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OriginalArticle

Evaluation an insecticide Helerate 5 % EC against Sugarcane Shoot Borer complex in the Sugarcane Plantations of Ethiopia

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ABSTRACT

Evaluation of Helerate 5 % EC against sugarcane shoot borer was made to generate efficacy data in the sugarcane plantations of Wonji-Shoa and Tendaho. The experiment was laid out in RCBD with four replications. The test insecticide was applied on plant cane and ratoon fields at Tendaho and Wonji-Shoa plantations, respectively. The result indicated that the test insecticide showed better control of sugarcane borer infestations as compared to the untreated check. Moreover, the test insecticide showed no significant variation as compared to standard check (Ethiozinon 60% EC) in all parameters considered. Furthermore, the study indicated that twice application of Helerate 5% EC @ 350 ml/ha and Ethiozinion 60 % EC @ 2 liter/ha showed significantly better control of sugarcane shoot borer complexes both on plant cane and ratoon fields in contrast with once application. Therefore, the plantations should apply Helerate 5 % EC @ 350 ml/ha twice at 11^{th} and 14^{th} weeks after planting for plant cane fields. Whereas, for ratoon fields, they should apply twice the test insecticide at 8^{th} and 11^{th} weeks after harvest for the control of sugarcane shoot borer complex in the sugarcane plantation of Ethiopia. Lastly, this study clearly revealed that the test insecticide (Helerate 5% EC) as effective as the recently used insecticide Ethiozinion 60 % EC. Since, Ethiozinion 60 % EC had been used by the Sugar Estates for long years now; Helerate 5% EC could be used as good substitute to avoid resistance due to continuous use of the same insecticide redundantly.

Key words: Sugarcane borer, insecticides, resistance.

INTRODUCTION

Diseases, weeds and insect pests are among the major production constraints of sugarcane production in Ethiopian Sugar Estates (Abera and Tesfaye, 2001). Among the insect pest problems, sugarcane shoot borers are widely distributed in all the plantations and causing serious damage on the crop. Field assessment study at Wonji-Shoa on the prevalence and distribution of shoot borer indicated that the pest can inflict up to 54 % dead-shoot (Leul, 2008). Similar study at Tendaho Sugar Project indicated that shoot borer has caused 2.5 to 33.8 % (mean = 15.98 %) dead-heart on young cane fields (Leul *et al.*, 2009). Similarly, Patil

and Hapase (1981) reported that heavy incidence of early shoot borer can cause 20-30% reduction in sugarcane yield and 1 to 5 unit reduction in sugar recovery in India. However, in the sugarcane plantations of Ethiopia due to damage symptom similarity of black beetle and shoot borer, little attention was given so far for sugarcane borer management. Moreover, the pest biology indicated that borers had continuous and overlapping generations that enabled them to have continuous prevalence over the cropping season (Shanower *et al*., 1993).

Different control options like cultural practices, biological control, use of resistant varieties and insecticides have been recommended for the control of borers worldwide. Among control practices, insecticides were found effective in some countries where their application considered basic information on the insect biology and time of heavy infestation over the cropping season (Kishore, 1989). In line with the above facts, Mishra *et al*, 1998 revealed that effective control of *Chilo infuscatellus* using 0.4 kg/ha of monocrotophos achieved by application between 30 to 105 days after crop emergence and with 1-6 spray frequency. Furthermore, their study showed that six spray of the insecticide resulted in the lowest dead hearts percentage (9.2 %) and highest cane yield (110.7 t/ha).

Currently utilized borer management practice in Ethiopian sugarcane plantations has several problems in terms of diversity, in use similar insecticides year after year without changing, in the time and frequency of application. Moreover, recently utilized insecticide (Ethiozinion 60 % EC) for the control of borer has been banned for agricultural utilization. Furthermore, the Ethiopian government has issued a special decree for the registration and control of pesticides in 1990 for newly introduced pesticides. Hence, for a pesticide to be registered its efficacy for the control of the intended pests should be tested or verified through domestic Research Centers. Accordingly, this study was accomplished with the objective of evaluating the efficacy of new insecticide Helerate 5% EC as compared to the standard check Ethiozinon 60% EC in the control of sugarcane shoot borer for the newly verified insecticide to be utilized as a substitute to the currently used in the sugarcane plantations of Ethiopia.

MATERIALS AND METHODS

Study on evaluation of Helerate 5% EC against sugarcane borer complex was accomplished in the sugarcane plantations of Wonji-Shoa and Tendaho for one cropping season. The two sites were selected due to their high sugarcane borer infestation (hot spot) as compared to other plantations. Similarly, N14 and B52/298 varieties were utilized and selection was made due to the varieties' susceptibility to the insect as indicated on Leul (2008). The trial was conducted on clay soil of Wonji-Shoa and on sandy loam soil of Tendaho Sugar Project. The study was accomplished on plant cane and ratoon fields at Tendaho and Wonji-Shoa Sugarcane plantation fields, respectively.

The experiment was done in randomized complete block design with four replications. The treatments included in the study were the test insecticide (Helerate 5 % EC @ 350 ml/ha) and standard check (Ethiozinon 60 % EC @ 2 liter/ha) and unsprayed check (free check) (Table 1).

Table 1: Treatments and their details

No.	Treatments	Active Ingredient (a.i.)	Rate and Frequency (per ha)
1	Helerate 5 % EC	Lambda-Cyhalothrin	350 ml/ha ×twice appl.
2	Ethiozinon 60 % EC	Diazinon	2000 ml/ha × twice appl.
3	Unsprayed check	-	-

Application frequency was at 20 days interval starting 8th week after harvest for ratoon crop and 11th week after planting for plant cane following the procedures of Faqir (2007), Singh *et al.*, (2002) and Reagan *et al.*, (2005). A plot size of six furrows of 17 m length each (148m²) was utilized. The experiment was made on four fields at Wonji-Shoa and on two

fields at Tendaho Sugar Project. The insecticides were applied on each plot using knapsack sprayer with sufficient amount of water. All other cultural practices were accomplished as recommended for each sites, except for insecticide applications.

In the course of the experiment data on germination count, tiller count, and stalk count were collected at 45 days, four months and ten months after planting/harvesting for plant cane and ratoon respectively. After each insecticide application, dead shoot count was recorded at 10 days interval. Moreover, bored stalk count, cane and sugar yield data were also collected. Data on dead shoot and bored stalk percentage values were square root transformed before analysis.

All numerical data were analyzed using SAS statistical software to reveal the variation among the treatments.

RESULTS AND DISCUSSION

Effect of Insecticides Applications on Shoot Borer Infestation

In this study, the average dead shoot percentages of the two successive counts at 10 days interval indicated that shoot borer infestation (dead shoot %) was significantly ($P \leq 0.05$) varied in relation to the untreated check (Table 2). Both insecticides, Helerate 5 % EC (at 325 ml/ha) and Ethiozinon 60% EC (at 2 lt/ha) have showed better control of the insect as compared to the untreated check at both Tendaho and Wonji-shoa. The overall result indicated that twice applications of Helerate and Diazinon were significantly better in reducing shoot and stalk borer infestations both on plant cane and ratoon fields as compared to the untreated check. However, there was non-significant variation among the two insecticides in their control potential at both locations (Table 2). However, the maximum control potential of 5.92% and 1.25% in terms of percent dead shoot and percent bored stalk was achieved by the insecticide Helerate followed by Ethiozinon with a potential of 8.46 % and 6.25 % in terms of percent dead shoot and percent bored stalk at Tendaho. Similarly, the maximum control potential of 2.94 % and 0.79 % in terms of percent dead shoot and percent bored stalk was achieved by the insecticide helerate followed by ethiozinon with a potential of 3.98 % and 0.94 % in terms of percent dead shoot and percent bored stalk at Wonji-shoa (Table 2). Generally, Helerate 5% and Ethiozinon 60% EC application has showed significantly lower percentage of bored stalk as compared to the untreated check both on plant cane and ratoon fields (Table 2).

Table 2: Infestation of shoot borers after insecticide applications on plant cane and ratoon crops

Treatment	Plant cane			Ratoon Crop		
	Dead shoot %		% Bored stalk	Dead shoot %		% Bored stalk
	11th WAP*	14th WAP		8th WAH**	11th WAH	
Helerate 5% EC	3.48 [b]	5.92 [b]	1.25 [b]	3.04 [b]	2.94 [b]	0.79 [b]
Ethiozinon 60 % EC	5.02 [b]	8.46 [b]	6.25 [b]	4.58 [b]	3.98 [b]	0.94 [b]
Untreated Check	9.22 [a]	16.89 [a]	22.00 [a]	9.89 [a]	15.11 [a]	6.90 [a]
CV (%)	**12.61**	**9.77**	**30.68**	**29.24**	**19.11**	**20.81**

- *WAP weeks after planting **WAH weeks after harvesting
- Means followed by the same letter along columns are statistically non-significant at 5% probability level according to DMRT

In line with this study, Leslie *et al.*, (2000) indicated that damage after 3 monthly aerial application of alphacypermethrine against *Eldana saccharina* was 3.2% of internodes bored but in the untreated plot was 11.7 % internodes bored. Moreover, Wajih et al., (1969) reported the effectiveness of five times applications of Diazinon and other insecticides from April to November, in reducing shoot borer incidence on treated plots as compared to the untreated ones. Further, Khan and Jan (1994) reported that application of Basudin 10G @ 25 kg/ha as a side dressing reduced the stem and root borers infestation to 17.89 % as compared to the untreated check.

Yield and Yield Component

The study showed that insecticide application resulted significant variation ($P \leq 0.05$) among treatments in tiller and stalk counts; and in cane yield both on plant cane and ratoon fields (Table 3). Plots received Helerate 5% EC @ 350 ml/ha and Ethiozinon 60 % EC @ 2 lt/ha application revealed significantly superior tiller and stalk count, and cane yield as compared to the untreated check. Accordingly, maximum tiller and stalk count as well as cane yield of 166.22, 96.67 and 127.83 was achieved on plots treated with Helerate 5% EC followed by plots treated with Ethiozinon 60% with tiller and stalk count as well as cane yield of 163.84, 98.07 and 126.32 respectively(Table 3). In this study, plots received insecticide applications (Helerate 5% EC and Ethiozinon 60% EC) have showed about 13.27 and 17.42 % increase on average in cane yield on plant cane and ratoon crop, respectively (Table 3).

Table 3. Yield and yield after insecticides applications on plant cane and ratoon crops

Treatment	Plant cane			Ratoon Crop		
	Tiller ('000/ha)	Stalk count ('000/ha)	Cane yield (ton/ha)	Tiller ('000/ha)	Stalk count ('000/ha)	Cane yield (ton/ha)
Helerate 5% EC	166.22 [a]	98.07 [a]	127.83 [a]	180.79 [a]	100.33 [a]	106.74 [a]
Ethiozinon 60 % EC	163.84 [a]	96.67 [ab]	126.32 [a]	174.40 [a]	98.98 [a]	97.19 [a]
Untreated Check	133.36 [b]	86.11 [b]	110.21 [b]	160.33 [b]	88.20 [b]	84.20 [b]
CV (%)	3.39	6.85	6.53	3.87	3.13.	7.55

- Means followed by the same letter along columns are statistically non-significant at 5% probability level according to DMRT

Recent study in the Ethiopian sugar estates with regard to loss of cane and sugar yield confirmed this truth in that, sugarcane borer complex inflicted a loss of cane and sugar yield by 23.4 and 34.3 %, respectively irrespective of the variety (Leul, et al. 2009). Thus, this study revealed that application of insecticides for the control of sugarcane shoot borer could minimize the loss of cane yield at least by 50%. In with this study, Kuniata (2000) reported the successful use of lambda-cyhalothrine and permethrin against borer at a rate of 25 g and 250 g a.i. per ha for achieving 57 % and 64 % greater sugarcane yields, respectively, than those of the unsprayed plots.

CONCLUSIONS AND RECOMMENDATIONS

The study indicated that the test insecticides showed better control of sugarcane borer infestations as compared to the untreated check. In this experiment, twice application of insecticides at twenty days interval starting 11^{th} weeks (for plant cane) and 8^{th} weeks (for ratoon crop) reduced cane yield loss at least by half. Though, application of insecticides in the above mentioned period has resulted satisfactory control, it is well known that, time of insecticide application should strictly coincide with the economic damaging level of the pest infestation in the production areas which in turn highly governed by climatic factors. Moreover, this study revealed that twice application frequencies of Helerate 5% EC @ 350 ml/ha and Ethiozinion 60 % EC @ 2 liter /ha significantly better control of sugarcane shoot borer complexes both on plant cane and ratoon fields at both locations. Therefore, the plantations should use twice application of Helerate 5 % EC @ 350 ml/ha and/or Ethiozinon 60 % EC @ 2 liter /ha at 11^{th} and 14^{th} weeks after planting for plant cane fields. Whereas, for ratoon fields, they should apply twice the aforementioned insecticides at 8^{th} and 11^{th} weeks after harvest for the control of sugarcane shoot borer complex. Moreover, strict periodic sugarcane borer monitoring should be made during hot season in order to apply insecticide by giving due consideration on cost-benefit analysis. Lastly, this newly verified insecticide (Helerate 5 % EC) should be used by the plantations as an alternative to the existing

insecticide (Ethiozinon 60 % EC) to avoid the development of resistance as a result of repeated use.

REFERENCE

Tafesse, A., and T.H. Michael (eds). 2001. Review of sugarcane research in Ethiopia: II. Crop Protection (1970-1998). Ethiopian Sugar Industry Support Center Research and Training Service, Wonji.

Faqir, G. 2007. Distribution and management of sugarcane borers in Peshawar Valley. Dissertation, NWFP Agricultural University Peshawar, Pakistan.

Kishore, P. 1989. Chemical control of stem borers. *In: International Workshop on Sorghum stem borers*. 17-20 November 1987. ICRISAT, Patancheru, India.

Khan, M., and A. Jan. 1994. Chemical control of sugarcane shoot borer (Chilo infuscatellus snell and root borer Emmalocera depresslla swin). *Pakistan Sugar Journal.* VIII (2):3-5.

Kuniata, L.S. 2000. Integrated management of sugarcane borers in Papua New Guinea. In: Sugarcane Pest Management in the New Millennium (eds P.G. Allsopp and W. Suasa-ard), pp: 37–50. *Proceedings of the International Society of Sugar Cane Technologists, Fourth Sugarcane Entomology Workshop*, Khon Kaen, Thailand

Leslie, G.W. 2002. Treatment of sugarcane setts for suppression of the Pyralid borer *Eldana saccharina. Proceeding of South Africa Technology Association*, 76.

Mengistu, L. 2008. Shoot Borer Management in the Sugarcane Plantation of Wonji-Shoa. *Proceeding of Wonji-Shoa Sugar Factory*.

Mengistu, L., F. Yirefu and Y. Zekarias. 2009. Distribution and management of sugarcane borer At Tendaho Sugar Project (Advisory Note).

Padmanadhan, M.D., J. Raja, and S. Rajasekaran. 1990. Evaluation of new early season sugarcane clones for resistance to pests of sugarcane. *Indian Sugar.* 40 (1): 33 – 34.

Patil, A.S. and D.G. Hapse. 1981. Research on sugarcane borer in Maharashtra. *Proc. Natn Symposium*. Stalk borer, Karnal. pp. 165-175.

Reagan, T.E., W. Akbar, C.D. Mcallister and F.P.F. Reay-Jones. 2005. Small plot assessment of insecticides against the sugarcane borer. *Louisiana Agriculture, Research and Extension*. Vol. 48. No. 1.

Rochat, J., R. Goebel, E. Tabone, L.M. Begue, E. Fernandez, R. Tibere, J.C. Gauvin and B. Vercambre. 2001. Integrated control of the sugarcane spotted stalk borer *Chilo sacchariphagus* (Lepidoptera: Pyralidae) in Reunion Island. *Proceeding of South Africa Technology Association*, 75.

Shanower, T.G., F. Schulthess and N.A. Bosque-Perez. 1993. The effect of larval diet on the growth and development of Sesamia calamistis Hampson (*Lepidoptera: Noctuidae*) and Eldana saccharina Walker (Lepidoptera: Pyralidae). *Insect Science and Its Application.* 14: 681-685.

Sheshagiri Rao, C. and M.M. Krishnamurthy. 1973. Studies on loss in yield of sugarcane due to shoot borer incidence, Chilo infuscatellus Snellen (Pyralidae: Lepidoptera). *Indian Sugar*. 22: 867-868.

Singh, S.B., G.P. Rao and S. Easwaramoorthy. 2002. Sugarcane crop management. Rainbow processors and printers, New Delhi, India.

Wajih, I. 1969. Borers of sugarcane and its leaf hopper. *Provincial sugar seminar, Hyd*. pp: 73-79.