Effects Of Different Rates Of Pig Manure On The Growth And Yield Of Cucumber (*Cucumis sativus L.)* In South Western Nigeria

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Abstract: Degraded soils and low soil fertility are the major constraints to food security and income levels of smallholder farmers in developing countries. A trial was conducted to evaluate the effect of variable rates of pig manure on the growth and yield of cucumber (*Cucumis sativus*) at Teaching and Research Farms of Rufus Giwa Polytechnic, Owo, Ondo State. The treatments consist of pig manure at 0, 0.5, 1.0, 1.5, 2.0kg/plant laid out in Randomized Complete Block Design (RCBD) replicated thrice. Data collected were vine length, number of leaves/plant, number of branches, stem girth, fruit circumference (cm), fruit length (cm), and fruit weight at maturity. Vegetative growth parameters were significantly promoted as the rate of pig manure increased from 0kg to 2.0kg/plant. Yield attributes increased as the rates of pig manure increased; the highest fruit yield and yield attributes were recorded at 2.0kg/plant rate. However, stem girth and fruit circumference were not significantly ($P \geq 0.05$) influenced by application rate of pig manure. Pig manure applied at 2.0kg/plot improved growth and yield of cucumber. The pig manure has fertilizing effect on cucumber production and could be used as substitute or replacement for scarce and expensive chemical fertilizer and as well reduce environmental hazard posed by the disposal of the pig waste.

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Introduction

Cucumber is used widely in a wide variety of salads and is a very good source of vitamins A, C, K, B_6, potassium, pantothenic acid, magnesium, phosphorus, copper and manganese (Vimala *et al.*, 1999). The ascorbic acid and caffeic acid contained in cucumber help to reduce skin irritation and swollen (Okonmah, 2011). Due to the continued realization of the importance of fruits in our diets and the overwhelming importance of cucumber's health benefits along with skin care, there is increasing demand for the product in Nigeria (Daily Sun, 2011). The demand for the product locally is far overwhelming accounting for its high cost in the market and a worthwhile Agribusiness with high degree of turnover over 200%.

In spite of the increasing relevance of cucumber in Nigeria, low yields are obtained in farmers' fields because of declining soil fertility due to continuous cropping and disregard for soil amendment materials. Fertile soils are required for the production of cucumber as infertile soils result in lower quality of fruits which are not often accepted by consumers (Eifediyi and Remison, 2010). Application of organic manure is one of the ways of improving soil fertility and yield of crops (Enujeke, 2013). Although organic manures contain plant nutrients in small quantities compared to inorganic fertilizers, the presence of growth promoting principle like enzymes and hormones, besides plant nutrients make them essential for improvement of soil fertility and productivity (Bhuma, 2001). However, there seems to be little use of pig manure nationwide, and there is little knowledge available on the effects of the manure on crops for efficient utilization. The study therefore, seeks to evaluate the effects of different rates of pig manure application on the growth and yield of cucumber in South Western Nigeria Agro ecological zone.

Materials and Methods

Experimental site

The experiment was conducted at the Teaching, Research and Commercial Farms of Rufus Giwa Polytecnic, Owo, Ondo State, Nigeria. The land was predominated by *Impereta cylindrica, Sida acuta*, Siam weed and some other common weeds. The land had being under continuous cultivation for three years with no history of fertilizer application. The land was ploughed and harrowed and then stumped manually in order to obtain a clean fine tilt soil.

Experimental design and treatments

The experimental land was divided into 3 blocks of 7.5mx5.93m ($44.5m^2$) each and given a discard

area of 0.6m and 0.5m between each plot. Each plot size was 1.5x5.93m (8.9m^2) which produced a total number 45 plots. The total area of land used was 24mx19m (456m^2).

The experiment were laid out in a Randomized Complete block Design (RCBD) with five (5) treatments replicated three (3) times on each block. The treatments are: T_1= 0kg of pig manure, T2= 0.5kg of pig manure, T3= 1.0kg of pig manure, T4= 1.5kg of pig manure, T5= 2.0kg of pig manure/plant. The manure was applied to the plots four weeks after planting (4 WAP) by ring method of application in order not to burn the root of plants.

Crop establishment and management

The seeds of cucumber were sown at one seed per hole in a spacing of 1mx1m within the rows by dibbling method and supplying was carried out a week after germination. Weeding was done at the early stage by roughing (hand pulling) and at the latter stage; a small hoe and cutlass as at when due. Daksh, (Dichlorvos 1000 % EC, W/V at 500 active ingredients ha-1) insecticide was applied as a prophylactic treatment against leaf bugs and flea beetle infestation 2 weeks after germination to avert insect pest incidence (Aniekwe and Okechukwu 2014).

Analysis of manure and soil

Sample of the pig manure obtained from the livestock session of the Teaching, Research and Commercial Farm of Rufus Giwa Polytechnic Owo was taken for chemical analysis in the Laboratory using standard method (IITA, 1982). Soil samples at a depth of about 0-30cm deep were collected at ten different points on the experimental field before planting using a soil auger. The samples were bulked, air dried and sieved through a 2mm sieve. Representative samples was analyzed for PH using 1:2 (soil: water) suspension, particles size (Bouyuoucos 1962), total nitrogen using the micro Kjeldahl method (Bremner, and Mulrang 1982) and exchangeable cations (K, Ca, Mg and Na) after extraction with NH_4 AOC (PH_7). K in the filtered extract was determined with a flame photometer, while Ca, Na, and Mg were determined with an Atomic Absorption Spectrophometer (Model 210-VGP). Available phosphorus was determined with the Bray I method (Bray and Kurtz, 1965) and total organic carbon was determined by Walkey black method (Nelson and Sommers 1982).

Data collection and Statistical analysis

Five middle stands of cucumber were selected and targeted for data collection. Data collected were: vine length, number of leaves/plant, number of branches, stem girth, fruit circumference (cm), fruit length (cm), and fruit weight at maturity. Vine length was measured with tape from the base to the growing tip of the plant. Number of leaves and branches/plant were determined by direct counting. Stem girth was measured 5cm above the ground level using of digital vainer caliper Fruits circumference were measured using digital venier caliper and fruit length were measured using tape rule, number of fruits were determined by direct counting of harvested fruits, while fruit weight was measured using electronic weighing scale after harvest.

Data collected were subjected to Analysis of Variance (ANOVA) procedures for (RCBD) as described by Gomez and Gomez (1984). Means were compared using Duncan Multiple Range Test (DMRT).

Result

Soil and Pig Manure Analysis

The properties of the soil at the site prior to experimentation and the pig manure used are shown in Table 1. The result of the soil analysis showed that the soil was sandy loam. By this classification, it could be inferred that the soil was of good drainage and well aerated for good root penetration. The soil pH showed that the soil was slightly acidic with pH value of 5.49 (H_2O). The organic matter content was low 0.90% (0.9kg). The low organic matter content could be attributed to the effect of erosion and seasonal burning that was very common in the early January and March annually. The total N was quite low at 0.07% (0.7kg). The low total nitrogen could also be attributed to low organic matter content of about 75% of total organic nitrogen in the soil (Ehiokhilen, 2010). The available phosphorus was quite high at 9.18ppm (9.18mgkg-1). Thus could be as a result of low fixation of P in the study area by sesquioxides or as a result of parent material. The exchangeable cations in Cmol/kg contents of Ca, Na, K and Mg were 0.40, 0.98, and 0.20 cmol/kg, respectively. Hence there was need for application of soil amendment in form of inorganic or organic fertilizers.

Pig manure analysis results show that it had a pH 7.20, OC 28%, OM 41%, total nitrogen content of 0.73%, 14.84mg/kg p of available P, exchangeable cations contents were 0.73% N, 61.500mg/kg, 32 400mg/kgN, 21.350mg/kgCa (table 1) and 13.300mg/kg or Mg.

Growth parameters

The application of pig manure had significant effect on the mean number of leaves, number of branches and leaves area development, while stem girth development was not significantly influenced. However, the growth parameters increased as the rate of pig manure increased from 0kg to 2.0kg/plant (Table 2). This show that the pig manure used contained N, which promoted the vegetative growth

of cucumber and these results might be due to the effective use of the applied pig manure at the plant early stage of growth. This finding is similar to that of Akanbi et al. (2005) and Olaniyi *et a*l. (2008) who reported better vegetative growth of vegetables with N addition. The increase in growth parameters as pig manure rates increased, confirmed the role of organic manure in promoting vigorous vegetative growth in fruit vegetables (Olaniyi *et a*l., 2005; Olaniyi and Ajibola, 2008; Eifediyi and Remison 2010).

Table 1: Soil physical and chemical properties before planting and manure analysis.

Soil	**value**	**Pig Manure**	**Values**
Sand (%)	46	pH (H_2O)	7.20
Silt (%)	45	OC (%)	82
Clay (%)	9	OM (%)	41
Textural class	sandy loam	N (mg/kg)	0.73
Soil pH (H_2O)	5.49	K (mg/kg)	61.500
Organic carbon (%)	0.52	Na (mg/kg)	32.400
Organic matter (%)	0.90	Ca (mg/kg)	21.850
Total nitrogen (%)	0.07	Mg (mg/kg)	13.300
Available P (mg/kg)	9.18	Available P (mg/kg)	14.84
Exchangeable cations			
Na (coml./kg)	0.95		
Ca (coml./kg)	0.40		
K (coml./kg)	0.98		
Mg (coml./kg)	0.20		

Table 2: Mean vegetative growth of cucumber under the effect of pig manure application

Pig manure Kg/plot	Number of leaves	Number of branches	Stem girth (cm)	Leaf Area(cm^2)
0	13.23c	1.19c	1.06a	13.8c
0.5	12.01c	1.08c	1.00a	13.4c
1.0	15.75b	1.48bc	1.08a	17.6ba
1.5	18.80b	1.67a	1.16a	19.6ba
2.0	23.43a	1.99a	1.12a	21.5a

Values followed by the same letter(s) in a column are not significantly different at P<0.05 according to Duncan's Multiple Range Test (DMRT).

Table 3: Mean yield attributes of cucumber under the effect of pig manure application.

Pig manure Kg/plot	Number of fruit	fruit length	fruit circumference	fruit weight(kg)
0	16.3c	45.0c	13.5a	3.7c
0.5	22.3bc	47.8c	12.5a	3.4c
1.0	28.0ba	50.1bc	14.2a	7.20ba
1.5	28.6ba	52.2ba	14.5a	8.06b
2.0	34.0a	54.8a	13.5a	11.009a

Values in the column followed by the same letter(s) are not significantly different DMRT (P<0.05)

Control plots (i.e. without pig manure) could not support appropriate growth of the plants because the residual nutrient content of the soil was inappropriate to support growth of cucumber and the nutrient content of the soil was below the critical level hence poor performance of the crop. This means that the higher the nutrients applied to the soil, the higher the number of growth parameters. The vigorous growth experienced in the crop was evidenced in the increase in number of leaves, branches, leaf area and stem girth /plant with an increase in treatments level of pig manure. This observation agrees with the works of (Aduloju *et al*., 2010 and Dada and Fayinminnu, 2010). They earlier reported that nutrients from mineralization of organic matter promoted growth and yield of cucumber. This further confirmed the study of Lawal (2000) who reported that the improved supply of plant nutrients to cucumber by the application of pig manure would lead to better utilization of carbon and subsequent synthesis of assimilates (Lawal, 2000). The non-significant effect observed in stem girth development corresponded with Ojeniyi (2000) who reported that variation in manure levels do not usually give a significant variation on leaf area per plant of any crop

Fruit yield attributes

The fruit yield attributes (number of fruit, fruits length, fruit circumference, fruit weight per plant), produced by cucumber plants were significantly (P≤0.05) influenced by application of pig manure

(Table 3). These yield attributes increased as the rates of pig manure increased; the highest fruit yield and yield attributes were recorded at 2.0kg/plant rate. However, fruit circumference was not significantly influenced ($P \geq 0.05$) by application rate of pig manure. An increase in quantity of pig manure applied, equally led to a significant increase in number of fruit yield attributes per plant. These results agree with previous report from Ayoola and Adeniran (2006) that variation in nutrients source among treatments will result in a significant variation on fruit yield per plant in most crops. These results could mean that the more the quantity of nutrients supplied in a treatment, the more the increase in fruit yield attributes. However, the less the quantity of nutrients supplied in a treatment, the less the significant increase in the fruit yield attributes per plant as observed by (Ayoola and Adeniran, 2006)

The significant response of parameters evaluated in this study to the applied pig manure may be an indication that the nutrients taken up by the plant was well utilized in cell multiplication, amino acid synthesis and energy formation, hence increase in photosynthesis. This was in consonance with the findings of El-Badawi, (1994) and Lawal, (2000) who reported significant response of cucumber fruit weight per plant and total yield to applied organic manure.

The cucumber vegetative characters such as number of leaves, number of branches, leaf area and stem girth response significantly to the applied pig manure up to the 2.0kg/plot. This resulted in the development of the crop and therefore enhancing assimilates production and accumulation. The result of this study was also in consonance with the findings of Ogunremi, (1990) who reported increase in the yield of melon fruits due to organic manure application.

From the experiment, there is the need for effective manure application as infertile soils result in bitter and misshapened fruits which are often rejected by consumers and hence, reduction in the farmer's earnings (Eifediyi and Remison, 2010). Pig manure applied at 2.0kg/plot improved growth and yield of cucumber. The pig manure has fertilizing effect on cucumber production and could be used as substitute or replacement for scarce and expensive chemical fertilizer and as well reduce environmental hazard posed by the disposal of the pig waste. Further study is required in other to determine the optimal rate of pig manure application for the production of cucumber in south western Nigeria agro-ecological zone.

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