Original Research Article

Field Survey of cassava susceptibility to termite infestation as influenced by time, scale and management strategy in selected Owerri Agricultural zones, Southeast Nigeria.

ABSTRACT

Aim: In Africa, cassava provides a basic daily source of dietary energy and has gained popularity as one of the most important root crops in Nigeria especially in the Southern States. However, a thorough survey on cassava susceptibility to termite infestation in relation to time and management strategy has not received attention by farmers in Owerri (Southeastern Nigeria). **Study design:** Therefore, the need to carry out a field survey of cassava susceptibility to termite infestation as an influence by time, scale and management strategy in selected Owerri Agricultural zones.

Place and duration of study: The field survey was conducted in 2016 in four selected Agricultural zones of Owerri, Namely; Ezinnihite Mbaise (Zone 1), Owerri North (Zone 2), Mbaitoli (Zone 3) and Owerri West (Zone 4).

Methodology: A random selection of 30 cassava farmers from each of the study areas was made, totalling 120 respondents. Data were collected through structural questionnaire administration to the respondents on the four selected zones and were analyzed using Descriptive Statistics.

Results: Result shows that cassava stems were more susceptible to termite attack than tubers, especially during dry periods. Equally cassava devastation by termite occurred mostly at planting where newly planted cuttings suffered most. Termite infestation on cassava was more between January and May as well as between October and December. On the other hand, the use of chemical control either singly or in synergy with other non-chemical means to control termites appears to be very popular amongst respondents. Youths and mature adults were actively engaged in cassava farming, but the majority of them were unskilled by virtue of their low literacy levels.

Conclusion: Farmer education is recommended to enable the integration of pest/termite avoidance principle into termite control strategy.

Keywords: Termite, survey, cassava, infestation, time, zone.

1.INTRODUCTION

Cassava (*Manihot esculenta* Crantz.) is a perennial woody shrub with an edible root which grows in tropical and sub-tropical areas of the world. It has the ability to grow on marginal lands and can tolerate long dry spell (IITA, 2000) [1]. However, cassava does well on well-drained, rich and friable loamy soils (Akinsanmi, 1987) [2] [23].

In Africa, cassava provides a basic daily source of dietary energy and has gained popularity as one of the most important root crops in Nigeria especially in the Southern States (Nwokoma, 1998) [3]. Cassava is the second most important staple food in sub-Saharan Africa and accounts for more than 100 calories per day in the diet of an individual (IITA, 1988) [4].

Cassava roots are processed into a wide variety of granules, pastes, flour etc. or consumed freshly boiled or raw. It is used in the production of starch, garri, 'foo-foo', wet and dry chips (Nwokoma, 1998) [3]. The fresh cassava tuber can be used considerably as a source of feed for livestock (sheep, goats, cattle, pigs etc.). In many rural households, cassava peel is fed to domestic animals (Ihekoronye and Ngoddy, 1985) [5].

In the traditional farming systems where cassava is usually one of the many crops being grown, pest control is often given a low priority and so cassava receives minimal pesticide application. Under such conditions yields are often low (Henry, 1995) [6]. Arthropod pests and diseases are major factors causing this yield reduction (Belloti *et al*., 1999) [7]. In the humid lowlands, the predominant diseases of cassava include cassava mosaic virus (CMV), cassava bacterial blight (CBB), cassava anthracnose disease (CAD) and root rots. The major insect pests are cassava green mite (CGM: *Mononychellus* spp.), elephant grasshopper (*Zonocerus elegans* L. and *Zonocerus variegatus* Thumb.), cassava mealybug (CM: *Phenococcus manihotis*), a wide range of rodents and termites (Hillocks and Thresh, 2002) [8] [22].

A survey of the distribution of termites in the country by Malaka (1973) [9] has revealed that certain species are restricted to a particular vegetation zone while some are distributed all over the zones. For instance, rainforest appears to have a more dominant species than other vegetation zones [24]. About 26 species have been recorded from the Guinea Savanna (ODM, 1997) [10] and of which only 10 are dominant. Altogether 120 species of termites have been identified in Nigeria (Logan *et al*., 1992) [11] out of which only 20 damage crops and building

However, a thorough survey on cassava susceptibility to termite infestation in relation to time and management strategy has not received attention by our farmers in Owerri , therefore, the need to carry out a field survey of cassava susceptibility to termite infestation as influenced by time, scale and management strategy in selected Owerri Agricultural zones of Southeastern Nigeria forms the objective of this study.

2. Materials and Methods

The study was conducted in 2016 cropping season. It was carried out in Owerri Agricultural zone located at the South-western part of Imo State. Owerri is located between Latitude 4^0 40^i and 8^0 15^i N and Longitude 6^0 40^i and 8^0 15^i E (FDALR, 1985) [12]. It is of the humid tropics. It records means annual rainfall of about 18000 mm-2190 mm which spans from early March to October. The minimum and maximum mean annual temperatures were 22.5^{0}C and 31.9^{0}C respectively with a relative humidity of about 82.6%. (Nwosu and Adeniyi, 1980) [13]. The zone comprises ten Local Government Areas, namely; Aboh Mbaise, Ahiazu Mbaise, Ezinihite Mbaise, Mbaitoli, Ikeduru, Ngor-okpala, Ohaji/ Egbema, Owerri Municipal, Owerri North and Owerri West. Farmers in the zone are

mainly smallholders known for growing such arable crops as maize, melon, yam, cassava etc. (ISADP. 2000) [14].

Four out of the ten Local Government Areas were randomly selected for the study. The selected areas are Ezinihite Mbaise in Owutu Community, Owerri North in Azaraubo Community, Mbaitoli in Obinnoha Community, and Owerri West in Obinze Community. These areas were selected based on the quantum of cassava cultivation that was being carried out by farmers. A random selection of thirty cassava farmers from each of the study areas who had admittedly been producing cassava for the past ten years was made. The sample size was made up of a total of one hundred and twenty (120) respondents.

Data was collected through a structured questionnaire administered to the respondents on the four selected Local Government Areas.

All Data collected were analyzed using Descriptive Statistics such as the use of Percentages, Frequencies and Means.

3. Results and Discussion

Table 1 indicates the degree of susceptibility of different parts of the cassava plant to termites infestation in the field. 50 % (zone 4) and 43 % (zone 1) proportion of the respondents under study claimed that cassava stems tend to exhibit high susceptibility to termites infestation. Also, 33 % (zone 2) and 20 % (zone 1) of them accepted that cassava leaves were attacked by termites, while 6 % (zone 4), 3 % (zones 1 and 2) and 0 % (zone 3) agreed that cassava tubers were susceptible to termites infestation. In the same Table, 60 % multiple responses from zone 3 claimed that optimal termites infestation in cassava field was recorded on different parts of the plant.

Also, the distribution of the different levels of termite damage to cassava at various growth phases was presented in Table 2. Result reveals that 73 % (zone 4) and 56 % (zone 1) proportion of the respondent sampled in the study area claimed that cassava incurred more damage from termites infestation at planting (establishment) period. This was upheld by 50 % (zone 2) and 36 % (zone 3) proportion of them. Equally, 16 % (zones 1 and 4) and 23 % (zone 1) of the respondents agreed that termites cause economic damage to cassava at maturity and harvest periods respectively. Also, the table shows the distribution of respondents by their regular observation in the study area (multiple responses) where 53 %(zone 3) and 36 % (zone 2) agreed that attack on cassava by termites occurs at any period of its growth phase.

The high susceptibility of cassava stems to termites attack as well as the plant's prone to attack at planting period as claimed by respondents was in line with Onwueme (1978) [15] that termite activities in cassava field are more devastating on the stems and at early stages of their development resulting to poor stand establishment.

Table 3 presents the distribution of termite infestation in the cassava field by time. 43 % (zone 4), 33 % (zone 1), 30 % (zone 3) and 16 % (zone 2) proportion of the respondents agreed that termites infestation occur from January to May, while 46 % (zones 1 and 2), 40% (zone 3) and 50 % (zone 4) proportion of them claimed that infestation takes place more in October to December. However, 20 % (zone 1) and 13 % (zone 2) of the respondents accepted that termites infestation occur in June to September

This claim that termite infestation on cassava was more extensive between January to May and between October to December, implies that optimal periods of termites infestation in cassava field coincides with periods of prolonged dry spell. This is in conformity with Taylor (1977) [16] who

reported that termites attack the roots, tubers, young seedlings, shoots and stems of crops and their damage is more extensive during the dry season when the crops are weakened by water stress or drought.

Table 4 shows the distribution of economic loss from termites in the cassava field by plant part. Majority of the cassava farmers sampled under the study area across the zones admitted that the greatest economic loss from termites infestation occurs on the stems. 50 % (zone 4) and 46 % (zone 1) proportion of them believed that the greatest economic loss on cassava by termites comes from the stems. On the other hand, none of the respondents in zone 1 (0 %) and zone 3 (0 %) agreed that cassava leaves exhibited any evidence of economic loss from termites infestation. However, 6 % (zone 4) and 3 % (zone 2) proportion of them accepted that cassava leaves suffered economic loss from termites. Equally, 26 % (zone 2) and 16 % (zone 4) of the respondents maintained that cassava tubers also showed marked evidence of economic loss from termites. In the same vain, 56 % (zone 3) and 40 % (zone 1) from multiple responses claimed that huge economic losses were recorded on different parts of the plant, while 26 % (zones 2 and 4) proportion of them concurred to this claim

Higher economic loss from cassava stems as a result of termite infestation was described by Nweke *et al*. (1994), [17] that cassava field planted early or late in the rainy season often have poor establishment record because termites feed on the planted sticks (cuttings).

Result in Table 5 shows different methods of termites control measures employed by farmers in their cassava field. Majority of the respondents in zone 4 (30 %) and zone 2 (60 %) claimed to employ cultural and chemical methods of control respectively. On the other hand, 3 % (zone 2) of the respondents employed Biological method. In the same Table, 73 % (zone 3) and 43 % (zone 1) of the farmers sampled agreed to employ two or more different methods (multiple responses) of control. This claim was upheld by 33 % (zone 4) and 10 % (zone 2) proportion of them

Application of chemical control and other non-chemical means at different periods of time either singly or in synergy in the cassava field to control termites appears to be very popular amongst respondents in the study area. Though chemical control is effective but most chemical control measures rely principally on the use of organochlorine insecticides such as aldrin, dieldrin, lindane etc. (Umeh, 2002) [18]. Unfortunately, this type of control measure is no longer popular due to the associated environmental contamination and health hazards (PAN, UK, 2003) [19]. Any control measure that ensures adequate synergy of these methods and which promote the rapid growth of the healthy crop is a suitable means for avoiding termites damage (Schmutterer *et al*., 1978) [20].

The Socio-economic characteristics of respondents were described in Tables 6, 7, 8 and 9 below. In Table 6, 33 % (zone 2) and 16 % (zone 1) of the respondents sampled under the study area were between the age group of 25-40 years, while 56 % (zone 1), 46 % (zone 2) and 36 % (zones 3 and 4) were between 41-55 years. Also, 56 % (zone 3) and 50 % (zone 4) were between the age group of 56-70 years and 6 % (zone 3) and 3 % (zone 1) were between 71-100 years. However, the mean age group of respondents were 50 % (zone 1), 45 % (zone 2), 59 % (zone 3) and 53 % (zone 4).

In Table 7, larger proportion of the cassava farmers in zone 2 (100 %), zone 1 (90 %), zone 4 (83 %) and zone 3 (80 %) sampled cultivated under farm size of 1-5 hectares (ha) while, 10 % (zone 1), 20 % (zone 3) and 13 % (zone 4) of them had farm size of 6ha and above. The mean land area were 3.5ha (zone 1), 3.00 (zone 2), 4.00ha (zone 3) and 3.57ha (zone 4). On the other hand, Table 8 shows that majority of respondents in zones 1 and 2 (70 %) and zone 4 (60 %) sampled were males, while 56 % (zone 3) were females.

Apart from that, Table 9 indicates that 93 % (zone 3), 70 % (zone 1), 56 % (zone 2) and 50 % (zone 4) of the respondents sampled acquired non-degree educational training. However, 36 % (zone 2) and 26 % (zone 1) of them obtained a Bachelor of Science Degree, while 30 % (zone 4) had a Master of Science Degree.

Different ages and mean age of respondents sampled found to fall between the range of 25-70 years and 59.00 years respectively, implies that the majority of them were at their productive age group. It also shows that youths and mature adults are actively involved in cassava production. Equally, the indication that majority of the respondents cultivated under the land area of 1-5 ha and on a mean land area of 4.00 ha across the zones, showed that land as a productive resource was not a constraint in the study area. Also, on gender balancing and participation, majority of the respondents were males. This is probably because traditionally, men have the right to land than women. Quisumbing (1994) [21] opined that there has been a great disparity between women and men in the size of landholdings. Apart from that, the majority of the respondents sampled were found to be literate but obtained certificates other than Degree. This implies that a larger proportion of them was primarily un-skilled.

Termite infestation in cassava field and their subsequent attack were more severe during dry periods than in wet season. However, cassava stems appeared to be more susceptible to attack than the tubers. On the other hand, farmers in the study areas combined chemical and cultural means a method of controlling termites in their cassava field.

Equally, the study indicated that youths and mature adults actively engaged in cassava farming. However, a greater proportion of the respondents agreed that land as a productive resource was not a limiting factor. Finally, the majority of the farmers sampled were primarily unskilled evidenced in their low literacy level.

Farmers in a termite endemic area such as Owerri, Imo State, Nigeria are advised to be conscious of the two extremes of heavy termite infestation by ensuring that planting of cassava is not carried out between January and May. Also, harvesting of cassava tubers should not be delayed up to October through December in the season. However, the study strictly recommends that farmers under this condition should adopt late planting and early harvesting options.

Also, Farmers through the acquisition of qualitative education can aptly adopt the use of pest avoidance strategy in such a manner that sound and sustainable peculiar termite control package across the zones under study can be achieved. This will not only be efficacious in reducing termite load and damage on cassava but also economical in the application.

Table 1: Frequency and Percentage Distribution of Plant Parts Most Susceptible to Attack by Termites According to Zones

Plant Part	Zone 1 Frequency	Percent (%)	Zone 2 Frequency	Percent (%)	Zone 3 Frequency	Percent (%)	Zone 4 Frequency	Percent (%)
Stems	13	43	9	30	10	33	15	50
Leaves	6	20	10	33	2	6	1	3
Tubers	1	3	1	3	0	0	2	6
All Parts	3	10	3	10	0	0	5	16
Multiple rep.	7	23	7	23	18	60	7	23
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**

Source: Computed from Field Survey Data (2016).

Table 2: Frequency and Percentage Distribution of Damage at Different Plant Growth Phases According to Zone

Growth phase	Zone 1 Frequency	Percent (%)	Zone 2 Frequency	Percent (%)	Zone 3 Frequency	Percent (%)	Zone 4 Frequency	Percent (%)
planting	17	56	15	50	11	36	22	73
maturity	5	16	4	13	3	10	5	16
harvest	7	23	0	0	0	0	3	10

multiple rep	1	3	11	36	16	53	0	0
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**

Source: Computed from Field Survey Data (2016).

Table 3: Frequency and Percentage Distribution of Termites Infestation by Time According to Zones

Time (months)	**Zone 1 Frequency**	**Percent (%)**	**Zone 2 Frequency**	**Percent (%)**	**Zone 3 Frequency**	**Percent (%)**	**Zone 4 Frequency**	**Percent (%)**
Jan – May	10	33	5	16	9	30	13	43
June – Sept	6	20	4	13	0	0	2	6
Oct-Dec	14	46	14	46	12	40	15	50
Multiple rep.	0	0	7	23	9	30	0	0
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**

Source: Computed from Field Survey Data (2016).

Table 4: Frequency and Percentage Distribution of Economic Loss from Termites by Plant Part According to Zones

Plant part	**Zone 1 Frequency**	**Percent**	**Zone 2 Frequency**	**Percent**	**Zone 3 Frequency**	**Percent**	**Zone 4 Frequency**	**Percent**

		(%)		(%)		(%)		(%)
Stems	14	46	13	43	10	33	15	50
Leaves	0	0	1	3	0	0	2	6
Tubers	4	13	8	26	3	10	5	16
Multiple rep.	12	40	8	26	17	56	8	26
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**

Source: Computed from Field Survey Data (2016)

Table 5: Frequency and Percentage Distribution of Control Measures in Use According to Zones

	Zone 1		**Zone 2**		**Zone 3**		**Zone 4**	
Control Method	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
Cultural	8	26	5	16	5	16	9	30
Chemical	6	20	18	60	1	3	7	23
Biological	0	0	1	3	0	0	0	0
All	2	6	0	0	0	0	4	13
Multiple rep.	13	43	3	10	22	73	10	33
Others	1	3	3	10	2	6	0	0
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**

Source: Computed from Field Survey Data (2016).

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210 **Table 6: Frequency and Percentage Distribution of Farmers by Age According to Zones**

	Zone 1		Zone 2		Zone 3		Zone 4	
Age of Farmers	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
25 – 40	5	16	10	33	0	0	4	13
41 – 50	17	56	14	46	11	36	11	36
56 – 70	7	23	6	20	17	56	15	50
71 – 100	1	3	0	0	2	6	0	0
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**
Mean		**50.17**		**45.83**		**59**		**53.43**

211 **Source: Computed from Field Survey Data (2016).**

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213 **Table 7: Frequency and Percentage Distribution of Farmers by Farm Size According to Zones**

	Zone 1		Zone 2		Zone 3		Zone 4	
Farm Size (ha)	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
1 – 5	27	90	30	100	24	80	25	83
6 – 10	3	10	0	0	6	20	4	13
11 – 15	0	0	0	0	0	0	0	0

16 - 20	0	0	0	0	0	0	1	3
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**
Mean		**3.5**		**3**		**4**		**3.57**

Source: Computed from Field Survey Data (2016).

Table 8: Frequency and Percentage Distribution of Farmers by Gender According to Zones

	Zone 1		**Zone 2**		**Zone 3**		**Zone 4**	
Gender	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
Male	21	70	21	70	13	43	18	60
Female	9	30	9	30	17	56	12	40
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**

Source: Computed from Field Survey Data (2016).

Table 9: Frequency and Percentage Distribution of Farmers by Level of Education According to Zones

Education	Zone 1		Zone 2		Zone 3		Zone 4	
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)
B.Sc	8	26	11	36	2	6	5	16
M.Sc	1	3	1	3	0	0	9	30
PhD	0	0	1	3	0	0	1	3
Others	21	70	17	56	28	93	15	50
Total	**30**	**100**	**30**	**100**	**30**	**100**	**30**	**100**

Source: Computed from Field Survey Data (2016).

COMPETING INTERESTS Authors have declared that no competing interests exist.

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25.

Appendix

SECTION A (Biodata)

1. **Name of Respondent:**……..
2. **Age:** ……..
3. **Gender:**……..
4. **Marital Status:**……..
5. **Educational Attainment:**

(i) B.Sc. (ii) M.Sc. (iii) Ph.D (iv) Any other

6. **Occupation**

(i) Farming (ii) Trading (iii) Civil Servant (iv) Any other

7. **Farm location**
   a. TOWN
   b. VILLAGE
8. **Farm Size**
9. **Number of Farm Organization you belong:**……
10. **ANY OTHER INFORMATION:**……..

SECTION B (Specific Objectives)

a. **CASSAVA CULTIVATION**

i. **Do you grow Cassava in your Farm?**

Yes ( ) No ( )

ii. **If yes, what variety (ies)**

- TMS 30555
- TMS 30572
- TMS 4(2)1425
- NR 8083
- ANY OTHER

iii. What problems do you often encounter in your cassava Farm?

b.PESTS

i.Do you encounter pests problems in your Farm?

Yes ( ) No ( )

i. If yes , name the common pests that attack the crop

(a) Grasshopper (b) Mealybug (c) Green spider mites (d) Termites (e) Any other

ii. Indicate the parts of the plant that are mostly affected by the named pests

(a) Stems (b) Leaves (c) Tubers (d) All of the above

iv.Do Termites pose serious problem to cassava cultivation in your locality?

Yes ( ) No ( )

v. If **yes, what time of the year do Termites become more prevalent?**

vi. Which part of the plant show more visible signs of attack in the field?

(a) Stems (b) Leaves (c) Tubers (d) All of the above

vii. Which stage of the plant development is more susceptible to termites attack?

ix. Do you recognize more than one kind of termites in your field?

Yes ( ) No ( )

x. If yes, specify names

xi. Specify the major losses that you experience from termites attack

xii. which part of the plant record more economic loss

(a) Tubers (b) Stems (c) Leaves

xiv. What is **the degree of damage caused by termites**

a. 0% No Infestation
b. 1-20% Slight Infestation
c. 21-40% Moderate Infestation
d. 41-60% Extensive Infestation
e. 61-80% Very Extensive Infestation
f. 81-100% Plant completely Infested

Quantify the economic loss from termites

(a) Readily (b) Significantly (c) Difficult (d) Not at all

xv**. What method(s) do you use to prevent or control termites**?

(a) Cultural (b) Chemical (c) Biological (d) All of the above

(e) None/ any other method.