Fall armyworm Monitoring, Identification and Management Options

Foreword

This technical brief was developed by a group of Fall armyworm experts in Kenya during a workshop funded by Precision Agriculture for Development (PAD) and facilitated by CABI in March 2018. The brief contains the latest, agreed advice for FAW management in Kenya by farmers and will be used to support the development of a range of information materials and activities for use by extension workers, agro-dealers and farmers. The brief has been reviewed by all parties and hereby authorized for circulation on 14th May, 2018 by

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Ministry of Agriculture and Irrigation
A. Farm preparation

Strong plants grow in healthy soils. Add manure or compost to your fields and fertilize your crops to maintain high soil fertility to make your crops grow well and make them compensate for any FAW damage better.

Certain birds and insects eat FAW caterpillars. Growing trees, hedgerows and a variety of crops in your fields helps increase the number of these predators which will help limit the impact of FAW on your maize.

B. Planting

Plant your maize at the start of the rains, to avoid the peak migration of FAW adult moths. Avoid late and off-season planting, and planting of new maize crop next to a visibly FAW infested field. Also avoid staggered planting of maize, as the older crops cause build-up of the pest that can ravage the younger crop that is planted later. It’s a good strategy to adhere to a regional planting schedule.

Plant maize during the long rains season in your region, but grow non-cereal alternative crops in the short rains season. Possible alternative crops could include: beans, groundnut, cowpeas, sunflower, sweet and Irish potatoes. Farmers are discouraged from using sorghum, Napier grass and millet as the alternative crop. These crops are related to maize and also hosts to FAW

Intercrop your maize with legumes like beans, groundnut and soy beans as these can help reduce the spread of the FAW by repelling FAW, hence interrupting egg laying, and increasing the diversity of natural enemies of the pest.

C. Management during growth

Practice field hygiene by weeding and removing infested crop residues from the farm.
a) Monitoring
It is important to monitor your crop frequently after germination for signs of the FAW because early detection can lead to early management, which may help to keep yield losses low unlike when high pest infestations occur.

- Check your maize at least twice per week after germination. Checking should be done early in the morning or at sunset because this is when the FAW caterpillars are most active. Walk through your maize farm in an ‘X’ or ‘zig-zag’ direction checking for signs of the pest (eggs and larvae) and its damage.
- As you walk through the field check 50 maize plants (5 groups of 10 plants) for the signs. Note down how many are affected by fall armyworm.
- If FAW is present then we recommend taking protective measures immediately. A quick response while the caterpillars are few gives the best results in managing a FAW outbreak. If any egg masses are encountered during monitoring, these should be removed and crushed to prevent them from hatching into the damaging stage of larvae.

The different measures to be undertaken are outlined below in the ‘Control measures’ section

b) Community scouting and response
Community action (an area-wide approach) is required for effective control of FAW. Scouting collectively together and applying control measures for Fall armyworm as a community is better than individual farmer interventions. Inform your neighbours if you find FAW on your farm.

c) Pheromone traps
Pheromone traps can complement field scouting for FAW, especially on large farms where manual scouting may be difficult. If you notice FAW moths in the trap check your crop thoroughly to determine the presence of the FAW and take necessary control measures accordingly.
d) Identifying the signs of Fall armyworm

- FAW caterpillars have an inverted Y pattern on the head and 4 black dots forming a square on the eighth segment towards the tail.
- FAW eggs are whitish/cream in colour when fresh, turning dark when they are about to hatch. They are covered in fine hairs.
- FAW eggs can be found in clusters of 150-200 on both sides of the leaves.
- FAW caterpillars range in colour from green to brown and grey to black. Check for them in the funnel.
- Newly hatched FAW caterpillars are black in colour and move in a mass away from the eggs towards the maize funnel.
- FAW caterpillars hide inside the maize whorl during the day. They are nocturnal.
- Tiny holes, large ragged holes and orange sawdust like material on leaves are signs that you have Fall Armyworm in your maize.
- FAW caterpillars are cannibalistic. Older caterpillars feed on younger caterpillars.
- FAW moths fly long distances, mate, and lay eggs at night.

D. Control measures

If you find the Fall armyworm on your crops, you should take action to control them. The control option you take should be guided by the extent of the infestation.

After monitoring your crop, record the number of plants that have signs of Fall armyworm. The chart below can help you make a decision about the most appropriate option. The FAW can cause more damage to crops at the early growth stage, which is why the threshold for the use of chemicals is lower than in older crops.
<table>
<thead>
<tr>
<th>Extent of infestation</th>
<th>Stage of growth of plant</th>
<th>Control measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 or less plants infested (out of 50)</td>
<td>Early growth</td>
<td>Handpick and crush, cultural control options (outlined below)</td>
</tr>
<tr>
<td>10 or more plants infested (out of 50)</td>
<td>Early growth</td>
<td>Handpick and crush, cultural control options (outlined below) plus chemical use.</td>
</tr>
<tr>
<td>19 or less plants infested (out of 50)</td>
<td>Late growth</td>
<td>Handpick and crush, cultural control options (outlined below)</td>
</tr>
<tr>
<td>20 or more plants infested (out of 50)</td>
<td>Late growth</td>
<td>Handpick and crush, cultural control options (outlined below) plus chemical use but remember to leave 21-day pre-harvest interval unless the chemical label states otherwise.</td>
</tr>
</tbody>
</table>

**a) Non-chemical control options**

- Crush all egg masses you find. Killing one caterpillar potentially prevents more than 1000 caterpillars that would form within a one month period
- Hand pick and crush or drown all caterpillars in soapy water
- Put crushed/ground chillies, wood ash, soapy water and sand in the funnel to suffocate the FAW
- Crush neem leaves/seeds and mix with water. Apply to the maize plant

**b) Chemical options**

At present, the following 10 Active Ingredients have been recommended by the government for management of FAW (for each active ingredient, there are several products available in Kenya).
### Recommended pesticide Active Ingredients

<table>
<thead>
<tr>
<th>Active Ingredient (AI)</th>
<th>Pesticide class</th>
<th>WHO classification</th>
<th>Mode of action</th>
<th>Pesticide brand examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gamma-cyhalothrin</td>
<td>Pyrethroid</td>
<td>NL (not listed)</td>
<td>contact</td>
<td>Vantex 60CS</td>
</tr>
<tr>
<td>Alpha-Cypermethrin</td>
<td>Pyrethroid</td>
<td>II</td>
<td>contact</td>
<td>Bestox 20EC, Navigator 100EC</td>
</tr>
<tr>
<td>Flubendiamide</td>
<td>Ryanoid</td>
<td>III</td>
<td>systemic</td>
<td>Belt 480c</td>
</tr>
<tr>
<td>Chlorantraniliprole</td>
<td>Ryanoid</td>
<td>U</td>
<td>systemic</td>
<td>Coragen 20SC,</td>
</tr>
<tr>
<td>Lambda Cyhalothrin</td>
<td>Ryanoid</td>
<td>II</td>
<td>contact</td>
<td>Duduthrin Karate</td>
</tr>
<tr>
<td>Indoxacarb</td>
<td>Oxadiazine</td>
<td>III</td>
<td>contact</td>
<td>Merit 150SC, Avaunt150SC</td>
</tr>
<tr>
<td>Acephate</td>
<td>Organophosphate</td>
<td>III</td>
<td>contact/systemic</td>
<td>Lotus 75% SP, Ortran 97, Orthene pellet</td>
</tr>
<tr>
<td>Carbosulfan</td>
<td>Carbamate</td>
<td>II</td>
<td>systemic/contact</td>
<td>Marshall 250EC</td>
</tr>
<tr>
<td>Abamectin + Chlorantraniliprole</td>
<td></td>
<td>II</td>
<td>Contact</td>
<td>Voliam Targo 063</td>
</tr>
<tr>
<td>Lufenuron</td>
<td>Benzoylurea</td>
<td>II</td>
<td>Systemic</td>
<td>Heritage 5%, Legacy, Match</td>
</tr>
<tr>
<td>Spinetoram 120 g/l</td>
<td>Analogue of spinosad</td>
<td>U</td>
<td></td>
<td>Radiant 120 Sc</td>
</tr>
</tbody>
</table>

### c) Spraying chemicals on Fall armyworm

Apply pesticides very early in the morning or late in the evening to maximize their effectiveness.

When applying contact pesticides target the maize funnel. When applying systemic pesticides target the leaves.

Chemicals take time to work on the FAW caterpillars, do not expect instant results. Be patient and check for fresh signs of FAW infestation after 2 weeks before making a decision on the need to spray again.

It may take up to two sprays to control the FAW on your crop to a level where the infestation is manageable and not too damaging for your crop.
Don’t use different chemicals to manage FAW on your crop within one season. Instead pick a pesticide with a different active ingredient for the following season to avoid FAW becoming resistant to pesticides. Ask your extension service provider for advice on active ingredients.

d) Other good practices When Using Pesticides

- Do not exceed the dose rate indicated on pesticide label. It is not efficient and is dangerous to your health and environment.

- It is more economical, more effective and safer to apply chemicals using a knapsack sprayer. Ensure you use proper personal protection and equipment.

- Keep written records of which pesticide you have used, when they were applied, and the dosage used.

- Pesticides stay on crops for some time, make sure you wait for the advised pre-entry period (check the label) before re-entering the field after spraying.

- Only use recommended chemicals. When unsure check with your local agricultural extension service provider.

- Do not use paraffin or battery acid to control FAW. This will harm your crops and poses a risk to humans and livestock.

- Do not mix different pesticides to make a “concoction” without proper advise. Instead of making product more effective against FAW, the mixture may harm your crops. This practice may also lead to rapid build-up of FAW resistance against available pesticide products. This practice is also dangerous to your health and environment.

More general advice on safe use of pesticides can be found on the product label and also at the end of this document.

Effective control of FAW requires an area wide approach. All farmers within an area should collectively work together to control FAW in all their farms by sharing
equipment. When using a knapsack sprayer, use the correct nozzle to ensure effectively delivery.

**E. Fall armyworm lifecycle**
- FAW moths lay eggs on either side of the leaf. The eggs hatch in 2 to 3 days in the warm tropical conditions typical of Kenya.
- The young caterpillars move to the maize funnel and feed on the young leaves hiding in the funnel during the day.
- Caterpillars grow for around 2-3 weeks while actively feeding on the crops causing great damage, before pupating in the soil.
- The pupal stage lasts 1-2 weeks, ending with the emergence of the adult moth.
- FAW moths mostly lays eggs in the first 5 days after emergence after multiple mating, but can live for up to 3 weeks and fly long distances at night to colonize new areas.

**F. Messages to address Fall armyworm myths**
The following messages are aimed at addressing common myths about FAW.
- Fall Armyworm does not come from seeds or fertilizer. FAW is not transmitted or transported through seed or fertilizers, but through the movement of moths, which lay eggs in new areas.
- Fall Armyworm caterpillars are not poisonous to humans or animals. You can feed FAW infested maize stoves to animals after drying the materials appropriately. However do not feed livestock with crop materials that have been sprayed with pesticides without observing the recommended PHI.
- Fall Armyworm do not cause yellowing of the maize leaves. If you notice leaf discoloration, it may be due to disease or a nutrient deficiency.
- Heavy rainfall can help wash FAW caterpillars away but this will not fully control the infestation.
- Rouging, uprooting or burning FAW affected plants is not an effective way of controlling this pest due to the rapid spread characteristics.
Chemical pesticides will not provide a “silver bullet” to controlling FAW. This pest is best managed by deploying varied integrated pest management options.

G. General messages

Crop pests and diseases when not properly managed will cause huge crop losses. Farmers are advised to save and set aside some funds for use in undertaking FAW control operations to minimise crop damage from this pest. If you practice early monitoring and apply appropriate control measures, the damage due to FAW can be minimized. Seek professional advice and do not panic.

Notes on responsible use of Pesticides

<table>
<thead>
<tr>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals are poisonous, If you accidentally consume any, call toll free line 0800720021 for help</td>
</tr>
<tr>
<td>Put on protective clothing (cap, goggles, mask, gloves, overall and boots) at all steps when handling, mixing and applying pesticides</td>
</tr>
<tr>
<td>Use clean, well calibrated pumps (in good condition) and clean water for mixing the pesticides</td>
</tr>
<tr>
<td>Strictly use knapsacks and not basins/buckets for mixing &amp; application of pesticides</td>
</tr>
<tr>
<td>Use the correct quantity/dose during mixing (always follow the instructions on the label)</td>
</tr>
<tr>
<td>Open pesticide containers with extreme care to avoid spillage</td>
</tr>
<tr>
<td>Always mix pesticides in an open place to avoid accumulation of pesticide fumes</td>
</tr>
<tr>
<td>Have plenty of clean water and soap at the application site for emergency cleaning in case of a spillage</td>
</tr>
<tr>
<td>Mix pesticides using a long stick or stirrer and not bare hands</td>
</tr>
<tr>
<td>Windy conditions and possibility of rain must be avoided before application</td>
</tr>
<tr>
<td>Never eat, smoke, drink, apply makeup or breast feed during application</td>
</tr>
<tr>
<td>Elderly persons, children and the sick should never apply pesticides</td>
</tr>
<tr>
<td>Don’t use your phone while spraying to avoid contamination</td>
</tr>
<tr>
<td>If you feel unwell during spraying - (nausea, headache, weak), you should stop the application immediately and seek medical advice.</td>
</tr>
<tr>
<td>Don’t apply pesticides close to, during or after harvesting. Always check the pre-harvest interval (PHI)</td>
</tr>
</tbody>
</table>
Do not apply pesticides with long Pre-harvest interval when maize plants are at cobs stage because poisonous residues will be left on the grains.

When taking off the protective gear, gloves should be removed last and after rinsing them.

If you have an open wound – do not spray unless you have protectively dressed the wound.

Dispose of leftover chemicals in the pump by spraying the land surrounding the crops.

Don’t leave empty pesticide containers in the field to avoid contamination of the environment.

Do not burn empty pesticide containers or throw them into pit latrines as they produce poisonous gas harmful to humans and environment.

The empty pesticide container should be rinsed three times, punctured, crushed and flattened or returned to the agro-input dealers for onward disposal/incineration.

Don’t reuse your empty pesticide containers to avoid re-use for a wrong purpose.

Do not rinse empty pesticide containers near a water source or throw them into water bodies to avoid contaminating the water source.

Do not throw empty pesticide containers in the pit latrine since they produce fumes that are harmful to users.

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References


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Partners

[Image: CABI logo]  [Image: Plantwise logo]  [Image: Precision Agriculture for Development logo]