

Effective Management Strategies Against Fall Armyworm (FAW), *Spodoptera frugiperda* on Maize

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Maize (*Zea mays* L.) Is the most important crop among cereals which belongs to family poaceae. Maize, known as 'queen of cereals' and India's third most significant crop, occupying 9.28 million hectares of land, resulting in a production of 26.74 million tones with an average yield of 3.1 tons per hectare. Fall armyworm, *Spodoptera frugiperda* is an important and destructive pest causing heavy damage to maize crops. It is an invasive pest which has been first reported During the middle of 2018 in maize fields in Karnataka. The ICAR-National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru has reported the damage intensity of FAW as 9 to 62% with the yield loss of 34% in India.

Integrated Pest Management Strategies

A meticulous and step wise plan is needed to prevent outbreaks, further spread of fall armyworm.

A. Preventive Methods

Monitoring: - Installation of the pheromone traps @ 5/acre in the current and potential area of spread in crop season and off-season.

Scouting: - Start scouting in 'W' manner as soon as maize seedlings are emerge.

- ✚ At seedling to early whorl stage of the maize (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 the mid whorl stage and 20% whorl damage in late whorl stage.
- ✚ At tasselling and post tasselling (Silking stage)- Do not spray insecticides (No insecticide application). But 10% ear damage needs action.

Cultural Measures

- ✚ Deep ploughing is recommended before sowing. This will expose FAW pupae's to the predators.
- ✚ Timely sowing is advised. Avoid staggered sowings.
- ✚ Intercropping of maize crop with suitable pulse crops of particular region. (e.g. Maize + pigeon pea/black gram / green gram).

- ✚ Erection of bird perches @ 10 numbers/acre during the early stages of the crop (up to 30 days).
- ✚ Sowing trap crops of 3-4 rows (e.g. Napier) around maize field and spray with 5% NSKE or azadirachtin 1500 ppm as soon as the trap crop shows symptom of FAW damage.
- ✚ Clean cultivation and balanced use of fertilizers in reduced manner.
- ✚ Cultivation of maize hybrids with tight husk cover that will reduce ear damage by FAW.

Mechanical control

- ✚ Collection and destruction of egg masses and neonate larvae in mass by crushing or immersing in kerosine water.
- ✚ Application of dry sand material in to the whorl of affected maize plants soon after observation of FAW incidence in the field.
- ✚ Mass trapping of male moths by using pheromone traps @15 numbers/acre.

Traps

- ✚ Spread blue cloth measuring 2 m in places randomly in an acre area to attract and kill the larvae.
- ✚ Install Fall army worm pheromone trap @ 5 numbers/acre and light trap @ 1 number/ha at early stage of crop

B. Curative Methods

Biological control

- ✚ In-situ protection of natural enemies by habitat management: Increase in the plant diversity by intercropping with pulses and ornamental flowering plants which help in build-up of natural enemies' population.
- ✚ Various plant species have shown insecticidal properties against FAW; for example, extracts of neem, *Azadirachta indica* (Family: Meliaceae), *Argemone ochroleuca* Sweet (Family: Papaveraceae).
- ✚ Augmentative release of *Trichogramma pretiosum* @ 50,000 per acre at weekly intervals or based on trap catch of 3 moths/trap.

- ✚ Biopesticides: Suitable at 5% damage in seedling to early whorl stage and 10% ear damage with entomopathogenic fungi and bacteria.
- ✚ Entomopathogenic fungal formulations: Application of *Metarhizium anisopliae* in talc formulation (1x10⁸ CFU/g) @ 5g/litre whorl application at 15-25 days after sowing. Another 1-2 sprays may also be given at an interval of 10 days depending on pest damage status.
- ✚ Application of *Bacillus thuringiensis* (Bt) var *kurstaki* formulations @ 2g/litre.

Chemical Control

- ✚ Seed treatment with Cyantraniliprole 19.8% + Thiomethoxam 19.8% @ 4 ml per kg seed was reported to offer protection up to 2-3 weeks after germination. (Note that this formulation is not registered in India and also has not been evaluated in AICRP PROGRAMME. However, based on the feedback from the seed growers this insecticide is giving protection for 2-3 weeks after germination to maize seeds)
- ✚ First Window (seedling to early whorl stage): To control FAW larvae at 5% damage to reduce hatchability of freshly laid eggs, spray 5% NSKE OR Azadirachtin 1500 ppm @ 5ml/ litre of water.
- ✚ Second window (mid whorl to late whorl stage): To manage 2nd and 3rd instars larvae at 10-20% damage spray Spinetoram 11.7% SC as per the recommendation of CIB, India OR Thiamethoxam 12.6% + lambda cyhalothrin 9.5% @ 0.5 ml/l of water OR Chlorantraniliprole 18.5% SC @ 0.3 ml/litre of water.

- ✚ Poison baiting: Poison baiting is recommended for late instar larvae of second window. Keep the mixture of 10 kg rice bran + 2 kg jaggery with 2-3 litres of water for 24 hours for to ferment. Then add 100g thiodicarb just before half an hour of application in field. The bait should be applied into the whorl of the maize crop.
- ✚ Third Window (8 weeks after emergence to tasselling and post tasselling): Insecticide management is not cost effective at this stage. Hand picking of the larvae is advisable for effective control.

Important Considerations

- 1) All the sprays should be directed towards whorl and either in the early hours of the day or in the evening time.
- 2) Capacity building and mass awareness.
- 3) Application and timely plant protection measures to avoid spread of the insect from the abandoned crop.
- 4) Creation of awareness among important stake holders through trainings / group discussions.
- 5) Community based and area-wide approach for implementing management strategies.

References

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