Non -chemical management practices

Pre-planting practices

- Deep plough the fields to expose pupae to sun light and predatory birds.
- Apply neem cake @ 200kg/acre to the fields when maize is grown with zero tillage or wherever possible
- Cultivate flowering plants (marigold, sesame, sunflower, etc.) along the border to attract natural enemies

From sowing to six leaf stage

- Timely and uniform sowing: use ridge and furrow method
- Apply recommended NPK dosage
- Plant 3-4 rows of trap crop (napier grass/ Intercrop maize with legumes (2:1 to 4:1 ratio)
- Install pheromone traps @ 4/acre soon after sowing for monitoring
- Destruction of egg masses and larvae by crushing
- Application of sand or soil mixed with lime in 9:1 ratio into whorl of maize plants
- Use NSKE (5%) or azadiractin, 1500 ppm @5ml /litre: release egg parasitoids viz.,*Telenomus remus* or *Trichogramma pretiosum*
- Apply biopesticides like *Bacillus thuringiensis* or *Metarhizium anisopliae or Beauveria bassiana* @ 5 g/lit. or SfNPV

From seven leaf stage to flowering

- Monitoring of FAW using pheromone traps @ 4/acre should be continued
- Spray 5% NSKE or azadiractin, 1500 ppm (one litre/acre) @5 ml /l after observation of one moth/trap/day or 5% of fresh FAW infestation
- If infestation is more than 10%, whorl application of *Bacillus thuringiensis* formulations @ 2g/litre (400g/acre) or *Metarhizium anisopliae* or *Beauveria bassiana* (1×108 cfu/g) @ 5g/litre (1 kg/acre) or SfNPV (1.5X1012 POBs/ha) @4ml/litre (800 ml/acre) or entomopathogenic nematode (*Heterorhabditis indica*) @20g/litre of water (4kg/acre) is recommended.
- Poison baiting is effective for late instar larvae and is optional. Mix 10 kg rice bran + 2 kg jaggery with 3 litres of water. Keep the mixture for 24 hours to ferment. Add anyone of the recommended insecticides mentioned above at their recommended dosages and 1 kg of sand just half an hour before application. Make into small pellets and apply into whorls of infested plants only. [Use hand gloves during mixing and application].

From flowering to harvest

- Hand picking and destruction of larvae boring into ears
- At 10% ear damage, whorl application of *Bacillus thuringiensis* formulations @ 2g/litre (400g/acre) or *Metarhizium anisopliae or Beauveria bassiana* (1×108 cfu/g) @ 5g/litre (1 kg/acre) or SfNPV (1.5X1012 POBs/ha) @4ml/litre (800 ml/acre) or entomopathogenic nematode (*Heterorhabditis indica*) @20g/litre of water (4kg/acre) is recommended.
- **Pheromone traps–** Funnel trap with FAW lure should be installed at a height adjusted each week matching with crop canopy. Traps should be separated by a minimum distance of 75 feet. Observe traps for number of moths caught twice or once in a week and work out the catch/day. FAW lures should be changed once in 30 days.
- **Preparation of Neem Seed Kernel Extract (NSKE) for one acre–** 10 kg of neem seed kernel is required for one acre. Grind 10 kg of need seed kernels to make powder. Soak the powder in 50 litres of water overnight. Stir and filter the contents using cotton cloth. Add 200 g detergent powder or 200 ml of soap solution to the filtered solution. Make up the volume to 200 litres by adding water.
- **Caution upon release of egg parasitoids -** Minimum one week interval should be there between parasitoid release and application of neem.

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Fall Armyworm and their Organic Management Practices

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Introduction

The fall armyworm (FAW), *Spodoptera frugiperda* (Noctuidae: Lepidoptera), was first reported on maize in the year 2018 in Shivamogga district of Karnataka, India. This pest is native to tropical and subtropical regions of the Americas and feeds on a diverse range of crops (> 80 crops) such as corn, paddy, jowar, millet, sugarcane, vegetable crops and cotton. Maize is a preferred host for fall armyworm, with damage percentages varying from 6 to 100 in Africa and India. Recently severe FAW incidence on maize crops has also been reported recently in North East India's Nagaland, Tripura, Manipur, Sikkim, Meghalaya, Arunachal Pradesh, and Mizoram.

Identification characteristics of fall armyworm

Adult female lay 100-200 eggs on the lower leaves. They change from green to light brown before hatching

Eggs are covered in protective scales rubbed off the moths abdomen

After hatching, the young caterpillars begin feeding on the leaves

As they grow, caterpillars changes from light green

Larvae have four dark spots forming a square on the second to last body segments

Larvae have a dark head with a pale, up-side down Y shape on the front

Larvae are most damaging when they are 3-4 cm long

The pupa is shiny brown and usually found 2-8 cm into the soil

Nature of damage and symptoms of fall armyworm

Adult moth (top-female, bottom-male). The females are slightly bigger than male

Feeding by young caterpillars results in semi-transparent patches on the leaves called windows

Young caterpillars can spin silken threads which catch the wind and transport the caterpillars to a new plant

Feeding through the whorl can cause a line of identical shot holes, when the leaf unfurls

As they develop, larvae move permanently into the leaf whorls. This means it is difficult to detect early infestation

Feeding can cause the whorl and upper leaves to be a mass of holes, ragged edges and caterpillar frass

The caterpillars usually burrow into the sides of the cob

Stunting and destruction of developing tassels and kernels which reduces grain quality and yield

Source: Image No. 1-16 (CABI, 2019)