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Efficacy of Insecticides Against Subterranean Termites in Sugarcane

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ABSTRACT

For effective and economic control of subterranean termites in sugarcane in Kacha area of Indus near Bhakkar, an experiment was laid down in a Randomized Complete Block Design to sort out the efficacy of imidacloprid 25 WP @ 250 g/acre, chlorpyrifos 40 EC @ 1000 mL/acre and monomehypo 5 G @ 9 kg/acre. Chlorpyrifos gave control of the termites' population after 15, 45, 60, 75 days of application on setts and significantly reduced the termites as compared to imidacloprid and monomehypo. Results were non-significant and had no effect of any treatment after 30 days. Similarly the termites' population on the sett was also very low in the plots treated with chlorpyrifos as compared to imidacloprid and monomehypo. Sugarcane eyes damaged were non-significant, whereas the effect was significant, among the treatments, on seedlings damaged by termites in the sugarcane field.

Key Words: Efficacy of insecticides; Subterranean termites; Bhakkar

INTRODUCTION

Termites' control was based purely in recent past on chemicals especially synthetic insecticides. The satisfactory control of termites in agro-ecosystem was mainly dependent upon persistent organochlorine (OC) insecticides. The restriction on cyclodiene (= OC) insecticides closed a chapter from history of termites control and underscored dire need for alternative insecticides, which would have economic viability, environmental acceptability, abundant availability, consumer safety and termiticidal efficacy (Khan & Singh, 1985; Anonymous, 2000).

Today many safe and simple practices of termites' management including cultural and biological control, queen removal, plant resistance, natural products, physical barriers and baiting systems have been proposed but insecticides are still playing a key role for the termites' control. Chemicals like chlorpyrifos, thiodan, cypermethrin, imidacloprid, fipronil, carbosulfan and triazophos are being recommended (Kumawat, 2001; Rana *et al*., 2001).

The major constraint in termites' management through these new chemicals in sugarcane was what would be appropriate method and frequency of application? Most commonly termiticides are applied during irrigation to a crop (Kolo *et al.,* 2000). Seed dressing with EC and G formulation of insecticides have also shown good results with lowest plant damage (Mishra, 1999).

MATERIALS AND METHODS

Experiment was laid down in a Randomized Complete Block Design to sort out the efficacy of imidacloprid 25 WP @ 250 g/acre, chlorpyrifos 40 EC @ 1000 mL/acre and monomehypo 5 G @ 9 kg/acre against termites in sugarcane crop. Four treatments including a control were replicated thrice in a net plot size of 12 × 36 m for each treatment. After placing the setts in furrows at sowing, imidacloprid 25 WP, chlorpyrifos 40 EC and monomehypo 5 G were applied in the furrows with setts in them. This was followed by irrigation. Then starting from 15 days after application, data were collected by digging a soil core of 30 x 30 x 30 cm to estimate the termites' population from 10 points. Hence, the numbers of termite individuals were expressed as termites per 0.27 m^2. In the initial stage of crop, sugarcane setts were pulled up for termites' damage estimation, and after germination, total number of damaged stools were counted for termites' damage. The data were analyzed by using the Minitab II applying Friedman Test of non-parametric statistics. The second application was considered necessary, where termites' number reached 100 per sample.

RESULTS

Termites population in the field. Data regarding to the effect of insecticides on termite population at different time intervals are given in Table I. Friedman Test showed that difference among the treatments was significant ($p = 0.029$) at 15 days after application. Maximum termites' population was observed in T_4 (Control), having 15.12 individuals (estimated median value). However, T_2 (imidacloprid) showed minimum (0.00) number of individuals followed by chlorpyrifos (T_1) and monomehypo (T_3) with estimated median values of 1.50 and 5.37, respectively. All the treatments had non-significant effect among themselves on the termite population ($p = 0.21$), with estimated median

Table I. Effect of insecticides on termites' population in soil (0.27 m^{-2}) at different intervals after application on setts

Treatments	Intervals after application				
	15 days	30 days	45 days	60 days	75 days
chlorpyrifos (T_1)	1.50 (6)	0.00 (4.5)	2.50 (3.0)	3.06 (3.0)	4.50 (3.0)
imidacloprid (T_2)	0.00 (3)	2.50 (8.0)	8.12 (6.0)	5.93 (6.0)	7.62 (6.0)
monomehypo (T_3)	5.37 (9)	5.00 (11.0)	14.5 (10.5)	17.18 (9.0)	16.50 (9.0)
control (T_4)	15.12 (12)	0.00 (6.5)	14.87 (10.5)	19.56 (12.0)	24.37 (12.0)
Friedman Test					
Grand median	5.50	1.87	10.0	11.44	13.25
p-value	0.03	0.21	0.04	0.03	0.03
Df	2	2	2	2	2
S	9.00	4.50	8.10	9	9.00

Values represent estimated median values and in parenthesis sum of ranks which were compared with Friedman Test of non-parametric statistics. Values are taken from three replication.

values and their sum of ranks as 0.00, 2.50, 5.00 and 0.00 and 4.5, 8.5, 11.0 and 6.5 for chlorpyrifos (T_1), imidacloprid (T_2), monomehypo (T_3) and control (T_4), respectively at 30 days after application. All the four treatments showed significant difference among themselves ($p = 0.04$). Maximum termites population (14.87) was observed in control (T_4), and minimum T_1 (chlorpyrifos) with estimated median value of 2.50, followed by T_2 (imidacloprid) and T_3 (monomehypo) with estimated median values of 8.125 and 14.50, respectively at 45 days after application. A similar trend of difference in termites' population was observed at 60 and 75 days after application (Table I).

Termites population on pieces of setts (25 cm). A significant difference was found among the treatments ($p = 0.03$), highest number being showed by control treatment (30.06). Minimum number of termites per sett was found in T_1 (chlorpyrifos) with estimated median value of 1.06 individuals, followed by T_2 (imidacloprid) and T_3 (monomehypo) with estimated median values of 2.94 and 5.19 individuals, respectively 15 days after application. At 30 days after application, maximum number of termites (56.44) per sett was observed in control (T_4) with estimated median value of 56.44 individuals whereas minimum number of termites was found on T_1 (chlorpyrifos) with estimated median value of 2.44 individuals per sett followed the T_2 (imidacloprid) and T_3 (monomehypo) with their estimated median values 3.06 and 6.31 individuals, respectively. A significant difference was found among the treatments ($p = 0.04$), with highest number of individuals (32.75) in control (T_4). Minimum population of termites per sett was found on T_1 (chlorpyrifos) with estimated mean value of 2.25 individuals followed by the T_2 (imidacloprid) and T_3 (monomehypo) with their estimated median value 3.13 and 7.88 individuals, respectively at 45 days after application (Table II).

Number of sett eyes (bud) damaged by termites. All the treatments including control had non-significant difference among them with regard to effect of insecticides on the sugarcane eyes damage, with estimated median values for T_1 (chlorpyrifos), T_2 (imidacloprid), T_3 (monomehypo) and T_4 (control) were 0.00, 0.00, 0.50 and 0.50, at 15 days after application. All the treatments including control had non-significant difference among them with regards to sugarcane eyes damage after 30 days of application, with estimated median value for T_1 (chlorpyrifos), T_2 (imidacloprid), T_3 (monomehypo) and T_4 (control) was, respectively 0.12, 0.37, 1.06 and 1.50; at 30 days after application. All treatments including control had non-significant effect on the sugarcane seedling damage with estimated median values, 0.19, 0.44, 0.56 and 1.06 for the treatments T_1 (chlorpyrifos), T_2 (imidacloprid), T_3 (monomehypo) and T_4 (control), respectively (Table III).

Table II. Effect of chlorpyrifos, imidacloprid and monomehypo on termites' population per set (25 cm long) at different intervals after application on setts

Treatments	Intervals after application		
	15 days	30 days	45 days
chlorpyrifos (T_1)	1.06 (3)	2.44 (3.0)	2.25 (4.5)
imidacloprid (T_2)	2.94 (6.5)	3.06 (6.0)	3.13 (4.5)
monomehypo (T_3)	5.19 (8.5)	6.31 (9.0)	7.88 (9.0)
control (T_4)	30.06 (12)	56.44 (12)	32.75 (12)
Friedman Test			
Grand median	9.81	17.06	11.25
p-value	0.03	0.02	0.04
Df	2	2	2
S	8.50	9.00	8.10

Values represent estimated median values and in parenthesis sum of ranks which were compared with Friedman Test of non-parametric statistics. Values are taken from three replication.

Cane damage by termites. A significant difference was found among treatments with regards to cane damage. The highest cane damage was recorded in control (T_4) with 14.81% estimated median value of the observations. The minimum damages was observed in T_1 (chlorpyrifos) with estimated median value 1.622% followed by T_2 (imidacloprid) and T_3 (monomehypo) with 5.12% and 7.67% (estimated median values), respectively at 60 days after application. After 75 days of setts sprayed with insecticides, followed by irrigation, showed a significant difference among the treatments, with highest sugarcane damage (17.09%) in control (T_4). Minimum damage was observed in the T_1 (chlorpyrifos) with estimated median value 2.567% followed by T_2 (imidacloprid) and T_3 (monomehypo) with estimated median value of 7.04% and 9.81%, respectively 75 days of application (Table IV).

DISCUSSION

The results from the study carried out to find out the effective insecticides against termites in sugarcane reveals that the chlorpyrifos gave the best results in controlling the termites' population after 15, 45, 60, 75 days of application of insecticides on setts and significantly reduced the termites' population as compared to imidacloprid and monomehypo. Results were non-significant and had no

Table III. Number of sett eyes (bud) and seedling damage by termites at different intervals after application

Treatments	Bud damage		Seedling damage
	Intervals after application		
	15 days	30 days	45 days
chlorpyrifos (T_1)	0.00 (4.0)	0.12 (5.0)	0.19 (4.5)
imidacloprid (T_2)	0.00 (5.0)	0.37 (4.5)	0.44 (6.0)
monomehypo (T_3)	0.50 (11.0)	1.06 (9.0)	0.56 (7.5)
control (T_4)	0.50 (10.0)	1.50 (11.5)	1.06 (12.0)
Friedman Test			
Grand median	0.25	0.75	0.56
p-value	0.06	0.08	0.9
Df	2	2	2
S	7.40	6.70	6.30

Values represent estimated median values and in parenthesis sum of ranks which were compared with Friedman Test of non-parametric statistics. Values are the taken from three replication

Table IV. Effect of insecticides on sugarcane damage by termites at different intervals after application

Treatments	Damaged sugarcane	
	Intervals after application	
	60days	75 days
chlorpyrifos (T_1)	1.62 (3.0)	2.57 (3.0)
imidacloprid (T_2)	5.12 (6.0)	7.04 (6.0)
monomehypo (T_3)	7.67 (9.0)	9.81 (9.0)
control (T_4)	14.81 (12.0)	17.09 (12.0)
Friedman Test		
Grand median	7.38	9.17
p-value	0.02	0.05
Df	2	2
S	9.0	6.0

Values represent estimated median values and in parenthesis sum of ranks which were compared with Friedman Test of non-parametric statistics. Values are the taken from three replication

effect of any treatment after 30 days, which might be due to the environmental factors or due to the other agronomic practices. Similarly the termites' population on the sett was also very low in the plots treated with chlorpyrifos as compared to imidacloprid and monomehypo. These setts usually harbour the termites once the sugarcane started germinating. The data of damaged sugarcane eyes were non-significant among the treatments, which means that all the treatments had no effect on the eyes damaged by termites but had the significant effect on seedlings damaged by termites in the sugarcane field. Chlorpyrifos registered the best control with minimum seedlings damage as compared to the plots treated with imidacloprid and the monomehypo and all treatments also had the significant difference as compared to the control plot.

The above findings are in confirmation with the Mishra (1999), who reported the efficacy of chlorpyrifos 10 G as a soil treatment and chlorpyrifos 20 EC as seed dressing in groundnuts against termites. Seed dressing with chlorpyrifos had the lowest plant damage. Vitarana *et al.* (1998) tested chlorpyrifos (0.1%), imidacloprid (.05% & 0.03%) and common salt @ 12.50 L/ha. Blocks treated with chlorpyriphos, imidacloprid showed lower termite activity than the blocks treated with common salt and un-treated control. Anonymous (2003) studied the efficacy of various insecticides against termites each after 60 and 100 days, respectively. The results revealed that 60 days after treatment, minimum stool infestation (2.53%) was recorded in plots treated with Lorsban @ 3705 mL/ha followed by Lorsban @3088 mL/ha (3.13%) and both the treatments were at par with each other. The results 100 days after treatment showed that both the doses of lorsban i.e. 3705 mL/ha and 3088 mL/ha gave significantly minimum stool infestation i.e. 2.13% and 2.60%, respectively.

Manager-Singh *et al.* (2002) investigated the effect of sett and soil treatments with insecticides on bud damage (caused by termite infestation) and germination of sugarcane c.v. Cos 767. Maximum bud damage was observed in the control (32.21% & 31.66%). Among the treatments, sett dipping in 0.20% solution of imidacloprid recorded the minimum bud damage of 6.84%, which was at par with soil application of phorate 10 G at 2.5 kg a.i./ha, chlorpyrifos 20 EC at 1 kg a.i./ha and chlorpyrifos 15 G at 2.5 kg a.i./ha. These treatments resulted in 56.76% – 59.14% increase in germination. Manager-Sigh *et al.* (2003) determined the effects of certain insecticides on the incidence of termites on emerging shoots and millable canes of sugarcane c.v. Cov 767. Sett treatment with 0.2% solution of Gaucho 70 WS (imidacloprid) and soil treatment with phorate at 2.50 kg a.i./ha, chlorpyrifos 15 G at 2.5 kg a.i./ha and chlorpyrifos 20 EC at 1 kg a.i./ha were highly effective in significantly minimizing termite infestation in sugarcane shoots and millable canes.

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