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Efficacy of insecticide and bio pesticides against *Helicoverpa armigera* (Hubner) on chickpea in Western Uttar Pradesh

Spoorthi GS, Rajendra Singh, Ritesh Sharma, Amit, Sudhir Kumar, Nirvesh Singht and SS Tomar

Abstract
A field experiment was conducted on *Helicoverpa armigera* (Hubner) in chickpea during *Rabi*, 2016- 17 at B.E.D.F. (Research Farm)/APEDA, S.V.P.U.A & T, Meerut,-250 110 (U. P.) *H. armigera* is a major pest of chickpea and weather factors are the major regulating causes for the insect pest population under field conditions. Among all the treatments the minimum pod infestation was 4.78 per cent recorded with Methomyl 40% SP@ 1.6g/l., treatment which was significantly superior from the rest of the treatment, the maximum grain yield of 22. 45 q/ha was recorded with Methomyl 40% SP@ 1.6g/l with highest cost benefit ratio. Among the bio pesticides treatments, *Ha* NPV $2x10^9$pob/ml @ 250 LE/ha was recorded with highest grain yield as 19.01 q/ha with highest cost benefit ratio of 1:14.15

Keywords: Efficacy, Novel insecticides, Bio-pesticides, Helicoverpa armigera

Introduction

Chickpea *Cicer arietinum* (L.) is an important pulse crop of India, commonly known as 'Chickpea' or Chana, Bengal gram, Gram, belongs to leguminosae family. Chickpea originated from south western Asia, which has been considered as 'King of Pulses'. Itis generally grown under rainfed or residual soil moisture conditions in *Rabi* season and the plant grows to 20-50 cm height and has small, feathery leaves on either side of the stem. Chickpeas are nutrient-dense food. It contains 25% proteins, which is the maximum provided by any pulse and 61.1% carbohydrates (Singh and Yadav 2007) [1]. In India chickpea occupies 9.93 million ha with a production of 9.53 million tons, accounting for 30.9% and 39.9% of total pulse area and production respectively. In Uttar Pradesh the area, production, productivity of chickpea is 557 thousand ha, 475.5 thousand tons, 824kg/ha respectively and it is lower than other states (Anonymous, 2013-14) [2]. The production of cereals has increased manifold in the recent past but that of pulses has remained more or less static. Various factors responsible for low production and productivity of pulses due to poor genetic base, weeds, diseases but insect pests are major. Insect pests are probably the main factor limiting the legume production. More than 150 species of insect pests are known to attack pulse crops in India. Among these, about 25 species cause serious damage to pulse crops grown in monsoon and winter (Bindra, 1968). Out of them, gram pod borer, *Helicoverpa armigera* (Hubner), Hardwick (Lepidoptera: Noctuidae) is one of the most devastating crop pest worldwide (Fitt, 1989; Sigsgaard *et al.*, 2002) [4, 5]. In western Uttar Pradesh, in addition to other insect pests, the gram pod borer *Helicoverpa. armigera* seriously damages the crop during fruiting stage and is considered to be a major limiting factor for the production of chickpea. A single larva may destroy several pods before reaching to maturity and this pest is reported to damage 5 to 40 per cent pods of chickpea crop during different year (Chaudhary *et al*., 1982 and Chauhan, 1992.) [6, 7] To control *H. armigera* and its wide existing population, many methods are being applied that include insecticides, biological control, pheromones, and host plant resistance, mechanical and genetically modified crops. The above methods of control can be successful after careful studies of different biological parameters of this injurious pest in the laboratory. Effects of insecticides and radiations on fecundity and growth and its own biology. Bio pesticides are now emerging as a valuable component of IPM strategies in all crops due to their efficacy to insect pests and safety to their natural enemies and they are become promising tool against insect pests by offering many advantages compared to insecticides such as host specific, non-toxic to mammals and beneficial organisms, less prone to insect resistance, readily biodegradable and less expensive.

Materials and Methods

The present investigation on "Biology and management of *Helicoverpa armigera* (Hubner) in chickpea in Western U.P" was carried out during *Rabi*, 2016-2017. The field experiment was conducted at Basmati Export Development Foundation (BEDF), Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.), India.

Treatments and design of layout

The experiment was conducted in a Randomized Block Design (R.B.D) with three replications, each containing seven treatments.

Treatments details

A field trial was conducted to study on the efficacy of bio-pesticide for the control of gram pod borers *Helicoverpa armigera*. All the insecticides and bio-pesticides under study were applied as foliar spray using Knapsack sprayer. To determine the efficacy of chemicals, two sprays of insecticides on chickpea crop was done. First spray at pod initiation stage and second spray after fifteen days.

Preparation of spray solution

The spray solution was prepared by using the following formula-

$$\text{Amount of Insecticidal Formulation} = \frac{\text{Concentration required}(\%) \text{ X Volume required(litter)}}{\text{Concentration of Toxicant in Insecticidal Formulation}}$$

Details of treatments and their dose:

T_1 *Bacillus thuringiensis* var. *Kurstaki* (Biolep) 0.1% @ 1.5 g/l of wáter, T_2 Neemoil (Neemolin) 1500 ppm@ 2ml/l. of wáter T_3 *Beauveria bassiana*, 2 X 10^9 cfu/g 2 g/l @ 1.6g/l of water of wáter, T_4 *Metarhizium anisopliae* 2 X 10^9 cfu/g 2 g/l of wáter, T_5 Methomyl (Lannate) 40SP T_6 *Ha*NPV 2 X 10^9 pob/ml @ 250 LE/ha and T_6 Control.

Observations on seasonal incidence of *H. armigera*

Larval population of *H. armigera* present on the chickpea was recorded in the morning hours at weekly intervals and started from 15 days after sowing (DAS) to harvest of crop. The populations of larvae were recorded separately on randomly selected 10 plants from control plots.

Relationship between number of larvae and meteorological variables was worked out using simple correlation analysis. Simple correlation coefficient analysis was done using the following formula-

$$^{r}X_1Y_1 = \frac{\sum XY - \frac{(\sum X_1)(\sum Y_1)}{N}}{\sqrt{[\sum X_1^{\,2} - \frac{(\sum X_1)^2}{n}][\sum Y_1^{\,2} \frac{(\sum Y_1)^2}{n}]}}$$

Where,

$^{r}X_1Y_1$ = Simple correlation coefficient

X_1 = Number of larvae

Y_1 = Meteorological parameter

n = Number of observation

Efficacy of bio-pesticides

In order to take decision regarding application of treatments regular weekly monitoring was done to record initiation of flower bud/pod formation in the experimental field. Data on healthy and damaged pods of 10 plants from each plot were also recorded and percent damaged pods ***and per cent loss in yield*** were calculated before statistical analysis by using following formula.

$$\text{Percent infested pod} = \frac{\text{Number of infested pods}}{\text{Total number of pods}} \text{X } 100$$

The data recorded were subjected to logarithmic transformation before statistical analysis. Since most of the values were small (less than 10) hence the values were changed with Log (X +1) where X is the original data.

Yield of grain per plot was converted into per hectare before statistical analysis andeconomics of different treatments was also calculated.

Cost: benefit ratio

Increase in yield over control was worked out by deducting the yield recorded in control plot from the yield of the respective treated plots. The monetary value of increased yield was computed in rupees using local market price of chickpea. A comparison of cost involved in different treatments was also done on the basis of the maximum retail price printed on the smallest pack. Net return for each treatment was calculated by deducting the cost of treatment from the monetary value of increased yield. Cost: benefit ratio, net return per rupees invested was calculated by using the following formula.

Statistical analysis

The data recorded during the course of investigation was subjected to statistical analysis by using analysis of variance technique (ANOVA) for Randomized Block Design as suggested by Panse and Sukhatme (1961). The data were transformed necessarily as and when required.

Experimental finding:

I. Efficacy of bio pesticides against *H. armigera* (Hubner) following first spray.

i. Pod infestation at one day before first spray.

The pod infestation one day before imposition of treatment was almost uniform in all the treatments as indicate by the non-significant difference among the different treatment (Table-1) and (Fig:1). The mean per cent pod infestation by *H. armigera* larvae ranged from 4.42 to 5.00 per cent.

ii. Pod infestation at one day after first spray.

One day after spray, pod damage in different treatments were significantly differences among the different treatments and it is shown in (Table-1) and (Fig.1).The lowest pod infestation (3%) was recorded in the plots treated with Methomyl 40% SP, 1.6 g/l. of water followed by*Ha*NPV 2x10^9pob/ml @ 250 LE/ha,*Bacillus thuringiensis* 0.1% @1.5 g/l, neem oil 1500 ppm @ 2 ml/l,*Beauveria bassiana* 2x10^9 cfu/g @ 2 g/land *Metarhizium anisopliae* 2x10^9 cfu/g @ 2 g/l, with 3.15, 3.17, 3.18, 4 and 4.15 per cent respectively. Highest mean pod infestation recorded in control with 6%.

iii. Pod infestation at fifth days after first spray.

Five days after first spray, the pod damage significantly differ

among the different treatments. The obtained data have been presented in (Table-1) and (Fig.1). All the treatments during cropping season 2016-17 were found statistically superior to the untreated control in minimizing the pod infestation caused by *H. armigera* larvae. The least mean pod infestation of 3.23 per cent was observed in Methomyl 40% SP @ 1.6 g/l treated plots and it was found best treatment among all the treatments. And followed by *Ha*NPV 2x10^9 pob/ml @ 250 LE/ha, *Bacillus thuringiensis* 0.1% @1.5 g/land neem oil 1500 ppm @ 2 ml/l, which recorded with 3.51, 3.81 and 4.4 per cent pod infestation, respectively and were statistically at par in minimizing the pod infestation with the best treatment *i.e.* Methomyl 40% SP @ 1.6g/l. Result of *B. bassiana* 2x10^9 cfu/g @ 2 g/l, *M. anisopliae* 2x10^9 cfu/g @ 2 g/l, was recorded 5.21 and 5.38 respectively for decreasing the pod infestation per cent. The maximum infestation of 6.54 per cent was recorded in untreated control.

iv. Pod infestation at tenth days after first spray

After ten days of first spray the minimum pod infestation 3.56 per cent was recorded with Methomyl 40% SP @ 1.6 g/l. treatment which was significantly superior form the rest of the treatment and was statistically at par with *Ha*NPV 2x10^{9}pob/ml @ 250 LE/ha, *Bacillus thuringiensis* 0.1% @1.5 g/l were recorded with 3.96, 4.22 and 4.00 per cent pod infestation respectively, and were statistically at par in minimizing the pod infestation with the best treatment *i.e* Methomyl 40% SP @ 1.6g/l. The pod infestation 4.55, 5.36 and 5.99 per cent was found with neem oil 1500 ppm @ 2 ml/l, *Beauveria bassiana* 2x10^9 cfu/g @ 2 g/l, *Metarhizium anisopliae* 2x10^9 cfu/g @ 2g/l respectively all the treatments were statistically superior to the untreated control in minimizing the pod infestation caused by *H. armigera* larvae. The data have been presented in (Table-.1) and (Fig1).

v. Pod infestation at fifteenth days after first spray

Observation was recorded in various treatments on the pod damage by *Helicoverpa* larvae after fifteen days of first spray presented in (Table-1) and (Fig-1).All the treatments were found significantly superior as compare to untreated control in minimizing the pod infestation caused by *H. armigera* larvae. The minimum pod infestation was obtained in Methomyl 40% SP @ 1.6 g/l. (4.78 per cent) followed by *Ha*NPV 250 LE/ha(4.89) and *Bacillus thuringiensis* (4.98) and were statistically at par. The other treatments *i.e.*, neem oil 1500 ppm @ 2 ml/l,*Beauveria bassiana* 2x10^9 cfu/g @ 2 g/l, *Metarhizium anisopliae* 2x10^9 cfu/g @ 2g/l and control with 5.12, 5.98, 6.21 and 8.16 per cent pod infestation respectively.

II. Following second spray.

i. Pod infestation at one day after second spray.

One day after spray, pod damage in different treatments were significantly differences among the different treatments and it is shown in (Table-2) and (Fig.2). The lowest pod infestation (2.47%) was recorded in the plots treated with Methomyl 40% SP, 1.6g/l. of water followed by *Ha*NPV 2x10^9 pob/ml @ 250 LE/ha, *B thuringiensis* 0.1% @1.5 g/l, neem oil 1500 ppm @ 2 ml/l, *B. bassiana* 2x10^9 cfu/g @ 2g/l and *M anisopliae* 2x10^9 cfu/g @ 2g/l, with 3.15, 4.23, 4.35, 4.50 and 5.85 per cent respectively. Highest mean pod infestation recorded in control with 8.55%.

ii. Pod infestation at fifth days after second spray

Observations on pod infestation were recorded 5th day after the spray; bio pesticides significantly reduce the pod borer *H. armigera* infestation as compare to untreated control. According to data observation after five days of second spray the minimum pod infestation of 3.65 per cent was recorded in Methomyl 40% SP @ 1.6 g/l treated plots followed by *Ha*NPV 2x10^9 pob/ml @ 250 LE/ha, *Bacillus thuringiensis*0.1% @1.5 g/l. Which recorded 3.98 and 4.18 per cent pod infestation, respectively and were statistically at par in minimizing the pod infestation with the best treatment. The treatments with neem oil 1500 ppm @ 2 ml/l, *B. bassiana* 2x10^9 cfu/g @ 2 g/l, *M. anisopliae* 2x10^9 cfu/g @ 2 g/l was found with 4.98, 5.65 and 6.28 per cent pod infestation, respectively. All the treatments were found statistically superior to the untreated control in minimizing the pod infestation caused by *H. armigera* larvae. The data has been presented in (Table-2) and (Fig.2).

iii. Pod infestation at tenth days after second spray

Result for percent infestation of pod after ten days of second spray indicated that treated plot had minimum infestation showed in (Table-2) and (Fig.2). This was a result of minimum pod infestation which shows that Methomyl 40% SP @ 1.6g/lit, was more effective than the other treatments while the maximum infestation of 11.00 per cent in untreated control. The other treatment to follow was *Ha*NPV 2x10^9 pob/ml @ 250 LE/ha recorded 4.25 was statistically at par in minimizing the pod infestation with the best treatment i.e. Methomyl 40% SP @ 1.6g/l with 3.81. The pod infestation was statistically similar in *Bacillus thuringiensis* 0.1% @1.5 g/land neem oil 1500 ppm @ 2 ml/l, which recorded with, 4.73 and 5.51 per cent respectively. The pod infestation of 6.55 and 76.96 percent was recorded with*Beauveria bassiana* 2x10^9 cfu/g @ 2 g/l*Metarhizium anisopliae*2x10^{9}cfu/g @ 2 g/l, respectively. All the treatments were found statistically superior to the untreated control in minimizing the pod infestation.

iii. Pod infestation at fifteenth days after second spray

Among all the treatment Methomyl 40% SP @ 1.6 g/l was found most effective treatment with respect to reduction of mean per cent infestation of pods 3.67 after fifteen days of second spray showed in (Table-2) and (Fig.2). In comparison to maximum infestation of 10.89 percent in untreated control. The other treatments followed by *Ha*NPV 2x10^9 pob/ml @ 250 LE/ha, recorded with 4.10 percent pod infestation by *Helicoverpa armigera* and was statistically minimizing the pod infestation with the best treatment *i.e* Methomyl 40% SP @ 1.6 g/l. Among the treatments *Bacillus thuringiensis* 0.1% @1.5 g/land neem oil 1500 ppm @ 2 ml/l, which were recorded with 4.51 and 5.28 percent pod infestation, respectively. *Beauveria bassiana* 2x10^9 cfu/g @ 2 g/l,*Metarhizium anisopliae* 2x10^9 cfu/g @ 2 g/l, was not much effective to decrease the pod infestation of 6.23 and 6.54 percent was recorded respectively. All the treatments were found effective and significantly superior in comparison to untreated in minimizing the pod infestation. The data has been presented in (Table-2 and Fig.2).

Effect of different treatments on grain yield.

The data recorded on the grain yield after application of different treatments are revealed that the maximum grain yield of 22.45 q/ha was recorded with Methomyl 40% SP @ 1.6 g/l. Among the bio pesticides treatments, *Ha*NPV @ 250 LE/hawas recorded with highest grain yield as 19.01 q/ha. This was followed by *Bacillus thuringiensis* var. *kurstaki* @ 1.5 g/l, 18.98q/ha, Neemoil @ 2 ml/l and *Beauveria bassiana*

@ 2 g/l with grain yield of 16.75, and 15.12 q/ha, respectively. The lowest gain yield of 14.58 q/hawas obtained from *Metarhizium anisopliae* @ 2 g/l among the treated plots. However, the lowest grain yield of 9.35 q/ha was recorded with untreated control. The data have been presented in (Table-3 and Fig.3).

Effect of different treatments on basis of cost: benefit ratio.

Data indicated in (Table-4. The cost incurred on different treatments varied from Rs.3550/ha (Methomyl 40% SP @ 1.6 g/l) to Rs.2350 /ha (*Beauveria bassiana* @ 2 g/l and *Metarhizium anisopliae* @ 2 g/l). In other cost of treatment was Rs.3124/ha (*Bacillus thuringiensis* var. *kurstaki* @ 1.5 g/l), Rs.2574/ha (Neemoil @ 2ml/l), Rs.2870/ha (*Ha*NPV @ 250 LE/ha). Highest cost: benefit ratio obtained (1:15.61) from Methomyl 40% SP @ 1.6 g/l, followed by *Ha*NPV @ 250 LE/ha (1:14.15), *Bacillus thuringiensis* var. *kurstaki* @ 1.5 g/l (1:12.87), Neemoil @ 2 ml/l (1:11.94), *Beauveria bassiana* @ 2 g/l (1:10.05). Lowest cost: benefit ratio obtained from *Metarhizium anisopliae* @ 2 g/l (1:9.01).

Discussion

The experimental finding clearly showed that damage caused by *Helicoverpa* was significantly less in all the treatment over control. The present experimental findings are supported by **G**owda *et al.* (2005) [8] who tested five *Bacillus thuringiensis* formulations (*B.t.*), *Ha*NPV and *Beauveria bassiana* against *Helicoverpa armigera* in chickpea and results were compared with that of untreated check and endosulfan and found, highest grain yield in *Ha*NPV treated plots followed by *Bacillus thuringiensis* var. kenyae and Halt. Methomyl 40% SP @ 1.6 g/lwas significantly reduced the percentage of pod damage, is supported by Biradar *et al* (2001) [9] who reported all the treatments of methomyl 40%SP, applied alone or in combination with other insecticides against *Helicoverpa armigera* in chickpea gave higher significant yield and reduced larval population and also it is supported by Pandey and Tripathi (2016) [10]

Summery and Conclusion

All the protected treatments were found effective and significantly superior over control. Methomyl 40% SP @ 1.6 g/l treatment which was significantly superior with reducing the larval population and highest cost: benefit ratio from the rest of the treatment and *Ha*NPV 2x10^9 pob/ml @ 250 LE/ha, proved to be next effective treatment in reducing the larval population and high cost: benefit ratio followed by *Bacillus thuringiensis* 0.1% @1.5 g/l, neem oil 1500 ppm @ 2 ml/l, *Beauveria bassiana* 2x10^9 cfu/g @ 2 g/l and *Metarhizum anisoplae* 2x10^9 cfu/g @ 2 g/l.

Conclusion

Methomyl 40% SP @ 1.6 g/ltreatment which was significantly superior from the rest of the treatment with minimum larval population and pod damage, maximum grain yield and highest cost: benefit ratio, among bio pesticides *Ha*NPV 2 X 10^9/ml, 250 LE/ha proved to be best.

Table 1: Efficacy of insecticides and bio pesticides on the pod damage against *H. armigera* following first spray

Treatment no.	Treatment name	Dose	Mean pod damage (%)				
			1 DBS	1 DAS	5 DAS	10 DAS	15 DAS
T_1	*Bacillusthuringiensis*0.1%	1.5 g/l of water	4.42 (12.10)	3.17 (10.25)	3.81 (11.25)	4.00 (11.53)	4.98 (12.89)
T_2	Neemoil 1500 ppm	2 ml/l of water	5.00 (12.91)	3.18 (10.26)	4.4 (12.10)	4.55 (12.31)	5.12 (13.07)
T_3	*B. bassiana*2 X 10^9 cfu/g	2 g/l of water	4.51 (12.23)	4.00 (11.52)	5.21 (13.19)	5.36 (13.38)	5.98 (14.15)
T_4	*Metarhizium*2 X 10^9 cfu/g	2 g/l of water	4.42 (12.14)	4.15 (11.74)	5.38 (13.41)	5.99 (14.16)	6.21 (14.4)
T_5	Methomyl 40% SP	1.6g /l of water	4.90 (12.78)	3.00 (9.96)	3.23 (10.35)	3.56 (10.87)	4.78 (12.62)
T_6	*Ha*NPV 2 X 10^9 pob/ml	250 LE/ha	4.81 (12.64)	3.15 (10.21)	3.51 (10.79)	3.96 (11.47)	4.89 (12.77)
T_7	Control	-	4.72 (12.55)	6.00 (14.17)	6.54 (14.81)	6.98 (15.38)	8.16 (16.59)
SE(m)±		-	0.205	0.191	0.156	0.327	0.040
CD at 5%		-	N/A	0.595	0.487	1.020	0.124

Figures in parentheses are angular transformed value,
DBS-Day before spray,
DAS-Days after spray.

Table 2: Efficacy of different insecticide and bio pesticides on the pod damage against *H. armigera* spray

Treatment no.	Treatment name	Dose	Mean Pod damage (%)			
			1 DAS	5 DAS	10 DAS	15 DAS
T_1	*Bacillusthuringiensis*0.1%	1.5 g/l of water	4.23 (11.86)	4.18 (11.79)	4.73 (12.56)	4.51 (12.26)
T_2	Neemoil 1500 ppm	2 ml/l of wáter	4.35 (12.03)	4.98 (12.89)	5.51 (13.57)	5.28 (13.28)
T_3	*B. bassiana*2 X 10^9 cfu/g	2 g/l of wáter	4.50 (12.23)	5.65 (13.75)	6.55 (14.82)	6.23 (14.45)
T_4	*Metarhizium*2 X 10^9 cfu/g	2 g/l of wáter	5.85 (13.98)	6.28 (14.51)	6.96 (15.29)	6.54 (14.81)
T_5	Methomyl 40% SP	1.6g /l of wáter	2.47 (9.038)	3.65 (11.01)	3.81 (11.25)	3.67 (11.04)
T_6	*Ha*NPV 2 X 10^9 pob/ml	250 LE/ha	3.15	3.98	4.25	4.10

			(10.218)	(11.50)	(11.89)	(11.68)
T_7	Control	-	8.55 (16.99)	9.35 (17.80)	11.00 (19.36)	10.89 (19.26)
SE(m)± CD at 5%		-	0.220 0.684	0.092 0.286	0.213 0.665	0.136 0.424

* Figures in parentheses are angular transformed values,
DAS-Days after spray

Table 3: Effect of different treatments on the grain yield during *Rabi*, 2016-17.

Treatment No.	Treatments	Yield (q/ha)	Saved yield over control (q/ha)
T_1	*Bacillusthuringiensis*var. *kurstaki*	18.98	9.63
T_2	Neemoil 1500 ppm	16.75	7.4
T_3	*B. bassiana*2 X 10^9 cfu/gm	15.12	5.77
T_4	*Metarhizium*2 X 10^9 cfu/gm	14.58	5.23
T_5	Methomyl 40% SP	22.45	13.1
T_6	*Ha*NPV 2 X 10^9 pob/ml	19.01	9.66
T_7	Control	9.35	----

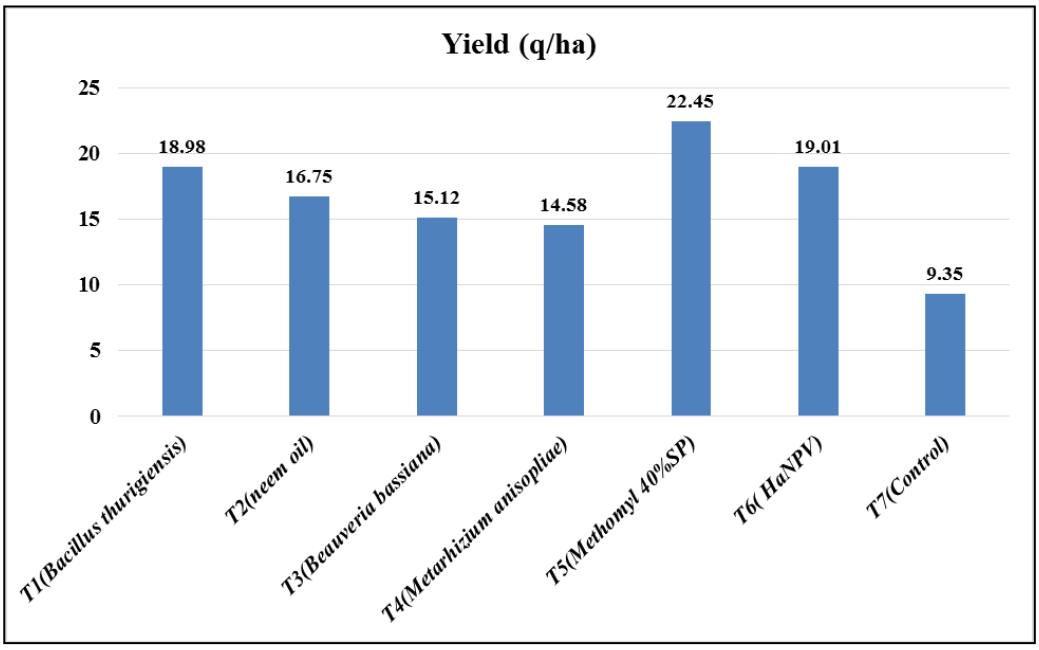

Fig 3: Effect of different treatments on the grain yield during *Rabi*, 2016-17.

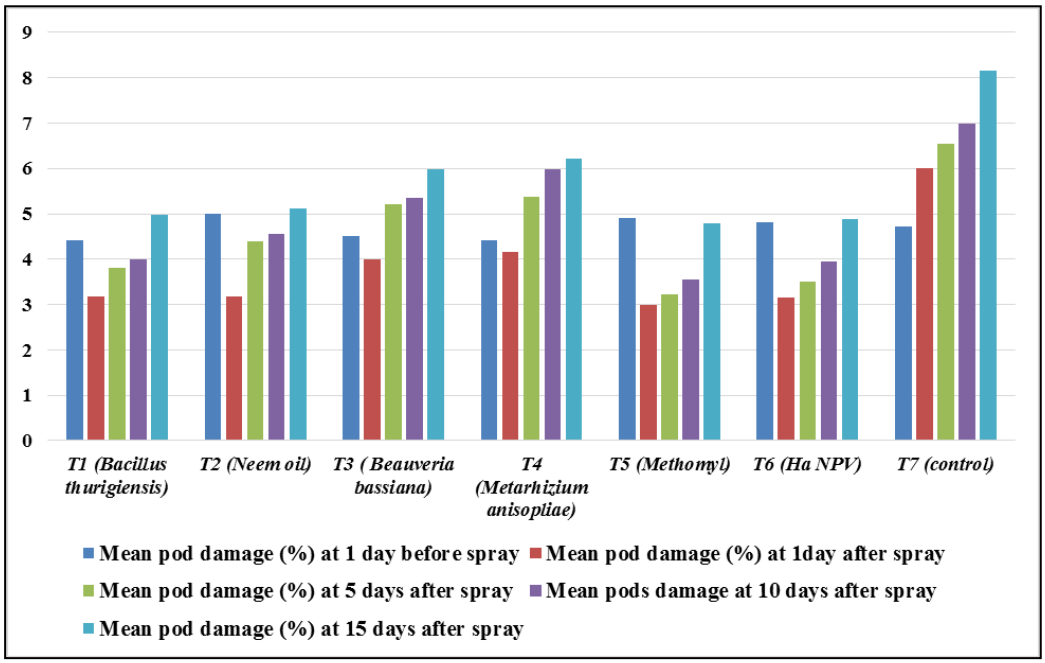

Fig 1: Efficacy of insecticides and bio pesticides on the pod damage against *H. armigera* first spray.

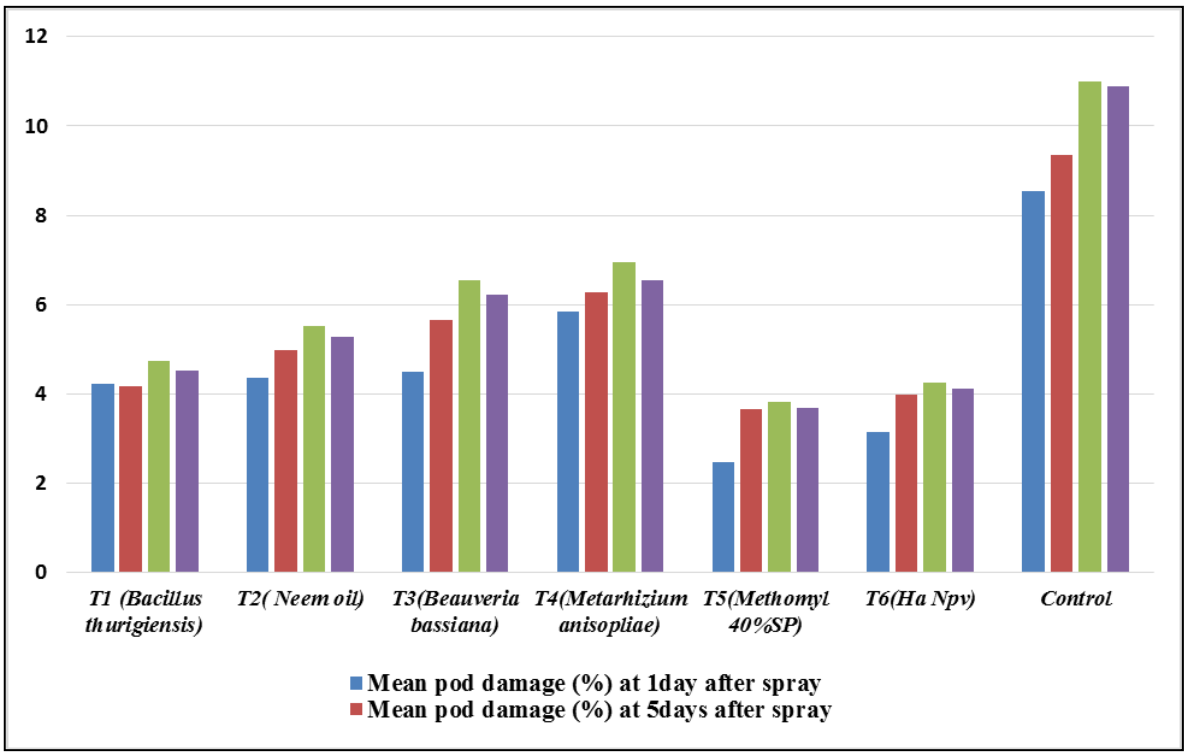

Fig 2: Efficacy of bio insectide and pesticides on the pod damage against *Helicoverpa armigera* (Hubner) following second spray.

Table 4: Cost benefit ratio of different treatments.

Treatments No.	Name of Treatments	Yield (q/ha)	Increase in yield over control (q/ha)	Value of increase yield (Rs./ha)	Cost of treatment (Rs./ha)	Net profit (Rs./ha)	Cost: benefit ratio
T_1	*B.thuringiensis*var. *kurstaki*	18.98	9.63	43,335.00	3124	40,211.00	1:12.87
T_2	Neemoil 1500 ppm	16.75	7.4	33,300.00	2574	30,726.00	1:11.94
T_3	*B. bassiana*2 X 10^9 cfu/g	15.12	5.77	25,965.00	2350	23,615.00	1:10.05
T_4	*Metarhizium*2 X 10^9 cfu/g	14.58	5.23	23,535.00	2350	21,185.00	1:9.01
T_5	Methomyl 40% SP	22.45	13.1	58,950.00	3550	55,400.00	1:15.61
T_6	*Ha*NPV 2 X 10^9 pob/ml	19.01	9.66	43,470.00	2870	40,600.00	1:14.15
T_7	Control	9.35	----	------			

Price of Chickpea @ Rs. 4500/q Labour charge @ 173/day/120 days Sprayer charges 100/day

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