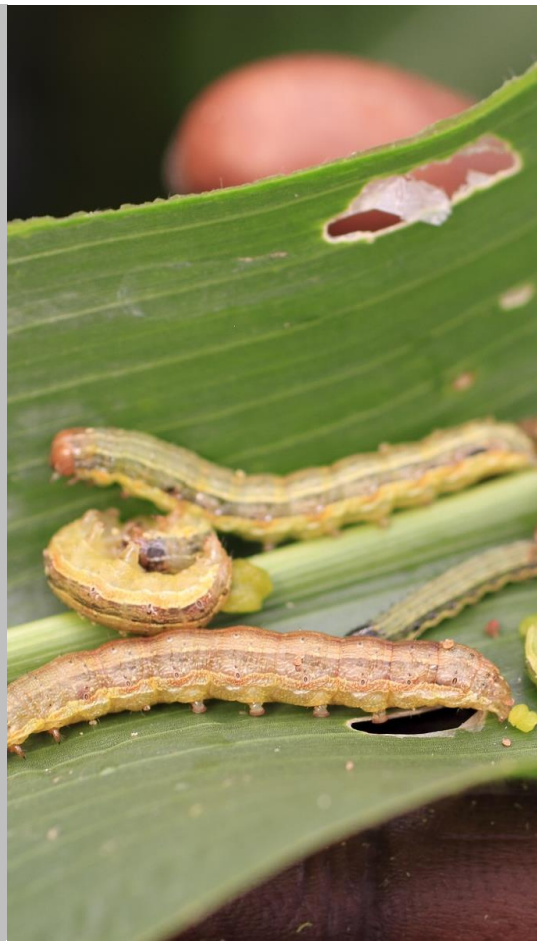
Fall armyworm Technical Brief with reference to Maize production in Uganda



Fall armyworm Monitoring, Identification and Management Options

Background

Fall Armyworm (FAW) scientifically called *Spodoptera frugiperda* is an insect pest native to tropical and subtropical regions of Americas. It is new to Africa and was first detected in Central and West Africa in early 2016. The pest was first reported in Uganda in June 2016 at Kayunga, Kasese and Bukedea districts. By end of 2017, the pest had spread to all the districts of Uganda. FAW is capable of feeding on more than 100 plant species with maize and sorghum being the most preferred hosts. In Uganda, the pest has been confirmed to be feeding on maize, sorghum, sugarcane, rice, millet, wild sorghum, cotton, napier grass, capsicum and rhodes grass (*Chloris gayana*) by April 2018.

FAW is migratory in nature and moths fly for over 100km per night. The pest can persist in an area throughout the year where there is availability of alternative hosts and favorable temperatures such as in Uganda.

Garden preparations

Prepare your garden 1 – 2months before onset of rains

Deep plough your garden before planting. This will expose any FAW pupae to the surface of the soil, where they will be killed by the sun or attacked by other organisms such as insects, birds, etc

Planting

- Plant your maize early at the start of the rains, to escape the peak migration of FAW adults to your garden.
- Boost the crop growth vigour by using optimum fertilizer application or manure so that your maize plant can withstand pest infestations and damage.

Community Action

Community action is required to control FAW. Scout for fall armyworm together, as a village. Farmers in the same community are encouraged to plant at the same time where possible. If you find FAW on your garden, alert your neighbours and take action.

Management during growth

A) Monitoring

Monitoring is the deliberate effort of checking for the presence of Fall armyworm on maize growing in your garden. It is important to monitor your maize crop frequently after germination for presence of the pest and or signs/damage symptoms. Early detection of the pest allows quick and timely response which will help minimise damages to your maize crop and reduce harvest losses. The Fall Armyworm caterpillar attacks all stages of maize growth i.e. seedling, vegetative, tasseling and grain filling stages. The following guidelines are recommended during monitoring;

1. Start monitoring your garden two weeks after planting and continuously visit your garden every 3 days.
2. Walk through the maize garden in either a X, Zig Zag or any other pattern while avoiding the edges of your garden
3. Randomly select 5 spots (per acre) in your garden. The spots should be spread out through your garden. Carefully examine 10 maize plants at each spot for signs and symptoms paying attention to the newest 2 – 3 leaves, tassels and cobs. It is important to note that FAW caterpillars and moths hide inside the maize funnel during the day so check the funnel.

4. Record the number of affected maize plants from each spot
5. Take immediate action if the Fall armyworm is present in your garden. Alert your neighbours and follow appropriate control measures as described in the next section of this document or consult your Agriculture Officer
6. Check for presence of FAW on other alternate hosts like sorghum, sugar cane, rice, millet and pasture grasses (rhodes grass and elephant grass).
7. Pheromone traps can also be used for monitoring the presence of FAW in the garden. If you notice the presence of the male FAW moth in the trap, take appropriate control measures as described in the next section of this document

B) Lifecycle and key identification features

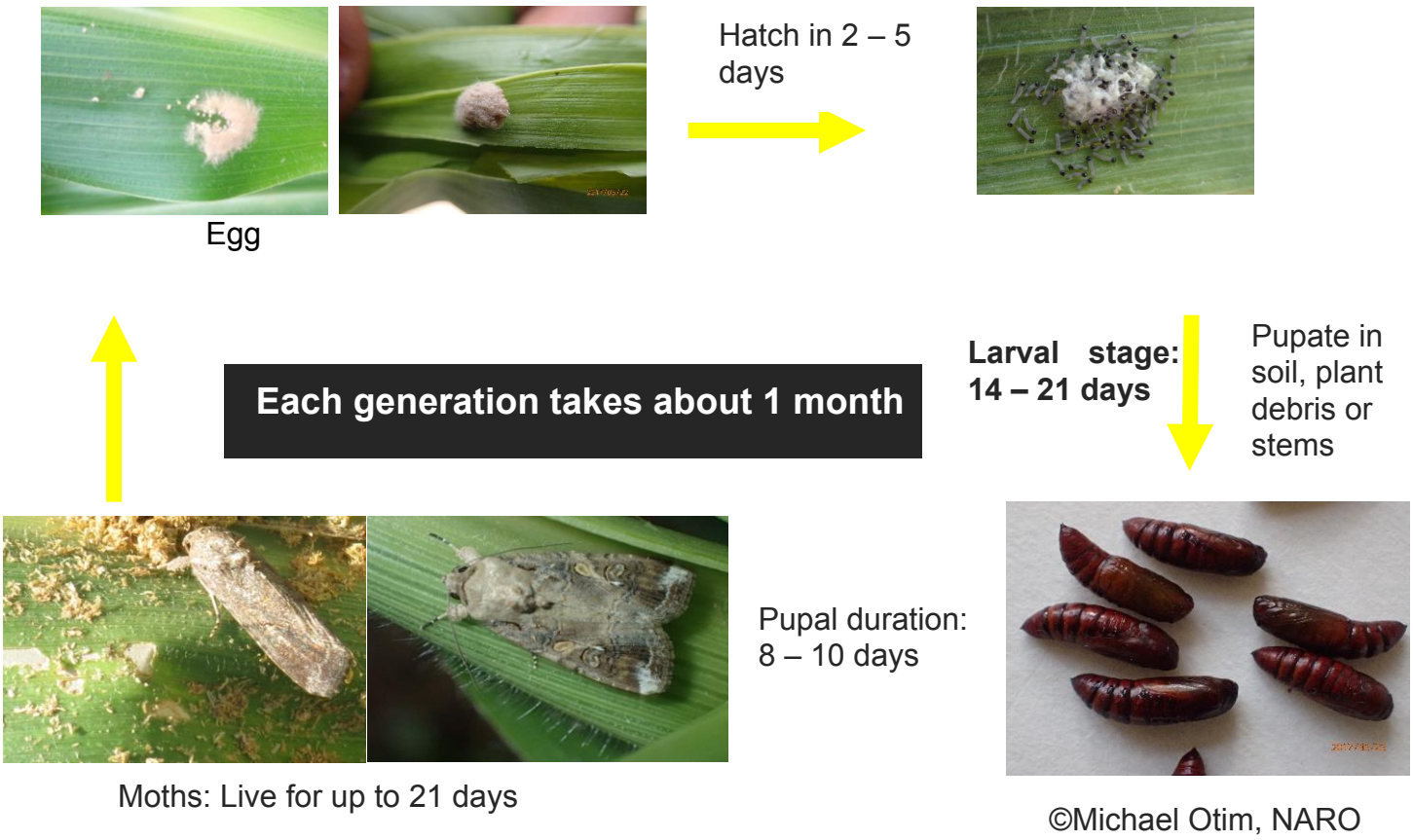


Fig.1. Fall armyworm life cycle

Stage	Features	Image
Egg	• Eggs are creamish white or grey in color covered by a whitish wool-like material • Eggs are laid in clusters between 100 - 200 eggs per cluster usually on the upper, lower sides of the leaf, the stalk and the funnel of the maize plant • Eggs hatch within 2-3 days after being laid	 
Caterpillars (6 instar stages)	• The young caterpillars spin silken threads that they use to move from one plant to another aided by wind. • Newly hatched caterpillars are green in colour during the1st – 2nd instars and turn brown to black from 3rd – 6th instar. • Caterpillars have a dark head with a pale, upside down Y-shaped mark on the front • Big caterpillars have four raised dark spots that form a squared pattern on the 2nd to last segment when seen from above • Caterpillars can live for 12-20 days depending on temperature and other environmental conditions	 
Pupa	• The pupa is reddish brown in colour and forms a cocoon of about 20 -30mm in length and is oval in shape mostly found in the soil in 2-8cm deep • Pupa lives 12-14 days before the moth emerges	
Adult	• The moth is grey-brown in color • The male moth has conspicuous white spots on the tip and center of the forewings. The forewings are grey and	**Male moth**

	brown in color • It will live 2-3 weeks before dying • Migratory and can travel long distances	 **Female Moth** 

a) **Symptoms of pest damage**

1. Check for small to large irregular and elongated holes on the leaves. Window panes of translucent patches are cause by small FAW in the 1^{st} – 2^{nd} instars while large irregular elongated holes on leaves are caused by big FAW in the 3^{rd} – 6^{th} instars.
2. Sawdust-like material (“frass”) in the maize funnel or on the leaves, tassels and cobs showing heavily infestation in the plant.

C) Control measures

The best and most effective strategy for managing FAW is taking preventive measures and immediate action when the Fall armyworm is detected. The action taken will be guided by the extent of infestation. After monitoring and recording the number of maize plants affected by FAW, the chart below can help you make a decision about the most appropriate management option. The FAW can cause more damage to maize at the early growth stage, which is why the threshold for the use of pesticides is higher than in older maize crops

Cultural control methods/mechanical control methods

1. Destroy the eggs, larvae and pupae in the crop residues after harvest by deep burying the plant residues in soil (at least 12cm deep).
2. Practice crop rotation. Alternate maize with crops that are not attacked by the FAW e.g. cassava

3. Intercropping with pigeon pea, beans, groundnuts can attract more beneficial insects, and can help repel FAW from your garden and control other weeds
4. If you notice the number of eggs or caterpillars are few, handpick and crush them. This is only practical for small gardens or few affected plants.
5. FAW is food for certain birds and insects. Growing trees, hedgerows and a variety of crops in your garden helps increase the number of these predators that can feed on the FAW and will help to reduce on infestation in the farm.

a) Use of pesticides

i) When to apply pesticides

- If you find 10 out of 50 randomly selected maize plants in your garden are affected then start spraying with the recommended dose of the right pesticides.
- For the pesticides to be effective you must spray early in the morning from 6:00-10:00am or late afternoon 4:00-7:00pm provided the conditions are favourable for spraying because FAW actively feeds at night.

ii) How to apply pesticides

1. Put on protective wears when handling, mixing and applying the pesticides, these include overalls, goggles, gloves, boots and mask and follow the instructions on the product label.
2. Always use a clean pump and clean water for mixing the pesticides.
3. Spray using the cone-shaped nozzle as this will target the plant and the maize funnel.
4. Remember that FAW caterpillars and eggs can be found anywhere on the maize plant, spray the whole plant and target the funnel where the caterpillars are usually found.
5. Avoid spraying when it is windy or if rain is imminent.

iii) How often to apply pesticides

1. Spray your crops and check for presence of caterpillars 4 days after spraying. Thereafter continuously monitor for the presence of caterpillars.
2. If after 7-14 days live caterpillars are identified in 10 out of 50 randomly selected plants, re-spray with the same pesticide.
3. Two to three (2-3) times of spraying may be adequate in a maize season

4. Remember to alternate pesticides with different modes of action after every season to avoid development of pest resistance

iv) Which pesticides to apply

The pesticides listed below have been recommended to control FAW;

Trade names	Active ingredients	Mode of action	*WHO classification/ Toxicity Class	IRAC	Dose
• Striker • Engeo, • Bash	Thiamethoxam 141g/l + Lambda-Cyhalothrin 106g/l	Contact Contact and systemic (but strongly systemic)	Class III Class II	IRAC 4A + IRAC 3A	At a rate of 20-25mls in 20 litres of water depending on stage of caterpillars (Older caterpillars require higher dosage)
• Rockett • Larvet • Supa Profenofos • Profecron • Agro-Cypro • Hitcell • Dudu Fenos • Extreme • Misile • Cypercal • Socket plus • Profex super	Profenofos 40% + Cypermethrin 4%	Contact	Class II Class II	IRAC 1B + IRAC 3A	Use 20-30ml per 20 liters of water for small caterpillars on maize less than 1 month and 30-50mls for big caterpillars

WHO classification; Class II: Moderately hazardous, Class III: Slightly hazardous. IRAC – insecticide resistance action committee

Frequently asked questions and responses:

1. **Where did FAW come from?**

Fall Armyworm is a migratory pest, it came from the Americas but it's not known how it arrived to Africa. It's a new pest in the African continent.

2. **Is FAW here to stay?**

FAW is here to stay, because the conditions for its reproduction are favourable.

3. **Will rain get rid of the Fall armyworm?**

Rain reduces population by washing them away or submerging the caterpillars in the funnel of maize plant. But it will not get rid of the pest you still have to manage the pest.

4. **Can Fall armyworm be controlled immediately after one spray?**

No, FAW has different growth stages on a single crop. Regular monitoring is still required to detect its presence for appropriate action that may include a second spraying depending on the population of the pest

5. **Is FAW spread through the seed including seeds distributed by OWC?**

No. Seed does not carry the FAW caterpillars or eggs.

6. **Is a single spray adequate for FAW?**

Yes, provided you follow the recommended spray practice

7. **How does FAW Spread?**

The moth can fly for over 100km per night when aided by wind and can cover over 1000km in its lifetime. The moth lays eggs in clusters of 100 – 200 on the leaves. .

8. **Is every pesticide effective against FAW?**

No. There is a list of recommended pesticides for controlling FAW, which have been proven to be effective. They include: Rocket, Super Profenos, Profecron, Hitcell, Dudu Fenos, Agro-Cypro, Striker and Engeo among others.

9. **Is it recommended to mix different pesticides in the same knapsack spray pump when spraying FAW?**

No. It is advisable to use the recommended pesticides dosage because they are made for such specific pests use. Please use the recommended pesticides and dosage.

10. Is it recommended to mix pesticides with foliar fertilisers in the same knapsack spray pump when spraying FAW

No. It is advisable to use the recommended pesticides dosage because they are made for such specific pests use. Please use the recommended pesticides and dosage.

11. Why are some pesticides not effective against FAW?

There are several reasons why pesticides may not be effective for instance;

a) Use of adulterated or expired pesticides

b) Applying pesticides at the wrong time of day,

c) Using non-recommended pesticides,

d) Not following recommended application guidelines,

e) The pesticides may have developed resistance

12. Are there any local innovations that can control FAW?

Traditionally substance like ash, sand, tephrosia among others were used to control pest, but research is still testing if these are also effective with FAW

13. Is coordinated group spraying necessary?

Yes. It helps area wide management of the FAW. If you spray and your neighbour does not, the pest can still migrate to your garden

14. Is FAW affected maize safe for consumption?

FAW mostly eats the leaves of maize. Occasionally it will infest ears/cobs as well. Usually, such ears are not consumed by humans. While direct damage from FAW doesn't affect the food safety of the maize, it could make the maize more susceptible to aflatoxin and other fungal diseases such as smut

15. Is spraying in advance an effective way of controlling FAW?

No, it is not cost effective and the recommended pesticide will only work when the pest is present.

Note: Its advisable to always consult with your agricultural extension officers.

Guidelines on safe application and disposal of pesticide containers

No	Message
	safe application of pesticides
1.	Use clean pumps and clean water for mixing the pesticides.
2.	Use strictly knapsacks and not basins/buckets for mixing & application of pesticides
3.	Use the correct quantity/dose during mixing (always follow the instructions on the packet)
4.	Open pesticide containers with extreme care to avoid spillage
5.	Always mix pesticides in an open place to avoid accumulation of pesticide fumes
6.	Have plenty of clean water and soap at the application site
7.	Mix pesticides using a stick or stirrer and not bare hands
8.	Windy conditions and possibility of rain must be avoided before application
9.	Never eat, smoke, drink or breast feed during application.
10.	If possible all women, elderly, children and sick should avoid applying pesticides
11.	Don't use your phone while spraying to avoid contamination
12.	If you feel unwell (nausea, headache, weak), stop the application immediately and seek medical advice.
13.	Don't apply pesticides close to, during or after harvesting. Always check the pre-harvest interval.
14.	Put on protective wear when handling, mixing and applying the pesticides
15.	When taking off the protective gear, gloves should be removed last and after rinsing them
16.	If you have an open wound – do not spray
17.	Mix adequate pesticide for your garden to avoid wastage of the chemical
18.	Do not fill the Knapsack sprayer with pesticide mixture beyond the recommended mark
	Safe disposal of pesticide containers
19.	Do not rinse empty pesticide containers near a water source to avoid contaminating the water source
20.	Do not leave empty containers of pesticide in the garden to avoid contamination of the environment
21.	Do not burn empty pesticide containers as they produce poisonous fumes
22.	The empty pesticide container should be rinsed three times, punctured or returned to the agro-input dealers for onward disposal/incineration
23.	Do not sell your empty pesticide containers to avoid re-use for a wrong purpose

24.	Do not throw empty pesticide containers into water bodies to avoid contamination
25.	Do not throw empty pesticide containers in the pit latrine since they produce fumes that are harmful to users

References

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2. CABI (2017), Fall armyworm identification and maize damage photo sheet accessed online: www.plantwise.org/FullTextPDF/2017/20177801116.pdf
3. FAO (2018). Integrated management of Fall armyworm on maize: A guide for farmer field schools in Africa.

Partners