Termite Biocontrol on Cacao Seedling: Vetiver Grass Application

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Abstract.

Just in the last decade, cacao (Theobroma cacao) has been introduced to the agroforestry systems in some upland provinces of southern Vietnam, especially in cashew plantation for improving the income of local farmers. However termite attack on cacao seedlings is the main constraint to the development of this crop in these systems. Chemical application is the only method available for farmers to protect their cacao crop. So far there is no study on non-chemical termite control method. An experiment on natural termite control using vetiver grass was established by Nong Lam University (NLU) team from August to December, 2007 in Nghia Trung (site 1) and Nghia Binh (site 2) communes of Bu Dang district, Binh Phuoc province. The experiment aims to test the hypothesis that the natural oil compounds and some of its constituents in composted vetiver grass biomass can repel termite and its organic matter can enhance the growth of cacao seedlings. In each site, the trial was carried out with 6 month-old cacao seedling in a randomized complete block (RCB) design with 4 treatments and 3 replications. The 4 treatments were T1 (control treatment with manure only, no chemical, and no vetiver compost), T2 (farmer's practice with chemical termite control), T3(mixture of manure and lime), and T4 (mixture of manure and vertiver grass compost, and planting 6 vetiver clumps surrounding each cacao seedling). Manure, lime and vetiver compost were spread in the holes one week before planting. A total of 72 cacao seedlings were used in each site. Two months after planting, the rate of seedlings damage in site 1 were recorded to be 66%, 22%, 39%, and 17% but rate of seedling death due to termite were only 44%, 11%, 23%, and 0% for the treatments T1, T2, T3, and T4 respectively. The result shows that, no cacao seedling was damaged by termite in T4 (vetiver compost). The height of cacao seedlings after 4 months planting were recorded to be 61, 51, 58 and 80cm; the trunk diameter by 12, 10,14, 17mm per plant; and the number of primary branch were 3, 3, 3, and 4 per plant in the treatments T1, T2, T3 and T4 respectively. In site 2, the rate of seedling death by termite in the treatment T1, T2, and T3 were 72%, 61% and 61% respectively, while only 27% were recorded for the treatment T4 indicating that damage due to termite attack was lowest when applying vetiver compost. Because of the large seedlings were died in site 2, so some characteristics of cacao growth were monitoring only in site 1. The initial findings suggest that vetiver grass can be used not only as a tool for soil erosion control, but its biomass can used as a compost form for termite control also, instead of chemical, in cacao development in agroforestry systems.

Keywords. termite, biocontrol, vetiver, cacao

INTRODUCTION

Just in the last decade, cacao (Theobroma cacao) has been introduced to the agroforestry systems in some upland provinces of southern Vietnam, especially in cashew plantation for improving the income of local farmers. However termite attack on cacao seedlings is the main constraint to the development of this crop in these systems. Presently, control of termites depends mainly on the incorporation of synthetic chemical treatments with a long persistence into the soil and it is the only method available for farmers to protect their cacao crop. There is an interest in using natural products in pest control because of their low mammalian toxicity and environmental safety (Duke, 1990).

Vetiver grass, *Vetiver zizanoides (L.)* Nash is native to India and now commonly uses for soil and water conservation where soil erosion in problematic (Chomchalow, 2001). Beside the very high in biomass production, vetiver grass can produce many natural compounds that are repellent of insects (Duke, 1990). Chemical components of vetiver roots are also very important because they possess fungicidal, herbicidal and insecticidal properties. Vetiver oil and some of its constituents are repellent and toxic to termite (Hendersen et al., 2005b; Ibrahim et al., 2004; Zhu et al., 2001a, 2001b). With 25% vetiver root mulch treatment proved to decrease tunneling activity and wood consumption and increase termite mortality (Nix et al., 2006). Trees surrounded by vetiver do no require traditional anti-termite treatment with lime.

So termite biocontrol on cacao seedlings by vetiver grass application was studied to test the hypothesis that the natural chemical compounds and some of its constituents in composted vetiver grass biomass can repel termite and its organic matter can enhance the growth of this crop.

TRIAL METHODOLOGY

Time and location.

Two field trials were established with cacao planting under cashew plantation, at Nghia Trung (site 1) and Nghia Binh (site 2) communes of Bu Dang district, Binh Phuoc Province, from August to December, 2007.

Trial design.

In each site, the trial was carried out with 6 month-old cacao seedling in a randomized complete block (RCB) design with 4 treatments and 3 replications. The 4 treatments were T1 (control treatment, using 10kg of cow manure only, no chemical, and no vetiver compost), T2 (farmer practice, 10kg cow manure with chemical termiticide, commercial name- NoKap 20EC), T3 (mixture of 10kg of cow manure and 0.5kg of lime), and T4 (mixture of 5kg of cow manure and 5kg of vetiver grass compost, and planting 6 vetiver clumps surrounding each cacao seedling). Manure, lime and vetiver compost were spread in the holes one week before planting. A total of 72 cacao seedlings were used in each site.

Objectives.

Vetiver grass biomass can used as compost form for termite repelling and its organic matter should enhance the growth of cacao seedling.

RESULTS AND DISCUSION

Effects on Vetiver grass on repellence to termites.

Cacao seedlings often was damaged by termite during the raining season of the first year of planting- farmers experiences. The effects of vetiver grass the cacao seeding damaged was presented in table 1 (site 1) and table 2 (site 2).

Table 1. Percentage of cacao seedlings damaged 2 months after planting

Treatment	Total damaged (%)	damaged by termite (%)
T1	66 [a]	44 [a]
T2	22 [b]	11 [b]
T3	39 [b]	23 [ab]
T4	17 [b]	0 [b]
Prob.	0.004	0.014

Four (4) months after planting, the total cacao seedlings damaged was so high in all treatments, especially in T1 (66%) and T3 (39%). Only the seedlings died in T1 was significant higher than the others. But in T4 (vetiver grass) treatments, no seedlings died by termite attack, the seedlings in this were damaged by another disease (Phytophthora palminova). While in the T1 (control) T2 (chemical) and T3 (lime used as a way of termite control) treatments, the seedling damaged was so high, 44%, 11% and 23%, respectively.

The results shown that, vetiver grass using as a compost form and planting its surrounding cacao seedlings can markedly reduced the attack of termite on this crop and its effectiveness as same as the chemical treatment. This is possible due to the natural chemical compounds content in the whole vetiver grass (including leaves and roots), those compounds, possibly release during the decomposing of compost and repel termites away.

Site 2.

Table 2. Percentage of cacao seedlings damaged 2 months after planting

Treatment	Total damaged (%)	damaged by termite (%)
T1	72[a]	72 [a]
T2	61[ab]	61 [ab]
T3	61 [ab]	61 [ab]
T4	27[b]	27 [b]
Prob.	0.037	

Although the Cacao seedlings died was so high, and the all of the seedlings were damaged by termites in this site, but it was considered that the seedlings damaged in T4 was lowest (27%) , and significant lower than that of the control treatment (72%).

Compare to that in site 1, it shown that the seedlings died by attack of termites was higher, this is possible due to the poor establishment of live vetiver planting surrounding cacao seedlings.

Effects of vetiver grass on the growth characteristics of cacao seedlings, 4 months after planting in site 1

Table 3. Some characteristics of cacao growth , 4 month after planting.

Treatment	Plant height (cm)	Diameter of base tree (mm)	Primary branch (no.)
T1	61[ab]	12[ab]	3.0 [ns]
T2	51 [b]	10[b]	2.7 [ns]
T3	58 [ab]	14 [ab]	3.3 [ns]
T4	80[a]	17 [a]	3.7 [ns]
Prob.	0.007	0.046	0.34

The plant height, diameter of base tree of cacao seedlings in T4 were almost higher than the others, significantly. This is possibly due to the role of organic matter that can improve soil water holding capacity and nutrients and chemical compounds, those release from the decomposition of the compost (Mao et. Al. 2006).

Findings

The findings suggest that vetiver grass can be used not only as a tool for soil erosion control, but its whole biomass also done as a compost form for termite repelling, instead of chemical, and enhancing the growth of cacao crop development in agroforestry systems.

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Pictures:

Cacao seedling death by the attack of termites


Termites are attacking cacao seedling


Vetiver with cacao seedling


When using vetiver grass as a mulch. It is feed of termites (like wood)