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Efficacy of Different Insecticides in Controlling Sugarcane Termites

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ABSTRACT

Insecticides largent 3GR, e-gent 3GR, legend 50SC of fipronil group; suncloprid 20 SL, premier 200 SL, gain 20 SL, tez 20SL, shoddopid 20 SL, adclop 20 SL, margin 20 SL of imidacloprid group; bonanja 505 EC (of chloropyrifos + cypermethrin group) and before 50 EC, heraban 20 EC, expert 20EC, chlorifs 20 EC, superfos 20EC chloropyrifos group were tested at varying doses against sugarcane termites in the field at Akandabaria farm under Carew & Co. Sugar mills and Chunarughat, Habigonj farmars field during the cropping season 2010-2011. Standard regent 3GR (fipronil) and untreated control plots were also included in the trial. All the test insecticides significantly controlled termites population but Largent 3GR, e-gent 3GR, legend 50SC (@ 50 gm ai ha^{-1}); adclop 20 SL, margin 20 SL (@ 200 ml ai ha^{-1}) and e-gent 3GR (@ 50 gm ai ha^{-1}) ; shoddopid 20 SL, adclop 20 SL, margin 20 SL (@ 200 ml ai ha^{-1}) ; bonanja 505 EC (@ 2.25 litre ai ha^{-1}) were found more effective in controlling termites population of sugarcane at both locations. As a result of pest control by test insecticides sugarcane yield was increased. Yield increase over control was of 8.46 to 61.24% in Akandabaria farm site and 11.55 to 74.65% in Chunarughat site was recorded in insecticides treated plots.

Key words: Sugarcane, termite control, fipronil, imidacloprid, chlorpyrifos.

INTRODUCTION

In Bangladesh, Sugarcane (*Saccharum officinarum* L) is a major cash crop but its production per unit area is considerably lower than many other sugarcane producing countries of the world. Sugarcane pests especially termites are serious problem in cane cultivation. Among the sugarcane pests termites causes severe damage to sugarcane plants from planting to harvest and play a major role in reduction of cane yield. Termite is one of the major soil pests of sugarcane in Bangladesh. Five species of termite viz. *Odentotermes parvidens* Holm and Holm, *Odentotermes lokanardi* Chaterjee et Thakur, *Odentotermes* sp., *Microtermes obesi* Holm and *Microtermes* sp. have been identified in Bangladesh (SRTI Annul Report,1979). *Odentotermes obesus* and *Microtermes* sp. are considered as serious pests of sugarcane in Bangladesh (Dean, 1979). Termite cause damage to eye buds of planted setts, young shoot on germination and infest lower internodes of growing canes (Khanna *et al* 1956; Rajani, 1964).These damages cause death of young plants and produce gap in cane rows with resultant poor yield (Karim *et al* 1979). Termite infestation is observed both in sett and standing canes. Bud damage by termites may reach up to 60% (Singh and Kishan, 1946; Avasthy, 1967).Crop yield and Sugar recovery reduced by 2.5 and 4.5% respectively (Agarwala, 1955). Substantial loss is caused due to their attack in to later stages. In the past Chlorinated hydrocarbons (Heptachlor, Dieldrin, Chlordane, and BHC etc.) were extensively used against termites

all over the world, which is very toxic and hazardous with long residual effects. These chemicals are now banned in Bangladesh and else where. Therefore, there is an urgent need to find out effective, as well as less hazardous insecticides to suppress termites. So, it is a demand to undertake research to find out effective and cheaper substitute(s) of chlorinated hydrocarbons. Hence to increase the crop productivity in sugarcane, management of insect pest is of great significance. With this aim in view some selected insecticide of fipronil, imidacloprid and chloropyrifos group were used for trial against termites. Fipronil insecticide is a pseudo-systemic with predominantly contact and stomach action. Fipronil can be applied in furrow as soil spray at 50-200g ai ha^{-1} provides excellent, long term control of termites and positive influence in root developing. Imidacloprid insecticide is a systemic, contact and stomach action. Toxicity level: WHO class -2 & 3 and dose is low. Chlorpyrifos insecticide is a contact, stomach action and vapor. It has three dimensional mode of action and also effective to control soil inhabiting wide range of insect pests.

A novel method of termite management with largent 3GR, e-gent 3GR, legend 50SC (of fipronil group); shoddopid 20 SL, adclop 20 SL, margin 20 SL (of imidacloprid group); bonanja 505 EC (of chloropyrifos + cypermethrin group) and before 50 EC, heraban 20 EC, expert 20EC, chlorifs 20 EC, superfos 20EC (from chloropyrifos group) were evaluated on sugarcane in present study. Alam, *et al* (2001) reported that these chemicals are less toxic and less hazardous to the environment compared to chlorinated hydrocarbons.

MATERIALS AND METHODS

The experiment was set at Akandabaria farm, Carew & Co. Sugar mills, Darsana, Chuadanga and growers plot at Chunarughat, Habigonj, Bangladesh during the cropping season 2010-2011. The name of insecticides, their dosages in fourteen treatments and time of planting are given below:

T_1 - Largent 3GR @ 50 gm ai ha^{-1} at planting, T_2 - E-Gent 3GR @ 50 gm ai ha^{-1} at planting, T_3 - Shoddopid 20 SL @ 200 ml ai ha^{-1} at planting, T_4 - Adclop 20 SL @ 200 ml ai ha^{-1} at planting, T_5 - Margin 20 SL @ 200 ml ai ha^{-1} at planting, T_6 - Legend 50SC @ 50 g ai ha^{-1} at planting, T_7 - Bonanja 505 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May), T_8 - Before 50 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May), T_9 -Heraban 20 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May), T_{10}- Expert 20EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May), T_{11} - Chlorifs 20 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May), T_{12} -Superfos 20EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May), T_{13} - Regent 3GR @ 50 gm ai ha^{-1} at planting (standard) and T_0 -Untreated (Control).

The experiment was designed in a Randomized Complete Block Design (RCBD) with three replications. Individual plot size was 6m X 6m. Block to block distance was 2 m and within block was 1 m. Planting was done through conventional sett placement (end to end) in the trenches in the month of December 2010 with the variety Isd 32 in termite prone farm, Akandabaria under Carew & Co. Sugar mills and the variety Isd 16 in growers plot at Chunarughat, Habigonj. Fipronil and imidacloprid (common name) insecticides were applied in the trenches only once at plantation while the chlorpyrifos insecticides were applied thrice, 1st at planting and 2nd at days after planting (DAP) i.e. in

March and 3rd at days after planting (DAP) i.e. in May. Granular insecticides were applied by broadcasting and SC, EC and SL chemicals were applied after mixing with water by using sprayer. March and May applications were done in furrows on both sides of cane rows and then covered with soil. Prevalence of the pest was common since land was selected only in termite prone farm and endemic throughout the season in sugarcane fields.

To study the efficacy of test insecticides, data on termite population was taken three times. First data was taken in the month of March, second data in May when maximum setts are attacked and finally in July when lower part of mature canes are attacked. At each time, 5 clumps per plot were uprooted by digging with the help of a spade. The uprooted setts/ stools along with soils and counted the number of termites in infested setts/stools by splitting with a knife and also recorded then in collected soils from the base of the uprooted cane. The yield of canes per plot was recorded at harvest in December, 2011.

RESULTS AND DISCUSSION

All the test insecticides showed satisfactory performance in suppressing sugarcane termites at akhandabaria farm by the doses applied (table 1). Statistically significant difference in termite population was found in March and May data among treatments. The rate of effectiveness in March and May ranged from 31.82- 98.11% and 20.42-97.22% respectively. Which is the maximum treatment showed the desired level of effectiveness (80%) except shoddopid 20 SL, heraban 20EC, chlorifs 20EC and superfos 20 EC in March and May data showed e-gent 3GR, shoddopid 20 SL, adclop 20SL, margin 20 SL, legent 50SC and regent 3GR desired level of effectiveness. The termite population in July (2011) had significant differences in compared to untreated control plot. Here insect ides largent 3GR, e-gent 3GR, shoddopid 20 SL, margin 20SL, legent 50SC, bonanja 505EC and regent 3GR gave desired level of effectiveness (over 80%), whereas rest of the insecticides failed to show the desired level of efficiency (Table-1). The pooled values (48.31 - 95.42%) indicated that the tested largent 3GR, e-gent 3GR, adclop 20SL, margin 20 SL, legent 50Sc and regent 3GR insecticides fulfill the requirement for recommendation.

From the table 2 it was found that the termite populations in chemical treated plots of March 2011 at Chunarughat, Habigonj were significantly lower compared to untreated control. Results of March indicated that over 80.00 percent control of termite population was achieved in e-gent 3GR, shoddopid 20SL, adclop 20SL, margin 20 SL, regent 3GR, legent 50SC, bonanja 505EC, before 50 EC, heraban 20EC and chlorifs 20EC which applied @ 50gm, 200ml. and 2.25 litre ai ha^{-1}. The termite population obtained in May showed that chemical treated plots were significantly lower compared to untreated control. Here the level of control ranged from 48.89-88.89% in which largent 3GR, e-gent 3GR, shoddopid 20SL, adclop 20SL, margin 20 SL and regent 3GR reached the desired level (80%) of control. The termite infestation of treated plots in July (2011) showed that the result were satisfactory (over 80%) except those of before 50 EC, heraban 20EC, expert 20EC, chlorifs 20EC and superfos 20EC treated plots. The pooled values revealed that e-gent 3GR, shoddopid 20SL, adclop 20SL, margin 20 SL, bonanja

505 ES and regent 3GR gave over 80% control (Table 2). Minimum 80% efficacy over control is the requirement for getting recommendation of an insecticide against the pest as per pesticide regulatory rules in Bangladesh (PTAC, 1980). Here largent 3GR, e-gent 3GR, shoddopid 20SL, adclop 20SL, margin 20 SL, legent 50SC, bonanja 505EC and regent 3GR fulfilled the requirement.Some reports (Anon, 1996a, 1996b) indicated that Regent has been tested against several insect pests of corn, rice, cotton, potato and citrus including foliar and soil pests elsewhere with varying doses from 25-300 g a.i ha^{-1}.But for controlling sugarcane stem borer and termite this doses of regent varied from 50-200 g a.i ha^{-1} which produced satisfactory results that supported the present findings. Alam *et al.* (2001) reported that regent 3 GR and regent 50SC @ 100 g a.i ha^{-1} significantly reduced sugarcane termites. Alam *et al* (2004) also recommended some chlorpyrifos chemicals @ 2.0-2.5 Kg a.i ha^{-1} against sugarcane termites. Madan and Singh (1998) found that, chlorpyrifos 20EC @ 1.25 Kg a.i.ha^{-1} satisfactorily controlled sugarcane termites among the tested organophosphate insecticides including sevidol 4G and quinalphos 5G which is also in accordance with the present findings.

Results presented in Table 3 showed higher yield in treated plots compared to untreated control plots at akhandabaria farm, Carew & Co. Sugar Mills Ltd., Darsana and Chunarughat, Habigonj. Which were statistically significant over untreated control plots. The highest yield was obtained in regent 3GR treated plots which were statistically identical to this of e-gent 3GR treated plots in both locations. The yield increase over control in different treatments varied from 8.46-61.24% and 11.55-74.65% in Akhandabaria farm and Chunarughat respectively. The highest yield (75.83 and 86.28 tha^{-1}) was recorded in Regent 3GR treated plot at both locations. Therefore, effective control of sugarcane termite population could be achieved by applying fipronil group (largent 3GR, e-gent 3GR, regent 3GR, legend 50Sc applied @ 50 gm ai ha^{-1}), imidachloropid (shoddopid 20SL, adclop 20SL and margin 20SL applied @ 200ml ai ha^{-1}) and chloropyrifos + cypermethrin group (bonanja 505EC applied 2.25 litre ai ha^{-1}). Alam *et al.* (2001, 2004) also reported higher cane yield by applying the same group of insecticides. The present findings suggested that all the tested insecticides were found effective in suppressing termite population over 80% and might be recommended for termite prone sugarcane area of Bangladesh.

Table 1. Effectiveness of different insecticides of long residual and short residual toxicity in suppressing Termites at Akandabaria farm, Carew & Co. Sugar Mills Ltd, Darsana (2010- 2011).

Treatments	Termite population (5 clumps plot^{-1})			Pooled values
	March/11	May/11	July/11	
T_1 : Largent 3GR @ 50 gm ai ha^{-1} at planting	7.67e (95.64)	33.00def (77.03)	22.67de (81.67)	84.78
T_2 : E-Gent 3GR @ 50 gm ai ha^{-1} at planting	2.67e (98.48)	4.00g (97.22)	11.67e (90.56)	95.42
T_3 : Shoddopid 20 SL @ 200 ml ai ha^{-1} at planting	98.33bc (44.13)	4.00g (97.22)	22.33de (81.94)	74.43
T_4 : Adclop 20 SL @ 200 ml ai ha^{-1} at planting	3.67e (97.91)	28.33defg (80.28)	31.33cde (74.67)	84.29
T_5 : Margin 20 SL @ 200 ml ai ha^{-1} at planting	33.33de (81.06)	18.67efg (87.00)	18.33e (85.18)	84.41
T_6 ; Legend 50SC @ 50 g ai ha^{-1} at planting	3.33e (98.11)	7.00fg (95.13)	21.00de (83.02)	92.09
T_7 : Bonanja 505 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	33.33de (81.06)	114.33b (20.42)	20.33de (83.56)	61.68
T_8 : Before 50 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	8.33e (95.27)	54.33cd (62.18)	58.00bc (53.10)	70.18
T_9 : Heraban 20 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	44.00de (75.00)	99.00b (31.09)	50.00bcd (59.57)	55.22
T_{10}: Expert 20EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	8.67e (95.07)	72.33c (49.66)	66.67b (46.09)	63.61
T_{11}: Chlorifs 20 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	49.33cd (71.97)	35.67de (75.17)	50.00bcd (59.57)	68.90
T_{12}: Superfos 20EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	120.00b (31.82)	37.33de (74.02)	75.33b (39.09)	48.31
T_{13}: egent 3GR @ 50 gm ai ha^{-1} at planting.(standard)	3.33e (98.11)	6.33fg (95.59)	13.33e (89.22)	94.31
T_0 : Control (Untreated)	176.00a	143.67a	123.67a	-
LSD (5%)	38.77	24.56	26.77	

- Figures accompanied by the same letters are not significantly different at 5% level as per LSD test.
- Figure in parenthesis is percent effectiveness over control.

Table 2. Effectiveness of different insecticides of long residual and short residual toxicity in suppressing Termites at Chunarughat, Habigonj (2010- 2011).

Treatments	Termite population (5 clumps plot^{-1})			Pooled values
	March/11	May/11	July/11	
T_1 : Largent 3GR @ 50 gm ai ha^{-1} at planting	39.33a (23.88)	7.67cd (82.96)	13.33b (89.42)	65.42
T_2 : E-Gent 3GR @ 50 gm ai ha^{-1} at planting	5.67b (89.03)	5.00d (88.89)	8.33b (93.39)	90.44
T_3 : Shoddopid 20 SL @ 200 ml ai ha^{-1} at planting	4.00b (92.26)	6.33d (85.93)	16.00b (87.30)	88.50
T_4 : Adclop 20 SL @ 200 ml ai ha^{-1} at planting	8.33b (83.88)	7.33d (83.71)	22.33b (82.28)	83.29
T_5 : Margin 20 SL@ 200 ml ai ha^{-1} at planting	2.67b (94.83)	7.00d (84.44)	4.33b (96.56)	91.94
T_6 : Legend 50SC @ 50 g ai ha^{-1} at planting	6.67b (87.09)	11.00cd (75.56)	32.33b (74.34)	79.00
T_7 : Bonanja 505 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	7.00b (86.45)	12.00bcd (73.33)	21.00b (83.33)	81.04
T_8 : Before 50 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	7.00b (86.45)	12.00bcd (73.33)	45.67ab (63.75)	74.51
T_9 : Heraban 20 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	10.33b (80.00)	10.33cd (77.04)	48.33ab (61.44)	72.83
T_{10}: Expert 20EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	11.00b (78.81)	14.00bcd (68.89)	60.67ab (51.85)	66.52
T_{11}: Chlorifs 20 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	5.33b (89.68)	19.67bc (56.29)	54.33ab (56.88)	67.62
T_{12}: Superfos 20EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	11.33b (78.07)	23.33b (48.89)	63.00ab (50.00)	58.99
T_{13}: Regent 3GR @ 50 gm ai ha^{-1} at planting.(standard)	3.67b (92.90)	5.67d (87.40)	12.67b (89.94)	90.08
T_0 : Control (Untreated)	51.67a	45.00a	126.00a	-
LSD (5%)	25.77	10.59	72.32	

* Figures accompanied by the same letters are not significantly different at 5% level as per LSD test.
* Figure in parenthesis is percent effectiveness over control.

Table 3. Effectiveness of different insecticides of long residual and short residual toxicity on the yield of Sugarcane (2010-2011).

Treatments	Yield (t ha^{-1})			
	Akandabaria farm		Chunarughat	
	Mean	% increase over control	Mean	% increase over control
T_1 : Largent 3GR @ 50 gm ai ha^{-1} at planting	57.00bcd	23.25	74.04bc	44.88
T_2 : E-Gent 3GR @ 50 gm ai ha^{-1} at planting	69.33ab	47.42	79.60ab	61.13
T_3 : Shoddopid 20 SL @ 200 ml ai ha^{-1} at planting	51.29cd	9.06	60.25e	21.96
T_4 : Adclop 20 SL @ 200 ml ai ha^{-1} at planting	56.96bcd	21.11	59.52e	19.43
T_5 : Margin 20 SL @ 200 ml ai ha^{-1} at planting	57.59bcd	22.45	55.11ef	11.55
T_6 : Legend 50SC @ 50 g ai ha^{-1} at planting	63.98abc	36.04	56.74ef	14.85
T_7 : Bonanja 505 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	51.01bcd	8.46	56.78ef	14.93
T_8 : Before 50 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	52.96bcd	12.61	69.03cd	39.73
T_9 : Heraban 20 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	55.00bcd	16.95	59.56e	20.56
T_{10}: Expert 20EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	56.57bcd	20.28	61.23de	23.94
T_{11}: Chlorifs 20 EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	57.78bcd	22.86	75.02bc	50.52
T_{12}: Superfos 20EC @ 2.25 Litre ai ha^{-1} at (Planting + March + May)	54.35bcd	15.56	62.35de	26.21
T_{13}: Regent 3GR @ 50 gm ai ha^{-1} at planting.(standard)	75.83a	61.24	86.28a	74.65
T_0 : Control (Untreated)	47.03d		49.40f	-
LSD (5%)	13.08		7.871	

* Figures accompanied by the same letters are not significantly different at 5% level as per LSD test.

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