

Original Research Article

Studies on Efficacy of Botanicals against *Helicoverpa armigera* (Hubner) on Chickpea (*Cicer arietinum* L.)

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ABSTRACT

The present investigations entitled “Studies on population dynamics of *Helicoverpa armigera* (Hubner) on chickpea” was carried out at Students’ Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad during Rabi, 2016. All the treatments were found significantly superior over control, indoxacarb (14.5 SC) performed best among the treatments followed by Neem oil. The effectiveness of treatment determined in the terms of grain yield of chickpea obtained in different treatments revealed that the Indoxacarb @ 14.5SC, Neem seed oil @ 5ml and karanj oil @ 5ml were significantly superior over untreated control. Indoxacarb 14.5@ SC, gave maximum grain yield of chickpea in compared to other treatments as well as in managing the population of *H. armigera*. Besides Neem seed oil @ 5ml and karanj oil @ 5 ml were found the second and third most effective treatments respectively

Keywords

Gram, chickpea, botanicals, *Helicoverpa armigera*, insecticide, management, etc.

Introduction

Gram (chick pea) is the crop of tropical, subtropical and temperate region and widely grown in Uttar Pradesh, Madhya Pradesh, Punjab, Rajasthan and Maharashtra which is popularly used as a protein adjunct to starchy diets. Seeds are widely consumed as pulse and in the form of flour which is largely fed to the horse and eaten after roasting. Seeds of chick pea contain 17.1% proteins, 5.3% fats, 16.2% carbohydrates, 3.9 % fibres and 2.7% minerals. Moderate to high levels of resistance to cypermethrin and moderate resistance to endosulfan were recorded in field populations of *H. armigera*. The growing awareness of the hazards of pesticide use has created a worldwide interest in pest control agents of

plant origin that are bioactive and yet ecologically safe. Hence, the present experiment was conducted to assess the performance of Neem Seed Kernel Extract (NSKE) along with safer new molecule Flubendiamide 39.35 SC as an effective combination of oviposition inhibitor and larvicidal effect for the management of *H. armigera* on chickpea.

Pod borer *Helicoverpa armigera* Hubner (Noctuidae: Lepidoptera) is one of the major pest of gram. The pest starts its attack at early stage and become severe during maturity stage of the crop. The pest accounts for 90-95% of total damage. A single larva of *H. armigera* can damage 25-30 pods of

gram in its life time. It feeds on tender shoots and young pods. It make holes in pods and insert its half body inside the pod to eat the developing seeds. The pod borers inflict heavy crop losses from seedling to maturity and the losses reach at its peak when the pods appear. The seed yield losses due to *H. armigera* were 75-90% and in some places the losses were up to 100%. The yield loss in chickpea due to pod borer was reported as 10 to 60 per cent in normal weather conditions, while it was 50 to 100 per cent in favorable weather conditions, particularly in the state where frequent rain and cloudy weather is prevailing during the crop season. These losses can be reduced by the application of insecticides. In favorable conditions pod borer may cause 90-95 per cent of pod damage.

Materials and Methods

Field experiments were carried out during Rabi season in 2016-17 at Students' Instructional Farm (SIF), at Narendra Deva University of Agriculture and Technology, Narandra Nagar, (Kumarganj), Faizabad (U.P.) in a randomized block design with 10 treatments and three replications for evaluating the relative efficacy of SC formulations of insecticides against gram pod borer in chickpea, (*C. arietinum* L.). Chickpea cv. Pant G-186 was taken for the experiment. The size of each plot was 3.0 x 4 m² and distance from row to row and plant to plant were maintained at 30 cm and 10 cm, respectively. The crop was sown on October 20, 2016. Ten botanicals viz; NSKE @5%, Dhatura leaf extract @ 5%, Neem seed oil @5ml, Mint leaf extract @5%, Papaya leaf extract@5%, Karanj oil@5ml, Citronella oil@5ml, Garlic leaf extract@5% and indoxacarb (14.5 SC) @ 60 g a.i. ha-1 were selected for experimentation. Insecticides were sprayed on chickpea crop one time, spraying of insecticide was made

at the time of ETL with a rocker sprayer. The control plots were sprayed with water only. The spray of treatment was applied as and when infestation was reach at ETL. Gram pod borer population was recorded 1 day before spraying, 3 DAS, 7 DAS, 10 DAS, 14 DAS. (DAS=Days after spraying). The cost effectiveness was determined by working out cost benefit ratio

Per cent pod damage was worked out by using the following simple mathematical formula

$$\text{Per cent pod damage} = \frac{\text{No. of damage pods}}{\text{Total number of pods}} \times 100$$

The data so obtained were transformed to Arc sin, square root, percentage and analyzed statistically. After harvesting the crop, the data on the grain yield were recorded from each plot and analyzed statistically. The economics of the insecticidal application was calculated in context of the applicability and suitability of individual insecticidal treatments.

The net income was deducted by taking the difference between the gross income obtained by selling the produce at market price and the cost of insecticidal application. The incremental cost benefit ratio (ICBR) was calculated by dividing the additional income over control to the additional cost incurred for pest control.

Results and Discussion

Efficacy of botanicals against *H. armigera* on chickpea

All the insecticide tested against *H. armigera* were found significantly effective over untreated control out of 9 treatment evaluated the safer insecticide against *H.*

armigera, indoxacarb 14.5 SC was found most effective (0.58 larvae/plant) followed by neem seed oil 5ml (1larvea/plant) and karanj oil 5ml (1.58larvea/plant) the present finding are also according with the finding (Jayshri *et al.*, 2008) who reported that the % pod and grain damage by *H. armigera* was lowest with use of indoxacarb however these comical insecticide was notice superior over the biopesticide.

The present finding are also according with the finding (Anandhi *et al.*, 2011) who studies the among treatment, indoxacarb recorded the highest reduction of pod borer population in 1st and 2nd spray followed by spinosad. Among the plant products, the best treatment with the highest reduction of pod borer population in the first and second spray was neem seed kernel extract, followed by garlic extract.

The present finding are in contrary with the finding of (Kumar *et al.*, 2015) who reported that Among botanicals and combination of botanicals and indoxacarb spray, least number of *Maruca* webbings, minimum *Helicoverpa* larval population (18.3), *Helicoverpa* pod damage (16.3%) were recorded in Neem soap (10g) followed by indoxacarb (0.5ml) (5.7/ 10 plants) with maximum yield of 732.9 kg/ha in Pongamia soap (10g) followed by indoxacarb (0.5ml).

Effect of treatments on fruit yield of chickpea

The effectiveness of treatment determined in the terms of fruit yield of okra obtained in different treatments revealed that the Indoxacarb 14.5SC @ (24.50q/ha), Neem seed oil @5ml (23 q/ha) and karanj oil @ 5ml (22.50q/ha) were significantly superior over untreated control (18.20q/ha). Indoxacarb 14.5SL @ (24.50q/ha), gave maximum grain yield of chickpea in

compared to other treatments as well as in managing the population of *H. armigera*. Besides, Neem seed oil @5ml (23 q/ha) and karanj oil @ 5ml (22.50q/ha) were found the second and third most effective treatments respectively as compared to Citronella oil @ 5ml (21.90 q/ha), NSKE @ 50 (21.70 q/ha), Dhatura leaf extract @ 5% (21.50 q/ha), Mint leaf extract @ 5% (20.40 q/ha), Garlic leaf extract @ 5%. (19.70q/ha) and papaya leaf extract @ 5% (19q/ha). The present finding are also partial agreement with the finding of Anandhi *et al.*,(2011) who reported that the pretreatment count was made a day before the first and second sprays, whereas the post treatment counts were made on third and fifth days after each spray.

Results showed that the population reduction after spraying in all treatments were superior compared to the control. Among the treatments, indoxacarb recorded the highest reduction of pod borer population in first and second spray, followed by spinosad. Among the plant products, the best treatment with the highest reduction of pod borer population in the first and second spray was neem seed kernel extract, followed by garlic extract.

Economics of treatments

The economics of the treatments was determined to find out the cost effectiveness of various treatments in terms of cost-benefit ratio. The highest net income (Rs. 24200/ha) was found in indoxacarb @ 15.4 SC a.i./ha treated plots followed by Neem seed oil (Rs. 18300/ha) and karanj oil (Rs. 16350/ha) treated plots. Citronella oil, NSKE, Dhatura leaf extract, mint leaf extract, garlic leaf extract and papaya leaf extract was also found effective as compared to control with net income of Rs. 14050, 13250, 12450, 8050, 5250 and 2850/ha, respectively.

Table.1 Effectiveness of botanicals insecticide against *H. armigera* during Rabi 2016-17

Treat. No.	Treatments	Conc. (%)	No. Of spray	Mean number of <i>H. armigera</i> Population/5 plant				
				Pre-treatment*	Post-treatment**			
				1 DBS	3 DAS	7 DAS	10 DAS	14 DAS
T ₁	Neem seed kernel extract	5%	1	2.67 (1.77)	2.33 (1.58)	2.33 (1.58)	2.67 (1.87)	3.00 (1.58)
T ₂	Dhatura leaf extract	5%	1	3.00 (1.86)	2.33 (1.87)	2.00 (1.22)	2.33 (1.87)	2.33 (1.87)
T ₃	Neem seed oil	5ml	1	2.00 (1.56)	1.67 (1.22)	1.33 (1.22)	0.67 (1.22)	0.33 (0.71)
T ₄	Mint leaf extract	5%	1	2.33 (1.68)	2.00 (1.58)	2.33 (1.58)	2.67 (1.58)	3.00 (1.58)
T ₅	Papaya leaf extract	5%	1	3.00 (1.86)	3.33 (2.35)	4.00 (1.87)	4.00 (1.87)	4.33 (1.12)
T ₆	Karanj oil	5ml	1	2.67 (1.77)	2.33 (1.58)	2.00 (1.86)	1.33 (1.58)	0.67 (0.71)
T ₇	Citronella oil	5ml	1	2.33 (1.68)	2.00 (1.87)	1.67 (1.22)	1.33 (1.22)	2.00 (1.87)
T ₈	Garlic leaf extract	5%	1	2.67 (1.76)	2.33 (1.87)	2.67 (1.58)	3.33 (1.58)	3.67 (2.35)
T ₉	Indoxacarb	14.5SC	1	3.33 (1.95)	1.67 (1.22)	0.67 (1.22)	0 (0.71)	0 (0.71)
T ₁₀	Untreated(control)	-	-	2.33 (1.64)	3.00 (2.35)	4.67 (2.35)	5 (1.87)	5.67 (2.12)
	SEm±	-	-	0.15	0.16	0.14	0.18	0.15
	C.D. (0.5)	-	-	0.44	0.47	0.43	0.54	0.44
	C.V (%)	-	-	14.8	16.6	15.1	19.8	15.5

* Pre-treatment: 1 Day before spray (DBS)

** Post treatment: Day after spray (DAS)

Day of spraying: 02/02/2017

Figures in the parentheses are $\sqrt{X + 0.5}$ transformed values

Table.2 Effect of botanicals insecticides on seed yield of chickpea variety

Treat. No.	Treatments	Conc. (%)	Yield	
			Kg/plot	Q/ha
T ₁	Neem seed kernel extract	5%	4.34	21.70
T ₂	Dhatura leaf extract	5%	4.30	21.50
T ₃	Neem seed oil	5ml	4.60	23.00
T ₄	Mint leaf extract	5%	4.08	20.40
T ₅	Papaya leaf extract	5%	3.80	19.00
T ₆	Karanj oil	5ml	4.50	22.50
T ₇	Citronella oil	5ml	4.38	21.90
T ₈	Garlic leaf extract	5%	3.94	19.70
T ₉	Indoxacarb	14.5SC	4.90	24.50
T ₁₀	Untreated(control)	5%	3.64	18.20
	SEm±	-	0.06	0.32
	C.D. (0.5)	-	0.18	0.95
	C.V (%)	-	7.7	4.8

Table.3 Economics of treatments against *H. armigera* in gram crop during Rabi, 2016-2017

S. No.	Treatments	Quantity required/ha	Cost of insecticides (Rs./L)	Cost of treatments (Rs./ha)	Yield (Q/ha)	Saved yield over control	Value of saved yield (Rs./ha)	Net income (Rs./ha)	Cost: benefit
T ₁	Neem seed kernel extract	5%	550	750	21.70	3.50	14000	13250	17.66
T ₂	Dhatura leaf extract	5%	550	750	21.50	3.30	13200	12450	16.60
T ₃	Neem seed oil	5ml	700	900	23.00	4.80	19200	18300	20.33
T ₄	Mint leaf extract	5%	550	750	20.40	2.20	8800	8050	10.73
T ₅	Papaya leaf extract	5%	550	750	19.00	0.80	3200	2850	3.27
T ₆	Karanj oil	5ml	650	850	22.50	4.30	17200	16350	19.23
T ₇	Citronella oil	5ml	550	750	21.90	3.70	14800	14050	18.73
T ₈	Garlic leaf extract	5%	550	750	19.70	1.50	6000	5250	7.00
T ₉	Indoxacarb	14.5 SC	800	1000	24.50	6.30	25200	24200	24.20
T ₁₀	Untreated(control)	-	-	-	18.20				

*Labour charges= 150/day (labour required 3/ha for spraying)

**Sprayer rent= 50/day

***Price of mungbean yield= Rs. 4000/q

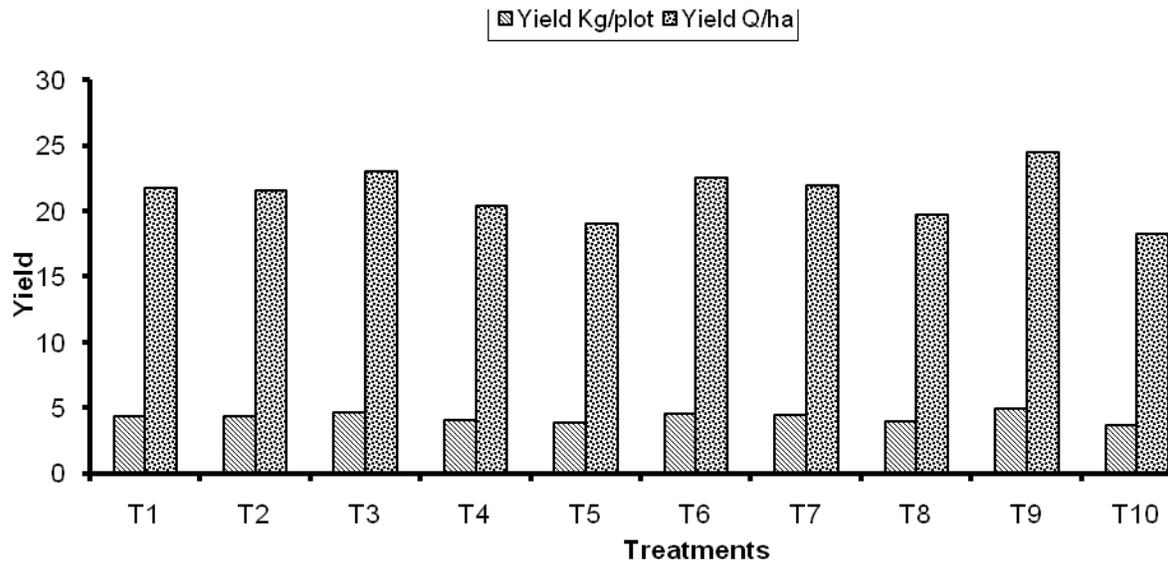


Fig.-2: Effect of botanical insecticides on seed yield of chickpea var

The highest cost : benefit (1:24.20) was found in indoxacarb @15.5 SC treated plots followed by Neem seed oil (1:20.33) and karanj oil @ 5ml (1:19.23), Citronella oil, NSKE, Dhatura leaf extract, mint leaf extract, garlic leaf extract and papaya leaf

extract was also found effective as well as economical with cost : benefit 1:18.73, 1:17.66, 1:16.60, 1:10.73, 1:7, and 1: 3.27 respectively. The economics of the treatments taken in the present study has not been worked out by the other workers and

hence the results could not be compared. The present findings are also in partial agreement with the findings of Anandhi *et al.*, (2011) who reported that a cost benefit ratio was recorded in indoxacarb and proved to be effective among the treatments. However, quinalphos recorded second highest cost benefit ratio due to the low cost of insecticide, followed by emamectin benzoate, spinosad, NSKE, garlic extract and pongamia leaf extract.

All the treatments were found significantly superior over control, indoxacarb (14.5 SC) performed best among the treatments followed by Neem seed oil @ 5ml, citronella oil @ 5ml, mint leaf extract @ 5%, karang oil @ 5 ml, Neem seed karnal extract @ 5%, Dharura leaf extract @ 5%, garlic leaf extract 5%, and papaya leaf extract 5%. The effectiveness of treatment determined in the terms of grain yield of chickpea obtained in different treatments revealed that the Indoxacarb 14.5SC @ (24.50q/ha), Neem seed oil @ 5ml (23 q/ha) and karanj oil @ 5ml (22.50q/ha) were significantly superior over untreated control (18.20q/ha). Indoxacarb 14.5SC @ (24.50q/ha), gave maximum grain yield of chickpea in compared to other treatments as well as in managing the population of *H. armigera*. Besides, Neem seed oil @ 5ml (23 q/ha) and karanj oil @ 5ml (22.50q/ha) were found the second and third most effective treatments respectively as compared to Citronella oil @ 5ml (21.90 q/ha), NSKE @ 50% (21.70 q/ha), Dhatura leaf extract @ 5% (21.50 q/ha), Mint leaf extract @ 5% (20.40 q/ha), Garlic leaf extract @ 5%. (19.70q/ha) and papaya leaf extract @ 5% (19q/ha). Although the maximum net income of Rs. 24200/ha was obtained in indoxacarb @ 14.5 SC (24200q/ha). Treated plot followed by Neem seed oil @ 5ml/ha (Rs. 18300/ha). The maximum Cost: Benefit ratio was obtained

in plot treated with indoxacarb @ 14.5 SC (1:24.20) followed by Neem seed oil @ 5ml/ha (1:20.33).

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