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Utilization of Organic Soil Amendments to Improve Soil Properties and Groundnut Productivity in an Ultisol of Southeastern Nigeria

Angus Onwudiwe Ikeh[1]*, Demben Moses Esang[2], Adaobi Daian Unaegbu[1], Ali Rahmat[3], Debasis Mitra[4]

[1] Department of Crop Science, Faculty of Agriculture, University of Agriculture and Environmental Sciences, Umuagwo, Imo State, Nigeria
[2] Department of Crop Science, Faculty of Agriculture, University of Uyo, Uyo, Akwa Ibom State, Nigeria
[3] National Research and Innovation Agency, Indonesia
[4] Department of Microbiology, Graphic Era (Deemed to be University), Dehradun, Uttarakhand 248002, India

*Correspondence E-mail: angus.ikeh@uaes.edu.ng/ iykeh2007@yahoo.com

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Abstract

Background: Ultisols are highly weathered, acidic, and low-fertility soils commonly found in tropical and subtropical regions. They typically exhibit low pH, low nutrient content (particularly phosphorus, potassium, calcium, and magnesium), and high aluminum toxicity.
Aims: This study aimed to evaluate sustainable soil management practices using organic amendments to improve the fertility and reduce the acidity of Ultisols in southeastern Nigeria.
Methods: he field study was conducted in March, 2025 to explore sustainable soil management practices that could improve soil fertility status and enhance yield stability of groundnut. The research was carried out at the Teaching and Research Farm of the University of Agriculture and Environmental Sciences, Umuagwo, Imo State, Nigeria. The treatments included poultry manure (PM), cassava peel waste (CP), cow dung (CD), compost manure (CM), and a control (no soil amendment, C). The experiment was laid out in a randomized complete block design with three replications. Data were collected and analyzed using ANOVA and followed by an LSD test.
Result & Conclusion: The results of soil analysis at harvest showed that poultry manure application increased organic matter by 56%, while cow dung increased it by 36%. PM also increased total N by 62%, while cow dung increased it by 26%. Cow dung treatment produced significant seed yields of 2672.51 kg/ha, followed by cassava peel waste, which produced 2487.45 kg/ha. The control treatment had the lowest seed yield of 1574.83 kg/ha. This study demonstrated that the application of organic soil amendments, particularly cow dung, cassava peels, and poultry manure, significantly improved the fertility of Ultisols in southeastern Nigeria. Among the tested materials, cow dung proved most effective for groundnut cultivation, as it provided the optimum soil conditions required for maximizing yield in Ultisols.

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1. Introduction

Ultisols are highly weathered, acidic, and low-fertility soils commonly found in tropical and subtropical regions. They are characterized by a subsurface horizon of clay accumulation and typically exhibit low pH, low nutrient content (particularly phosphorus, potassium, calcium, and magnesium), and high aluminum toxicity (Ikeh *et al.,* 2026). These properties make Ultisols challenging for crop establishment, growth, and yield. Effective management often requires liming, organic amendments, and appropriate fertilization (Sampson *et al.,* 2025). Ultisols are strongly leached, with low cation exchange capacity (CEC), low base saturation (usually less than 35%), and high acidity. They generally have a deep solum (90–120 cm), a clay-rich texture, and a sticky or plastic consistency. Because of their acidity and poor natural fertility, Ultisols are often classified as marginal soils (Prasetyo *et al.,* 2001). Understanding how soil properties vary under different land uses is critical for guiding sustainable land management and ensuring long-term productivity. Chemical attributes such as pH, organic carbon (OC), total nitrogen (TN), available phosphorus (AP), cation exchange capacity (CEC), and exchangeable cations serve as valuable indicators of soil quality and degradation status (Yousif *et al.,* 2025).

Soil sustainability involves managing soil as a living ecosystem to maintain its long-term health, productivity, and functionality for plants, animals, and humans (Ikeh *et al.,* 2023). Healthy soil supports rich biodiversity, including bacteria and fungi, as well as animals such as insects and worms. It enables consistent crop productivity without over-reliance on external inputs (Ikeh *et al.,* 2026; Orji *et al.,* 2026). This is because soils rich in organic matter and microorganisms, which break down organic materials, make nutrients available to plants. These processes reduce the need for synthetic fertilizers as nutrients are available within the soil (Anonaba *et al.,* 2026). Soil health is central to achieving long-term agricultural sustainability. Healthier soils reduce the risk of crop failure by ensuring resilience. They also help stabilise and increase production as soil fertility and structure enable consistent growth. Finally, they reduce the reliance on chemical inputs. Altogether, this means that healthy soil can support longer-term food security and farmers' livelihoods (Ananoba *et al.,* 2026). The degradation of soils due to unsustainable management practices presents significant challenges to global agriculture and environmental protection (Terribile *et al.,* 2024).

Groundnut is an important food crop, ensuring food and nutritional security for many populations in the sub-Saharan region of the world. Groundnut promotes soil sustainability through nitrogen fixation, reducing synthetic fertilizer needs, and acting as an ideal rotation crop to improve soil health (Ikeh *et al.,* 2026). Groundnuts improve soil structure and fertility, though they require crop rotation to prevent soilborne diseases. Sustainable soil management includes using organic matter and maintaining calcium levels for pod development. Groundnut grows on soils rich in macronutrients (N, P, K, Ca, S, Mg) and micronutrients (Fe, Mn, Zn, Cu, B, Mo) and with a well-defined pH (Rajitha *et al*., 2018; Anonaba *et al.,* 2026). Phosphorus supplementation increases groundnut yield (Kamara *et al*., 2011), while potassium deficiency in the soil leads to an inability to use nitrogen and water and increased susceptibility to diseases. Soil condition has a strong influence on groundnut seed yield (Kamara *et al*., 2011). Soil texture affects soil fertility and how air and water move through the soil.

The cardinal significance of this study lies in its potential to enhance groundnut productivity in southeastern Nigeria, which is characterized by Ultisol soils typically associated with poor fertility and high acidity. The study investigates various organic amendments such as poultry manure, cassava peel waste, cow dung, and compost manure, all of which are readily available in southeastern Nigeria for improving soil fertility. *The novelty of this study lies in demonstrating the potential of cow dung, cassava peel waste, and poultry manure as sustainable amendments for enhancing groundnut productivity in Ultisols.*

2. Material and Method

2.1 Description of the Study Area

The experiment was carried out at the Teaching and Research Farm of the University of Agriculture and Environmental Sciences (UAES), Umuagwo, Imo State, Nigeria. Umuagwo is located at latitudes 5°18 21– 5°30 58 N and longitudes 6°56 44 6°94 56 E. The area belongs to the low-lying part of southeastern Nigeria, and soils are derived from Coastal Plain Sands and shale. Rainforest vegetation is dominant in the area, which has a humid tropical climate. Total mean annual rainfall is between 1800 and 2500 mm, and is bimodal, with long (March- July) and short (September–November) rainy seasons. The annual temperature ranges from 26 to 30 °C. The land in the inland valley of the Otamiri stream had reliable available water from the stream or groundwater, which maintained the soil moisture content of the experimental site.

2.2 Experimental treatments, Design and Layout

In this study, different organic soil amendments were sourced and prepared to ensure nutrient stability and safe application. The treatments included poultry manure (PM), cassava peel waste (CP), cow dung (CD), compost manure (CM), and a control (no soil amendment, C). Poultry manure was obtained from the UAES poultry farms and subsequently composted to minimize pathogens and reduce ammonia toxicity. Cassava peel waste, a by-product of cassava processing, was either sun-dried or composted before use to enhance its suitability as an amendment. Cow dung was collected from the Obinze cattle market in Owerri and composted to stabilize its nutrient content and improve its agronomic value. Compost manure was produced by mixing organic residues, including crop waste, kitchen scraps, and animal manure, and allowing them to decompose under controlled conditions until a stable, humus-rich material was formed. These treatments, along with a control (no amendment), were applied to evaluate their effects on soil fertility and crop performance. The experiment was laid out in a randomized complete block design (RCBD). The treatments were replicated three times. The experiment occupied a land area of 40 m × 24 m (960 m^2). Each plot size was 5 m × 5 m (25 m^2) with a space of 1.5 m between each plot and 2 m between.

2.3 Soil Sampling and Analysis

Composite soil samples were collected with the aid of a soil auger, before planting and at harvest, at two soil depths: 0-15 cm and 15-30 cm. The soil samples were collected in polythene bags, labeled, air-dried, crushed, and sieved through a 2.0 mm-mesh for physico-chemical analysis. Soil pH was determined in water 1:2 (soil: water ratio) using a pH meter with a glass electrode (Bates, 1954). Total nitrogen in the soil was determined by micro-Kjeldahl digestion and the distillation method (Ibia & Udo, 2009). Organic matter content of the soil was determined by the dichromate wet oxidation method of Walkley and Black (1934). Available P in the soil was determined by the Bray-1 method (Bray & Kurtz, 1945). Exchangeable cations were extracted with neutral NH4OAc. Calcium and magnesium were determined in the extract by EDTA titration (Jackson, 1962), while potassium and sodium were determined using a flame photometer.

2.4 Agronomic Practices

The following agronomic practices were carried out:

i) Land preparation: The experimental site was manually prepared by slashing, raking, and marking out with measuring tapes, rope, and pegs. Ridges measuring 5m x 5m were made with spades and native cultivating hoes, which are predominantly used in the farming systems of southeastern Nigeria.

ii) Planting: The planting was done in the second week of March during both cropping years. The groundnut seeds, sourced from the National Seed Service of Nigeria, were planted on the crests of the ridges. A total of three (3) seeds from the popular variety, SAMNUT 22, were planted at a spacing of 30 cm x 60 cm and later thinned down to two seeds at two weeks after planting (WAP).

iii) Fertilizer Application: Organic soil amendments were incorporated into the soil during land preparation on a treatment basis. Each treatment received an application rate of 7.5 t/ha of the respective organic soil amendment.

iv) Weeding: Manual weeding was carried out using a native weeding hoe at 3 and 9WAP.

v) Harvesting: The groundnuts were harvested at 13 WAP; the groundnuts were pulled from the soil carefully to avoid damage. After pulling, the plants were shaken gently to remove excess soil.

2.5 Data Collection and Analysis

i) The number of pods per plant was determined by counting the total number of pods attached to each stand.

ii) The number of seeds per pod was obtained by counting the number of seeds in each pod.

iii) Weight of 100 seeds: After dehulling, 1000 seeds were counted and weighed with the aid of an electronic weighing balance. All the 1000 seeds were weighed according to the treatment.

iv) Seed yield (kg/ha) will be determined with a top load weighing balance. The weight in kilograms was converted to tonnes per hectare.

All the growth and yield data collected were subjected to analysis of variance (ANOVA). Means that differed significantly were separated with the least significant difference (LSD) at 5% probability level.

3. Results

3.1 Soil Chemical Properties

The soil pH, as influenced by soil amendments, is presented in Table 1. The initial soil pH was 5.40. At harvest, the soil pH varied significantly according to the different soil amendments. The poultry manure (PM) treatment greatly improved the soil pH to 6.40, with a percentage increase of 18.50%. The cow dung treatment also improved soil pH, reaching 6.30. The control treatment had soil pH values of 5.50, with only a slight increase of 1.85%.

The results of the organic matter content in the experimental soils, both before and after treatment, are presented in Table 1. There was a notable improvement in the organic matter content of the soils that received fertilizers. Among the treatments, the application of poultry manure (PM) yielded the highest organic matter content at harvest, measuring 2.76% compared to the initial organic matter content of 1.77%. The increase in organic matter concentration recorded with PM treatment resulted in a 56% rise from the initial soil organic matter content to the point of harvesting. The control treatment, which involved no soil amendment, had the least organic matter content during both seasons.

The total nitrogen results recorded before and at harvest are presented in Table 1. The initial total nitrogen levels measured in the experimental soil were 0.09%. The findings indicated a significant increase in total nitrogen when comparing the results obtained from different soil amendments. This treatment demonstrated a percent increase in nitrogen 77%. The poultry manure (PM) recorded total nitrogen levels of 0.146%. The cow dung treatment had total nitrogen contents of 0.113%, with a percentage increase of 26%. The control treatment, which exhibited the least total nitrogen concentration at harvest, was 0.093%, with a percentage increase of 3%.

Table 1. Soil Chemical status of the experimental site before and after planting.

Soil Amendments	Soil pH			Organic matter (%)			Total N (%)		
	Initial	After	Changes at harvest	Initial	After	Changes at harvest	Initial	Initial	Changes at harvest
Cow dung	5.40	6.30^{a}	16.67%	1.77	2.41a	36%	0.09	0.113	26%
Poultry manure	5.40	6.40^{a}	18.50%	1.77	2.76a	56%	0.09	0.146	62%
Cassava peel	5.40	6.00^{ab}	11.11%	1.77	2.31a	31%	0.09	0.102	13%
Compost	5.40	5.70^{b}	5.56%	1.77	2.12b	20%	0.09	0.100	11%
Control	5.40	5.50^{b}	1.85%	1.77	1.78c	1%	0.09	0.093	3%
LSD (p<0.05)		*0.50*			*0.69*			*0.06*	

Note: Values in the same column followed by different letters are significantly different at P < 0.05 according to LSD for separation of means.

3.2 Exchangeable calcium, potassium, and available phosphorus of the experimental soil before and after planting

The exchangeable calcium content is summarized in Table 2. The results indicated significant variations in calcium levels associated with different soil amendments at harvest. The PM treatment exhibited substantial calcium content, recording 3.636mg/kg in 2024 and 3.66 mg/kg in 2025, compared to the initial calcium levels of 2.18 mg/kg and 2.20 mg/kg in both cropping seasons. The recorded calcium increases amounted to a 68% increase at harvest. The CD treatment showed calcium concentrations of 3.60 mg/kg at harvest, against initial levels of 2.20 mg/kg, reflecting percentage increases of 63%.

The results for potassium (K) at harvest varied based on the different treatments applied (Table 2), among all soil amendments. The treatment with poultry manure (PM) resulted in a K content of 1.21 mg/kg at harvest, with a 36% increase in K level at harvest. The control treatment recorded the lowest K concentrations at harvest, at 0.72 mg/kg.

The available phosphorus (P) content recorded before planting was 34.11 mg/kg. At harvest, the PM treatment resulted in P values of 47.33 mg/kg, with a consistent percentage increase of 39%. The CD treatment recorded P values of 45.12 mg/kg at harvest. The lowest available P content at harvest was recorded in the control treatment, with values of 31.12 mg/kg.

Table 2. Exchangeable calcium, potassium, and available phosphorus of the experimental soil before and after planting.

Soil Amendments	Ca			K			Available P		
	Initial	After	Changes at harvest	Initial	After	Changes at harvest	Initial	Initial	Change at harvest
Cow dung	2.20	3.60^{a}	63%	0.89	1.16^{b}	30%	34.11	45.12^{al}	32%
Poultry manure	2.20	3.66^{a}	68%	0.89	1.21^{a}	36%	34.11	47.33^{a}	39%
Cassava peel	2.20	2.86^{a}	30%	0.89	0.99^{b}	11%	34.11	38.93^{b}	14%
Compost	2.20	2.55^{bc}	16%	0.89	0.96^{b}	9%	34.11	37.18^{b}	9%
Control	2.20	1.91c	-13%	0.89	0.72^{b}	-19%	34.11	31.12^{c}	-9%
LSD ($p<0.05$)	-	*0.87*			*0.63*			*4.01*	

Note: Values in the same column followed by different letters are significantly different at P < 0.05 according to LSD for separation of means.

3.2 Number of Groundnut Leaves per Plant and Plant Height(cm) Influenced by Soil Amendments

The number of groundnut leaves per plant as influenced by organic soil amendments is presented in Figure 1. The results varied significantly at 3, 6, and 9 weeks after planting (WAP), with the treatment of PM having the highest number of leaves per plant: 15.77, 67.51, and 83.67 at 3, 6, and 9 WAP, respectively. This was followed by 10.33, 39.78, and 57.18, respectively, recorded in the cow dung treatment. The least number of leaves per plant, 8.01, 19.12, and 26.71, respectively, was recorded in the control treatment.

Plant height(cm) influenced by soil amendments is shown in Figure 1. The results varied significantly. The PM treatment had significantly taller plants: 29.90, 51.13, and 51.62 cm at 3, 6, and 9 WAP. Cow dung treatment had 37.66 cm plant height at 9 WAP, while the shortest plant at 9 WAP, 28.33 cm, was recorded in the control treatment.

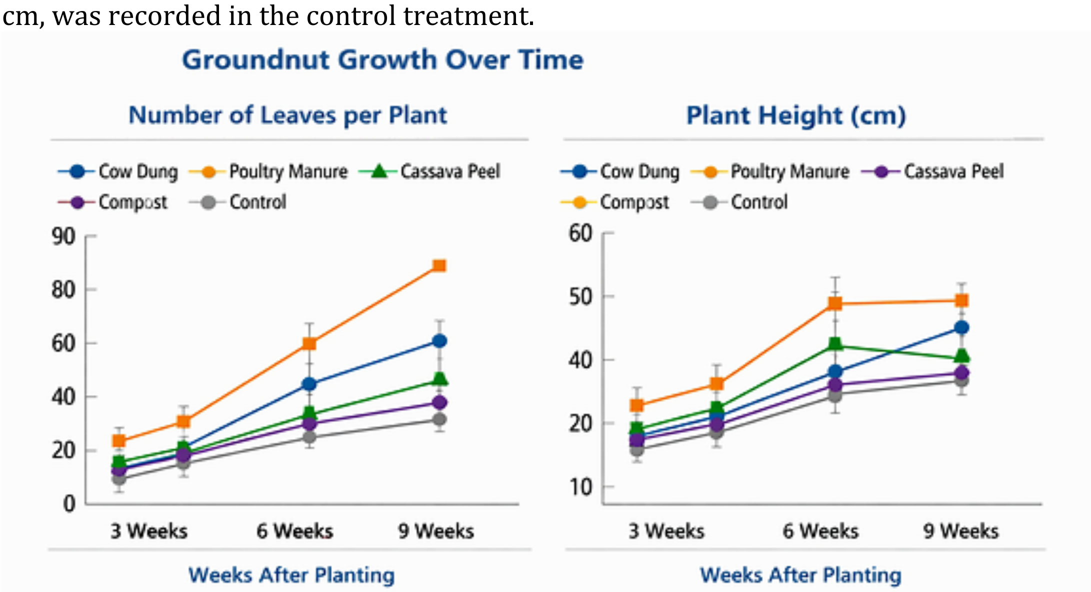

Figure 1. Number of Groundnut Leaves per Plant and Plant Height(cm) Influenced by Soil Amendments

3.3 Yield and Yield Components of Groundnut as Influenced by Soil Amendments

The number of pods per plant, as influenced by soil amendment, varied significantly among the soil amendments (Table 3). The treatment of CD produced a significantly higher number of pods per plant: 78.01. This was followed by 68.91 pods per plant recorded in the treatment of CP. The least number of pods per plant, 32.43, was recorded in the control (no soil amendment) treatment. The result showed that the treatment of CD produced the highest number of pods per plant with a percentage difference of 12-58 %.

The number of seeds per pod as influenced by soil amendments is shown in Table 3. The result of the number of seeds per pod showed no statistically significant difference when compared to all the treatments. The number of seeds per pod ranged from 2.22 in the control to 2.70 in the treatment of CD. The weight of 100 seeds of groundnut as influenced by soil amendments differed significantly in both cropping seasons (Table 3). The treatment of CD had the heaviest weight of 66.52 g. The treatment of CP had 65.50 g seed weight while 65.41 g was recorded in the CM treatment. The treatment of PM had 100 seed weight of 65.33 g. The least weight of 100 seeds, 56.01 g, was recorded in the control treatment.

The number of root nodules per plant as influenced by soil amendments is presented in Table 3. The results differed significantly among the treatments. The treatment of CP had significantly higher numbers of root nodules, 60.33 and 59.91, followed by CM and CD. The least number of root nodules per plant, 23.68, was recorded in the control treatment. Haulm weight as influenced by soil amendments differed significantly in both cropping seasons (Table 3). The treatment of NPK produced a significant haulm weight of 3936.60 kg/ha. The least haulm weight of 1574.83 kg/ha was recorded in the control (no soil amendment) treatment.

The effect of soil amendments on groundnut seed yield is shown in Table 3. The result showed that all the soil amendments resulted in an increase in groundnut seed yield in both cropping seasons. The treatment of CD produced significantly higher yields of 2672.51 kg/ha. This was followed by 2487.45 kg/ha recorded in the treatment of CP. The treatment of PM produced a seed yield of 2163.77 kg/ha. The least seed yield, 1574.83 kg/ha, was recorded in the control treatment. The result showed that CD produced 7-41 % more seed yield in both cropping seasons compared to the other treatments.

Table 3. Yield and yield components of groundnut as influenced by soil amendments.

Soil Amendments	Number of Pods per plant	Number of Seeds per pod	Weight of 100 Seeds (g)	Number of Root Nodules per plant	Haulm Weight (kg/ha)	Seed Yield (kg/ha)
Cow dung	78.01^{a}	2.51^{a}	66.52^{a}	45.33^{c}	3213.44^{d}	2672.51a
Poultry manure	62.30^{c}	2.11^{a}	65.33^{a}	48.62^{c}	3818.71^{a}	2163.77d
Cassava peel	68.91^{b}	2.70^{a}	65.50^{a}	60.33^{a}	3572.62^{b}	2487.45b
Compost	51.03^{d}	2.23^{a}	65.41^{a}	59.91^{b}	3273.03^{c}	2279.33c
Control	32.43^{e}	2.22^{a}	53.01^{b}	23.68^{d}	1216.18^{e}	1574.83e
LSD (p<0.05)	*3.21*	*NS*	*1.12*	*3.99*	*20.15*	*17.66*

Note: Values in the same column followed by different letters are significantly different at P < 0.05 according to LSD for separation of means.

4. Discussion

The chemical analysis of the experimental soil conducted before and after planting revealed that the soil was strongly acidic, with nutrient concentrations below the critical thresholds recommended by Ndaeyo *et al.* (2013). Such conditions underscore the necessity of soil amendments to enhance fertility and sustain crop production. Notably, the available phosphorus (P) level was relatively high before planting. This elevated P content is consistent with the characteristic properties of Ultisols in southeastern Nigeria, as documented by Akata *et al.* (2025). While phosphorus abundance may appear advantageous, the overall nutrient imbalance, particularly deficiencies in other essential minerals, highlights the importance of integrated soil management practices to optimize crop growth and productivity.

The soil analysis conducted at harvest revealed that plots treated with organic amendments exhibited improved soil pH. The application of organic amendments significantly reduced soil acidity, thereby creating a more favorable environment for groundnut growth. This increase in soil pH demonstrates the liming effect of organic materials, a phenomenon widely reported in the literature. For instance, Ikeh *et al.* (2025) noted that organic amendments effectively mitigate soil acidity, while Guo *et al.* (2025) and Lee *et al.* (2025) emphasized that the processing of fertilizers directly influences their physicochemical properties, which in turn govern nutrient release dynamics and soil behavior. These findings collectively highlight the dual role of organic amendments in both ameliorating soil acidity and enhancing nutrient availability, thereby supporting sustainable crop production.

The results indicated a significant enhancement in organic matter content when organic soil amendments were applied. The organic amendments showed a markedly higher percentage increase in organic matter at the time of harvest. This finding aligns with the studies conducted by Sedlář *et al.* (2023) and Ikeh *et al.* (2025), which highlight that the application of organic fertilizers contributes positively to the organic matter content of soils. Specifically, Sedlář *et al.* (2023) noted that the addition of organic manures not only boosts soil organic matter content but also improves various soil properties, including water holding capacity, porosity, infiltration capacity, hydraulic conductivity, and water-stable aggregation, while simultaneously reducing bulk density and surface crusting. Rahmat *et al.* (2026) reported that application of biochar as an organic soil amendment displayed properties suitable for enhancing acidic soils, improving nutrient retention, contributing to long-term carbon sequestration, increasing porosity, enhancing nutrient availability, alkaline pH, and structural stability.

Despite the high nutrient content of poultry manure, the yield obtained from cow dung was significant. The observation agrees with the report of Singh *et al.* (2025) that Important reasons for the low average yield of groundnut are improper or excessive agronomic practices and application of fertilizers. The result of the study showed a significant increase in the percent of N, P, K, Ca, and Mg in all the soils treated with organic fertilizers. This observation was consistent with the report of Singh *et al.* (2025) that the application of organic manure helps in mitigating multiple nutrient deficiencies and, at the same time, provides a better environment for growth and development by improving the physical, chemical, and biological properties of soil.

In comparing the application of conventional and non-conventional fertilizers, Ikeh *et al.* (2023) and Sampson *et al.* (2025) reported that organic manures are a relatively cheap source of both macronutrients and micronutrients, which also enhances soil porosity and microbial activity in the soil. Patel *et al.* (2022) reported that the use of organic sources such as vermicompost is generally helpful for improving soil aggregation, structure, and fertility, improving the moisture-holding capacity, and increasing crop yield.

The results showed significant variations in the yield and yield components of groundnut under different treatments, with the control treatment producing the lowest yield parameters. The higher haulm yield recorded in the PM treatment and the other soil amendments could be due to the better yield performance by increasing activities of N-fixing bacteria and an increased rate of humification (Singh *et al.* 2025). Humic acid present in organic fertilizers may enhance the availability of added micronutrients in soil, thus improving yield attributes.

The treatment of CD produced significant seed yield; the higher seed yield recorded in CD and other soil amendments might be due to an adequate supply of nutrients at an optimal level required by groundnut through organic soil amendments, which enhanced biological nitrogen fixation, which might facilitate better root proliferation and increase the seed yield (Santosh *et al.*, 2021). The low seed yield observed in PM compared to CD and CP treatments could be attributed to the higher N level recorded in PM, which resulted in luxuriant growth and production of more vegetative traits, which translated to significantly higher haulm weight as it was recorded in the study. Gao *et al.* (2025) similarly reported that excessive vegetative growth negatively affects seed production, as resource allocation shifts away from pod development and seed filling, ultimately compromising seed quality. These findings emphasize the importance of balanced nutrient management to ensure adequate assimilate partitioning for optimal seed development and yield.

Despite the high N content recorded in organic soil amendment, available phosphorus could also be a factor in the high groundnut yield. Agha *et al.* (2025) reported that phosphorus is crucial for legumes as it supports energy transfer (ATP), seed development, biomass production, nodule formation, and grain yield.

The increase in growth and yield parameters of groundnut observed in this study could be attributed to the nutrient content of the organic soil amendments, which were translocated within the plant to support higher dry matter accumulation. This accumulation translated into a stronger carbon sink, enabling the plant to store and utilize assimilates more efficiently. The enhanced nutrient availability stimulated greater cell division and expansion, thereby improving vegetative growth and reproductive development. These observations agree with the report by Anonaba *et al.* (2026) that the application of organic and inorganic fertilizers enhanced tiger nut yield in Rivers State, a high-humid zone of southern Nigeria.

Physiologically, nutrients such as nitrogen, phosphorus, and potassium play critical roles in photosynthesis, energy transfer, and assimilate translocation. Adequate nitrogen promotes chlorophyll synthesis and delays leaf senescence, thereby ensuring sustained photosynthetic activity and a continuous supply of assimilates for pod filling. Phosphorus enhances root development and energy metabolism, thereby improving nutrient uptake and reproductive success. Potassium regulates stomatal function and carbohydrate movement from source leaves to developing pods, resulting in better seed filling and higher seed weight. Micronutrients such as zinc, boron, and iron further influence enzyme activity, pollen viability, and seed development, which are essential for reproductive efficiency. The early report of Ikeh *et al.* (2026) on groundnut yield in southeastern Nigeria indicated that organic soil amendments, which contained both micro and micronutrients, improved the soil conditions and enhanced groundnut yield compared to the yield obtained from the control treatment.

5. Conclusion

This study showed that organic soil amendments, particularly cow dung, cassava peels, and poultry manure, enhance soil fertility by increasing organic matter, nitrogen content, and pH of the experimental soil. These improvements translated into higher groundnut yields, with cow dung proving most effective in Ultisols. The findings suggest that adopting cow dung as a soil amendment can help farmers in southeastern Nigeria achieve better yields while promoting sustainable soil management and food security.

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