

Evaluation and Demonstration of selected Insecticides to control chick pea Pod borer (*Helicoverpa armigera*) in Guji Zone, Southern Ethiopia

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Abstract: Chickpea (*Cicer arietinum* L.) production is challenged mostly by the pod borer insect pest in Ethiopia. Pod borer (*Helicoverpa armigera*) is the cosmopolitan and polyphagous insect pests which is more severe in Guji zone. This study was conducted to evaluate the efficacy of the recently introduced insecticides for effective foliar spray against the *H. armigera* and to give awareness on the use and effectiveness of the insecticide on chickpea crop at Midlands of Guji zone. The experiment was conducted using one chickpea variety; Habru and three insecticides helerate (350ml/ha), profit 72 %EC and dimethoate (1200-1500ml/ha). The result revealed that insecticides, dimethoate (90.87%) and helerate (88.31%) insecticides were effective against pod borer on percent larval reductions and profit (79.18%) followed. Dimethoate resulted maximum seed yield (1965.95kg/ha) which was the same to helerate (1907.74kg/ha) and minimum seed yield was recorded on untreated check (1041.87). The highest yield advantage was observed on dimethoate (47.00%) followed by helerate (45.39%). The highest benefit cost ratio was recorded on dimethoate (28.2072) sprayed plot whereas the lowest benefit cost ratio was recorded on unsprayed plot (21.3258). Therefore, using the dimethoate insecticides in the production of chickpea when pod borer is challenging is the most profitable to the farmers and other stakeholders of the study area.

Keys words: benefit cost ratio, efficacy, insecticides, larva reduction, yield increment

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is a legume crop of the Fabaceae family originated in present day South Eastern Turkey and adjoining Syria (Sexena and Singh, 1987). It is the second most important food legume in the world after common bean. The major chickpea-producing countries are India (67.41%), Australia (6.21%), Pakistan (5.73%), Turkey (3.86%), and Myanmar (3.74%) (FAOSTAT, 2015). Ethiopia is considered as secondary center of genetic diversity for chickpea

and the wild relative of cultivated *C. arietinum* L., is found in Tigray region (Yadeta and Geletu, 2002). In Ethiopia the area coverage and the volume of production of chickpea in 2017/2018 are 242703.73 ha⁻¹ and 4994255.5 quintal with average productivity of 2.05ton/ha. It contributes 15.18% of Ethiopia's total pulse production and is second after faba beans (CSA, 2018). It has the ability to grow on residual moisture which gives farmers the opportunity to engage in double cropping, since chickpea is sown at the end of rainy season.

Nutritionally chickpea contains 24% protein, 59.6% carbohydrates, and 3.2% minerals (Bakr *et al.*, 2004). Its fiber reduces cholesterol and regulates blood sugar. Hence, it is an important crop as source of food and income commonly used as a green vegetable (Yasin, 2014). It is very important component of cropping systems which can fix up to 140 kg N per ha from air and meet most of its nitrogen requirement. It increases substantial amount of residual nitrogen for subsequent crops and adds some amount of organic matter to maintain and improve soil health and fertility. It saves the fertilizer input cost not only for chickpea but also for subsequent crops. Chickpea production is important for crop rotation with cereals such as wheat and tef which are widely grown in relatively well-drained black soils (Menale *et al.*, 2009).

However, the production of chickpea is challenging because of different insect pests and diseases. Among the insect pests, gram pod borers *H. armigera* (Hubner) (Lepidoptera: Noctuidae) is a serious obstacle and a global concern for the production of chickpea. This pest is a cosmopolitan, multi-voltine and highly polyphagous, which attacks a number of crops which have agricultural importance throughout the world (Dabhi and Patel, 2007). Pod borer is a key pest of chickpea causing 90-95% total damage and it can cause damage up to 100% in unprotected chickpea fields (Sarwar *et al.*, 2009). A single *H. armigera* larva can damage up to 40 pods throughout its larval stage (Khan *et al.*, 2009). The chickpea economic threshold is one pod borer larva per one-meter row length (Zahid *et al.*, 2008).

There is a high infestation of pod borer on chickpea, in chickpea growing districts of Guji Zone (Shumi *et al.*, 2024). *Helicoverpa armigera* control with insecticides on chickpea is not common in the study area; rather the majority of the farmers follow a “do nothing” strategy. Ethiopian agriculture is fast transforming from subsistence to commercial farming system and use of pesticides is expected to increase rapidly as scales of production increase. So that Insecticides monocrotophos 36 WC, endosulfan 35 EC, carbaryl WP, cypermethrin 25 EC, indoxacarb 14.5 SC, Profenofos 50EC and coragen 20 SP showed the highest mortality of *H. armigera* larvae on chickpea (Iqbal *et al.*, 2014). Mesfin *et al.* (2012) reported synthetic insecticides have resulted in fast and effective pest control. Several chemical control methods have been evaluated but the pest keeps developing resistance to synthetic insecticides on repetitive use. This may be solved by demonstrating and evaluating the recently introduced insecticides to farmers with recommended doses. Therefore, the objective of this study was aimed to demonstrate and evaluate the efficacy

of the recently introduced insecticides for effective foliar spray against the pod borer on chickpea in the Midlands of Guji zone.

MATERIALS AND METHODS

Descriptions of the study Area

The experiment was conducted at Adola Rede districts of three (3) kebeles under rain-fed conditions during the 2024/25 cropping season (September-December). Adola Rede is located at about 463 km South from Addis Ababa, the capital city of the country. The climatic condition of the area is a humid moisture condition, with a relatively shorter growing season. The area receives annual rainfall of 1084 mm with a bimodal pattern extending from April to November. The mean annual minimum and maximum temperature is 15.93°C and 29.89°C, respectively. The type of the soil is red basaltic soil (Nitisols) and Orthic Aerosols. The soil is clay in texture and moderately acidic with pH of around 5.88.

Treatments, Experimental Design and experimental procedures

Susceptible chickpea variety, Habru (Kabuli type) was used. Fertilizers 150 Blended NPS kg ha⁻¹ (19% N, 38% P₂O₅, and 7% S) was used as sources of N, P and S, respectively, for the study. The treatments consisted of three insecticides (Helerate 5% E.C, Profit 72% E.C and Dimethoate 40 EC) with unsprayed. The experiment was laid out in simple plots with non-replicated four plots. The gross plot size was 5 m*5m. The spacing between blocks and plots was 2 m and 1.5 m, respectively. Each plot consisted of 12 rows spaced 40cm apart and 10cm between seeds. Normal agronomic practices were applied for all treatments. Application of insecticides was started at the appearance of insects at their recommended doses. Data was recorded twice (before and after application) for each application before and after application of insecticides.

Treatment combinations

T1- Helerate, T2- Unsprayed, T3- Profit, T4- Dimethoate 40 EC where, T= treatment

Table 1: Full information of the selected insecticides

Trade name	Common name	Group	Rate per hectare	Water per hectare
Profit	Profenofos	Organo phosphate	750ml	300 litre
Helerate	Lambda cyhalithrin 5% EC	Organo phosphate	350ml	325 litre
Wantox	Dimethoate 40 EC	Organophosphate	1200-1500ml	450 litre

Data collected

Five plants were randomly selected from each plot and data were recorded at 7days intervals. Number of larvae of pod borer, damaged pods and total pods per plant were collected from five randomly selected plants in each treatment. The yield was taken from the harvested net plot area

excluding the borders. The infestation percentage and larval reduction were calculated using the formula:

$$\text{Infestation percentage} = \frac{\text{number of damaged pods per plant}}{\text{Total number of Pods}} \times 100\%$$

$$\bullet \quad \% \text{ Larval Reduction} = \frac{\text{Larval population on control} - \text{Larval population on treated plot}}{\text{Larval population on un treated plot}} \times 100$$

$$\text{Yield increased over control} = \frac{\text{Yield of treated plot} - \text{yield of untreated plot}}{\text{Yield of treated plot}} \times 100$$

Farmers Selection and Evaluations

Farmers were participated on training to evaluate the insecticides against chickpea pod borer in the study area. Selection and evaluations were considered on the farmers 'interests and motivation toward the technology. Farmers' selection criterion was set and selection was conducted on the field.

Cost benefit analysis was done based on the local price of chickpea, insecticides price and labor cost of the study area.

Data Analysis

Data collected was subjected to analysis of variance using SAS version 9.1(SAS, 2004) and Tukey's SRT was used to compare differences among treatment means (P<0.05).

RESULT AND DISCUSSIONS

Larval Populations

The result revealed that there is significance differences (p<0.05) among the treatments in larvae population (table 2). The lowest larvae number was recorded on dimethoate (0.39b) which is similar to helerate (0.56) and profit (0.56) while the highest larvae were on control (5.00). The larval reductions recorded on the insecticides sprayed were 79.18- 90.87 (table 2). The highest larval reduction was observed on dimethoate (90.87) followed by helerate (88.31) insecticides sprayed plot whereas the lowest larval reduction was recorded on profit (79.18). The unsprayed plot was recorded as the highest number of pods damaged per plant (10.95) followed by profit sprayed plot (2.28) which is statistically similar to Helerate (1.28) and dimethoate (1.00). In supporting of this result, Gebretsadkan *et al.*, (2019) reported application of profit insecticide has reduced larval population by 54.76% in Tigray region. Similarly, Dagne *et al.* (2018) reported that the highest pod borer larval reduction (90.63%) was found in Diazenon sprayed plot followed by Karate 5% EC (71.87%) sprayed plot. Moreover, Khan *et al.* (2009) conducted a trial against gram pod borer and to assess comparative efficacy of insecticides (thiodan 40EC, lorsban 40EC, ripcord 10EC, nurellID (chlorpyrifos + cypermethrin 50+500g/L EC) and methomyl 45 WP). Methomyl was found most effective against the tested pest under field conditions.

Table 2: Larval Populations, Number of damaged pods and larval reductions of Pod borer (*Helicoverpa armigera*) on Chickpea before and after spray of Insecticides at Adola Redde districts in 2024/2025 Cropping Season.

Insecticide treatments	Mean larval population/plant		NDPPP	Larval Reduction %
	Before spray	After spray		
Control	3.61	5.00a	10.95a	-
Profit	3.33	0.56b	2.28b	79.18
Helerate	3.11	0.056b	1.28b	88.31
Dimethoate	3.22	0.39b	1.00b	90.87
LSD	-	1.13***	2.157***	-
CV (%)	-	26.75	19.69	-

NB: Means assigned with the same letter shows no significance difference among treatments. LSD, Least Significance Deference; CV, Coefficient of Variation; NDPPP, Number of damaged pods per plant

Grain Yield and Yield components

The result showed that the application of insecticides significantly ($P < 0.05$) affected the grain yield and yield components. From the result, Plant height was not significantly affected by insecticides application while the numbers of pods per plant were affected by insecticides application on chickpea field. The highest NPPP was recorded on dimethoate (30.05) which statistically similar to helerate (29.95) and profit (24.99). Dimethoate resulted maximum grain yield (1965.95 kg/ha), which was statistically similar to Helerate 5%EC (1907.74kg/ha) whereas the minimum grain yield (1041.87kg/ha) on unsprayed plot. Maximum percent of grain yield (47%) was increased over check by Dimethoate. The minimum percent of grain yield (31.90%) was increased over check by Profit.

Table 3: Average Grain Yield at Adola Redde district in 2024/2025 Season E. C

Insecticide treatments	PH	NPPP	Grain Yield in Kg/ha	% yield increased over check
Control(check)	44.077	15.003b	1041.87c	-
Profit	47.650	24.99a	1529.96b	31.90
Helerate	38.830	29.95a	1907.74a	45.39
Dimethoate	43.223	30.053a	1965.95a	47.00
LSD	12.49 ^{ns}	9.93**	200.94***	-
CV (%)	10.18	14.06	4.41	-

NB:PH, plant height; NPPP, number of pods per plant; LSD, least significant difference; CV%, coefficient of variation

In supporting to this result, Lekha *et al.* (2017) reported Lambda cyhalothrin 5% EC gave the highest reduction in the larval population of pod borer which was conducted to evaluate insecticides efficacy. Dagne Kora *et al.* (2018) reported that Karate 5 EC and Diaznon were effective against pod borer even and caused maximum percent larval reductions at both Ginnir and

Goro. Gebretsadkan *et al.* (2019) also suggested profit 72% EC and lambda-cyhalothrin reduced larvae population and the lowest damaged pods in the profit 72% EC sprayed field of chickpea. However, in this finding profit was the least of the three insecticides in grain yield and yield components increment.

Farmers' Perceptions

About 34 farmers were participated on the evaluation and selection of insecticides at Adola Redde districts of two kebeles. At both locations the farmers were selected the plot sprayed by Dimethoate as their first choice and Helerate as a second choice. During the evaluation and selections, the farmers mostly considered the number of pod damaged per plant and infestation levels per plot as the main selection parameters. Accordingly they said that the plot with no insecticide applications was more damaged by the larvae as compared to the untreated plot. To avoid the biasness during evaluation and selection farmers haven't get any clue on the sprayed and unsprayed plot. They simply observe the status of the plots only.

Table 4: Results of farmers' evaluation and selection based on pod damage per plant and infestation per plot thereafter ranking the insecticides used on the fields at Adola Redde districts in 2024/2025 Season. E. C

Treatments	Pod damage per plant	Infestation per plot	Total	Rank
Helerate	4	4	8	2
Dimethoate	5	5	10	1
Profit	3	3	6	3
Control	0	2	2	4

Economic Analysis

The result of the cost benefit analysis showed that dimethoate sprayed plot provided the highest gross returns (ETB294, 892.5/ha) and net returns (284,892.5) followed by helerate gross returns (ETB286,161/ha) and net returns (276,761) while the lowest gross return TB156280.5/ha and net return (ETB 149,280.5) was observed from untreated check. The highest benefit cost ratio was recorded on dimethoate (28.2072) sprayed plot whereas the lowest benefit cost ratio was recorded on unsprayed plot (21.3258). Therefore, using the dimethoate insecticides in the production of chickpea when pod borer is challenging is the most profitable to the farmers and other stakeholders of the study area. Moreover, a farmer who produced chick pea without using a dimethoate insecticide in case of managing pod borer lost 135,612ETB in 2024 cropping season at Adola Redde district.

Table 3: Return and Benefit Cost Ratio of Treatments for the Control of Pod borer in Chickpea during 2024/25 Cropping Season at Adola Redde district

Treatments	Yield obtained (Qt/ha)	Sale price (ETB/Qt)	Total Variable Cost (ETB/ha)	Gross Return (Price x Qt) (ETB/ha)	Net Return (GR-TVC)	Benefit cost ratio (NR/TVC)
Control(check)	1041.87	15,000	7000	156,280.5	149,280.5	21.3258
Profit	1529.96	15,000	9800	229494	219,694	22.4178
Helerate	1907.74	15,000	10200	286,161	276,761	27.1334
Dimethoate	1965.95	15,000	10100	294,892.5	284,892.5	28.2072

NB: *Qt*, quintal; *ha*, hectare; *ETB*, Ethiopian birr; *GR*; growth return; *TVC*, total variable cost; *NR*, net return

CONCLUSION

The result revealed that Dimethoate 40%EC and helerate 5% EC were the most effective insecticides to give high mortality of pod borer on chickpea under field conditions. The maximum yield was obtained from Dimethoate sprayed plot and followed by helerate sprayed plots. It has been indicated that insecticides, Dimethoate and helerate were remained the most effective against pod borer on chickpea and resulted in the maximum reduction percentage of larval population of pod borer on chickpea. Farmers should use both or alternatively the insecticides for the management of pod borer in chickpea to increase their productivity and quality.

Recommendation

Therefore, it is recommended that these effective insecticides, dimethoate 40 % EC at the rate of 1200-1500ml per hectare and on the second helerate 5% EC at the rate 350ml/ha 325L water volume were suggested to the growers/farmers or other stake holders for management of the pod borer population below economic threshold level under field conditions.

Conflict of interest: There is no competing interest on this paper.

REFERENCES

- Bakr MA, Afzal MA, Hamid A, Haque MM, Aktar MS (2004). Blackgram in Bangladesh. Lentil, Blackgram and Mungbean Development Pilot Project, Pulses Research Centre, BARI, Gazipur.
- Central Statistics Authority (CSA) (2007/2018). Agricultural Sample Survey. Report Area and production of major crops (Private Peasant Holdings, Meher Season). Statistical Bulletin 1(586). CSA, Addis Ababa, Ethiopia.
- Dabhi MV, Patel CC (2007). Life expectancy of *Helicoverpa armigera* on chickpea. Journal of SAT Agricultural Research 5(1):1-2.
- Dagne K, Ermias T, Amare B (2018). On Farm Demonstration and Evaluation of Synthetic Insecticides for the Control of Pod Borer (*Helicoverpa armigera* Hubner) on Chickpea in Bale Zone. American Journal of Plant Biology 3(3):29-32.

- Food and Agricultural Organization of the United States (FAOSTAT) (2015). www://faostat.fao.org/site/339/default.aspx. Accessed in June 12, 2015.
- Zereabruk Gebretsadkan, Weldu Nahom and Wolday Kiros. 2019. Efficacy of insecticides and crop critical stage for the management of chickpea pod borer (*Helicoverpa armigera*) in Central Zone of Tigray, Ethiopia. *Journal of Plant Breeding and Crop Science*, 11(9): 254-259. DOI: 10.5897/JPBCS2019.-0819
- Iqbal J, Farooq SU, Jamil M, Khan HAA, Younis M (2014). Relative efficacy of selective insecticides against gram pod borer, (*Helicoverpa armigera*) of chickpea. *Mycopath* 12(2):119-122.
- Khan SM, Muhammad YI, Muhammad AK (2009). Varietal screening of chickpea and the efficacy of different insecticides against chickpea pod borer *Helicoverpa armigera*. *Gomal University Journal of Research* 25(1):20-24.
- Lekha, O.P. Ameta and Hemant Swami. 2107. Evaluation of new generation pesticides to control pod borer, *Helicoverpa armigera* (Hubner) infesting chickpea. *Legume Research*, 40 (2), 384-387. DOI:10.18805/lr.v0iOF.11040.
- Menale K, Bekele S, Solomon A, Tsedeke A, Geoffrey M, Setotaw F, Million E, Kebebew A (2009). Current situation and future outlooks of the chickpea subsector in Ethiopia. International Crops Research Institute for the SemiArid Tropics, Nairobi, Kenya.
- Mesfin W, Eman G, Geremew T (2012). *Neem Azadirachta indica* (A. Juss) extracts negatively influenced growth and development of African bollworm, *H.armigera* (Hubner) (Lepidoptera: Noctuidae). *Academic Journal of Entomology* 5(1):22-27.
- Sarwar M, Ahmad N, Toufiq M (2009). Host plant resistance relationships in chickpea (*cicerarietinum* L.) against gram pod borer, *Helicoverpa armigera* (Hubner). *Pakistan. Journal Botany* 41(6):3047-3052.
- Sexena M, Singh K (1987). The chickpea. pp. 163-189. In: Saxena, MC., Singh, KB. (ed.): CAB international, UK.
- Yasin G (2014). Evaluation of chickPea (*Cicer arietinum* L.) Varieties for yield Performance and adaptability to Southern Ethiopia. *Journal of Biology, Agriculture and HealthCare* 4(17):34-38.
- Zahid MA, Islam MM, Reza MH, Prodhan MHZ, Rumana BM (2008) Determination of economic injury levels of *Helicoverpa armigera* (Hubner) in chickpea. *Bangladesh Journal of Agricultural Reserch* 33(4):555-563.