Indian Journal of Entomology Online published Ref. No. e24140 DoI. No.: 10.55446/IJE.2024.2140

EVALUATION OF MANAGEMENT MODULES AGAINST *SCIRPOPHAGA EXCERPTALIS* WALKER IN SUGARCANE

Anil Kumar*

Department of Entomology, Sugarcane Research Institute,
Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur 848125, Bihar, India
*Email: anil.kumar@rpcau.ac.in (corresponding author): ORCID ID 0000-0002-4544-4743

ABSTRACT

An experiment on the evaluation of management modules against sugarcane top borer *Scirpophaga excerptalis* was conducted from 2019-20 to 2021-22 at the Pusa Farm, SRI, Pusa. Data on incidence and yield in different modules (M_1, M_2, M_3, M_4, M_5 and M_6) reveals that all modules are significantly superior though they varied in their efficacies at 120 DAP and 180 DAP, respectively. Among these modules, M_2 (Comprised of RDF, removal of deadhearts, collection and destruction of egg masses followed by drenching with chlorantraniliprole 0.4 G @ 25 kg/ ha after 90 DAP) recorded least incidence (5.23%) followed by M_6 after120 and 180 DAP. The module M_4 gave maximum yield (86.52 t/ ha) and generated the highest net income of 0.65 lakhs and BC ratio of 0.32.

Key words: *Scirpophaga excerptalis*, mechanical control, drenching, efficacy, management, insecticides, economics, Benefit-cost ratio, top borer, sugarcane

Sugarcane (*Saccharum* spp.) is one of the major cash crops, generally grown in tropic and subtropic regions globally. It belongs to C4 grasses and major source of raw materials for sugar industries. Besides sugar production, sugarcane is also used to produce ethanol, a renewable fuel alternative. However, its production is severely challenged by a large number of insect pests, of more than 1500 insects globally (Box, 1953). In the different growth stages sugarcane is infected by several pests which ultimately cause 20-25% reduction in yield (Kumar et al., 2019). Among which the sugarcane top borer, *Scirpophaga excerptalis* Walker (Lepidoptera: Crambidae), is regarded as one of the most destructive pests not only in India but also throughout South-east Asia (Sallam and Allsopp, 2005; Srikanth et al., 2012). Due to the attack of *S. excerptalis,* brix % in juice decline by up to 0.11% and pol % in juice also showed similar reductions for every 10 % rise in damage (Kuniata et al., 2012). Similarly, with each increase of 10 cm in the length of borer tunnels, pol % juice decreases by 1.2 units (Kuniata et al., 2012). Effective management of *S. excerptalis* relies on the integration of multiple control tactics as modules encompassing cultural practices (like application of a recommended dose of fertilizers), mechanical practices (like removal of dead hearts, collection and destruction of egg masses) and safest synthetic insecticides. Adaption of different practices along with chemicals provides more effective and sustainable control. The evaluation of different management modules is thus necessary.

MATERIALS AND METHODS

The experiment with different management modules was conducted during the three consecutive years from 2019-20 to 2021-22 at Pusa Farm, SRI, RPCAU, Pusa (85.67^{0}E 25.98^{0}N, 52.92 masl). The selected field was well ploughed and planting of cane crop with variety CoP 112 was done in February, following all the agronomical practices recommended. One meter space was left between two blocks to facilitate irrigation, mechanical operation, and spraying of insecticides, besides lessening the border effects. The trial was laid out in randomized block design with 7 treatments in 3 replications with a spacing of 90 cm in between furrows and plot size (6.00 x 5.40 M^2). The tested modules include M_1: Comprised RDF, removal of dead hearts, collection and destruction of egg masses followed by drenching with Indoxacarb-14.5 SC @ 500 ml/ ha after 90 DAP, M_2: Comprised RDF, removal of dead hearts, collection and destruction of egg masses followed by drenching with Chlorantraniliprole -0.4 G @ 25 kg/ ha after 90 DAP, M_3: Comprised RDF, removal of dead hearts, collection and destruction of egg masses followed by drenching with Flubendiamide-480 SC @ 200 ml/ ha after 90 DAP, M_4: Comprised RDF, removal of dead hearts, collection and destruction of egg masses followed by drenching with Chlorantraniliprole – 18.5 SC @ 375 ml/ha after 90 DAP, M_5: Comprised RDF, removal of dead hearts, collection and destruction of egg masses followed by drenching with Carbofuran –

3 G @ 33 kg/ ha after 90 DAP, M_6: Comprised RDF, removal of dead hearts, collection and destruction of egg masses followed by drenching with Fipronil – 5 SC @ 2 lit/ ha after 90 DAP and M_7: Control (Untreated). The top borer incidence was recorded by counting the healthy and infested canes in three places randomly of 6 m rows of each replication at the interval of 120 and 180 DAP (Days after planting) based on symptoms of shot hole on leaf/ dead heart and bunchy top. These data were subjected to statistically analyze using OPSTAT software and the benefit-cost ratio was computed using standard methodology.

RESULTS AND DISCUSSION

The pooled mean data presented in Table 1 on the incidence and yield in relation to different modules (M_1, M_2, M_3, M_4, M_5 and M_6) revealed that all modules outperformed the untreated control plot (M_7), though they varied in their efficacies at 120 DAP and 180 DAP, respectively. At 120 DAP, the pooled data revealed that all the different modules under investigation were observed to be significantly superior over module- 7 (untreated) in reducing % incidence of top borer. The overall results indicated that Module -4 comprised RDF, removal of dead hearts, collection and destruction of egg masses followed by drenching with Chlorantraniliprole – 18.5 SC @ 375 ml/ha after 90 DAP recorded the lowest % incidence of top borer with 5.13% and proved to be superior over the entire remaining modules. Whereas Module-3, comprised RDF, removal of dead hearts, collection and destruction of egg masses followed by drenching with Flubendiamide-480 SC @ 200 ml/ ha after 90 DAP resulted in 6.17% incidence. At 180 DAP, M_4 imparted the highest control resulting least borer infestation of 3.7%, followed by M_3. The other modules can be arranged on the basis of % pest incidence in the following descending order of performance: M_2>M_6>M_5 >M_1.

The present results are in partial conformity with Jaipal (2000) who showed that the timely mechanical removal of top borer infested shoots or its egg masses and adults helped reduce the incidence of most damaging third brood alone by over 50 percent and these results are also in line with Kumar et al. (2021). Sugarcane yield revealed that the highest yield was recorded in module M_4 of 86.52 t/ ha being at par with M_3 of 83.47 t/ ha. Yield of, M_2 of 81.10 t/ ha, M_6 of 78.11 t/ ha and M_1 of 77.71 t/ ha followed of those two. Module M_5 produced least yield among all the modules of 75.87 t/ ha, just leaving behind the untreated control

Table 1. Evaluation of management module against top borer of sugarcane (2019-20 to 2021-22)

Treatments	% incidence of top borer								Yield			Pooled yield (t/ha)	Cost (in lakh)	Net income (in lakhs)	Benefits (in lakhs)	BCR
	2019-20		2020-21		2021-22		Pooled mean									
	120 DAP	180 DAP	120 DAP	180 DAP	120 DAP	180 DAP	120 DAP	180 DAP	2019-20	2020-21	2021-22					
M_1	7.9	6.9	8.3	7.4	8.6	5.8	8.27	6.7	77.33	78.63	77.16	77.71	1.95	2.41	0.46	0.24
M_2	6.7	5.9	6.1	4.7	7.5	5.3	6.77	5.3	80.13	81.77	81.40	81.10	1.98	2.50	0.52	0.26
M_3	6.3	5.4	5.4	3.6	6.8	4.8	6.17	4.6	82.63	84.56	83.22	83.47	1.99	2.56	0.57	0.29
M_4	5.6	4.7	3.7	2.5	6.1	3.9	5.13	3.7	86.92	86.89	85.74	86.52	2.00	2.65	0.65	0.32
M_5	8.4	7.6	7.8	5.2	9.1	6.7	8.43	6.5	75.56	76.88	75.17	75.87	1.96	2.35	0.39	0.20
M_6	7.1	6.3	6.4	4.1	7.8	5.8	7.10	5.4	79.44	80.55	74.34	78.11	1.96	2.41	0.45	0.23
M_7	9.5	11.9	10.9	13.7	13.3	15.1	11.23	13.57	67.22	69.87	66.85	67.98	1.93	2.17	0.24	0.12
SEm ±	0.45	0.49	0.35	0.41	0.45	0.43	0.24	0.26	3.20	2.90	3.29	1.61	-	-	-	-
CD at 5%	1.37	1.51	1.08	1.26	1.39	1.32	0.69	0.74	9.97	9.05	10.25	4.57	-	-	-	-
C.V.	10.5	12.20	8.73	12.06	9.22	10.97	9.54	11.77	7.07	6.30	7.34	6.13	-	-	-	-

plot yielding 67.98 t/ ha. Module M_4 and M_3 generated highest net income of 0.65 and 0.57 lakhs, and BC ratio of 0.32 and 0.29, respectively. These results are on par with Umar et al. (2021) who concluded that chlorantraniliprole 0.4% G and chlorantraniliprole 20% SC were the most effective insecticides against the control of sugarcane top borer, *S. excerptalis* with regard to both yield and cost benefit ratio. The study conducted by Paudel et al. (2021) has also supported the results as chlorantraniliprole 18.5 SC and spinosad 45 SC provided the most effective control against sugarcane top borer and produced the highest yield.

The research focuses on the principles of Integrated Pest Management (IPM). Adoption of different pest management practices along with soil drenching of chemicals provide more effective management of top borer. It not only helps to reduce number of insecticidal spray, but also helps in conservation of natural enemies in sugarcane ecosystem.

ACKNOWLEDGEMENTS

The author thank Dr A K Singh, Director, Sugarcane Research Institute, Dr Rajendra Prasad Central Agricultural University, Pusa, for providing facilities.

FINANCIAL SUPPORT

The research received financial support from the Sugarcane Research Institute, Dr Rajendra Prasad Central Agricultural University.

AUTHOR CONTRIBUTION STATEMENT

Anil Kumar conceptualized the research proposal, conducted the experiment, collect and analyze data, and prepared the original draft.

CONFLICT OF INTEREST

No conflict of interest.

REFERENCES

Box H E. 1953. List of sugar-cane insects- a synonymic catalogue of the sugarcane insects and mites of the world, and of their insect parasites and predators, arranged systematically. Commonwealth Institute of Entomology, London, UK, 101pp.

Jaipal S. 2000. An IPM module for the management of major insect pests of sugarcane in Indian subtropics. Sugar Tech 2:1-8.

Kumar A, Chand H, Paswan S, Dwivedi G P. 2016. Field efficacy and economics of insecticides against top borer, *Scirpophaga excerptalis* Walk (Pyralidae: Lepidoptera) of sugarcane. Bioved 27(1): 79-83.

Kumar A, Pal S, Hari C. 2019. Insect pests of sugarcane and their management: An overview. In K. Ghoneim (Ed.), Advances in Agricultural Entomology, New Delhi: AkiNik Publications 3: 1-18.

Kumar A, Pal S, Rai C P. 2021. Eco-friendly pest management modules against sugarcane borer complex. Pesticide Research Journal 33(2): 75-80.

Kuniata L S, Korowi K T, Pupue P. 2012. Estimation of potential losses from the top shoot borer, *Scirpophaga Excerptalis* Walker (Lepidoptera: Pyralidae) in Ramu, Papua New Guinea. Proceedings of Australian Society of Sugar Cane Technology 34: 1-7.

Paudel K, Dangi N, Aryal S, Regmi R. 2021. Evaluation of chemical pesticides for the management of top borer (*Scirpophaga excerptalis* Walker) in sugarcane. Journal of Agriculture and Natural Resources 4(1): 282-290.

Sallam N M, Allsopp P G. 2005. Our home is girt by sea-But how well are we prepared in Australia for exotic cane borers. Proceedings of the Australian Society of Sugar Cane Technology, 27: 358-366.

Srikanth J, Salin K P, Jayanti R. 2012. Sugarcane pests and their management, Sugarcane Breeding Institute (ICAR) Coimbatore, pp 16-21.

Umar M Y, Zia S, Ahmad M., Ali Q, Anwar H, Akhtar M F, Aslam A. 2021. Bio-efficacy of some new chemistry insecticides against sugarcane top borer, *Scirpophaga nivella* (fabricius) under field conditions. Journal of Agricultural Research 59(4): 367-373.

(Manuscript Received: July, 2024; Revised: July, 2024;
Accepted: July, 2024; Online Published: September, 2024)
Online First in www.entosocindia.org and indianentomology.org Ref. No. e24140