

“Comparative efficacy of botanicals and chemicals against chickpea pod borer, *Helicoverpa armigera* (Hubner) on chickpea”

ABSTRACT

The present investigation was carried out at Central Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P. during *Rabi*, 2021-2022. The field was laid in Randomized Block Design (RBD) with seven treatments and one controlled plot. The mean larval population plant was taken day before and 3, 7 and 14 days after each spray. The research was conducted using insecticides like Emamectin benzoate 5 SG, Spinosad 45%SC, Neemoil 0.2%, Karanj oil 0.2%, Chlorantraniliprole 18.5 SC, Flubendiamide 480SC, Profenophos 50 EC. Among all the treatments, the lowest larval population of *Helicoverpa armigera* on Chickpea was recorded in Spinosad 45SC followed by Flubendiamide 480 SC, Emamectin Benzoate 5SG, Chlorantraniliprole 18.5 SC and Profenophos 50EC. The next effective are botanicals namely., Neem oil 0.2% and Karanj oil 0.2% was found to be least effective but comparatively superior over the control. The highest yield was recorded in Spinosad 45SC (24.3 q/ha) followed by Flubendiamide 480SC (23.1 q/ha), Emamectin benzoate 5SG (21.5 q/ha). While, the highest cost benefit ratio was observed in Flubendiamide 480SC (1:4.76) followed by Emamectin benzoate 5SG (1:4.38), Spinosad 45SC (1:4.14), Chlorantraniliprole 18.5SC (1:3.53), Profenophos 50EC (1:3.19), Neem oil 0.2% (1:2.89) and Karanj oil 0.2% (1:2.72) as compared to control (1:1.79). However, all the treatments controlled chickpea pod borer, *Helicoverpa armigera* infestation effectively as compared to untreated control.

Keywords: Chickpea, Cost benefit ratio, *Helicoverpa armigera*, Insecticides, Neem products, Population.

INTRODUCTION

Chickpea, *Cicer arietinum*, is a member of the legume, pea, or pulse family, "Fabaceae". Chickpea is the common name for an annual plant, *Cicer arietinum*, of the Fabaceae (or Leguminosae) family that is widely cultivated for its typically yellow-brown, pea like seeds. It is the only cultivated crop within the *Cicer*. Two types of chickpea cultivars are recognized globally- kabuli and desi (**Pundir *et al.*, 1985**).

Chickpea is an important *Rabi* crop mainly sown in September-November and harvested in February to April. Crop duration is 90-120 days, depending on the variety. It is best suited to areas having low to moderate rainfall and a mid-cold weather. Excessive rains soon after sowing or at flowering stage are harmful for the crop. Severe cold is injurious, and is very harmful. It is best suited to areas having moderate rainfall of 600-900 mm per annum. It has an indeterminate growth habit, which means that the growth cycle extends as long as moisture is available (**Maurya *et al.*, 2018**).

In India, chickpea accounts for about 45% of total pulses production. Similar to the case of other pulses, India is the major chickpea producing country and contributing for over 75% of total world chickpea production. The chickpea production in the country has gone up from 3.65 to 9.53 million tones between 1950-51 and 2013-14, registering a modest growth. During the period while the area has also gone up from 7.57 to 9.93 million ha, the yield has steadily increased from 482 kg/ha to 960 (**Maurya *et al.*, 2018**). Madhya Pradesh contributes highest (39%), followed by Maharashtra (14%), Rajasthan (14%), Andhra Pradesh (10%), Uttar Pradesh (7%), Karnataka (6%) and other remaining states and UTs of India (10%) to the total chickpea area and production (**Preeti *et al.*, 2021**).

Among the many biotic factors responsible for low yield, damage due to insect pests is the major limiting factor (**Bhagwat *et al.*, 1995**). Chickpea crop is attacked by nearly 57 species of insect and other arthropods in india (**Lal 1992**). Among them, pod borer *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is most important. And accounts for about 90 to 95 % of the total damage caused by all the insect pests (**Sachan and Katti. 1994**).

Chickpea faces the attack of more than 60 insect-pests right from germination to maturity. The problem of this pest is magnified due to its direct attack on fruiting structures, voracious feeding habits, high mobility and fecundity, multivoltine nature, overlapping generations, nocturnal behaviour *etc.* (**Sarode *et al.*, 1999**).

The yield loss in chickpea due to pod borer has been estimated to be 10 to 60 % under normal weather conditions and 50 to 100 % in favorable weather conditions, particularly when there are frequent rains and cloudy weather during the cropping season **(Vaishmpayam and Veda 1980)**.

MATERIALS AND METHODS

The experiment was conducted during *rabi* season of 2021-2022 in Randomized Block Design having three replications and Eight treatments with Using a variety NBEG-49(Nandyal) with 2×2m² plot size for evaluation of efficacy of certain insecticides and botanicals against pod borer *Helicoverpa armigera* in chickpea at the experimental research plot of the Department of Entomology, Central Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences. The soil of the experimental site was well drained and medium high. Research field situated at 25°27' North latitude 80°05' East longitudes and at an altitude of 98 meter above sea level the maximum temperature reaches upto 42°C in summer and drops down to 4°C in winter. Agronomical practices were followed to raise the crop. Each treatment was sprayed twice at recommended doses when larval population reaches its ETL level (3 to 5 larvae per plant).

The observation on population of *Helicoverpa armigera* were recorded visually per plant from five randomly selected and tagged plants in each plot. The insecticides were sprayed at recommended doses when larval population reaches its ETL level. Larvae count was taken 24 hours before spraying at 5 tagged plants per treatment, which was further converted into per plant population and subsequent observation was recorded at 3, 7 and 14 days after spraying on same plants.

The healthy marketable yield obtained from different treatments was collected separately and weighed. The cost of insecticides used in this experiment was recorded during *rabi* season. The cost of botanicals used was obtained from nearby market. The total cost of plant protection consisted of cost of treatment, sprayer, rent and labour charges for the spray. There are two sprays throughout the research period and the overall plant protection expenses was calculated. Total income was realized by multiplying the total yield per hectare by the prevailing market price, while the net benefit is obtained by subtracting the total cost of plant protection from the total income. Benefit over the control for each sprayed treatment was obtained by subtracting the income of the control treatment from that of each sprayed treatment.

RESULTS AND DISCUSSION

The results revealed that all the treatments were significantly effective in reducing the larval population of pod borer and thus increasing the yield significantly as compared to control.

As per the data mentioned in Table-1 after 3rd, 7th and 14th days of first spray Among all the treatments, the least mean larval population of pod borer was recorded in

Spinosad 45SC (1.18) followed by Flubendiamide 480SC (1.33) followed by Emamectin benzoate 5SG (1.38) followed by Chlorantraniliprole 18.5SC (1.58) and Profenophos 50EC (1.89). Next effective are the botanicals namely Neem oil 0.2% (2.07) which was followed by Karanj oil 0.2% (2.15) and was found to be least effective but superior over control (4.29). The treatment T2 (1.18) was at par with T6 (1.33) which was also at par T1(1.38) and T5 (1.8). The treatment T3 (2.07) was at par with T4 (2.15).

After 3, 7 and 14 days of second spray Among all the treatments, the least larval population of pod borer was recorded in Spinosad 45SC (1.49) followed by Flubendiamide 480SC (1.69) followed by Emamectin benzoate 5SG (1.78) followed by Chlorantraniliprole 18.5SC (1.96) and Profenophos 50EC (2.24). Next effective are the botanicals namely Neem oil 0.2% (2.40) which was followed by Karanj oil 0.2% (2.51) and was found to be least effective but superior over control (5.38).

The treatment T6 (1.69) was at par with T1 (1.78). The treatment T7 (2.24) was at par with T3 (2.40) and T4 (2.51).

The data revealed that the overall mean (3rd, 7th and 14th DAS) larval population of first spray and second spray revealed that all the treatments except untreated control are effective and at par. Among all the treatments, the least larval population of *Helicoverpa armigera* on Chickpea was recorded in Spinosad 45SC (1.33) with similar findings made by **Gayathri and Kumar (2021)**, Flubendiamide 480SC (1.51) and the findings supported with Flubendiamide 480SC was **Yadav et al., (2019)**, Emamectin Benzoate 5SG (1.58), Chlorantraniliprole 18.5SC (1.77) with similar finds made by **Venkataiah et al., (2015)** and it was followed by Profenophos 50EC (2.06) with similar findings made by **Shekhara et al., (2016)**, Neem oil 0.2% (2.23) findings was supported by **Mahajan et al., (2020)** and Karanj oil 0.2% (2.33) supported with **Chandra et al. (2018)** findings and Karanj oil 0.2% was found to be least effective but comparatively superior over the control (4.83).

The highest yield was recorded in Spinosad 45SC (24.3 q/ha) and 1:4.14 cost benefit ratio followed Flubendiamide 480SC (23.1 q/ha) and (1:4.76) cost benefit ratio, Emamectin benzoate 5SG (21.5q/ha)(1:4.38) cost benefit ratio, Chlorantraniliprole 18.5SC (20.7 q/ha) and (1:3.53) cpst benefit ratio, Profenophos 50EC (16.40 q/ha) (1:3.19) cost benefit ratio, Neem oil 0.2% (14.80 q/ha) (1:2.89) cost benefit ratio and Karanj oil 0.2% (13.20 q/ha) (1:2.72) cost benefit ratio as compared to control (8.3 q/ha) (1:1.79) cost benefit ratio. These findings are supported by **Udikeri et al. (2004)** with a yield of 15.95 q/ha for Emamectin benzoate 5SG, **Babariya et al.(2010)** with a yield of 9.07 q/ha for

flubendiamide 480 SC, **Deshmukh *et al.*, (2010)** with a yield of 17.6 q/ha and 16.65 q/ha for spinosad 45SC Emamectin benzoate 5SG, **Venkataiah *et al.*, (2015)** reviewed that Chlorantraniliprole 18.5 SC results showed highest yield of 19.83 q/ha.

The present studies revealed that Spinosad has shown minimum larval population and highest yield. While as Karanj oil has shown highest larval population and lowest yield.

Table-1. Effect of treatments on larval population after first and second spray:

S. No	Treatments	Mean larval population per 5 plants								Overall Mean	Yield q/ha	C:b ratio
		First spray				Second spray						
		1DBS	3DAS	7DAS	14DAS	1DBS	3DAS	7DAS	14DAS			
1	Emamectin benzoate 5SG	3.47	1.2 ^{ef}	1.33 ^d	1.6 ^{cd}	2.53	1.4 ^{de}	1.8 ^{cd}	2.13 ^{cde}	1.58 ^d	21.5	1:4.38
2	Spinosad 45SC	3.6	0.93 ^g	1.27 ^d	1.33 ^d	2.60	1.2 ^e	1.53 ^d	1.73 ^e	1.33 ^d	24.3	1:4.14
3	Neem oil 0.2%	3.4	1.73 ^{bc}	2 ^b	2.47 ^b	2.53	2.27 ^b	2.33 ^b	2.6 ^{bc}	2.23 ^b	14.8	1:2.89
4	Karanj oil 0.2%	3.53	1.93 ^b	2.2 ^b	2.33 ^b	2.73	2.4 ^b	2.4 ^b	2.73 ^b	2.33 ^b	13.2	1:2.72
5	Chlorantraniliprole 18.5SC	3.6	1.4 ^{de}	1.53 ^{cd}	1.8 ^c	2.8	1.67 ^{cd}	2 ^{bc}	2.2 ^{bcde}	1.77 ^{cd}	20.7	1:3.53
6	Flubendiamide 480SC	3.6	1.07 ^{fg}	1.4 ^d	1.53 ^{cd}	3.07	1.33 ^e	1.73 ^{cd}	2 ^{de}	1.51 ^d	23.1	1:4.76
7	Profenophos 50EC	3.47	1.53 ^{cd}	1.87 ^{bc}	2.27 ^b	2.33	1.93 ^c	2.27 ^b	2.53 ^{bcd}	2.06 ^{bc}	16.4	1:3.19
8	Control	3.67	4 ^a	4.4 ^a	4.47 ^a	4.73	5.2 ^a	5.4 ^a	5.53 ^a	4.83 ^a	8.3	1:1.79
	S.Ed (±)	0.20	0.12	0.16	0.17	0.22	0.13	0.20	0.26	0.54		
	C.D (P=0.05)	—	0.26	0.35	0.36	—	0.28	0.42	0.56	0.437		

- Labour charges=200₹/day (4 labours)
- Cost of yield= 6500₹/q

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