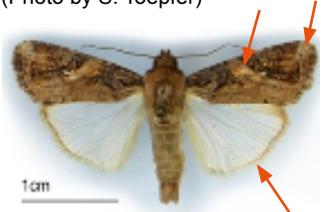


# Fall armyworm on maize

*Spodoptera frugiperda* (Fall armyworm in English)

	Prevention	Monitoring	Direct Control
 <p>^ sign on front of head. Fine hairs on body. (Photo by S. Toepfer)</p>  <p>4 squared dots at end of body. Caterpillars ¼ to 4 cm long. (Photo by S. Toepfer)</p>  <p>Adult armyworm moth, mottled greyish-brown forewings, whitish hindwings with dark edge. Male forewing with white areas near tips and in middle. (Photo by G. Georgen, IITA)</p>	<p>Fall armyworm is a migratory moth with caterpillars that damage maize, rice, pastures and other grassy plants. Therefore, it is difficult to prevent fall armyworm.</p> <p>Plant at the same time as neighbouring farmers to prevent fall armyworm concentrating in your field. Thus, avoid staggered planting, and off-season planting.</p> <p>Avoid planting maize near infested fields.</p> <p>Plant maize varieties with hard husk to prevent caterpillar penetrating.</p> <p>Intercrop maize with plants not attacked by fall armyworm such as cassava, yam, Desmodium, or others.</p> <p>Removing weeds is of little help, as armyworms prefer maize.</p> <p>Crop rotation does not help, as the pest is mobile.</p> <p>Keep or plant flowering plants on the field edges for beneficial insects such as predatory bugs, predatory lady-beetles, or parasitic wasps or flies, against armyworm.</p> <p>Mulch improves soil and soil moisture retention, but also enhances predatory insects, such as ants. They attack armyworms when they move over the ground from plant to plant.</p> <p>In larger maize areas, take control actions jointly to avoid armyworm re-infesting fields.</p>	<p>Monitor maize from very young plant stage up to early cob stage.</p> <p>Set up pheromone traps to monitor moths (1 trap / 2-3 acres or 1 ha or 10 to 20 mu). Look for 2 to 3 cm moths with mottled greyish-brown forewings, whitish hindwings with dark edge. Consider action at or just before peak of moth occurrence when most eggs are laid, and caterpillars hatch.</p> <p>Visit and monitor field weekly. Check at least 3 sets of 10 plants.</p> <p><i>Early symptoms:</i> Search for shot holes and window panes on leaves. If found, search for caterpillars in whorl.</p> <p><i>Late symptoms:</i> Search for chewed leaves with big ragged elongated holes. Search for damage and saw-dust-like frass in whorls. Caterpillars are in the whorls and furrows. They also bore into young cobs from the side, but rarely into mature cobs.</p> <p><i>Young caterpillars:</i> ¼ to 1 cm, grey or green with fine hairs. Usually several on a plant.</p> <p><i>Older caterpillars:</i> 1 to 4 cm pale-grey to grey-brownish with whitish and dark stripes along the back and sides. Dark head with a pale ^ on the front. Body end has 4 dark spots on back in a square.</p> <p>Note, the Black (African) armyworm often has a similar ^ sign on the head like fall armyworm, but has no clear 4 small dots (in a square) on back near the end, and no hairs, and is often blackish.</p> <p><i>Thresholds:</i> Consider green direct control when 5 to 20 % of plants show early feeding symptoms, and if caterpillars are found. Act immediately at heavy damage symptoms and many caterpillars. Consider yellow direct control when 15 to 30 % of plants show early damage, and if young caterpillars are found. Act immediately at heavy damage symptoms and many caterpillars.</p> <p>Repeat monitoring weekly as treated plants are often quickly re-infested.</p> <p>Action may be too late, when whorls are so much damaged that maize cannot re-grow, when most maize cobs are already attacked, or when maize is maturing.</p>	<p>Smash small caterpillars in leaf sheaths and whorls.</p> <p>Hand pick larger caterpillars from whorls; avoid destroying the whorl.</p> <p>Spray virus-based biopesticide (<i>Spodoptera frugiperda</i> NPV, <i>Spodoptera littoralis</i> NPV) over maize plants at peak moth flight (eggs are laid) or when young caterpillars are found.</p> <p>Spray beneficial nematodes (<i>Steinernema abassi</i> or carpocapsae or others) as oil or gel or water formulations into whorls.</p> <p>Check whether parasitoid or predatory insects are available as biocontrol agents for release against fall armyworm.</p> <p>Mix a half-hand full ground chili (100g) with a bucket of ash (2kg), and put a spoonful into leaf whorls when plants are at knee-high.</p> <p>Adding sand, soil or ash into whorls repels some caterpillars, but has limited effect on fall armyworm.</p>



Damage to young maize leaf  
(Photo by S. Toepfer)



Window pane damage to the  
maize plant. (Photo by S. Toepfer)



Damage to the leaf whorl of the  
maize plant. (Photo by S. Toepfer)



Maize cob damage by  
fall armyworm (Photo by  
L. Durocher-Granger)

Direct Control	Restrictions
<p>Flat sprays over a maize field are little effective as caterpillars hide in whorls and furles. Spray against the caterpillars into the maize whorls and furles. Sprays may need to be repeated every 2 weeks if plants are re-infested by caterpillars. It helps if all farmers in a maize growing area take control action to reduce re-infestation levels.</p> <p>Select from below what is registered in your country against fall armyworm in maize. Use a different insecticide each season to avoid the caterpillars becoming resistant. Prefer biopesticides and pesticides of WHO toxicity class U (unlikely acute hazardous) over the more hazardous class III and class II. Do not spray on maize if intercrops are flowering to avoid killing pollinators, and not when intercrops or maize are to be harvested to avoid poisoning consumers. Do not use WHO class I products and highly hazardous products (HHPs)</p>	
Neem (Azadirachtin) products. Multi-site action pesticide. Contact, systemic, trans-laminar, anti-feedant pesticide.	Not classified by WHO, but considered unlikely acute hazardous in normal use. Restricted re-entry interval (r.e.i.) ½ day after spray. Pre-harvest interval (p.h.i.) 1 day. Max 2 sprays / season.
Maltodextrin products.	Not classified by WHO, but considered unlikely acute hazardous in normal use. r.e.i. ½ day; p.h.i. 1 days. Max 2 sprays / season.
Chlorantraniliprole. Anthranilic diamide group. Ingestions pesticide.	WHO toxicity class U (unlikely acute hazardous in normal use). r.e.i. ½ d, p.h.i. 3 d. Max 2 sprays / season.
Spinetoram or Spinosad. Spinosyn group. Bacteria-derived contact+ingestion pesticide.	WHO class III (Slightly acute hazardous). r.e.i. ½ d, p.h.i. 3 d. Max 2 sprays / season. Negative effects on aquatic organisms and pollinators.
Emamectin benzoate products. Avermectin group. Bacteria-derived.	Not classified by WHO, but considered slightly acute hazardous. r.e.i. 1 d, p.h.i. 7 d. Max 2 sprays / season.
Bacillus thuringiensis kurstaki or aizwai –biopesticide. Ingestions pesticide. Multi-site action.	WHO class III (Slightly acute hazardous). r.e.i. ½ d; p.h.i. 2 d. Max 2 sprays / season. Little effects on the environment and on natural enemies. Will not work well in sunshine. Spray in late afternoon. Other BT strains are not against caterpillars.
Lufenuron -products.. Benzoylurea group. Insect growth regulator.	WHO class III (Slightly acute hazardous). r.e.i. ½ d; p.h.i. 3 d. Max 2 sprays / season. Harmful to some water organisms.
Methoxyfenozide. Diacylhydrazine group. Insect growth regulator.	Not classified by WHO, but considered slightly hazardous in normal use. r.e.i. 1 d, p.h.i. 7 d. Max 2 sprays / season. Harmful to soil organisms.
Natural pyrethrin -products. Pyrethroid group. Contact pesticide.	WHO class II (moderately acute hazardous). r.e.i. 1 d; p.h.i. 3 d. Max 1 spray / season. Toxic to pollinators, many beneficial insects, and to aquatic organisms.
Alpha-cypermethrin -products. Pyrethroid group. Contact pesticide.	WHO class II (moderately acute hazardous). r.e.i. 1 d; p.h.i. 3 d. Max 1 spray / season. Toxic to pollinators, many beneficials, and aquatics. Zeta-cypermethrin is highly acute toxic to humans.
Lambda cyhalothrin–products. Pyrethroid group. Contact pesticide.	WHO class II (moderately acute hazardous). r.e.i. 1 d, p.h.i. 14 d. Max 1 spray / season. Toxic to many beneficial insects and to aquatic organism.
Deltamethrin -products. Pyrethroid group. Contact pesticide.	WHO class II (moderately acute hazardous). r.e.i. 1 d, p.h.i. :3 d; Max 1 spray / season. Toxic to pollinators and many beneficial insects, and aquatic organisms.
Buprofezin –products. Pyrethroid group. Contact + ingestion pesticide.	WHO class II (moderately acute hazardous); r.e.i. 1 d, p.h.i. :3 d; Max 1 spray / season. Harmful to some beneficials.
Indoxacarb – products. Oxadiazine group. Contact + ingestion pesticide.	WHO class II (moderately acute hazardous); r.e.i. 1 d, p.h.i. :21 d; Max 1 spray / season. Toxic to birds, and some beneficials.
Acetamiprid – products. Systemic, translaminar, contact neonicotinoid.	WHO class II (moderately acute hazardous); r.e.i. 2 d; p.hi. 28 d; Max 1 spray / season. Toxic to soil and aquatic organisms.
Chlorpyrifos-product. Organophosphate group.	WHO class II (moderately acute hazardous); r.e.i. 1 d; p.hi. 28 d; Max 1 spray / season. Toxic to pollinators, many beneficial insects, and aquatic organisms.
<p>When using a pesticide or botanical, always wear protective clothing and follow the instructions on the product label, such as dosage, pre-harvest interval, max number of sprays, restricted re-entry interval. Do not empty into drains and water sources. Always consult recent list of registered pesticides in your country.</p>	