

Provided for non-commercial research and education use.

Not for reproduction, distribution or commercial use.



This article was published in an Sjournals journal. The attached copy is furnished to the author for non-commercial research and education use, including for instruction at the authors institution, sharing with colleagues and providing to institution administration.

Other uses, including reproduction and distribution, or selling or licensing copied, or posting to personal, institutional or third party websites are prohibited.

In most cases, authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Sjournals's archiving and manuscript policies encouraged to visit:

<http://www.sjournals.com>

© 2018 Sjournals Publishing Company

Contents lists available at Sjournals

Scientific Journal of Crop Science

Journal homepage: www.sjournals.com



Original article

On-farm demonstration of insecticide for the control of pod borer (*Helicoverpa armigera* Hubner) on chickpea in Bale zone, Ethiopia

Dagne Kora^{a,*}, Ermias Teshome^b, Amare Biftu^c, Ayalew Sida^c

^aOromia Agricultural Research Institute (OARI), Pulse Crops Entomologist, Sinana Agricultural Research Center P.O. Box-208, Bale-Robe, Ethiopia.

^bOromia Agricultural Research Institute (OARI), Pulse Crops Pathologist, Sinana Agricultural Research Center P.O. Box-208, Bale-Robe, Ethiopia.

^cOromia Agricultural Research Institute (OARI), Agricultural Research-Extensionist, Sinana Agricultural Research Center P.O. Box-208, Bale-Robe, Ethiopia.

*Corresponding author: dagnekor@gmail.com

ARTICLE INFO

Article history,

Received 11 October 2018

Accepted 12 November 2018

Available online 19 November 2018

iThenticate screening 13 October 2018

English editing 11 November 2018

Quality control 18 November 2018

Keywords,

Chickpea

Pod borer

Helicoverpa armigera

Insecticide

Net return

Habru

Diazenon

Karate

ABSTRACT

Chickpea (*Cicer arietinum* L.) is the world's second most important grain legumes after common bean (*Phaseolus vulgaris* L.) among food legumes grown for production worldwide. Ethiopia is considered as a secondary center of genetic diversity for chickpea. Field experiment was conducted at two districts with the objectives to demonstrate different insecticide for the control of pod borer on chick pea and to give awareness on the use and effectiveness of the insecticide against pod borer on chickpea. The experiment was conducted using one chick pea varieties; Habru (more preferred) and two insecticide Diazenon (1.2l/ha) and Karate (400 ml/ha). The result revealed that both insecticides are effective against pod borer even if they have slight percent larval reductions at both districts. The pod borer damage reduction by different treatments ranged from 71.87 % to 90.63 % and 58.33 % to 66.66 % compared to that in control at Ginir and Goro, respectively. Diazenon resulted maximum seed yield 2610 kg/ha and 2200 kg/ha at Ginir and Goro, respectively. The plot sprayed with Diazenon gave the maximum net return birr 75,348/ha and 61,120/ha at Ginir and Goro, respectively. It is recommended that these insecticides are suggested to the growers for management

of the pod borer population below economic threshold level under field conditions.

© 2018 Sjournals. All rights reserved.

1. Introduction

Chickpea (*Cicer arietinum* L.) is the world's second most important grain legumes after common bean (*Phaseolus vulgaris* L.) among food legumes grown for production worldwide (Guar et al., 2012). Ethiopia is considered as a secondary center of genetic diversity for chickpea and the wild relative of cultivated chickpea (*Cicer arietinum* L.), is found in Tigray region of Ethiopia (Yadeta and Geletu, 2002; Kanouni et al., 2011). An average chickpea yield in Ethiopia on farmers field is usually below 1t/ha although its potential is more than 5 t/ha (Jagdish et al., 1995; Melese, 2005). This is resulted from susceptibility of landraces to frost; drought, water logging and poor cultural practices; low or no protection measures against weeds, diseases and insect pests (Tilaye et al., 1994; Bejiga et al., 1994). Chickpea is susceptible to a number of insect pests, which attack on roots, foliage and pods. Chickpea pod borer (*Helicoverpa armigera* Hubner) (*Lepidoptera:Noctuidae*) is a major field insect pest affecting pulses in several agro-ecological zones. There is a high infestation of pod borer on chick pea, field pea and lentil in three woreda of Bale Zone, namely Goro, Ginnir and Golelcha. Farmers are trying to protect his crops from these pests by spraying different insecticides chemicals purchased from local pesticide dealers and farmers union. So farmers are asking for effective insecticide chemicals for the management of pod borer and also they asked the frequencies. Most of our farmers have limited information on the use of insecticide for pulse crops. So to alleviate such limitation the activity was initiated with the following objectives:

- ✓ To demonstrate different insecticide for the control of pod borer on chickpea
- ✓ To give awareness on the use and effectiveness of the insecticide against pod borer on chickpea

2. Materials and methods

2.1. Description of study area

The experiment was done on the farmer's field at one location Ginnir and Goro districts during 2017 - 2018 crop seasons. The location is suitable for appearance of pod borer every year under natural conditions. The experiment was conducted at Ginir located at 907 - 2524 meters above sea level receiving mean annual rainfall of 612 - 1214 mm and mean annual temperature of 11.31 - 24.72 °C. Goro located at 1272 - 3275 meters above sea level receiving mean annual rainfall of 796 - 1138 mm and mean annual temperature of 12.93 - 22.59 °C (Adamu Zeleke unpublished survey). Goro is characterized by *Chromic Cambisols* soil type and Ginir is characterized *Pellic Vertisols* soil type.

2.2. Treatments and experimental design

The experiment was conducted using one chick pea varieties; Habru (more preferred). Two insecticide Diazenon (1.2l/ha) and Karate (400 ml/ha) were used in the experiments. The experiment was laid out in none replicated with three plots.

- ✓ Plot one Diazenon sprayed plot
- ✓ Plot two Karate sprayed plot
- ✓ Control (unsprayed plot)

The plots have a size of 100m² (10m x 10m). Normal agronomic practices were followed for raising the crop. The insecticide was applied starting from the appearance of the insects. Data on pod borer population before and after insecticide application was recorded from 5 randomly selected plants in each treatment after the emergence of the pod borer. The number of larval population per plant from 5 randomly selected plants in each plot before and after first spray of insecticides was recorded. The reduction percentage of larvae was recorded by counting of larval population over check.

2.3. Farmers selection and evaluations

Farmers were participated on the evaluations of insecticide against chickpea pod borer. Selection and evaluations was considered on the farmers' interests and motivation toward the technology.

$$\% \text{ Larval reduction} = \frac{\text{Larval population on untreated plot} - \text{Larval population on treated plot}}{\text{Larval population on untreated plot}} \times 100$$

$$\% \text{ Yield increased over check} = \frac{\text{Larval population on treated plot} - \text{Larval population on untreated plot}}{\text{Larval population on treated plot}} \times 100$$

3. Results and discussion

Data collected on the comparative efficacy of two insecticides tested for the management of pod borer in chickpea was presented in Tables.

3.1. Larval population

Five plants were randomly selected from each plots and observation were recorded at 7 days intervals. The result revealed that both insecticides are effective against pod borer even if they have different percent larval reductions at both locations. At Ginir the data summarized in Table 1 revealed that the pest population of *Helicoverpa armigera* ranged from 1.6 to 3.4 larvae per plant before spray and 0.3 to 3.2 after spray during the season. It indicated that the pest was active during December. This period coincided with the flowering and pod formation stage of the crop. The pod borer damage reduction by different treatments ranged from 71.87 % to 90.63 % compared to that in control at Ginir. The highest pod borer larval reduction (90.63%) was found in Diazenon sprayed plot followed by Karate 5% EC (71.87%) sprayed plot. At Goro the result revealed that both insecticides are effective against pod borer even if they have different percent larval reductions. The data summarized in Table 1 revealed that the pest population of *Helicoverpa armigera* ranged from 1.3 to 3.6 larvae per plant before spray and 0.8 to 2.4 after spray during the season. The pod borer damage reduction by different treatments ranged from 58.33 % to 66.66 % compared to that in control at Goro. The highest pod borer larval reduction (66.66%) was found in Diazenon sprayed plot followed by Karate 5% EC (58.33 %) sprayed plot.

Table 1

Average larval populations of pod borer (*Helicoverpa armigera*) on chickpea before and after spray of insecticides at Ginir and Goro districts in 2017/2018 cropping season.

Districts	Insecticide treatments	Mean larval population/plant		Reduction percentage over check
		Before spray	After spray	
Ginir	Diazenon	1.6	0.3	90.63
	Karate 5 % EC	3.3	0.9	71.87
	Check (no spray)	3.4	3.2	
Goro	Diazenon	3.6	0.8	66.66%
	Karate 5 % EC	1.3	1	58.33
	Check (no spray)	2	2.4	

3.2. Grain yields of chickpea

The data of seed yields (kg/ha) and increased percent over check is presented in Table 2. From the result obtained at Ginir, Diazenon resulted maximum seed yield 2610 kg/ha, followed by Karate 5% EC 1800 kg/ha, and where as the minimum seed yield 820 kg/ha on unsprayed plot. Maximum percent of seed yield (68.58%) was increased over check by Diazenon. The second maximum percent of seed yield (54.44%) was increased over check by Karate 5% EC. Again at Goro Diazenon resulted maximum seed yield 2200 kg/ha, followed by Karate 5%EC 1600 kg/ha, and where as the minimum seed yield 600 kg/ha on unsprayed plot. Maximum percent of seed yield (72.73%) was increased over check by Diazenon. The second maximum percent of seed yield (62.5%) was increased over check by Karate 5% EC.

Table 2

Average grain yield of chickpea at Ginir and Goro districts in 2017/2018 season.

Districts	Insecticide treatments	Grain yield Kg/ha	Percent yield increased over check
Ginir	Diazenon	2610	+68.58
	Karate 5% EC	1800	+54.44
	Check (no spray)	820	
Goro	Diazenon	2200	+72.73
	Karate 5% EC	1600	+62.5
	Check (no spray)	600	

3.3. Return and benefit cost ratio

At Ginir the result showed that Diazenon sprayed plot provided the highest gross returns (ETB 91350/ha) and the lowest gross return ETB 28700/ha was computed from untreated check. The plot sprayed with Diazenon gave the maximum net return ETB 75,348/ha and also gave the highest benefit cost ratio (4.7).

The unsprayed plot gave the minimum net returns birr 15,054/ha and gave the lowest benefit cost ratio (1.10). In addition at Goro district Diazenon sprayed plot provided the highest gross returns (ETB 77, 000/ha) and the lowest gross return ETB 21, 000/ha was computed from untreated check. The plot sprayed with Diazenon gave the maximum net return ETB 61,120/ha and also gave the highest benefit cost ratio (3.85). The unsprayed plot gave the minimum net returns ETB 7,420/ha and gave the lowest benefit cost ratio (0.55).

Table 3

Return and benefit cost ratio of treatment for the control of pod borer in chickpea during 2017/18 cropping season at Ginir and Goro districts.

Districts	Variety and treatment	Yield obtained (qt/ha)	Sale price (ETB/qt)	Total variable cost (ETB/ha)	Gross return (Price x Qt)	Net return (GR-TVC)	Benefit cost ratio (NR/TVC)
Ginir	Hab. + Diazenon	26.1	3500	16,002	91,350	75,348	4.71
	Hab. + Karate 5%	18	3500	15,760	63,000	47,240	2.998
	Hab. + no spray	8.2	3500	13,646	28,700	15,054	1.10
Goro	Hab. + Diazenon	22	3500	15,880	77,000	61,120	3.85
	Hab. + Karate 5%	16	3500	15,700	56,000	40,300	2.57
	Hab. + no spray	6	3500	13,580	21,000	7,420	0.55

3.4. Farmers' perceptions

About 54 farmers were participated on the evaluation and selection of insecticides at Goro and 56 farmers were participated at Ginir. At both locations the farmers were selected the plot sprayed by Diazenon as their first choice and Karate as a second choice. During the evaluation and selections farmers mostly considers the number of pod damaged per plots. 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.

4. Conclusion

The result revealed that Diazenon and Karate 5% EC were the most effective insecticides to give high mortality of pod borer on chickpea under field conditions. The most economic benefit for pod borer management was obtained from Diazenon sprayed plot and followed by karate sprayed plots. It has been indicated from the present studies that insecticide Deazenon and karate are remained the most effective against pod borer on chickpea and resulted in the maximum reduction percentage of larval population of pod borer in chickpea even if they have slight difference on efficacy at both locations. Farmers should have used both insecticides for the

management of pod borer in chickpea. They can be used one insecticide in the absence of the other as an option/alternatives to increase their productivity and also quality.

Therefore, it is suggested/recommended that these effective insecticides are suggested to the growers/farmers or other stake holders for management of the pod borer population below economic threshold level under field conditions.

Acknowledgements

This improved chickpea management demonstration work in Bale zone was accomplished by the financial support of ICARDA project. The authors acknowledged the project funding stakeholders (USAID and others) for the support. We are greatly indebted to Oromia Agricultural Research Institute (OARI), Sinana Agricultural Research Center (contributed vehicles and other facilities for successful completions of this work), multidisciplinary team of SARC researchers (Breeder, Agronomist, Weed Scientist, Pathologist, Entomologist, Economist and Research-Extensionist) and other collaborating stakeholders found at zone and district level for giving us all round supports during the research work.

References

- Gaur, M.P., Aravind, K.J., Rajeev, K.V., 2012. A review of impact of genomic technologies on chickpea breeding strategies. *Agron.*, 2, 200-203.
- Geletu, B., Anbessa, Y., 1994. Breeding chickpea for resistance to drought. International symposium on pulse research, April 2-6. New Delhi, India, 145-146.
- Jagdish, K., Sethi, S.C., Jonansen, C.T., Kelley, M.R., Rheene, H.A., 1995. Earliness- a cure for most illness of chickpea. 20-23P. In: Intentional Chickpea and Pigeonpea Newsletter, ICRISAT, Andhra Pradesh, India.
- Kanouni, H., Taleei, A., Okhovat, M., 2011. Aschchyta blight (*Ascochyta blight* (Pass.) Lab.) of chickpea (*Cicer arietinum* L.): Breeding strategies for resistance. *Int. J. Plant Breed. Genet.*, 5, 1-22.
- Melese, D., 2005. Morphological and RAPD marker variation analysis in some drought tolerant and susceptible chickpea (*Cicer arietinum* L.) genotypes of Ethiopia. M.Sc Thesis, Addis Ababa University, Ethiopia, 2-5p.
- Tilaye, A., Gelatu, B., Berhe, A., 1994. Role of cool season food legumes and their production constraints in Ethiopia agriculture. In: Cool Season Food Legumes of 67 Ethiopia, 3-18p.
- Yadeta, A., Geletu, B., 2002. Evaluation of Ethiopian chickpea landraces for tolerance to drought. *Genet. Resour. Crop Evol.*, 49, 557-564.

How to cite this article: Kora, D., Teshome, E., Biftu, A., Sida, A., 2018. On-farm demonstration of insecticide for the control of pod borer (*Helicoverpa armigera* Hubner) on chickpea in Bale zone, Ethiopia. Scientific Journal of Crop Science, 7(11), 371-376.

Submit your next manuscript to Sjournals Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in DOAJ, and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.sjournals.com



The Academic and Scholarly Research Publication Center Ltd. (ASRPC), a corporation organized and existing under the laws of the England country with No., 10401338. Established in 2016, Academic and Scholarly Research Publication Center Ltd. is a full-service publishing house. We are a leading international publisher as well as distributor of our numerous publications. Sjournals Publishing Company is published under cover of ASRPC Publishing Company Ltd., UK. <http://asrpc.co.uk>

