



RESPONSES OF DIFFERENT POULTRY MANURE LEVELS ON THE GROWTH AND YIELD OF CUCUMBER (*Cucumis sativus* Linn.) IN IBADAN, NIGERIA

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ABSTRACT

The experiment was conducted at the research Farm, Federal College of Forestry Technology, Ibadan, Nigeria, to determine the Effect of Organic Manure (Poultry Manure) levels on the Growth and Yield of Cucumber (*Cucumis Sativus* Linn.) in Ibadan, Nigeria. *Cucumis sativus* seed purchased from Institute of Agricultural Research and Training (IAR&T) Ibadan, were planted on 5m by 3m pieces of land comprising of (15) beds which were divided into five columns and three rows consisting of two treatments and five replicates, treatment of 10g and 15g of poultry manure was applied per replicate. The experiment was laid out in a randomized completely block design (RCBD) comprising two treatments (including control) and each replicated five times making a total of fifteen. Both treatments showed significant variations in growth and yield parameters. The results showed that cucumber plant treated with poultry manure at 15g had highest numbers of leaves (62.28), vine length (44.04 cm), vine diameter (4.86 cm), numbers of branches (4.5 cm), which eventually resulted into bountiful fruit production with fruit length (18.1 cm/ha), fruit diameter (4.5 cm/ha), number of fruits (4.8), average fruit weight (169.5 g/ha) and yield (31.9 t/ha) on the average, The increase in vine diameters and leaves production was significant at ($p < 0.1$ and $p < 0.05$) respective. The interactions of all other parameters were found non-significant except on average fruit weight. The application of poultry manures at 15 t/ha is thereby recommended for commercially production of cucumber plants in Ibadan for rapid growth and yield.

Keywords: Manure, levels, growth, yield, cucumber.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is an important and one of the most popular fruit from Cucurbitaceae family and of the oldest vegetables cultivated by early man (Eifediyi and Remison, 2010). It is fourth in importance in Asia after tomato, cabbage and onion. It is the second recognized fruit after tomato in Europe (Eifediyi and Remison, 2010). The plant is a creeping vine that bears edible fruits when matured. The plant has big leaves that form a canopy over the fruits of the cucumber, the fruits is generally roughly cylindrical elongated with tapered end and may be as large as 60cm long and 10cm in diameter. It has an enclosed seed that developed from a flower, botanically, cucumbers are classified

as fruits. However, just like tomatoes and squash they are frequently seen, prepared and eaten as vegetable. Cucumbers are generally characterized of having over 90% of water.

A few varieties of cucumber are parthenocarpic, the blooms can make the vine fruit without fertilization. Pollination of these varieties degrades the quality of the fruit produced. Most cucumber varieties are seeded and require pollination, symptoms of insufficient fertilization includes fruits abortion and distorted fruits. Some pollinated flowers may grow fruits which are green and grow normally close to the stem end however light yellow and withered at the blossom end (Ayoola and Adediran, 2006).

Cucumbers are a good source of different vitamins and minerals, including potassium, vitamin K, calcium and vitamin B5 (Pantothenic acid). The vitamin and minerals contribute formation, bone health and blood clotting. A cucumber contains 45 calories, 2 g of protein, 0.3 g of fats, 11 g of carbohydrates and 1.5 g of fiber (Akanbi *et al.*, 2010). There are three primary varieties of Cucumber; Slicing, pickling and Burpless. The cucumber is initially from India however is currently grown in most continent. Like other Cucurbits, cucumbers have a wide scope of consumption utilizes diversely. They are commonly eaten fresh or pickled and are especially important in the diets of people living in Russia and East, South, Southeast Asia and Nigeria where they may likewise be served as a fresh or cooked vegetable. In Eastern part of Nigeria, the fruits are utilized in the preparation of chutney and curries. Cucumbers seeds, young leaves, and cooked stems are likewise consumed. Furthermore, Cucumbers have been used in the production of an enormous variety of cosmetics, including Fragrances, body creams, shampoos and cleansers (Robinson *et al.*, 1997).

Due to the world population increase and more area covered by infrastructure, which decreased agriculture lands and conventional agriculture, farmers shifted to modern agricultural practices by excessive utilization of inorganic fertilizer, hybrid varieties, irrigation methods, pesticides etc. Modern agriculture produces high yield, which reduces the requirement of food crises, but some problems created such as infertility of soil, new pest and diseases and health problems (Tavakoli and Khoshkam, 2013). Fertile soils significantly affect the quality and yield of the crop as compared to infertile soil (Eifediyi and Remison, 2010). Organic manure is a sustainable source of energy and reduces the expenses of inorganic fertilizer for crops (Ayoola and Adediran, 2006). Almost, 44 % organic manure presents in the soil, which increases the 25 % and moisture retaining up to 16 times (Gangwar *et al.*, 2006). Organic manure repairs the infertile soil such as improve the soil texture, color, mineral availability to plant, water retention ability and survival of microorganisms and the utilization of organic manure with a little amount of inorganic

fertilizer highly increases crop productivity. (Kaith and Bhardwaj, 2009) Organic manure extends the water retaining in sandy soil and improve drainage of clay soil while excess applications of inorganic fertilizer badly affect the soil formation, soil erosion and soil nutrients (Ojeniyi, 2000). Growing of crops through organic manure contained nontoxic chemicals, good taste and maintained better health (Rai and Yadav, 2004).

Poultry manure is used in agriculture from ancient times which is economical and superior nutritive organic source for crops. The physical and chemical properties of soil improve with the application of poultry manure (Enujeke, 2013). Poultry manure at 10-50 t/ha have positive impact on soil physical attributes such as soil temperature, water holding capacity and improves the number of pores (Ewulo *et al.*, 2008). The concentration of N, P, K, Ca and Mg increased in sorghum leaves with the application of Poultry manure (Agbede *et al.*, 2008). Poultry manure at 24 t/ha enhanced the vegetative growth and yield because poultry manure contains nitrogen 1.0-1.8 %, P 0.4-0.8 % and K 0.5-1.9 % (DIPA, 2006). Application of poultry manure to the field is very difficult due to bulky size, but has a significant effect on the environment and soil fertility (Eifediyi, *et al.*, 2010) Infertility of Pakistan soil is the main cause of small productivity of cucumber. Low productivity is due to deficiency of essential nutrients and lack of natural fertilizer in the soil. Nitrogen plays the main role in the biochemical process of the plant. The low level of nitrogen results in decreasing the availability of other mineral nutrients (Ali, *et al.*, 2011). Regular cropping and using unbalance of chemical fertilizer devastated the soil fertility and decreased the yield of cucumber in Pakistani soil. Poultry manure is not limiting to easy availability, but also provide all essential nutrients to the plants and maintaining the soil fertility and give superior growth and yield (Mangila, *et al.*, 2007). The cucumber has great potential in Pakistani soil, but until the local cultivars of cucumber are not identified to give a positive response to poultry manure, therefore, the present research was aimed to determine the optimum level of poultry manure for better

cucumber production and identify the high yielding cucumber cultivar for Peshawar growers.

Natural manures are regular material of either plant or animal origin, including Livestock excretal, Green manure, Crop residue, household waste and wood- ash (Dada and Fayinminnu, 2010). Agricultural wastes are rich in fundamentals plant nutrient like; N, P, and K. Utilization of natural compost to the soil keeps up soil fertility for a more longer time, than the manufactured fertilizer. It is additionally a product gotten after disintegration of natural manure like poultry dungs, cow dung which replenishes the soil with basic components and adds humus to the soil. The utilization of natural manures has been suggested for long term cropping in the tropics as moderate mineralization of these

composts advances crop yield for a significant period of time (Gramb, et al., 2008).

Poultry dung as an organic fertilizer has been credited to high accessibility of N: P: K content it contains. It is a good depositor of major and minor mineral elements that are fit for improving soil fertility on application. Poultry manure isn't just essentially considered as nitrogen source but as a lesser degree of potassium, which its application is accepted to improve soil physical properties and upgrade nutrient conveying as it applies direct enzymatic or hormone impact on plants roots accordingly instigating growth and development (Odoemena, 2002). Pictorial representation of cucumber plant and fruits is shown below.



Plate 1: Cucumber Fruits with Vines and Leaves



Plate 2: Cucumber Plant



Plate 2: Cucumber Plant Cucumber Fruits

MATERIALS AND METHODS

Experimental Site

This experiment was conducted at the Research Farm of Federal College of Forestry Technology, Jericho Hills, Ibadan and Oyo State. The College is situated at Jericho Hill in Ibadan North Local Government Area. The Area lies between latitude 7° 23' to 7° 24N and longitude 3° 51 to 3° 52E. The climate condition of the region is tropically dominated with a yearly precipitation of between 1300-1500 mm and normal temperature of 32°C, the relative humidity is about 65% (FRIN, 2019).

Treatments

i. Organic Manure

Poultry manure was applied in the following rates, 10 ton/ha and 15 ton/ha.

ii. Seed collection/ Source of Planting Materials

The *Cucumis sativus* seed was bought from Institute of Agricultural Research and Training (IAR&T) Ibadan.

iii. Fertilizer application

After clear and clean clearing of the experimental plot, beds were made; well-decomposed poultry manure was applied to the beds according to specification.

Preparation of land and sowing

The beds were made; the seeds were planted on beds. After germination of seeds, thinning was not done until the infestation of beetle was completely over. The following parameters were studied during the course of experiment: Vine length (cm), number of leaves per plant, leaf area (cm²), number of branches /plant, fruit diameter (cm), fruit length (cm), fruit weight (g), number of fruits/ plant, yield (t/ ha). After harvesting, yield (t/ ha) of Cumber (*Cucumis sativus*) fruits was calculated using the formula below:

$$\text{Yield (t/ha)} = \frac{\text{plot yield (kg)}}{\text{plot area (m}^2\text{)}} \times 10000\text{m}^2$$

Experimental Design

The experiment was conducted in a Randomized Completely Block Design (RCBD), comprising two treatments and a control and each replicated five times making a total of fifteen replicates on a plot size of 5 m by 3 m, on beds of 1.5 m width, which were 0.5 m apart.

Data Collection

Data were collected and the following parameters were studied.

Vine length (cm): Vine length was determined using measuring tape. The tape was used to measure the Vine length (cm) of the plant from germination point of the plant to the shoot apex.

Number of Leaves per plant: Number of Leaves per plant was determined by counting the number of leaves per plant (Salisu, 2018).

Leaf area (cm²): Leaf area was determined by measuring the length and breadth using measuring tape,

Number of branches/ plant: Number of branches/ plant was determined by counting the number of branches per plant

Fruit diameter (cm): Fruit diameter was determined using measuring tape, by putting the tape round the fruits of the plant (Tahir *et al.*, 2015).

Fruit length (cm): Fruit length was determined using measuring tape. The tape was used to measure the fruits length (cm) of the plant from stalk end to the fruit apex.

Fruit weight (kg): Fruit weight was measured using weighing scale

Number of fruits/plant: Number of fruits/plant was determined by counting the number of fruits per plant

Plant Yield: Plant Yield was determined by measuring the weight of cucumber fruits.

Data Analysis

The research detail was analyzed using observation of change with Analysis of Variance (ANOVA), SAS (2002) statistical package. Least Significant Different (LSD) was also used to compare treatment mean (P<0.005).

RESULTS

Soil Analysis

Prior to the application of poultry manure on the experimental plots, soil samples were collected at

depth of 15 to 25 cm and analyzed for different physicochemical in the laboratory of soil science, The physicochemical properties as shown in table 1 below indicate that the soil is of sandy loam textural

class and slightly acidic with a pH of 6.50. It had an organic matter content of 4.50% and organic carbon of 1.39 %. The N, P and K contents were 1.03 %, 9.70 mg kg⁻¹ and 0.34 cmol kg⁻¹ respectively.

Table 1: Physicochemical properties of the collected soil sample

Elements	Values
Soil PH	6.50
Sand %	88.4
Silt %	7.20
Clay %	4.40
Ca (cmol)	35.5
Organic matter %	4.50
Mg (cmol)	2.75
Na (cmol)	0.66
K (cmol)	0.34
Al + H	0.07
CEC (cmol)	39.32
N (%)	1.03
C (%)	1.39
P (mg/kg)	3.70
Fe (mg/kg)	37.63
Cu (mg/kg)	2.61
Zn (mg/kg)	13.54
Mn (mg/kg)	67.3

Poultry Manure Analysis

Poultry manure was brought from poultry farm of the College. The results revealed that poultry manure is highly rich in Iron, Manganese, Copper and Zinc which are good constituents for rapid cucumber growth and development, Results from analyzed poultry manure also indicate that the

poultry manure is slightly alkaline with a pH of 7.20. It was high in organic matter (640 mg/kg) and had more nitrogen (10.20 %) and calcium (7.87 %) than potassium (4.81 %) and Magnesium (3.81 %). The low nitrogen and phosphorus of the soil are expected to benefit from the application of the poultry manure.

Table 2: Elements as analyzed from Poultry Manure

Elements	Values
PH	7.20
Organic matter (mg/kg)	640
Ca (%)	7.87
Mg (%)	3.81
Na (%)	1.20
K (%)	4.81
N (%)	10.12
Org. C	5.91
P (%)	6.62
Mn (mg/kg)	542
Fe (mg/kg)	1465
Cu (mg/kg)	048
Zn (mg/kg)	226

Table 3 below showed that cucumber plant treated with poultry manure (at 15 g) had the longest vine with average mean of 44.04 cm followed by cucumber plant grown with the application of poultry manure (at 10 g) 39.50 cm while cucumber plant grown without the utilization of poultry manure(control) had minimal performance with mean estimation of 28.88 cm. The means was compared by LSD test of significance by statistics software, the outcome got also reveals that cucumber plant treated with poultry manure (15 g) are exceptionally significant by carrying the first letter (letter a) when compared with different treatments. Means with similar letters are not altogether quite the same as one another. Result on vine diameters shows that cucumber plant treated with poultry manure (at 15 g) had the best performance with normal mean of 4.86 mm, followed by cucumber plant treated with poultry compost (at 10 g) with normal mean of 3.96 mm

while cucumber plant grown without the utilization of poultry natural manure (the control) had minimal performance with normal mean of 3.66 mm. Further test additionally reveals that cucumber plant treated with poultry manure (15 g) gave an extraordinary result via carrying the main letter (a) when compared with every single other treatment.

Table 3 below also shows that cucumber plant grown with the application of poultry manure (15 g) had the best performance in leaf production with mean value of 62.28 followed by treatment at 10 g, with mean value of 4.86 while cucumber plant grown without the use of manure produced the least number of leaves with average mean value of 42.70 leaves. LSD test also revealed that cucumber plant treated with poultry manure (15 g) gave high significant effect on leaf production of cucumber plant by carrying the first letter (a) when compared with all other treatments.

Table 3: Effect of organic manure on the Vine length, Vine diameters and leaf count of cucumber plant

Treatment	Vine length (cm)	Vine branches (cm)	Leaf count	Leave area (cm ²)
T ₀	28.88 ^b	3.66 ^b	42.70 ^b	116.7 ^b
T ₁ (10g)	39.50 ^{ab}	3.96 ^b	45.08 ^b	125.2 ^b
T ₂ (15g)	44.04 ^a	4.86 ^a	62.28 ^a	136.8 ^a
LSD	5.06	0.43	13.09	2.054
Grand Mean	37.47	4.16	50.02	287.5
%CV	9.79	7.46	18.98	3.011

Note: Means with the same letters are not significantly different from themselves.

Vine Length of cucumber plant

Table 3.0 above on Vine length indicated that cucumber plant treated with poultry manure (at 15 g) had the longest vine with average mean of 44.04 cm followed by cucumber plant grown with the application of poultry (at 10 g) 39.50 cm while cucumber plant grown without the use of manure (control) had the least performance with mean value of 28.88 cm. The highest vine length in plants with a highest production, decreased the temperature, bulk density, and improved the total porosity of the soil. The means were separated using LSD test, the result obtained also reveals that cucumber plant treated with poultry manure(15 g) are highly significant by carrying the first letter (letter a) when compared with

other treatments. Means with the same letters are not significantly different from each other.

Vine Branches of cucumber plant

Result on stem branches shows that cucumber plant treated with poultry manure(at 15 g) had the best performance with average mean of 4.86 mm. followed by cucumber plant treated with poultry manure (at 10 g) with average mean of 3.96 mm while cucumber plant grown without the use of poultry organic manure (the control) had the least performance with average mean of 3.66 mm .

From the table, there is significant difference among the treatments at 1% level of probability which indicate that the use of organic manure employed gave high significant effect on stem

diameter of cucumber plants. Further test also reveals that cucumber plant treated with poultry manure(15 g) gave an outstanding outcome by carrying the first letter (a) when compared with all other treatments. The results of Dauda *et al.* (2008), also indicating that the water melon requires more nutrients for vigorous vegetative growth. According to the results of Enujoke (2013), high levels of poultry manure encouraged the production of maize. The genetic make ups of cultivars and environmental factors also have a significant effect on the growth of plants. This was also noted by Young et al, 2004 who stated that variation in plant growth was due to genetic nature of cultivars.

Leaf Count of cucumber plant

From Table 3 above leaf count production shows that cucumber plant grown with the application of poultry manure(15 g) had the best performance in leaf production with mean value of 62.28 followed by treatment at 10 g, with mean value of 4.86 while cucumber plant grown without the use of manure produced the least number of leaves with average mean value of 42.70 leaves. The cause of maximum numbers of leaves plant-1 might be the organic manure; it made the soil more fertile and favorable for plant growth. Poultry manure contains nitrogen which boosts the growth of the plant. This statement is approved by the results of Mangila *et al.* (2007) and Enujoke *et al.* (2013) who reported that poultry manure (which is superior animal manure) was contained more nutrients, which improved the physical condition of soil for plant growth and development. Similar results were also found by Agbede *et al.* (2008) and Ewulo *et al.* (2008) who said that the high concentration of nitrogen present in poultry manure,

easily available to plants, produced high production decreased the temperature, bulk density, and improved the total porosity of the soil.

ANOVA test as shown below test also revealed that cucumber plant treated with poultry manure(15 g) gave high significant effect on leaf production of cucumber plant by carrying the first letter (a) when compared with all other treatments. Result from the table below reveals that there is significant difference among the treatments at 5 % level of probability. The treatments used that is, poultry manure at varying level gave high significant effect on leaf production of cucumber plant.

Leaf Area of cucumber plant (cm²)

From above, leaf area shows that cucumber plant grown with the application of poultry manure(15 g) had the best performance in leaf production with mean value of 136,8 followed by treatment at 10 g, with mean value of 125.2 while cucumber plant grown without the use of manure have the least leaves area with average mean value of 116.7 leaves. The plants which receive more light have maximum leaf area because more light capturing causes more transpiration and photosynthesis. Leaf area increases with the increase of poultry manure level. It might increase the concentration of nitrogen and improve the soil chemical and physical properties which in turn enable the plants to take up more nutrients from the soil easily. These results resemble with the findings of (Adesina et al 2014), (Aliyu, 2002, Aliyu, 2003 and Alabi, 2006) who stated that poultry manure improved the vegetative growth of pepper plants, and enhanced the nutrients uptake.

Table 4: Fruit length, Fruit diameter, Number of fruits, Fruit weight and Yield of cucumber as affected by poultry manure levels

Poultry manure	Fruit length(cm)	Fruit diameter(cm)	Number of Fruits	Fruit weight	Yield
0 tha-1	12.9 ^d	4.1 ^c	3.2 ^d	155.9 ^d	19.2 ^d
10 tha-1	15.5 ^c	4.4 ^b	4.1 ^c	165.4 ^c	26.6 ^c
15 tha-1	18.1 ^b	4.5 ^b	4.8 ^b	169.5 ^b	31.9 ^b
LSD at p≤0.05	0.764	0.344	0.323	3.352	1.591

* Significant at a level of 5% of probability (.01 =< p < .05)

Fruits length (cm)

The poultry manure levels significantly affected ($P \leq 0.05$) the fruit length of cucumber. Maximum fruit length (18.1 cm) was seen in plants, which received poultry manure at 15 t/ha, while minimum fruit length (12.9 cm) was observed in plants which did not received any poultry manure (Table 4). The fruit length might be increased due to the optimum amount of macro and micro nutrients available in poultry manure, which is required for the synthesis of photo assimilates and the enhanced amount of photo assimilates produced maximum fruit length. Similar results were noted by Adediran *et al.* (2003), he found that the high level of poultry manure as a rich source of nutrients, significantly increased fruit length. Agyarko and Asiedu (2012) also reported that fruit size and fruit girth of cucumber was improved with poultry manure application.

Fruit diameter (cm)

In table 4 The fruit diameter was increased from 4.1 cm in control group to 4.9 cm in the plants received poultry manure 15 t/ ha. Poultry manure increases the water holding capacity and moisture in the soil which in turn the uptake of nutrients from the soil becomes easy for the plants. Those plants which receive all the essential nutrients grow vigorously and give more yields. A similar statement was reported by John *et al.* (2004) who noted that poultry manure increased the growth and yield of crops.

Numbers of fruits

The number of fruits/ ha was 4.8 in plants to which poultry manure was applied at 15 t/ ha and 3.2 in cucumber that did not receive poultry manure (Table 4). This indicating that high poultry manure level improved the yield of cucumber. Poultry manure improved the availability of nutrients to plants, bulk density and the water holding capacity of the soil. This, in turn, increases the vegetative growth, accelerate the division of meristematic tissue and metabolic reactions and the plants take more food as a result of which increase in the number of fruits/ plant-1 occurred. The results are in line with Dauda *et al.* (2008) who reported that poultry manure as a rich source of nutrients

improved the soil texture and encouraged the nutrients uptake by the plants which enabled the plants to become healthy and produce more fruit in water melon. Nwokwu and Anickwe (2004) reported that variation in the average fruit weight of watermelon was due to the genetic variations. The table indicated that there is significant difference among the treatment at 5% level, which mean that uses of organic manure employed lead to increase in number of the cucumber fruits.

Average fruit weight of cucumber (g)

Maximum average fruit weight (169.5 g) was observed in plants supplied with poultry manure at 15 t/ha, while the minimum average fruit weight (155.9 g) was noted in those plants which did not receive poultry manure from Table 4 The increase in average fruit weight might be due to the high concentration of nutrients in high poultry manure level which boost up the growth and yield. Dauda, et al. (2008) noted that high poultry manure level which is a rich source of nitrogen, phosphorus, magnesium and calcium increased the fertility of the soil lead to increase in the fruit weight.

From the table, it obvious that the organic manure have significant effect on the weight of cucumber fruits. Analysis of variance from the above table revealed that there is significant difference among the treatments at 1% level of probability; this implies that the use of organic manure gave high significant effect on the yield of cucumber plant.

Yield of cucumber fruits (t/ ha)

The yield was increased from 19.2 t/ha in control plants to 31.9 t/ ha in plants which received poultry manure at 15 t/ ha. Adediran et al. (2003) also reported that poultry manure at 15t/ ha having a high concentration of plant nutrients, produced maximum yield in tomato plants. The background of high yield was more number of leaves /plant, which captured more sun light to promote the photosynthesis and respiration and as a result, the plant produced maximum yield. The findings are similar to the results of O'Hare (2001) who reported that high yield was observed due to the vigorous vegetative growth of plants.

CONCLUSIONS

Based on above findings, it can be concluded that poultry manure significantly increased the growth and yield of cucumber. The poultry manure level at 15 g was observed to be the most appropriate quantity for enhancing growth parameters and yield,

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