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Keywords: *Cicer arietinum; Helicoverpa armigera*; Insecticides; Pod damage; Grain yield

Introduction

Among insect pests that damage legumes worldwide, chickpea pod borer, *Helicoverpa armigera*, has been identi ed as the most harmful [1]. *Helicoverpa armigera* (Hubner) belongs to . Noctuidae of Lepidoptera, is commonly known as pod borer [2]. e yield loss in chickpea due to pod borer was reported as 10-60 per cent in

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Received: 3-May-2022, Manuscript No. acst-22-58231, **Editor assigned:** 6-May-2022, PreQC No. acst-22-58231 (PQ), **Reviewed:** 11-May-2022, QC No. acst-22-58231, B17-May-2022, Manuscript No. acst-22-58231(R), **Published:** 25-May-2022, DOI: 10.4172/2329-8863.1000512

Citation: Atumo AA (2022) E f cacy of insecticides against (Order, Lepidoptera: Family, Noctuidae) of Chickpea (L.) at Areka and Kokate, Southern Ethiopia. Adv Crop Sci Tech 10: 512.

e pod borers were considered to be the most important group causing crop loss to the tune of 60 to 80 per cent. Synthetic insecticide provide dramatic e ect initially, and hence chemical control methods are still in use among farmers. Earlier, conventional insecticides like Malathion and hostathion chlorpyriphos were reported in management of pests on legumes. In recent times, new insecticide molecules o er advantages over earlier chemistry in terms of greater levels of safety, better performance and reduced environmental impact [6]. Hence, in order to manage this insect e ectively to reduce yield loss with recent safe organophosphate insecticides should be necessary and contribute better for food security. erefore, this study was undertaken with the objective of evaluation and screening of di erent insecticides which have high e cacy against chickpea pod borer (*Helicoverpa armigera*) damage.

e eld experiment was carried out at Areka Agricultural Research Center Kokate and Areka station in Southern Nation Nationality and people region of Ethiopia. Areka is located about 300 km south west of Addis Ababa, in Ethiopia found at 7°04'N longitude and 37°41'E latitude and altitude of 1800 meters above sea level. e soils at Areka are deep, highly weathered with a pH of 4.8. e climate is tropical, with mean annual rainfall of about 1500 mm. e daily mean maximum and minimum temperature of the area is 25 ^{0}c and 13 ^{0}c, respectively. e main soil type in the area is nit soils. However, Kokate station global position system of Latitudinal and Longitudinal reading is 6°85'28'' N, 37°76'10'' E respectively, and altitude of 2156 meter above sea level. e soil Kokate a pH of 5.2 and type is clay loam and, mean annual rainfall of about 655 mm. e daily mean maximum and minimum temperature of the area is 24.2^{0}c and 13.6^{0}c, respectively. e experimental design used was Randomized Complete Block Design (RCBD). e experiment was laid down with ve treatments and one-control plots for comparison. e plot size was 2mX2m, susceptible Habru chickpea variety was used, and it was sowed on 30cmx10cm spacing between plot and plants respectively [7].

e outbreak of *Helicoverpa armigera* in both study years on chickpea trials had been early and larvae infestation was aggravated uniformly on the whole plots before insecticides sprayed. e damage was begin instantly on the actively growing shoot tips of leafs. e larvae of *Helicoverpa armigera* feed on the leaves, buds, owers and rather serious on pods. Several young pods and developing seeds in pods are consumed. e di erent (EC) emulsi able concentrate and (WS) Water dispersible powder formulated based on the factory recommendation with 200L/ha of water and ready to use. A er insecticides sprayed the larva populations on treated plots were reduced gradually and however, leave damage level and larvae population was increased highly on untreated plots [8].

A er insecticide application di erent parameters, plant number per plot, number of larvae per plot, pod number per plant, damaged number of pod per plant, grain yield per plant, grain yield per plot and grain yield kilogram per ha were collected and insecticides was sprayed with in fortnight intervals. e result indicates that the pod damage of *Helicoverpa armigera* on untreated plots had been sever than that of insecticides treated plots. e above revealed that the average number of pod damaged on untreated plots were 12-17 whereas, from 1-6 on insecticides treated plots and this result con rmed with that of(Ali *et al.,* 2009). Based on their e cacy variation pod damage recorded was varied for Karate 5EC (3%), iodan 35% (6%), Diazinon 60% (3%), Apron Star 42 WS (19%) and Dimetho 40% (24%) respectively. erefore, the damage percent implied that among treated insecticides the list e ective was Dimethoate and Severely damage on untreated plots. e cumulative percentage pod damage of *Helicoverpa armigera* on untreated plots from 36.5-51.8% higher than on insecticides treated plots from 3.04-24%. All the treatments were found better to control *Helicoverpa armigera* relatively than untreated plots. Among the insecticides that was sprayed based on their pod damage controlled e ciency, Karate 5 EC >Diazinon 60% > iodan 35% > Dimetho 40% > Apron star 42 WS illustrated. Percent pod damage was calculated by using the following formula [9].HelicoverpalariTnodan 35% ere foundra treated followed by untreated one. Based on their relative performance arrangement iodan 35% > Karate 5EC>Diazinon60%>Apron star 42WS>Dimetho40% in 2021 study results. As the same trend the lowest yield was recorded from Dimetho 40% sprayed followed by untreated plots.

e combined data result revealed that insecticides Karate 5EC, iodan 35% and Diazinon were gave higher yield followed by Apron star 42 WS and Dimetho 40%. e lowest yield has been recorded form Dimetho 40% sprayed owed by untreated one. At 2020 Diazinon 60%EC, Karate 5EC* and iodan 35%EC gave 52.23%, 51.91%and 50.79% higher yield per ha^{-1} than untreated one . Whereas, in 2021 iodan 35%EC*, Karate 5EC*and Diazinon 60%EC gave 53.47%, 52.75% and 49.35% higher yield per ha^{-1} than unsprayed one. Based on their relative e ciency of *Helicoverpa armigera* control from high to low Karate 5EC > iodan 35%>Diazinon 60%>Apron star 42 WS> Dimetho 40%.

e lowest e cient insecticide from this study was Dimetho 40%. Hence, this study result revealed that based on the relative e ciency Karate 5EC and iodan 35% had been e ectively controlled *Helicoverpa armigera* followed by Diazinon 60%EC and Apron star 42WS. Dimetho 40% had lower e ciency based on its capacity to control *Helicoverpa armigera*. e outbreak and population damage of *Helicoverpa armigera* in 2020 at Kokate was higher due to the e ects of hot humid and warm temperature. However, low damage and outbreak at Areka because of low temperature and cold weather condition. In 2021 outbreak and damage of *Helicoverpa armigera* at Areka was high and however, at Kokate outbreak and damage was low due to cold weather condition and lower temperature e ects.

According to insecticides purchased price and relative e ciency of *Helicoverpa armigera* control, cost bene t (CB) ratio analysis result showed that the highest net bene t was recorded from Karate 5EC and iodan 35% followed by Diazinon and Apron star 42 WS. Net bene t recorded from Dimetho 40% was relatively higher than that of untreated one. e lowest net bene t was obtained from untreated one. e BC ratio revealed that among treated insecticides Karate 5EC and iodan 35% were gave higher income and feasible to *Helicoverpa armigera* management. Diazinon 60% and Apron star 42 WS were relatively gave higher net bene ts followed by Dimetho 40% and Untreated one. is cost bene t ration express that all treated insecticides had been proved to be better than that of untreated plots. Hence, among treated insecticides Karate 5EC and iodan 35% insecticides could have high e ciency to control *Helicoverpa armigera* and they were gave feasible net bene t results followed by Diazinon 60%. However, the lowest net bene ts were obtained from Apron star 42 WS and Dimetho 40% treated followed by untreated one.

Present investigation con rmed that e ective insecticides based on their e ciency Karate 5EC and iodan 35%EC revealed promising impacts in control of *Helicoverpa armigera* and gave higher yield followed by Diazinon 60%EC. Even so, this result was obtained with fortnight interval sprayed frequency of twice. erefore, the right time of spraying is mandatory to e ectively control this insect pest. So if, the condition is favorable larvae outbreak embark on rst week of crop emergency. e implication for future study on di erent time period with spraying frequency and the biology of this insect in laboratory will be important to know about the accurate time of insecticide spraying.

Author, has a heartfelt thanks to Southern Agricultural Research Institute (SARI) of Ethiopia for the facilities and budget allocation to accomplish this work. I thank Senior Researcher Mr. Fisaha Negash for his kind cooperation to give a clue about SAS so ware analysis. I also sincerely thank our technical assistance Mr. Grima Bobicha for his everyday monitoring of experimental eld and data collection.

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