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Effects of Organic Manure and NPK Fertilizer Application on Selected Soil Properties, Growth and Yield of Cucumber (Cucumis sativus L.) in Obio Akpa, Akwa Ibom State, Nigeria

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Abstract: A bag experiment was conducted in AKSU Research Farm in the early planting season of 2024 to evaluate the effects of Organic manure and NPK fertilizer application on selected soil properties, growth and yield of Cucumber (Cucumissativus L) in Obio Akpa. The treatments were T_1 Control, T_2 Goat manure, T_3 Pig manure, T_4 Poultry manure and T_5 NPK fertilizer (12:12:17). The bags were arranged in a Complete Randomized (CRD) block design in three replications. The bags were filled with 10kg of soils and Cucumber seeds were planted at 2-3cm depth. The organic manures and NPK fertilizer were applied at two weeks before planting of seeds. Initial and post-harvest soil samples were collected acrossed the treatments, processed and analyzed for selected soil properties, Cucumber growth and yield data were sampled and analyzed at 2, 4, 6, 8 and 10 weeks respectively. The results showed that application of organic manures and NPK fertilizer had significant effects on Cucumber vine length, numbers of leaves per plant, leaf area, fruit length and weight at different stages of growth. When compared with control, poultry and pig manures had significant effects on Cucumber growth and yield parameters generally. The results showed that organic manures, especially poultry manure, significantly improved soil pH, organic matter, and effective cation exchange capacity, resulting in better plant growth and higher yields. Poultry manure-treated soils had the highest organic matter content (2.31%) and produced the longest mean vines (138.8 cm) and heaviest fruits (228 g). NPK fertilizer also enhanced early vegetative growth but had a lesser impact on long-term soil properties due to nutrient leaching. Control plots exhibited poor growth and yield, highlighting the importance of fertilizer application. The treatments were significant at $p<0.05$ level. The correlation results showed that organic matter correlated significantly positive with total exchangeable bases (TEB), r=0.910*, Effective cation exchange capacity (ECEC), r= 0.978**, Cucumber vine length, r= 0.935*, Number of leaves/plant r= 0.912*, Fruit weight, r=0.932*, Fruit length, r= 0.902* and fruit circumference, r= 0.970*. Therefore, the application of organic manure especially Poultry manure was recommended for the improvement of Soil's fertility, and Cucumber production.

Keywords: Organic manures, Soil Fertility, Nutrient Availability, Soil structure, Cucumber yield.

1. Introduction

Soil fertility is a key factor influencing agricultural productivity, particularly in tropical regions like Obio Akpa, Akwa Ibom State, Nigeria. Soils in this region are often characterized by low nutrient content and poor organic matter, which can lead to suboptimal crop growth and yield Ibia *et al.*,

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2012). To address these challenges, the use of organic manures and inorganic fertilizers such as NPK (Nitrogen, Phosphorus, and Potassium) has been widely adopted. Organic manure, derived from plant and animal residues, is known to improve soil structure, increase microbial activity, and enhance nutrient availability (Umoh et al., 2022). Many researchers have been reported that applications of rabbit Urine Banana peels, eggshell and goat manure in soils significantly increased soil nutrient levels and improved the yield of pepper, and cocoyam production, in acidic soil (Ekwere *et al.,* 2023), Udounang *et al.,* 2025; Effiong *et al.,*2025. On the other hand, NPK fertilizer is a popular inorganic fertilizer that provides essential nutrients in readily available forms, promoting vigorous plant growth and high yields of crops (Udoh *et al*., 2001). The application of organic manure and NPK fertilizer has been reported to have significant effects on soil properties and crop performance. In recent years' studies has shown that organic manure enhances soil organic matter, improves water retention, and promotes the slow release of nutrients, which can complement the immediate nutrient availability provided by NPK fertilizers. Udoh *et al*., (2021) also reported higher yield of cocoyam with the application of poultry and NPK fertilizers. Yield parameters recorded higher values with treatments of poultry manure. Umoh et al., 2023. Cucumber (*Cucumissativus* L.), a widely cultivated vegetable crop, is of significant economic importance in many regions, including Nigeria. The demand for cucumber is driven by its nutritional values, including its high-water content, vitamins, and minerals, which are essential for human health. Since there is a limited information as regard the development of sustainable agricultural practices that optimize crop production and soil health in the region the research therefore aims to evaluate the effects of organic manure and NPK fertilizer on soil properties, growth, and yield of cucumber plants in Obio Akpa, Akwa Ibom State, Nigeria.

1. Materials and Method

Study Area

The experiment was carried out in 2024 early planting season at the, Akwa Ibom State University Research Farm, in Oruk Anam Local Government Area of Akwa Ibom State. The geographical coordinates of the study site is 4°47' N and 7°45' E. The area is characterized with a bimodal rainfall pattern that peaks in July and September, and a short dry season between December and February. The mean annual rainfall ranges from 2000 to 3000 mm, with temperatures averaging between 26°C and 32°C. The soil of the area is classified as an ultisol, low fertility and high acidity. The vegetation of the area is secondary forest with a predominance of grasses, shrubs and trees.

2.1 Soil Samples Collection and preparation

Bulk soil samples were collected from AKSU Teaching and Research Farm Obio Akpa at the depth of 0-20cm. Soil Samples were air-dried, crushed, sieved with 2mm mesh to determined the physical and chemical properties. Part of the soil were used for bag experiments. The manures source of pig, goat, poultry were collected from the AKSU research farm and curel under shade for five weeks, sieved and use for the experiment.

2.2 Laboratory Analysis

2.3 Experimental Design and Treatments

The experiment followed a Randomized Complete Randomize Design (CRD) with three replications. The treatments used were organic manures (goat, and poultry manures) and NPK fertilizer (12:12:17) at different rate a total of 15 bags were obtained. The bags were perforated for water drainage The treatments were as follows: T_1: Control (no fertilizer or manure), T_2: Goat manure (50g/10kg of soil), T_3: Pig manure (50g/10kg of soil), T_4: Poultry manure (50g/10kg of soil), T_5: NPK fertilizer (3.33g/10kg of soil), and treatment were applied at two weeks before planting. Two seeds of cucumber (Saira T_1), planted at the depth of 2-3cm, weeding was done by hand picking. The following growth and yield parameter were measure as follows; Plant height data were collected at 2, 4, 6, 8, and 10 weeks and was measured using a measuring, tape from the base of the plant (at soil level) to the tip of the highest point of the plant. The data on the number of leaves were collected at five specific intervals: 2, 4, 6, 8, and 10 weeks and was assessed by counting the fully open leaves per plant. Stem girth were measured at 2, 4, 6, 8, and 10 weeks using venniar caliper. Leaf area were collected at 2, 4, 6, 8, and 10 weeks The leaf area was measured using the correction method proposed by Montgomery (1911), which is L×W×0.75 a widely recognized and accurate approach for estimating leaf surface area. Fresh weight parameters of maize were assessed by collecting data on fresh weight, dry weight and was determined by harvesting maize plants at the specified intervals, separating different plant parts (e.g., leaves, stems, cobs), and weighing them immediately using a digital weighing scale. This measurement provided an indication of the biomass accumulated at each stage of growth. At 14 weeks, maize was harvested and the dry weight was measured accurately using digital weighing balance. Harvesting was done using matchete to cut the maize stalks, remove the ears (cobs) and separate them from the plant. Mature cobs were harvested, and the number of rows of grains on each cob was counted manually. The number of grains in a single row was counted manually by carefully inspecting the cob. This data point helps in understanding kernel setting and overall productivity. Grains were carefully removed from the cob, and their total weight was measured using a digital weighing balance. The 100-grain weight was also determined to assess grain size and quality.

Laboratory Analysis

Soil and plant samples were analyzed for specific parameters following the procedures outlined by Udo *et al.,* (2009). Soil pH was measured using a glass electrode pH meter with a 1:2.5 soil-water ratio. Total Nitrogen was determined using the Macro-Kjeldahl digestion method. These analyses were conducted to assess soil fertility, nitrogen availability, and the impacts of the applied treatments. Available Phosphorus was determined using Bray-p1 method as described in Udo *et al.,* (2009). Organic carbon was determined using Walkley Black wet oxidation method (Nelson and Sommers, 1984). The value was multiplied by 1.724 to obtain organic matter content. Exchangeable cation (Sodium, Potassium, Calcium, and Magnesium) were determined by using spectrophotometer and flame photometer the methods of Udo *et al.,* (2009).Exchange acidity was extracted with 1M KCl solution, and the acidity in the extracts was measured by titration with 0.01M NaOH as described by Udo *et al.,* (2009).Effective cation exchange capacity (ECEC) was calculated by the summation of total exchangeable cations and exchangeable acidity as outlined by Udo *et al.,* (2009) and the Percentage base saturation was determined by summation of Total exchangeable cations × 100 / ECEC as described by Udo *et al.,* (2009).

2.4 Data analysis

The data obtained from the experiment were subjected to analysis of variance (ANOVA) and mean were separated using least significant difference (LSD) at 5% level of probability according to the method described by Singh and Chardhary (1986).

3. Results and Discussion

3.1 The Initial Soil Chemical Properties of the Study Site before Planting

The results of the initial soil chemical properties of the soil before treatment application is presented in Table 3.1; Chemical characteristics of manure used for the experiment is presented in table 3.1.2 respectively. The textural classification of the soil in the study area was sandy loam, with a high proportion of sand (80.73%), silt

(10.63%), and clay (8.67%), respectively. This soil property could adversely affect crop growth due to high nutrient leaching cause by high sand content with lower clay content. Sunday et al., 2021. The pH of the soil was moderately acidic, with a value of 4.37. The EC of the soil before treatment was fairly low (0.07) ds/cm. The total nitrogen content was 0.035%. The low level of nitrogen was attributed to leaching and nitrate loss caused by excessive rainfall and erosion. (Essien *et al*., 2019). The low nitrogen status of the soil has serious implications for fertility, as crops require this nutrient in large quantities for growth and development. The organic matter content was 1.428% in the initial soil properties. This value was lower than the 10% recommended by Esu (2000) as ideal for crop production in Akwa Ibom State. This suggests that the soil lacked the ability to adequately supply essential nutrients, such as organic matter and exchangeable cations, for crop growth. The soil requires the application of organic manure to improve crop production. Available phosphorus content was 10.55 cmol/kg in the initial soil analysis. Effective cation exchangeable capacity (ECEC) was 8.63 mg/kg. Base saturation was 62.08%. this indicated low slightly low to nutrient status and similar observation were obtain by Umoh *et al.,* 2021; Ibia *et al.,* 2024) on coastal plain sand parent material.

Table 3.1: Physiochemical Properties of Soil before Treatment

Particle size analysis	Values
Sand %	80.73
Silt %	10.60
Clay %	8.67
Textural class	Sandy loam
pH 1:2.5	4.37
E/C ds/cm	0.07
Organ carbon %	0.826
Organic Matter %	1.428
T/N mg/kg	0.035
Avail P mg/kg	10.55
E/Acidity	3.28
Al^{+}Cmol/kg	0.27
CaCmol/kg	3.48
Mg Cmol/kg	1.81
K Cmol/kg	0.040
Na Cmol/kg	0.018
CEC Cmol/kg	2.71
E CEC Cmol/kg	8.63
Base Saturation%	62.0
TEB Cmol/kg	5.348
CNR %	15.88

Table 3.2: Effects of applied treatments on soil physicochemical properties

Soil Properties	Control T_1	Goat manure T_2	Pig manure T_3	Poultry Manure T_4	NPK T_5
pH 1:2.5	4.80	5.20	5.08	5.30	5.26
EC (ds/m)	0.09	0.08	0.01	0.08	0.01
OM (%)	0.22	1.86	1.59	2.31	1.45
TN (%)	0.05	0.05	0.04	0.06	0.04
Av. P (mg/kg)	25.5	30.5	71.5	86.0	33.0
Ca (cmol/kg)	1.72	3.32	3.16	3.40	3.44
Mg (cmol/kg)	1.32	2.31	2.19	2.36	2.38
Na (cmol/kg)	0.02	0.02	0.02	0.02	0.02
K (cmol/kg)	0.03	0.04	0.06	0.09	0.09
EA (cmol/kg)	3.19	3.43	3.66	4.33	3.23
ECEC (cmol/kg)	6.42	9.12	9.09	10.2	9.18
B.sat (%)	50.3	62.39	59.7	57.5	64.7
Sand (%)	80.9	77.87	77.8	77.8	77.8
Silt (%)	11.3	13.45	13.4	13.5	13.4
Clay (%)	7.76	8.68	8.69	8.70	8.69
Textural class	LS	SL	SL	SL	SL

EC = Electrical Conductivity, OM = Organic Matter, TN = Total Nitrogen, Av. P = Available Phosphorus, CA = Calcium, Mg = Magnesium, Na = Sodium, K = Potassium, EA = Exchangeable Acidity, ECEC = Effective Cation Exchange Capacity, Bsat= Base Saturation, LS = Loamy sand, SL = Sandy loam

Table 3.3 Effects of organic manure and NPK fertilizer application on vine length of cucumber

Treatment	Stages of growth				
	2 WAP	4 WAP	6 WAP	8 WAP	10 WAP
T_1 control	15.7^{a}	38.4^{a}	41.0^{a}	41.0^{a}	42.0^{a}
T_2 goat	19.0^{ab}	79.1^{b}	105.8^{b}	108.0^{b}	115.4^{b}
T_3 pig	18.0^{ab}	76.1^{b}	112.2^{b}	129.8^{c}	135.3^{c}
T_4 poultry	18.2^{ab}	74.2^{b}	122.5^{c}	135.5^{c}	138.8^{c}
T_5 NPK	17.5^{ac}	52.9^{c}	104.1^{b}	107.7^{b}	109.5^{b}
LSD ($P<0.05$)	**3.19**	**18.92**	**33.73**	**21.92**	**21.19**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRT Means without the same letter are significantly different at 5% level of significance using DMRT

3.2 Effects of applied treatments on soil physicochemical properties

Table 2 show the effects of treatment on soil properties, the result indicated that manure application in soils increased to level of pH, Om, TN, Av.P, Ca, Mg and K in soil compared to control, also indicated that sand content decrease while silt and clay content increases. Similar finding were observed by Umoh *et al.,* 2023) who observed a slight decreased in sand fraction with application of animal manure.

Table 3.4 Effects of Organic manure and NPK fertilizer application on vine girth of cucumber

Treatments	Stages of Growth				
	2 WAP	4 WAP	6 WAP	8 WAP	10 WAP
T_1 control	2.1^{a}	2.8^{a}	3.1^{a}	3.2^{a}	2.4^{a}

T_2 goat	2.7[b]	4.5[b]	4.1[b]	4.1[b]	3.4[b]
T_3 pig	2.6[b]	3.9[c]	3.7[c]	3.7[c]	3.5[b]
T_4 poultry	2.7[b]	3.8[c]	3.7[c]	3.7[c]	3.8[c]
T_5 NPK	2.5[c]	3.1[d]	3.0[a]	3.4[c]	3.4[b]
LSD (*P*<0.05)	**0.33**	**1.25**	**0.69**	**0.76**	**0.62**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRT; Means with the same letter are significantly different at 5% level of significance using DMRT

Table 3.5 Effects of organic manure and NPK fertilizer application on Number of Leaves of cucumber

Treatment	Stages of Growth				
	2 WAP	4 WAP	6 WAP	8 WAP	10 WAP
T_1 control	6.0[a]	8.3[a]	9.7[a]	5.7[a]	6.7[a]
T_2 goat	5.3[a]	14.3[b]	15.7[b]	14.0[b]	17.0[b]
T_3 pig	5.0[a]	13.7[b]	18.3[b]	16.3[c]	23.0[c]
T_4 poultry	15.3[b]	12.3[b]	23.0[c]	21.0[d]	24.0[c]
T_5 NPK	4.6[a]	10.7[c]	18.3[b]	17.7[c]	18.0[b]
LSD (*P*<0.05)	**0.33**	**1.25**	**7.47**	**4.61**	**7.51**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRT; Means with the same letter are significantly different at 5% level of significance using DMRT

3.3: Effect of Organic Manure and NPK fertilizer application on growth and yield parameter of cucumber.

Results show that poultry manure had the highest length of vine, vine girth, numbers of leaves area and was observed at ten (10) week after germination as shown in table 3.3,3.4,3.5,3.6. The results leves was not significantly different from goat, pig and NPK application but significantly higher than the control, the increased could be attributed to its nutrient rich in the manure. These findings are consistent with Hamma *et al.,* (2012), who observed increased in vegetative growth in cucumber when poultry manure was applied. Application of NPK significantly increase the number of cucumber node as show in table 3.7 but was not significantly different other from treated soils. Internode length were significantly higher in poultry manure-treated plants. By 10 WAP, poultry manure resulted in 10.6 nodes and an internode length of 9.8 cm, followed by pig manure with 9.2 nodes and an internode length of 10.3 cm. NPK-treated plants showed similar internode lengths (10.2 cm) but fewer nodes (12.7) as shown in table 3.8. Fruit weight at 8 WAP was highest in poultry manure-treated plants (228.0 g), followed by pig manure (129.0 g) and NPK (117.7 g). Goat manure and NPK treatments also performed well (112.7 g and 114.0 g, respectively). By 10 WAP, poultry manure remained superior. The positive impact of poultry manure on fruit weight and yield demonstrates its ability to improve soil fertility and enhance nutrient availability as show in table 3.11. This aligns with findings from Shehata*et al.* (2012), who noted the beneficial effects of organic fertilizers on cucumber productivity. Fruit circumference followed a similar trend. At 8 WAP, poultry manure-treated plants recorded the highest circumference (17.4 cm). By 10 WAP, poultry manure continued to outperform other treatments, emphasizing its role in enhancing fruit quality as shown in table 3.12. The enhanced fruit dimensions under organic manure treatments may be linked to better nutrient cycling and moisture retention. This is supported by findings from Muhammad et al. (2021), who observed significant improvements in cucumber fruit size with poultry manure application.

Table 3.6 Effects of organic manure and NPK fertilizer application on leaf area of cucumber

Treatment	Stages of Growth				
	2 WAP	4 WAP	6 WAP	8 WAP	10 WAP
T_1 control	81.0^a	79.4^a	80.2^a	39.1^a	27.8^a
T_2 goat	94.1^a	211.0^b	227.2^b	159.3^b	164.2^b
T_3 pig	68.1^b	217.3^b	241.9^b	130.9^c	207.3^c
T_4 poultry	85.5^a	217.9^b	230.6^b	186.6^d	217.5^c
T_5 NPK	71.2^b	148.8^c	184.9^c	173.5^b	159.6^b
LSD (*P* 0.05)	**43.44**	**59.58**	**86.97**	**33.89**	**41.22**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRTMeans with the same letter are significantly different at 5% level of significance using DMRT

Table 3.7 Effects of organic manure and NPK fertilizer application on number of node of cucumber

Treatment	Stages of Growth				
	2 WAP	4 WAP	6 WAP	8 WAP	10 WAP
T_1 control	2.0^a	5.5^a	6.0^a	3.1^a	3.3^a
T_2 goat	5.3^b	11.2^b	12.0^b	9.2^c	9.6^b
T_3 pig	5.6^b	10.0^b	10.3^b	6.8^b	9.2^b
T_4 poultry	4.8^b	10.5^b	10.5^b	9.7^c	10.6^b
T_5 NPK	5.1^b	7.4^c	11.2^b	11.6^c	12.7^b
LSD (*P*<0.05)	**0.51**	**2.32**	**2.07**	**2.32**	**3.16**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRTMeans with the same letter are significantly different at 5% level of significance using DMRT

Table 3.8 Effects of organic manure and NPK fertilizer application on Internode length of cucumber

Treatment	Stages of Growth				
	2 WAP	4 WAP	6 WAP	8 WAP	10 WAP
T_1 control	1.9^a	4.5^a	5.9^a	4.5^a	4.8^a
T_2 goat	4.6^b	8.3^b	10.6^b	9.3^b	10.2^b
T_3 pig	5.0^b	8.4^b	10.4^b	8.3^c	10.3^b
T_4 poultry	5.0^b	7.3^c	10.8^b	9.7^b	9.8^b
T_5 NPK	4.8^b	7.1^c	9.0^c	9.0^b	10.2^b
LSD (*P*<0.05)	**0.40**	**3.31**	**0.63**	**1.31**	**1.72**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRTMeans with the same letter are significantly different at 5% level of significance using DMRT

Table 3.9 Effects of organic manure and NPK fertilizer application on Tendril length of cucumber

Treatment	Stages of Growth			
	4 WAP	6 WAP	8 WAP	10 WAP
T_1 control	14.4^a	17.1^a	16.3^a	16.7^a
T_2 goat	28.0^b	30.4^b	22.7^b	23.3^b
T_3 pig	26.2^b	27.5^c	21.7^b	26.8^c
T_4 poultry	26.6^b	29.1^b	27.5^c	24.3^b

T5 NPK	24.3c	26.1c	22.8b	21.3d
LSD (*P*<0.05)	**7.59**	**3.77**	**6.79**	**1.23**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRT
Means with the same letter are significantly different at 5% level of significance using DMRT

Table 3.10 Effects of organic manure and NPK fertilizer application on fruit length of cucumber(cm)

Treatment	Stages of Yield		
	6 WAP	8 WAP	10 WAP
T1 control	5.9a	6.5a	6.8a
T2 goat	8.8b	12.2b	9.2b
T3 pig	13.6c	15.4c	10.0b
T4 poultry	17.3d	16.5d	13.4c
T5 NPK	15.5d	13.8c	14.5c
LSD (*P*<0.05)	**4.21**	**2.65**	**8.92**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRT
Means with the same letter are significantly different at 5% level of significance using DMRT

Table 3.11 Effects of organic manure and NPK fertilizer application on Fruit weight of cucumber(g)

Treatment	Stages of Yield		
	6 WAP	8 WAP	10 WAP
T1 control	9.0a	17.3a	7.0a
T2 goat	75.0b	112.7b	42.7b
T3 pig	81.0b	129.0c	89.7c
T4 poultry	166.7c	228.0d	87.0c
T5 NPK	160.3c	117.7b	114.0c
LSD (*P*<0.05)	**166.63**	**86.45**	**46.69**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRT Means with the same letter are significantly different at 5% level of significance using DMRT

Table 3.12 Effects of organic manure and NPK fertilizer application on fruit circumference of cucumber

Treatment	Stages of Yield		
	6 WAP	8 WAP	10 WAP
T1 control	8.2a	10.7a	7.5a
T2 goat	10.8b	15.0b	12.8b
T3 pig	14.0c	13.7b	14.4c
T4 poultry	13.6c	17.4c	12.9b
T5 NPK	14.1c	14.0b	13.7c
LSD (*P*<0.05)	**3.21**	**5.24**	**2.99**

Means followed by the same letter in the treatment group are not significantly different at 5% level of significance using DMRT
Means with the same letter are significantly different at 5% level of significance using DMRT

3.4 Correlation Analysis showing the relationship of some selected soil properties, growth and yield parameters of Cucumber

The correlation analysis of this study highlights the significant interactions between soil physicochemical properties when organic manure and NPK fertilizer are applied. These results are consistent with previous findings by Ojeniyi *et al.* (2012), who noted that organic amendments enhance soil properties in tropical soils. This means that organic manure improves the soil's ability to retain and exchange nutrients, which makes it more fertile. Akpan-Idiok *et al.* (2012) also found that organic materials increase soil fertility by improving nutrient availability. A significant negative relationship exists between soil pH and Total Exchangeable Bases (r = -0.890*) and Effective Cation Exchange Capacity (r= -0.834). This indicates that lower pH (increased acidity) reduces the availability of essential nutrients like calcium and magnesium, which make up TEB, and affects soil's ability to retain nutrients indicated by ECEC. This aligns with findings in acidic soils where excessive fertilizer use leads to nutrient leaching and imbalances. This suggests that acidic conditions reduce the availability of exchangeable bases and the soil's buffering capacity, supporting findings from Brady and Weil (2017). pH also shows negative relationship with Vine Length (r = -0.908*), Number of leaves (r = -0.775), Fruit Length (r= -0.856) this implies that high acidity interferes with nutrient uptake (e.g., nitrogen and phosphorus), stunting plant growth and reducing yields.

Organic matter shows strong positive relationship with TEB (r =0.910*) Indicating improved nutrient availability with increased organic matter and (ECEC, r= 0.978**) which Suggests enhanced soil fertility with higher organic matter. However, the non-significant correlation between OM and total nitrogen (TN) suggests that nitrogen availability may depend more on fertilizer application than solely on organic matter inputs, as noted by Ayeni (2011).Organic matter also shows strong positive correlations with growth and yield parameters: VL (Vine Length, r= 0.935*), NL (Number of Leaves, r= 0.912*), FW (Fruit Weight, r= 0.932*), FL (Fruit Length, r= 0.902*), FC (Fruit Circumference, r= 0.970*) this indicates that Organic matter is critical for cucumber productivity. It enhances soil fertility, water retention, and microbial activity, leading to better growth and higher yields. Total Exchangeable Bases (TEB) shows Positive Relationships with (ECEC, r= 0.956*) and Base saturation (B. Sat, r= 0.883*) TEB contributes to overall soil nutrient exchange capacity. Vine Length (VL, r= 0.912 *). Adequate TEB ensures plants have access to critical macronutrients, promoting growth. Number of leaves (NL, r= 0.924*) and Fruit Length (FL, r= 0.894*). The availability of bases like calcium and potassium supports robust growth and fruiting.

Effective Cation Exchange Capacity (ECEC) shows Strong Positive Correlations with Number of Leaves (NL, r= 0.974**), Fruit Length (FL, r= 0.955*) and fruit circumference (FC, r= 0.942*). Higher ECEC implies better nutrient retention, especially of ammonium, calcium, and potassium, critical for growth and fruit production Vine Length (VL, r= 0.963**) which Indicates nutrient availability due to high ECEC enhances vine development and reflects the soil's ability to hold and supply cations, directly influencing plant nutrient uptake. Available Phosphorus (Av. P) shows moderate positive relationship with growth parameters:

Vine Length (VL, r= 0.748), Fruit Length (FL, r= 0.785) this indicates that Phosphorus supports root development and energy transfer within plants, leading to enhanced growth and productivity. Total Nitrogen (TN) shows Available Phosphorus (Av. P) shows Weak and inconsistent correlations: It shows Positive with FW (r= 0.293) and FL (r= 0.326) and Negative with VL (r= -0.096) and FL (r= -0.095).This implies that Total nitrogen availability alone may not have a significant direct effect on cucumber growth. Other factors might mediate its impact consistent with findings by Suleiman *et al.,* (2020). Base saturation (Bsat) shows positive relationship with Total Exchangeable Bases (r= 0.883*) and Number of Leaves (r= 0.669), This indicates that high base saturation enhances soil fertility and plant nutrient uptake efficiency.

Organic matter (r= 0.935*), TEB (r= 0.912*), and ECEC (r= 0.963**) were strongly linked to longer vine growth. This shows that improving soil fertility allows cucumber plants to grow more vigorously. Daudaet al. (2008) similarly observed better vine development in nutrient-rich soils. The number of leaves was also strongly influenced by OM (r= 0.912*), TEB (r= 0.924*), and ECEC (r= 0.974**). This suggests that applying both organic and inorganic fertilizers promotes better leaf production, which is important for photosynthesis and plant growth. OM (r= 0.932*), TEB (r= 0.799), and ECEC (r= 0.938*) were positively related to the fresh weight of cucumber fruits. This shows that improved soil fertility directly increases the yield of cucumber fruits. Adekiya*et al*. (2019) also reported similar results, where fertilizer application boosted fruit yield. OM (r= 0.902*), TEB (r= 0.894*), and ECEC (r= 0.955*) had strong positive correlations with fruit length, meaning that proper nutrient management helps cucumbers grow longer, which is important for market value. OM (r= 0.970**) and ECEC (r= 0.942*) were significantly linked to larger fruit circumference, meaning fertile soils result in bigger fruits. Akpan-Idiok *et al.* (2012) found similar results, where soil fertility improved cucumber fruit size and quality.

4. Conclusion and Recommendations

This study showed that organic manures, particularly poultry manure, significantly increase sand content, increase soil nutrient levels, N, OM, Av. P, K, Ca, Mg, and increase pH level which was not significantly different from pig, Goat, NPK but significantly lower than control. NPK fertilizer bearing a positive effect on cucumber growth and its yield. Treatment (poultry manure) had the most effective performance on vine length, stem diameter, leaf area, and fruit yield relative to other treatments. NPK fertilizer provided nutrients in an accelerated way organic manure effects. It is, therefore, concluded that farmers should give preference to the application of poultry manure for cucumber cultivation for higher yield and maintaining soil productivity base on these findings.

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Table 4.13 Correlation analysis showing the relationship of some selected soil properties, growth and yield parameters of cucumber

	OM	pH	TN	Av.P	TEB	ECEC	Bsat	VL	NL	FW	FL	FC
OM	-											
pH	-0.801	-										
TN	0.138	0.428	-									
Av.P	0.656	-0.469	0.340	-								
TEB	0.910*	-0.890*	-0.246	0.444	-							
ECEC	0.978**	-0.834	0.003	0.661	0.956*	-						
Bsat	0.633	-0.827	-0.607	0.021	0.883*	0.707	-					
VL	0.935*	-0.908*	-0.096	0.748	0.912*	0.963**	0.667	-				
NL	0.912*	-0.775	-0.038	0.703	0.924*	0.974**	0.669	0.941*	-			
FW	0.932*	-0.636	0.293	0.825	0.799	0.938*	0.426	0.895*	0.939*	-		
FL	0.902*	-0.856	-0.095	0.785	0.894*	0.955*	0.634	0.987**	0.970**	0.914*	-	
FC	0.970**	-0.637	0.326	0.668	0.835	0.942*	0.503	0.854	0.893*	0.961**	0.842	-

OM- Organic matter, TN - Total nitrogen, Av. P - Available phosphorus, ECEC- Effective cation exchange capacity, TEB- Total exchangeable bases, B. sat- Base saturation, VL- vine length, NL- Number of leaves, FW- Fruit weight, FL- Fruit length, FC- fruit circumference*Correlation is significant at the 0.05 level (2-tailed).** Correlation is significant at the 0.01 level (2-tailed)

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