Journal of King Saud University – Science (2018) 30, 214–222

King Saud University
Journal of King Saud University – Science
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Farmers' perception of the usefulness of vetiver grass for termite control on Ogbomoso Agricultural Zone farmlands, south-western Nigeria

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Received 3 October 2016; accepted 3 January 2017
Available online 9 January 2017

KEYWORDS

Vetiver;
Termite infestation;
Termite control strategy;
Ogbomoso Agricultural Zone

Abstract The study investigated farmers' perception on the use of vetiver grass for termite control in Ogbomoso Agricultural Zone, south-western Nigeria. Respondents were selected using purposeful sampling technique from four out of the five local government areas (LGAs) that made up the agricultural zone. Sampling was restricted to the farmers that could identify vetiver, based on our preliminary informal investigation. Information was elicited from the respondents on damage caused by termites, termite control practices, awareness of the potentials of vetiver grass for termite control, perception of the usefulness of vetiver grass for termite control and reasons for adoption of vetiver. Sixty five validly filled questionnaires were analysed using descriptive statistics and chi-square. A larger proportion of the respondents (33.3%) were 40–49 years old and 81.5% of the respondents were married. A larger percentage of the respondents (35.4%) had no formal education, while 23.1% had primary education. The respondents were predominantly Christians (58.5%) while 38.50% practised Islam. Male gender formed the majority (72.3%) of the respondents. Respondents' perception of the type of damage caused by termites on crops was significantly affected by their educational qualification ($X^2 = 4.941$, $p = 0.026$), the majority (81.8%) who were illiterates agreed that termite reduced crop yield. The proportion of the respondents who used chemical method for control of termites was significantly affected by secondary occupation ($X^2 = 4.740$, $p = 0.029$) with the civil servants (53.8%), those who have private businesses (63.9%) and the students (66.7%) being the predominant users of chemical termiticides. Respondents' perception of the effectiveness of vetiver grass for the control of termites was significantly affected by their secondary occupation ($X^2 = 3.853$, $p = 0.050$); the majority (77.8%) who were

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Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.jksus.2017.01.002

into private businesses strongly agreed on the effectiveness of vetiver grass for the control of termites. It is recommended that agricultural extension agents should educate farmers on the potentials of vetiver grass as a compatible strategy with chemical method for control of termites.

1. Introduction

Termites constitute major menace to agricultural production in the tropics. The economy of any nation can be affected by the infestation of its farmlands, animal pens, residential and storage facilities by multiple termite species. This is because termites can cause denudation of farmlands, destroy growing crops, farm structures as well as the harvest in the store (Adejumo and Raji, 2007; Musa et al., 2014; Loko et al., 2015; Ogedegbe and Ogwu, 2015). Therefore, termites should not be left uncontrolled whenever they are noticed.

Planting of cassava cuttings when the rain becomes steady, application of NPK fertilizer and early harvesting of yam tubers had been reported as workable cultural control strategies against termite infestation of farmland in south eastern Nigeria (Atu, 1993). Synthetic chemicals are often used to control pests in the study area. The class of chemicals used are the organophosphates and pyrethroids. Incidentally, some rural uneducated farmers even scout for the banned/prohibited products like aldrin, lindane and DDT to control termites. It is possible that the uncontrolled use of these synthetic pesticides can cause several ecological problems like human health hazards, toxicity against the beneficial organisms and emergence of new strain of termites that has developed resistance against the synthetic pesticides. It is necessary that control measures should be carefully selected to ensure reduction or even elimination of the infestation. Bearing in mind the concept of sustainability, selection of appropriate termite control strategy under tropical condition should be eco-friendly and economically sound to grant resource-poor farmers the privilege of affordance (Babarinde et al., 2014). The use of botanicals can be a promising alternative to overdependence on synthetic chemicals due to the comparative availability, low cost and ecological safety of the former (Adeyemo et al., 2015; Babarinde et al., 2016a,b).

Vetiver (*Vetiveria nigritana* (Benth.) Stapf) grass is a multifunctional species which has been reported in different countries for several purposes. It has a deep thick root system which spreads vertically rather than horizontally, which allows it to efficiently endure harsh conditions (Maneecharoen et al., 2013). Evidence abound that vetiver has been tremendously used to solve the problem of erosion and loss of soil nutrients (Truong and Loch, 2004; Sanguankaeo et al., 2011; Cao et al., 2015; Donjadee and Tingsanchali, 2016). Its use in bioremediation of heavy metal-polluted soils has also been reported (Truong and Baker, 1988; Shu et al., 2000; Wong, 2003). It is pruned as fodder for ruminants during dry season, roof thatching, mushroom production substrate, compost, mulching material (Oku and Aiyelari, 2014). It is used in unconventional water treatment as a phytoremediation scheme (Keshtkar et al., 2016). Its dry roots are used to make curtains, mats, fans and other fancy goods as the product emits a sweet cooling aroma for a long period when moistened during summer season. Its oil is used in perfumery, cosmetics and scenting of soaps (Kumar and Nikhil, 2016). Zhu et al. (2001a) gave a list of the usefulness of vetiver roots and oil to include biological activities like antioxidant, antimicrobial, insecticidal, anticancer and termiticidal effects. Ever since the discovery of vetiver, its uses have been on the increase especially in the tropics and sub tropics. It is based on that premise that scientists are seeking its potentials to control other threatening issues in the developing countries.

Although in few home steads in southern, western and eastern Nigeria, vetiver is being planted for termite control or as ornamentals; many farmers might not have been informed of some other vetiver agronomic values. Recently, Jayashree et al. (2014) demonstrated the potential of powder from leaf and root of vetiver as an anti-termite formulation. The prospect of vetiver for exploration as a termite control strategy is that it produces a scent which serves as a repellent to termites. Repellence and toxicity of essential oils from vetiver grass against formosan subterranean termites was reported by Zhu et al. (2001a). Nootkatone (a sesquiterpene ketone) which is a component of *Vetiveria Zizanioides* (L.) Nash grass oil has been reported as a strong repellent and toxicant to formosan subterranean termites (Zhu et al., 2001b). Jayashree et al. (2014) and Kasseney et al. (2016) reported that vetiver has feeding deterrence, toxic and termiticidal potentials.

Chemical composition of vetiver oil is extremely complex with over a hundred sesquiterpene type of compounds and their derivatives belonging to 11 structural classes (Khalil and Ayoub, 2011). The essential oil of roots of *V. nigritana* from Benin contained terpenes, alcohols, acids, aldehydes and ketones. The major components were ledene oxide (52.1%), zizanoic acid (49.8%), hexadecanoic acid (43.5%), prezizanoic acid (29.1%), cedrol (43.6%), khusinol (23.0%), cedr-8-en-15-ol (21.5%), khusimol (14.8%), khusian-2-ol (14.0%), phytol (13.4%) and α-cedrene (16.1%) (Kossouoh et al., 2008). However, according to Khalil and Ayoub (2011), the main constituents identified in the essential oil of *V. nigritana* root grown in Sudan were longifolene D (25.1%), 2-hydroxycyperol (9.7%) and aromadendrene oxide (1) (8.8%). Some compounds like terpenes and acids identified in vetiver essential oils have been reported to be either repellent or toxic against insects (Zhu et al., 2001b; Babarinde et al., 2016a). According to Nix et al. (2006) and Mao et al. (2006), the recommended use schemes for vetiver in termite control include the use of the grass root as mulch around tree crops and incorporation of vetiver essential oil into growth media. This research was therefore designed in order to evaluate farmers' perception of the usefulness of vetiver grass for control of termite' infestation on farmlands in Ogbomoso Agricultural Zone, south-western Nigeria. To achieve this aim, this study was set to provide answers to the following questions: (a) What were the farmers' perceptions on the types of damage termites pose on crops? (b) What were the farmers' reasons for the

adoption of vetiver grass? (c) What were the farmers' perceptions of the usefulness of vetiver grass for termite control? (d) What level of awareness of vetiver grass as a means for termite control had the farmers in the study area?

2. Methodology

The study was carried out in selected local government areas (LGAs) of Ogbomoso Agricultural Zone, south-western Nigeria. Ogbomoso Zone is made up of five LGAs, which are Ogbomoso South, Ogbomoso North, Oriire, Surulere and Ogo Oluwa LGA (Fig. 1). The primary occupation in the study area is farming. The information used for this study was obtained from administering of questionnaires to the farmers. Information was elicited from the respondents on damage caused by termites on crops, management practices for controlling termites, awareness of vetiver grass as a means for termite control, respondents' perception of the usefulness of vetiver grass for termite control and the reasons for the adoption of vetiver grass. The farmers were visited in their villages to administer the questionnaires. The illiterate farmers were interviewed in their local language and their responses were used to fill the questionnaires, while the literates were guided to personally fill the questionnaires. Eighty one farmers were randomly selected from the list of farmers made available by a contact farmer from four out of the five LGAs of the studied agricultural zone using purposeful sampling technique because not all farmers could identify vetiver grass. Therefore, sampling was restricted to the farmers that could identify the grass, based on a preliminary informal investigation. Of the number of questionnaires administered, sixty five validly filled ques-

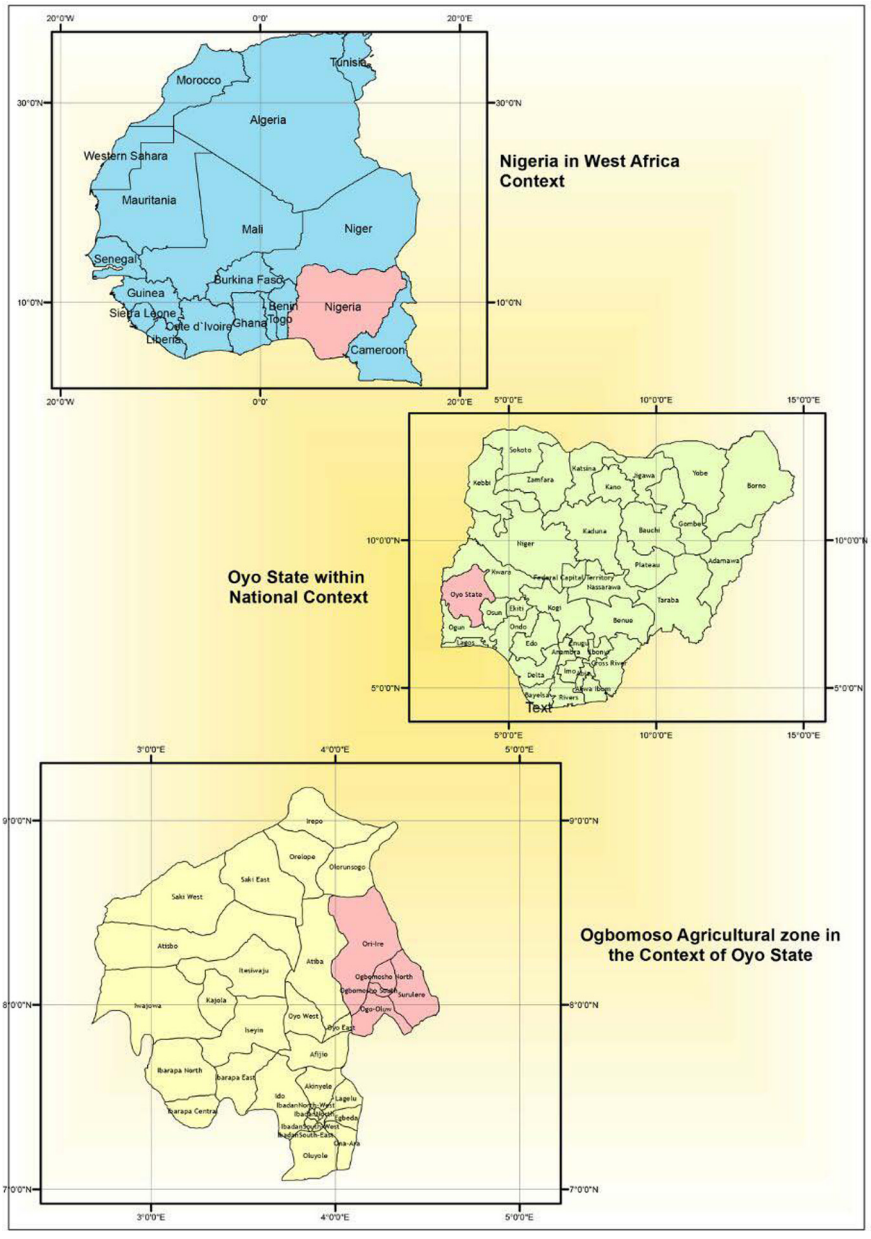

Fig. 1 Map showing the study area: Ogbomoso Agricultural Zone in the context of Oyo State, Nigeria.

tionnaires were selected. The overall response rate (successful questionnaires completed) was above 80%. The survey data were encoded, entered into excel sheets and verified prior analysis. SPSS version 15.0 (SPSS Software, 2006) was used for the descriptive statistics and chi-square. A 5% probability level was used for the linear by linear association.

3. Results

3.1. Socio-economic characteristics of the respondents

Table 1 provides a summary of respondents surveyed on their socio-economic background. The respondents from Ogbomoso South LGA were 22.2%; 43.2% were from Ogbomoso North LGA, 32.1% were from Surulere LGA and 2.5% from Oriire LGA. The highest percentage of the age category (33.3%) was between 40 and 49 years and the majority 81.5% were married while 23.1% had primary education. A larger percentage of the respondents (35.4%) had no formal education. The respondents were predominantly Christians (58.5%) while 38.5% practised Islam. Majority (72.3%) of the respondents were male (Table 1).

3.2. Farmers' perception of the major type of damage caused by termites on crops

The major type of damage caused on crops by termites, as indicated by the larger proportion of the respondents, was reduction in crop yield. The respondents' perception of the major damage termites caused on crops was not significantly affected by age category ($X^2 = 3.742$, $p = 0.053$). About 35.7% who identified reduction in crop growth as termite' major damage on crops were 20–29 years old. The majority (90.9%) who were of the opinion that reduction of crop yield was the major damage caused by termites on crops were 40–49 years old, while 20.0% who reported that termites caused no damage at all were 30–39 years old (Table 2). However, the respondents' perception of the major type of damage termites caused on crops was significantly affected by educational qualification ($X^2 = 4.941$, $p = 0.026$). The proportion (46.7%) who indicated reduction in crop growth as the major type of damage done on crops by termites had post-secondary education, the majority (81.8%) who stated that reduction in crop yield was the major type of damage done on crops by termites had no formal education while 13.3% who said termite caused no damage at all had primary education. The respondents' perception of the major type of damage termites pose on crops was not significantly affected by secondary occupation ($X^2 = 1.338$, $p = 0.248$). The proportion (38.5%) who indicated reduction in crop growth as the major type of damage done on crops by termites was civil servants. The majority (88.9%) who indicated reduction in crop yield as the major type of damage done on crops by termites were into private business, while (11.1%) who were students formed the proportion that said termites caused no damage to crops (Table 2).

Table 1 Socio-economic characteristics of the respondents ($N = 65$).

Characteristics	Frequency	Percentage
Farm location (LGA)		
Ogbomoso south	14	22.2
Ogbomoso North	28	43.2
Surulere	21	32.1
Orire	2	2.5
Age (yr)		
<20	2	3.7
20–29	12	18.5
30–39	14	21.0
40–49	22	33.3
50 and above	15	23.5
Gender		
Male	47	72.3
Female	18	27.7
Religion		
Christianity	38	58.5
Islam	25	38.5
Traditional	2	3.0
Marital status		
Married	53	81.5
Single	12	18.5
Educational level		
No formal education	23	35.4
Primary school	15	23.1
Secondary school	12	18.4
Post-secondary school	15	23.1

LGA = Local Government Area.

3.3. Farmers' management practices for controlling termites on their farmland

Management practices for the control of termites by respondents was not significantly affected by age category ($X^2 = 0.201$, $p = 0.654$). About 58% that used chemical method for termite control were 30–39 years old, while 18.2% of the respondents who used clearing of bush as termite control strategy were 40–49 years old. Respondents between 20 and 29 years old formed 35.7% who used crop rotation to control termites (Table 3). Management practices for the control of termites by the respondents was not significantly affected by educational qualification ($X^2 = 0.009$, $p = 0.923$). Above half of the respondents (54.5%) who used chemical method had no-formal education, while 20.0% who used clearing of bush had primary education. About 46.2% who used crop rotation as termite control strategy had secondary education (Table 3). The management practices adopted by respondents for termite control was significantly affected by secondary occupation ($X^2 = 4.740$, $p = 0.029$). The majority (63.9%) who used chemical method were into private businesses, while 23.1% that used clearing of bush as termite management strategy were civil servants and 22.2% who were students formed the proportion of the respondents who used crop rotation for termite control (Table 3).

3.4. Farmers' awareness of vetiver grass as a means for termite control

Awareness of respondents on use of vetiver for controlling termites was not significantly affected by age category ($X^2 = 2.616$, $p = 0.106$) (Table 4). The majority (64.3%) aged 20–29 years had the awareness of the usage of vetiver grass for

Table 2 Farmers' perception of the major type of damage termites pose on to crops on farmland.

Farmers' category	Perception of damage caused on crops by termites			
Age	Crop growth reduction	Crop yield reduction	No damage at all	Total
< 20	2(66.7)	1(33.3)	0(0)	3(100)
20–29	5(35.7)	9(64.3)	0(0)	14(100)
30–39	1(6.7)	11(73.3)	3(20.0)	15(100)
40–49	2(9.1)	20(90.9)	0(0)	22(100)
50 and above	1(9.1)	10(90.9)	0(0)	11(100)
Linear-by-linear association 3.742, ($p = 0.053$)				
Education	Crop growth reduction	Crop yield reduction	No damage at all	Total
No formal education	3(13.6)	18(81.8)	1(4.5)	22(100)
Primary	1(6.7)	12(80.0)	2(13.3)	15(100)
Secondary	0(0)	13(100)	0(0)	13(100)
Post-secondary	7(46.7)	8(53.3)	0(0)	15(100)
Linear-by-linear association 4.942, ($p = 0.026$)				
Secondary occupation	Crop growth reduction	Crop yield reduction	No damage at all	Total
Civil servant	5(38.5)	7(53.8)	1(7.7)	13(100)
Private business	3(8.3)	32(88.9)	1(2.8)	36(100)
Student	2(22.2)	6(66.7)	1(11.1)	9(100)
Clergyman	0(0)	4(100)	0(0)	4(100)
Linear-by-linear association 1.336, ($p = 0.248$)				

Figures in parenthesis are percentages.

Table 3 Farmers' management practices against termites on their farmlands.

Farmers' category	Termite management practices			
Age	Chemical method	Bush clearing	Crop rotation	Total
< 20	3(100)	0(0)	0(0)	3(100)
20–29	8(57.1)	1(7.1)	5(35.7)	14(100)
30–39	8(58.3)	3(20.0)	4(26.7)	15(100)
40–49	11(50.0)	4(18.2)	7(31.8)	22(100)
50 and above	7(63.6)	1(9.1)	3(27.3)	11(100)
Linear by linear association 0.201, ($p = 0.654$)				
Education	Chemical method	Bush clearing	Crop rotation	Total
No formal education	12(54.5)	4(18.2)	6(27.3)	22(100)
Primary	9(60.0)	3(20.0)	3(20.0)	15(100)
Secondary	7(53.8)	0(0)	6(46.2)	13(100)
Post-secondary	9(60.0)	2(13.3)	4(26.7)	15(100)
Linear by linear association 0.009, ($p = 0.923$)				
Secondary occupation	Chemical method	Bush clearing	Crop rotation	Total
Civil servant	7(53.8)	3(23.1)	3(23.1)	13(100)
Private business	23(63.9)	5(13.9)	8(22.2)	36(100)
Student	6(66.7)	1(11.1)	2(22.2)	9(100)
Clergyman	0(0)	0(0)	4(100)	4(100)
Linear-by-linear association 4.740, ($p = 0.029$)				

Figures in parenthesis are percentages.

termite control, while majority (68.2%) who were above 50 years old had the same awareness. Awareness of respondents of vetiver's use for controlling termites was not significantly affected by educational qualification ($X^2 = 0.726$, $p = 1.394$). The majority (81.2%) without formal education had awareness of the usage of vetiver grass for termite control, while 18.2% who were without formal education had no awareness of vetiver's potentials for controlling termites

Table 4 Farmers' awareness of vetiver grass as a means of termite' control.

Farmers' category			
Age	Yes	No	Total
< 20	2(66.7)	1(33.3)	3(100)
20–29	9(64.3)	5(35.7)	14(100)
30–39	4(26.7)	11(73.3)	15(100)
40–49	15(68.2)	7(31.8)	22(100)
50 and above	10(90.9)	1(9.1)	11(100)
Linear-by-linear association 2.616, (p = 0.106)			
Education	Yes	No	Total
No formal education	18(81.8)	4(18.2)	22(100)
Primary	5(33.3)	10(66.7)	15(100)
Secondary	7(53.8)	6(46.2)	13(100)
Post-secondary	10(66.7)	5(33.3)	15(100)
Linear-by-linear association 0.726, (p = 1.394)			
Secondary occupation	Yes	No	Total
Civil servant	10(76.9)	3(23.1)	13(100)
Private business	22(61.1)	14(38.9)	36(100)
Student	5(55.6)	4(44.4)	9(100)
Clergyman	2(50.0)	2(50.0)	4(100)
Linear-by-linear association 1.821, (p = 0.214)			

Figures in parenthesis are percentages.

(Table 4). Secondary occupation (X^2 = 1.821, p = 0.214) also had no significant effect on the awareness of the respondents on the potentials of vetiver for controlling termites. Regardless of the respondents' secondary occupations, the proportion (55.6–76.9%) that had awareness of the potentials of vetiver for controlling termites was higher than the proportion without the awareness, except for the clergy men which had equal responses (50% for the respondents with and without the awareness) (Table 4).

3.5. Farmers' perception of the usefulness of vetiver grass for termite control

The farmers' perception of the effectiveness of vetiver grass was not significantly affected by age (X^2 = 2.084, p = 0.149). The majority (73.3%) who were 30–39 years strongly agreed on the termite control usefulness of vetiver grass. The majority (90.9%) of the farmers aged 40–49 years old were in strong agreement with the termite control usefulness of vetiver grass. About 36% of the respondents aged 20–29 years agreed, while 4.5% of the respondents aged 40–49 years disagreed that vetiver grass has termite control usefulness (Table 5). The farmers' perception of the termite control usefulness of vetiver grass was not significantly affected by the educational qualification of the farmers (X^2 = 0.013, p = 0.910). The majority (68.2%) that strongly agreed that vetiver has termite control usefulness had no formal education, while 66.7% formed the majority which had post-secondary education that strongly agreed (Table 5). The farmers' perception of the usefulness of vetiver grass for termite control was significantly affected by the secondary occupation of the respondents (X^2 = 3.853, p = 0.050). The majority (77.8%) who were involved in private businesses strongly agreed that vetiver grass has termite control usefulness. The majority (88.9%) of the students and 100% of the clergymen strongly agreed that vetiver grass has termite control usefulness (Table 5).

Table 5 Farmers' perception of the effectiveness of vetiver grass in termite' control.

Farmers' category	Level of agreement			
Age	Strongly agree	Agree	Disagree	Total
< 20 years	1(33.3)	2(66.7)	0(0)	3(100)
20–29	9(64.3)	5(35.7)	0(0)	14(100)
30–39	11(73.3)	4(26.7	0(0)	15(100)
40–49	20(90.9)	1(4.5)	1(4.5)	22(100)
50 and above	8(72.7	3(27.3)	0(0)	11(100)
Linear by linear association 2.084, (p = 0.149)				
Education	Strongly agree	Agree	Disagree	Total
No formal education	15(68.2)	7(31.8)	0(0)	22(100)
Primary school	12(80.0)	3(20.0)	0(0)	15(100)
Secondary school	12(92.3)	1(7.7)	0(0)	13(100)
Post-secondary school	10(66.7)	4(26.7)	1(6.7)	15(100)
Linear by linear association 0.013, (p = 0.910)				
Secondary occupation	Strongly agree	Agree	Disagree	Total
Civil servant	7(53.8)	6(46.2)	0(0)	13(100)
Private business	28(77.8)	7(19.4)	1(2.8)	36(100)
Student	8(88.9)	1(11.1)	0(0)	9(100)
Clergyman	4(100)	0(0)	0(0)	4(100)
Linear-by-linear association 3.853, (p = 0.050)				

Figures in parenthesis are percentages.

3.6. Farmers' reasons for the adoption of vetiver grass

The farmers' reasons for the adoption of vetiver grass after it was introduced to them by those who planted it in their neighbourhood for termite control was not significantly affected by age category ($X^2 = 0.398$, $p = 0.58$). About 29% who adopted vetiver because of its ease of cultivation were 20–29 years old, 13.3% who planted vetiver due to its low cost implications were 30–39 years old whereas 40–49 years old respondents formed the majority (77.3%) that adopted planting of vetiver for termite control due to its ease of maintenance. Also, the farmers' reason for the adoption of vetiver grass was not significantly affected by educational qualification ($X^2 = 0.68$, $p = 0.410$). About 28% of the respondents that adopted vetiver due to ease of cultivation were primary school leavers. The proportion (20.0%) that indicated the reason for adoption of vetiver to be its low cost implication had post-secondary education whereas, those that had no formal education formed the majority of the respondents who indicated ease of maintenance as their reason for adoption of vetiver. The farmers' reason for the adoption of vetiver grass was not significantly affected by the secondary occupation ($X^2 = 0.079$, $p = 0.77$). The proportion (15.4%) that planted vetiver because of its ease of cultivation was civil servants. About 22.0% of the respondents who planted vetiver due to its low cost implication were students. Those that were into private businesses formed the majority (66.7%) who indicated ease of maintenance as the reason for adoption of vetiver (Table 6).

4. Discussion

The study assessed farmers' perception of the use of vetiver grass as a means for termite control on agricultural farmlands. The population of the study consisted of farmers in Ogbomoso Agricultural Zone, south-western Nigeria. The proportion of the respondents that was aware that termites reduced crop growth and/or yield was greater than those who said that termite caused no damage to plant. Specifically, those who were aware that termites caused growth reduction were literates with post-secondary education. This is a clear indication of the impacts of educational exposure (level of literacy) on farmers' practical field knowledge. The literates could have had access to many extension materials that detailed the damage pattern of arable farmlands and crops by termites in the tropics. In a recent study conducted in north central Nigeria by Musa et al. (2014), the major type of damage caused by termites on farmland was crop destruction. The results of this study agree with previous studies on the influence of educational status and farmers' perception and/or adoption of new innovations or technologies. For instance, Chirwa (2005) reported that literacy level had positive relationship with the level of adoption of fertilizer technologies among small holder maize farmers in southern Malawi. According to the report of a study conducted by Oladosu and Okunade (2006) in Nigeria, level of literacy can improve farmers' right perception of agricultural problems and how to proffer solution to them. Also, according to Croppenstedt and Demeke (1996), literacy level affected the adoption and levels of demand of fertilizer for cereal growing farmers in Ethiopia.

Although, a large proportion of the respondents had the awareness of the potential of vetiver for termite control, the most popular termite control strategy used by them, according to the survey, was chemical control. The respondents whose secondary occupation was business enterprise were the highest category that indicated the usage of synthetic chemicals for termite control. This could be due to the fact that they wanted a

Table 6 Farmers' reasons for the adoption of vetiver grass after it was introduced to them byprevious planters in their neighbourhood.

Farmers' category	Reason for adoption			
Age	Ease of cultivation	Low cost	Ease of maintenance	Total
< 20	0(0)	0(0)	3(100)	3(100)
20–29	4(28.6)	2(14.3)	8(57.1)	14(100)
30–39	3(20.0)	2(13.3)	10(66.7)	15(100)
40–49	4(18.2)	1(4.5)	17(77.3)	22(100)
50 and above	0(0)	4(36.4)	7(63.6)	11(100)
Linear by linear association 0.398, ($p = 0.528$)				
Education	Ease of cultivation	Low cost	Ease of maintenance	Total
No formal education	2(9.1)	3(13.6)	17(77.3)	22(100)
Primary school	4(26.7)	0(0)	11(73.3)	15(100)
Secondary school	3(23.1)	3(23.1)	7(53.8)	13(100)
Post-secondary	2(13.3)	3(20.0)	10(66.7)	15(100)
Linear by linear association 0.680, ($p = 0.410$)				
Secondary occupation	Ease of cultivation	Low cost	Ease of maintenance	Total
Civil servant	2(15.4)	0(0)	11(84.6)	13(100)
Private business	6(16.7)	6(16.7)	24(66.7)	36(100)
Student	2(22.2)	2(22.2)	5(55.6)	9(100)
Clergy man	0(0)	0(0)	4(100)	4(100)
Linear by linear association 0.078, ($p = 0.779$)				

Figures in parenthesis are percentages.

quick action termite control package since they were engaged in other business enterprises which restricted their constant physical presence on their farm lands. In an earlier study on rural farmers' perceptions, knowledge and management of insect pests of fruit vegetables in the same study area, Olaniran et al. (2014) reported chemical control as one of the strategies used for the control of the insect pests. Several authors had reported the effectiveness of synthetic termiticides in termite control (Cowie et al., 1989; Akhtar and Shahid, 1991; Pearce, 1997; Asogwa et al., 2009).

Farmers' attitudes to pest outbreak include prompt action of control strategies. They usually choose options that are believed to be time-effective. Despite the fact that the cost of synthetic termiticides could be often high, the majority of the farmers still preferred chemical control to the use of vetiver in termite control. In spite the awareness of its termiticidal potentials, the reason for the low level of adoption of vetiver was its comparatively slower action than the synthetic chemicals. However, farmers should be aware of the fact that continuous and unguided use of synthetic termiticides can induce emergence of termite strains that are resistant against chemical products. It is therefore necessary for natural product bioprospecting specialists to explore the termiticidal or termite repellent potentials of vetiver and produce farmer-adoptable and eco-friendly vetiver formulations with quick action termiticidal potentials. Farmers' access to other methods of pest control and promoting training on the use of Integrated Pest Management may be a positive step in controlling termites on the farmlands. This has the tendency of reducing the hazards of human and ecological poison associated with unguided use of synthetic chemicals (Khan et al., 2015), and additional financial costs which are characteristic of over-dependence on synthetic chemicals for termite control. To that end, several authors (Babarinde and George, 2008; Babarinde et al., 2008; Adeyemo et al., 2015) had reported bio-activity of different plant materials against termites.

Although, secondary occupation affected farmers' perception of the usefulness of vetiver for termite control, the overall level of perception was reasonably high; a negligible proportion disagreed on the usefulness of vetiver for termite control. Regardless of the secondary occupation of the respondents, the proportion that 'strongly agreed' or 'agreed' that vetiver has potentials for termite' control was lower than the proportion that disagreed. The reason for this high level of awareness could be informal education obtained by the interactions of the farmers with their neighbours who planted vetiver or from documented materials that were accessed by the literate respondents. Factors indicated by the majority of the respondents for the adoption of vetiver after it was introduced to them by those who planted it in their neighbourhood were: ease of cultivation, low cost implication and ease of maintenance; although these factors were not affected by age, education or secondary occupation of the respondents. In the study area, vetiver tillers were not difficult to obtain by farmers. This was because it was the custom of the farmers to freely share seed materials of the plants that were perceived to be of low economic values with their colleagues. This is particularly real, when the desired quantity is not high. Also, farmers have the tendency to prioritize ease of maintenance over ease of cultivation because crop maintenance takes larger resources than mere establishment.

5. Conclusions and recommendations

This study shows that there was an awareness of the damage potentials of termites on farmlands. Based on that awareness, farmers used cultural and chemical control strategies, with the latter being the more popular strategy. Respondents whose secondary occupations were civil service, private businesses and the students were the predominant users of chemical termiticides. The majority that knew the effectiveness of vetiver grass in termite control was those whose secondary occupation was private business. Although termite's ecological role is recognized in the structuring of soils, this neither affected the perception of the farmers nor influenced termite control methods. This was because the respondents identified damage pattern of termites to include growth and yield reduction and would not ordinarily tolerate any potential reduction in crop growth and yield.

Based on the findings from this study, the following recommendations are made: (a) Apart from the reduction in plant growth and yield which the respondents identified as the damage done on crops by termites, agricultural extension agents should educate farmers on other havocs of termites on their farmlands like destruction of storage facilities (b) They should also educate farmers on the potentials of vetiver grass as a compatible strategy with chemical control to form an eco-friendly Integrated Pest Management Scheme for termites on their farmlands (c) Natural product and bio-prospecting specialists should explore the knowledge of the termiticidal potentials of vetiver towards the development of eco-friendly termiticidal formulations that are compatible with tropical farming system. This will improve vetiver's efficiency as termiticide or termite repellent.

Acknowledgement

The authors acknowledge Drs O.A. Akindele, F.O. Adigun and Mr Adewole Festus of the Department of Urban and Regional Planning, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria for the production of the map of the study area.

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