

“Comparative Bioefficacy of botanicals and chemicals
different insecticides against chickpea-pod borer, *Helicoverpa armigera*
(Hubner) on-in chickpea crop”

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 experiment was laid conducted in Randomized Block Design (RBD) with seven-eight treatments and 3 onecontrolled plotreplications. The mean larval population plant was taken day before and 3,7and 14 days after each spray. The research was conducted using insecticides like Emamectin emamectin benzoate 5 SG, Spinosad spinosad 45% SC, Neemoil 0.2%, Karanj oil 0.2%, Chlorantriliprole chlorantriliprole 18.5 SC, Flubendamide flubendamide 480SC, Profenophos profenophos 50 EC @ ... were applied. The mean larval population per plant was recorded one day before and 3, 7 and 14 days after each spray. Among all the treatments insecticidal tratments, the lowest larval population of *Helicoverpa armigera* on Chickpea chickpea was recorded in Spinosad spinosad 45SC followed by Flubendiamide flubendiamide 480 SC, Emamectin emamectin Benzoate 5SG, Chlorantraniliprole chlorantraniliprole 18.5 SC and Profenophos profenophos 50EC. The next effective are botanicals namely., Neem neem oil 0.2% and Karanj karanj oil 0.2% was found to be least effective but comparatively superior over the control. The highest yield (24.3 q/ha) was also obtained with application of recorded in Spinosad spinosad 45SC @ (24.3 q/ha) while maximum C:B (1:4.76) was achieved with spary of 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

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~~borer, *Helicoverpa armigera* infestation effectively as compared to untreated control.~~

Keywords: Chickpea, Compared, Cost benefit ratio, *Helicoverpa armigera*, Insecticides, Neemproducts, Population.

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INTRODUCTION

Chickpea, *Cicer arietinum*, ~~crop~~ is a member of the Leguminosae legume, pea, or pulse family, 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**).

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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 and~~ best suited to areas having low to moderate rainfall ~~and with~~ 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**).

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~~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

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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**).

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

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~~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~~ foliage, flower buds, pods, developing grains; voracious feeding habits; high mobility and fecundity; ~~;~~ multivoltine nature, overlapping generations, nocturnal behaviour ~~behavior~~ etc. (Sarode *et al.*, 1999).

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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).

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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 *rabi* season of 2021-2022 in Randomized Block Design ~~having with~~ three replications and ~~Eight-eight~~ treatments ~~with U~~ using a variety NBEG- 49(Nandyal) with $2 \times 2 \text{ m}^2$ plot size for evaluation of efficacy of ~~ertain~~ chemical insecticides and botanicals insecticides against pod borer *Helicoverpa armigera* in chickpea crop. ~~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 up to 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. What about pod damage also need to give per cent pod damage The insecticides viz. (write name of insecticides @dose) were sprayed at recommended doses and when larval population reaches its ETL level, total two sprays were given. Larvae-Larval population was counted 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 fromn tagged plants.

The crop was harvested and threshed plot wise. The grain was cleaned, dried 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; benefit was also worked out. 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 cost (insecticidal cost + labour) and income was realized by multiplying the total calculated 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.

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RESULTS AND DISCUSSION

The results revealed that all ~~the insecticidal~~ treatments were significantly ~~effective in~~ ~~reducing~~reduced ~~the~~ larval population of pod borer, pod damage and ~~thus~~ ~~increasing~~increased the grain 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

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~~Spinosad 45SC (1.18) followed by Flubendiamide flubendiamide 480SC (1.33) followed by Emamectin emamectin benzoate 5SG (1.38) followed by Chlorantraniliprole chlorantraniliprole 18.5SC (1.58), and Profenophos profenophos 50EC (1.89). Next effective are the botanicals namely Neem oil 0.2% (2.07) and which was followed by Karanj oil 0.2% (2.15). The botanical insecticides and was were found to be least effective but superior over control (4.29). The insecticidal treatment (name of insecticide) 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). Similar insecticidal trends results were also observed after second spray~~

~~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 The similar findings were also 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 and cost : benefit in with application of Spinosad spinosad 45SC (24.3 q/ha) and Rs. 1:4.14, respectively cost benefit ratio followed Fflubendiamide 480SC with yield (23.1 q/ha) and C: B (Rs. 1:4.76) cost benefit ratio, Emamectin emamectin benzoate 5SG (21.5q/ha) and (Rs. 1:4.38) cost benefit ratio, Chlorantraniliprole chlorantraniliprole 18.5SC (20.7 q/ha) and (Rs.1:3.53) cost benefit ratio, Profenophos profenophos 50EC (16.40 q/ha) (1:3.19) cost benefit ratio, Neem neem~~

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oil 0.2% (14.80 q/ha) (1:2.89) cost benefit ratio and ~~Karanj-karanj~~ oil 0.2% (13.20 q/ha) ~~and (Rs. 1:2.72) cost benefit ratio~~ as compared to control (8.3 q/ha) (1:1.79) cost benefit ratio. These findings are also supported by ~~Udikeri et al. (2004) with a yield of 15.95 q/ha for Emamectin benzoate 5SG, Babariya et al.(2010) and~~ 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.~~

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

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