KHEA
Knowledge Hub for Organic Agriculture in Eastern Africa

TOAM
Tanzania Organic Agriculture Movement

Control of the Fall Armyworm in Maize

Implemented by giz

In corporation with Biovision Africa Trust

About the Author

Tanzania Organic Agriculture Movement (TOAM) is an NGO dedicated to developing and promoting organic agriculture in Tanzania.
We are motivated by the desire to empower farmers, protect the environment, and provide healthy food for all.

Copyright Statement

Contacts

Knowledge manager,
Tanzania Organic Agriculture Movement (TOAM)
P.O.BOX 70089, Dar es Salaam –Tanzania
Email: brigitha.massawe@kilimohai.org
Telephone: +255 652 699 554

Introduction

About Fall Armyworm (FAW)

- Fall Armyworm (*Spodoptera frugiperda*) is a polyphagous insect that feeds mainly on maize and more than 80 other crops, including wheat, sorghum, millet, sugarcane, vegetable crops, and cotton.
- Fall armyworm moths generally disperse in a radius of about 500 km (300 miles) before oviposition, which is sufficient for them to move from seasonally dry habitats to wet habitats in Central America. This makes it possible for fall armyworms to spread over large areas rapidly.
- Recognizing FAW is the first step for management. The pest is new to Africa, and farmers need to be able to recognize FAW and distinguish it from other pests. FAW has six main development stages as described in the next section:

Recognizing and understanding of the Fall Armyworm

Fig shows a cluster of FAW eggs on the leave

Stage 1. Egg mass of S. frugiperda

Eggs are pale green or white at the beginning, get covered in scales, and turn clear brown to brown before hatching. They hatch within 2-3 days.

Stage 2. Neonate larvae

In this stage, Eggs hatch into small caterpillars within 3–5 days, and move to the funnel. The small caterpillars can also be carried to other plants by wind (Figures 7–8). Small caterpillars may appear greenish, while bigger caterpillars vary in colour from orange to green and black or brown Caterpillars mature within 14–22 days (2–3 weeks), after which they drop to the ground to pupate.

Fig shows eggs hatching into caterpillars

Recognizing and understanding of the Fall Armyworm

Fig shows five stages of FAW.

Stage 3. Larva from 1st to 5th Stage.

There are 6 larvae stages. Young larvae are pale-colored. They become brown to pale green, then turn darker at the latest stages. The larvae stages last 12 to 20 days (depending on ambient temperature and other environmental conditions)

Stage 4. Larvae of S. frugiperda at 6th stage

Half-grown or fully-grown caterpillars are the easiest to identify. The larvae are generally characterized by 3 yellow stripes on the back, followed by a black, then a yellow stripe on the side. Look out for four dark spots forming a square on the second to last segment (photo). Each spot has a short bristle (hair). The head is dark; it shows a typical upside down Y-shaped pale marking on the front.

Fig shows full grown caterpillar of FAW

Recognizing and understanding of the Fall Armyworm

Fig shows the FAW in pupa stage

Stage 5. Pupa Stage.

The pupa is dark brown and hides in the soil, more rarely in the stalk. Pupa lives 12-14 days before an adult emerges

Fully-grown caterpillars normally drop or crawl down the plant to the ground to pupate. Occasionally, they may pupate in plant parts, especially after ear tissue feeding

Fig shows adult Moss fully developed

Stage 6. Adult Moth stage

The moth is 3 to 4 cm wide. Its front wings are dark brown while the rear wings are grey white. Highly active at night, hide during the day. In maize, adults can be found hiding in between leaves or inside whorls. It will live 2 to 3 weeks before dying

Fall armyworm: Life Cycle and damage to Maize

The fall armyworm life cycle includes egg, 6 growth stages of caterpillar development, pupa and moth.

After approximately **14 days** the fully grown caterpillar will drop to the ground.

DAY 6-14

LARVAL GROWTH STAGES 4-6

By stage 4 the caterpillar will be bigger and have reached the whorl, where it does the most damage, resulting in ragged holes in the leaves. Feeding on young plants can kill the growing point, resulting in no new leaves or cobs developing.

If the plant is older and has already developed cobs, then the caterpillar will eat its way through the protective leaf bracts into the side of the cob, where it begins to feed on the developing kernels (seeds).

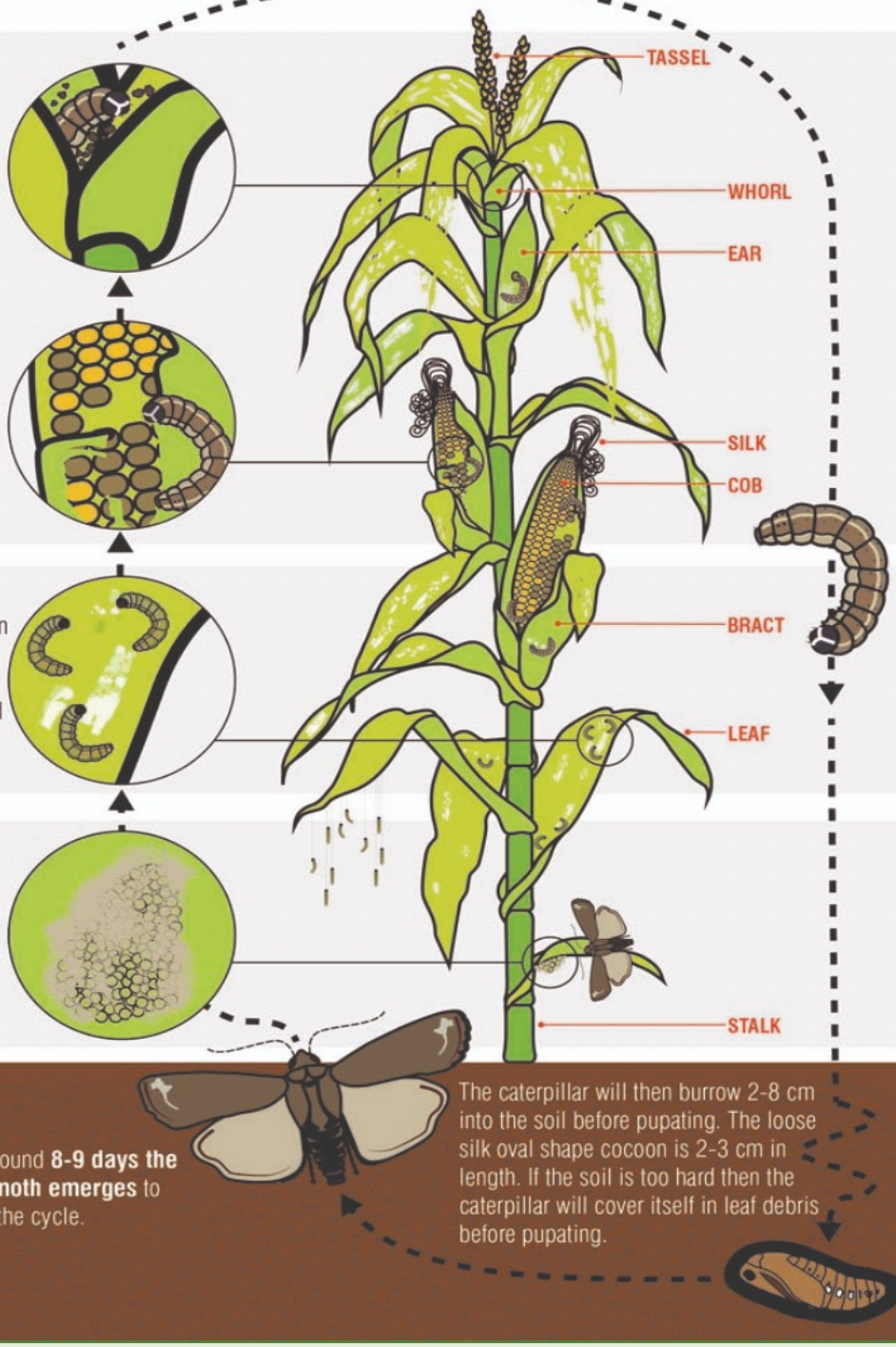
DAY 3-6

LARVAL GROWTH STAGES 1-3

After hatching, the young caterpillars begin feeding, which creates patches on the leaves called windows. Young caterpillars can spin silken threads that catch the wind and transport the caterpillars to a new plant.

DAY 1-3

Batches of **100-200 eggs** are laid on the lower leaves.



The caterpillar will then burrow 2-8 cm into the soil before pupating. The loose silk oval shape cocoon is 2-3 cm in length. If the soil is too hard then the caterpillar will cover itself in leaf debris before pupating.

After around **8-9 days the adult moth emerges** to restart the cycle.

Prevention and Management

There are several ways proposed to be used in managing FAW in Maize and other crops but because Fall armyworm is still a new pest in Africa, there is still ongoing research to find the accurate solutions to the problem.

Techniques to prevent/avoid the arrival of the pest to a particular area include regulatory control and cultural methods.

Regulatory control refers to the role played by multiple government agencies in conjunction with other regulatory agencies and governments to stop the spread of fall armyworms via inspection and destruction of infested material.

It includes the critical role of governments in implementing scientific review panels and streamlined processes to review and approve new tools to manage the fall armyworm in a new country.

Cultural crop management

Cultural crop management is critical to enable a healthy crop, minimizing plant stress , and avoiding field characteristics that invite fall armyworm infestations. These include:

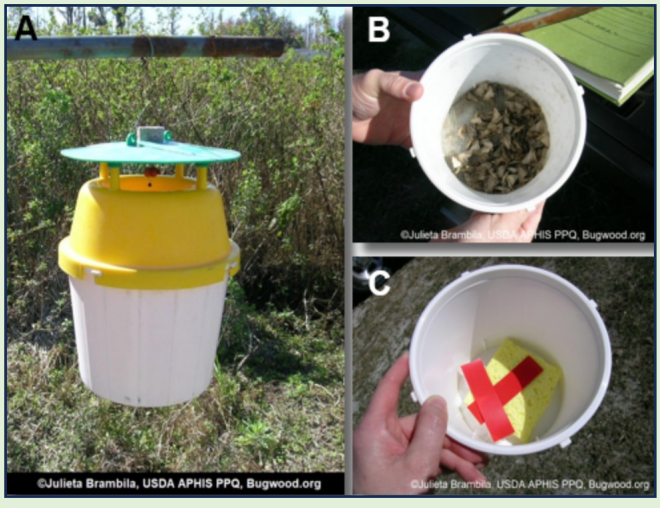
- Early planting to avoid heavier pest densities in the late season.
- Weed management – Eliminate weed hosts that sustain larval populations before they migrate to a new crop.
- Avoid adjacent sequential planting to prevent migrations of larvae from a maturing crop to new fields.
- Avoid plant stress – Proper fertilization, irrigation, cultivation, etc. Healthier plants tend to recover faster and recover from some yield loss.

Monitoring

Farmers should take action to control the Fall armyworm only when monitoring efforts show a need for control measures. They should enter their fields twice a week for monitoring efforts.

What should the farmer be looking for during monitoring?

- Cream-colored or grey egg masses on the surfaces of lower leaves, covered in a felt-like layer of grey-pink scales.
- Light green to dark brown larvae with three thin, yellowish-white stripes down the back and a distinct white inverted “Y” on the head.
- Larvae covered with fresh, coarse, clumped, yellowish-brown frass (excrement) inside the leaf whorl.
- Patches of skeletonized leaves or small “window panes.” Leaves are “skeletonized” where young caterpillars have chewed on one side of the leaf, and created large ragged, and elongated holes in the leaves that emerge from the whorl.



For effective monitoring, farmers can use traps or field scouting methods.

Pheromone Traps alert farmers on the arrival of the adult FAW to the area.

Adult data collected over several seasons provide an indication of when peak adult trapping is normally expected to occur in an area

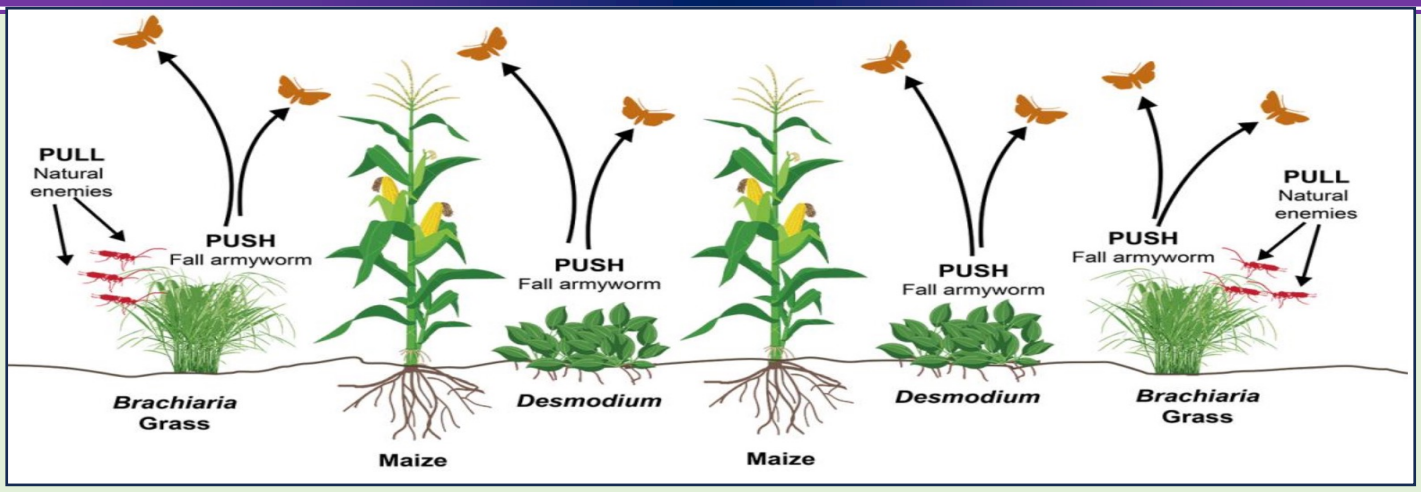
Monitoring…

Field Scouting

- It is one of the most important activities a farmer can do to manage infestations based on informed decisions which involves entering the field looking for the presence of fall armyworm eggs, larvae, etc., and feeding signs.
- Relies on the ability to identify correctly the fall armyworm, understand its biology and behavior, and recognize early feeding.

- Fields should be “scouted” at a minimum of once per week or more often when conditions favor infestations, e.g. crops in the vegetative stage, increase in male moth trapping, presence of egg masses, etc.

Push –Pull technology



'Pull'

The grasses are planted in the border around the maize and sorghum fields where invading adult moths become attracted to chemicals emitted by the grasses themselves. Instead of landing on the maize or sorghum plants, the insects head for what appears to be a tastier meal. These grasses provide the "pull" in the "Push-Pull" strategy. They also serve as a haven for the borers' natural enemies. Good trap crops include well-known grasses such as Napier grass (*Pennisetum purpureum*). Napier grass has a particularly clever way of defending itself against the pest onslaught: once attacked by a borer larva, it secrets sticky substance that physically traps the pest and effectively limits its damage. The natural enemies lurking among the grasses go into action and dispatch the borers in both maize or sorghum and grass hosts plants

Push –Pull technology

'Push'

The "push" in the intercropping scheme is provided by the plants that emit chemicals (kairomones) which repel stemborer moths and drive them away from the main crop (maize or sorghum). The best candidates discovered so far with the repellent properties are members of leguminous genus *Desmodium spp*. Desmodium is planted in between the rows of maize or sorghum. Being a low-growing plant it does not interfere with the crops' growth and, furthermore, has the advantage of maintaining soil stability, improving soil fertility through enhanced soil organic matter content and nitrogen-fixation. It also serves as a highly nutritious animal feed and effectively suppresses striga weeds. Another plant showing good repellent properties is molasses grass (*Melinis minutiflora*), a nutritious animal feed with tick-repelling and stemborer larval parasitoid attractive properties.

It was developed by scientists at the icipe in Kenya, and Rothamsted Research, in the United Kingdom, in collaboration with other national partners

TOAM

Tanzania Organic Agriculture Movement

KHEA Project Partners:

Implemented by

In corporation with