

Original Research Article

EFFICACY OF VARIED CONCENTRATIONS OF FIPRONYL 200G/L IN THE GRAVEYARD (FIELD TRIAL TEST) CONTROL OF TERMITES.

ABSTRACT

Fipronyl is chemical formulation phenyl pyroazole insecticide acting on the chloride channel of nervous system of insects to hinder chloride metabolism of γ - amino butyric acid of insect's nervous system. It has good control against *Microtermes nataensis* from attacking buildings. This study evaluated the efficacy of Termidor and Fipronyl 200g/l commercial formulations at various treatment concentrations on treated timber. Termidor was the experimental standard. The experiments were laid out in Randomised group design carried out in graveyard with 100 samples, five treatments and ten replicates .Both termiticides were tested at Fipronyl 200g/l concentrations (2ml/l, 4ml/l and 6ml/l) and Termidor under concentration of (10ml/l). This showed that 2ml/l, 4ml/l and 6ml/l levels of concentrations for Fipronyl or termidor (10 ml/l) have equal impact on termites since there was no significant difference in weight loss in the treated timbers compared with untreated timbers that had weight loss. Fipronyl treatment is effective at different concentration. This was determined by assessing the magnitude of timber attack by subterranean termites under different treatment regimes. It is advisable for the user to use Fipronyl at medium concentration this is because too high concentration may kill termites faster than expected while at lower concentration may not supply a sufficient dose for contaminated termites to transfer a lethal dose to unexposed termites. Appropriate concentration of a termiticides should be applied to achieve a wide coverage

INTRODUCTION

The Formosan subterranean termite are social insects living in colonies, *Coptotermes formosanus* Shiraki (Isoptera: Rhinotermitidae), is one of the most economically important termite pests and with a widespread global distribution (Henderson 2008, Rust & Su 2012).Among them, the introduced Formosan subterranean termites. It was established that *Coptotermes formosanus* Shiraki, is the most damaging species (Song & Hu, 2006).Due to the *macrotermes nataensis* which is widely distributed in Kenya with an extraordinary economic importance, intensive

research has been cantered on two main methods for subterranean termite control, based on bait technologies and liquid termiticides, have been widely used (Henderson 2001, Gautam& Henderson 2012, Rust & Su 2012).According to Haagsma and Rust (2007), Saran and Rust (2007) and Bagnères *et al.*, (2009) they established that, There is growing evidence that at least some non- repellent termiticides can be transferred among individuals within colonies. However, it was established by Thoms *et al.*,(2009), Liu *et al.*, (2011), Gautam and Henderson (2012), that termite baits have some obvious advantages in long-term termite control and structural protection for its low chemical expense and environmental friendliness but soil treatment with termiticides remains popular in termite control (Anonymous 2002, Su 2002,Su *et al.*,2004). One of the recent termiticides is Fipronil a phenyl pyrazole. It was reported that phenyl pyrazole is chemical that interferes with the function of the central nervous system (Cole *et al.*, 1993).It was discovered that, fipronil have activity on termite colonies beyond the immediate zone of treated soil (Potter and Hillery 2002, Osbrink and Lax 2003, Ripa *et al.*, 2007, Parman and Vargo 2010),therefore it leads to colony elimination. The main objective of this research is to evaluate the efficacy varied concentrations of Fipronyl 200g/l in the graveyard control of termites when compared to Termidor. Termidor is experimental standard. The severity of the risk posed to termites by Fipronyl200g/l and Termidor is primarily dependent upon the insecticide applied and their exposure to it and its residues. Fipronyl is an insecticide that blocks the g-amino butyric acid (GABA)-gated chloride channel of insect nervous systems, it is a highly effective, broad-spectrum insecticide which degrades slowly and has a degradation product more toxic and persistent than the parent compound. Therefore, it is effective insecticides to control termites hence it helps in preventing economic loss due to the damage to timber in both developed and developing countries.

Key words:

1. Efficacy 2.Fipronyl 200g/l 3.Controlling 4.Termites 5.Graveyard,

MATERIALS AND METHODS

Description of study site: The research was carried out in Kenya forestry research institute in Kibwezi sub- centre. The Kenya forestry research institute Kibwezi sub-centre is located in Kibwezi 1 km from Kibwezi town, off Nairobi – Mombasa highway.

Experimental design: The experimental research was carried out in between September 2014 and July 2015 .The experiments were laid out in Randomised group design carried out with five treatments, ten replicates and one hundred samples. Testing was carried out on Fipronyl at the rate of 200g/l against an approved and registered chemical known as Termidor. Whereby Termidor was experimental standard, the treated wood samples and controls was set up in a grave yard following the Protocols for assessment of wood preservatives; A production of the Australian wood preservation committee (AWPC) (2007). It was a Wood preservation experiment whereby the main target was building materials. *Eucalyptus grandis* and *Gravellia robusta* were treated using Fipronyl 200g/concentrations (2ml/l, 4ml/l and 6ml/l) and termidor concentration (10 ml/l).

Study sample: During the field trial experiment the test chemical was Fipronyl 200g/l. The recommended concentration to use is 4ml/l, this testing was carried out by using the same chemical at a lower and higher concentration. Fipronyl 200g/l was tested against an approved and registered chemical Termidor that have concentration of 10ml/l. The field experiment had control samples. Graveyard trial was carried out by using *Eucalyptus grandis* and *Gravellia robusta* commonly used as timber. These chemicals were applied in dip diffusion.

Experimentation design: Eucalyptus and gravellier samples of size 4 by 2 inches were measured from the market then cut into 1metre length and their weights were recorded .Labelling was done by assigning each a code. The samples were immersed for four days in Fipronyl 200g/l with concentrations of 2ml/l, 4ml/l and 6ml/l, termidor concentration of 10 ml/l. Some samples were kept to serve as controls. After four days the samples were removed and the weights were measured and recorded. The colour changed from golden brown to black on *Eucalyptus grandis* and no colour change in *Gravellia robusta* when treated with termidor. Slight change of colour to black but others no change of colour on *Gravellia robusta* when treated with Fipronyl 200g/l. The colour changed from golden brown to black on *Eucalyptus grandis*.

Data analysis: Data analysis was performed using STATA version 13 special edition after the data had been entered in Excel package before being exported to STATA software. Categorical variables were summarized as frequencies and its corresponding percentages, while weight loss, the only continuous variable of interest, was positively skewed because of some weighted outlier, therefore it was summarized as median and it's corresponding inter quartile range (IQR). Two-way ANOVA was the only statistical technique which was used to find out if there was any

difference in weight loss given that different concentration of treatments were applied using different modes of application in the field trial test . Results were presented in form of tables and graphs.

RESULTS

Magnitude of termites attack on treated and untreated timbers:

A total of 100 timbers generated data from graveyard trial test which was included for analysis. This represented 100% evaluation in each experimental trial. In graveyard trial test experiment, the number of timbers in the control group 20(20%) were not equal to that of intervention 80(80%) respectively. Data on weight loss by treatment captured during graveyard trial experiments for both overall and group summary statistics like median, minimum, maximum and inter quartile range (IQR) were presented in Table1. The median weight loss value for Eucalyptus timbers was 0(IQR: 0-0) kilograms and its respective minimum and maximum weight loss were 0 kilogram and 1 kilogram, and for Gravelier timbers had a median 0(IQR:0-0) and its minimum value of 0 gram and a maximum value 0.9 kilogram. In the experiment this variable (weight loss) was significant for the grouped factors median and IQR statistics which is a measure of variability in data. Majority of the timbers in the grave yard trial test treated with either Termidor or Fipronyl did not have their weights changed from the weights after exposure to termites, representing 80 (80%). This showed that the treatment was so highly effective that it suppressed the termites from finding the foods and for those termites which probed to eat the timber were completely killed by both Fipronyl and termidor.

Table1: Findings of weight loss stratified by treatment and control group as compared with its overall.

Outcome variable	Experiment type	Grouping factor	Freq.(%)	min	max	IQR	Median
	Graver yard	Control	20(20%)	0	0	0.1-0.4	0.3
		Treated	80(80%)	0	0	0-0	0
		overall	100(100%)	0	1	0-0	0

Control timbers which were under field trial experimental and had a weight loss of approximately 0.1 were 4(4%), those with a weight loss of 0.2 represented 5(5%), with 0.3 kilograms loss in weight were 5(5%), with 0.4 kilograms change from initial weight before exposure to termites were 3(3%) while all those which had a weight loss of 0.5, 0.8 and 1 kilograms represented a total of 1(1%), (figure 1). The median weight loss for controls and interaction timber were different. Furthermore, the shape of distribution was assessed and was not similar. Also the treated group and the control group had different inter quartile ranges, in graveyard trial test treated group had IQR: 0-0 kilograms while the control group had (IQR: 0.1-0.4 kilograms).

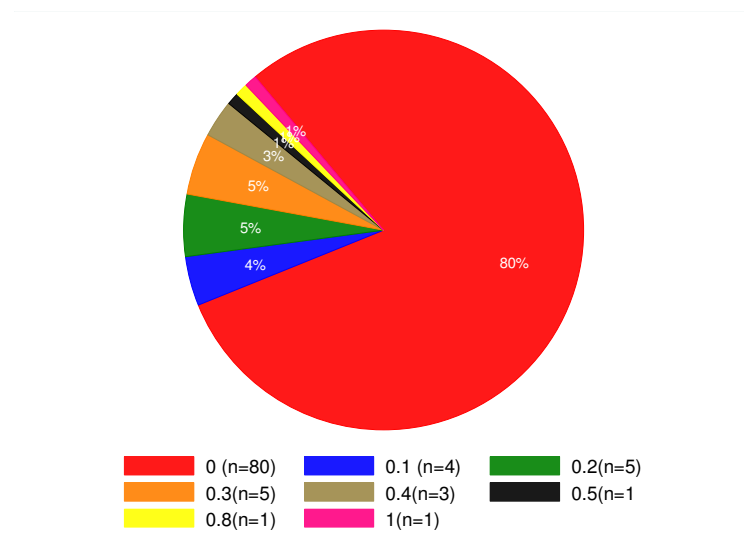


Figure 1: Distribution of Timbers by weight loss in the field trials

(n= numbers of pieces, decimal units are weights)

Different concentration of treatments applied to timbers was coded as T1, T2, T3, and T4 and the only control allotment was coded as T5. All timbers which were subjected to different concentration of treatment and showed no change in their weight were in 80(80%) during the field trial test, while timbers which were under control (T5) and were attacked by the termites showed different weight loss of (0.1, 0.2, 0.3, 0.4, 0.5, 0.8 and 1) kilograms being in total 80(80%) under field trial test (figure 2). Similarly, in the field trial test there was a significant difference in weight loss between control and treated timbers in their weight loss where mode of application of Fipronyl or termidor was achieved through dip diffusion, p- value (0) and adjusted

132 R-squared value (30.91%) of explanatory variable explaining the effect of treatment on termites
 133 among 100 timbers, (Table 3). That showed how effective the treatment (Fipronyl or termidor)
 134 was in controlling termites from destroying timber.

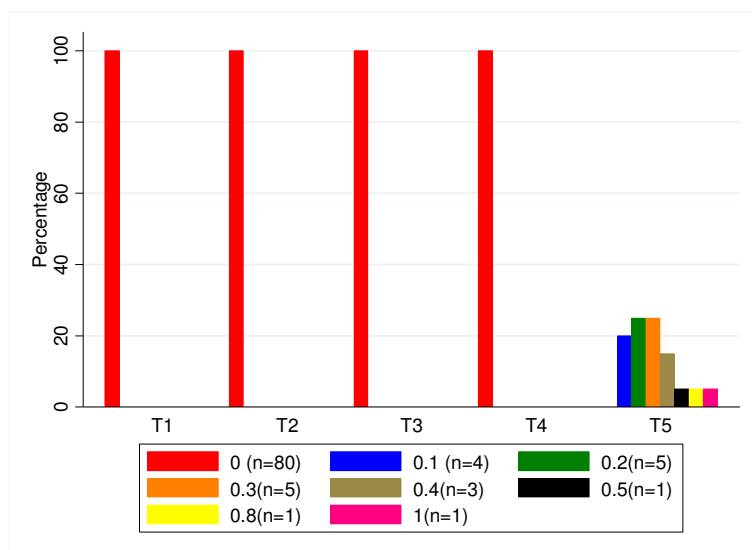


Figure. 2

Table 2: showing statistics on the loss weight of timbers

Variable	Mode of application	Sample size	Median	IQR
Weight loss	Dip diffusion(R1)	100	0	0-0

Table 3: Distribution of timbers by species and treatments applied under field trial test

	Treatment						
	Timber Species	T1	T2	T3	T4	T5	TOTAL
Field trial experiment	EU	10(20%)	10(20%)	10(20%)	10(20%)	10(20%)	50(50%)
	GR	10(20%)	10(20%)	10(20%)	10(20%)	10(20%)	50(50%)

T1-Standard recommended dosage **T2**- Higher dosage **T3**- Lower dosage **T4**-Termidor and **T5**- Control. **EU**-*Eucalyptus grandis* and **GR**- *Gravellier robusta*

Discussions

There was no difference in termite attack on timbers treated with different levels of concentration of either Fipronyl or termidor, the standard product. This study found out those different levels of concentrations of 2, 4 and 6 ml for Fipronyl or termidor (10 ml) have equal impact on termites since there was no difference in weight loss in the treated timbers. The results from experiment supported the fact that Fipronyl and termidor were more effective in controlling termites at different rates, a recent field study carried out by the author in Kibwezi (September 2014-July2015), the median weight loss for the treated timbers of sand was 0 grams while the control group varied from 0.1-0.4 kilograms. These findings showed that all levels of concentrations for the termiticides were equally effective when applied on timber. These findings are coherent with (Bagneres 2009) who suggested that intake of these fluids facilitates the transmission of toxic compounds. It also agrees with (Hu and Hickman 2006) who suggested that non-repellent compounds circumvent the difficult task of creating a continuous chemical barrier around a structure to exclude termites. This study analyses the quality of samples based on the two types of treatments (Fipronyl and termidor).From the results of this study showed that there is sufficient support for significant difference in termites attack between untreated and treated timbers with termiticides basing on weight loss rating of termite's attack, p-value (0) in graveyard studies. The study established that the difference was from untreated timbers which lost their weights after exposure to termites. Therefore, fipronyl is highly effective against a variety of termites. It disagrees with Su (2005) who found that fipronil did not meet the criteria for liquid termiticides baits. Result from this study shows that fipronyl treatment was as effective as termidor treatment on timbers which is consistent with (Gautam & Henderson 2011; Shelton, 2012) that suggested that termiticides transfer, or the movement of delayed action non-repellent

166 termiticides from exposed termites to naive nest mates, has been the subject of much research
167 over the past decade.

168 **Conclusions**

169 Termite galleries were evident after 10 months on untreated timber in graveyard trial test, which
170 showed that they were attacked. Termites generally did not get in touch with treated timbers.
171 Therefore, Fipronyl are effective termicides at the rates of 2, 4 and 6 ml/l and termidor is the
172 experimental standard. Significant differences in termites attack between untreated and treated
173 timbers with termiticides were based on weight loss.

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