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EFFECT OF POULTRY MANURE ON BEACH SAND, GROWTH AND YIELD OF GROUNDNUT (*Arachis hypogea* L.) IN ABAKALIKI, SOUTH EASTERN NIGERIA

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Abstract

This research was carried out to study the effect of poultry manure on beach sand, growth and yield of groundnut (*Arachis hypogea* L.) in Abakaliki in the screen house of Department of Crop Science and Landscape Management, Ebonyi State University, Abakaliki. The beach sand used was collected from Nkpana Beach in Ogoja Local Government Area. Samnut 22 variety of groundnut was used as the test crop. The pot experiment was laid in completely randomized design (CRD) with five treatments and four replications. The poultry manure was applied at the rates of 5, 10, 15, 20 tha^{-1} and control equivalent to 4.5, 9.0, 13.5 and 18g pot^{-1} to 7.0kg of beach sand in each pot. Groundnut seeds were planted two seeds per pot and later thinned to one stand. Data collected were subjected to statistical analysis. Results showed significantly higher bulk density, total porosity and gravimetric moisture content ($p<0.05$) at 20 tha^{-1} of poultry manure compared to control. Soil pH, available P, CEC, OC and exchangeable acidity of the beach sand were significantly ($P<0.05$) higher for pots amended with 20tha^{-1} compared to control. The improvement of available phosphorus was in the order of 0 t ha^{-1}< 5 t ha^{-1}< 10 t ha^{-1}< 15 t ha^{-1}< 20t ha^{-1}. The order of increase in plant height was 20 t ha^{-1} > 15 t ha^{-1} > 10 t ha^{-1}> 5 t ha^{-1}> C and their percentage increase was thus 38%, 25%, 19% and 6% respectively whereas the increasing order of grain yield was C < 5tha^{-1} < 10tha^{-1} = 15 tha^{-1} < 20tha^{-1} corresponding to 0.4, 0.6, 0.7, 0.8 0.9 tha^{-1} Highest yield parameters were obtained at 20tha^{-1} of the amendment. Different rates of PM especially 20t ha^{-1} proved superior in ameliorating conditions of beach sand but for higher productivity without compromising environmental health, 15t ha^{-1} is recommended.

Keywords: Poultry manure, beach sand, soil properties, groundnut yield

INTRODUCTION

Groundnut (*Arachis hypogea* L.) originated from south America but is today cultivated throughout the world (Ranga *et al.*, 2010). It used to be a very important export crop in Nigeria, accounting for as much as 20% of the total foreign earnings and as well satisfy local nutritional requirements. According to Okello *et al.* (2013) groundnuts are produced in the tropical and sub-tropical regions of the world on sandy soils. The crop can also be grown in regions with a rainfall ranging 200 to 1000mm/year. Yields are affected by day length and light intensity but performs optimally on clear days with adequate sunlight (Cranfurd *et al.*, 2006; Angin and Yaganoglu, 2011). Optimum temperature ranges between 20ºC and 30ºC for maximum production (Prased *et al.*, 2003).Since the past decades, groundnut production has recorded low yields, to the extent that Nigeria exports have dwindled due to high incidence of rosette disease, insufficient rainfall and inadequate supply of plant nutrients (Babalola *et al.*, 2005).

Soil selection and nutrient requirement for groundnut production are very important as pods are produced under the surface. The best soil for groundnut production should be well- drained, light colored sand, loamy sand or sandy loam (Lourduraj, 1999). Groundnut gives highest yields in soils with pH of 6.0 -6.5, even though the crop is considered tolerant to acid soils, some cultivars can grow well in slightly alkaline soils with a pH > 8.0 as it facilitates nitrogen fixation (Prasad *et al.*, 2003; Lourduraj, 1999). Availability of nitrogen and phosphorus are essential to successful growth and development of groundnut.
Tropical sandy soils have a wide range of limiting factors for agricultural use which are; nutrient deficiencies, acidity,low water storage and general poor physical attributes (Maniyunda, 2018; Asadu *et al.*, 2008). These limiting factors if not properly managed would have a major bearing on the economic viability of agriculture on sandy soils. Low nutrient levels are common on sandy soils for example,sandy soils in southeastern Nigeria was deficient in macro and micronutrients like N, P, K Zn, Cu and Mo (Maniyunda, 2018; Akamigbo and Asadu, 1983) and crops grown on these soils commonly express multiple nutrients disorders which limit productivity of crops (Mbah *et al.*, 2018; Amuyou *et al.*, 2013; Obi and Ebo, 1995). Generally, sandy soils have lower organic matter

levels than heavier textured soils given similar rainfall, temperature, land use and tillage (Kolo, 2019). Clay levels on deep sandy soils may be too low to protect organic matter from oxidation (Kolo, 2019). High percolation rate and leaching of N and other nutrients may also limit the soil productivity even when water is not limiting. Acidity and salinity are common on sandy soils (Asadu *et al*., 2008) but for arain fed crops, acdity may give rise to a range of fertility constraints including Al and Mn toxicities and deficiencies of nutrients(Dierolf *et al*., 2001). Poor N fixation in legumes is often a consequence of soil acidity due the low tolerance of rhizobia to acidity and low levels of plant available Mo (Maniyunda, 2018).

Productivity on sandy soils tends to be low even when recommended agronomic practices are followed due nutrient deficiency, but application of organic manures can supply nutrients in slowly available forms and improve soil physico-chemical properties (FAO, 2000). Nitrogen can be supplied in the soil by the plant through fixation but P is not and has to be provided from the soil through input amendments such as poultry manure. Poultry manure (PM) is composed mostly of feaces, urine and part of chicken feeds which contains mineralizable nutrients capable of promoting soil productivity (Tewolde *et al.,* 2005). It is a good source of essential plant nutrients, majorly organic matter which restores and improves the physical chemical and biological conditions of soil (Diana *et al.,* 2008). Mubarak (2004) reported significant yield and yield components with application of poultry manure. Sandy loam which is the best soil for groundnut production is gradually becoming scarce in the study area due to urbanization and population increase, in view the above, an alternative could be developed from river sand amended with organic manure like poultry droppings. Studies on groundnut and nutrient management are vast in literature (Nwite *et al*., 2022; Okello *et al*., 2013; Mubarak, 2004). However, information on management of beach sand and performance of groundnut is highly limited. It is on account of this that the study becomes imperative. The objectives of the investigation are to find the effect of poultry manure on amelioration of condition of beach sand as well as study effect of treatment on yield of groundnut.

MATERIALS AND METHODS

Site location

The experiment was carried out at screen house of Department of Crop Science and Landscape Management, Ebonyi State University, Abakaliki. The area lies between latitude $06^{o}\ 4^{1}$N and Longitude $08^{o}6^{1}$E in the derived savanna zone of southeastern Nigeria. There are two marked seasons in Abakaliki area, the dry and rainy seasons. The area experiences bimodal pattern of rainfall usually spread from April-July and September- October with a dry spell in August. The rainfall ranges from 1700 to 2000mm with mean annual rainfall of 1800mm (ODNRI, 1989; Anyadike 2002). The dry season begins in November and ends in March. The mean annual temperature ranges from 27ºC to 31ºC throughout the year. The relative humidity is 80% during rainy season but declines to 65% in the dry season (ODNRI, 1989; EBADEP, 2005)

Field Methods

Beach sand was collected from Nkpana river beach and 7kg each of beach sand was weighed into pots of 3 m x 5 m dimensions. Poultry manure at rates of 0,5,10,15 and 20 t ha^{-1} equivalent to 0,4.5, 9.0, 13.5 and 18kgpot^{-1} were weighed out and mixed with beach sand in each pot. The pots were arranged in completely randomized design (CRD) with 0.5cm space between pots. Treatments were replicated four times to give a total of 20 experimental pots.

Groundnut (*Arachis hypogea*L) seeds were planted at two seeds per pot two weeks after treatment application. Thinneg was carried out to one plant per pot at two weeks after planting (WAP). The pots were irrigated adequately with 5mm of water per day till maturity. Weeds were removed with hand every two weeks.

Soil sampling

Soil samples were collected before and after planting using core samplers and hand trowel at 0 – 15 cm depth. The samples collected were bulked to obtain composite samples, which were air-dried, passed through 2mm sieve and analyzed for physicochemical properties whereas the core samples (undisturbed samples) collected were used for other physical properties determination in accordance with the standard procedures.

Agronomic determinations

The following agronomic parameters were collected starting from four weeks after planting (WAP); plant height, leaf area index, no of braches and yield. Plant height, leaf area index, no of braches and yield. Plant height (cm), leaf area index (cm^2) and number of branches were determined at four and ten weeks after planting (WAP). Number of pods and yield were determined at maturity.

Laboratory Methods

Particle size distribution was determined using Bouyoucos hydrometer method (Gee and Bauder, 1986). Textural class of the soil was determined using a textural triangle. Soil bulk density was determined using the core method according to

Blake and Hartage (1986), Total porosity was evaluated from soil bulk density data using particle density of 2.65gcm^{-3}. Hydraulic conductivity was assessed by method of Klute (1986). Moisture content was determined by gravimetric method (Obi, 2000).

Soil pH was determined using glass-electrode pH meter. The pH was determined on a 1:2.5 soil: solution ratio in both water and 0.01M $CaCl_2$ solution (Mc Lean, 1982). Available phosphorus was obtained by the Bray-2 method as described by Olson and Sommers (1982). Organic carbon was determined by Walkley-Black dichromate wet oxidation method (Nelson and Sommer, 1982), Total Nitrogen was extracted using the micro-kjeldahl technique (Bremner and Mulvaney, 1982). Exchangeable H^+ and Al^{3+} were extracted with 0.1N (Normal) KCl and the extract titrated with 0.05N NaOH (Mclean, 1982). The total exchangeable acidity was estimated by summing the amounts of H^+ and Al^{3+} determined (Grant, 1982). Exchangeable bases (Ca^{2+}, Mg^{2+}, K^+ and Na^+) were extracted with 1N (Normal) neutral ammonium acetate (NH_4OAC) solution (Grant, 1982) Ca^{2+} and Mg^{2+} were determined by titration, while K^+ and Na^+ were measured by flame photometry (Grant, 1982). Cation exchange capacity was obtained by the summation of exchangeable bases and acidity. Base saturation was obtained using the formula:

$$\%BS = \frac{TEB}{CEC} \times 100$$

Where, BS = Base saturation
TEB = Total Exchangeable Bases and
CEC = Cation Exchange Capacity

Data Analysis
Data obtained from the pot experiment with completely randomized design (CRD) were analysed using analysis of variance (ANOVA) Obi (2002). Separation of treatment means for significant effect was done using Fisher's –Least significance difference (F-LSD).

RESULTS AND DISCUSSION

Initial Soil Properties
Physical and chemical properties of the soil before the experiment are shown in Table 1.The result of pre-planting analysis shows that the soil was 92.30% sand, 1.90% silt and 5.80% clay. The soil pH was 4.20 with total N 1.0gkg^{-1} available P was 0.88mgkg^{-1} and organic carbon 4.8gkg^{-1} Exchangeable K, Ca, Na and Mg were 0.14, 2.0, 0.15 and 1.80 cmolkg^{-1} respectively. The exchangeable acidity was 0.32 comlkg while base saturation was 96% (Table 1).The soil was characterized by low organic matter, total N, available P, K, Na and CEC (Enwezor *et al.*, 1981). Ca and Mg recorded higher values of 2.00 and 1.80 comlkg^{-1} and dominated the exchange complex of the soil (Table 1).

The textural class was sandy soil and the soil is acidic. Generally, the soil was poor in soil nutrients (Landon 1991; Asadu and Nweke, 1999) and of low fertility status for economical crop production. The low level of nutrients in the soil was probably due to its sandy nature (Busari *et al*, 2005). The nutrient composition of the poultry manure applied to the soil is shown on Table 2.

Properties of Poultry Manure

Poultry manure had a pH of 5.90, total N of 2.56%, available P of 21.6mgkg^{-1}, organic carbon 17.33%, exchangeable K 1.10cmolkg^{-1}. Content of Ca, Na and Mg were 1.61, 1.78 and 0.54cmolkg^{-1}respectively. Generally, the result shows that the nutrient concentration was higher in the amendment (poultry manure) than in the soil and contained adequate amount of nutrient element suitable for plant growth and development (Table 2).

Table 1: Initial soil properties

Parameters	Values
Sand(gkg^{-1})	923
Silt (gkg^{-1})	19
Clay (gkg^{-1})	58
Textural Class	Sandy Soil
pH (H_2O)	4.20
Available phosphorus (mgkg^{-1})	0.88
Total Nitrogen (gkg^{-1})	1.0
Organic Carbon (gkg^{-1})	4.8
Organic matter (gkg^{-1})	8.4
Calcium (molkg^{-1})	1.00
Magnesium (molkg^{-1})	0.10
Potassium (molk^{-1})	0.04
Sodium (molkg^{-1})	0.15
Exchangeable acidity (molkg^{-1})	0.32
CEC (molkg^{-1})	3.03
Base saturation (%)	49.0

CEC = Cation Exchange Capacity

Table 2: Nutrient composition of Poultry Manure (PM)

Parameters	Values
pH	5.90
Available phosphrous (mgkg^{-1})	21.60
Total Nitrogen (gkg^{-1})	25.6
Organic carbon (gkg^{-1})	173.3
Calcium (cmolkg^{-1})	2.00
Magnesium (cmolkg^{-1})	0.54
Potassium (cmolkg^{-1})	1.10
Sodium (cmolkg^{-1}	8.4

Effect of poultry manure on some soil physical properties.
The physical properties of soil after amendment are shown in Table 3. The bulk densities ranged between 1.25 – 1.44 gcm^{-}3. The bulk density

obtained at 20 t ha^{-1} was lower than other rates of amendment compared to control. The pots amended with PM significantly (P< 0.05) improved the bulk densities of the soil. The order of decrease of bulk density of the soil is 20 t ha^{-1}< 15 t ha^{-1}< 10 t ha^{-1}< 5 t ha^{-1}< C and the percentage decrease is as follows; 13%, 11%, 8% and 3% compared to control. Soil bulk density values of the amended plots were significantly (P<0.05) lower relative to the control. The lowest value for bulk density (1.25gcm^{-3}) was observed in pots amended with 20 t ha^{-1} of PM which may be attributed to large quantity of organic matter and carbon in poultry droppings which helps in opening the soil (Abiven *et al.,* 2007). The higher bulk density (1.44gcm^{-3}) recorded in control could be due to the low organic matter (OM) and organic carbon (OC) observed in the soil.

Total porosity: Poultry Manure at 20 t ha^{-1} recorded the highest total porosity of 52.5% (Table 3). All amended pots significantly (P< 0.05) recorded higher total porosity when compared with control. Generally, total porosity increased with increase in PM. The trend in enhancement of total porosity by the different rates of PM application is 20 t ha^{-1}> 15 t ha^{-1}>10 t ha^{-1}> 5 t ha^{-1}> C and the order of percentage increase of total porosity is 13%, 12%, 9% and 4% compared to control. The general increase of total porosity as the PM increases could be attributed to organic carbon content which increases soil volume and therefore reduces soil bulk density (Nwite *et al*., 2018). The total porosities of both pots amended with PM and control ranged from critical to limiting values for soil productivity (Nwite *et al*., 2018).The highest value recorded by pots amended with 20 t ha^{-1} PM was significantly higher than other amended pots and which agrees with Mbah and Mbagwu (2006) that reported increased total porosity of the soil due to animal waste application.

Hydraulic conductivity: The soil hydraulic conductivity was higher in the amended pots compared to the control. The values range from 0.82 – 1.09 cmhr^{-1}. The result shows that there was a significant difference (P < 0.05) among the treatments with respect to hydraulic conductivity (Table 3).Pots amended with 20 t ha^{-1} of PM recorded the highest value for hydraulic conductivity which is higher (1.09%) than the pots amended with 15 t ha^{-1} of PM 0.9%.The higher hydraulic conductivity in amended pots agrees with Anikwe (2000) that amended soil with low bulk density and high total porosity increases hydraulic conductivity.

Gravimetric moisture content: The result shows that the values for gravimetric moisture content ranged from 4.75 – 12.00%. Generally, gravimetric moisture content of the amended pots increased greatly when compared with control. There was significant difference (P<0.05) between pots amended with 20 t ha^{-1} PM and the ones amended with 15 t ha^{-1}. The treatment with 20 t ha^{-1} of PM recorded 22.9% increase of gravimetric moisture content compared with that of 15 t ha^{-1}. The order of increasing values of gravimetric moisture content is 20 t ha^{-1}> 15 t ha^{-1}>10 t ha^{-1}> 5 t ha^{-1}> C. The higher values of gravimetric moisture content recorded by amended pots agrees with the findings of Obi and Edo (1995) and Nwite *et al*. (2022) that stated that increased moisture content may be attributed to the colloidal content of organic manure which increased water holding capacity.

Table 3: Effect of Poultry Manure on physical properties of beach sand.

Treatment	Bulk Density (g/cm^3)	Total porosity (%)	Hydraulic Conductivity (Cm/hr)	Gravmetic moisture content (%)
Control	1.44	45.75	0.82	4.75
5 tha^1 of PM	1.39	47.50	0.87	6.75
10tha^{-1} of PM	1.32	50.00	1.02	7.75
15tha^{-1} of PM	1.28	52.00	1.08	9.25
20tha^{-1} of PM	1.25	52.75	1.09	12.00
FLSD (P<0.05)	0.05	1.85	0.3157	1.87

PM – Poultry manure

Table 4 : Effect of poultry on chemical properties of beach sand

Treatment	pH	P (mgkg^{-1})	N (gkg^{-1})	OC (gkg^{-1})	OM (gkg^{-1})	Ca	Mg	K cmolkg^{-1}	Na	CEC	EA	BS%
Control	7.40	6.97	0.4	3.8	6.6	3.09	2.17	0.10	0.13	5.65	0.16	97.16
5 t ha^{-1} PM	6.2	11.77	0.7	7.2	12.3	9.47	4.80	0.15	0.17	14.90	0.32	97.33
10 t ha^{-1} PM	6.3	13.17	0.5	7.4	12.7	9.87	4.53	0,19	0.15	14.90	0.16	98.67
15 t ha^{-1} PM	6.4	14.63	0.7	8.9	15.4	10.53	4.93	0.15	0.19	16.00	0.19	98.83
20 t ha^{-1}) PM	6.5	28.03	1.3	11.9	22.0	8.93	5.20	0.14	0.21	14.46	0.24	98.36
FLSD (P<0.05)	NS	8.74	0.05	0.53	0.91	NS	NS	NS	NS	NS	NS	NS

PM = Poultry Manure N-Nitrogen, P = Phosphorous, OC – Organic carbon OM – Organic Matter, CEC = Cation exchange capacity, EA = Exchangeable acidity, BS = Base saturation.

Effect of poultry manure on soil chemical properties.

Table 4 shows the pH of the soil after planting. The pH values ranged from 4.20 – 6.50 with pots amended with 20 t ha^{-1} PM recording the highest value (6.50). The improvement of the pH of the soil from acidic medium to slightly acidic medium on application of amendment is as follows 0 t ha^{-1}< 5 t ha^{-1}< 10 t ha^{-1}< 15 t ha^{-1}< 20t ha^{-1}(i.e 4.20 < 6.20 < 6.30 < 6.40 < 6.50). The result shows that there was no significant difference (P<0.05) among the treatments with respect to soil pH. On the average it was observed that there was a general increase in pH of the soil after application. The pH values recorded are very suitable for the growth of groundnut as it is known to grow best in slightly acidic soils with optimum pH ranging from 5.5 to 6.5 (Prasad *et al.*,2003; Gibbons, 1980).

Available Phosphorus: The available P (mgkg^{-1}) were 6.97, 11.77,13.17,14.63 and 28 for control (C), 5 t ha^{-1}, 10 t ha^{-1},15 t ha^{-1}and 20t ha^{-1} (Table 4). The result showed that there was significant differences (P < 0.05) among the treatments especially between 20t ha^{-1} and15 t ha^{-1} where the former showed 48% increase compared with later. The improvement of available phosphorus is in the order of 0 t ha^{-1}< 5 t ha^{-1}< 10 t ha^{-1}< 15 t ha^{-1}< 20t ha^{-1}. It was observed that available phosphorous levels increased considerably as a result of the different rates of treatment used. The increase was more at higher rate of the poultry manure application (20 t ha^{-1}). The result shows that the soil in pots amended with poultry manure had significantly (P≤0.05) available phosphorous than the control. This may however be due to the higher mineralization and release of the organic manure, (Mbah and Mbagwu, 20003; Azeez and Adetunjii, 2005) .However, the values of available P recorded in all the pots amended with PM were low (<15mg/kg) except the pots amended with 20 t ha^{-1} (Enwezor *et al.,* 1981).

Total nitrogen: The result of total N ranged from 0.4-1.3gkg^{-1}(Table 4).The pots with 20 tha^{-1} PM recorded 69% increase of total N compared to control. Pots amended with 5 t ha^{-1} and15 t ha^{-1} recorded the same value (0.07%) for total N whereas pots amended with 10 t ha^{-1} PM recorded a lower value (0.5). The irregular trend of total N could be attributed to the rate of its mineralization. Generally, the values of total nitrogen were very low when compared to the critical levels of 0.2%N (equivalent to 2 g/kg) recommended (Akinrinde and Obigbesan, 2000).

Organic Carbon (OC): The values organic carbon recorded ranged from 3.8 – 11.9 (Table 4). The result showed that soil organic carbon increased as a result of the amendment. The order of increase is as follows 20 t ha^{-1}> 15 t ha^{-1}>10 t ha^{-1}> 5 t ha^{-1}> C and their percentage increase is 47%.<49%<57% < 68%. The results show that there were significant differences among the treatments with respect to organic carbon. The increase in organic carbon contents of the soil is as a result of poultry manure (PM) amendment. The increase in organic carbon content observed in the amended pots could be due to the capacity of poultry manure to improving the nutrient condition of the soil (Mbah *et al.,* 2018). Generally, the values of organic carbon recorded in all the pots used for the study were low considering the recommended critical level of 3.0% (equivalent to 30 g/kg) OC for crop production (Akinride and Obigbesan, 2000). This condition indicates low nutrient status of the soil.

Exchangeable cations: The results of exchangeable cations (Ca, Mg, K and Na) are shown in Table 4. Ca and Mg recorded high (5.09 -10.53 cmolkg^{-1}) and medium (3.17-5.20 cmolkg^{-1}) values respectively. K and Na recorded low values which ranged 0.12- 0.19 and 0.15-0.21cmolkg^{-1} respectively. The increasing order of exchangeable Ca is 15 t ha^{-1}> 10 t ha^{-1}>5 t ha^{-1}> 20 t ha^{-1}> C whereas that of exchangeable Mg is in the order of 20 tha^{-1} > 15 tha^{-1}>5 tha^{-1} = 10tha^{-1}> C. Plots amended with 15 t ha^{-1} PM recorded 15% increase of Ca compared to plots amended with 20 tha^{-1}. The pots amended with 15 t ha^{-1} PM are relatively higher in exchangeable K 0.19cmolkg^{-1} than others whereas the plots amended with 20 tha^{-1}recorded higher value (0.21cmolkg^{-1}) for Na than other pots. Generally, results show no significant difference among the treatments for exchangeable cations. The observed increase in the exchangeable cations from organic waste application has been documented (Das, 2008, Olayinka, 1990; Howeler, 1996; Landon, (1991). Low values of Na and K, in amended soil of the tropics have also been observed (Asadu and Nweke, 1999; Akirinde and Obegbesan, 2000).

Cation exchange capacity (CEC): The result showed that values of CEC ranged between 5.65 – 16.00 comlkg^{-1}. The value recorded at 15 tha^{-1} was significantly higher than that of 20 tha^{-1} with 10%. The increasing order of CEC values was 15 tha^{-1} >10 tha^{-1} = 5tha^{-1}> 20tha^{-1}> C. According to Ogunlade (2008), Olowoake (2009) Asadu and Akamigbo (1990) and Akande *et al*. (2010) application of poultry manure/ organic fertilizer increased significantly cation exchange capacity of the soil in the tropics.

Exchangeable Acidity (EA): The values of exchangeable acidity (comlkg^{-1}) ranged from 0.16 - 0.24. There is no significant difference observed among the treatments. The result agrees with the findings of Adeniran (2003) who reported that animal wastes decreased exchangeable acidity (EA) by removal of Al^{3+} from the exchange site.

Exchangeable acidity (EA) were significantly (P<0.05) higher in PM amended soil than in control.

Effect of poultry manure on agronomic parameters.

Plant height: The height ranged from 36.75cm - 54.05cm at 10WAP (Table 5). The highest and lowest values for plant height were recorded by pots amended with 20 tha^{-1} and control respectively. The order of increase in plant height is 20 t ha^{-1}> 15 t ha^{-1}>10 t ha^{-1}> 5 t ha^{-1}> C and their percentage increase is thus 38%, 25%, 19% and 6% respectively. Addition of 20 tha^{-1} of PM significantly increased the plant height as it recorded the maximum height at 10WAP when compared with other treatments and control. This is line with the observation of Yanduraju *et al.* (1980) which reported significant increase in plant height with the use of poultry manure.

Number of branches: The results show that number of branches at 10WAP ranged from 11 – 20 (Table 5). Additions of PM to the soil resulted in significant difference in number of branches across the different rates of treatment applied. The pots amended with 20 tha^{-1} of poultry manure (PM) recorded the highest values for number of branches at 10 WAP. This also agrees with Yanduraju *et al.* (1980).

Leaf Area Index (LAI). The higher values for LAI were recorded by the pots amended with poultry manure compared to the control pots (Table 5). The highest value (9.60 cm) was recorded by the pots amended with 20 t ha^{-1} and least value (5.62 cm) recorded among the treated pots was by 5tha^{-1}. However, 20 tha^{-1} of PM significantly increased leaf area index when compared with other treatment rates. Generally, the amended pots were statistically different when compared with control, this agrees with the findings of Nwite *et al.* (2022).

Pod number: The result shows that pod number ranged from 4 – 9 with pot amended with 20 tha^{-1} recording thehighest value (9) for pod number (Table 5). Control pots recorded the lowest value (4) for pod number. Application of poultry manure affected the pod number (Nwite *et al.,* 2022).

Yield/ Seed tha^{-1}: The grain yield (tha^{-1}) ranged from 0.4 – 0.9 (Table 5). The increasing order of grain yield was C< 5tha^{-1}< 10tha^{-1} = 15 tha^{-1}< 20tha^{-1} corresponding to 0.4, 0.6, 0.7, 0.8 0.9 tha^{-1}. The increased groundnut grain yield could be attributed to higher nutrient in the poultry manure. This agrees with Mubarak (2004) who reported an increase of 10% grain yield of groundnut when poultry manure was applied at the rate of 5 tha^{-1}. Ahmed *et al.* (2010) reported highest dry matter accumulation and kernel yield when groundnut was fertilized with 3 t ha^{-1} of poultry manure.

Table 5: The effect of Poultry manure on some agronomic parameters

	Plant height (cm)		Number of leaves				
	4WAP	10WAP	4WAP	10WAP	Leaf Area (LAI)	Pod Number	Yield tha^{-1}
Control	20.38	36.75	6.0	11	5.40	4	0.4
5tha^{-1} PM	24.50	39.25	7.0	12	5.62	5	0.6
10tha^{-1} PM	27.43	45.38	7.5	14	7.68	6	0.7
15tha^{-1} PM	29.10	49.13	9.0	19	8.82	7	0.8
20tha^{-1} PM	31.50	54.05	9.5	20	9.66	9	0.9
FLSD (P<0.05)	2.36	2.46	0.7	2.9	1.02	NS	NS

WAP = Week After Planting

CONCLUSION

The study revealed that application of poultry manure at appropriate level (20 t ha^{-1}) on a river sand improved its productivity and increased growth and yield of groundnut. The organic manure significantly improved the soil physical and chemical properties. Comparatively, poultry manure at 20 tha^{-1} significantly increased beach sand productivity and growth and yield of groundnut more than other rates. Application of PM tends to be promising practice for management of beach sand for higher productivity. In order to maintain and enhance the productivity of beach sand 20 tha^{-1} of PM is recommended for treatment of beach sand and for high yield of groundnut.

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