Effect of Organic Manure on the Growth of Cucumber in Anyigba, Kogi State, Nigeria.

By

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ABSTRACT

This research determined the effect of organic manure (saw dust, poultry manure and cow dung) on growth and yield of cucumber. Cucumber (Cucumis sativus L.) is an important vegetable and one of the most popular members of the Cucurbitaceae family. Cucumber is a very good source of vitamins A, C, K, and B6, potassium, pantothenic acid, magnesium, phosphorus, copper and manganese. The aim of this study is to ascertain the effect of organic manure on growth of cucumber. The experiment was conducted at Kogi State University Nursery Farm during the 2020 dry season. The experiment was laid in a randomized complete block design with 4 treatments and five replications. Four rates of well decomposed cattle manure levels (0t ha^{-1}, 5 t ha^{-1}, 10t ha^{-1}, and 20t ha^{-1}) were used. Organic matter content, soil pH, soil texture, inherent N, P and K for the four soil types and nutrient quality for manure were evaluated prior to crop establishment. Cattle manure, poultry droppings and saw dust were analysis for its nutrient composition (0.95% N, 0.17% P, 0.63% K, 1.52% Ca, 4.7% Zn and a pH of 6.7) before application. This trial clearly indicated that production of cucumber can be enhanced by combined application of poultry manure. Farmers are therefore advised to use the highest rate of combined application of 10,000 kg/ha of poultry manure. They have proved to be effective in supplying the required nutrients for growth and yield of cucumber crop.

Keywords: Determination, Organic manure, Growth, Cucumber

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is an annual vegetable crop that belongs to the family of *Cucurbitaceae*, which comprises of 90 genera and 750 species (Onyia *et al*., 2012). It is native to Africa and Asia where it has been consumed for over 3,000 years (Dilson 2002). It is one of the oldest vegetable crops grown for at least five thousand years (Okonmah, 2011). Cucumber is cultivated for fresh fruit which is locally consumed or exported to increase national income.

The crop is cultivated in most parts of Northern Nigeria and some parts of Eastern Nigeria by peasant farmers (Ekwu, 2007). The fruit varies in shape, size and color. On analysis, mature fruit nutrient composition is 3.8 g dry matter, 0.6 g protein, 2.0 mg calcium, 0.4 mg riboflavin, 0.2 mg niacin and 11 mg vitamin. The fruit also serves as remedy in the treatment of constipation, jaundice and indigestion (Chadha, 2006).

One of the abiotic challenges facing crop production in the Tropics is the inherent low concentration of essential nutrients in the soil for crop growth and development (Schlecht, 2007). Essential nutrients are those nutrients which are required by plants to complete their life cycle such as Nitrogen (N), phosphorous (P), potassium (K) often referred to as primary nutrients, calcium (Ca), magnesium (Mg) and sulphur (S) called secondary nutrients and Boron (B), Chlorine (Cl), copper(Cu), manganese (Mn), Iron (Fe), molybdenum (Mb) and Zinc (Zn) called micronutrients (Barker and Pilbeam, 2007). These nutrients can be provided to the soil through the use of fertilizers. Fertilizer can be organic or inorganic form. According to Ayoola and Makinde (2006) inorganic fertilizers are usually not available and are always rather expensive for the low-income, small scale farmers. Organic manure such as cow-dung, poultry manure, swine waste, sewage sludge, crop residue can be used as an alternative for inorganic fertilizer. The nutrient contained in organic manure is released more slowly and are stored for a long time. Manure application also increase soil porosity and aggregate stability, promotes soil water infiltration and holding capacity, elevates soil organic matter content, soil pH, cation exchange capacity and nutrient availability (Ayoola and Makinde 2006).

In spite of increasing relevance of cucumber in Nigeria, low yields are obtained in farmers' field because of declining soil fertility due to continuous cropping and disregard for soil amendments, which has led to several nutrients becoming deficient. Organic manures are useful in replenishing the soil. The use of inorganic fertilizers has not been helpful as it is associated with increased soil acidity, leaching and nutrient imbalance. The observations from different researchers recently has proven that organic manure such as cow dung, poultry droppings and saw dust have more nutrient and are very helpful for the production of agricultural crops.

This is because it is organic and naturally compost. Since agricultural activities are just for the peasant farmers but for all who have the interest of agriculture, it is therefore important to have a first-hand information that will encourage the use of organic manure in the production of crop instead of depending wholly on inorganic materials. Cucumber has for long been cultivated extensively in the Northern states of Nigeria, but scarcely in the South Eastern part of Nigeria where it is widely consumed. It is in attempt to fill the gap in our present knowledge that this research work was carried out to evolve a package for the optimization of the production of cucumber in the Anyigba, Guinea Southern Eastern Nigeria agro-ecology through adequate manure applications such as saw dust, cow dung and poultry droppings.

The main aim of this study is to ascertain the effect of organic manure (saw dust, poultry manure, cow dung) on the growth of cucumber.

The specific objectives were to;

i. access the vegetative growth of the cucumber plants

ii. evaluate the vegetative growth of the cucumber plants in response to different organic manures.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Kogi State University Nursery Farm during the 2020 dry season. The University Nursery farm is located within the school campus along Ankpa road in Anyigba, Dekina Local Government Area of Kogi State, Nigeria. The soils are moderately deep-to-deep well-drained **fersiallitic** red clays.

Experimental Design and Procedure

The experiment was laid in a randomized complete block design with 4 treatments and 5 replications. The treatments were randomly assigned to the plots using random number tables. Four rates of well decomposed cattle manure levels (0 t ha^{-1}, 5t ha^{-1}, 10 t ha^{-1}, and 20 t ha^{-1}) were used.

Organic matter content, soil pH, soil texture, inherent N, P and K for the four soil types and nutrient quality for manure were evaluated prior to crop establishment. Cattle manure, poultry droppings and saw dust was analyzed for its nutrient constituents (0.95% N, 0.17% P, 0.63% K, 1.52% Ca, 4.7% Zn and a pH of 6.7) before application.

Well decomposed cattle manure from cattle feedlots with no visible straw, poultry droppings and saw dust was used in the experiment. The manure was spread evenly on the soil surface in each plot according to their application rates and then incorporated into the soil using hoes at a depth of 15 cm within the plots. No manure was applied in the control plots. Inherent manure in the different soil types was used as the 0% manure control treatment.

Data collection and analysis

The three seeds planted in twenty polythene bags were watered to field capacity and left for 4 days prior to seedlings transplanting. The variety Ashley (determinate) was planted 80 cm within the rows and 1.0 m between rows giving a total 18 plants per plot and 12500 plants per hectare. A meter rule was used along with a string to measure vine length from 4 weeks after crop emergence at two weeks intervals up to senescence. Male and female flowers, branch number and leaf number were physically counted from 4 weeks after crop emergence at a two-week interval up to senescence of the vine. Fruits were harvested from 10 weeks after crop emergence and a digital scale shall then be used to weigh the fruit mass. The yield for each treatment was determined in kilograms 18 m^{-2} plots.

The data on cucumber yield (kg) and yield components such as male and female flower number, leaf number and vine length (cm), were subjected to analysis of variance (ANOVA) using GenStat version 8.1 statistical package. Least significant difference (LSD) was used in mean separation at 5% significance level.

Data collected

Vine Length

The length of the plant of four sample plants were taken per plot with the use of meter rule at 3, 6 and 9WAP and the means were determined.

Number of Leaves

The numbers of leaves of four sample plants from the discard were taken per plot at 3, 6 and 9WAP and the means were determined.

Stem Girth

With the aid of a veneer caliper, the stem girth of cucumber was determined from the 4 sample plants from each plot, and averages were determined.

Number of Branches

The number of branches was counted per plot manually from the sample plants of the experimental plots.

Leaf Area

From the 4 sample plants on each plots of the experiment the length and width of the leaves were taken and the multiplied with the leaf coefficient of the leaf of cucumber to determine the area of each plot.

Dry matter

Shoot fresh and fruit weights were recorded for each plant. Plants were dried at 70°C to become constant weight and this weight was recorded. The dried plant and soil samples were ground and sieved through 2.0 mm mesh. The total N was determined by the Kjeldahl method [Ahn, Y.S., 2017]. Nitrogen uptake was calculated as the product of dry matter multiplied by N concentration in shoots. Nitrate was determined in the soil according to Singh (Singh *et al*., 2018). Saturation percentage (%) of compost was determined by adding distilled water at intervals.

Composting mixture

Fresh poultry manure combined with sawdust and wood shavings were used as experimental materials. Poultry manure was collected from poultry farms, whereas sawdust and wood shavings were purchased from a wood‑chipping mill. Sawdust and wood shavings were mixed (1:1) and the initial moisture content, organic matter content, pH, EC and the C/N ratio of the compost were determined. The manure with sawdust and wood shavings was mixed by means of a concrete mixer to achieve better homogenization of the material.

The initial moisture content and C:N ratio were adjusted to approximately 65 and 25%, respectively, for filling the three reactors, (Rukuni and Eicher, 2013).

RESULTS AND DISCUSSION

Soil physical and chemical properties

Table 1 shows the physical and chemical properties of the soil used for the research. Sand, Silt and Clay content of the soil were 69.72, 1.88 and 28.40%, with percent sand greater than others. Soil texture was sandy loam indicating that the soil may be well drained. Soil pH in both water and KCl were below 7 showing that the soils were acidic. Organic matter content was low with value of 1.57%. Nutrient contents of the soil were low and included 0.75 N, 2.01mg kg-^{1}P, 0.96 +Cmol kg-^{1} Ca, 0.58 Cmol kg-^{1} Na, and 1.31 Cmol kg-^{1}K. Moisture content of the soil was low probably due to its high drainage condition. Based on the nutrient status of the soil, it would be taken to be low in fertility and requires the addition of nutrients to sustain crop production.

Table 1: Results of soil analysis showing the soil physical and chemical properties

Properties	Value
pH in (H_2O)	5.10
pH in Kcl	4.80
Organic matter (%)	1.57
Organic Carbon (%)	0.91
Nitrogen (%)	0.75
Phosphorus mg kg-^{1}	2.01
Magnesium (Cmol kg-^{1})	0.96
Sodium (Cmo1/kg)	0.58
Potassium (Cmo1/kg)	1.31
Calcium (Cmo1/kg)	0.74
Moisture content (%)	0.93
Bulk density (g/cm^{3})	1.24
Silt (%)	1.88
Clay (%)	28.40
Sand (%)	69.72
Textural class	Sandy loam

Table 2 shows significant difference in results obtained in vine length of cucumber on the application of saw dust, cow dung and poultry manure at P≤ 0.05 level of significance. The result shows that poultry manure has the best impact on the vine length at 3, 6 and 9 WAP. It produced vine lengths of 45.60, 49.60 and 82.40cm across the weeks. The control however gave the least treatments across the weeks of observation. The effect of organic manure on the number of leaves of cucumber shows that, application of organic manures at 20kg/ha had a significant difference effect from the control. The highest number of leaves was produced from the application of poultry manure at 3, 6, and 9WAP. At 3WAP had average of 5 leaves and at 6 WAP it had an average of 8 approximately 9 leaves and at 9WAP it had an average of 14 leaves each at P≤0.05 level of significance. The effect of application of saw dust, cow dung and poultry manure which had a significant effect from the control. The result shows that the application of the different organic manure has the same statistical effects as they had the same alphabets "a" but at 6WAP there was no significant difference in the application of organic manure on the number of branches at P≥0.05 though, the application of poultry manure still gave the highest effect which was 7.40, and at 9WAP the result obtained shows a significance difference with T3 having the highest effect and T4 having the least effect value.

Table 3 shows significant difference in the leaf area at 3, 6 and 9WAP from the application of saw dust, cow dung and poultry manure to cucumber. T3 had the highest area across the weeks. The observations were 738.40, 798.60 and 858.00 respectively. The least values were obtained from the control treatments, 480, 560.80 and 609.00 respectively at significance P≤0.05. Table 3 also shows significant effect at P≤0.05 on the stem girth of cucumber. The result shows that the application of poultry manure had the highest effect both at 3, 6 and 9WAP. Though at 6 WAP, the result shows that the application of the different organic manures had no significant difference at P≥0.05.

Table 2: **Effect of organic manure on cucumber**

	Vine length (cm)			Number of Leaves			Number of branches		
Treatments	3WAP	6WAP	9WAP	3WAP	6WAP	9WAP	3WAP	6WAP	9WAP
T1	39.52^{b}	40.46^{b}	67.40^{b}	3.60^{b}	9.60^{b}	9.80^{b}	4.20^{ab}	6.20	8.20^{ab}
T2	39.20^{b}	44.60^{ab}	61.20^{b}	3.60^{b}	9.80^{b}	10.00^{b}	4.80^{a}	5.60	6.60^{bc}
T3	45.60^{a}	49.60^{a}	82.40^{a}	5.00^{a}	17.60^{a}	33.20^{a}	6.00^{a}	7.40	8.80^{a}
T4	21.00^{c}	24.80^{c}	44.40^{c}	3.20^{b}	8.60^{b}	14.00^{b}	2.80^{b}	4.40	5.60^{c}
LSD	5.564	5.972	13.286	0.733	2.550	6.384	1.853	-	2.078
Significance	**	**	**				**	N.S	**

Source: Field Experiment, 2020

Means having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level of probability. Treatment T1 –T4 indicates the composition of each treatment where T1-Saw Dust20kg/ha, T2-Cow Dung kg/ha, T3-Poultry Manure kg/ha, T4-Control. WAP = weeks after planting, NS = non-significant, LSD =least significant difference, * = significant, ** = highly significant.

Table 3: **Effect of organic manure (saw dust, cow dung and poultry manure) on the leaf area, and stem girth of cucumber**

	Leave Area (cm^2)			Stem Girth (cm)		
Treatment	3WAP	6WAP	9WAP	3WAP	6WAP	9WAP
T1	630.80^{ab}	822.00^{a}	869.00^{a}	4.20^{ab}	6.20	8.20^{ab}
T2	595.80^{ab}	600.60^{b}	656.60^{b}	4.80^{a}	5.60	6.60^{bc}
T3	738.40^{a}	798.60^{a}	858.00^{a}	6.00^{a}	7.40	8.80^{a}
T4	480.00^{b}	560.80^{b}	609.00^{b}	2.80^{b}	4.40	5.60^{c}
LSD	160.690	149.792	135.539	1.853	-	2.078
Significance	**	**	**	**	N.S	**

Source: Field Experiment, 2020

Means having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level of probability. Treatment T1 –T4 indicates the composition of each treatment *where T1-Saw Dust20kg/ha, T2-Cow Dung kg/ha, T3-Poultry Manure kg/ha, T4- Control*

Discussion

The result obtained from the research on the application of organic manures (saw dust, poultry manure, and cow dung) on the growth indices of cucumber shows that the application of organic manure had a significant effect on the vine length of cucumber on the application of saw dust, cow dung and poultry manure at a level of significance $P \leq 0.05$, the result shows that poultry manure has the best impact on the vine length, this agrees with a study by Enujeke (2013) who reported that a variety of cucumber (Market more) that received the highest rate of poultry manure (20 t ha^{-1}) was superior with respect to vine length, number of leaves, fruit diameter, fruit length and fruit weight at 4, 6 and 8 weeks after planting for two years. The result on the number of leaves of cucumber shows that the application of organic manures at 20kg/ha had a significant difference effect from the control treatment; the highest number of leaves was produced from the application of poultry manure at 3, 6, and 9WAP. The application of cow dung and poultry manure had no significant effect from the control treatment in the experiment at 3WAP. At 6WAP there was no significant difference in the application of organic manure on the number of branches at $P \geq 0.05$. At 9WAP the result obtained shows a significance difference with T3 having the highest effect and T4 having the least effect value. More so, the application of saw dust, cow dung and poultry manure were applied to cucumber shows a significant difference on the leaf area at 3, 6 and 9 WAP at T3 had the highest area across the weeks the observations were made 738.40, 798.60 and 858.00 respectively, the least values were gotten from the control treatments, 480, 560.80 and 609.00 respectively at $P \leq 0.05$ significant level. The result on stem girth of cucumber shows that at 3WAP and 6WAP of the application of different organic manures, there was a significantly different effect at $P \leq 0.05$ on the stem girth of cucumber. The application of poultry manure had the highest value effect both at 3, 6 and 9WAP though at 6 WAP the experimental result shows that the application of the different organic manures had no significant difference at $P \geq 0.05$. These results agrees with the experimental findings and conclusions made by Enujeke (2013) who reported that 20 t/ha of poultry manure significantly increased the vine length, number of leaves/plant, number of branches/plant, and fruit weight of water melon compared to the control.

Aliyu, (2000) made similar report that higher rates of poultry manure resulted in higher yield of egg-plant. This result obtained on the use of organic manures when used for the growing of cucumber is due to the fact that; organic manures increase soil water holding capacity and this means that nutrients would be made more readily available to crops where manures have been added to the soil, and because organic manure release nutrients in slow and steady manner to crops.

Conclusion and Recommendations

The research on the growth response of cucumber to application of organic manure showed that organic manure is good for the growing of cucumber since it is environmentally friendly, and has a soil salvaging effect when used. It is relatively cheap compare to inorganic fertilizers. More so, the use of poultry manure as discovered from the experiment done is more effective in the cultivation of cucumber this may due to the fact that it contains higher proportions of N. P. K which are the major require of plants for growth, development and yield compare to saw dust and cow dung that were also used. Farmers should adopt the use of organic manure for the cultivation of Cucumber especially poultry droppings.

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