Food and Agriculture Organization of the United Nations

Agriculture Department

CABI

Integrated Pest Management (IPM) of

Fall Armyworm

Spodoptera frugiperda (J.E. Smith)

on Maize

Punjab-Pakistan

Pest Identification & Damage Symptoms

Fig 1: Damage to maize leaf (shot holes and window panes on leaves)

Fig 2: Creamy/grey egg masses covered in silk

Fig 3: Newly hatched larvae

Fig 4: Dark head with a pale inverted Y on the front. Four dark spots forming a square on the second-to-last body segment. Caterpillars ¼ to 4 cm long.

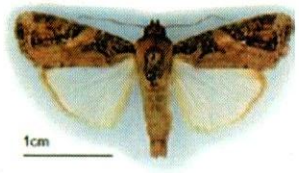


Fig 5: Adult Fall Armyworm moths have mottled greyish-brown forewings, whitish hind wings with dark edge. Male forewing with white areas near tips and in middle.

Surveillance & Monitoring

Install pheromone traps or light traps (1 trap for 3 acres) and check the traps twice a week. Look for 2 to 3 cm moths with mottled greyish-brown forewings and whitish hind wings with dark edge (Fig.5).

Start scouting of the pest and symptoms just after five days of germination and continue monitoring till tasseling on weekly basis

Visit and monitor field weekly, check at least 3 sets of 10 plants for one acre

Look for creamy/grey egg masses covered in silk (Fig 2) located on the underside or top of the leaves and on the stems

As a part of FAW monitoring and early warning system, use FAO's FAMEWS mobile app (bit.ly/2BZEW8q) to determine the pest attack

Early Symptoms

Look for creamy/grey egg masses covered in silk located on the underside or top of the leaves and on the stems

Search for shot holes and window panes on leaves. If found, search for caterpillars in whorl (Fig 1)

Late Symptoms

Examine chewed leaves with big ragged elongated holes

Search for damage and saw-dust-like frass in whorls. Older caterpillars (1-4 cm long) are pale-grey to grey-brownish with whitish and dark stripes along the back and sides of the body. The caterpillar has dark head with a pale inverted Y on the front. Body end has 4 dark spots on back in a square at L4 stage. (Fig 4)

* Monitor other host crops (Especially Sorghum) in order to determine pest infestation status

Action Threshold Level

Integrated control actions should be considered on appearance of egg masses, larvae or damage by FAW including cultural practices like collection and destruction of egg masses, release of parasitoids and predators and use of bio pesticides

Prevention & Cultural Control

Preventive Measures

To prevent the pest attack, sow the maize crop according to the recommendations of agriculture department for your area

Use certified/good quality seed of recommended maize varieties to avoid the pest attack

Apply seed treatment (with recommended chemical) before sowing to escape pest attack at initial stages of the crop

Use recommended dose of fertilizer based on soil analysis report and crop need

New planting must be discouraged near already infested fields

Apply Neem Extract (not more than two times in one crop) to repel the moths and to avoid egg laying on the crop

Ensure the judicious use of pesticides

Cultural Practices

Remove and destroy previous crop residues from the field

Practice deep plough in soil to expose hiding pupae/ resting stage of pest for the birds and other natural control agents

Practice weeding regularly to minimize the alternative host and for better plant health

Destroy egg masses and caterpillars by crushing

Avoid to move the infested plants from the field to reduce its spread

Repelling and attracting plants (push-pull strategy) should be planted on the field edges for FAW management. Grow Desmodium (clover) for push and Napier (elephant grass) for pull to FAW and apply pesticides in the trap crop (Napier).

Ensure crop rotation and plant diversification at farm

Biological Control

Practice conservation, mass rearing and release techniques to increase the population of beneficial insects (predators and parasitoids) in the field

Conservation of Beneficial Insects

Avoid indiscriminate use of pesticides, which can harm the beneficial insects

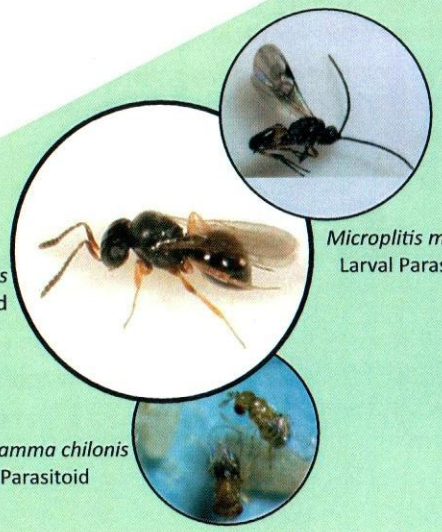
Plant refuge/insectary crops along the borders or surrounding of maize crop to attract and provide shelter to beneficial insects

Mass Rearing and Release of Natural Enemies

Release natural enemies or place the egg cards of beneficial insects in the field to increase their population

Adopt Natural Enemies Field Reservoirs (NEFR) approach for rearing and release of beneficial insects in field

Apply the registered bio-pesticides at recommended doses



Telenomus remus
An Egg Parasitoid

Microplitis manilae
Larval Parasitoid

Trichogramma chilonis
Egg Parasitoid

Restrictions and Chemical Control

Flat sprays over a maize field are little effective as caterpillars hide in whorls and furls. Hence, spray against the caterpillars into the maize whorl and furl. Repeated spray may be needed depending on pest infestation status.

Use insecticides with different mode of actions within a single season to avoid the caterpillars becoming resistant. Prefer bio-pesticides and pesticides of WHO toxicity class U (unlikely to present acute hazard) to the more hazardous class III (slightly hazardous) and class II (moderately hazardous). Apply chemical at clear weather during good sunshine when larvae are active, and rain is not expected to minimize the drift and wash off. Avoid sprays at silk and tassel stages of maize crop.

In Pakistan, the following pesticides have been registered and some are under label expansion process with Department of Plant Protection for use against Fall Armyworm on given doses.

Spinetoram 120 SC @ 100ml per acre	WHO class III (Slightly acute hazardous). r.e.i ½ d, p.h.i 3 d. Max 2 sprays / season.
Alpha-Cypermathrin + Teflubenzoran 150 SC @ 60ml per acre	WHO class II (Moderately acute hazardous) r.e.i 1 d, p.h.i 3 d. Max 1 spray / season.
Emamectin benzoate 19 EC @ 240ml per	Not classified by WHO but considered slightly acute hazardous. r.e.i 1 d, p.h.i 7 d. Max 2 sprays / season.
Chlorantraniliprole 20 SC @ 100 ml per	WHO toxicity class U (Unlikely acute hazardous in normal use). r.e.i ½ d, p.h.i 3 d. Max 2 sprays / season.
Flubendiamide 480 SC @ 40ml per acre	WHO toxicity class U (Unlikely acute hazardous in normal use). r.e.i ½ d, p.h.i 3 d. Max 2 sprays / season.
Lufenuron 50 EC @ 240 ml per acre	WHO toxicity class III (Slightly acute hazardous). r.e.i ½ d, p.h.i 3 d. Max 2 sprays / season.

Safe Handling and Use of Pesticides: All pesticides are potentially hazardous to humans, animals, other organisms, and the environment if used and handled inappropriately. People who handle and apply pesticides may potentially come in contact or exposed to them. Therefore, they must understand importance of safe handling and use of pesticides. Some of the precautionary measures to ensure safe handling and use of pesticides are as under:

a) Purchase only the required quantities of registered pesticides after carefully reading the information on the label

b) Always, carry the pesticides separately from foods and other materials

c) Use clean water to make the spray solution of required volume and it should not spill outside of sprayers

d) Always, wear the Personal Protective Equipment (PPE)/gears during handling and spraying of pesticides and follow the recommended rates/doses

e) Keep the pesticides away from home and out of the reach of children

f) Dispose off empty containers/obsolete pesticides carefully away from water resources

g) In case of any sign of pesticides' hazard/emergency consult the doctor.