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IMPACT OF TERMITE CONTROL ON SOIL ORGANIC MATTER CONTENT IN SOUTH–SOUTH ECOLOGY ZONE, NIGERIA

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ABSTRACT
A field experiment was conducted to assess the effect of termite control on soil organic matter content as well as on the fertility and productivity of soil using maize as a crop test. The research was carried out at Delta State Polytechnic. Ozoro to ascertain if termite control has impact on soil organic matter contents. The termite was controlled using different organic pesticide. The result obtained indicated that controlling termites significantly enhances soil organic matter content. It was also noted that Nitrogen, exchangeable potassium, percentage base saturation, effective cation, exchange capacity, soil pH and exchangeable acidity of the soil were equally enhanced statistically by the treatment. Maize dry grain yield was statistically improved by the treatment. Therefore, termite control helps to reduce loss of organic matter and nutrient in soils of humid tropics and improve soil productivity.
Keywords: *Organic Matter, Productive, Termite, Maize.*

INTRODUCTION
Organic matter is made up by the orienting, or decomposed plant remains, animal manures and dead animal. Soil organic manure has long been recognized as a key element in soul

quality. It determines the durability and productive capacity of a soil. (Foth, 2004, Tisdale *etal,* 2004). The resistance of structural units to breakdown is low wett ability, which principally depends on the organic matter. Organic matter application reduces aluminum toxicity and enhances good structural attributes, (Cooks and Ellis, 2008). The relative magnitude of permanent and pH dependent charge in soil is also determined by the type and amount of clay materials and organic matter present. Soil with high organic matter has a higher cation exchange and buffer capacity, (Sheila, 2016). The major biological impact of soil organic matter on the total ecosystem results from its role as a source of the plant macronutrient. Nitrogen phosphorus and sulphur compounds (Tate III 2017)

However, organic matter depletion in tropical soil has been discovered to be rapid. The constant loss of organic matter in the tropical soil is attributed to high rainfall, high rate of mineralization, bush burning and high carbon losses accompanying tillage operations (Shelia, 2016 and Foth, 2014). Termites have been recently reported to be one of the most important factors in organic matter decomposition and nutrient losses in the tropics (Mishra 2017). Activities of termites feeding on woods, crops, trees, rangeland, etc reduce organic materials for littering. Loss of sodium and potassium was significantly higher in termite affected soil on accumulative basis. Loss of phosphorus was lowest, while nitrogen loss was similar in termite affected and unaffected soil (Sem-Sarma et al, 1996: Wood, 1996; Solanki, 1995; Larvette et al, 1991 and Mando, 1998). Akamigbo (1984); Lopezi and Febre (1990) have shown that chemical changes in soils are induced by the pressure of termites. The use of

organic pesticides (Plant extracts) in the control of insect pest in the tropics has been an old practice adopted by uneducated farmers. Croft (2000); Olaita *et al* (2007); Ivibijaro *et al* (2000) reported that plant materials and plant extracts are used for pest control both in the store room and in the field. The control of termite has been an age long practice possibly to prevent damages to plants as well as farm equipment and its impact on organic matter content as well as soil fertility status may not be seriously looked into. Hence, this work was initiated to evaluate the impact of termite control on organic matter content and soil productivity using maize plant yield as a parameter for soil productivity in south – south ecological zone.

MATERIALS AND METHODS

This field experiment was established in October, 2014 Delta State Polytechnic, Ozoro. A total of four treatments were set in Randomized Complete Block Design (RCBD). The treatments were replicated three times giving a total of 12 plots. The treatments were:

Treatment 1	Control
Treatment 2	Neem seed extracts
Treatment 3	Pawpaw slurry
Treatment 4	Wood ash

The field was weeded of the stubbles were and the stubble weighed plot by plot to determine the initial weight using weighing balance. The weighed stubbles were later sprayed on the soil surface and treatments were applied per plot size of 2 beds measuring 1.5 x 4m per bed. Four months later, the extent of the termite destruction in both the treated and untreated plots was determined by re-weighing the stubbles

to get the second weight. During the rainy season April 2014, the plots were cultivated with the stubbles incorporated into the soil. The plots were cropped to Orba – super 2 maize variety sown at spacing of 75cm x 50cm inter and intra – rows respectively. Two seeds were sown per hole giving a plant population of 64 plants per plot. Weeding was done manually.
On maturity, the dehusked maize cobs were dried under the sun and later shelled. The shelled grains were weighed and the weights were determined plot by plot; and were subjected to statistical analysis using Analysis of variance (ANOVA). Soil samples were collected from the site at a depth of 0-30cm. The collection of sample was done before and after cultivation. The soil samples were analysed in the laboratory. The following were analyzed for cation exchange, organic matter, total nitrogen cation exchange capacity (ECEC) exchangeable acidity, available phosphorus, exchangeable base. effective base saturation, pH and particle size Analysis.

RESULT AND DISCUSSION

Effects of treatments on the organic matter, percentage in the soil, maize grain yields and other soil chemical characteristics are shown in Tables 1 and 2. Organic matter weight was not statistical significant before the application of the treatments, but showed statistical significant difference ($P<0.05$) at the second weight determination (Table 1 & 2). The low values of organic matter in termite affected plots could be attributed to the fact that termites consume and evacuate organic matter materials and use them to feed their kings, Queens and Soldiers in their mound, thereby depleting the soil organic matter. This agrees with findings of Pomeroy (2013) and Akamigbo (1984) that termites reduce the organic matter content of soil and concentrate it in their mounds

where they use it to feed their Kings, Queen and Soldiers. From Table 1 initial soil analysis before planting showed no significant difference (P>0.05) in all the elements except Nitrogen and phosphorus.

The result in Table 2, showed that organic matter percentage was statistically enhanced by controlling termites in the field. The Total Nitrogen and Available phosphorus also showed statistical difference (p>0.05). Controlling termites significantly increased the exchangeable bases except calcium level. Though, calcium did not show any statistical difference in relation to the treatments, as shown in tables 1 & 2, that the exchange complex of the studied soil is dominated by $Ca2^{+}$and Mg2+.

The ECEC was statistically (p>0.05) enhanced by controlling termite. The lower ECEC indicated in termite affected plots is attributed to reduced organic matter content of these plots. The base saturation of termite unaffected plots was increased statistically (p>0.5). The above result did not agree with the work of Akamigbo (1984). The base saturation in adjacent soil is relatively higher than termite mounds.

The higher pH value recorded in termite unaffected plots (Table 2) reflects the higher content of organic materials in this soil which composed major basic cations which take the positions of Aluminum and Iron in the exchange complex site, thereby buffering the soil, hence increase in pH. This result is in contrast with the results of Lopez-Hernandez and Febres (1990), who found that the soil pH of termite affected soils was significantly higher than termite

unaffected soil. It can be seen from table 2 that pH level was highly enhanced by the application of wood ash.

The result in table 2 show that mean maize grain yield increased from an average of 1.43 t/ha in termite effected plots to 2.87 t/ha in termite unaffected plots. The relative increase in the maize grain yield of termite unaffected plots over termite plots is attributed to many factors which may include; higher organic matter content, increased total nitrogen, pH levels, Potassium, available phosphorus; and reduced termite activities. These results however, confirmed the works of Nwite and Enwezor 2001 at University of Nigeria, Nsukka, using chemical insecticide (Gamma Linane-20EC) in the control of termite. The results obtained in these years of research at University of Nigeria Nsukka indicated maize grain yield ranged from an average of 2.4t/ha in termite affected plots to 3.1t/ha in termite unaffected plots.

Table 1: Summary of statistical analysis of studied soil before treatment application

Treatment	pH H2O	Org. matter %	Ava.P ppm	**Exchangeable Basses**						ECEC Cmol kg^{-1}	BS %
				Ca Cmol kg	Na cmol kg^{-1}	K cmol kg^{-1}	EA cmol kg^{-1}	ECEC Cmol kg^{-1}	EA Cmol kg^{-1}		
T_1 in Rep 1	4.88	2.80	0.08	36.6	2.80	1.20	0.13	0.24	1.60	5.84	68.04
T_1 in Rep 2	5.20	2.26	0.09	32.9	2.60	1.30	0.16	0.26	1.70	5.80	70.69
T_1 in Rep 3	4.98	2.19	0.09	25.4	3.00	1.60	0.13	0.23	2.10	8.08	70.20
T_2 in Rep 1	4.90	2.97	0.11	40.1	3.80	1.80	0.13	0.23	1.60	7.45	71.40
T_2 in Rep 2	5.0	2.42	0.09	25.4	3.60	2.40	0.14	0.24	1.80	8.00	68.00
T_2 in Rep 3	5.10	3.20	0.11	37.7	2.40	1.10	0.16	0.28	1.80	5.63	69.50
T_3 in Rep 1	5.0	2.74	0.12	36.6	3.40	1.70	0.14	0.21	1.70	6.46	68.50
T_3 in Rep 2	4.80	2.12	0.12	31.2	4.20	2.10	0.16	0.60	1.60	9.11	73.00
T_3 in Rep 3	4.99	2.18	0.09	22.9	3.80	1.70	0.14	0.24	1.50	8.25	67.50
T_4 in Rep 1	5.0	2.18	0.09	52.9	3.00	1.40	0.16	0.26	1.80	6.78	70.00
T_4 in Rep 2	4.90	2.61	0.01	19.7	3.00	1.50	0.13	0.24	1.70	7.08	70.25
T_4 in Rep 3	5.10	2.71	0.13	30.0	3.20	1.60	0.12	0.23	1.80	5.21	69.30
LSD (0.05)	NS	NS	0.0108	1.332	NS	NS	NS	NS	NS	NS	NS

Table 2: Summary of Statistical Analysis of Studies Soil after Treatment Application and Harvest.

Treatment	pH H2O	Org. matter %	N%	Ava.P ppm	**Exchangeable Basses**						
					Ca Cmol kg^{-1}	Mg cmol kg^{-1}	Na cmol kg^{-1}	K cmol kg^{-1}	EA Cmol kg^{-1}	ECEC Cmol kg^{-1}	Maize Dry Grain yield (t/ha1)
T1 in Rep 1	5.24	1.80	0.068	180	2.20	0.80	0.05	0.13	2.00	6.20	1.8
T1 in Rep 2	5.32	1.62	0.070	150	2.40	1.00	0.06	0.16	1.60	5.45	0.6
T1 in Rep 3	5.16	1.60	0.0082	100	3.40	1.10	0.05	0.13	1.90	6.88	1.9
T2 in Rep 1	5.20	2.45	0.10	160	3.50	1.80	0.06	0.13	1.30	7.35	2.3
T2 in Rep 2	5.25	2.10	0.12	190	3.30	2.20	0.07	0.14	1.60	8.30	2.7
T2 in Rep 3	5.30	2.60	0.11	220	2.20	1.30	0.07	0.16	1.30	7.20	3.0
T3 in Rep 1	5.51	2.30	0.10	200	2.80	1.55	0.07	0.14	1.20	7.20	2.2
T3 in Rep 2	5.23	1.76	0.10	220	3.70	2.00	0.09	0.16	1.40	8.44	2.4
T3 in Rep 3	5.33	2.45	0.12	190	3.00	1.30	0.08	0.14	1.10	7.56	3.1
T4 in Rep 1	6.70	2.00	0.11	290	2.30	1.45	0.12	0.16	1.10	6.50	2.8
T4 in Rep 2	6.40	2.11	0.08	190	2.80	1.30	0.12	0.13	1.20	6.60	2.1
T4 in Rep 3	6.50	2.30	0.10	220	2.80	1.40	0.10	0.12	1.0	7.00	3.4
LSD (0.05)	0.113	0.196	0.0115	5.104	NS	0.275	0.187	NS	0.187	0.174	0.368

CONCLUSION

Organic matter is constantly lost from the soil as a result of many factors prominent among which is termite activities. Controlling termites becomes a panacea to maintain the organic matter content of soil. In this study, the selected organic pesticides (Need Seed extracts, pawpaw slurry and wood ash) showed different levels of termites control and soil sustainability. Wood ash was found to have enhanced statistically the pH, exchangeable sodium and potassium levels in the soil more than other treatments. The result indicated that Base Saturation and ECEC of the soil were enhanced more with the application of pawpaw Slurry and wood ash. In conclusion, the role of termite in the decomposition of organic matter and nutrient losses from the soil cannot be overestimated. Controlling termites will ensure soil organic matter content and availability of some essential plant nutrients. It is therefore recommended that termites should be controlled in order to enhance the fertility of the soil and ensure sustainable soil and crop productivity. It is also recommended that the use of organic pesticides (plant extracts) for termite control be encouraged in place of chemical substances in order to reduce the soil degradation association with chemic al application

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