Community-Based **Armyworm Forecasting**

Manual for Training of Trainers and Forecasters

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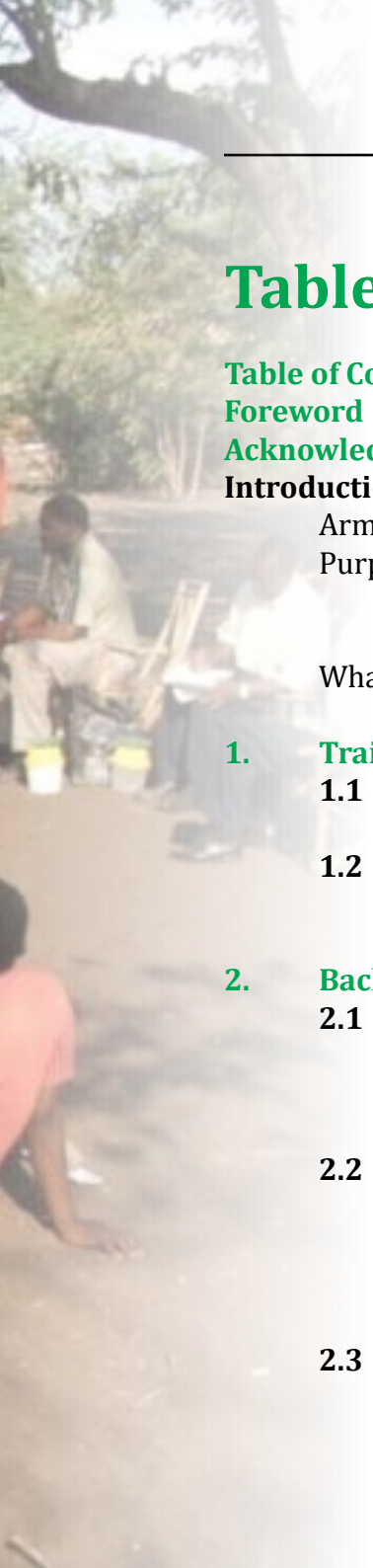

Table of Contents

Foreword

When we first developed an armyworm monitoring and forecasting service over 40 years ago, through collaboration between the governments of Eastern Africa and the Tropical Development and Research Institute (UK), we used light traps to catch the adult moths. Sorting through a light-trap catch was interesting but time-consuming, as light traps catch many types of moths as well as other insects.

In the 1970s, the armyworm's unique sex pheromone was identified and synthesised. Consequently, we started using pheromone traps that, unlike the light traps, do not require electricity and only catch *Spodoptera exempta*. This made it feasible to run traps in more locations, and this helped us to produce more accurate armyworm outbreak forecasts.

National networks of pheromone traps continue to be used by migrant pest control units to monitor armyworm populations, supporting timely government-managed control operations.

The Community-Based Armyworm Forecasting (CBAF) is a significant step forward in managing the armyworm menace. The rationale for providing local forecasts is as good as when we first developed national armyworm forecasting, but the community-based approach puts technology in the hands of farmers, empowering them to take a proactive and major role in combating seasonal armyworm infestations.

Governments, through their plant protection departments, must continue to oversee management of migrant pests, as the biology of the armyworms as well as the severity of their attack mean farmers cannot be left to tackle them on their own. At the same time, it is appropriate to encourage farmers to take responsibility for solving their own problems wherever possible, so that they do not always have to rely on government intervention. Community-based forecasting is not a replacement for national forecasting, but it clearly delivers benefits at the community level, and is therefore a welcome addition to our arsenal.

Hundreds of villages in Ethiopia, Kenya, Malawi, Tanzania and Zimbabwe have already experienced the value of Community-Based Armyworm Forecasting. The challenge now is to scale up this innovative approach so that thousands of communities across Eastern and Southern Africa can also benefit.

This manual is a valuable aid towards that aim. It provides a step-by-step guide to the training of trainers, whose job it will be to mobilise and train communities. It also gives the trained trainers all the information they need to support and sustain the approach; and so contribute to local, national, and international food security.

Peter O Odiyo

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Desert Locust Control Organisation for Eastern Africa (DLCO-EA)
Addis Ababa, 2010

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The European Union is made up of 27 member states who have decided to gradually link together their knowhow, resources and destinies. Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy, and sustainable development whilst maintaining cultural diversity, tolerance, and individual freedoms.

The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders. The European Commission is the EU's executive body.

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Introduction

The African armyworm, *Spodoptera exempta*, is a pest of cereal crops and pasture in Africa south of the Sahara, Asia, Australia and the Pacific region. It is a moth most prevalent on the eastern side of the African continent.

The adult armyworm is highly migratory. And this is the main problem with the moth. Outbreaks of the caterpillars or larvae can appear very suddenly and at a very high density, catching farmers unawares and unprepared. The armyworm larvae are capable of infesting thousands of square kilometres, destroying a large amount of crops in just a few days.

Consequently, the African armyworm has gained notoriety as a pest species. It attacks such important cereal crops as maize, wheat, sorghum, millet, rice, teff and barley.

The armyworm causes considerable economic losses both to individual farmers, communities, and to nations. Poor smallholder farmers are particularly vulnerable to severe losses because of insufficient resources to cope with the armyworm invasions.

Armyworm forecasting

For armyworm control measures to be effective, they must be carried out in the first few days after larvae emerge from the eggs. But often this does not happen. The presence of larvae is usually noticed at an advanced stage of infestation, making control of the armyworm outbreak too expensive or too late to be effective.

Monitoring, forecasting and prompt reporting of armyworm outbreaks are essential for effective and efficient control actions. In East Africa, regional and national forecasting systems that provide warnings on the likelihood of armyworm outbreaks have been operating since the 1960s.

The central forecasting service makes forecasts based on information collected from army-

worm moth traps. These traps are mostly located at the district level. The central forecasting service has played an important role in the control of armyworms.

However, it has experienced a number of challenges. For example, the forecasts are issued for districts rather than for each village. Due to lack of effective communication, the forecasts often do not reach the susceptible farmers in time, if at all.

This has led to the search for better options that complement the centralised forecasting system and take account of the challenges it faces. An innovative approach called "Community-Based Armyworm Forecasting", (CBAF), emerged in 2001. Since then, the new approach has been piloted and tested in different East African countries and has proved to be efficient, effective, and sustainable.

The CBAF approach establishes a system that allows each village to have its own trap for monitoring armyworm populations. A farmer is trained to be the armyworm forecaster for the village. The farmer-forecaster operates the armyworm moth trap, collects data, and makes village-level forecasts. The forecaster then disseminates the information using locally available networks and channels of communication.

Purpose of this manual

This manual supports the wide-scale implementation of CBAF. It assists those who plan and organise the necessary training activities, and provides all the information for the two types of training courses involved.

Training of Trainers
To implement CBAF on a wide scale, it is necessary to train people who will then undertake and oversee the farmer training. Typically these include division and district extension workers as well as crop production and protection experts.

Training Forecasters
CBAF involves training farmers in the community to be the armyworm forecasters for their community.

Some parts of the manual are also useful to the community forecasters themselves.

What does the manual provide?

The manual covers information on armyworm and Community-Based Armyworm Forecasting that is needed to make sure CBAF is implemented effectively. It includes sections on participatory training, facilitation, and communication skills – activities that are important to the success of CBAF.

The manual is divided into three parts.

Part 1
Provides suggested curriculum and session plans for the two types of training courses mentioned above – training of trainers and training forecasters.

The curriculum and session plans can be used as presented here, or modified for the particular situation as may be needed.

Part 2
Contains background information that those delivering the courses need to know. It is recommended that course leaders read this part thoroughly before running the course.

Specific sections in Part 2 provide information relevant to the course, and are referred in certain session plans in Part 1.

Part 3
Provides details of practical activities that can be used during the training courses. These activities are referred to in the session plans in Part 1.

Other practical activities that the trainers are familiar with can also be used.

1. Training workshop curriculum

1.1 Training of Trainers

The Training of Trainers' course will acquaint trainees with the various aspects of the armyworm, the CBAF approach, and participatory training. The course also looks at facilitation techniques and other related areas.

This section of the manual describes 9 modules for use in the training of trainers' course. It also has the suggested training programme in Table 1 below.

Table 1. Training programme for Training of Trainers

Day	Time	Description
Day 1	**08:30–09:00**	Arrival and registration
	09:00–09:30	Welcome address and introductions *(module 1)*
	09:30–09:45	Opening address *(module 1)*
	09:45–10:00	Announcements *(module 1)*
	10:00–10:30	Participants' experiences and expectations *(module 1)*
	10:30–11:00	Tea break
	11:00–11:30	Overview of training programme and objectives *(module 1)*
	11:30–12:30	Armyworm biology and migratory behaviour *(module 2)*
	12:30–14:00	Lunch break
	14:00–15:30	Armyworm biology continued *(module 2)*
	15:30–16:00	Coffee break
	16:00–17:00	Armyworm control *(module 3)*

Day	Time	Description
Day 2	**08:30–09:00**	National armyworm forecasting *(module 3)*
	09:00–10:30	Participatory training and communication *(module 6)*
	10:30–11:00	Tea break
	11:00–12:30	Community-based armyworm forecasting *(CBAF)* – process and benefits *(module 4)*
	12:30–14:00	Lunch break
	14:00–15:30	Pheromone traps and rain gauges – how they work *(module 5)*
	15:30–16:00	Coffee break
	16:00–17:00	Record-keeping activities in the classroom – moth, rainfall, and vegetation *(module 5)*
Day 3	**08:30–10:00**	Record-keeping activities in the field (calculating forecasts) and reporting the results in a plenary session *(module 5)*
	10:00–10:30	Vegetation observation and identification *(module 5)*
	10:30–11:00	Tea break
	11:00–12:30	Participatory discussion on communication channels and strategies *(module 6)*
	12:30–14:00	Lunch break
	14:00–15:30	Non-formal adult education and facilitation skills *(module 7)*
	15:30–16:00	Coffee break
	16:00–17:00	Plenary discussion

Day	Time	Description
Day 4	**08:30–12:30**	Field visit to armyworm infested farm/area and or national trap sites *(module 5 and 6)*
	12:30–14:00	Lunch break
	14:00–15:00	Feedback and reflections on field visit *(module 5, 6 and 7)*
	15:00–15:30	Coffee break
	15:30–17:00	Introduction to outcome mapping and its significance for CBAF *(module 8)*
Day 5	**08:30–10:30**	Action planning and presentation in plenary *(module 9)*
	10:30–11:00	Tea break
	11:00–12:00	Facilitated discussion
	12:00–12:30	Course evaluation *(module 9)*
	12:30–13:00	Close and departure *(module 9)*

1.1.1 Modules

The following nine modules reflect the objectives, activities, and background information for the Training of Trainers' course. The modules should be covered in the time available, and can easily be adapted for the programme in Table 1 above.

If time is a constraint, the facilitator should at least ensure the training covers the economic importance of the armyworm, collecting data and making accurate forecasts, as well as dissemination of armyworm alerts and control of the pest.

Module 1	**Introductory session – setting the scene**
Learning objectives	• To get to know each other • To understand the experiences and expectations of participants • To introduce the objectives and contents of the training
Topics	• Interactive introduction of participants • Opening remarks/address • Participants' expectations and experiences • Setting out of the learning norms • Course objectives and overview of the training programme
Methods	• Self-introduction with icebreaking exercises • Speeches by officials • In pairs or in groups, participants to give their experiences and expectations ◗ The information could be collected on cards and clustered • Discuss the learning norms • Facilitator to present objectives and the programme in a plenary session
Activities	Section 3.2 activities 1 and 2 *(pages 65 and 66)*
Material and equipment	Flipcharts, marker pens, pins, LCD projector, cards

Module 2	Armyworm biology and migratory behaviour
Learning objectives	• To introduce various aspects of the armyworm including its lifecycle, characteristics, and how outbreaks happen • To create awareness and understanding about the feeding habits of the armyworm and the damage it causes

Topics	• What is the armyworm?
	• Why the name the African armyworm?
	• The lifecycle of the armyworm
	  ◗ Identifying the different stages
	  ◗ The biology of the armyworm at the different stages
	  ◗ Moth emergence, migration, and outbreaks
	  ◗ The feeding habits of the armyworm attacks

Methods	• Interactive lecture presented by the trainer • Buzz session in between the lecture that includes showing posters, leaflets, and specimens • Activity on the economic importance of the armyworm • Video show and debriefing • Question and answer session
Background information	Section 2.1 *(page 25)*
Activity	Section 3.2 activity 6 *(page 70)*
Additional information	Rose *et al.* (2000). Armyworm Handbook
Material and equipment	LCD projector, armyworm specimens, flipcharts, video, TV sets, marker pens, armyworm poster

Module 3	Armyworm forecasting and control
Learning objectives	• To understand the centralised armyworm forecasting system and its limitations • To show importance of CBAF and how it complements the national forecasting service • To discuss existing armyworm control methods and the merits and demerits of each

Topics	• The national armyworm forecasting service in various countries
	• The challenges and limitations of the centralised forecasting system
	• Why an alternative approach to monitoring and forecasting armyworm attacks
	• Armyworm management and control
	  ◗ Cultural control
	  ◗ Biological control
	  ◗ Physical control
	  ◗ Chemical control

Methods	• Brief presentation by the facilitator and plenary discussion • Debate the challenges and limitations of the centralised forecasting system • Plenary discussion
Background information	Section 2.2 *(page 32)*
Activity	Section 3.2 activity 8 *(page 72)*

Additional information	Rose *et al.* (2000). Armyworm Handbook
Material and equipment	LCD projector, flipcharts, marker pens, cards

Module 4	Introduction to CBAF
Learning objectives	• To familiarise participants with the concepts, processes, and practices of CBAF • To discuss the benefits of CBAF
Topics	• Origins of CBAF • Benefits of CBAF • How CBAF works ◗ The steps in CBAF
Methods	• Interactive presentation by trainer • "CBAF versus central forecast". Debate the statement followed by plenary discussion • Question-and-answer session
Background information	Section 2.3 *(page 37)*
Activity	Section 3.2 activity 8 *(page 72)*
Additional information	Rose *et al.* (2000). Armyworm Handbook RIU Pocket Guide No. 5
Material and equipment	LCD projector, flipcharts, marker pens

Module 5	**Forecasting equipment, identification of vegetation, and communication strategies**
Learning objectives	• To introduce the different forecasting equipment and their operation • To practise collecting data, recording it, and calculating forecasts • To discuss communication channels and strategies for disseminating forecast information
Topics	• How pheromone traps and rain gauges work • Vegetation observation and identification • Keeping records of moth catches, rainfall, and vegetation • Calculating forecasts • Participatory discussion on communication channels and strategies
Methods	• Interactive presentation by facilitator • Classroom demonstration and activity on forecast equipment, data recording, and forecast calculation • Field activity in groups on setting up forecast equipment, data recording, and calculating forecasts • Plenary group presentation and discussion • Brainstorming and discussion on communication channels and strategies
Background information	Sections 2.3 *(page 37)*

Activities	Section 3.1 activities 1–6 *(pages 59-64)* Section 3.2 activities 3 and 7 *(pages 67 and 71)*
Additional information	RIU Pocket Guide No. 5
Material and equipment	LCD projector, flipcharts, marker pens, moth traps, rain gauges, armyworm posters, data sheets, outbreak report cards

Module 6	**Participatory training and communication**
Learning objectives	• To acquaint participants with concepts, principles, and benefits of participatory approaches • To familiarise participants with basic concepts and roles of participatory communication • To create awareness about the use and importance of group dynamic exercises
Topics	• Participatory training approaches ◗ What is participation? ◗ Principles of participation ◗ Benefits of participation ◗ Challenges encountered in participation ◗ Participatory training approaches and techniques ◗ Uses and types of group dynamic activities • Participatory communication ◗ A new understanding of communication ◗ Participatory communication in CBAF
Methods	• Visualised brainstorming • Interactive presentation by the facilitator • Group discussion and presentation • Role play and other dynamic group activities
Backgroun information	Section 2.4 *(pages 44)*
Activities	Section 3.2 activities 3–5 *(pages 67-69)*

Additional information	Pretty, Jules N *et al.* (1995). Participatory Learning and Action World Bank (2009)
Material and equipment	LCD projector, flipcharts, marker pens, A4 papers, cards

Module 7	**Non-formal adult education and role of adult trainer**
Learning objectives	• To introduce basic concepts and principles of adult learning • To understand factors encouraging adult learning and the roles and functions of a trainer in adult learning
	• To familiarise participants with basic understanding of facilitation functions, techniques, and skills
Topics	• Non-formal adult education ◗ Basic features and key concepts of adult education ◗ Characteristics of adult learners ◗ How do adults learn best? ◗ The roles and functions of a trainer in adult learning • Facilitation skills ◗ Definition of facilitation ◗ Facilitating functions ◗ Key facilitation skills and qualities
Methods	• Interactive lecture • Visualised brainstorming using cards • Plenary participatory discussion
Background information	Section 2.5 *(page 50)*
Additional information	Pretty, Jules N *et al.* (1995). Participatory Learning and Action Financial Literacy Foundation (2006). Adult Education Guide
Material and equipment	LCD projector, flipcharts, marker pens

Module 8	**Use of outcome mapping and stakeholder analysis for effective armyworm management**
Learning objectives	• To identify key CBAF stakeholders and understand the role of each stakeholder • To understand the importance of involving the stakeholders and look into ways of strengthening their involvement • To acquaint participants with concepts and practices of outcome mapping and related issues
Topics	• Outcome mapping • Boundary partners • Progress markers • Stakeholder analysis and its uses • Techniques for stakeholder analysis
Methods	• Introduction by facilitator • In small groups, identify the key stakeholders, their roles, and the linkages. To also look at the challenges facing the stakeholders and ways to overcome these • Presentations and plenary discussions
Background information	Section 2.6 *(page 54)*
Activity	As indicated in methods above
Additional information	Earl *et al.* (2001). Outcome Mapping
Material and equipment	LCD projector, flipcharts, marker pens

Module 9	Action planning, training evaluation, and closing
Learning objectives	• To encourage each participant to develop an action plan for scaling up CBAF • To familiarise participants with ways of obtaining feedback on the strengths and limitations of the training sessions
Topics	• Action planning and presentation • Evaluating a workshop ◗ Daily evaluation e.g. mood metre or graffiti feedback board ◗ Final evaluation e.g. simple questionnaire or plenary feedback • Training workshop closure
Methods	• Work plan preparation and presentation • Participatory discussion on workshop evaluation techniques • Close of workshop
Activities	Section 3.2 activities 9-11 *(pages 73-75)*
Material and equipment	LCD projector, flipcharts, marker pens

1.2 Training community forecasters

Training of forecasters is mostly concerned with details of the CBAF process, but some background on armyworm biology is also included. Experience in different countries shows two days is enough to train the forecasters.

In some cases it may be possible to complete the training in one day, and this may be necessary to reduce costs. For a shorter training period, it is very important to ensure that the trainees can forecast properly.

This section outlines a two-day training course for forecasters, including what to cover and how, as outlined in Table 2 below, in four sessions described below.

Table 2. Training programme for forecasters

Day	Time	Description
Day 1	**08:30-09:00**	Arrival and registration *(session 1)*
	09:00-09:30	Welcome address and introductions *(session 1)*
	09:30-09:45	Opening remarks *(session 1)*
	09:45-10:00	Announcements *(session 1)*
	10:00-10:30	Participants' experiences and expectations *(session 1)*
	10:30-11:00	Tea break
	11:00-11:30	Overview of training programme and objectives *(session 1)*
	11:30-12:30	Armyworm biology, migratory behaviour, and management *(session 2)*
	12:30-14:00	Lunch break
	14:00-15:00	Armyworm biology continued *(session 2)*
	15:00-15:30	CBAF process and benefits *(session 3)*
	15:30-16:00	Coffee break
	16:00-17:00	CBAF continued *(session 3)*

Day	Time	Description
Day 2	**08:30-09:30**	Pheromone traps and rain gauges – how they work *(session 3)*
	09:30-10:30	Vegetation observation and identification *(session 3)*
	10:30-11:00	Tea break
	11:00-12:30	Record-keeping activities in class – moth, rainfall, and vegetation *(session 3)*
	12:30-14:00	Lunch break
	14:00-15:00	Record-keeping activities in the field and calculating forecasts *(session 3)*
	15:00-15:30	Reporting findings of the activities in plenary *(session 3)*
	15:30-16:00	Coffee break
	16:00-16:30	Participatory discussion on communication channels and strategies *(session 3)*
	16:30-17:30	Evaluation, presentation of forecasting packs, and certificates *(session 4)*
		Close *(session 4)*

1.2.1 Sessions

The two-day training course for forecasters can be in the four sessions below. The time allocation is as per the programme above, but this can be adjusted to fit the time available to a particular situation.

Session 1	**Introductory session**
Learning objectives	• To get to know each other • To identify experiences and expectations of participants • To introduce objectives and contents of the course
Topics	• Interactive introduction of participants • Opening remarks • Experiences and expectations of the participants • Setting of the learning norms • Objectives and overview of the training programme
Methods	• Self-introduction with icebreaking exercises • Plenary speech by officials • Feedback by participants about their experiences and expectations in pairs or in groups • Brainstorming learning norms • Plenary presentation of the objectives and training programme by the facilitator
Activities	Section 3.2 activities 1 and 2 *(pages 65 and 66)*
Material and equipment	LCD projector, flipcharts, marker pens, collection cards

Session 2	**Armyworm biology, migratory behaviour, and management**
Learning objectives	• To introduce various aspects of the armyworm including its lifecycle, migratory patterns, and how outbreaks happen • To create awareness and develop understanding of the damage caused by armyworms • To discuss existing control methods and their merits and demerits

Topics	• Defining the armyworm and its etymology
	• The lifecycle of the armyworm
	  ◗ identification and biology of the different stages of the armyworm
	  ◗ moth emergence, migration, and outbreaks
	  ◗ feeding habits and crops attacked by armyworms
	• Armyworm pest management and control
	  ◗ Cultural control
	  ◗ Biological control
	  ◗ Physical control
	  ◗ Chemical control

Methods	• Interactive lecture presented by the facilitator • Buzz session in between lecture to show posters, leaflets, and specimens • Group work and presentation • Video show and debriefing • Question and answer session

Background information	Section 2.1 *(page 25)*
Activity	Section 3.2 activity 6 *(page 70)*
Additional information	Rose *et al.* (2000). Armyworm Handbook
Material and equipment	LCD projector, moth specimens, flipcharts, marker pens, armyworm poster

Session 3	Community-Based Armyworm Forecasting (CBAF)
Learning objectives	• To introduce the process, practices, and benefits of CBAF • To familiarise participants with the different forecasting equipment and their operation • To practise taking records and calculating forecasts • To discuss communication channels and strategies to use in disseminating forecast information
Topics	• Defining CBAF • Benefits of CBAF • The CBAF process • Pheromone traps and rain gauges – how they work • Record-keeping activities in the classroom (moth catches, rainfall, and vegetation) • Record-keeping activities in the field (calculating forecasts) • Vegetation observation and identification • Participatory discussion about communication channels and strategies
Methods	• Interactive presentation by the facilitator • Classroom activities with pheromone traps and rain gauges • In groups, taking and recording data in the field as well as calculating forecasts • Plenary group presentations and discussion • Identifying and collecting different vegetation from the locality, and identifying any attacked by armyworms • Group and class discussions about communication channels and strategies

Background information	Sections 2.3 and 2.4 *(page 37 and 44)*
Activity	Section 3.1 activity 1-8 *(page 59-64)*
Additional information	Rose *et al.* (2000). Armyworm Handbook RIU Pocket Guide No. 5
Material and equipment	LCD projector, flipcharts, marker pens, moth traps, rain gauges, armyworm posters, data sheets, outbreak report cards

Session 4	**Workshop evaluation, presentation of forecasting pack, and closing of workshop**
Learning objectives	• To obtain feedback on the proceedings of the training workshop • To present forecasting packs to forecasters from different villages
Tasks	• Evaluate the training workshop using suggested techniques • Presenting of forecasting packs and certificates by officials • Closing remarks
Methods	• Participants evaluate the training programme using one or more of the activities in section 3.2 • Official presents forecasting kits, certificates, etc. • Closing remarks
Activities	Section 3.2 activities 9-11 *(pages 73-75)*
Material and equipment	Flipcharts, marker pens, forecasting packs

2. Background information

2.1 Armyworm biology and migratory behaviour

To be able to control the armyworm, it is important to know its lifecycle, its movement, and its economic importance.

2.1.1 What is an armyworm?

The African armyworm, *Spodoptera exempta*, is the caterpillar or larval stage of a moth that flies at night. The caterpillar has various local names that include *viwavijeshi* in Swahili, *temch* in Amharic, *nchembere* or *zandonda* in Chichewa, and *mhundururu* in Shona.

It is called the African armyworm because it occurs in many parts of the continent, especially south of the Sahara. It is most common in the Eastern and Southern parts of Africa. Scientifically, it is a member of a family of moths called the Noctuidae.

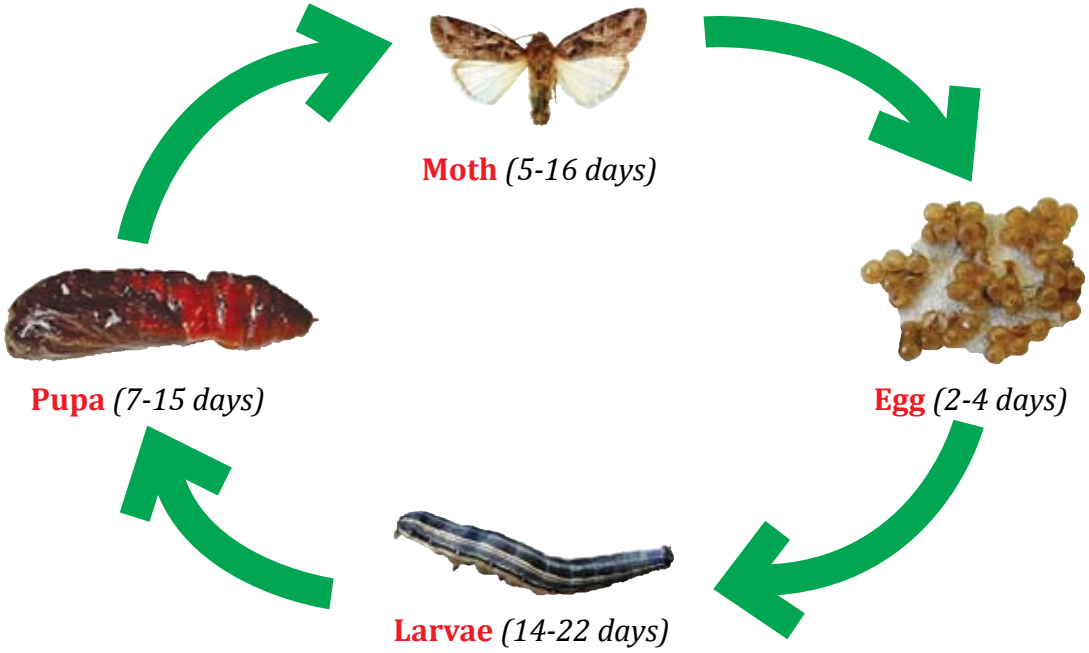
It is known as "armyworm" because the caterpillars or larvae often occur in very large numbers and appear to be marching together like an army in search of food.

2.1.2 Lifecycle

Like all moths, the African armyworm has four stages in its lifecycle. These are the egg, larva, pupa, and adult.

The diagram below shows the various stages of the African armyworm and the duration taken at each stage.

Figure 1. Lifecycle of *Spodoptera exempta*



Egg

The eggs are tiny, about 0.5 mm in diameter. At first they are yellow in colour, but get darker as they develop.

The eggs are laid in masses of up to several hundreds. Some female moths lay over a 1000 eggs during a period of up to six nights. They usually lay the eggs in one layer, making it easy to see.

They are covered in hair-scales from the body of the female moth. The black hair-scales protect the eggs from drying out and from predators.

The armyworm moth lays its eggs on host plants, but it can also lay them on other surfaces such as tree leaves, buildings, and dry grass.

The eggs hatch into larvae in 2-4 days.

Larva

Young larvae are very small and hard to see. Just after they hatch out of the egg, they eat the eggshell. The larvae then make a silken thread like a spider's web.

The young larvae are so light that the silken thread catches the wind, and they are blown from where they hatch to a nearby crop plant.

As the armyworm larvae grow, they pass through a series of moults. The stage between each moult is known as an ***instar***. The number of instars is variable, depending on food quality and phase. Typically, there are five or six instars, completed in 2-3 weeks.

The larvae occur in two forms. One form is the black, crowded or ***gregarious*** form, seen during armyworm outbreaks. The other is the green-brown, non-crowded or ***solitary*** form, which is rarely seen. The form is determined by the density of the armyworms in an area at a particular time. At higher density, the armyworm becomes gregarious while at lower density it becomes solitary. It is the gregarious form of the armyworm that destroys crops.

The solitary form is difficult to distinguish from the larvae of other species especially at early instar stages. Usually sparsely distributed, solitary armyworms are difficult to find. During the day, the solitary larvae hide at the base of food plants, feeding at night.

Whether in high or low densities, the larvae remain green during the first three instars, so they are not easy to see as they are the same colour as the host plant.

But gregarious larvae become black at the fourth instar, and that is why often armyworms are not noticed by farmers until they are already 10 days old.

The last instar larvae burrow into the earth to pupate, which is why they seem to disappear suddenly.

Larval feeding habits

Newly-hatched larvae are only capable of feeding on the young leaves of their host plants. Their mouthparts allow them to scrape the surface of the leaf, leaving a visible thin area. This pattern on the leaves is known as windowing.

When young larvae start feeding, they climb up the plant to feed on the youngest parts of the plant that are rich in nitrogen. So although they are very small, they can be spotted by looking closely at the plants.

At the third moult, gregarious larvae develop mouthparts referred to as mandibles. This allows them to bite and cut through leaves. Consequently, it is in the fourth and later instars that the main damage to crops occurs.

As the larvae get bigger, the more they need to eat, and they can eat most of the plants in a field. When this happens they start "marching", looking for other plants and fields to feed on.

Armyworm larvae normally feed on plants in the families Gramineae and Cyperceae. These families include crops of major economic importance: millet, maize, rice, sorghum, teff, wheat, barley, sugarcane, and pasture grasses.

The age, species, and quality of plants affect the duration of larval development. The more nutritious the host plant, the shorter the armyworm lifecycle, the fewer the number of instars, and the higher the survival rate of the armyworm.

Larval mortality is increased by starvation and drowning in the rain. Without food, young larvae can only survive for about a day.

Apart from cereal crops, armyworms also attack and cause considerable damage to pastures and rangeland. This in turn affects livestock production. By causing severe and extensive damage to pastures and rangeland, armyworms change the sward composition that can persist for many years if the damage to grasses gives dicotyledons (broad-leafed plants) a growth advantage.

Moreover, when herds graze on pastures that have recently been heavily infested by armyworms, the animals may die of food poisoning. Studies indicate that high levels of cyanide are produced by some grasses when they are attacked by the armyworm.

Pupa

Full-grown armyworm larvae seek soft soil, the base of plants, or sandy banks in which to burrow and pupate. The pupa is a critical stage in the survival of the armyworm. When the soil is very dry and hard and difficult for the larvae to burrow into, most of the larvae die. On the other hand, when the soil is soft, sometimes farmers report that all the larvae have died when in fact they have all burrowed underground to pupate.

Having ceased feeding and burrowed underground, the larva constructs a flimsy, silk-lined chamber 2-3 centimetres below the surface. The pupa is pale-green and soft when newly formed, but its colour gradually changes to a deep red-brown as it hardens.

In an armyworm outbreak, the development of the gregarious larvae is well-synchronised such that most larvae pupate over a relatively short time of 3-7 days. This is in contrast to the development of the solitary larvae which is slower, so population development is spread over a longer period with subsequent

generations of the solitary sometimes overlapping.

When the moth is ready to emerge from the pupa, it splits open down the back of the head. The emerging moth then pushes its way up through the soil to the surface.

2.1.3 Moth emergence, migration, and outbreaks

The adult armyworm moths emerge from the pupae during the early part of the night. Moth emergence from an outbreak may extend over a period of about two days. Immediately after emergence, the moths climb up grass stems or other nearby vegetation, where they remain motionless while haemolymph (insect blood) is pumped into their wing veins.

When the wings are dry, the moths expand their wings and fly away. Flying up from the vegetation, most moths fly downwind. Flight activity peaks during three periods – at dusk, in the middle of the night, and at dawn. The dawn flight only results in local movement, ending with the moths seeking shelter for the day.

The main flight starts at dusk. During this flight, the moths ascend rapidly to a height of up to 400 metres above the ground. Using the wind, the moths can fly distances of several hundred kilometres away from where they emerged. The direction and speed of the wind at the time of the migratory flight therefore plays a major role in determining where the moths fly to and where they can cause more outbreaks.

Armyworm outbreaks occur only if the flying moths are brought together by wind patterns that are associated with rainstorms or hills. When this happens, many migrating moths can become concentrated in one small area. They then land and lay eggs together, leading to an outbreak.

When the migrating moths encounter rain, they drink the rainwater and become sexually mature, mate, and lay eggs. But if the migrating moths do not find water, they die without reproducing.

To attract a male, the female moth produces a sex pheromone or scent. Females release the pheromone only at specific times of the night when they are ready to mate. Only sexually-receptive males are attracted by the pheromone.

What is an armyworm outbreak?

An armyworm outbreak refers to the sudden occurrence of larvae in very large numbers with the majority being in the gregarious form, resulting in extensive damage to host plants. Outbreaks occur during the rainy season. This is because the flying moths are concentrated in one area by wind patterns that result in large numbers of moths laying their eggs in the same area at the same time.

The first outbreaks in a rainy season are known as *primary outbreaks*, and they may go undetected if they occur in areas with low human population density. The extent to which primary outbreaks produce more moths that migrate and cause more (*secondary*) outbreaks, is enhanced by preceding drought, storms suitable for the concentration of the moths, the flush of young grass, and moist conditions after the moth concentration.

In eastern Africa, primary outbreaks mostly occur in inland areas, away from the coastal region. The wet seasons, and the storms associated with them which are the main cause of moth concentration in the region, are related to the position of the inter-tropical convergence zone (ITCZ). The ITCZ is the meeting place of the north-easterly trade winds from the northern hemisphere and the south-easterly trade winds from the southern hemisphere.

The ITCZ seasonally moves northwards and southwards, so the rains and any

consequent armyworm attacks occur at different times in different parts of the region.

But the first rains during the short wet season in such countries as Kenya and Tanzania are very crucial in initiating and spreading armyworm outbreaks in the region. These rains should be carefully monitored.

After the dry season, outbreaks can occur only where there has been sufficient rain to allow for the growth of grass and other vegetation that provide food for the larvae.

2.2 Armyworm forecasting and control

Forecasting armyworm outbreaks is important for the pests to be effectively and efficiently managed and controlled. Armyworm forecasting systems have evolved over the years.

2.2.1 Importance and evolution of armyworm forecasting

Armyworm forecasting and warning alerts farmers to monitor their fields, looking for young armyworms. It provides time in which to prepare to take effective control measures. Armyworm forecasting therefore helps avoid or reduce damage to crops.

The migrant nature of the moths and the spread of armyworm outbreaks from one country to another necessitated cooperation and collaboration amongst countries. Regional and national forecasting systems were launched in eastern and southern African countries in the 1970s.

Regional organisations such as the Desert Locust Control Organisation for Eastern Africa (DLCO-EA) and the International Red Locust Control Organisa-

tion for Central and Southern Africa (IRLCO-CSA) as well as national institutions have taken the lead role and responsibility in monitoring and controlling armyworms.

National forecasting units in affected countries prepare a weekly or fortnightly forecast during the armyworm outbreak season. An important source of information for forecasting is armyworm moth traps.

2.2.2 Armyworm traps

Two types of traps are used to monitor armyworm moths – the light trap and the pheromone trap. Light traps catch many different kinds of insects, and require a source of electricity, so are not very easy to use. Pheromone traps on the other hand only attract sexually-receptive male armyworm moths. This is because the pheromone traps use artificial sex attractants (pheromones) that are specific to the species.

The pheromone traps are recommended for widespread use while light traps are restricted to use at research centres where trained staff can sort and identify the different catches and where electricity is available. Pheromone traps are simple to use, only catching mature *Spodoptera exempta* males.

If a pheromone trap catches a large number of moths, it is a good indication that there is a large population of both male and female armyworm moths in the area; and if other conditions are suitable, an outbreak is likely to occur.

2.2.3 Limitations of centralised forecasting system

The regional and national forecasting services are important in monitoring, forecasting, and alerting governments, farmers and others to the possibility of imminent outbreaks. But they have a number of limitations and practical dif-

ficulties. Notably, farmers do not receive adequate information from the centralised forecasting system.

The major drawbacks of the centralised forecasting system include:

- There is often delay in communication between the pheromone trap operators and the national forecasting unit. This means national orecasters have to make forecasts without all the relevant information.
- Forecasts are usually issued for districts rather than for the more localised villages. The forecast is therefore useful for the district office, but not very useful for villages and farmers. Even when outbreaks occur in a district, some villages experience the outbreaks while others do not.
- The centralised system in which trap operators are assigned duties, and forecasting equipment and pesticides are provided to the districts, can create a sense of dependency and lack of ownership among the local communities.

2.2.4 Armyworm control methods

Different methods can be used to control armyworm infestation. The most common one is chemical control using pesticides. Others are cultural, biological, and physical control.

Cultural control

This method involves use of proper agricultural practices that reduce the damage caused by armyworms. For instance, maize plants greater than 30 centimetres in height are unlikely to become seriously infested by newly-hatched armyworms, as the leaves are too tough for the small larvae to eat. By keeping the maize crop free of grass weeds, the farmers deny the armyworm alternative food consequently avoiding crop infestation.

Moreover, the armyworms prefer certain varieties of crops. For example, Ka-

tumani, a dryland maize variety developed and widely grown in Kenya, is preferred by the armyworm to other hybrid maize varieties. Farmers are hence advised to plant less susceptible crop varieties in areas where there is a high probability of armyworm infestation. They can also plant broad-leafed crops that are not attacked by armyworms.

Biological control

This is the use of living organisms that feed on a pest and thereby control them. Such organisms are known as "natural enemies". Natural enemies of armyworms include the following:

- Predators such as birds, ants, and beetles.
- Parasitoids – small wasps and flies – that lay their eggs inside armyworm larvae, and so kill them.
- Pathogens (viruses) such as SpexNPV.

None of the predators and parasitoids is numerous enough to effectively control armyworm outbreaks. Yet rearing armyworm predators or parasitoids in large numbers is not practical.

However, the naturally-occurring pathogen SpexNPV can be produced to control an outbreak. A factory in Tanzania is starting to produce SpexNPV for sale.

Formulations of the bacterium Bacillus thuringiensis also kill armyworm larvae, but they are not available widely.

Physical control

This includes the use of physical barriers to control and stop the movement of the armyworm. The physical barriers include ploughing a deep trench and filling it with water to stop the movement of the armyworm larvae from one crop or field to another.

Physical killing (hand-picking) can also be applied in small and scattered larval population, but it is tedious and not effective for large-scale infestations.

Chemical control

This is the most common method of controlling armyworms. Chemical control targets the most damaging stage, the larvae. Various pesticides kill armyworm larvae, including Malathion, Fenitrothion, Trichlorphon, Phoxim, Chlorpyriphos, Quinalphos, Tetrachlorvinphos, Pirimiphos-methyl, Carbaryl, Cypermethrin, Deltamethrin, Fenvalerate, and Permethrin. However, not all these chemicals are registered for armyworm control in every country, so only insecticides registered specifically for armyworms should be used.

Synthetic pyrethroids are preferred due to their low toxicity to humans and other mammals. For environmental and human safety, persistent and more toxic pesticides should not be used. Moreover, the application of dusts is not recommended as pesticides in this form are difficult to apply efficiently and can be inhaled by people and other animals.

In all situations, the instructions on the label should be followed exactly, including the use of protective clothing.

There are several factors to consider when selecting the type of equipment and the application method to use in any control operation. These factors include area to be treated, safety of humans and the environment, time available, cost, and efficacy of the control measure.

Sometimes individual farmers are not able to purchase pesticides because they are too expensive or are sold in too large amounts. In this case, several farmers could together purchase the pesticide.

2.3 Community-Based Armyworm Forecasting (CBAF)

The possibility of decentralised forecasting was developed at a workshop in Tanzania in 2001. This led to the birth of a new approach, Community-Based Armyworm Forecasting (CBAF).

Starting in 2002, the new approach was piloted and tested in different East African countries such as Ethiopia, Kenya, and Tanzania. It proved to be efficient, effective, and sustainable.

In CBAF, each village has an armyworm moth trap, and a trained farmer-forecaster. The forecaster operates the trap, collects and interprets data, and makes forecasts at the village level. The forecaster then disseminates the information to the rest of the village community.

The village communities also identify the best ways to disseminate the warning rapidly throughout the village, using local channels and networks. The CBAF approach needs little technical knowhow, uses simple forecasting rules, and the equipment is affordable and available.

2.3.1 Benefits of CBAF

- The forecasts are made quickly and are specific to a village.
- The early warning system alerts farmers to monitor their fields, finding the armyworms when they are still young. CBAF effectively prevents crop loss by providing more time for decision-making, preparation, and taking control actions.
- CBAF involves tools and structures that can operate at the local level. It encourages more participation of farmers, developing their skills and capacity.
- CBAF creates a sense of ownership and responsibility among the local community.

- The CBAF system is efficient and sustainable.

CBAF does not replace the central forecasting system, but complements it. Centralised forecasting is still important for decision-making at the district level, as well as for making long-term plans for resources such as importation and distribution of pesticides. It also plays an important role in facilitating regional collaboration to check the migration of the pest across borders.

The centralised forecasting unit is also important for supporting CBAF through capacity building and provision of resources.

2.3.2 Establishing CBAF

Establishing and managing CBAF involves a number of sequential steps.

District meeting

Before starting CBAF in a district, it is important that the district agricultural staff are aware of the approach, so a meeting is necessary. The main objectives of this meeting are:

- To introduce the CBAF initiative and explain the different steps involved.
- To discuss roles of the different stakeholders.
- To discuss how to select villages for the CBAF initiative.

Those who attend the district meeting include:

- National armyworm coordinator
- District agricultural development officer
- Specialists in crop production, crop protection, agricultural extension work, and monitoring and evaluation.
- Other relevant staff from the district

Socioeconomic baseline survey

This step is not always necessary, but is useful when CBAF is being piloted for the first time. A socioeconomic survey can be carried out prior to the implementation of the CBAF activity. It is conducted using structured questionnaires.

The objectives of the socioeconomic baseline survey include the following:

- To assess perceptions and knowledge of farmers, extension staff, pesticide dealers, and other stakeholders.
- To assess experience and practices related to armyworm infestation and control.
- To identify existing coping strategies.

Village meeting

The village meeting follows the district meeting and any conducted survey. It engages the community and allows detailed discussions and explanations about CBAF.

Participants in the village meeting include:

- Village leaders
- Village extension officers
- District representative
- National armyworm coordinator
- Pesticide dealers

The issues and activities at the village meeting include:

- Introduction of the participants and the objectives.
- The risks of the armyworm, its lifecycle, and its migratory behaviour.
- The CBAF system and its benefits.
- If appropriate, the results of the socioeconomic baseline survey.
- Election of two community forecasters – a leader and an assistant. Criteria

to nominate and elect the forecasters include the ability to read and write, respect and acceptance by the community, as well as residing and farming in the village.

The election method can be chosen by the community,

- Identification of suitable communication strategies and channels. This is based on the communication channels available locally, how accessible they are, degree of current use by the community, and whether they can effectively communicate forecast information.
- The response to positive forecasts or outbreak warnings.
- Distribution of leaflets and posters to participants.
- Invitation to the elected forecasters, village extension officer, and a village leader to forecasters' training.

Training of forecasters

Training of forecasters takes place as soon after the village meeting as possible. The training includes the following people.

- Elected forecasters from each village (lead and assistant)
- Village extension officers
- Village leaders
- District representative
- NGO representatives, where available

The programme and topics to be covered during the training of the forecasters are as provided in part 1 above.

At the end of the training session, each participating village is provided with a forecasting pack. The forecasting pack should contain the following items.

- Armyworm moth trap with two rubber baits
- Rain gauge with a rain collection cup and a measuring cylinder
- Armyworm moth instruction sheet

- Rain gauge instruction sheet
- Pheromone trap instruction sheet
- Forecasting instruction sheet
- Data sheets
- Stationery (pen, pencil, notebook, etc.)
- Outbreak record cards
- Armyworm leaflets and posters
- Pesticide for the trap

Community forecasting

After the forecasters have been trained, they go back to their villages and set up the traps and rain gauges. They then daily collect data and make weekly forecasts during the outbreak season.

The duties and responsibilities of the forecasters include:

- Recording the number of moth catches and the amount of rainfall on a daily basis.
- Making a local armyworm forecast on a weekly basis, preferably every Friday morning.
- If the data shows a positive forecast, issuing warnings using agreed communication channels.

Details of how the data are collected, recorded, and used to make a forecast are given in Annex 1.

Supervision and monitoring

Local extension officers should monitor whether the forecasting system in a community is working well, and keep the village authorities informed. In addition to the regular supervisory and monitoring activities, a mid-season assessment can be carried out by district or national staff.

The aims of the assessment include the following.

- Assessing knowledge, interest, and performance of the forecasters.
- Assessing effectiveness and progress of the forecasting activities.
- Assessing acceptance of the forecasters and CBAF by the community.
- Examining effectiveness of the communication of forecast information and the community's response to warnings and outbreaks.
- Evaluating roles, actions, and interactions of the different stakeholders.
- Identifying areas requiring revision or modification.

Assessment methods

Mid-season assessment is carried out in a participatory manner. It uses the following tools.

- Key informant interviews
- Group discussions with farmers and other stakeholders
- Trap observation
- Field days
- Review of forecasting records and other documents

Field days in particular are useful in monitoring progress, encouraging the community, and raising awareness. During the field days, forecasts can be validated with the rest of the community. Were the predictions correct?

Forecasters can explain what they have been doing. This is a chance to assess their understanding of the process. Exchange visits can also be organised to facilitate sharing of information and experiences.

Participatory end-of-season evaluation

This evaluation is important to understand how knowledge and practices have changed as a result of introducing CBAF. It may be done formally, or as part of regular monitoring of agricultural activities. The end-of-season evaluation is often participatory and so is carried out by the relevant stakeholders.

The main objectives of the end-of-season evaluation are similar to the mid-season monitoring, and include the following.

- To assess understanding and perception of the forecasting process by the farmers.
- To assess the knowledge, competence, and performance of forecasters.
- To examine the process, flow, and effectiveness of forecasting information among different stakeholders.
- To document the response of farmers and other stakeholders to positive forecasts and the actions taken following outbreaks.
- To assess the roles, participation, and collaboration of the relevant stakeholders.
- To examine the procedures and accuracy of the forecasting.
- To assess integration and sustainability of the Community-Based Armyworm Forecasting.
- To identify any constraints and suggest solutions for improvement.

Evaluation methodologies

- Semi-structured interviews and discussions with farmers, forecasters, and other stakeholders.
- Key informant interviews with selected stakeholders.
- Focus group interviews with farmers and other stakeholders.
- Observation and data review.

2.4 Participatory training and communication

Conventional thinking in research and extension education is rooted in a "diffusion of innovation" model. Transfer of technology and one-way flow of information has received much emphasis. It is an approach that considers local communities as passive receivers and mere adopters of technologies. But the approach undermines the community's role in generating, adapting, and disseminating information and technology.

As a result, many past interventions received limited acceptance, made little impact and were not sustainable. This dissatisfaction necessitated the search for alternative approaches, which led to the emergence of participatory methods in research and extension education.

2.4.1 Participatory approach

Participatory approach has been understood and interpreted in different ways by different people. Some consider it as giving information and receiving the benefits of a project. Others perceive participation as active involvement of local people as equal partners at the different stages of a programme. The former is passive participation, while the latter is a process of empowerment.

Genuine participation implies active engagement. It is a process of interactive dialogue, collective analysis, and joint action. Participation is progressively handing over power and control to local partners so that they can set their own development agenda.

Principles of participation

Participatory approach is based on the following principles.

- Inclusion
- Joint learning

- Cooperation
- Equal partnership
- Facilitation
- Iterative action
- Transparency
- Flexibility
- Sharing power and responsibility
- Empowerment

Benefits of participation

- Assists in recognising, tapping and capitalising on local knowledge, technologies, and capacities.
- Encourages community members to voice and find solutions to their issues.
- Enhances relevance and applicability of interventions.
- Increases effectiveness
- Builds technical and interactive capacity at the local level, fostering self-confidence.
- Develops local leaders and role models.
- Generates enthusiasm and enhances sense of ownership and responsibility, creating conditions suitable for sustainability.

Participation challenges

Participation is not quick, easy, or simple. Those who use the participatory approach in training need to be genuinely committed and ready to face various challenges.

The major challenges to be encountered in the participatory approach include the following.

- Social and cultural obstacles, since participation requires attitudinal and behavioural change of all stakeholders.

- Structural and administrative obstacles.
- The nature, mission, and policy of the implementing agency.
- Time, human, and financial resources.
- Scaling up of participatory initiatives.
- Learning new facilitative skills.

Participatory training approach and techniques

Participatory training approaches and techniques have rapidly gained popularity in recent years. Due consideration is given to the knowledge, experience, and needs of adult learners.

Participatory training is different from traditional teaching in that it encourages participants to be a source of information and knowledge. They actively participate in the learning process.

Many of the principles of participatory training draw on theories of adult learning, which stress that adult learners need opportunities to *think*, to *understand*, and to *apply.* To facilitate the desired change in adult learners, experiential activities are more effective than lectures.

Making a training process participatory

Participatory tools and techniques are specific activities designed to encourage joint analysis, learning, and action. No single tool or technique is applicable to all situations. Each tool encourages different levels of participation.

That participatory approaches and techniques are specific to a particular situation means there is no blueprint. Participatory training is constantly adjusted and adapted based on the local setting.

Good training courses include a variety of learning activities. Popular participatory training activities include the following.

- Interactive lecture/presentation
- Buzz group sessions
- Group discussions and presentations
- Brainstorming
- Demonstrations
- Plenary discussions
- Problem-solving activities
- Debates
- Simulation
- Role play
- Case study
- Games and exercises

2.4.2 Participatory communication

Communication is a basic tool that helps communities to be involved at different stages of a development process. Extension work is basically an act of communication. Sharing of ideas and of information by extension workers are a large part of their duties. The communication skills of an extension worker are thus the basis of all their extension activities.

Communication was largely viewed as the process of passing messages or information from one person to another. But many now view communication as the act of exchanging rather than transmitting information. The purpose of communication is to develop a common understanding.

During communication, the message received is not always the one that the source intends to pass. The message may be distorted because receivers may interpret or understand the message differently, depending on their experiences and environment. The more channels a message passes through, the more the chances of distortion.

Probability of message distortion is reduced if the source is receiver-oriented, and if feedback is used to know whether or not the message has been correctly interpreted.

Different communication channels also have different effects on the information exchange. But there is no perfect medium for communication. An effective medium is the one which is accessible and suitable to the people taking part.

Generally, information should be communicated in a way that suits the needs, levels of understanding, and expectations of the audience.

A new understanding of communication

Most development programmes use communication strategies that help them to inform and persuade the target community. This top-down approach emphasises dissemination of information, without paying much attention to indigenous knowledge and local social systems.

But today, communication is no longer a one-way flow of information. It is a process of creating and stimulating understanding rather than just transmitting information. The emphasis is now more on interaction, dialogue and information exchange rather than on attempting to persuade the other party.

Participatory communication aims to facilitate the expression of people's needs and priorities through effective communication processes. It includes giving people access to communication channels and enabling them to participate freely and equally in dialogue, debate, and information sharing.

Participatory communication is an empowering and transforming process characterised by a horizontal flow of information based on dialogue. It emphasises interpersonal, traditional, and community-based forms of communica-

tion methods and media.

Community and interactive radio programmes facilitate participatory communication. Core elements of participatory communication include the following.

- Listening
- Dialogue
- Action, reflection, and reaction
- Giving voice to the community
- Ownership by the community
- Respect for local knowledge, languages, and culture
- Integration with local communication systems

CBAF taps and capitalises on participatory communication and its strengths.

2.4.3 Participatory communication and CBAF

The various ways that CBAF uses participatory communication include the following.

- CBAF views the community as key partners and actively involves them in decision-making processes such as:
  - selection of forecasters
  - selection of villages
  - selection of strategies and channels of communication

- CBAF utilises local communication channels to disseminate information
- CBAF uses folk media to sensitise and inform the community
- CBAF employs participatory training sessions and meetings
- Communication of forecast information is horizontal and bottom-up

2.5 Non-formal adult education and adult trainers

Adult education is different from the normal school system. This section looks at various unique aspects of non-formal adult education.

2.5.1 Non-formal adult education

Extension workers deal with farmers who are adults with a wealth of knowledge, skills, and experience. Adult learning is therefore based on principles and conditions different from those of normal schooling.

Unlike children, adults are not as affected by the expectation and influences of teachers and parents. Adult learners have a higher degree of motivation, more experience, are usually more engaged in the learning process, and apply the learning more than children.

It is often said that child education is like filling an empty cup with tea while adult education is like stirring to blend the ingredients.

Adult education is best facilitated in an atmosphere that:
- encourages the adult learners to be active
- promotes and facilitates discovery
- recognises that mistakes are normal
- accepts differences of the learners
- encourages openness, self-respect, and respect of others
- makes learning a cooperative process
- encourages peers to learn together

There are several important characteristics of adult learners

- **Adults are autonomous and self-directed**
  They enter any learning situation as self-directing, independent, and self-reliant people. Thus they must be actively involved in the learning process and need to be free to direct themselves.

- **Adults have a wealth of skills, knowledge, and experiences**
  They want to contribute and to relate the learning to their skills, knowledge, and experiences. Adults learn best when new information builds on their past skills, knowledge, and experiences.

- **Adults are goal-oriented**
  They need to be convinced and to know why they should learn something before they invest their time in it. Trainers must show the adults how the course will help them attain their goals and how it is related to their lives.

- **Adults are practical and relevancy-oriented**
  The learning has to be applicable to their work or their life to be of value to them. Adults have a strong readiness to learn those things that help them to effectively cope with daily life, to perform a task, or to solve a problem. Trainers should show how the course will help the participants in their day-to-day life.

- **Adults need respect**
  Trainers must acknowledge the experience that adult participants bring to the learning. Adults are more responsive to such internal motivators as increased self-esteem than to external motivators. Trainers need to ensure that this internal motivation is not blocked by such barriers as a poor self-concept or time constraints.

- **Adults have different levels and styles of learning**
  Trainers of adult learners should identify and adopt different paces and

techniques during training.

2.5.2 The role of the trainer

Adult learners need opportunities to think, to understand, and to apply. To facilitate these changes, experiential learning activities are more effective. Facilitators need to apply active learning methods that incorporate direct participation of the learners and that create an atmosphere for sharing knowledge and experiences.

An adult trainer plays several roles to ensure that the learners and the learning process are at the centre of all the training. Generally, adult trainers adopt a facilitation role.

Adult trainer as a facilitator

In facilitating the learning of adults, the trainer has the following roles.

- Facilitates group processes to keep the group together and to let it grow as a group and individually.
- Initiates discussions, articulating unresolved group issues.
- Manages the heterogeneity within the group.
- Summarises and synthesises information.
- Appreciates and encourages the group and individuals.
- Creates a suitable learning environment by pursuing, nudging, pushing, and building the learner's confidence.

Adult trainer as an educator

In educating adults, the trainer plays the following roles.

- Provides new information and concepts.
- Elicits the experiences and analysis of the learners by setting up structures, asking questions, and encouraging discussions.
- Synthesises, consolidates, and conceptualises new information and analysis.

- Directs and manages the structured learning experiences.
- Uses learning aids effectively

Facilitation skills

Facilitation skills are essential for anyone seeking to guide a group of people through a process of learning or development in a way that encourages all members of the group to participate.

Facilitation is the act of encouraging more participation in the learning and development process. It is the creation of an environment that enables participants to exchange ideas, concepts, questions, and problems. Many view facilitation as the art of drawing ideas out rather than putting ideas into people's heads.

A facilitator is a moderator of participatory learning and development process. The facilitator's role is to draw out and build on the knowledge and ideas from the different members of a group. The facilitator helps the learners to learn from each other and to think and act together.

Skills and qualities of a good facilitator

The following are some of the key skills and qualities a good facilitator should have.

- Strong belief in the capacity of people to learn.
- Open to change. The facilitator must be willing to learn too.
- Empathetic to understand the learners.
- Sensitive to the needs of others.
- A good communicator and observer.
- Well-prepared for the learning process yet flexible.
- Creative thinker and doer.
- Able to deal with sensitive issues and to manage people's feelings.
- Encourages humour and respect
- Keeps time without being driven by it.

2.6 Outcome mapping and stakeholder analysis in CBAF

These are the tools used to determine the success of Community-Based Armyworm Forecasting.

2.6.1 What is outcome mapping?

Outcome mapping is a methodology for planning, monitoring, and evaluating development initiatives that aim to bring about social change. The process of outcome mapping helps a project to be specific about the target group, the expected changes, and the strategies to employ.

Outcome mapping comprises several tools, which can be adapted to different situations. Results are measured in terms of change in the behaviour, relationships, interactions, activities, and or actions of the people, groups, and organisations with whom a programme directly engages.

Outcome mapping refers to the individuals, groups, and organisations with which a programme interacts directly as "boundary partners". It is the behaviour and actions of the boundary partners that a programme aims to influence.

Changes in behaviour are monitored against "progress markers", the types of change that a programme anticipates should or may occur if it is successful. Progress markers can be generated by a group comprising of relevant boundary partners, making it participatory.

Progress markers can be set at three levels – those the participants would "expect to see"; those they would "like to see"; and those they would "love to see".

Annex 4 are examples of progress markers identified by a group of boundary

partners in Malawi.

In implementing CBAF, elements of outcome mapping have been employed in combination with stakeholder mapping and other tools. This is particularly in:

- Identifying key stakeholders or boundary partners
- Describing the roles, linkages, and interaction patterns of the stakeholders.
- Describing the flow of information and products.
- Defining what changes might occur as a result of CBAF.

CBAF stakeholders in a country can be identified at a workshop. Annex 3 shows the boundary partners identified for villages in Malawi. Strategies to communicate with and involve the key stakeholders so as to ensure effective implementation of CBAF are also designed at the workshop. This greatly helps in tracking changes in behaviour, relations, and actions.

2.6.2 What is stakeholder analysis?

Stakeholder analysis and stakeholder mapping can complement the outcome mapping approach.

Stakeholders are persons, groups, or institutions with interest in a project or a programme. Stakeholder analysis is an important first step in implementing CBAF.

The purpose of stakeholder analysis is to identify all the people and or institutions who have an interest in or who can contribute to the implementation of a project. It also establishes the relative importance and influence of people, groups, and or institutions.

Stakeholder analysis adds value to the early orientation, analysis, and planning of a project.

Based on the stakeholder analysis, a plan on how to involve each group in the subsequent stages of the project is developed. The analysis is enriched by the following tools.

- organisational mapping
- focus-group discussions
- matrix ranking
- venn diagramme
- actor linkage matrix
- problem trees analysis
- outcome mapping

Suggested technique for CBAF stakeholder analysis

The following are some useful techniques utilised in CBAF stakeholder analysis.

1. Participants identify the individuals and institutions involved in or influencing armyworm forecasting and control. The identified stakeholders can be listed in the first column of a matrix table.

2. Establish the interests, influences, and importance of each stakeholder. This could be through focused discussions or idea cards. Use a simple description or a scoring method, recording these in subsequent columns in the matrix table.

3. Additional descriptions such as the relations and linkages of the stakeholders can be added. Separately indicate the stakeholders that need to be encouraged to change, those that are to be influenced directly, and those that could help or hinder the project.

4. Once the table is complete and the information is synthesised with the help of a facilitator, the group can map the results into a matrix.

5. Use open questions to check the reasons and logic for the group's decisions.

Table 3. Example of stakeholder analysis

Stakeholder	Interests	Influences	Importance	etc
Farmers	Reduce crop loss	Neighbours Extension officers	High	
Extension officer	etc			
etc				

3. Practical activities

This section suggests practical activities that can be used or adapted during the forecasting course. There are two categories of activities. The first set of activities is related to CBAF methods and techniques, while the second constitutes group dynamic activities that facilitate the learning process.

3.1 Activities on CBAF methods and techniques

Activity 1	Assembling a pheromone trap
Objectives	• To understand the pheromone trap, its various parts, and their uses • To be able to disassemle the pheromone trap
Duration	20 minutes
Material and equipment	• One pheromone trap for each participant • One pheromone lure for each participant • Pesticide
Methods	• Facilitator demonstrates parts of a pheromone trap and their uses • Participants disassemble and reassemble the pheromone traps • Plenary discussions and questions • Feedback from facilitator
Background information	Pheromone trap sheet (Annex 1)
Additional information	Rose *et al.* (2000). Armyworm Handbook [xiv]

Activity 2	**Assembling and reading the rain gauge**
Objectives	• To understand parts of a rain gauge • To be able to disassemble and assemble the rain gauge • To understand how to measure amount of rainfall
Duration	20 minutes
Material and equipment	• One rain gauge and one measuring cylinder for each participant • Empty data sheet • Water
Methods	• Facilitator demonstrates parts and uses of rain gauge • Participants disassemble and reassemble the rain gauge • Facilitator adds some water into the measuring cylinder and asks participants to read and record the amount • Plenary discussions and questions • Feedback from facilitator
Background information	Rain gauge instruction sheet (Annex 1)

Activity 3	Classroom activity on data recording and calculating armyworm forecasts
Objectives	• To understand how to fill in the data sheet on a daily basis • To summarise recorded data and calculate armyworm forecasts
Duration	40 minutes
Material and equipment	Data record sheet for each participant
Methods	• Facilitator gives arbitrary data of moth catches and rainfall for a two-week duration • Each participant fills the data sheet using the arbitrary data given by the facilitator • Observe availability of vegetation in the area • Summarise the information and calculate forecasts

Activity 4	**Field activity on data recording and calculating armyworm forecasts**
Objectives	• To understand how to set up traps and rain gauges in the field • To practise how to record data on a daily basis • To practise how to calculate data and communicate the forecasts
Duration	1 hour
Material and equipment	• 14 moth traps and 14 rain gauges to represent a duration of two weeks • Data sheets • Water • Moth specimens
Methods	• Participants select proper sites and set up the traps and rain gauges • Facilitator adds some moth specimens (or some leaves to simulate moth catches) • Facilitator adds different amounts of water in the rain gauges • In groups, the participants take records representing two weeks • The groups calculate forecasts and present them in plenary • Feedback from facilitator

Activity 5	Vegetation identification
Objectives	• To enable participants distinguish between types of vegetation attacked by armyworms and those that are not
Duration	40 minutes
Material and equipment	• Different types of vegetation • Flipcharts and marker pens
Methods	• Participants collect all types of vegetation available in the area • Participants sort the different types of vegetation according to whether armyworms attack the vegetation or not • If training during dry season and there is no green vegetation in the area, participants can discuss all the types of vegetation/crops grown in the area • Participants to list the vegetation in columns according to whether they are attacked by armyworms or not
Additional information	Rose *et al.* (2000). Armyworm Handbook [xv]

Activity 6	Identifying communication channels and strategies
Objectives	• To identify potential communication channels and networks for disseminating forecast information • To emphasise the role of different stakeholders and local channels in disseminating CBAF information
Duration	30 minutes
Material and equipment	Flipcharts, marker pens, idea cards
Methods	• Participants to discuss all communication channels available in the village • Participants prioritise the channels to effectively use to communicate CBAF information

3.2 Group dynamic activities

Group dynamic activities are integrated into the various sessions. They are games and exercises that enhance learning by energising, stimulating participation, as well as strengthening group communication and solidarity.

Group dynamic activities could be categorised into the following.

- introduction activities (icebreakers)
- energisers
- group formation and team-building exercises
- evaluation activities

This section suggests some relevant group dynamic activities that can be used during training sessions.

Activity 1 Introduction

- It could be paired interviews, participants introducing themselves in plenary or in groups, etc.

Objectives	• To help participants relax at the beginning of a course • To know about the participants and what they want to get from the training course
Duration	20 minutes
Methods	• In pairs, participants could interview each other about their name, background, hobbies, and experiences; including any experience about armyworms and CBAF

	• Participant to tell partner why they are attending the training and what they hope to get from it • Participants to introduce their partners to the plenary, summarising the main information about their partner in one minute
Source	Adapted from IIED (1995) [xvi]

Activity 2	**Stepping stone**
Objectives	• To identify participants' experiences regarding the armyworm • To learn about the participants and to hear what is important to them
Duration	20 minutes
Methods	• In pairs or in groups, participants to interview each other. Each to choose 3-4 important experiences or 'stepping stones' in their lives in relation to the armyworm, extension work, and other experiences • Pairs or groups to relate chosen stepping stones in plenary
Source	Adapted from IIED (1995) [xvii]

Activity 3	Role play disseminating forecast information
Objectives	• To demonstrate how forecasters and other stakeholders should disseminate warnings without delay
Duration	30 minutes
Methods	• Facilitator asks for volunteers to represent village forecaster, village leader, village extension worker, village runners, farmers, and district authority • Participant demonstrates what forecaster does on calculating a positive forecast • Other participants role-play other people involved in communicating forecast information • Debriefing/reflections by the participants

Activity 4	Role-play relaying messages
Objectives	• To illustrate how forecast information could be distorted as it passes several channels • To understand the need to use simple language, short channels, and to obtain feedback
Duration	30 minutes
Methods	• Facilitator gives one long message about armyworms to one participant representing high authority in the ministry, who then reads the message and whispers it to the next person (divisional official). Participants cannot ask for clarification • The message is relayed down through various officials until it reaches the farmers • The famer (last participant in the chain) is then to say aloud the message they receive. Compare this with the original message • What happened? What were the difficulties? Why was the message distorted? How can we relate relaying the message to disseminating armyworm forecasting activities?
Source	Adapted from IIED (1995) [xviii]

Activity 5	Folding paper
Objectives	• To demonstrate the importance of feedback and visualisation of instructions • To show that even simple instructions can easily be misinterpreted by the recipients
Duration	20 minutes
Material	Four sheets of A4 paper
Methods	• Four volunteers to go to the front, face the group, and close their eyes • Facilitator to give each volunteer an A4 paper • Volunteers to fold the paper in half and tear off the bottom-right corner • Volunteers to fold the paper in half again and tear off the upper-right corner • Volunteers to fold the paper in half again and tear off the lower left-hand corner • Volunteers to open their eyes, unfold the papers and show them to the participants • In plenary, participants relate the experiences, difficulties, and areas for improvement
Source	Adapted from IIED (1995) [xix]

Activity 6	**Debate economic importance of the armyworm and whether there is need for control actions**
Objectives	• To know what participants think about the economic importance of the armyworm • To learn in a relaxed way
Duration	30 minutes
Methods	• Two volunteer groups comprising of four participants each to go to the front. • One group to argue in favour of the economic importance of the armyworm and the need for its control while the second group argues against its control • Other participants to gradually join the debate • Debriefing/reflections by the participants

Activity 7	Role-play actions that follow positive forecast
Objectives	• To enable participants understand the actual and potential roles and actions of different stakeholders following warning about an outbreak
Duration	30 minutes
Methods	• Volunteers to represent village forecasters, farmers, village leader, extension worker, pesticide dealers, district authority, and national authority • Participant to demonstrate forecaster reporting warning to village leader and village extension officer who then inform the rest • The rest to demonstrate actions the stakeholders would take on getting information about the likelihood of an outbreak • Debriefing/reflections by the participants

Activity 8	**Debate the merits and demerits of central forecasting system versus CBAF**
Objectives	• To enable participants develop better understanding of the merits, benefits, and limitations of the two forecasting systems
Duration	30 minutes
Methods	• Facilitator to project the following statement *"Central forecasting service has already been properly serving the farming community very well; as such, there is no need for the alternative approach called CBAF"* • Find open space at the front or back of the room and label with agree, not sure, and disagree • Participants to move to one of the three spots • Participants to say why they agree, disagree, or are not sure about the statement • Groups in opposing camps to react, with facilitator moderating the debate • Facilitator or one of the participants to take notes and summarise the key issues

Activity 9	The mood metre
Objectives	• To monitor mood changes of the participants during the course
Duration	5 minutes every day
Material and equipment	• Flipcharts, marker pens
Methods	• Prepare the mood metre sheet. This may be a flipchart placed lengthwise, with a horizontal line drawn across the centre. Positive moods are indicated above the line and negative moods below the line • You can have two mood metres in a day; one for morning and another one for afternoon sessions • Participants to fill the mood metre at the end of every session by a tick or a dot • Facilitator to assess the mood of the participants during the training period. This can be at the end of a session, the day, or at the end of the workshop • Take corrective actions

Activity 10	Role play for creative evaluation
Objectives	• To evaluate a session or a workshop in a relaxed and creative way
Duration	30 minutes
Methods	• Facilitator to tell participants early in the workshop that they will engage innovatively in evaluating the workshop at the end • Participants to prepare a short play about happenings at the workshop • Participants to have time to rehearse for the play near the end of the workshop • Participants to act out the plays
Source	Adapted from IIED (1995)[xx]

Activity 11	Graffiti feedback boards
Objectives	• To enable participants to anonymously provide feedback or their reactions
Duration	5 minutes each day or at the end of the course
Material and equipment	• Graffiti board or flipcharts, marker pens
Methods	• Prepare graffiti board such as a flipcharts, white board, black board, etc. • Topics may be provided at the top of the graffiti board *e.g. I did not like…, I liked…, and Suggestions* • Participants to anonymously write down their reactions, observations, and ideas • If for daily feedback, volunteers can analyse the graffiti boards to identify general trends. They should report their findings to the facilitator and to the group
Source	Adapted from IIED (1995) [xxi]

Annexes

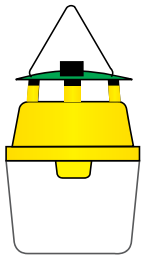
Annex 1
The forecasting pack sheets

Armyworm forecasting pack

The armyworm forecast pack contains the following items:

- Armyworm moth trap
- Two rubber baits in an airtight bottle
- Insecticide cube for the trap
- Armyworm moth trap instruction sheet
- Rain gauge, rain collection cup, and measuring cylinder
- Rain gauge instruction sheet
- Forecasting instruction sheet
- Data sheets
- Pens, pencils
- Outbreak record cards
- Armyworm posters
- Armyworm leaflets

Using the armyworm moth trap

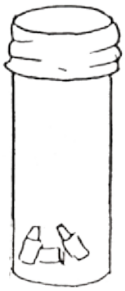


1. Setting up the trap

- Select a secure area not too close to a building
- Hang the trap up about 1-1.5 metres from the ground
- Put in one of the rubber baits (keep the other for later use)
- Put the insecticide cube inside the trap
- Make sure the trap will not be disturbed by animals or children

2. Check the trap every day

- Look inside and count how many moths are there
- Record on the data sheet the date and the number of moths
- Throw the moths away
- Leave the trap ready again



3. Change the bait after two months

- Keep the spare bait in an airtight bottle
- Keep the bottle in a cool, dry, and safe place
- Replace the bait after two months of use
- Throw away the old bait
- Record that the bait was changed
- Leave the trap ready again

4. Pack up equipment at the end of the season

- Forecasting stops on 31st May
- Store the trap with the village leaders
- Record that the trap was stored

Using the rain gauge

1. Setting up the gauge

- Select an area near the armyworm moth trap away from trees and buildings
- Make a small hole in the ground, for the lower part of the metal container to stand in
- Place the water collection cup inside the metal container
- Put the lid on the metal container
- Make sure the gauge will not be disturbed by animals or children

2. Check the gauge every day

- Open the lid of the container
- Lift out the water collection cup
- Pour the water into the measuring cylinder
- Record on the data sheet the rainfall in millimetre (mm)
- Throw the rainwater away
- Replace the collection cup and rain gauge lid

3. Pack up gauge at end of season

- Forecasting stops on 31st May
- Store the rain gauge with the village leaders
- Record that the gauge was stored

Forecasting armyworm attack

1. Equipment

The following equipment is needed by the armyworm forecaster. Instructions for the trap and rain gauge are provided above.

- Armyworm moth trap, insecticide cube, and spare bait
- Rain gauge
- Data file with data sheets

2. Record data every day

- Make observations at the same time every morning
- Record the date
- Check the moth trap, and record the number of moths caught
- Check the rain gauge, and record the rainfall

3. Calculate forecast every Friday morning

- Record data on Friday morning as usual
- Fill in the summary table on the data sheet
- Calculate the forecast
- Record on the data sheet if you give an armyworm alert

4. Publicise warning

If you give an armyworm alert, you must tell the people who need to know. This must be agreed with the village leaders.

Either you or somebody else should make sure the following people know as soon as possible that there is an armyworm warning:

- The village leaders
- The extension officer
- The local school
- The local mosque and or church
- Farmers in the village

5. Assist district office

From time to time someone from the district office will visit to see how the forecasting is going. When they come, please assist by letting them see the data file. You should inform them of your experiences as a forecaster, and any ideas you have for improving the forecasting.

If you have any problems, you should inform the extension officer immediately.

Armyworm forecasting weekly data sheet

A. Daily data

Day	Date	Number of moths	Rain (mm)
Saturday			
Sunday			
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			

B. Summary

Total number of moths caught this week
Number of days with more than 5 mm rain
Is there vegetation suitable for armyworms? (Yes/No)

C. Making the forecast

	Tick box
1 Is there any vegetation suitable for armyworms **THIS week?**	YES ☐ Go to number **2** NO ☐ Go to number **7**
2 Did you catch more than 30 moths **THIS week?**	YES ☐ Go to number **3** NO ☐ Go to number **4**
3 Did you get more than 5 mm rain on any day **THIS week?**	YES ☐ Go to number **6** NO ☐ Go to number **4**
4 Did you catch more than 30 moth **LAST week?**	YES ☐ Go to number **5** NO ☐ Go to number **7**
5 Did you get more than 5 mm rain on any day **LAST week?**	YES ☐ Go to number **6** NO ☐ Go to number **7**
6 GIVE AN ARMYWORM WARNING!	☐
7 Do NOT give an armyworm warning this week	☐

D. Other observations

Defeating the armyworm (Leaflet)

Danger!

Armyworms are dangerous to crops! They appear very suddenly in large numbers. In a short time they can destroy whole fields of maize, sorghum, millet, or rice.

This leaflet explains how to defeat armyworms. Everyone in the sub-location must know what to do.

There are four steps to defeating armyworms.

1. Understanding armyworms.
2. Knowing when armyworm outbreaks are coming.
3. Noticing the small armyworms before they become arge enough to damage crops.
4. Killing armyworms.

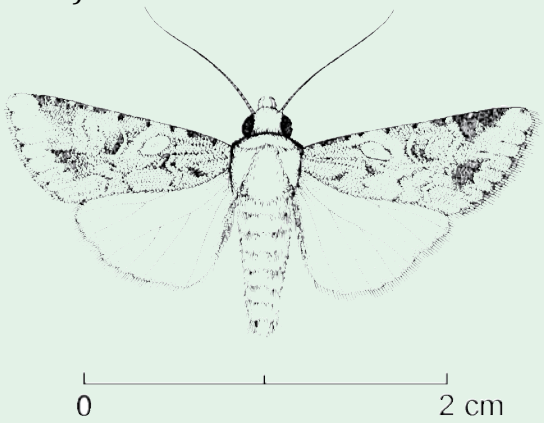
Step 1. Understanding armyworms

Armyworm larva (life size)

The large black armyworms that eat crops are the young of a moth. The moths fly at night, and lay tiny eggs on leaves.
Small armyworms hatch out of the eggs and start eating. As the armyworms grow, they become more obvious, and eat more and more.

Armyworm moths can fly long distances, helped by the wind. And one moth can lay hundreds of eggs. This is why armyworm outbreaks can be very sudden.

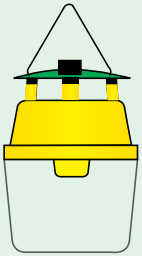
Armyworm moth (life size)



By understanding armyworms,
it is possible to know when outbreaks are coming.

Step 2. Knowing when armyworms are coming

Armyworm outbreaks can be expected when three things happen:



1. Armyworm moths fly into the area.
This can be known from special traps, which catch only armyworm moths.

2. There is heavy rain.

3. There are suitable plants for the armyworm moths to lay eggs on.

Working out when an armyworm outbreak is coming is called 'forecasting'.

Forecasting will be done for the whole sub-location by a farmer-forecaster in the sub-location. To do forecasting, training and equipment is required. When armyworm outbreaks are expected, a warning will be given.

The armyworm warning helps you to know when to look for the small armyworms in your fields.

Step 3. Noticing young armyworms

Small armyworms are difficult to see, so you have to look very carefully. They are very small and green, and do not look like full-grown armyworms.

Small armyworms can be noticed in two ways.

- Feeding marks. Small armyworms scrape the surface of the leaf. This makes small 'windows' in the leaves.
- Hanging from leaves. If young armyworms are disturbed, they hang from the leaf on a thread, like a spider. Several may be seen hanging from one leaf. If you walk through the crop and rub against the leaves, you may find the young armyworms on your shoes or clothes.

If you see small armyworms in your field, you should show the agricultural extension officer immediately. Do not delay!

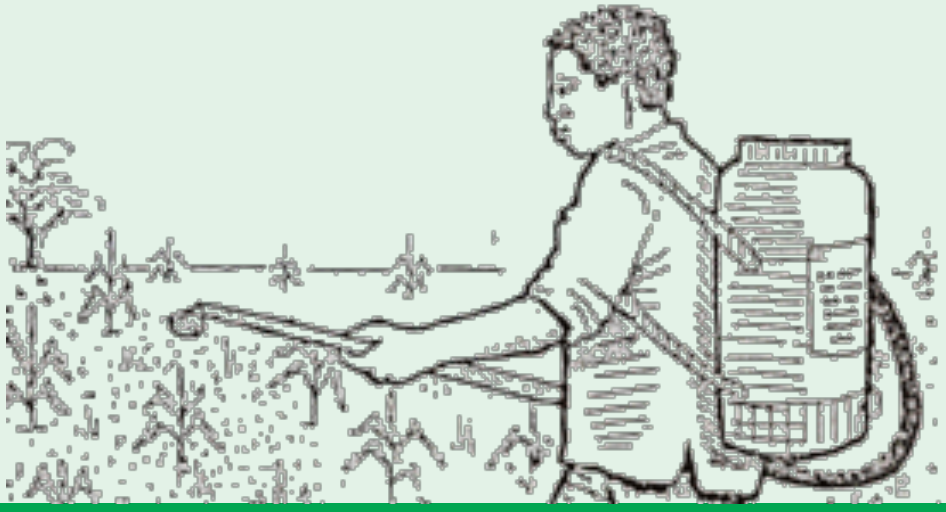
Noticing armyworms in your garden when they are still small gives time to make preparations for killing them.

Step 4. Killing armyworms

It is best to kill armyworms when they are small, before they destroy crops. If you know a way to kill them that works, use it! The most effective way to kill armyworms is to spray insecticide. This is expensive, but it is worth it. If spraying is done properly, it kills the armyworms before they become big enough to destroy crops. Neighbouring farmers must agree to work together to kill the armyworms, as the armyworms can walk from one field to another.

The sub-location usually has some sprayers. The extension officer can advise you how to utilise them.

If there is no insecticide in the sub-location, go to the nearest shop as soon as the small armyworms are seen or when the forecaster gives an armyworm outbreak alert.



Spraying insecticide kills armyworms and saves crops

Armyworm Questions

The following are frequently asked questions about the armyworm.

Do armyworms eat all crops?

No. Armyworms eat maize, sorghum, millet, rice, sugarcane, wheat, barley and grass. They do not eat beans, vegetables, tea, coffee, groundnuts, cassava, or cotton.

What colour are armyworms?

The very small armyworms are whitish, with a black head. They become green as they eat the green leaves. When they get older, they may turn darker green, brown, or black; especially if they are very many. The head is always shiny black.

Why do armyworms disappear so suddenly?

When armyworms become full grown, they burrow into the ground and turn into pupae. The adult moths emerge from the pupae and fly away during the night.

Will the government provide insecticide when I get armyworms in my garden?

The government will try to provide insecticide, but if you can, buy your own.

Insecticide is expensive. Is it worth using it?

If you have more than 2 armyworms on a maize plant, it is better to buy the insecticide and spray it. Otherwise the crop will be destroyed.

Are insecticides safe?

Insecticides are safe if used properly. Make sure you follow the instructions.

Annex 2
Training workshop material and equipment

- Forecast packs, 1 per village
- Stationery that include notebooks, pen, pencil, chalk, etc.
- Flipcharts, blackboard, and or white board
- Moths and larvae specimens
- Spare traps for practice
- Spare rain gauges for practice
- Buckets
- Data sheets
- Insecticide for traps
- Overhead/LCD projector
- Armyworm posters
- Armyworm leaflets

Annex 3
Boundary partners identified for Malawi

- National CBAF coordinator
- Farmer forecasters
- Farmers in village communities
- Researchers
- Agricultural extension workers
- Village leaders
- Pesticide dealers
- Non-governmental organisations
- District authority
- Pesticide registrars
- Ministry of Agriculture migrant pests coordination unit
- National plant protection advisory committee
- Mass media
- Corporate sector

Annex 4
Example of progress markers for village forecasters

DESIGN WORKSHEET: PROGRESS MARKERS

Outcome challenge: The project is intended for farmer-forecasters in each village. They will be effective, technically competent, and reliable. The forecasters will:

- set up and run pheromone traps and rain gauges
- calculate weekly forecasts
- store spare trap baits
- train other farmers to become forecasters
- produce timely and accurate outbreak warnings

Expect to see village forecasters

1	Take on role of forecaster
2	Attend training
3	Practise monitoring and forecasting activities (set traps and gauges, check vegetation, and record data)
4	Make weekly forecasts
5	Keep records for the projects

Like to see village forecasters	
6	Recognised by the village (farmers and village leaders)
7	Hand over pheromone traps to village authorities during off-season
8	Service the traps
9	Openly sharing forecasts through different channels including village leaders, extension workers, and neighbours
10	Applying rules correctly
11	Forecasting on their own

Love to see village forecasters	
12	Broaden knowledge to other areas
13	Become experts in forecasting and train other farmers to become forecasters
14	Recognise importance of monitoring and maintaining records

Annex 5
Example of workshop evaluation exercise

Please assist us in evaluating the training workshop. Please circle the number that best represents your views, 1 being negative, 4 being positive.

1.	Were the course objectives clearly evident to you?	1	2	3	4
2.	Did you learn what you expected to learn?	1	2	3	4
3.	Was the material relevant and valuable to you?	1	2	3	4
4.	Was there adequate time allotted to the topics?	1	2	3	4
5.	Were the visual aids (posters, flipcharts, transparencies, LCDs, videos, specimens, etc.) helpful to you?	1	2	3	4
6.	In relation to your job, was the course valuable?	1	2	3	4
7.	How were the presentation/training methods and the approach?	1	2	3	4
8.	Was the atmosphere conducive to participation?	1	2	3	4
9.	Was the course well-organised, allowing progression from one topic to another?	1	2	3	4
10.	Overall, how do you rate this course?	1	2	3	4
11.	Were your expectations for the training met?	1	2	3	4
12.	If no, why?				

_____

_____

13. Which part of the training did you find most useful?

_____

_____

14. What did you enjoy most about the course?

_____

_____

15. Additional suggestions for improvement?

_____

_____

Annex 6
Further information

If you need further information on CBAF, such as how to obtain the equipment, how to get

training, how to control armyworms, you should contact an extension officer, locally or at headquarters. Many countries have a national department or unit for plant protection which includes people with responsibility for migrant pest control, including armyworms.

Additional information on armyworm and participatory approaches can be found in the following publications. The African Armyworm Handbook is particularly useful for information on armyworm biology and control, but it does not contain information on CBAF.

- Clarke S, Blackman R, and Carter I (2004). Facilitation Skills Workbook. Tearfund, UK
- Financial Literacy Foundation (2006). Adult Education Guide: Principles of Adult Learning. http://www.understandingmoney.gov.au
- IDRC (2001). Outcome Mapping: Building Learning and Reflection into Development Programmes. Ottawa. http://www.idrc.ca
- IIED (1995). A Trainer's Guide for Participatory Learning and Action. IIED Participatory Methodology Series. IIED, London.
- Research into Use (nd). Community-Based Forecasting Saves Crops. Research Into Use. Pocket Guide No. 5 http://www.researchintouse.com/downloads/RIU_Pocketguide_5.pdf
- Rose D J, Dewhurst C F, and Page W W (2000). The African Armyworm Handbook: The Status, Biology, Ecology, Epidemiology and Management of *Spodoptera exempta* (Lepidoptera: *Noctuidae*). Second Edition. Chatham, UK: Natural Resources Institute.
- World Bank (2009). Participatory Communication. A Practical Guide. World Bank Working Paper No. 170. World Bank, Washington DC.

End notes

[i] Rose, D J, Dewhurst, C F and Page, W W (2000). The African Armyworm Handbook: The Status, Biology, Ecology, Epidemiology and Management of *Spodoptera exempta*

(Lepidoptera: *Noctuidae*). Second Edition. Chatham, UK: Natural Resources Institute.

[ii] Rose, D J et al, ibid

[iii] Rose, D J et al, ibid

[iv] Research into Use (nd). Community-based Forecasting Saves Crops. Research Into Use. Pocket Guide No. 5
http://www.researchintouse.com/downloads/RIU_Pocketguide_5.pdf

[v] Research into Use, ibid

[vi] Pretty Jules N, Guijt I, Thompson J, Scoones I (1995). Participatory Learning and Action: A Trainer's Guide. IIED Participatory Methodology Series.

[vii] World Bank (2009). Participatory Communication. A Practical Guide. World Bank Working paper No. 170. World Bank, Washington DC.

[viii] Pretty Jules N et al, ibid

[ix] Financial Literacy Foundation (2006). Adult Education Guide: Principles of adult learning. http://www.understandingmoney.gov.au

[x] Earl S, Carden F, Patton M Q, Smutylo T (2001). Outcome Mapping: Building Learning and Reflection into Development Programmes. International Development Research Centre, Ottawa

[xi] Rose, D J et al, ibid

[xii] Rose, D J et al, ibid

[xiii] Research into Use ibid

[xiv] Rose, D J et al, ibid

[xv] Rose, D J et al, ibid

[xvi] IIED (1995). A Trainer's Guide for Participatory Learning and Action. IIED Participatory Methodology Series. IIED, London.

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