



Integrated Pest Management for Maize Fall Army Worm, *Spodoptera frugiperda* (Noctuidae: Lepidoptera)

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Abstract

Maize (*Zea mays*) is a tropical cereal crop widely cultivated all over the world. Its production was adversely affected by an invasive pest, fall army worm, *Spodoptera frugiperda*. The young larva disrupts the photosynthetic system while the older larva affects the leaves and cob, thereby reducing the harvest quality and yield of the crop. This pest demands a meticulous and stepwise plan for its management by adopting IPM methods, viz., cultural, physical, mechanical, biological, and chemical methods.

Keywords: Fall Army Worm, Integrated Pest Management, Maize, *Spodoptera frugiperda*

Introduction

The fall armyworm is a major maize pest. It is native to the United States of America. It was first reported in India in May 2018. It is polyphagous in nature. The discovery is more worrisome because the pest feeds on around 80 different crop species, including rice, wheat, barley, oats, millet, sorghum, cotton, soybeans, and sugar beet. There are two strains of fall armyworm, namely the R strain, which attacks rice and Bermuda grass, and the C strain, which attacks maize and sorghum (Kandel and Poudel, 2020). The yield losses can be minimised by following proper management practices. The bionomics, damage symptoms, and management measures of the pest are described below.

Bionomics

The life cycle is completed in about 30 days during the summer, 60 days in the spring and autumn, and 80-90 days during the winter. Females lay white dome-shaped eggs (Figure 1) in clusters of 50-150 on the underside of the leaves. The egg period is 4-5 days. There are six instars in the fall armyworm. Larvae are greenish in colour during the first instar and orange during the second instar. Later, the larvae will be dull-colored with creamy yellow dorsal and lateral

lines in the body (Figure 2). It has a reddish-brown head with a predominant white inverted Y-shaped suture between the eyes. Four large black spots are arranged in a square shape on the 8th segment (Khatri *et al.*, 2020). Pupation occurs in the soil, and the pupa is reddish brown in colour (Figure 3). The pupal period varies with the season, lasting 8-9 days in the summer and 20-30 days in the winter. The forewing of an adult male moth consists of a fawn-coloured spot and a white patch at the apical margin of the wing (Figure 4), while female moths are less distinctly marked, ranging from uniform greyish brown to a fine mottling of grey and brown (Figure 5). The total life cycle is completed in about 30-35 days (Kumar *et al.*, 2020).



Figure 1: Eggmass



Figure 2: Larva

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Figure 3: Pupa



Figure 4: Male



Figure 5: Female

Damage Symptoms

Fall armyworm attacks all stages of maize crop from seedling emergence to ear development. Young larvae feed by scraping and skeletonising the upper epidermis leaving a silvery transparent membrane resulting into papery structure (Figure 6). The second or third instar larvae begin to make holes in leaves and eat from the edge of the leaves inward. Feeding in the whorl of corn often produces a characteristic parallel shot holes (Chimweta *et al.*, 2020). Older larvae cause extensive defoliation and also feed on cob or ear (Figure 7). Presence of chewed up frass material and fecal pellets in the leaf whorl (Figure 8) is the characteristic symptom.

Integrated Pest Management (IPM)

Cultural Method

- Deep summer ploughing kills the life stage of FAW.
- Early planting of maize reduces the pest incidence.
- Adopt ridge and furrow planting.
- Plant 3-4 rows of napier grass as a trap crop around maize field.



Figure 6: Scraping of upper epidermis



Figure 7: Ear damage



Figure 8: Fecal pellets in the whorl

- Intercrop maize with pigeon pea, cowpea, black gram in the ratio of 2:1 ratio (Hailu *et al.*, 2018).
- Application of sand with lime in the ratio of 9:1 into the whorl of the plant.

Mechanical Method

- Destruction of egg masses and larvae by crushing.
- Install pheromone traps at 4 acre⁻¹ to trap male adult moths.
- Install bird perches at 10 acre⁻¹ to encourage predation of larvae by birds.

Botanical Pesticides

- Spray azadirachtin 1% @ 2 ml litre⁻¹ of water at 7 days after sowing.
- Spray Neem seed kernel extract @ 5%.

Biological Control

- Release of egg parasitoids viz., *Telenomus remus* @ 4,000 acre⁻¹ or *Trichogramma pretiosum* @ 16,000 acre⁻¹.
- Release of predators like *Coleomegilla maculate*, *Doru luteipes* prey on FAW.
- At 5-10% infestation, whorl application of *Metarhizium anisopliae* or *Beauveria bassiana* with spore count of 5 g litre⁻¹.

Chemical Control

- When infestation is more than the Economic Threshold

level, apply any one of the recommended insecticides viz., Chlorantraniliprole 18.5 SC @ 0.4 ml litre⁻¹; Spinosad 12 SP @ 0.5 ml litre⁻¹; Emamectin benzoate 5% SG @ 0.4 g litre⁻¹; Thiodicarb 75 WP @ 2 g litre⁻¹.

Conclusion

The above mentioned IPM measures can be productively imposed wherever applicable for the management of fall armyworm in maize. The farmers should be made aware about this damaging pest and different management practices like cultural, mechanical, biological and chemical methods. Of these cultural and biological practices are more encouraged. Regular monitoring and scouting should be done for mass trapping and control of the pest effectively.

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