Direct RESEARCH JOURNALS

Direct Research Journal of Agriculture and Food Science
Vol.8 (7), pp. 217-223, July 2020
ISSN 2354-4147
DOI: https://doi.org/10.26765/DRJAFS596982147
Article Number: DRJAFS596982147

https://directresearchpublisher.org/drjafs/

Full Length Research Paper

Farmers' Knowledge and Perception of Termites and Termites Damage on Selected Rubber Plantations in Southern Nigeria

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Received 2 July 2020; Accepted 22 July, 2020

ABSTRACT: Termite's infestation and damage of young rubber plantations and budded seedlings of rubber plants is a major insect pest constraint to rubber farming. The study, therefore, investigated farmers' knowledge and perception of the ecology that could help in the formulation of sustainable termite management strategies in rubber plantations. The Surveys involved a purposive selection of 150 rubber farmers in three states (Ogun, Ondo, and Edo) of southern Nigeria, which is during the planting season in 2018. Structured questionnaires were used to elicit information on farmers' perceptions and knowledge of termite, factors enhancing termite' infestation and damage, temporal and spatial variability of termite in rubber plantations. Data were analyzed using descriptive and inferential statistics. Respondents' mean age was 50.8 years and the majority (82.9%) was male with 81.7% of the rubber farmers having more than five years of rubber farming experience. More than half (66.4%) of the respondents had privately-owned plantations. Results further show that respondents' had low (42.5%) perception of termite attack. There was no significant relationship between respondents' demographic characteristics (age and sex), rubber damage experience, identification of termite, rubber enterprise, knowledge of damage caused by termite, and their perception of damage caused by termite. The respondents had an unfavorable perceptions of termite and its damage to rubber plantation. Entomological extension services are further encouraged to boost farmers' knowledge to avert, termite infestation, and loss.

Keywords: Farmer's knowledge, rubber farmers, termite' damage, termite' infestation

INTRODUCTION

Natural rubber is one of the most important cash crops and economic crop and in the rainforest agro-ecological zone of Nigeria. It recently gained attention due the current attractive prices of the crop in the international market and the uncertain growths of the National income that emanated from over dependency on oil (Orimoloye, 2010).

The plant continued to gain awareness among farmers worldwide and in 2004, the percentage production growth rate of NR in the world was about 7.2% or higher if not for the 'threat' posed by the utilization of synthetic rubber (SR) production (Rubber Asia 2004). It is estimated that some 50,000 different products are directly or indirectly made from natural rubber. The main product of the rubber tree is the latex, used as a source for natural rubber. Today some 70% of the total natural rubber consumption is in the manufacture of tyres, tubes and other items associated with automotive transport. About 6% of the world's rubber is used for footwear, boots, shoes, soles or heels, and 4% for wire and cable isolation (Verheye, 2010).

Other rubber manufactured products include rubberized fabrics, shock absorbers, washers and gaskets, transmission and conveyor belting, hoses, sports goods, household and hospital supplies, contraceptive appliances, paints, etc, it is also used in upholstery, mattresses are manufactured with sponge rubber from foamed latex. Highly hard sulfurized rubber known as Vulcanite (or ebonite) is used in electrical and radio engineering industries and as protective lining in chemical

plants. Rubber powder with bitumen is used for road surfacing (Verheye, 2010).

The seeds consist of an oily shell and a kernel; the latter contains 30-50% of oil. Amazonian Indians use the kernels as human food. The oil in the shell is, after processing, similar to linseed oil, and is used as an ingredient in paints, varnishes and soaps. The residual cake after oil extraction is high in protein and carbohydrates and after elimination of its toxic cyanhydric acid content by boiling for 15 minutes at 350°C, can be used to feed cattle and poultry. Old rubber trees provides a valuable wood source for domestic and industrial fuel use (calorie value 4,500 – 4,700 kcal/kg), the manufacture of pulp for the paper industry, for furniture, the production of charcoal, and medium-dense fiber board, packing cases and pallets, etc. Delabarre and Serrier (2000) estimated that between 150 and 200 tons/ha of green wood can be gotten from a plantation of 30 years.

The major insect pests of rubber trees are the termite. Termites are important components of tropical and subtropical ecosystems. Termites are predominant members of the insect order, Isoptera now Blattodea and more than 2600 species of termite are found around the world (Khambhampati and Eggleton 2000). Termites are of great economic importance as they damage a great variety of wood in buildings, crops, local plantation and forests. They are highly devastative and polyphagous insect pest, which cause damage to buildings, furniture, plants and agricultural crops. Termite causes an estimate of about US$22 billion losses across the globe annually (Govorushko, 2011).

Termites are an essential member of the soil ecosystem and are found throughout the world, recycling improving soil fertility and serves as source of food sources to other animals, their harmful effects include damage to crops, forestry, and wooden structures (Changlu *et al*., 2009).

Based on their varied nesting strategies, they can be broadly classified as damp wood, dry wood, mound building or subterranean termite. Damp wood termite nest in clamp wood but do not leave the wood in which they nest and feed. Dry wood termite' nests and feeds by obtaining water they need for surviving through physiological processes in their bodies and their colonies develop very slowly. Termites attack rubber plants on the field by attacking the trunks, seeds and seedlings of rubber causing the plant to collapse after severe infestations. The workers attack the rubber plants by feeding on the outer dead bark or any part which is partially or wholly dead. In Nigeria termite killed 50-72% of budded stumps planted on the field (Omokhafe and Sagay, 1996). It normally makes tunnels which weakens plant stems, causing them to collapse or giving access to fungus and other diseases and usually feeds on dead vegetation. When bark of trees is gnawed, the phloem may be interrupted, causing the death of the tree. The mud runways with which some species cover the plants to reach dead wood may cause the plant to wither and collapse. The various earth-dwelling species tunnel underground from their nests and enter the building through its foundations or any wooden part in contact with the ground. To obtain the wood for their food they make extensive tunnels through the structures, weakening them and eventually causing their collapse (Mackean, 2006). They regularly and severely attack crops and can cause considerable damage to wooden structures in most tropical countries. In many African countries, a wide range of food and industrial crops are regularly attacked and destroyed by termite (Coulibaly *et al*., 2014). Hence, termite are fast attaining a new pest status (minor to major) and it is important in the economic entomology of agricultural crops and forestry in Nigeria.

However, termite are best known as pests, which cause severe damage to homes and agricultural products (Zaremski *et al*., 2009) in Africa such as cereals (Jouquet *et al*., 2011, 2016, Garba *et al*., 2011; Bignell and Eggleton, 2000). Roots and tubers (Loko *et al*., 2016; Atu, 1993; Faye *et al*., 2016); legumes (Malik *et al*., 2015; Vasanthi and Rajavel, 2016), and fruit trees (Tenon *et al*., 2016; Logan et al., 1990). In northeast Nigeria, for instance, termites are highly voracious and destructive causing substantial damage to agricultural products and buildings. The harvest losses caused by termite are enormous, in the order of 20 to 45% (Logan et al., 1990). Minute information is known on farmers' perceptions of termite pests and their management practices, despite the large extent of damage to crops (Ayuke, 2010). A better understanding of farmers' perceptions of the pests and their control methods is the first step towards the development and adaptation of successful pest management strategies (Sileshi *et al*., 2008; Debelo *et al*., 2015). Hence, it is a priority to determine the perception of farmers on the damage caused by termite in rubber farming. Such information is necessary for the formulation of a good pest management strategy. Therefore, this study compared the perception and knowledge of farmers involved in rubber production about termite and their damage on selected rubber plantations in southern Nigeria. The study also aimed to establish the most effective termite survey methods in Southern Nigeria.

METHODOLOGY

The study was carried out in southern agro-ecological zone of Nigeria which comprises of Ogun, Edo and Ondo states. The population for the study consisted of all rubber farmers. Multi-stage sampling procedure was used to select respondents for this study. One hundred and fifty Rubber farmers drawn from three states in Southern Nigeria were the major respondents in this study. The three states were purposively selected based on rubber farming and production.

Table 1. Farm and farmer related characteristics of the respondents.

Characteristics	Frequency	%	
Age group			
Up to 30	6	6.5	
31-40	17	18.5	Mean = 50.78
41-50	26	28.3	*S.D. =14.64
51-60	21	22.8	
61 and above	22	23.9	
Gender			
Male	97	82.9	
Female	20	17.1	
Rubber farm experience			
1-2	4	3.5	
3-5	17	14.8	
>5	94	81.7	
Level of education			
No formal education	3	2.7	
Primary	22	19.6	
Secondary	32	28.6	
Tertiary	57	49.2	
Household size			
1-5	47	48.0	
6-10	43	43.9	Mean = 6.31
11-15	7	7.1	*S.D. = 3.31
21-25	1	1.0	
Plantation ownership			
Government owned	20	17.7	
Private owned	75	66.4	
Inherited	18	15.9	
Farm size			
1-10	106	92.2	
11-20	5	4.3	Mean = 6.31
21-30	2	1.7	*S.D. = 6.62
31-40	1	0.9	
41-50	1	0.9	
Farming group or association			
Yes	90	23.7	

Source: Field Survey, 2018. *S.D. = Standard Deviation

Two local governments each was purposively selected from the three states due to the concentration of rubber farmers in the areas. The list of registered rubber farmers was collected from some farm settlements and the Agricultural Extension Department of Rubber Research Institute of Nigeria, Iyanomo, Benin City. The questionnaires and focus group discussions were intended to capture information such as:

(i) The proportion of farmers with termite infestation on rubber farms.
(ii) Farmers' perception of termite damage on rubber plantation.
(iii) Demographic characteristics of the respondents.
(iv) Farmers' knowledge of termite' species in rubber plantation.
(v) Knowledge of farmers on damage caused by termite in rubber plantations.

Data collected from questionnaire were analyzed using percentages, mean and analysis of variance. Respondents were presented with series of statements to test their knowledge level where there were required to respond with either 'yes or no'. A 5 point Likert-type scale was measure the respondents' perception on the incidence and severity of the MWP. Means were calculated from a scale of 1= strongly disagree, 2= disagree, 3= somewhat disagree, 4= agree and 5= strongly agree. Identification methods and management practices were used by respondents to deal with the termite's infestation, they were asked to respond to series of statements by ticking.

RESULTS AND DISCUSSION

Farm and farmer Related Characteristics of the Respondents

Table1 provides information on farm and farmer characteristics. The majority of the respondents (56.7%) were between 51 years of age and above whilst only 6.5%

Table 2a: Distribution of the respondents based on their knowledge of termite attack.

Questions	F	%	Mean
Termites are the major insect pest that damages rubber plants in my plantation.	107	89.2	0.89
Termite does not damage budded stumps in my plantation.	80	66.7	0.67
Termite damages rubber seedlings in my plantation.	82	68.3	0.68
Termites build galleries on rubber trees and inhabit the bark of rubber causing no damage.	38	31.7	0.32
Termites' damage is of less significance to rubber plantation compared to pathological disease.	47	39.2	0.39
Termite's damage does not reduce the quantity of latex to be harvested.	68	56.7	0.57
The presence of queen termite in rubber plantations is an indication of termite invasion.	112	93.3	0.93
Termites cause more damage in the dry season than in the raining season.	86	71.7	0.72
Termite damages in sole rubber plantation are higher compared to intercropped rubber.	64	53.3	0.53
Not all termites cause damage in my plantation.	57	47.5	0.48
Termite does not damage rubber plants sprayed with wood ash	39	32.5	0.33
Flooded/water logged rubber plantation does not disturb termite infestation.	41	34.2	0.34
Termite damage is high in cattle grazing areas.	76	63.3	0.63
Termites could be eradicated by burying animals in the plantation.	82	68.3	0.69
Poultry litter mulching has a way of reducing termites' infestation.	57	47.5	0.48
Percentage rate of damage in my plantation is very high.	74	62.7	0.63
Destruction of termites' mounds prevents termites' damage.	27	22.5	0.23
Burying dead animals in and around the rubber plantation does not control termites' damage.	40	33.3	0.33
Resistant clones of rubber can be used as control for termite.	99	82.5	0.83
Termites damages in my farm causes loss of significant amount of money in my plantation.	111	92.5	0.93
It is very difficult for me to detect termite damage in my plantation.	93	77.5	0.78

Source: Field Survey, 2018. Pooled mean = 0.59

were below 31 years. This suggests that most rubber farmers in Nigeria are getting aged and they are mostly below the productive age. Thus rubber farming in southern Nigeria is dominated by old people. The dominance of males (82.9%) in rubber farming is higher than that of females, which may be due to high intensive labour. The majority of the respondents had high more than five years of rubber farming experience (81.9%). The results of the study indicate that the majority of the respondents (49.2%) had tertiary level of education, which shows that rubber farming business is dominated by literate farmers while 28.6% had secondary level, 19.6% had primary secondary level, 2.7% had no formal education. A further 14.8% of them had been in rubber farming between three and five years, whilst only 3.8% of them had experience between one and two years. Apantaku *et al.* (2016) reported that farmers experience in farming count more than formal education in order to increase productivity. This finding indicates that most of the respondents have a vast experience in the rubber farming business.

The high level of education and vast experience in farming among respondents are likely to avoid adoption of improved management and control practices aimed at managing termite and reducing loss of budded seedlings on field. Nagaraju *et al*. (2002) reported that formal education as well as experience in farming can serve as a means through which farmers get informed. The common type of land ownership predominant amongst the respondents (92.7%) was privately owned. Majority of the farm owners had between 1-10 hectares 92.2% while 43.3% of the respondents had between 11-20 hectares. It was noted that 66.4% and 17.7% of the respondents had privately owned and Government owned plantation ownership respectively while 15.9% of the farmers owned inherited rubber plantation. The results indicated that the majority of the respondents (76.3%) do not belong to farm association with 23.7% belonging to a farm association.

Respondents' knowledge on termite attack

Table 2a provides information on the knowledge level of farmers on the termite attack on rubber plants. Respondents were averagely familiar with the identification, presence and attack of termite on their rubber farms. Greater percentage (89.2%) of the respondents had termite as the major insect pest attacking their rubber plants. Out of those experiencing termite attack 66.7% and 68.3% had termite attack on their budded stumps and rubber seedlings respectively while 31.7% had termite building galleries on rubber trees and inhibiting bark of rubber. Whereas 39.2% of the respondents indicated that termite attack is of less significance compared to pathological diseases in their rubber plantation.

About 56.7% of those experiencing termite attacks had no reduction in the quantity of latex being harvested. Greater percentage 93.3%of respondents asserted that the presence of queen termite in rubber plantation is an indication of termite invasion. Most respondents (71.7%) said termite's causes more damage in the dry season than in the raining season. While 18.3% were indifferent.

Table 2b: Distribution of the respondents based on their knowledge of termite attack.

Knowledge level	Knowledge score groups	F	%
Low	6.00 - 12.27	63	54.8
High	12.28 - 18.00	52	45.2

Mean = 12.28; Standard Deviation = 2.02

Table 3a: Distribution of the respondents based on their perception of termite damage.

Questions	Frequency	%	Mean
Termites does not seem to cause much damage in my rubber plantation	57	47.5	0.48
I find it very easy to detect the termites in my rubber plantation before they cause any damage	46	38.3	0.38
The occurrence of termite damage in my plantation gets me worried and anxious	51	42.5	0.43
The infestation of termites always causes loss of significant amount of money.	60	50.0	0.50
The quantity of tapped latex available for sales has been considerably reduced due to termite damage	48	40.0	0.40
Burying dead animals in my plantation seems to help prevent termite infestation	36	30.0	0.30
Rubber intercropping with other plants helps reduce termite damage in the farm.	40	33.3	0.33
There is need for proper orientation from extension agents to enlighten me more on termites in my rubber plantation: monitoring, diagnosis and control	51	42.5	0.43
I would not be bothered about experiencing termite damage in my rubber plantation, if I could get termite resistant varieties of rubber seedlings	54	45.0	0.45
Termites attack young rubber plantations than matured rubber plantations.	50	41.7	0.42
Termites are of less significant problem compared to pathological disease such as root rot and tapping panel diseases	44	36.7	0.37
Not all the termites present on my farm are destructive	38	31.7	0.32
Cattle grazing around my rubber plantation seem to encourage termite infestation	53	44.2	0.44
Removal of queen termites prevents termite damage in rubber plantation	46	38.3	0.38
Raining season does not disturb termite infestation	41	34.2	0.34
Resistant clones of rubber seedlings could help prevent termite damage in rubber plantation	75	62.5	0.63

The results indicated that majority of the respondents (53.3%) reported termite attack in sole rubber plantation are higher compared to intercropped rubber.

Few (32.5%) of the respondents agreed that spraying of wood ash on rubber plants prevents termite attack. A little below average (47.5%) claimed that not all termite cause damage in their plantation. The results indicate that the majority of the respondents 63.3% reported high termite damage in cattle grazing areas while 34.2% reported that waterlogged rubber plantation does not prevent termite infestation. 22.5% and 33.3% reported that destruction of termite mound prevents termite damage and burying dead animals in and around the rubber plantation does not control termite' damage respectively.

A greater percentage of 62.7% of respondents reported that rate of damage in their plantation is very high. The result is so because most of the respondents 92.5% reported that termite' damage in their plantation causes loss of significant amount of money in their plantation. Furthermore, the results of the study indicate that majority of the respondents (77.5%) found it very difficult to detect termite damage in their plantation. Table 2b shows the knowledge of respondents on termite infestation in respect of the respondents who had knowledge score grouped between 6.00-12.27, had low knowledge level 54.8% of termite attack while respondents grouped between12.28-18.00 had 45.2% knowledge level of termite in their plantation.

Farmers' perception of termite attack in rubber plantations

Information on farmers' perception of termite attack in rubber plantations is shown in (Table 3a). The respondents disagreed that termite does not seem to cause much damage in their rubber plantation. (Mean=0.48). Occurrence of termite damage get farmers worried (mean=0.43). The respondents disagreed that it is very easy to detect termite in their rubber plantation before they cause any damage (mean=0.38). The respondents also agreed that termite' infestation always causes loss of significant amount of money. (Mean=0.50). The quantity of tapped latex available for sales has been considerably reduced due to termite attack (mean=0.40). The respondents however somewhat disagreed that burying dead animals in plantation helps to prevent termite infestation. Again the respondents somewhat disagreed that intercropping rubber with other plants helps reduce termite damage in the farm (mean=0.33).

The respondents level of agreement to the need for proper orientation from extension agents to enlighten them the more on termite in their rubber plantation. This indicates that they have vast experience in rubber farming and their knowledge level in termite monitoring and diagnosis control is very low (mean=0.43). The respondents' perception on the effect of termite damage on their rubber plantation, if they are provided with

Table 3b. Distribution of the respondents based on their perception of termite damage.

Perception level	Perception score groups	F	%
LOW	3.00 – 7.55	51	42.5
HIGH	7.56 - 10.0	69	57.5

Mean= 7.55; Standard Deviation =1.91

resistant varieties of rubber seedlings was low (45%) This suggests that most respondents rely on the use of synthetic insecticides as the ultimate remedy for the control of termite in their plantation.

Respondents however somewhat agreed that termite attack young rubber plantation than matured rubber plantations mean=0.42, cattle grazing around rubber plantation encourages termite attack means=0.44. Also they strongly agreed that resistant clones of rubber seedlings could help prevent termite damage in rubber plantation than matured rubber plantations mean=0.63. On the hand, the respondents strongly disagreed that not all termite present on their farms are destructive mean=0.32. Termite are of less significant problem compared to pathological disease such as root rot and tapping panel disease mean= 0.37, raining season doesn't disturb termite infestation mean=0.34,removal of queen termite prevents termite damage in rubber plantation. Table 3b shows the respondents perception of termite attack in rubber plantation. All the respondents who were grouped between 3.00-7.55 had low level of perception of termite attack 42.5%, while on the other hand respondents with perception score grouped between 7.56 -10.0 had 57.5%.

Conclusions and Recommendations

The results of the study indicate that greater percentage of the respondents have adequate knowledge on termite attack in rubber plantation. They were able to identify termite as the major insect pest that attacks their rubber plantation. According to the study, the incidence and severity of termite attack in rubber seedlings plantation are higher than in established rubber plantation. However, the study showed that termite damage does not reduce the quantity of harvested latex, probably due to the fact that dead or attacked rubber plant stands are rouged out and replaced to cover up loss. The findings showed that termite infestation is higher during dry season than in the raining season. Again the occurrence of termite attack causes damage to plant and a significant loss of money to respondents. The study showed that respondents find it very difficult to detect termite damage in their plantation unless the attack is severe. The findings showed that some respondents employ some control strategies to manage termite infestation. Some of the management strategies includes, breaking up of termite mounds to remove queen termite, burying dead animals in and around the rubber plantation, poultry litter mulching, wood ash and synthetic insecticides application. The ministry of Agriculture and rural Development through agricultural entomologist extension agents should extend services to rubber plantations on recent agronomic practices involved in rubber farms. The farmers should be more enlightened on the factors that enhance the occurrence of termite attack in rubber plantations and the effective measures to avert and control termite attack.

ACKNOWLEDGEMENT

I specially want to appreciate my mother Mrs. Mary O. Adeyemi for her innumerable moral support, while escorting me through the rubber plantations to meet the rubber farmers for the administration of the questionnaires and many other areas of support. Special thanks also goes to Dr. K.A. Thomas for reviewing and vetting the questionnaires used for the research.

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