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# ASSESSMENT OF POULTRY MANURE AND NPK FERTILIZER ON THE YIELD COMPONENTS OF CUCUMBER VARIETY IN OWERRI

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**ABSTRACT:** *Cucumber is an annual vegetable crop grown for its vitamins and mineral-rich fruits. Although inorganic fertilizer improves crop yield, its consistent usage leads to soil acidity. This study was conducted to assess the effects of poultry manure (PM) and its combination with NPK fertilizer on the growth and yield of cucumber. The layout was a 3 x 3 factorial scheme with three replicates at the research field of Federal University of Technology, Owerri in 2017. Three treatments consisting PM (5tons/ha), PM (2.5tons/ha) + NPK (60kg/ha) and NPK (120kg/ha) were applied. At 6 weeks after planting (WAP), Poultry manure and its combination with NPK positively influenced growth parameters such as vine length and number of leaves. Fruit length, fruit circumference, fruit number and fruit weight were significantly increased by PM. Cu999 performed significantly better than other varieties for fruit length and fruit number while Cu102 had the highest fruit weight.*

**KEYWORDS:** Poultry manure, cucumber, NPK fertilizer, varieties, growth parameters, yield.

## INTRODUCTION

Cucumber (*Cucumis sativa* L.) a monoecious annual vegetable crop has been cultivated for over 3, 000 years (Okonmah, 2011). It belongs to Cucurbitaceae family which comprises of 118 genera and 825 species (Marliah *et al.*, 2020). Cucumber is a creeping vine that grows on the ground or trellises to suspend their fruits. Through the main varieties of cucumber namely; slicing, pickling, and seedless, many cultivars have emerged. Cucumber fruit is roughly cylindrical yet elongated with tapered ends. Cucumber emanated from India between the Bay of Bengal and the Himalayas and is widely distributed throughout the world (Adetula and Denton 2003). It ranks fourth after tomatoes, cabbage and onion in Asia, and second after tomato in Western Europe (Eifediyi and Remison 2010).

Cucumber fruit is usually soft and succulent which makes it desirable and eaten in unripe mature state with fried groundnut or sliced in salads. Its juice has been observed to contain vitamins and minerals which improve the health and complexion of the skin (Enujeke, 2014). Consumption of the fruit helps in healing diseases of urinary bladder and kidney; digestive problems like heartburn, acidity, gastritis and ulcer, (Tahir *et al.*, 2019). The ascorbic acid and caffeic acid contained in cucumber help to reduce skin irritation and swollenness (Okonmah, 2011).

China is the largest producer of Cucumber in the world with Iran, Turkey, Russia and Ukraine following closely (FAOSTAT, 2020). In Nigeria, cucumber is cultivated mostly in Jos, Kano, Imo, Oyo, Kogi, and in some other states of the country (Umeh and Ojiako, 2018). Its production in Tropical African countries including Nigeria is yet to be ranked. Earlier, Nigeria's production and supply rates of cucumber were low due to scarcity of improved planting seeds, lack of capital, presence of biotic and abiotic factors, lack of storage facilities, and lack of technical know-how (Umeh and Ojiako, 2018). However, its production and market demand has increased tremendously in recent time, this is probably as a result of the continuous awareness of its economic returns, early maturity period, health and skin care benefits.

Cucumber grows well on well-drained, slightly acidic fertile sandy loam soils with good moisture retention ability and rich in organic manure. The crop requires sufficient amount of sunshine, warmth and is mostly grown in green houses (Umeh and Ojiako, 2018). The cultivation of cucumber in South-eastern Nigeria is constrained by low soil fertility and as such results in bitter taste and mix-shaped fruits that are usually rejected by customers (Marliah *et al.*, 2020).

Increase in cucumber production can be achieved either by cultivating more lands or by using improved varieties with appropriate cultural practices. Shifting cultivation has been observed to be one of the most efficient methods practiced by farmers in maintaining soil productivity and reformation in the tropics (Eifediyi and Remison, 2010). However, this practice could no longer hold due to increase in population and this gave rise to continuous cropping which has adverse effect on soil fertility status, thus resulting in lower yields of cucumber crop (Ayoola and Adediran, 2016). Owing to the problem of lower yield caused by poor soil fertility, Marliah *et al.* (2020) opined that the use of organic and inorganic manure become imperative in the cucumber production.

Conventionally, chemical fertilizers such as NPK have been in use for decades. However, their continuous usage leads to destruction of the texture and structure of the soil which results to soil erosion, acidity, degradation and nutrient imbalance (Ojeniyi 2000). Furthermore, the high cost incurred in the use of inorganic fertilizer has not been helpful under intensive agriculture especially for rural farmers. Poultry manure therefore presents another alternative to boosting soil fertility and hence increased crop productivity.

According to Enujeke (2013), poultry manure is not only cheap and effective but also essential for establishing and maintaining optimum soil conditions for growth and yield of cucumber. Poultry manure improve moisture availability in the soil which in turn enhance nutrient release to plants for increased growth and yield (Adekiya and Ojeniyi, 2002). Although, organic manures are usually very bulky and the cost of transporting them from one location to another is high, it is a safer source of nutrient as they are environmentally friendly and release their

nutrient in a slow and steady manner thereby activating soil microbial activities (Eifediyi and Remison, 2010).

Other studies of various crops have shown that nutrients from organic and inorganic fertilizers combination improve and promote crop yields (Fuchs *et al.*, 1970; Titiloye, 1982; Costa *et al.*, 1991; Eifediyi and Remison, 2010). Maximum use of nutrient for cucumber production might be increased through the combine use of organic and inorganic fertilizer. Hence, this study was conducted to examine the effects of poultry manure (PM) and its combination with NPK fertilizer on the growth and yield of cucumber.

## MATERIALS AND METHOD

### Experimental Site

The experiment was conducted at the School of Agriculture and Agricultural Technology Teaching and Research Farm, Federal University of Technology, Owerri. The area lies between latitude 05° 30' N and longitude 07° 02' E with altitude 90.91 metres above sea level (masl) in the South Eastern rainforest agro-ecological zone of Nigeria. The rainfall pattern is bimodal with its peak in July and September and a break in August. Annual temperature ranges from 25 – 35 degree centigrade and the relative humidity of the study area 85-91% and rainfall 1500 mm-2500 mm.

### Land Preparation

The experimental field measuring 25 m x 10 m was cleared, stumped, pulverized and prepared for planting the seeds in experimental plots measuring 2 m x 2 m manually.

### Planting Materials and Method

Two viable seeds of each of the three improved varieties of cucumber namely: CU 999, CU 986, CU 102 were planted into the soil at the depth of 2 cm per hole at the spacing of 1 m between and 50 cm within rows, with a furrow of 0.5 m, and was later thinned down to one plant per hole at two weeks after emergence. Poultry manure was applied 2 weeks before planting at the rate of 4.5 kg/plot (5tons/ha), while the N.P.K fertilizer 48 g/plots (120kg/ha) was applied at planting, and NPK (24g/plot) + poultry manure (2.25kg/plot) was applied on control plots using ring method. All poultry manure applications were made two weeks before planting on the plots.

### Experimental Design

The experiment was carried out in a 3 x 3 factorial arrangement in a Randomized Complete Block Design (RCBD) with three replications.

### Experimental Treatments

Poultry Manure (PM)

NPK (Control)

NPK + Poultry manure (NPK+PM)

## Cultural Operation

**Weeding**: Plots were weeded manually with a hoe. Weeding was carried out whenever weeds reach a certain threshold.

**Fertilizer Application**: Pre-planting fertilizer application was done on all experimental plots.

## Data Collection

**Number of leaves per plant:** 5 plants were randomly selected per plot and their number of leaves counted and their mean taken at three weeks after planting (3WAP) and six weeks after planting (6WAP). This was achieved by counting.
**Vine length:** 5 random plants were selected per plot and the vine length measured using a measuring tape placed at the base of the plant to the shoot apex at 3WAP and at flowering. Care was taken not to shift the vine from their positions to avoid damaging them.
**Fruit length and weight:** Fruit length and weight were measured at harvests using meter ruler and weighing scale
**Number of fruits per plant:** Number of fruits per plant was taken at each harvest and recorded cumulatively.
**Fruit Circumference (cm):** 5 random plants' fruits were selected per plot and the circumference measured a standardized measuring tape.

## Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA) and treatment means were separated using Tukey HSD test at 5% level of probability using R studio package.

# RESULTS

## Vine length

Figure 1 below displays the effect of different treatments on the vine length for different cucumber varieties. For all the treatment and the three varieties, the fruit had the longest vine at 6 weeks after planting.

Among the three treatments at different weeks, cucumber treated with poultry manure had the highest vine length of 23.66 cm, followed by the NPK + PM which had an average vine length of 17.87 cm whereas the cucumber treated with NPK gave the lowest vine length with an average vine length of 15.13 cm (Table 1). Table 2 shows the response of the three cucumber varieties with respect to vine length. The varieties were not significantly different from each other. Cu999 was seen to have produced the longest vine with a mean value of 19.32 cm, whereas Cu102 produced the shortest vine with a value of 18.87 cm. The cucumber plants did best at 6 weeks after planting (Table 3).

**Table 1.** The effect of different treatments on growth and yield of cucumber

| Treatment | Vine length (cm) | Number of leaves | Fruit length (cm) | Fruit circumference | Fruit number | Fruit weight (g) |
|---|---|---|---|---|---|---|
| Poultry Manure | 23.66$^{a}$ | 3.87$^{a}$ | 20.51$^{a}$ | 17.44$^{a}$ | 7.56$^{a}$ | 123.33$^{a}$ |
| NPK + PM | 17.87$^{b}$ | 3.06$^{b}$ | 15.53$^{b}$ | 14.27$^{b}$ | 5.33$^{a}$ | 77.78$^{b}$ |
| Control | 15.13$^{c}$ | 2.64$^{c}$ | 15.42$^{b}$ | 14.43$^{b}$ | 5.67$^{a}$ | 77.22$^{b}$ |

The values are expressed as mean. In each row, value that are significantly different at $p \leq 0.05$ are indicated by letters

**Table 2.** The response of different varieties to growth and yield of Cucumber

| Variety | Vine length (cm) | Number of leaves | Fruit length (cm) | Fruit circumference | Fruit number | Fruit weight (g) |
|---|---|---|---|---|---|---|
| Cu999 | 19.32[a] | 3.36[a] | 18.78[a] | 16.04[a] | 7.78[a] | 91.11[a] |
| Cu986 | 18.48[a] | 3.00[b] | 17.07[b] | 14.91[a] | 5.44[b] | 87.78[a] |
| Cu102 | 18.87[a] | 3.20[ab] | 15.62[c] | 15.19[a] | 5.33[b] | 99.44[a] |

The values are expressed as mean. In each row, value that are significantly different at $p \leq 0.05$ are indicated by letters

**Table 3**. Growth of Cucumber varieties at different weeks after planting

| Weeks after planting | Vine length (cm) | Number of leaves |
|---|---|---|
| 6 | 31.32[a] | 5.05[a] |
| 4 | 17.60[b] | 2.86[b] |
| 2 | 7.75[c] | 1.66[c] |

The values are expressed as mean. In each row, value that are significantly different at $p \leq 0.05$ are indicated by letters

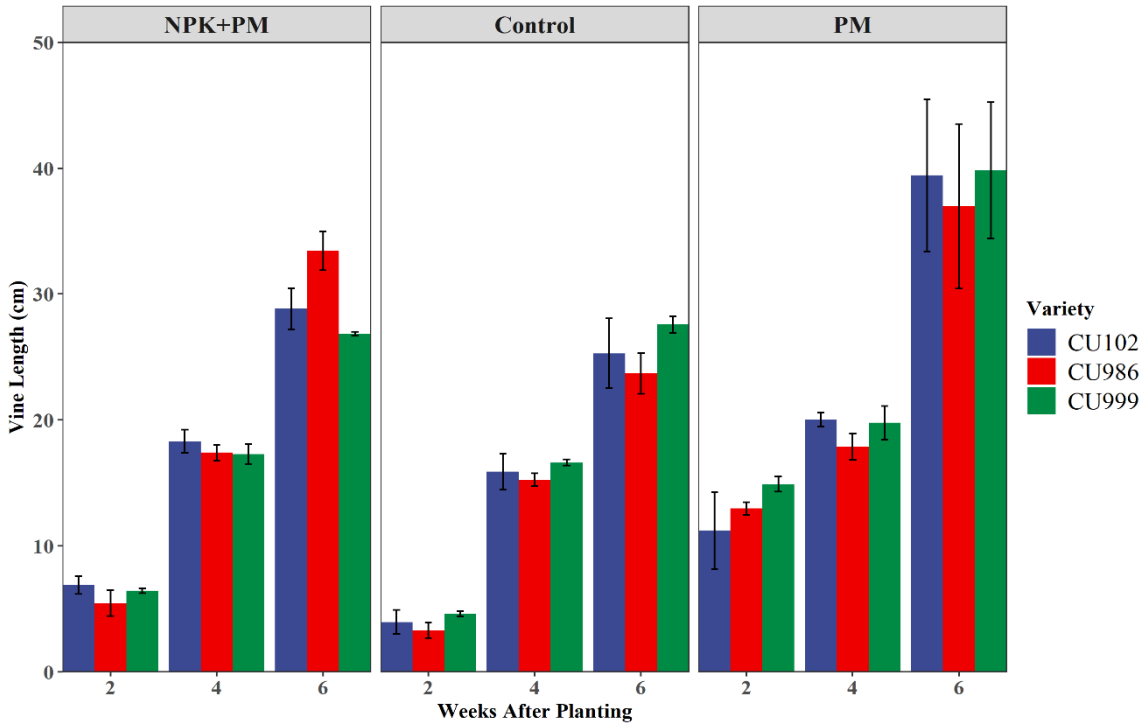


**Figure 1:** The effect of different treatments on the vine length for different cucumber varieties with respect to the weeks after planting.

**Number of leaves**

Figure 2 below shows the effect of different treatments on number of leaves for cucumber. Poultry manure treatments at 6 weeks after planting gave the highest number of leaves with an average value of 5.42 leaves. Cucumber treated with NPK + PM treatment had an average of 5 leaves whereas the control treatment produced an average value of 4.76 leaves.

Table 2 above illustrates the performance of different varieties. Cu999 variety produced the highest number of leaves with a mean value of 3.36 leaves, Cu102 was not significantly different from Cu999 and Cu986. There was a progressive increase in the number of leaves across the weeks after planting for all treatments. At 2 weeks the average number of leaves was 1.66, at 4th week it increased to 2.86 and at 6$^{th}$ week it increased to 5.05 leaves (Table 3).

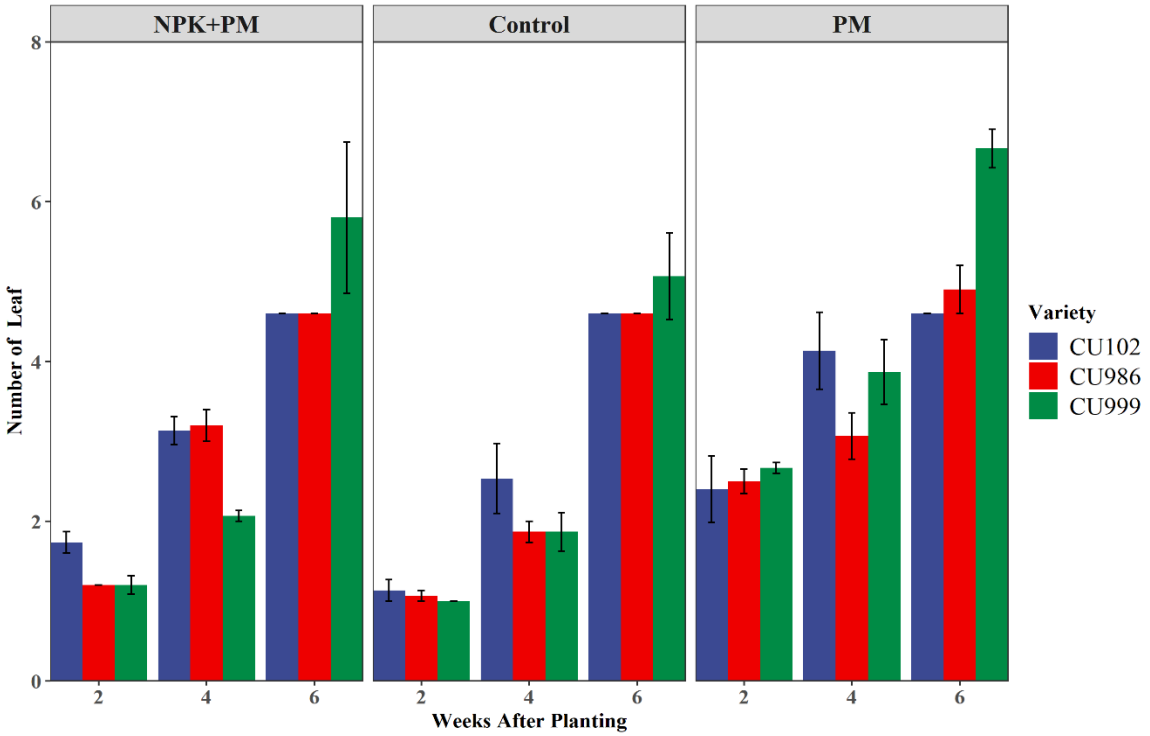


**Figure 2:** The effect of different treatments on number of leaves for cucumber with respect to the weeks after planting

**Fruit length**

Figure 3 below displays the effect of different treatments on fruit length. Cu999 treated with poultry manure produced the longest fruit of 23.03 cm and it was significantly different from the others. Cucumber treated with poultry manure produced the longest fruit with an average value of 20.51cm. There was no significant difference between cucumber varieties treated with NPK with an average value of 15.42 cm and those treated with NPK + PM with an average value of 15.53cm (Table 1). The performance of the varieties was considered and the result showed that the variety CU999 produced the longest fruit with a mean value of 18.78 cm and it was significantly different from the varieties Cu986 and Cu102 which produced fruit length of 17.07 cm and 15.62 cm respectively (Table 2).

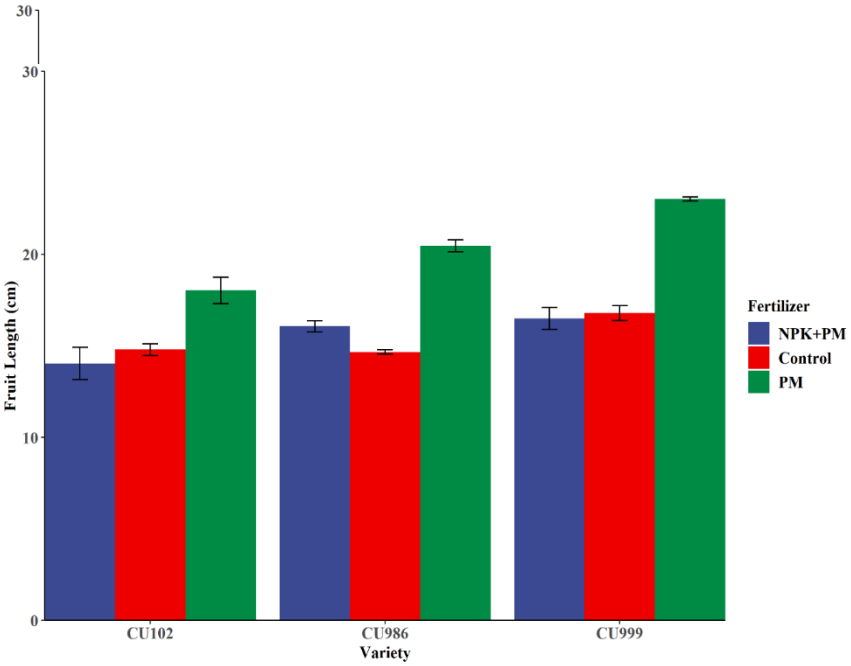


**Figure 2:** the effect different treatments on fruit length for Cucumber with respect to the weeks

The values are expressed as mean. In each row, value that are significantly different at $p \leq 0.05$ are indicated by letters

**Table 4.** Interaction between the treatments and varieties on yield of cucumber

| Varieties | Treatments | Fruit length (cm) | Fruit circumference | Fruit number | Fruit weight (g) |
|---|---|---|---|---|---|
| Cu102 | Poultry manure | $18.03^{bc}$ | $17.63^{ab}$ | $10.67^{a}$ | $116.67^{ab}$ |
| Cu986 | Poultry manure | $20.47^{b}$ | $17.87^{a}$ | $6.00^{ab}$ | $113.33^{abc}$ |
| Cu999 | Poultry manure | $23.03^{a}$ | $16.85^{abc}$ | $6.00^{ab}$ | $140.00^{a}$ |
| Cu102 | NPK + PM | $14.03^{e}$ | $15.40^{abcd}$ | $6.00^{ab}$ | $73.30^{d}$ |
| Cu989 | NPK + PM | $16.07^{cde}$ | $13.10^{d}$ | $5.33^{ab}$ | $86.00^{bcd}$ |
| Cu999 | NPK + PM | $16.50^{cde}$ | $14.30^{cd}$ | $4.67^{b}$ | $80.00^{cd}$ |
| Cu102 | Control | $14.80^{de}$ | $15.10^{abcd}$ | $6.67^{ab}$ | $83.33^{bcd}$ |
| Cu986 | Control | $14.67^{de}$ | $13.77^{cd}$ | $4.67^{b}$ | $70.00^{d}$ |
| Cu999 | Control | $16.80^{cd}$ | $14.43^{bcd}$ | $5.67^{ab}$ | $78.33^{cd}$ |

## Fruit Circumference

Table 1 above shows the effect of different treatments on fruit circumference of Cucumber. Poultry manure produced fruit with biggest circumference of 17.44 and it was significantly different from the treatments control and NPK + PM whose fruit circumference were 14.43 and 14.27 respectively. The performance of the varieties was not significantly different from each other (Table 2). The interactions between the treatments and varieties are shown in table 4 above. The result shows that the variety Cu986 treated with poultry manure produced fruits with largest circumference but it was not significant different from Cu102 treated with poultry manure, Cu999 treated with poultry manure, CU102 treated with control, CU102 treated with NPK + PM.

**Fruit number**

In table 1 above is also shown the effect of different treatments on fruit number of cucumbers. The treatments were not significantly different from each other. Table 2 shows the response of different varieties on fruit number. Cu102 had the highest fruit number with an average value of 7.78 fruits. The variety Cu102 treated with poultry manure produced the highest number of fruits thou not significantly different from many combinations (Table 4).

**Fruit weight**

The effect of different treatments on fruit weight is also illustrated in table 1 above. Poultry manure treatment yielded fruits with the highest weight with a mean value of 123.33 g and was significantly different from the other two treatments. The treatment NPK + PM and control yielded fruits with an average value of 77.78 g and 77.22 g, respectively. The result shows that the fruit weight of all the varieties were not significantly different from each other (Table 2). Table 4 above shows the effect of the combination of the treatments and the varieties on fruit weight of cucumbers. The result showed that the three varieties treated with poultry manure produced fruit with the highest weight and were not significantly different from each other.

## DISCUSSION

This study was conducted to assess the responses of three cucumber varieties to Poultry Manure (PM), combined application of (NPK+PM) and NPK (Control). The findings revealed that PM had a significant effect on the growth and yield of cucumber. Similar observation was also reported on Cucumber growth and yield by Sallam *et al.* (2021). This could be attributed to the readily available major nutrients such as Nitrogen and Phosphorus which were released to plants within the shortest period for its growth (Ghanbarian *et al*., 2008; Garg and Bahl, 2008).

The increase in the number of leaves and vine length measured at interval in succession of two weeks after planting further confirms the effects of PM on the vegetative growth of Cucumber and this result agrees with the findings of Hamma *et al*. (2012); Law-Ogbomo and Osaigbovo (2018) who also suggested that PM had a significant effect on the growth of cucumber. Aliyu (2000), Nweke and Obasi (2013) also made similar observations for garden egg and okra plant respectively. The higher number of leaves observed in this study is necessary for enhanced light interception, increased photosynthesis and translocation of assimilates to the storage organ, thus leading to higher yields.

The three varieties responded differently with variety CU999 having the highest values for vine length, fruit length while variety CU102 had the highest fruit weight and this could be attributed to increase in number of leaves, observed in this study, which was enhanced by readily available nutrient elements such as Nitrogen, Phosphorus and Potassium in PM. Nweke *et al*. (2014) also reported similar observations.

The growth and yield parameters of cucumber treated with PM showed significant higher result when compared to other treatment and this might be attributed to the nutrient composition of PM (Okoli and Nweke, 2015). The underlining evidence as reported by John *et al*. (2004), suggests that PM contained essential nutrient elements which in turn favours increased

photosynthetic activities boosting the vegetative and reproductive phases in growth of cucumber.

With respect to all the traits considered in this study, PM treated plots had the best performances. This implies that farmers could completely adopt the use of poultry manure in cucumber production as against the use of NPK fertilizer. Poultry manure do not only improve cucumber yield, it also helps to ameliorate the challenges of soil acidity and degradation imposed by inorganic fertilizers such as NPK. In addition, the use of poultry manure reduces the cost of production as it is relatively cheap compared to NPK fertilizer which may not be readily accessible. Most farmers can therefore increase their profit margins by adopting the extensive use of poultry manure and indirectly improving their standard of living.

## CONCLUSION

The study revealed that application of PM had significant effects on the growth and yield of cucumber compared to NPK. The highest values for growth and yield were recorded in PM treated plots in all the parameters measured. Poultry manure serves as a good source of soil amendment which resulted in improve growth and yield of cucumber.

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