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Efficacy of Ecofriendly Technological Intervention on Management of Pod Borer (*Helicoverpa armigera*) in Chickpea at Farmer's Field

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Abstract

Chickpea is generally grown under *rabi* season during October-March in Punjab state. Light to medium textured soils are best for crop growth. Chickpea can be sown on both areas including low-rainfall and irrigated but gives better results under irrigated conditions. Pod borer, *Helicoverpa armigera* is the most serious pest of chickpea whose larvae damage the crop by feeding on all aerial parts of plant including pods and grains inside pods. On-farm trials on chickpea variety, PBG 7 were conducted on 10 acres area by Krishi Vigyan Kendra, S.A.S. Nagar in district during *rabi* season 2022. The effectiveness of three treatments viz T1 Farmer practices, T2 Spray Chlorantraniliprole 18.5 SC @ 50ml in 100 L of water per acre, T3 Spray of Agniastra @ 3 L in 100 L of water/acre were observed at farmer's field. The results showed that the highest yield of chickpea (19.01 q/ha) was noticed in T2 followed by T3 (18.21 q/ha) whereas T1 recorded lowest yield (17.04 q/ha). The benefit cost ratio in T2 (2.35) and T3 (2.17) was found to be maximum as compared to control (2.05). On seventh day after spray, the effectiveness of all the treatments was recorded maximum whereas it decreased with the passage of time. Based on the research, the farmers are suggested to adopt natural and eco-friendly insecticides for management of pod borer due to minimal difference between B:C ratio of T2 and T3. Moreover, such techniques build up sound environment for our society.

Key words : *Agniastra, chickpea, chlorantraniliprole, ecofriendly, efficacy, Helicoverpa armigera, pod borer, Punjab.*

Introduction

In Punjab state of India, chickpea, *Cicer arietinum* (Family Leguminosae) is the major *rabi* pulse crop (1). The crop was grown on 1.8 thousand hectares area where its production and average yield was recorded 2.2 thousand tonnes and 13.17 quintals per hectare, respectively during 2021-22 (2). Gram pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is the major pest of chickpea crop (3, 4). The insect is highly polyphagous in nature. One of the key reasons for its incidence on chickpea crop is the availability of various alternate hosts and its cultivation in different agro-climatic zones (5, 6). The larvae impair the gram crop by feeding on aerial plant parts especially on pods. At the time of pod appearance, these losses reached at its peak level (7, 8). The first half of the pod borer larva was inside the pod during feeding while the rest body part was hanging outside. The larva move to the next pod after eating the grain content of the attacked pod. Under normal weather conditions, the yield losses in chickpea were recorded 10 to 60 per cent whereas in case of frequent rain and cloudy weather during cropping season, the losses reach upto 50 to 100 per cent (9, 10).

Farmers usually choose synthetic insecticides for management of this pest due to their availability, ease in application and quick results but excessive and injudicious use of such insecticides results into development of insecticidal resistance in the target pest and environmental pollution. Earlier researches were conducted on efficacy of microbial pesticides and botanicals for management of pod borer (11). In addition, the aim of this study is to develop an ecologically sound concept by using natural farming tactics for control of *H. armigera*. The present research assesses the relative efficacy of natural insecticide against pod borer in chickpea. Such ecofriendly insecticides are beneficial for human health and environment as well.

Materials and Methods

Seed of chickpea variety PBG 7 was procured from the Punjab Agricultural University, Ludhiana, Punjab, India. Research trials were conducted on chickpea crop at farmer's field of block Majri, SAS. Nagar during *rabi* season (October 2021 to April 2022) in ten plots/locations. The crop was sown on 25th October, 2021 with seed rate @ 15 kg per acre. The row-to-row distance was maintained at 30 cm and seed was sown at depth 10-12.5 cm. There were 10 rows in each plot and 10 plants in each row i.e. 100 plants per plot. The experiment involved three treatments and three replications under each treatment 1) T1: Mixing of unrecommended insecticides (Farmer's

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Table-1 : Mean yield parameters of chickpea crop during 2021-22.

Treatments	Yield (q/h)	Gross Return (Rs./h)	Total Cost of cultivation (Rs./h)	Net Return (Rs./h)	B:C Ratio
T_1	17.04[b]	89119	43476	45643	2.05
T_2	19.01[a]	99422	42314	57108	2.35
T_3	18.21[a]	90426	41670	48756	2.17

(=0.05); Value with same letter in a column not significantly different at =0.05 by SPSS analysis.

Table-2 : Effect of different treatments on pod borer population during 2021-22.

Treatments	Number of borers per 5 plants							
	Before spray	3DAS	7 DAS	14 DAS	Before spray	3DAS	7 DAS	14 DAS
T_1	0.66	0.45	0.29	0.41	0.41	0.33	0.25	0.29
	(1.08)	(0.97)	(0.89)	(0.95)	(0.95)	(0.91)	(0.87)	(0.89)
T_2	0.62	0.33	0.08	0.20	0.20	0.08	0.00	0.04
	(1.06)	(0.91)	(0.76)	(0.84)	(0.84)	(0.76)	(0.71)	(0.73)
T_3	0.58	0.37	0.12	0.29	0.29	0.16	0.04	0.12
	(1.04)	(0.93)	(0.79)	(0.89)	(0.89)	(0.81)	(0.73)	(0.79)

(=0.05); Values in parenthesis are DAS = Days After Spray.

practice), T2: Spray Chlorantraniliprole 18.5 SC @ 50ml in 100 L of water per acre, T3 Spray of Agniastra @ 3 L in 100 L of water/Acre. The crop yield and benefit cost ratio (B:C) was also worked out separately during April 2022.

For preparation of Agniastra, take 20 litres of desi cow urine. Add 5kg crushed neem leaves, 0.5 kg tobacco powder, 0.5 kg crushed green chillies and 0.5 kg crushed garlic. Boil all the material in cow urine. Allow the material to cool for 48 hrs after boiling. Filter the liquid with muslin cloth and keep under dry and shady place (12).

To evaluate effect of different treatments on pod borer population, observations were recorded from 10 locations (five plants selected randomly at each location). All the insecticides under study were applied as foliar spray using Knapsack sprayer. Two sprays were performed on chickpea crop (first at pod initiation stage, second at 15 days of first spray) to work out efficacy of treatments. Initial observations on larval population were recorded 24 hr before spray while rest observations were taken third, seventh and fourteenth day after spray application.

The data on crop yield and pod borer population were analyzed with randomized complete block design (RCBD) by using statistical software SPSS (13). Square root transformation v(x +0.5) was applied on pod borer population data and data analysis was performed with SPSS.

Results and Discussion

The highest average yield was observed in T2 (19.01q/h) followed by T3 (18.21q/h) which were statistically at par with each other (Table-1). The yield in both the treatments was considerably higher than the average yield of T1 plots (17.04 q/ha). The yield recorded in present studies is higher than earlier research on conducted control of chickpea pod borer by (14) with application of microbial pesticides and botanicals. Yield data revealed that the treatments *Bacillus thuringiensis* var. *kurstaki* recorded highest yield of 12.94 q/h followed by Azadirachtin, *Metarrhizium anisopliae*, HaNPV and *Beauveria bassiana* which resulted 11.83, 10.82, 10.05 and 9.6q/ha and were statistically at par with each other except treatment with water spray. In present findings, the maximum net returns (57108 and 48756 Rs./ha) and B:C ratio (2.35 and 2.17) were observed in T2 and T3 followed by T1 (45643 Rs./h and 2.05). Thus, farmers can adopt T3 treatment which is economic, cost effective and ecofriendly.

Efficacy of different treatments on pod borer population were presented in Table-2. In the experimental field, 24 hours before first spray, the larval population was statistical significant among all the treatments and it was above the economic threshold level. on 14th day after second spray, the pod borer population was found statistically different in all the treatments. The lowest larval population (0.04) was observed in T2 followed by T3 (0.12) whereas maximum larval count was noticed under T1 (0.29). These findings do not corroborate with the earlier findings by (14) who reported that the pod borer population was statistically at par (0.00-0.03) after 14 days of second spray after using microbial pesticides and botanicals except treatment with water spray (0.25). The present findings also confirm the results of (15) who tested ecofriendly biopesticide, neem seed kernel extract (5%) and reported its high efficiency in reducing the larval population and pod damage of *H. armigera*.

The lowest pod borer population was noticed on 7th day after insecticide spray in each treatment. The same trend was followed by (16) who conducted research at

Krishi Vigyan Kendra, Gangavathi University of Agricultural Sciences, Raichur and reported the efficacy of different insecticides against larval population of pod borer.

Due to hazardous effects of synthetic insecticides to the human health, environment and non-target organisms, use of ecofriendly insecticides is a viable and cost-effective option to check chickpea pod borer population. Moreover, the major ingredients of agniastra such as neem trees, green chillies and garlic are easily available in Punjab region. The insecticides can be easily prepared by farmers at their homes or farms.

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