Termite Management with Mulches of Plant Materials in Hot Pepper in the Bako Area of Western Ethiopia

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Abstract

The effects of maize stover, grass, haricot bean residue and tef straw each at the rate of 5 kg/ plot as mulches were evaluated for the control of termites in hot pepper at the Bako Agricultural Research Center in 2003/2004 and 2004/2005 cropping seasons. Diazinon 60% EC at 2lt/ha and an untreated check were included for comparison. The plot size was 4.2 m x 4.2 m. The experiment was laid out in a randomized complete block design with four replications. The treatments that showed promising effects were further evaluated on large plots (9.3 m x 9.1 m) in the 2005/2006 cropping season on farmers fields at Bako, Ijaji and BakoTibe. Results indicated significant differences among the treatments for all of the parameters considered. The percentage of damaged plants were significantly ($p<0.05$) lower on maize stover, grass and haricot bean residue mulches than that of the other treatments. The percent termite damage of hot pepper plants were 8.8, 12.4, 11.2 and 12.6 for the maize stover, haricot bean residue, grass mulches and insecticide treated plot, respectively. The damage in the untreated check was 21.1%. The percentage of damaged plants in the large plots ranged from 15.9-21.8 for the maize stover, haricot bean residue, grass mulches and diazinon, while damage in the untreated check was 53.6% at Ijaji. Similarly, the amount of plants at Bako Tibe ranged from 11.9-17.4 for the maize stover, haricot bean residue, grass mulches and diazinon, while that of the untreated check was 39.5%. The results elucidated that maize stover, haricot bean residue and grass mulches had comparable effects with that of diazinon 60% EC in controlling termites on hot pepper. These mulches can be recommended for use as part of the integrated management of termites on hot pepper.

Introduction

Termites are among the most important insect pests that cause severe damage to almost all crops. Hot pepper is one of the most susceptible crops to termites in the Bako area. Termites in the genera of Macrotermitidae, Rhinotermitidae, Ancistroterms, Pseudocantothers and Odonoterms are serious pests of agricultural crops, forestry trees, rangelands, furniture and buildings made of wood in Ethiopia, particularly in the Wollega region (Crowe et. al, 1977). Especially the genera Macrotermitidae and Rhinotermitidae are very serious in western Ethiopia. Abdurahaman (1990) reported that subfamily Macrotermitinae and the genera *Macrotermes, Microtermes, Odontotermes* and *Pseudacanthotermes* are very serious pest and forages throughout the year and after rain close to the nest in western Ethioipia (Mendi, Dembi Dollo, Arjo, Nejo Nekemt and the Bako areas). However,

the dominant species is *Macrotermes subhyalinus* builds dome-shaped epigeous mounds with a density ranging from 10-12 mounds per/ha in over all western Ethiopia (Abdurahaman, 1990). The density of *Macrotermes* spp. mounds reported per ha in the western Ethiopia ranged between 2-3 (Sands, 1976b) and 305 (Sanna, 1973). In Kajiado, Kenya, 8.5 and 9 mounds per ha were recorded for *M. subhyalinus* and *M. michaelseni*, respectively (Pomeroy, 1983).

According to Abdurahaman (1983) and Barnet (1987), termites cause up to 62% yield reduction in hot pepper at Mendi. Similarly, the yield of chemical treated and the untreated plots was 26.3 and 2.8 qt/ ha, respectively at Didessa (Abdurahaman, 1983), while at Bako it was 32.2 and 25.3 qt/ha for the treated and untreated plots, respectively (Ahmed, 2003 unpublished). The differences in yield between the treated and untreated plots were highly significant ($P < 001$) at both locations.

In spite of the efforts made at Bako and other areas to manage the pest, the problem is still prevailing and heavy crop losses are common in many crops. This is mainly because most of the species are subterranean and difficult to locate and destroy the colony. As a result, control measures heavily depend on organochlorin insecticides such as aldrin that persist for a long time. Environmental and health problems related to the use of persistent and toxic pesticides led to their banning and calling for alternative termite control strategies.

Logan *et. al,* (1990) showed that cultural control of termites in agriculture and forestry is attracting a renewed interest following the ban on use of persistent organochlorin insecticides. Cultural control methods may prevent termite access to plants, reduce termite numbers in the vicinity of plants and reduce susceptibility or increase the resistance of the plant themselves (Gold *et. al.*, 1991). Concrete research result on any of the non-chemical method is scarce, although numerous cultural methods have been suggested including measures to enhance plant vigor and to manipulate termite number and behavior. The benefits of application of mulch to the soil surface are widely appreciated in tropical agriculture (Schrthe *et. al,* 1992). Gold *et. al.* (1991) reported that mulches of plants with insect repellant properties such as neem and fistulosa resulted in significant protection to groundnut. Dawkin (1949) gathered empirical evidence in Uganda that repeated mulching of tree nurseries with grass over a period of year greatly reduced termite foraging. For the reason that termites prefer dry plants than wet plants because of cellulose content during foraging. The objective of this study was to evaluate effect of some plants used as mulch on termite damage to hot pepper in the Bako area.

Materials and Methods

The experiments were conducted in two phases. The first was on small plots (4.2 m x 4.2 m) at the Bako Agricultural Research Center for two cropping seasons (2003/2004 and 2004/2005). The treatments were arranged in a RCBD with four replications. The second was on non-replicated large plots (9.3 m x 9.1 m)) at two farmers fields, Ijaji and Bako Tibie. In both experiments four different plant materials, maize stover, haricot bean residue, grass (*Hyperhenia anthistrioides*) and tef straw, were used as mulching treatments. Diazinon 60% EC and untreated check were included for comparison. Based on the results of the first experiment, the amount of each much material used was 5 kg/ plot. Diazinone 60% EC was purchased from General Chemical and Trading Pvt. Ltd. Co, Ethiopia and used at the recommended rate (2 lt/ha). Hot pepper variety Bako local was planted on the plots at the space of 30 cm between plants and 70 cm between rows. The mulch treatments were applied two weeks after transplanting pepper seedlings in order to avoid mechanical damage. Data were collected on the number of damaged plants at the interval of two weeks, stand count at harvest and dry pod qt/ha. To avoid double counting damaged plants were tagged with strings of different color. The data obtained was subjected to analysis of variance using SAS v6.12 computer software and means were separated using Student-Newman-Keuls (SNK) Range Test.

Results

Effects of mulches on the percentage of damaged hot pepper plants, stand count at harvest and dry pod yield are shown in Table 1. Significantly ($p<0.05$) lower percentage of damaged plants and high pod yields were recorded in the maize stover followed by grass, haricot bean residue mulches

and Diazinon 60% EC than that of the tef straw mulch and the untreated check. The differences among the effective mulch treatments were not significant (Table1).

The percentage of damaged plants, number of plants at harvest and dry pod yield in the large plot experiments are shown in Tables 2 and 3. These measures were lower in the maize stover, haricot bean residue, grass mulches and the synthetic insecticide than that of the untreated check (Table 2 and Table 3).

Table 1. Combined effects of different mulches on termite damage and pod yield of hot pepper at Bako (2003/04 and 2004/05 cropping seasons).

Mulche treatments	Percent damaged plants	Stand count at harvest	Dry pod yield (qt/ha)
Maize stover	8.78 (17.17) ±1.48 b	73.88 (59.34) ±3.28 a	9.04 (17.12) ±4.03 a
Haricot bean residue	12.35 (20.43) ± 2.81 b	72.88 (58.63) ±1.78 a	8.59 (16.58) ±4.41 a
Grass(*Hyperhenia anthistrioides*)	11.16 (19.31) ± 3.26 b	73.75 (59.21)± 2.22 a	8.72 (16.67) ±4.60 a
Tef straw	20.39 (26.47) ± 5.50 a	65.63 (54.18) ±4.09 b	7.44 (15.02) ±5.58 b
Diazinon 60% EC	12.65 (20.36) ± 5.12 b	71.88 (58.01)± 2.37 a	8.47 (16.48) ±4.34 a
Untreated check	21.13 (27.14) ± 4.53 a	62.14 (52.02) ±1.78 b	7.05 (14.59) ±5.44 b
CV%	23.40	5.08	10.16

Means followed by the same letter within a column are not significantly different from each other at 5% level of probability (SNK Range Test) Values in the parenthesis are angular transformed.

Table 2. Effect of mulches on termite damage and pod yield of hot pepper in large plots at Ijaji (2005/2006 cropping season).

Treatments	Percent damaged plants	Stand count at harvest	Dry pod yield (qt/ha)	Yield advantage over the check (qt/ha)
Maize Stover mulch	15.88	339	14.87	8.13
Haricot bean straw mulch	20.84	319	12.55	5.81
Grass(*Hyperhenia anthistrioides*)	21.59	316	13.45	6.71
Diazinone 60%EC	21.84	315	14.32	7.58
Untreated check	53.59	187	6.74	

Table 3. Effects of mulches on termite damage in large plots at BakoTibe, West shoa in the 2005/2006 cropping season.

Mulch treatments	Percent damaged plants	Stand count at harvest (no)	Dry pod yield (qt/ha)	Yield advantage over the check (qt/ha)
Maize stover	11.91	355	16.01	6.79
Haricot bean straw	14.64	344	13.98	4.76
Grass(*Hyperhenia anthistrioides*)	17.37	333	17.54	8.32
Diazinone 60%EC	10.17	362	15.68	6.46
Untreated check	39.45	207	9.22	

Discussions

The study indicated that haricot bean residue, grass and maize stover mulches have showed less termite-damaged plants, high stand count at harvest and dry pod yield (Table1). The results are in agreement with the work of Dawkins (1949) who indicated that repeated mulching of tree nurseries with grass over a period of one year greatly reduced termite foraging. Although not strictly applied as mulch, tree trunks, branches and woody remnants are used in the Philippines and Sierra Leone to reduce termite attack in rice fields (Litsinger *et al.*, 1978; Raymundo, 1986). Epila and Ruyooka (1988) reported that leaves of the savanna trees Vitex doniana buried alongside cassava reduced termite damage and led to increased sprouting. Coaton (1950) also found that termite attack in fruit and forestry plantations was reduced to negligible level, even in areas with normally high level of damage, by leaving organic debris from land clearance and by cutting but not removing weeds. Experience in forestry plantation in Tanzania promoted Wardell (1987) to recommend leaving as mulch debris as possible on the site after clearing, to ring weed rather than clear weed young stands and to use dried out stoloniferous and rhizomatous materials from planting holes as mulch. Similarly mulching crops with various items including hay, manure, wood shavings or threshed maize cobs was said to dramatically reduce attack by small species of Macrotermitinae (Microterms, Ancistroterms and Allodonterms spp.) in South Africa, although it had much less effect on attack by larger species (Macrotermes and Odontotermes spp.) (Abdurrahaman, 1990). The tef straw mulch showed contradictory results in comparison with the other mulches. For the reason that it accumulated high amount of moisture (water logging) in the plots the plants become weakened by diseases (Fusarium wilt) and easily damaged by termite because of suffocation. In addition, According to Sekamate *et al.* (2001), the damage scores in plots with 10 kg and 20 kg of maize stover mulch were significantly higher than scores in plots with 30 kg and 40 kg maize Stover mulch and the damage in 40 kg mulch level plot in the two cropping season were 77% and 53% lower than in the un-mulched plot, respectively.

In general, the current findings are in agreement with that of other works elsewhere with the exception of the tef straw mulch.

Conclusions and Recommendation

From this study it can be concluded that maize stover, grass (*Hyparrhenia anthistrioides*) and haricot bean residue mulches each at 5 kg/ha effectively controlled termites in hot pepper and equivalent results were observed with synthetic insecticide Diazinon 60% EC at the recommended rate.

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