International Journal of Plant & Soil Science

Volume 37, Issue 8, Page 332-337, 2025; Article no.IJPSS.141050
ISSN: 2320-7035

Effect of Combination of Insecticides against Maize Stem Borer, *Chilo partellus* (Swinhoe)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ijpss/2025/v37i85634

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://pr.sdiarticle5.com/review-history/141050

Short Research Article

Received: 15/05/2025
Published: 30/07/2025

ABSTRACT

A field experiment was carried out during the *Kharif* season 2024 at the Crop Research Farm (CRF), Department of Entomology, SHUATS, Uttar Pradesh, India, to evaluate the effectiveness of various insecticidal treatments against *Chilo partellus* infestation in maize. The study was designed using a Randomized Block Design (RBD) comprising eight treatments with three replications each: T_1 (Neem Oil 1% + Imidacloprid 17.8% SL), T_2 (Chlorantraniliprole 18.5% SC + *Azadirachtin* 1500 ppm), T_3 (Carbofuran 3G + Imidacloprid 17.8% SL), T_4 (Imidacloprid 17.8% SL), T_5 (Carbofuran 3G), T_6 (Karanj Oil 3% + Imidacloprid 17.8% SL), T_7 (Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm), and an T_8 untreated control. Observations on larval population after the first and second sprays indicated that all treatments significantly reduced *Chilo partellus* infestation compared to the control. Among them, T_7 (Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm) was the most effective,

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Cite as: *Misal, Rahul Sambhaji, and Usha Yadav. 2025. "Effect of Combination of Insecticides Against Maize Stem Borer, Chilo Partellus (Swinhoe)". International Journal of Plant & Soil Science 37 (8):332-37. https://doi.org/10.9734/ijpss/2025/v37i85634.*

recording the lowest larval population (2.33 and 1.53), followed by T2 (Chlorantraniliprole 18.5% SC + *Azadirachtin* 1500 ppm), T6 (Karanj Oil 3%+ Imidacloprid 17.8% SL), and T1 (Neem Oil 1% + Imidacloprid 17.8% SL). The least effective treatment was T5 (Carbofuran 3G), with the highest larval counts (3.64 and 2.78) after both sprays. These findings highlight the superior efficacy of Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm in managing *Chilo partellus* under field conditions.

Keywords: Botanicals; Chilo partellus; chemicals; maize.

1. INTRODUCTION

Maize (*Zea mays* L.), often referred to as the "queen of cereals," is a highly adaptable and versatile cash crop capable of thriving under a wide range of Agro-Climatic conditions. It also boasts the highest yield potential among cereals. In India, maize is cultivated across approximately 9.43 million hectares, producing around 22.23 million tonnes annually, with an average productivity of 2.5 tonnes per hectare (Anonymous, 2014).

However, one of the major biotic constraints to maize production is the damage caused by stem borers. Among the pest complex, *Chilo partellus* (Swinhoe), *Sesamia inferens* (Walker), and *Atherigona soccata* (Rondani) are the most significant across different growing seasons in India (Kumar *et. al*., 2005). Yield losses attributed to *C. partellus* and *S. inferens* range from 26.7% to 80.4% and 25.7% to 78.9%, respectively, across various agro-climatic zones (Chatterji *et. al*., 1969).

Stem borers initially damage maize by feeding on leaf tissue, then continue to cause harm by tunneling into stems and sometimes the cobs (Jalali and Singh, 2002). For effective control, timely application of insecticides—particularly at the early whorl stage—is critical, since these pests are internal feeders and late-stage interventions are less effective (Songa *et.al*., 2001).

Emphasis should be placed on using environmentally safer insecticides with novel modes of action, which are essential for managing insecticide resistance. While chemical control remains a key strategy due to its fast-acting results (Kulkarni *et. al*., 2015), excessive dependence on synthetic pesticides poses environmental and health risks. Therefore, it's important to identify more efficient and safer insecticide options that are also compatible with natural enemy conservation. Approaches such as whorl application of granules, dust-based biopesticides, and foliar sprays using novel insecticides have shown promising results in managing stem borers (El-Wakeil *et.al*., 2013). Insecticides are the most effective and quick method of insect control but have so many adverse effects like mortality of biological control agents, environmental and water pollution, biohazards to human beings and animals. So, for sustainable low-cost maize production, it is necessary to have a low-cost technology and eco friendly management of pests. Hence attempts were made to utilize karanj oil, neem oil, *Bt.* and imidacloprid to minimize pests of maize crop (Shamas and Afzal, 1989).

2. MATERIALS AND METHODS

A field experiment was conducted during the *Kharif* season of 2024 at the Central Research Farm, Department of Entomology, SHUATS, Prayagraj to evaluate the impact of combined insecticides on the control of maize stem borer, *Chilo partellus* (Swinhoe). The experiment was laid out in a Randomized Block Design (RBD) with three replications and included eight treatments, including an untreated control. Each treatment was applied to plots measuring 3 × 2 m², with a plant and row spacing of 60 cm × 20 cm. The treatments tested were: T_1 – Neem Oil + Imidacloprid 17.8% SL, T_2 – Chlortantraniliprole 18.5% SC + *Azadirachtin* 1500 ppm, T_3 – Carbofuran 3G + Imidacloprid 17.8% SL, T_4 – Imidacloprid 17.8% SL, T5 – Carbofuran 3G, T6 – Karanj Oil 3% + Imidacloprid 17.8% SL, T_7 – Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm, and T_8 – Untreated Control. A total of 24 plots were sown with the local maize hybrid VNR 4226, and all recommended agronomic practices such as fertilizer application, thinning, interculture, and weeding were followed uniformly across all treatments. The larval population was recorded from five randomly selected plants in each plot, and the average population across the three replications was calculated for each treatment. Observations of *Chilo partellus* infestation were made one day before spraying and on the 3rd, 7th, and 14th days after insecticide application. Marketable yield of each plot of different treatment is collected and

weighted separately and then we calculated treatment cost, common cost of cultivation per hectare. Total gross return was calculated by multiplication of total yield and current market price. Net return is calculated by subtracting total cost from total income. The collected data were transformed and subjected to statistical analysis using OPSTAT software.

3. RESULTS AND DISCUSSION

The findings (Table 1) following the first and second spray insecticide applications indicated that all treatments were significantly more effective than the untreated control. The mean larval population of *Chilo partellus* recorded on the 3rd, 7th, and 14th days after the first and second spray showed that all chemical treatments performed significantly better in reducing pest incidence compared to the control. Among all treatments, Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm (2.33 and 1.53) recorded lowest larval population of *Chillo partellus* after both sprays followed by Chlorantraniliprole 18.5% SC + *Azadirachtin* 1500 ppm (2.62 and 1.80), Karanj oil 3% + Imidacloprid 17.8% SL (2.91 and 2.02), Neem Oil 1% + Imidacloprid 17.8% SL (3.13 and 2.22), Carbofuron 3G + Imidacloprid 17.8% SL (3.38 and 2.47), Imidacloprid 17.8% SL (3.60 and 2.73), Carbofuron 3G (3.64 and 2.78) was the least effective among all treatments respectively.

The highest yield was recorded in Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm (43.56 q/ha), followed by Chlorantraniliprole 18.5% SC + *Azadirachtin* 1500 ppm (41.508 q/ha), Karanj oil (3%) + Imidacloprid 17.8% SL (39.10 q/ha), Neem oil (1%) + Imidacloprid 17.8% SL (36.74 q/ha), Carbofuran 3G + Imidacloprid 17.8% SL 4 ml/kg of seed (32.98 q/ha), Imidacloprid 17.8% SL 4 ml/kg of seed (29.84 q/ha), Carbofuran 3G (28 q/ha), Control (20.5q/ha).

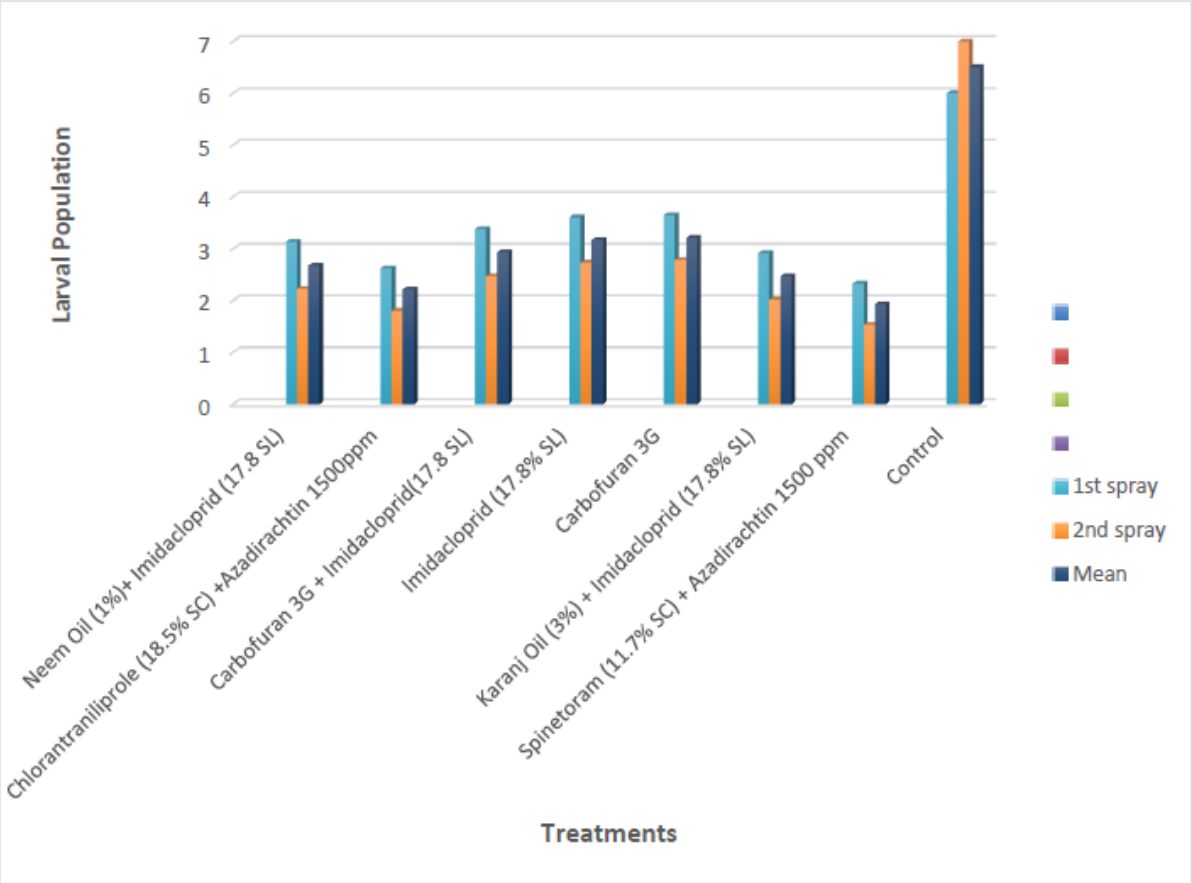

Fig. 1. Comparative efficacy of combination of different insecticides against larval population of maize stem borer (*Chilo partellus*, Swinhoe)

Table 1. Comparative study of combination of insecticides against maize stem borer, *Chilo partellus,* Swinhoe

Sr.No	Treatments	Dosage	Larval Population of Chilo partellus/ 5 plants									Overall mean	Yield q/ha	C: B Ratio
			First spray					Second spray						
			1 DBS	3 DAS	7 DAS	14 DAS	Mean	3 DAS	7 DAS	14 DAS	Mean			
T_1	Neem Oil (1%) + Imidacloprid 17.8 % SL	10 ml/lit + 2 ml/lit	5.00	3.47	2.73	3.20	3.13	2.47	2.00	2.20	2.22	2.68	36.74	1:2.01
T_2	Chlorantra- niliprole 18.5% SC + *Azadirachtin* 1500 ppm	0.2 ml/lit +2.5 ml/lit	5.40	3.00	2.40	2.87	2.62	2.00	1.60	1.80	1.80	2.21	41.508	1:2.41
T_3	Carbofuran 3G + Imidacloprid 17.8% SL	10 kg/ha + 4ml/kg of seed	5.80	3.60	2.80	3.73	3.38	2.80	2.20	2.40	2.47	2.93	32.98	1:1.82
T_4	Imidacloprid (17.8% SL)	4 ml/kg of seed	4.40	3.80	3.00	4.00	3.60	3.00	2.40	2.80	2.73	3.17	29.84	1:1.69
T_5	Carbofuran 3G	10 kg/ha	4.07	3.87	2.93	4.13	3.64	3.13	2.53	2.67	2.78	3.21	28.00	1:1.65
T_6	Karanj oil (3%) +Imidacloprid (17.8% SL)	30 ml/lit + 0.25ml/lit	5.13	3.13	2.60	3.00	2.91	2.27	1.80	2.00	2.02	2.47	39.10	1:2.19
T_7	Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm	0.25 ml/lit + 2.5 ml/lit	6.00	2.20	2.13	2.67	2.33	1.80	1.27	1.53	1.53	1.93	43.56	1:2.61
T_8	Control		5.53	5.73	6.00	6.20	5.98	6.80	7.00	7.20	7.00	6.50	20.50	1:1.29
F-Test			NS	S	S	S	S	S	S	S	S	S		
S.Ed.(±)			0.66	0.16	0.15	0.17	0.20	0.16	0.16	0.15	0.13	0.47		
CD(0.05)			1.41	0.34	0.33	0.36	0.43	0.34	0.34	0.33	0.27	1.10		

DBS- Day before Spraying, DAS- Day after Spraying, NS- Non significant, S- Significant

Among all the treatment combination best and most economic treatment was found to be Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm with cost benefit ratio (1:2.61) followed by Chlorantraniliprole 18.5% SC + *Azadirachtin* 1500 ppm (1:2.41) followed by Karanj oil (3%) + Imidacloprid 17.8% SL (1:2.19) followed by Neem Oil (1%) +Imidacloprid 17.8%SL (1:2.01) followed by Carbofuran 3G + Imidacloprid 17.8% SL @ 4 ml/kg of seed (1:1.82) followed by Imidacloprid 17.8% SL @ 4 ml /kg of seed (1:1.69) followed by Carbofuran 3G (1:1.65) followed by untreated control (1:1.29).

Among all the treatments evaluated, the combination of Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm was found to be the most effective, recording the lowest larval population. These results are in line with the findings of Yadav *et.al.* (2024), Jawalkar (2023), Bhandari *et. al*., (2024). The next most effective treatment was Chlorantraniliprole 18.5% SC + *Azadirachtin* 1500 ppm, which also resulted in a significantly reduced larval population, supported by the studies of Yadav *et. al*. (2024), Bajracharya *et.al*., (2020)_ and Jawalkar (2023). Similarly, the treatment Karanj Oil (3%) + Imidacloprid 17.8% SL showed promising results, with a considerable reduction in larval population, consistent with the observations of, Kurly *et. al.* (2020), Garhwal and Yadav (2024). Neem Oil 1% combined with Imidacloprid 17.8% SL also proved effective, as indicated by comparable findings reported by Kurly *et.al.* (2012) and the combination of Carbofuran 3G + Imidacloprid 17.8% SL showed moderate efficacy, which is supported by the work of Ahad *et.al.* (2012). Additionally, the individual applications of Imidacloprid 17.8% SL and Carbofuran 3G were found to be moderately effective in suppressing the pest population, aligning with previous reports by Ahad *et.al.* (2012).

4. CONCLUSION

The study revealed that all insecticidal combination of insecticides with biopesticides shows better synergistic effect on insecticides and also good response to natural enemies and environment. Especially, In case of Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm quick knockdown effect is seen. Chlorantraniliprole 18.5% SC + *Azadirachtin* 1500 ppm treatments were slightly less effective than Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm , in the treatment Karanj oil (3%)+ Imidacloprid 17.85% SL , Karanj oil (3%) seen to be enhancing the effect of 0.25 ml/L Imidacloprid greatly, treatment Neem Oil (1%) + Imidacloprid 17.8% SL shows substantial efficacy but in case of treatments Carbofuran 3G + Imidacloprid 17.8% SL, seen that seed treatment 4 ml/kg of Imidacloprid 17.8% SL enhances the efficacy of Carbofuran 3G than Carbofuran 3G and Imidacloprid 17.8% SL 4 ml/kg alone. Among the treatments, the combination of Spinetoram 11.7% SC + *Azadirachtin* 1500 ppm proved to be the most effective, recording the lowest larval population after both sprays (2.22 and 1.36 larvae per 5 plants). This was followed by Chlorantraniliprole 18.5% SC + *Azadirachtin* 1500 ppm, Karanj Oil (3%) + Imidacloprid 17.8% SL, and Neem Oil (!%)+ Imidacloprid 17.8% SL 2 ml/lit, which also showed substantial efficacy, Carbofuran 3G 10kg/ha being the least effective among all. Overall, the results suggest that integrated combinations of insecticides, especially those incorporating biopesticides, can provide effective management of maize stem borer and may be recommended as part of an integrated pest management strategy.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

ACKNOWLEDGEMENTS

The authors express their sincere gratitude to the Department of Entomology, SHUATS, for extending the essential facilities and a conducive environment that enabled the successful completion of this research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Ahad, I., Bhagat, R. M. and Ahmad, H. (2012). Efficacy of insecticides and some biopesticides against maize stem borer, *Chilo partellus* Swinhoe. *Indian Journal of Entomology, 74*(2), 99–102.

Anonymous. (2014). *Agriculture statistics at a glance*. Government of India.

Bajracharya, A. S. R., Bhat, B. and Sharma, P. (2020). Field efficacy of selected

insecticides against fall armyworm, *Spodoptera frugiperda* (J.E. Smith) in maize. *Journal of Plant Protection Society, 6*, 127–133.

Bhandari, G. S., Bhandari, P. and Sah, L. (2024). Efficacy of insecticides against fall armyworm, *Spodoptera frugiperda* (J.E. Smith) in maize field in Chitwan, Nepal. *Journal of Nepal Agricultural Research Council, 10*, 50–60.

Chatterji, S. M., Young, W. R., Sharma, G. C., Sayi, I. V., Chahal, B. S., Khare, B. P., Rathore, Y. S., Panwar, V. P. S., and Siddiqui, K. H. (1969). Estimation of loss in yield of maize due to insect pests with special reference to borers. *Indian Journal of Entomology, 31*, 109–115.

El-Wakeil, N., Gaafar, N., Sallam and A., Volkmar, C. (2013). Side effects of insecticides on natural enemies and possibility of their integration in plant protection strategies. In *Insecticides-development of safer and more effective technologies*. *Intech Open Journal.* DOI: 10.5772/54199

Garhwal, A., and Yadav, U. (2024). Comparative study of synthetic insecticides with biopesticides against spotted stem borer, *Chilo partellus* (Swinhoe) on maize (*Zea mays L.). Archives of Current Research International Journal*, *24*(5), 288-294.

Jawalkar, A. (2023). Studies on compatibility and bioefficacy of recommended pesticides in maize crop against *fall armyworm* under *in vitro* conditions.

Jalali, S. K. and Singh, S. P. (2002). Seasonal activity of stem borers and their natural enemies on fodder maize. *Entomon journal*, 2002, Vol. 27, No. 2, 137-146

Kulkarni, S., Mallapur, C. P. and Balikai, R. A. (2015). Bio-efficacy of insecticides against *fall armyworms*. *Journal of Experimental Zoology, 18*(1), 233–236.

Kumar, P., Sekhar, J. C. and Chaudhary, R. (2005). Management of insect pests of maize in tropics. *Stresses on maize in tropics. Directorate of Maize Research, New Delhi*, 298-323.

Kurly, S., and Kumar, B. (2020). Eco-friendly management of maize stem borer with botanical and chemical insecticides. *The Pharma Innovation Journal, 10*(2), 135–137.

Shamas MR, Afzal M. (1989) Effect of synthetic pyrethroids/ organophosphates on maize shoot fly: *Atherigona soccata* (Rond.) and maize borer, *Chilo partellus* (Swinhoe.). *Journal of Agriculture. Resources., 27*(1), 65-70.

Songa, J. M., Zohu, G. and Overholt, W. A. (2001). Relationship of stem borer damage and plant physical condition to maize yield in a semi-arid zone of Eastern Kenya. *International Journal of Trophical Insect Sciences, 21*(3), 243–249.

Yadav, U. (2024) *Efficacy of different insecticides against fall armyworm Spodoptera frugiperda* (J.E. Smith) on maize (*Zea mays* L.). *International Journal of Advanced Biochemistry Research, 8*(5), 109-114

Peer-review history:
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