelling and storage of maize

Last week we discussed when and how to harvest maize. We then harvested the maize. This week we look at how to shell and store the maize.

**Note**

*It is important to select only healthy and clean cobs for shelling. The diseased and rotten cobs must be destroyed because they may contain aflatoxin.*

- After shelling, the grain should be dried for 3 or more days, cleaned and stored in a dry place protected from rats
- After removing the grains, the cobs can be used as livestock feed particularly during the dry season (See **Season 1, Week 19)**

**Note**

*Keep separate records for Push-pull plots and for the Check plot.*

**Labour Costs**

| | Activity | No of people working on this activity | Time taken to complete the activity (Hours) | Cost of labour per day | Total cost of this activity |
|---|---|---|---|---|---|
| Established Push-pull plot | Shelling maize | | | | |
| | Harvesting desmodium | | | | |
| | Other activity | | | | |
| **Total** | | | | | |
| Vine-Established Push-pull | Shelling maize | | | | |
| | Harvesting desmodium | | | | |
| | Other activity | | | | |
| **Total** | | | | | |
| Check plot | Shelling maize | | | | |
| | Other activity | | | | |
| **Total** | | | | | |

**Estimated benefits**

| | Product | Quantity | Local market value |
|---|---|---|---|
| Established Push-pull | Maize (Gorogoro) | | |
| Vine Push-pull | Maize (Gorogoro) | | |
| Check plot | Maize (Gorogoro) | | |

**Benefits of livestock feed** (Please keep filling the number of units each week)

| | Type of Benefit | Quantity | Unit market price | Total value |
|---|---|---|---|---|
| Push-pull plot | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg desmodium (1 Unit) | | | |
| | 1 kg hay | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefit | | | |

**General observations (AESA): Farmer's Fields**

| General information | | | | |
|---|---|---|---|---|
| Date | | | | |
| Observations | | | | Farmer's comments |
| Rainfall: Number of days it rained the week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

Farmers' comments after the lesson: _____
_____
_____
_____

# Week 20

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Processing desmodium seed | 2 hours | Weighing balance, containers (2 kg tins), a flat grinding stone, rubber sole of an old shoe, wire mesh (30cm by 30 cm), polythene clothing, jembe, panga, clear polythene bags. |
| 2 | Hand out the final assessment questionnaire | 30 minutes | |

## Topic: Processing desmodium seed

You learned how to process desmodium in **Season 1, week 20**. Please refer to that lesson for details.

### Labour costs

| | Activity | No of people working on this activity | Time taken to complete the activity (Hours) | Cost of labour per day | Total Cost of this Activity |
|---|---|---|---|---|---|
| **Push-pull plot** | Processing desmodium seed | | | | |
| | Other activity | | | | |

### Benefits from desmodium seed

| | Type of Benefit | Quantity | Unit Market price | Total Value |
|---|---|---|---|---|
| **Push-pull plot** | Desmodium seed | | | |
| | Desmodium husks | | | |
| | Other benefits | | | |

**Benefits of livestock feed** (Please keep filling the number of units each week)

| | Type of Benefit | Quantity | Unit Market price | Total Value |
|---|---|---|---|---|
| **Push-pull plot** | 10 Kg Napier grass (1 Unit) | | | |
| | 3 Kg desmodium (1 Unit) | | | |
| | 1 kg hay | | | |
| | 5 kg Silage (1 unit) | | | |
| | Milk (litre) | | | |
| | Other benefits | | | |

**General observations (AESA): Farmer's fields**

| General Information | | | | |
|---|---|---|---|---|
| Date | | | | |
| **Observations** | | | | **Farmer's comments** |
| Rainfall: Number of days, week before: ____ | | | | |
| Soil moisture | | | | |
| Weather: *Sunny/Cloudy/Rainy Windy/Still Hot/ Cold* | | | | |

**Hand out the final assessment questionnaire**

# Week 21

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Managing the desmodium | 1 hour | Panga, jembe, chopping log, gunny bag, polythene sheet, mollases, bucket, sprinkler, string, rake |
| 2 | Gross margin analysis | 2 hours | |

## Topic 1: Managing the desmodium

Now that you have harvested all the pods from your Push-pull plots and seed multiplication plot, you have two choices:

1. Harvest the desmodium for fodder and hay-making (see **Season 1, week 13, 14,** and **16**).
2. Leave the desmodium to produce mature vines (as we did in Season 1) to establish new Push-pull plots or for sale of vines to neighbouring farmers.

## Topic 2: Gross margin analysis

In Season 1, Week 15 you learned about Gross Margin Analysis. Please refer to the lesson details.

**Note**

*Assessment of adoption rates (farmers practising PP). To be factored in the questionnaire.*

(Questionnaires returned)

# Week 22

| | Topic | Duration | What you need for this lesson |
|---|---|---|---|
| 1 | Evaluation of the FFS Curriculum | 3 hours 30 minutes | Push-pull manual, pen, markers, flips charts |
| 2 | Preparation for Graduation | 30 minutes | Certificates, questionnaires, |

## Topic 1: Evaluating the Push-pull Curriculum for FFS

Now that you have come to the end of your field school in learning about the Push-pull technology, you need to assess the value of what you have been doing. Evaluation looks at programme activities, human resources, material resources, information and facts in order to monitor progress and effectiveness, consider costs and efficiency, show where changes are needed and to help to plan more effectively.

This lesson shows you how to evaluate the school that you have been attending for over forty weeks.

### Learning objectives

On completion of this topic participants will be able to:

- State and explain reasons for evaluating the Push-pull curriculum for FFS
- Discuss and explain reasons for success or failure of the field school
- Explain the effectiveness of the technology in making a difference in crop yields and incomes

### Learning activities

- Facilitator-led introduction on meaning and importance of curriculum evaluation
- Groups of 4-6 members discuss overall performance of the FFS
- Divide a wall chart into 3 parts and brainstorm on these questions focusing on things that went well, things that did not go well or things were not useful, and suggestions for next time/ improvements. Groups then to present their discussions
- Facilitator-led discussion on relevance of the curriculum, duration of the school (too short / too long), effectiveness and quality of facilitation, integration of the FFS curriculum into farmer's interests and way of life

**Importance of doing evaluation**

**Evaluation in FFS is important in several ways.**

1. Achievement – assessing what has been achieved (knowledge, skills, attitudes, etc).
2. Measuring progress in accordance with the objectives of the school.
3. Improving monitoring for better management.
4. Identifying strengths and weaknesses to strengthen the school and programme.
5. Checking if the school or programme efforts made a difference.
6. Checking the cost-benefit of the FFS, to assess whether the costs were reasonable compared to the benefits achieved.
7. Collecting information to plan and manage programme activities later.
8. Sharing experiences to prevent others from making mistakes or encouraging them to use similar methods.
9. Improving effectiveness to have more impact.
10. Allowing for better planning more in line with the needs of participants, especially at the community level.

**Note**

*Facilitator to inform the participants that in addition to the group evaluation of the FFS curriculum, information related to the individual FFS members will be gathered through a questionnaire to be given some time later. The individuals will provide answers to a set of questions to find out what has happened after the school.*

**Some questions to help in assessing the FFS curriculum**

1. What were the most valuable things for you about the FFS?
2. What was the least valuable thing about the FFS?
3. Did you find it easy to participate in the school?
4. How did you find the quality of facilitation in terms of:
   a) Presentation skills
   b) Listening skills
   c) Interest in what people have to offer
   d) Clear thinking and observation of the whole group
   e) Understanding of the overall objectives
   f) Helping participants make use of the most decisions to do their tasks
5. Does the technology work for you?
6. How many other farmers have adopted the technology from you?
7. What suggestions do you have for improving the performance of the school?

**Example of a table that can be filled to establish impact among individual FFS members and the group**

Name of FFS Participant:_____ Name of FFS:_____

District_____ Division:_____ Sex: 1=Male 2=Female

| Parameter | At start of ffs | First season | Second season |
|---|---|---|---|
| Livelihood / food security information | | | |
| Size of land under Push-pull technology | | | |
| Number of food secure months during | | | |
| Yearly income from farm | | | |
| Yearly income from Push-pull | | | |
| Yield per unit area | | | |
| Amount of milk per month | | | |
| Number of livestock on the farm<br>a) Dairy cows<br>b) Dairy goats<br>c) Other | | | |
| Use of manure (quantity per acre) | | | |
| Use of fertilizer (quantity per acre) | | | |
| Number of other farmers adopting Push-pull | | | |
| AND SO ON… | | | |

## Topic 2: Preparing for graduation

Like all schools, the FFS must come to and end. Members need to develop some basic criteria of who qualifies to graduate. They may for instance use the attendance records or other considerations. The graduation event marks the end of the FFS session (cycle/season) and is a festive moment where farmers celebrate their achievements. Such an event requires invitation of key stakeholders to grace the occasion and in order to establish future collaboration and support. The members need to decide where the graduation event will be held, who will be invited, activities to be performed on this day, allocation of responsibilities, graduation certificates, etc.

# Week 23

| | Graduation and Certification | Duration |
|---|---|---|
| | **Things that should be in place**<br><br>• Program<br>• Place for the event,<br>• Furniture,<br>• Certificates,<br>• Meals (optional) | The whole day |

## Graduation and Certification

Group members to ensure that all the things planned for the graduation are in place. Good organization of the event will lead to an interesting and motivating graduation.

### Follow-up

Follow up after graduation is very important. At the end of a learning cycle and graduation ceremony, the FFS in most cases continues as a farmer group. The group may have problems that were not addressed in the study cycle, hence the need to plan for post-FFS. This could cover both technical and socio-economic activities. Such a follow-up activity may or may not require a facilitator to assist the group or funds for the study process. The FFS graduates can use the group to engage in other productive activities aimed at improving their livelihoods.

# Frequently asked questions

**Q. What is the maximum and minimum size of the Push-pull plot?**

A. A Push-pull plot can range from 50 m X 50 m to any size of the farm provided the fields are demarcated into 50m by 50m using border rows of Napier grass.

**Q. What is the minimum width of Push-pull plot?**

A. Not less than 10 meters

**Q. How long can the Push-pull plot be kept?**

A. You could benefit from your Push-pull plot for 5 or more years if well managed

**Q. Can I graze my cattle directly on the Push-pull plot?**

A. No. Grazing destroys desmodium and Napier grass.

**Q. Can I practice Push-pull if I don't have livestock?**

A. Yes, because you can sell Napier and desmodium forage and seed to your neighbour and desmodium can improve fertility of your soil.

**Q. Can I intercrop other crops and trees in the Push-pull plot?**

A. No.

**Q. Are there alternatives to Napier grass and desmodium?**

A. Yes. Forage sorghums like Sudan grass can be used to trap stemborers instead of Napier grass and molasses grass can be used to repel stemborers instead of desmodium. However, molasses grass does not control Striga weed.

**Q. How long can desmodium survive in a prolonged drought?**

A. Desmodium can always regenerate after a drought. However you are advised to plough and re-established a Push-pull plot incase of a prolonged drought where desmodium fails to regenerate.

**Q. Can I plant maize first, then Napier grass after a few weeks?**

A. No. You are advised to plant Napier grass before planting maize or if late plant both crops at the same time.

**Q. When do I start reaping the benefits of the Push-pull plot?**

A. You can reap benefits during second cropping season in areas where farmers plant maize twice in a year and during the second year in areas where farmers only plant once in a year.

**Q. Can I use Push-pull on sorghum?**

A. You can intercrop Greenleaf desmodium with sorghum to repel stemborers and control Striga weed.

**Q. Is Push-pull effective against other weeds and insect pests?**

A. Desmodium in the Push-pull can reduce other weeds by smothering them but both Napier grass and desmodium may not reduce other insect pests.

**Q. Where can I obtain Napier grass and desmodium seeds?**

A. Napier grass can be obtained from neighbour who have planted their farms with Push-pull. Desmodium seed is sold by Western Seed Company in Kitale.

**Q. What can I do if I don't get desmodium seeds?**

A. Use desmodium root splits or cuttings from your neighbour. However, ensure that you plant them immediately and, when there is adequate soil moisture.

**Q. How effective is Push-pull against stemborer and striga weed?**

A. Push-pull is very effective. It is even better than insecticides for the control of stemborer and better than manual removal of striga weed, both in terms of cost and effective control.

**Q. Can I be given a dairy animal if I establish a Push-pull plot?**

A. No. But you can qualify for various projects on dairy animals.

**Q. If I don't have desmodium seed, can I plant only Napier grass in my Push-pull plot?**

A. Yes. If you plant only Napier you will be able to reduce stemborers on maize but you will not be able to control striga weed.

**Q. Can Push-pull technology work in all parts of Kenya or Africa?**

A. Yes but only in areas recommended for growing desmodium. You will need to consult your agricultural extension staff.

**Q. Can I use other varieties of Napier grass other than Bana grass?**

A. Yes. You can plant Clone 13 Napier grass, French Cameroon, Kakamega 1, Kakamega 2 or Kakamega 3. However, they are not as good trap plants as Bana grass.

**Q. Can I use other species of desmodium other than silverleaf?**

A. Yes. You can use Greenleaf desmodium, but the results of silverleaf with maize are the best. Greenleaf desmodium do best in in dryer areas.