Performance of frontline demonstrations on integrated management of fall armyworm in maize at Thoothukudi, Tamil Nadu

PK MUTHU KUMAR

ICAR – SCAD Krishi Vigyan Kendra, Vagaikulam, Mudivaithanendal
Thoothukudi 628102 Tamil Nadu, India
Email for correspondence: kana448@gmail.com

 Received: 11.10.2022/Accepted: 05.11.2022

ABSTRACT

Maize (*Zea mays*) is an important crop cultivated in Thoothukudi district of Tamil Nadu. ICAR - SCAD Krishi Vigyan Kendra, Thoothukudi, Tamil Nadu conducted frontline demonstrations on fall armyworm management in maize at north Karaseri village of Karunkulam block, Tamil Nadu during rabi season of 2019-20. The integrated management of fall armyworm in maize strategies included summer ploughing, border crop with sorghum (2-4 rows), seed treatment with cyatranilprole 19.8 per cent + thiamethoxam 19.8 per cent (Fortenza Duo 480FS) @ 2 ml/ kg, installation of pheromone traps @ 4/acre at the time of sowing, collection and destruction of egg masses (8^{th} day onwards), azadirachtin 10,000 ppm @ 1 ml/l (8-15 days after crop emergence), if infesation was 5-10 per cent, spray of *Bacillus thuringiensis* formulation @ 2 ml/l or *Metarhizium anisopliae* @ 2 ml/l or *Beauveria bassiana* @ 5 ml/l and if infestation was more than 10 per cent, spray of emamectin benzoate 5SG @ 0.4 g/l or spinetoram 11.7SC @ 0.3 ml/l (30-60 DAS). The results revealed that adoption of IPM practices recorded the lower incidence of fall armyworm (16.0%) as compared to the farmers' practices (29.0%). Similarly, higher population of natural enemies (coccinellid population – 0.30 grubs and adult/plant) was recorded in IPM plots compared to farmers' practice (0.11 grubs and adults/plant). IPM demonstration plots recorded higher yield (37.5 q/ha), net return (Rs 38,000/ha) and benefit-cost ratio (2.03).

Keywords: IPM; maize; fall armyworm; coccinellid; yield; B-C ratio

INTRODUCTION

Maize (*Zea mays* L) belongs to the family Gramineae. It is an important cereal crop grown throughout the world (Araus et al 2002). It is a high yielding crop of considerable commercial and industrial value as many goods are made from its grains (Choudhry et al 1994). The arthropod pests are one of the main factors leading to low maize yield and production. Due to arthropod pests, despite of the use of pesticides, great crop losses are still present particularly in developing countries (Azerefegne et al 2001). The recently introduced pest fall armyworm (FAW), *Spodoptera frugiperda* (JE Smith 1797) (Lepidoptera: Noctuidae) is an polyphagous insect pest that originated in the America (Luginbill 1928). Almost 100 plant species are affected by FAW including maize, sorghum, rice, soybean, cotton, wheat and sugarcane. Montezano et al (2018) reported 353 hosts from 76 plant families with the Gramineae family having the largest hosts with106 taxa followed by Asteraceae and Fabaceae with 31 taxa each. Despite its ability to live on various host plants, the FAW is known to predominantly infest maize (Nagoshi et al 2018). Its good ability to travel and disperse long distances annually during the summer months may be the key reason for its rapid spread (Mallapur et al 2018). The use of insecticide sprays is the common management strategy for fall armyworm in its native ranges of America. Nevertheless, FAW has developed resistance for several insecticides (Abraham et al 2017) which suggests the use of integrated management strategies for sustainable management of this invasive pest. However, empirical information on different approaches of IPM against FAW are deficient in India. Keeping this view in mind, ICAR – SCAD Krishi Vigyan Kendra planned to demonstrate the integrated management of FAW in maize in the farmers' fields.

MATERIAL and METHODS

Integrated pest management (IPM) was demonstrated in 10 maize farmers' fields through frontline demonstrations (FLDs) in north Karaseri village of Kurungulam block of Thoothukudi district, Tamil Nadu during rabi season of 2019-20. Each farmer raised KSMH-1980 hybrid in an area of 0.4 ha. The IPM strategies included summer ploughing, border crop with sorghum (2-4 rows), seed treatment with cyatranilprole 19.8 per cent + thiamethoxam 19.8 per cent (Fortenza Duo 480FS) @ 2 ml/kg, installation of pheromone traps @ 4/acre at the time of sowing, collection and destruction of egg masses (8th day onwards), azadirachtin 10,000 ppm @ 1 ml/l (8-15 days after crop emergence) and at 5-10 per cent infestation, spray of *Bacillus thuringiensis* formulation @ 2 ml/l or *Metarhizium anisopliae* @ 2 ml/l or *Beauveria bassiana* @ 5 ml/l. If infestation was more than 10 per cent, emamectin benzoate 5SG @ 0.4 g/l or spinetoram 11.7SC @ 0.3 ml/l (30-60 DAS) was applied. The selected progressive farmers were trained on all scientific maize cultivation aspects before starting of FLDs. The observations on fall armyworm (FAW) damage, yield per ha, net income and B-C ratio were recorded. The demonstrated fields were regularly monitored and periodically observed by the KVK scientists. Damage was calculated as under:

$$\text{Damage (\%)} = \frac{\text{Number of infested plants}}{\text{Total number of plants}} \times 100$$

RESULTS and DISCUSSION

The results of pest damage and presence of natural enemies are presented in Table 1. The lower incidence of FAW was recorded in demonstration plots (16.0%) as compared to the farmers' practice (29.0%). Similarly, higher population of natural enemies (coccinellid population – 0.30 grubs and adults/plant) was recorded in IPM plots as compared to farmers' practice (0.11 grubs and adults/plant). The above findings are similar to those of Mallapur et al (2018) who reported that spinetoram recorded 98.13 per cent reduction over control at seven days after treatment followed by emamectin benzoate and spinosad. Deshmukh et al (2020) revealed that the effective insecticides against FAW were chlorantraniliprole 18.5SC followed by emamectin benzoate 5SG. Ramasamy et al (2018) revealed that spinoteram 11.7SC, chlorantraniliprole 18.5SC, thiodicarb 75WP and emamectin benzoate 5SG registered the lowest mean FAW score of 1.1, 1.2, 1.2, and 1.3 respectively as against 6.8 in untreated control.

The yield data presented in Table 2 reveal that the adoption of IPM practices recorded higher yield (37.5 q/ha), net return (Rs 38,000/ha) and benefit-cost ratio (2.03) compared to framers' practice with yield of 33.0 q/ha, net return of Rs 26,000/ha and benefit-cost ratio of 1.65 with yield advantage of 14 per cent over the farmers' practice. Usharani et al (2020) reported effectiveness of IPM module against FAW from Tamil Nadu.

Table 1. Effect of IPM strategies on fall armyworm incidence and coccinellid population

Component	Fall armyworm incidence (%)	Coccinellid beetle population (grubs and adults/plant)
Demonstration fields	16.0	0.30
Farmers' practice fields	29.0	0.11

Table 2. Effect of IPM strategies on yield and economics of maize crop

Component	Demonstration fields	Farmers' practice fields
Yield (q/ha)	37.5	33.0
Increase in yield (%)	14	-
Gross cost (Rs/ha)	37,000	40,000
Gross return (Rs/ha)	75,000	66,000
Net return (Rs/ha)	38,000	26,000
B-C ratio	2.03	1.65

CONCLUSION

The results of the present study indicate that adoption of integrated pest management practices drastically reduced the fall armyworm damage in maize fields. The farmers were satisfied that the IPM technologies in maize increased the yield and reduced the requirement of chemical pesticides with better control of pests.

REFERENCES

Abraham P, Beale T, Cock M, Corniani N, Day R, Godwin J, Murphy S, Richards G and Vos J 2017. Fall armyworm status: impacts and control options in Africa. Preliminary Evidence Note, April 2017, UKaid and CABI.

Araus JL, Slafer GA, Reynolds MP and Royo C 2002. Plant breeding and drought in C_3 cereals: what should we breed for? Annals of Botany **89(7):** 925-940.

Azerefegne F, Kitaw D and Asayehegne B 2001. Major insect pests of maize and their management: a review. In: Enhancing the contribution of maize to food security in Ethiopia, Proceedings of the 2nd National Maize Workshop of Ethiopia, 12-16 November 2001, Addis Ababa, Ethiopia, pp 89-96.

Choudhry MR, Choudhry AD, Akbar S, Iqbal M and Asif M 1994. Water and fertilizer conservation by improved irrigation methods. Pakistan Journal of Agricultural Sciences **31(1):** 87-90

Deshmukh S, Pavithra HB, Kalleshwaraswamy CM, Shivanna BK, Maruthi MS, Mota-Sanchez D 2020. Field efficacy of insecticides for management of invasive fall armyworm, *Spodoptera frugiperda* (JE Smith) (Lepidoptera: Noctuidae) on maize in India. Florida Entomologist **103(2):** 221-227.

Luginbill P 1928. The fall armyworm. Technical Bulletin Number 34, United States Department of Agriculture, Washington, DC, USA.

Mallapur CP, Naik AK, Hagari H, Praveen T, Patil RK and Lingappa S 2018. Potentiality of *Nomuraea rileyi* (Farlow) Samson against the fall armyworm, *Spodoptera frugiperda* (JE Smith) infesting maize. Journal of Entomology and Zoology Studies **6(6):** 1062-1067.

Montezano DG, Specht A, Sosa-Gomez DR, Roque-Specht VF, Sousa-Silva JC, de Paula-Moraes SV, Peterson JA and Hunt T 2018. Host plants of *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in the Americas. African Entomology **26(2):** 286-300.

Nagoshi RN, Goergen G, Tounou KA, Agboka K, Koffi D and Meagher RL 2018. Analysis of strain distribution, migratory potential and invasion history of fall armyworm populations in northern sub-Saharan Africa. Scientific Reports **8:** 3710; doi: 10.1038/s41598-018-21954-1.

Ramasamy S, Periasamy M and Othim S 2018. Fall armyworm in Africa: which 'race' is in the race and why does it matter? Current Science **114(1):** 27-28.

Usharani B, Ramesh C and Ananthi K 2020. Evaluation of different IPM modules for the management of fall armyworm in maize. In: Proceedings of the International Seminar on Transboundary Pest Management, 4-5 March 2020, Coimbatore, Tamil Nadu, India.