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EFFECT OF GROUNDNUT (*ARACHIS HYPOGEA)* RESIDUES ON SOIL CHEMICAL PROPERTIES IN THE SUB-HUMID SOUTHERN GUINEA SAVANNA ZONE OF NIGERIA

Achor, O.I., S.A. Ayuba and A. Ali
Department of Soil Science, University of Agriculture, Makurdi, Benue State.

ABSTRACT
This study was conducted at the University of Agriculture Makurdi Research Farm in the Sub-Humid Southern Guinea Savanna zone of Nigeria during 2008 and 2009 cropping seasons to determine the effect of groundnut (*Arachus hypogea*) residues on the growth and yield of maize (*Zea mays*). Five treatments (0.4, 6.8 and 10 t ha^{-1}) groundnut biomass were laid in Randomized Complete Block Design (RCBD) and replicated three times. The biomass was obtained after 90 days of planting from cultivated groundnuts on the same piece of land. The residue has a significant effect on the growth and yield of maize. The tallest plants (166.67 cm) were obtained from plots treated with 8 t ha^{-1} of the residues followed by plots treated with 10 t ha^{-1} (163.88 cm). The shortest plants (124.67 cm) were obtained from control plots in the two cropping seasons. Maize grain yield, number of seeds per cob and weight of 100 seeds followed the same trend except that the grain yield was highest in plots treated with 10 t ha^{-1} biomass. It is recommend that 8.10 t ha^{-1} of groundnut residues be used for maize production in the study area.

INTRODUCTION
Sustainable agricultural production in Nigeria is hampered by low soil fertility largely due to low organic matter, cation exchange capacity (CEC), nitrogen and phosphorus deficiencies prevalent in most soils of the Nigerian savanna region (Sanginga *et al*., 2001).

Attempts have been made by various stakeholders to overcome the problems posed by soil infertility to agricultural production. Farmers in the Southern Guinea Zone of Nigeria have over the years used the bush fallow system to solve the soil fertility problems (Ojeniyi, 2012). However, the traditional bush fallow system does not sustain much crop production because of low nutrient availability, shortened fallow periods and shortage of land due to increased population. Thus the bush fallow system has been rendered obsolete (FAO, 1989; Ojeniyi, 2012).

The use of chemical fertilizers has been advocated by various governments and agencies to overcome soil fertility problems. Yet the high cost of these fertilizers and the inadequate distribution system, inavailability of these fertilizers have often constituted a major constraint to their usage by the peasant farmers, who are the majority of the stakeholders of Nigerian agricultural economy (Sanginga *et al.*, 2001).

The cultivation of leguminous crops in rotation with other food crops offer a potential for meeting the soil fertility requirements at minimum cost to the farmer (Giler and Wilson, 1991). According to Martins *et al* 1976), organic manure like green manure, compost, farmyard manure (FYM) and urban wastes could improve soil fertility without problem. Regular application of green manure from *Leucaena leucocephala* (Lam de wit) and *Gliricidia Sepium (Jacq),* to crops can improve both the chemical and physical conditions of the soil as well as providing plant nutrients (Oguche, 2001).

Groundunt residue is usually discarded by farmers after harvest as crop waste. This residue can be gainfully used by farmers to improve soil fertility and crop performance at little cost. Groundnut residue can be used by farmers to supplement inorganic fertilizers in crop production as a source of nutrients to crops (Martins *et al.,* 1976). The incorporation and subsequent decomposition of groundnut residue would provide organic matter and other plant nutrients in the soil, especially nitrogen, phosphorus and potassium. These nutrients will improve the chemical and physical properties of the soil. This study was carried out to determine the effect of groundnut residue on the growth and yield of maize in the study area.

MATERIALS AND METHODS

A field experiment was conducted at the University of Agriculture Makurdi Teaching and Research Farm in the sub-humid Southern Guinea Savanna Agro-ecological zone of Nigeria (Lat. $7^0 41'$N and Long. $8^0 31'$E). The soil of the experimental site is an inceptisol. The experiment was carried out during the 2008 and 2009 cropping seasons (April-October). The site was cleared manually in March and ridging was done in Qpril in 2008/2009 cropping seasons respectively. Seeds of the Bunch type of groundnuts, were planted on ridges at inter-row spacing of 70cm and intra-row distance of 40cm. Seed rate was 2 seeds per hole, giving a population density of 70,000 plants ha^{-1}. Weeding was one at 4 weeks after planting. The groundnut crop was harvested manually at full maturity eleven weeks after planting.

The same site was cleared immediately after harvest of groundnuts and the experimental plots were measured. The total plot size was 459 m^2 (0.459 ha, measuring 27 m x 17m). The experiment consisted of five treatment plots measuring 5 m x 5 m each, replicated three times and laid in randomized complete block design (RCBD). Groundnut residues were allocated to the plots as follows 0, 4, 6, 8 and 10 t ha^{-1} respectively. An extra-early maturing maize (*Zae mays)* variety (Rzer-Y-SR) was planted two weeks after groundnut residue was incorporated. Two seeds were planted per hole. Weeding was done manually 40 days after planting in each of the cropping seasons.

Data Collection

The following parameters were measured:

i. Height of maize plant at 14, 28, 42, 56 and 70 days after planting.
ii. Leaf area was measured at 1, 28, 42, 56 and 70 days after planting.
iii. Relative leaf growth rate (RLGR).
iv. Number of seeds/cob.
v. Weight of 100 seeds.
vi. Weight of dry maize cob.

The data collected were subject to statistical analysis to test for analysis of variance. Means were separated using least significant difference (LSD) at 5% level of probability.

RESULTS AND DISCUSSION

The effect of groundnut residue treatments on the height of maize is presented in table 1. At

14 days after planting (DAP), the heights of maize in the treated plots were not significantly affected by the treatments except in plots treated with 10 t/ha^{-1}. At 42, 56 and 70 DAP, the heights of maize in all the treated plots were significantly different from that of

the plots in the control plot. Plots treated with 8 t/ha^{-1} groundnut residue produced the tallest plants (166.67 cm). The control plots produced the shortest plants.

Effects of groundnut residue on the growth of maize were also measured by the leaf area of the maize plants (table 2). The data indicated that the leaf areas of maize plants were significant different at 42, 56 and 70 DAR. Plots treated with 10 t/ha^{-1} groundnut residue had the most significant leaf areas at 70 DAP compared with the plants in the control plots. The relative leaf growth rate of maize plants was significant different in all the treatment plots at 42, 56 and 70 DAP compared with the control (table 3).

The effect of groundnut residue on the grain yield of maize measured by weight of 100 seeds, weight of dry cob and the number of seeds per cob is presented in table 4. The result showed that the grain yield of maize in all the treated plots were significantly different from that of the control plots. Plots treated with 10 t/ha^{-1} groundnut residue produced the highest grain yield (3.94 t/ha^{-1})/425 seeds per cob.

From these results, it can be deduced that the parameters measured significantly correlated with the quantity of groundnut biomass applied. Higher grain yields of maize were obtained from plots treated with higher rates of groundnut residue. Therefore application of groundnut biomass had a positive effect on the growth and yield of maize. Slightly higher yields were obtained in 2009 cropping season than 2008 cropping season. This may be attributed to the residual effect of the decomposition and mineralization of the groundnut residues incorporated in the provious year on the crops of the following year (2009). This result also showed that groundnut residues can be utilized by farmers to improve crop performance and subsequently increased yield.

CONCLUSION

This study has shown that farmers in the Nigerian Savanna zone can utilize groundnut residues for crop improvement and increased yield, by incorporating the residues into the soil two weeks piror to planting the crops. This study also showed that groundnut residues may supplement inorganic fertilizers as a source of nutrients to crops. Therefore 8-10 t/ha^{-1} groundnut residues is recommended for use by the farmers in the study area for increased maize production.

Table 1: Effect of Groundnut Residue Treatments on Maize Plant Height (cm) in 2008 and 2009 Cropping Seasons

	2008 Cropping Season					2009 Cropping Season				
DAP	**14**	**28**	**42**	**56**	**70**	**14**	**28**	**42**	**56**	**70**
(t/ha^{-1}) 0	14.30	34.57	57.43	121.50	124.67	14.60	28.33	53.40	120.11	125.0
4	14.87	40.30	68.77	13.30	142.20	14.70	38.90	69.56	131.60	143.0
6	17.20	43.47	71.40	148.40	156.37	16.80	41.60	74.80	150.50	150.50
8	16.28	44.77	73.90	161.50	166.67	16.40	44.27	76.77	158.70	167.0
10	17.33	44.50	75.10	157.50	163.15	17.20	47.07	76.89	160.20	168.0
LSD ($p<0.05$)	NS	3.60	2.36	6.93	6.75	NS	1.24	9.85	12.40	5.07

DAP = Days after planting
Trt = Treatment

Table 2: Effect of Groundnut Residue Treatments on Leaf Area of Maize (cm^2) in 2008 and 2009 Cropping Seasons

	2008 Cropping Season					2009 Cropping Season				
DAP	**14**	**28**	**42**	**56**	**70**	**14**	**28**	**42**	**56**	**70**
(t/ha^{-1}) 0	186.77	333.37	334.75	377.52	476.09	190.11	336.45	346.85	379.32	561.81
4	287.20	362.0	387.42	477.19	561.56	288.40	368.10	389.56	478.29	641.81
6	366.57	426.32	459.32	546.61	640.14	305.40	435.14	462.30	545.60	765.58
8	385.96	523.84	540.76	645.49	696.52	376.40	525.64	538.66	640.45	691.96
10	453.24	572.68	600.90	681.11	729.04	486.15	570.66	596.94	683.16	729.68
LSD ($p<0.05$)	NS	NS	14.37	29.66	20.0	NS	NS	9.10	5.85	8.64

DAP = Days after planting
Trt = Treatment

Table 3: Effects of groundnut residues on relative leaf growth rate (cm) of maize in 2008 and 2009 cropping seasons

	2008 Cropping season				2009 Cropping season			
DAP	**28**	**42**	**56**	**70**	**28**	**42**	**56**	**70**
(t/ha^{-1}) 0	0.28	0.34	0.36	0.36	0.27	0.38	0.39	0.38
4	0.23	0.30	0.21	0.43	0.25	0.30	0.31	0.46
6	0.24	0.41	0.47	0.46	0.25	0.42	0.47	0.46
8	0.34	0.30	0.39	0.52	0.35	0.36	0.49	0.58
10	0.38	0.36	0.43	0.54	0.46	0.51	0.53	0.61
LSD ($p<0.05$)	NS	NS	0.35	0.25	NS	NS	0.43	0.54

DAD = Days after planting
Trt = Treatment

Table 4: Effects of groundnut residues on the grain yield of maize in 2008 and 2009 cropping seasons

	2008				2009			
(t/ha^{-1}) Treatment	**Weight of Cob (g)**	**Number of seed per cob (g)**	**Weight of 100 seeds (g)**	**Yield/ Plot (t/ha^{-1})**	**Weight of Cob (g)**	**Number of seed per cob (g)**	**Weight of 100 seeds (g)**	**Yield/ Plot (t/ha^{-1})**
0	25	252	38	1.14	25.6	253	38.5	1.15
4	37.1	347	57.1	2.20	39.2	249	59.3	2.36
6	42.3	384	68.3	5.58	44.3	385	69.8	2.58
8	47.4	404	86.1	3.64	4.91	404	88.2	3.34
10	58.1	425	95.1	3.94	59.2	425	97.4	3.97
LSD ($p<0.05$)	0.04	8.20	4.12	0.14	0.05	5.12	4.20	

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