



Fall Armyworm: An Invasive Pest of Maize and Its Integrated Management Strategies

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Abstract:

Since its arrival in India in May 2018, the fall armyworm (*Spodoptera frugiperda*) has emerged as the most devastating pest of maize. Its rapid spread across diverse maize-growing regions poses a severe threat to smallholder farmers, industries, and food security. Additionally, other crops like sorghum and millets have also experienced fall armyworm infestations with varying levels of economic impact. This article discusses the significance of the fall armyworm, its life cycle, and the extent of crop damage. Effective management is crucial due to the substantial economic losses it causes, making an integrated management approach the most sustainable and effective method for controlling this pest.

Introduction:

Maize is considered as a queen of cereals and occupies third most important crop after rice and wheat. It is the crucial crop for food production, livestock feed, and fodder. It also serves as a key raw material for various industries, contributing to the production of alcoholic beverages, cosmetics, starch, protein, sweeteners, and biofuel. With 83% of its yield being utilized by the starch and feed industries, maize has gained recognition as a major industrial crop. However, Indian maize farmers face a serious threat from the invasive fall armyworm (FAW). Native to subtropical and tropical regions of North America, FAW predominantly damages maize crops during autumn (FAO, 2022). The pest was first detected in Nigeria and across Central and Western Africa in early 2016 and in India it was first time detected in 2018 at a place called shivamogga, Karnataka with the yield loss of nearly 35% (ICAR-NBAIR, Bangalore). It is causing devastating losses to the maize farmers because of its voracious feeding habits.

Taxonomic Position

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Scientific name: *Spodoptera frugiperda*
(J.E.Smith)

Order: Lepidoptera

Family: Noctuidae

Biology

Egg: Female moth lays nearly 1000 eggs in clusters on maize plants and the egg will be covered with tuft of hairs. Incubation period: 4-6 days

Larvae: FAW larvae passes through six larval instars. The larval duration is 15-16 days. The characteristic identification marks include

- ❖ Inverted ‘Y’ shaped marking on the head region
- ❖ Four large dark spots in square shape on the penultimate segment of abdomen
- ❖ Remaining abdominal segments contains four black spots which were arranged in Trapezoidal manner

Pupa: The pupa is oblong type and reddish brown in colour. The pupation takes place in the soil and pupal period lasts for about one week.

Adult: The male moth is greyish-brown in color with distinctive white triangular spots on its forewings, while the female moth is grey with mottled white spots on the forewings. These adult moths are nocturnal with longevity of about one week.

Nature and symptoms of damage:

The early instar larvae feed on one side of the leaf, while the 2nd and 3rd instar larvae chew through the leaf tissue, creating shot holes and papery windows. Older instars feed collectively within the whorls of the plant, which become filled with excreta. At the cob stage, they feed on the kernels, making it unfit for the consumption.



Fall army worm infestation in the Maize crop

Integrated Management Strategies

Monitoring

- ❖ Moth activity in the field can be monitored by the installation of Pheromone traps @ 5 per acre.

Scouting

- ❖ **FAMEWS---**(Fall Armyworm Early Warning System) software application for regular monitoring of fall armyworm, and data can be obtained from neighbouring areas if other

farmers or extension workers are using it. The App also has an image recognition feature that can help to identify fall armyworm if in doubt. FAMEWS mobile app can be used to determine percentage of infestation and mean plot infestation.

- ❖ **At seedling to early whorl stage (3-4 weeks after emergence)** --Action can be taken if 5% plants are damaged.
- ❖ **At Mid whorl to late whorl stage (5-7 weeks after emergence)** -- Action can be taken if 10% whorls are freshly damaged in mid whorl stage and 20% whorl damage in late whorl stage.
- ❖ **At tasseling and post tasseling (silking stage)** --At this stage, insecticides should not be sprayed. But if the 10% ear damage is noticed, any microbial insecticides like Bt can be sprayed.

Cultural measures

- ❖ Deep Summer ploughing should be done which will expose pupae of FAW to predatory birds and heat.
- ❖ Timely sowing is advised. Staggered sowings should be avoided
- ❖ Maize should be intercropped with suitable pulse crops of particular region. (eg. Maize + pigeon pea/ green gram / black gram).

- ❖ Erection of bird perches @ 10 /acre during early stage of the crop (up to 30 days)
- ❖ Sowing of 3-4 rows of trap crops (eg. Napier) around maize field and spray with 5% NSKE or azadirachtin 1500 ppm as soon as the trap crop shows symptom of FAW damage.
- ❖ Digging of trenches around the field and filling them with insecticides kill the larvae moving from one field to another.
- ❖ Some weed sps. acts as alternate hosts, therefore clean cultivation should be followed.
- ❖ Optimum dose of fertilizers should be used.
- ❖ Cultivation of maize hybrids with tight husk cover will reduce ear damage by FAW.

Mechanical measures

- ❖ Manually collecting and destroying egg masses and newly hatched larvae by either crushing them or submerging them in kerosene water.
- ❖ Apply dry sand into the whorls of affected maize plants immediately after noticing fall armyworm presence in the field.
- ❖ Sand + lime in a 9:1 ratio should be applied to the whorls at 30DAS.

Biological measures:

- ❖ Enhance plant diversity by intercropping with pulses and ornamental flowering plants, which support the build-up of natural enemies.
- ❖ Augmentative release of *Trichogramma pretiosum* or *Telenomus remus* at a rate of 50,000 per acre, either weekly or according to trap catches of three moths per trap.
- ❖ 5% damage in seedling to early whorl stage and 10% ear damage is noticed, then Entomopathogenic fungi *Metarhizium anisopliae* talc formulation (1x10⁸ cfu/g) @ 5g/litre and Bacteria like Bt. @ 2g/litre (or) 400g/acre can be used.
- ❖ Immediately, at one week after planting, apply neem oil @ 5 ml per liter or Azadirachtin 1% (EC) at 10,000 ppm should be applied to inhibit oviposition.
- ❖ **Second window --mid whorl to late whorl stage:**
To manage 2nd and 3rd instars larvae at 10-20% damage, Spinetoram 11.7% SC @ 0.5 ml/litre of water or Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% @ 0.25 ml/l of water or Chlorantraniliprole 18.5% SC @ 0.4 ml/litre of water should be sprayed.
- ❖ **Poison baiting**
For late instar larvae during the second window, poison baiting is recommended. A mixture of 10 kg rice bran, 2 kg jaggery, and 2-3 liters of water should be prepared and let it ferment for 24 hours. Add 100 g of thiodicarb just half an hour before applying the bait in the field. Place the bait into the whorls of the plants.
- ❖ **Third Window --8 weeks after emergence to tasselling and post tasselling:**
At this stage, insecticide management is not cost-effective. It is recommended to hand-pick the larvae instead.

Chemical measures:

- ❖ Seed treatment with Cyantraniliprole 19.8% + Thiamethoxam 19.8% FS at 6 ml/kg of seed should be followed.
- ❖ **First Window --Seedling to early whorl stage:**
To manage FAW larvae at 5% and to decrease the hatchability of newly laid eggs, NSKE 5% or Azadirachtin 1,500 ppm, @ 5 ml per liter of water should be sprayed.

References:

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