Maize Fall Armyworm (*Spodoptera Frugiperda*) and It's Management

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The fall armyworm (FAW) (*Spodoptera frugiperda*) is one of the devastating insect pest belonging to the family Noctuidae and falls in the Lepidoptera order. It is a polyphagous pest causing damage to economically important cultivated cereal crops such as maize, rice, sorghum, cotton and various vegetable crops and eventually impacts on food security. The FAW feeds on leaves, stem and reproductive parts of plant species. It is native to tropical and subtropical regions of the America. FAW, which was first found in America, is one of the common pests of maize in South and North America. In Africa, it was first reported in 2016 and has become one of the major invasive pests reaching over 30 countries across tropical and southern Africa including Madagascar, Seychelles and Cabo Verde at the end of 2017, which later reached over 44 countries. There are 353 plants reported as a host for this pest (Kansiime *et al.*, 2019).

Nature of damage

Caterpillars feed on maize at nearly all stages of growth from when the plant is young and also on the cob. Caterpillar damage on the leaves can sometimes be significant and disrupt the plant's ability to form good grain and healthy cobs

- Leaf feeding causes extensive "window pane" damage on maize.
- Large irregular and elongated holes on the leaves are caused by the big caterpillars while feeding.
- Small caterpillars cause the clear or window-like patches while larger caterpillars cause irregular elongated holes on leaves.
- Bigger caterpillars make larger holes when feeding, causing ragged whorl leaves and producing sawdust-like material called "frass".
- Fresh feeding produces big lumps of frass.
- Badly infested fields will have damage on the leaves similar to that caused by a hailstorm.
- During the day, caterpillars hide deep in the whorls (funnel).
- They feed inside whorls and can destroy silks and developing tassels on older crops, thereby limiting fertilization of the ear and leading to poor grain development.
- Caterpillars move to the ear zone/funnel and start feeding after tassel emergence.
- Damage to cobs may lead to fungal infection, aflatoxin contamination and loss of grain quality.
- Cobs that were attacked in the field will have many of the seeds eaten up by the caterpillar.

Management

Cultural Control

1. Control is largely achieved in the northern range through a winter kill by exposing larvae and pupae within the upper soil surface.
2. Freezing temperatures cause high larval mortality. Therefore, clean cultivation and weeding are recommended.
3. Some locally adaptable methods have also been tried such as soil, charcoal, ash, detergents, paraffin and engine oil.
4. Various plant extracts are often included, such as chilli, neem, *Tephrosia*, *Tithonia*, *Lantana* and garlic.
5. Handpicking egg masses and caterpillars has been tried in Africa. The efficacy of these methods is not well documented.

Biological Control

A large number of parasitic Hymenoptera, acting as larval parasitoids, have been reared from *S. frugiperda*, Natural levels of larval parasitism are often very high (20-70%), mostly by braconid wasps. Some 10-15% of larvae are often killed by pathogens.

The compound N-(17-hydroxylinolenoyl)-L-glutamine called volicitin (A non-essential amino acid present abundantly throughout the body and is involved in many metabolic processes.) was isolated

from oral secretions of *Spodoptera exigua* larvae. When applied to damaged leaves of maize seedlings, volicitin induced the seedlings to emit volatile compounds that attracted females of the parasitoid *Cotesia marginiventris*. Mechanical damage of the leaves, without application of this compound, did not trigger release of the same blend of volatiles. Volicitin appears to regulate tritrophic interactions among plants, insect herbivores and natural enemies of *S. exigua.*

Biopesticides

1. Virus-based insecticides, which are mostly in the Baculovirus group, such as the multiple nucleopolyhedrovirus (SfMNPV) have potential for use in the management of fall armyworm**.**
2. The pest is infected by ingesting the baculovirus. The symptoms of Baculovirus infection include appearance of blemishes, yellowing of the skin, and decline in feeding.
3. *Metarhizium anisopliae* and *Beauveria bassiana* have also shown efficacy against eggs and second-instar larvae of fall armyworm (Komivi *et al*., 2019).
4. *EPN are also used for the control of FAW.-* ***Heterorhabditis.***

Botanicals

1. Azadirachtin (neem) is effective against fall armyworm.
2. Also, extracts from *Synedrella nodiflora* and *Lupinus stipulatus* have shown to have biological effects on mature insects of the genus *Spodoptera*.

Chemical Control

In some areas resistance to insecticides may be widespread and control can be difficult. Recommended insecticides for *Spodoptera* spp. include esfenvalerate,carbaryl, chlorpyrifos, malathion, permethrin, and lamba-cyhalothrin.. Togola *et al.* (2018) showed that five insecticide compounds used against fall armyworm (cypermethrin, deltamethrin, lambda-cyhalothrin, permethrin, and chorpyrifos) remained in the soil.

Pheromonal Control

1. The sex pheromone for *S. frugiperda* contains (Z)-9-Tetradecenyl acetate (Z-9-14:OAca) which is common to *Trichoplusia ni*, *Spodoptera exigua* and *Agrotis ipsilon exigua.*
2. Mating disruption my be possible given the successes observed for S. exigua in which (9Z,12E)- 9,12-tetradecadienyl acetate released at high concentrations, caused mating disruption in tomato, lucerne and cotton fields.

IPM Programmes

1. Integrated control of *S. frugiperda* has been facilitated through cultivation practices to destroy overwintering sites, improved varieties with resistance to leaf feeding through conventional mechanisms or the introduction of Bt crops.
2. Biological controls are prevalent and should be encouraged through reduced spaying of insecticides. CIMMYT (2018) have published a technical guide for IPM of *S. frugiperda* in Africa.

Conclusion

- Use of biopesticides, botanicals and alternating sprays of old and newer insecticides is advocated in the absence of the IPM strategies.
- However, Farmers will need great support through Integrated Pest Management (IPM) to sustainably manage the fall armyworm in their cropping systems.
- There is need to fully elucidate the mechanism of fall armyworm control by CAPP technology to allow its optimization and strategic dissemination as a management tool for this invasive pest.

References

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