Cultural Method of Controlling Termite Attacks on Cassava (Manihot esculenta) with Vitex doniana: A Preliminary Study (Isoptera)

by

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ABSTRACT

Species of subterranean termites (not yet identified), foraging in a field 2 weeks prior to the choice-feeding experiments where cassava and *Vitex doniana* cuttings were simultaneously offered, showed marked preference for *V. doniana* over cassava. Indeed, *V. doniana* cuttings buried in close proximity to cassava attracted relatively higher termite populations which evidently resulted in a 3-fold increase in the sprouting of such cassava cuttings. Chemical(s) in the wood or bark were suspected to be the basis for the *V. doniana* attractancy to termites. Technical improvement of the method is suggested and the potential environmental advantages of this termite management strategy vis-a-vis the traditional chemical method of termite control under permissive tropical climates are briefly discussed.

INTRODUCTION

The bulk of agricultural production in the tropics is accomplished on small holdings by peasants. Indeed, it is remarkable that such levels of production are sustained using minimal inputs, e.g. simple hand tools, family labor, etc. The "package" of mutually dependent inputs, the most critical of which are improved high yielding crop varieties, fertilizers, and plant protection (principally pesticides), rarely reach peasant farmers because of poor extension services (Idachaba 1980, Opio-Odongo 1986). Even if such modern agricultural technology were to reach peasants, 2 factors would militate against their adoption and use. First, the peasants' concepts of traditional agricultural management practices are usually not sought and blended into such prescriptions (Opio-Odongo 1986).

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Secondly, agrochemicals are prohibitively expensive. That tropical peasants have maintained such productivity levels against these often times formidable odds suggests that a wealth of ethnosciences and/or practices exist and sustain agricultural production. Such primitive approaches to agricultural management have, until recently, been ignored by modern science. Agricultural practices which inadvertently lower pest and disease incidences plus those pest control strategies which evolved under primitive agricultures are classical examples of traditional pest control practices that modern agricultural management has relegated until the recent advent of Farming System Research (FSR).

The cultural method of combating termite attack on cassava (*Manihot esculenta* Crantz) using *V. doniana*, a deciduous savanna tree (Eggling 1951), is 1 such time honored traditional pest control tactic which has remained largely unrecognized in spite of extraordinary scientific interest generated by FSR. Yet the practice is widespread in the farming systems of northern Uganda. Precisely how the technique evolved is unknown even to the modern practitioners. It is quite possible that the method evolved accidentally because of the apathy with which colonial scientific mentors did view the roles of non-cash crop contributions to both colonial and peasant economies. Peasants probably searched and tumbled onto this environmentally safe way of combating termites attacking this important famine crop. In this paper we report the results of a preliminary study in which the validity of this ethno-scientific approach of combating termites was investigated at a site in Nambieco sub-county (2°0'N 32°8'E) located on a peneplain (Langdale-Brown *et al.* 1964), fringing the northern shores of Lake Kyoga, Uganda. The dominant vegetation at this site were *Combretum, Acacia*, and *Hypherenia* spp.

MATERIALS AND METHODS

Cuttings. *V. doniana* cuttings used in this study were obtained from the branches of several mature trees growing within a 1km radius of the experimental site. Mid-diameters of the cuttings varied between 2-3cm and were a standard length of 25cm. Cassava cuttings (a variety locally known as "Olepo") of similar sizes were cut from a 1-year old cassava crop. Both cuttings (*V. doniana* and cassava) were used 1 day later after cutting.

Experiments. Experiments were conducted in a field cultivated 2 weeks earlier. Two "planting" (burial) strategies of the cuttings were used in the investigations: (1) 143 cuttings each of *V. doniana* and cassava were paired, buried side by side in graves (*ca.* 6cm deep x 10cm wide x 30cm long) and spaced out at 1.0

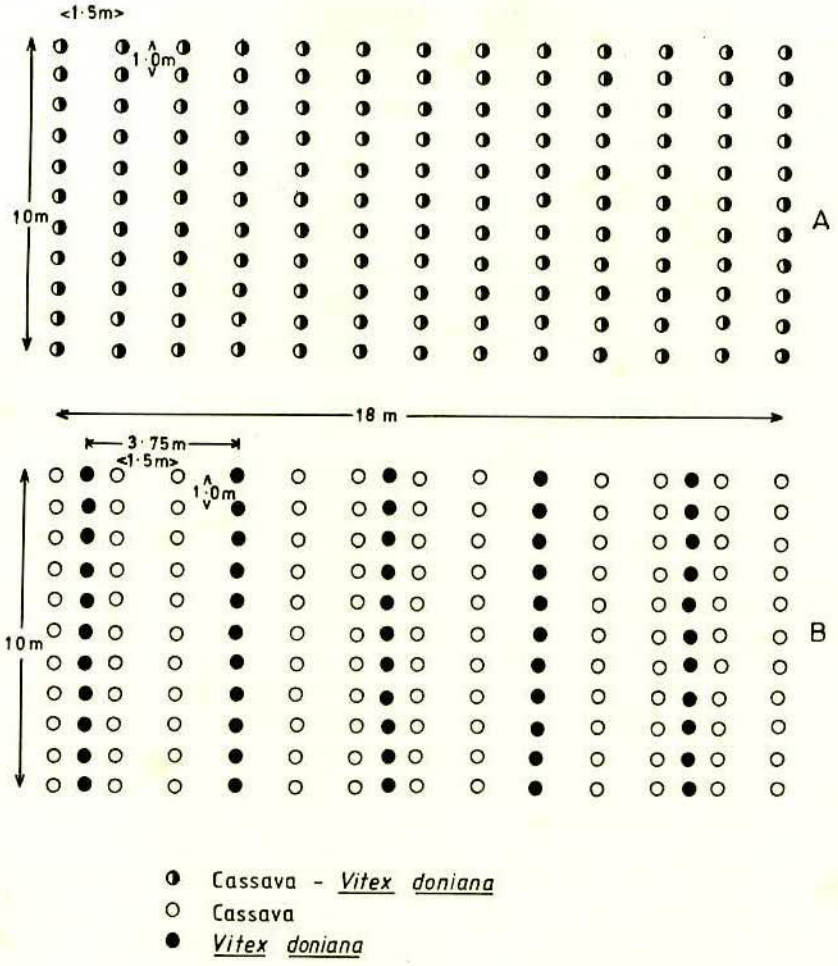

Fig. 1. Planting methods: A, Side by side; B, Interplanted.

by 1.5m (Fig. 1A), and (2) 55 *V. doniana* were "interplanted" at 1.0 by 3.75m with 143 cassava similarly spaced as in (1) (Fig. 1B). An experimental plot which was randomly assigned to a planting strategy measured 10 x 18m with a border of 2m all around it. Each experimental strategy was replicated twice while 143 cassava and 66 *V. doniana* cuttings buried at 1.0 x 1.5m in separate adjacent plots served as controls, the former occupying a plot measuring 10 x 18m and the latter a plot which was 5 x 12m.

Sampling. Populations of termites on cuttings from all burial experiments were assessed after 3 days. In the side by side experiment, a hollow metal frame made to fit the grave (6 x 10 x 30cm) was used to block most of the exit/entry galleries

to confine the invading termites to graves. Populations of termites on either of the cuttings were separated by inserting a rectangular tin plate (6 x 30cm) between the 2 cuttings as soon as the exhuming process was within 2cm of the cuttings. Otherwise for the "interplanting" experiment and controls, only the metal frame was used. Fifty control cuttings were sampled while a total of 25 cuttings from each of the 2 experimental plots were used to assess termite infestation behavior. We counted the termites in the field visually. Similarly, the resulting damage to the sampled cuttings was also subjectively assessed in the field, using the following ratings: <50% = low; 50-70% = moderate; and >70% = severe. After 10 days, 70-72 cassava cuttings were exhumed from both experimental and control plots to estimate sprouting.

RESULTS AND DISCUSSION

Invading populations. Table 1 shows that a higher proportion of the invading termite populations attacked *V. doniana* than cassava in all the experimental sets. The results were more interesting when the 2 types of food were exposed to termites side by side in the same grave. Here, twice as many termites were attracted to and attacked *V. doniana* in a manner almost disregarding the cassava cuttings. The more abundant cassava cuttings interplanted with *V. doniana* (Fig. 1B) appeared to have had a distracting effect on the infestation behavior of the termites. Nevertheless, even under this situation, the attractiveness of *V. doniana* in terms of demographic response, was still clear and dominant (Table 1). Evidently, the differential termite infestation behaviors on *V. doniana* and cassava cuttings that have been recorded in this study can no longer be unequivocally explained by the rather simplistic, ethno-scientific theory that "*V. doniana* wood is sweeter than cassava wood" (Unpubl. information). Neither do differences in the physical qualities of wood (e.g. Behr 1972, Bultman *et al.* 1978) offer a suitable explanation for our data. For example, cassava should have been preferred because of its softer wood which should make it easier to fragment and ingest instead of the harder wood of *V. doniana*.

We realize that the hardness of wood may not be a deterrent in the termites' choice of food. On the contrary, chemical attractants could be the basis for explaining the observed termites' behavior. The role of chemicals in phytophagy is important (Dethier 1982, Tallamy 1985). The works of Carter & Smythe (1974), Haverty & Nutting (1975), Carter *et al.* (1978, 1979), Carter & Mauldin (1981), and Carter & Huffmann (1982) give excellent accounts of chemical influences on food selections by termites.

Table 1. Consumption of Cassava and *V, doniana* cuttings by termites.

Treatment	Cuttings	No. Sampled	%Attacked	Mean
Side by side	Cassava	50	10	22.0
	V. doniana	50	24	46.0
Interplanted	Cassava	50	20	43.1
	V. doniana	50	14	52.7
Control	Cassava	50	24	54.9
	V. doniana	50	62	78.8

The chemicals can act as phagostimulants, repellents, attractants, or deterrents that enable termites to make subtle discriminations among different host plants and in some cases among strains of their preferred food plants. Other biodegrading agents such as fungi can also predispose wood of various plants to termite attack, apparently by altering the palatability of such woods (Watanabe & Casida 1963; Ruyooka & Edwards 1980). Both explanations are possible and neither are specifically supported by the data herein.

Termite damage and cassava sprouting. Even after only 3 days of exposure, the majority of infested cuttings had sustained low to moderate damage (Table 2). Almost all the samples of cassava cuttings that did not sprout were found to be severely damaged upon exhumation on day 10 (Table 3). The sprouting data support the contention that baiting the termites with *V. doniana* caused

Table 2. Frequency ratings of termite damage to samples of Cassava and *V. doniana* cuttings.

Treatment	Cuttings	Damage Scales			
		Low (50%)	Moderate (50-70%)	Severe (70%)	Total
Side by side	Cassava	5	0	0	5
	Vitex	9	3	0	12
Interplanted	Cassava	8	2	0	10
	Vitex	5	2	0	7
Control	Cassava	5	7	0	12
	Vitex	15	16	0	31

Table 3. Sprouting of experimental cassava cuttings.

Treatment	No. sampled	No. sprouted		No. unsprouted	
		Attacked	Unattacked	Attacked	Unattacked
Side by side	71	49	8	12	2
Interplanted	70	25	11	29	5
Control	72	16	13	39	4

increased sprouting of the cassava cuttings (ratio 3:1) (Table 3).

This is an important finding for termite management on tropical farms. Hitherto, soil pests, especially termites, have been controlled largely with conventional insecticides (e.g. aldrin, chlordane, dieldrin, and heptachlor) (see Lilly 1956, Beal & Smith, 1971, Telekar *et al.* 1983a & 1983b). But technical difficulties associated with rapid biodegradability of these chemicals in the soil medium, especially since the process is synergised by the permissive tropical climate, are rather disturbing (Harris 1972, Felsot *et al.* 1982). Because of long term persistence of some pesticides (Telekar *et al.* 1986a, b) the use of some of the chemicals for subterranean pest management has be curtailed.

V. doniana appears to be an environmentally safe and cheaper method for controlling subterranean termites as shown by this study. This bait could perhaps be substituted for chemical methods of control, although no comparative study was done. For example, *V. doniana* wood cut into effective dimensions could be placed into planting holes to bait termites prior to planting cassava cuttings. This suggestion is feasible because *V. doniana* is abundantly available in the cassava growing regions of Uganda. The benefits of the practice may offset the additional labor costs. Also, "beating up" operations designed to restore reasonable plant production after termite damage are also costly and would be less necessary if the cuttings were used.

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