Comparative Efficacy of Selected Insecticides against *Helicoverpaarmigera* (Hubner) on Cowpea, *Vigna unguiculata* (L.) in Prayagraj, U.P., India

ABSTRACT

The experiment was conducted at the Department of Agricultural Entomology at Central Research Farm (CRF), Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj during the *Kharif* season of 2023 in a Randomized Block Design with three replications and eight treatments against, *Vigna unguiculatai.e*., of (T_1) Spinosad 45SC, (T_2) Novaluron 10EC, (T_3) Emamectin benzoate 10EC, (T_4)*Ha*NPV, (T_5) Neem oil 5%, (T_6) Spinosad 45% + Neem oil 5%, (T_7) Nisco Sixer plus, (T_0) Control. Each insecticide was sprayed twice at 15 days interval. The larval population per plant was taken day before and 3, 7, and 14 days after each spray. All the insecticides tested significantly reduced the pest infestation compared to control. The lowest percentage infestation of larval population of *Helicoverpaarmigera* was observed in T_6 Spinosad 45% + Neem oil 5% (1.55 %), (1.08 %) at both sprayers followed by T_3Emamectin benzoate 10EC (1.66 %), (1.19 %), T_1 Spinosad 45SC (1.71 %), (1.24 %), (T_2) Novaluron 10EC (1.79 %), (1.35), (T_4) *Ha*NPV (1.86 %), (1.44 %), (T_5) Neem oil 5% (1.93 %), (1.55 %), (T_7) Nisco Sixer plus (2.02 %), (1.62 %), T_0 Control (30.87), (25.44). The crop yield and cost benefit ratio ranged between (10.36 q/ha and 19.49 q/ha), the highest being in Spinosad 45% + Neem oil 5% (19.49 q/ha), (1:3.8) followed by Emamectin benzoate 10EC (17.68 q/ha), (1:3.5), Spinosad 45SC (16.01 q/ha), (1:2.9), Novaluron 10EC (14.74 q/ha), (1:2.8), *Ha*NPV (13.23 q/ha), (1:2.7), Neem oil 5% (12.8 q/ha), (1:2.6) and Nisco Sixer plus (11.12 q/ha), (1:2.4) and Control plot (10.36 q/ha), (1:2.3).

Keywords: Cost benefit ratio; cowpea; Helicoverpaarmigera; Insecticide; Vigna unguiculata.

1. INTRODUCTION

"Cowpea [*Vigna unguiculata* (L.) Walp.] is an important grain legume mainly grown in tropical and sub-tropical regions for vegetables, grains, and fodder. The crop is grown predominantly in the dry Savannahs to the Sahel in the fringes of the Sahara Desert where the annual rainfall is around 300 mm or less. Cowpea provides shelter as a cover crop and improves soil fertility by fixing atmospheric nitrogen. The cowpea cultivar group, *unguiculata* is the most cultivated cowpea, while members of the cultivar group Textiles, which are grown in some parts of Nigeria and favored for their long peduncles, are cultivated for fiber production. About 6.5 million metric tons of cowpea were reported produced annually on about 14.5 million hectares worldwide"[1].

"Having originated in Africa, cowpea is now grown worldwide in 100 countries. Rough estimates indicate that annual global production is around 2 million tons from an area of 5 million hectares. India accounts for about 0.9 million tons of production from an area of around 1.5 million ha. In India, cowpea is grown in almost 1.3 m ha particularly in Western, Central, and in some of the Indian states including Maharashtra. In India, the major area under grain cowpea is confined to the states of Uttar Pradesh, Karnataka, Tamil Nadu, Andhra Pradesh, and Kerala where, it is mainly sown as a mixed crop with other legumes and cereals" [2].

"Gram Pod borer, *Helicoverpaarmigera*(Hubner) (Lepidoptera: Noctuidae) is one of the major

insect pests of cowpea and has great economic importance. *Helicoverpaarmigera* is a polyphagous pest that feeds on almost 182 plant species which belongs to 47 families anddue to its destructiveness at critical stages of crop growth *viz*., flowering and pod development stages especially to the economic plant parts such as flowers and pods, it become as a significant constraint to attain the maximum productivity from grain legumes. The caterpillars of gram pod borer not only defoliate the leaves but also feed on seeds. While feeding on the developing seeds nearly half of the anterior body portion remains inside while the rest of the half portion remains hanging outside. A single larva may destroy 30-40 pods before it reaches maturity. The caterpillars feed on their fellows if suitable vegetation is not available *i.e.,*cannibalism. They pupate in the soil. The pod damage due to *Helicoverpaarmigera* on cowpea crop could increase up to 100% in India. The best way to overcome this damage is to destroy the pest at its initial stage of the life cycle" [3].

2. MATERIALS AND METHODS

The experiment was conducted at the experimental research plot of the Department of Entomology, Central Research Farm, Sam Higginbottom University of Agriculture Technology and Sciences, during the *Kharif* season of 2023 in a Randomized Block Design with eight treatments replicated thrice using variety Maruti-52 in a plot size of 2m×1m at a spacing of 30cm×15cm with a recommended package of practices excluding plant protection. "The soil of the experimental site was well drained and medium high. Research field is situated at 25027" North latitude 80005" East longitudes and at an altitude of 98 metres above sea level. The maximum temperature reaches up to 47°C in summer and drops down to 20°C in winter" [2]. The treatments used in experiment are *viz.,* Spinosad 45SC (0.3 ml/lit), Novaluron 10EC (0.75 ml/lit), Emamectin benzoate 10EC (1.5 ml/lit), HaNPV (2 ml/lit), Neem oil 5% (50 ml/lit), Spinosad 45% + Neem oil 5% (0.3 ml/lit + 25 ml/lit), Nisco Sixer plus (2 ml/lit) and Control.

"Pest population was estimated by observing five plants selected randomly from each treatment for presence of egg masses and larvae at one day

Table 1. Efficacy of selected insecticides against *Helicoverpaarmigera*(Hubner) on cowpea, *Vigna unguiculata* (L.)

S.No	Treatments	Dosage (ml/lit.)	Larval population of *H. armigeral*5 plants										Yield (q/ha)	C:B ratio
			First spray					Second spray						
			1DBS	3 DAS	7 DAS	14 DAS	Mean	1DBS	3 DAS	7 DAS	14 DAS	Mean		
T_1	Spinosad 45 SC	0.3	2.33	1.80^{def}	1.60^{e}	1.73^{de}	1.71^{def}	1.73^{de}	1.46^{d}	1.00^{d}	1.26^{d}	1.24^{ef}	16.01	1:2.9
T_2	Novaluron 10 EC	0.75	2.13	1.86^{cde}	1.73^{d}	1.80^{cde}	1.79^{cde}	1.80^{cde}	1.53^{d}	1.13^{c}	1.40^{c}	1.35^{de}	14.74	1:2.8
T_3	Emamectin benzoate 10 EC	1.5	2.30	1.73^{ef}	1.60^{e}	1.66^{ef}	1.66^{ef}	1.66^{ef}	1.46^{d}	0.93^{d}	1.20^{de}	1.19^{ef}	17.68	1:3.5
T_4	*Ha*NPV	2.0	2.40	1.93^{cd}	1.80^{cd}	1.86^{bcd}	1.86^{bcd}	1.86^{bcd}	1.66^{c}	1.20^{c}	1.46^{c}	1.44^{cd}	13.23	1:2.7
T_5	Neem oil @ 5%	50.0	2.20	2.00^{bc}	1.86^{bc}	1.93^{bc}	1.93^{bc}	1.93^{bc}	1.73^{bc}	1.33^{b}	1.60^{b}	1.55^{bc}	12.8	1:2.6
T_6	Spinosad 45% + Neem oil 5 %	0.3 + 25.0	2.26	1.66^{f}	1.46^{f}	1.53^{f}	1.55^{f}	1.53^{f}	1.33^{e}	0.80^{e}	1.13^{e}	1.08^{f}	19.49	1:3.8
T_7	Nisco sixer plus	2.0	2.26	2.13^{b}	1.93^{b}	2.00^{b}	2.02^{b}	2.00^{b}	1.80^{b}	1.40^{b}	1.66^{b}	1.62^{b}	11.12	1:2.4
T_0	Control	____	2.33	2.40^{a}	2.46^{a}	2.86^{a}	2.62^{a}	2.86^{a}	2.60^{a}	2.66^{a}	2.73^{a}	2.66^{a}	10.36	1:2.3
	F- test		NS	S	S	S	S	S	S	S	S	S		
	CD.at 0.05%		____	0.15	0.12	0.14	0.17	0.14	0.13	0.11	0.12	0.16		
	S. Ed. (±)		0.26	0.07	0.05	0.06	0.08	0.06	0.06	0.05	0.05	0.07		

DBS- Days Before Spraying, DAS- Days After Spraying

prior to insecticide application and at 3rd, 7th and 14th days after each application" [2]. The per cent infestation over control against pod borer (*H. armigera*) was calculated by considering the mean of three observations recorded at 3rd, 7th and 14th days after first and second spraying.

Please check all equation

Population reduction = (Population in control - Population in treatment/ Population in control)X 100

Ultimately, the cost benefit ratio was calculated on the basis of prevailing market price of cowpea, insecticides and spraying cost

B: C Ratio = (Gross return/Total cost of cultivation)

3. RESULTS AND DISCUSSION

The results (Table 1) after 1st and 2nd spray revealed that all the treatments were significantly superior over the control in managing the larval population of *Helicoverpaarmigera* in cowpea. The data on the larval population of *Helicoverpaarmigera* in cowpea after first spray revealed that the overall mean of 3rd, 7th and 14th lowest larval population was recorded in (T_6) Spinosad 45% + Neem oil 5% (1.55) followed by (T_3) Emamectin benzoate 10 EC (1.66), (T_1) Spinosad 45SC (1.71), (T_2) Novaluron 10EC (1.79), (T_4) *Ha*NPV (1.86), (T_5) Neem oil 5% (1.93) and (T_7) Nisco Sixer plus (2.02). The treatment (T_6) Spinosad 45% + Neem oil 5% (1.55) was most effective among all the treatments, and is significantly superior over the control plot (T_0) (2.62) infestation.

Among all the treatments the overall mean of 3rd, 7th and 14th lowest larval population of *Helicoverpaarmigera* after second spray was recorded in (T_6) Spinosad 45% + Neem oil 5%, (1.08) followed by (T_3) Emamectin benzoate 10 EC (1.19), (T_1) Spinosad 45SC (1.24), (T_2) Novaluron 10EC (1.35), (T_4) *Ha*NPV (1.44), (T_5) Neem oil 5%, (1.55) and (T_7)Nisco Sixer plus (1.62). The treatment (T_6) Spinosad 45% + Neem oil 5%, (1.08) was most effective among all the treatments, and is significantly superior over the control plot (T_0) (2.66) infestation [4].

The crop yield and cost benefit ratio ranged between (10.36 q/ha to 19.49 q/h), (1:2.3 to 1:3.8) the highest being in Spinosad 45% + Neem oil 5%, (19.49 q/ha) followed by Emamectin benzoate 10EC (17.68 q/ha), Spinosad 45SC (16.01 q/ha), Novaluron 10EC(14.74 q/ha), *Ha*NPV (13.23 q/ha), Neem oil 5%, (12.08 q/ha) and Nisco Sixer plus (11.12 q/ha) were least effective among all the treatments Control plot (10.36 q/ha) yield [5,6].

Among all the treatments, Spinosad 45% + Neem oil 5% was found to be most effective in managing the larval population on cowpea. The values obtained in the first and second spray were (1.55 %) and (1.08 %). These results are supported by Kumar and Kumar [7].Emamectin benzoate 10EC was also found to be very effective in reducing the larval population. The same results were observed by Narayan et al. [8], Yadav et al. [9] and Santhosh and Kumar [10]. Who reported that application of Emamectin benzoate 10EC reduced the larval population and recorded the lowest percentage. Where the observations of first and second sprays obtained were (1.66 %) and (1.19 %) infestation over control. The efficacy of Spinosad 45SC on larval population in first and second spray are (1.71 %) and (1.24 %) respectively. These results are as per the findings of Chandar et al. [11], Upadhyay et al. [12] and Jagtap et al. [13].

Maximum cost benefit ratio (1:3.8) was obtained in Spinosad 45% + Neem oil 5% which was supported by Kumar and Kumar [7]. who reported that the Spinosad 45% + Neem oil 5% recorded the high yield. The cost benefit ratio of Emamectin benzoate 10 EC was (1:3.5) and the results were similar to the findings of Yadav et al. [14], Narayan et al. [8] and Santhosh and Kumar [10]. Spinosad 45 SC had a cost benefit ratio of (1:2.9) according to Chandar et al. [11], Upadhyay et al. [12] and Jagtap et al. [13].

4. CONCLUSION

From the present study, the results showed that (T_6) Spinosad 45% + Neem oil 5% is more effective and produced maximum yield and recorded the highest Cost-Benefit ratio compared to other treatments. While (T_3) Emamectin benzoate 10 EC, (T_1) Spinosad 45 % SC, (T_2) Novaluron 10% EC, (T_4) *Ha*NPV, (T_5) Neem oil 5% and (T_7) Nisco Sixer plus found to be least effective in managing *Helicoverpaarmigera*. Among the treatments studied, Spinosad 45% + Neem oil 5% gave the highest cost benefit ratio (1:3.8) and marketing yield (19.49 q/ha) followed by Emamectin benzoate 10 EC (1:3.5 and 17.68 q/ha), Spinosad 45 % SC (1:2.9 and 16.01 q/ha), Novaluron 10% EC (1:2.8 and 14.74 q/ha), *Ha*NPV (1:2.7 and 13.23 q/ha), Neem oil 5% (1:2.6 and 12.08 q/ha) and Nisco Sixer plus (1:2.4 and 11.12 q/ha). As such more trials are required in the future to validate the findings.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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