Effects of Pig and Goat Droppings on Soil Physiochemical Properties and Yield of Cucumber (*Cucumis sativus L.*)

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Abstract

This study was carried out at the teaching and research farm of the Department of Crop Production and Horticulture, Lagos State Polytechnic Ikorodu to determine the effects of different levels of goat and pig droppings on the performance of cucumber (Cucumis sativus). The experiment was laid out in Randomized Complete Block Design with five experimental treatments replicated three times. The treatments applied were goat droppings at 5 and 10 tonnes per hectare, pig droppings at 5 and 10 tonnes per hectare and control 0 tonne per hectare. Data collected were vine length (cm), vine girth (cm) number of leaves, number of branches, and days to 50% flowering, weight of fruit (kg), number of fruits, length of fruit (cm) and width of fruits (cm). The results from the data analysis indicated that number of branches of cucumber, its length and diameter were significantly affected by the different rates of application of goat and pig droppings. Based on the outcome of this study, 5 tonnes per hectare of goat manure should actually be adopted for farmers in Ikorodu Local Government Area of Lagos State. However, further research should be carried out to determine the rate of manure suitable for the optimum yield of cucumber (Cucumis sativus). Farmers are advised to use more tonnes of manure at a higher rate to improve soil physio-chemical properties and to enhance crop growth and yield.

Keywords: Pig droppings, Goat dropping, soil physiological properties, yield, cucumber

Introduction

Cucumis sativus is a widely cultivated plant in the gourd family, Cucurbitaceae. It is a creeping vine that bears cucumiform fruits that are used as vegetables. There are three main varieties of cucumber: slicing, pickling, and seedless. Within these varieties, several cultivars have been created. The cucumber is originally from South Asia, but now grows on most continents. Many different types of cucumber are traded on the global market (Nonneck, 1989; Wells, 2016).

The cucumber is a creeping vine that roots in the ground up trellises or other supporting frames, wrapping around supports with thin, spiraling tendrils. The plant may also root in a soilless medium and will prowl along the ground. The vine has large leaves that form a canopy over the fruits. The fruit is roughly cylindrical, but elongated with tapered ends, and may be as large as 60 centimetres (24 in) long and 10 centimetres (3.9 in) in diameter.

Cucumber fruit consist of 95% water. They are vine crops and grown on the ground or on poles or trellises to suspend to fruit (Nonneck, 1989; Wells, 2016) Cucumbers come in three different types: seedless, seeded, and mini. The soils where cucumber is cultivated require moderate to high nutrient levels so as to achieve high yields. Infertile soils result in bitter and misshapen fruits which are often rejected by consumers thereby reducing farmers' income. (Jannick *et al*., 2007).

Production of cucumber in Nigeria has increased probably due to awareness being created by its market demand and economic returns, short duration in maturity or due to its nutritional and medicinal values. Hence it has become a popular vegetable crop in Nigeria. Both older and young people enjoy the cucumber fruit of which many in their leisure time usually eat with fried groundnut in their offices, homes, and market place or recreational areas. This crop required high amount of soil nutrients from seedling stage to maturity and highly sensitive to excessive water or water-logs environment and adequate soil tillage for easy fragile root penetration, is required prior to sowing or planting (Nweke *et al*., 2014).

Nigeria soil has high potential for crop production but yields levels obtained under farmer's condition are usually low due to poor soil management and conservation method, because of problems associated with the use of chemical fertilizers as its scarcity, high cost, ineffectiveness due to blanket use, soil acidity, nutrients, hence the use of Organic Fertilizers to solve all these problems. This necessitates the need to carry out research for good and economical soil management practices in other to improve the soil condition and reduce harm caused by the use of inorganic fertilizers thereby increasing the productivity of arable land. The main objective of this study is to determine the effect of variable rates of pig and goat droppings on the soil physiochemical properties and yield of cucumber (*Cucumis sativus*).

Materials and Methods

Experimental location, land preparation, experimental design and treatments

The experiment was carried out at the Teaching and Research Farms of Lagos State Polytechnic, Ikorodu, Lagos State Nigeria. The experimental site has been under continuous cultivation for over three years without any forms soil amendments. The land was ploughed and harrowed to a fine tilt using a disc plough and harrow.

The experiment was laid out in Randomized Complete Block Design (RCBD**)** because of the heterogeneity of soil at the experimental location. The experiment was carried out on a total area of land measuring 100.8m^2 which was divided into 3 blocks of 18m x 1.2m (2.6m^2), each plot size is 1.2m x 3m (3.6m^2) with a discard of 0.5m to give a total number of 15 plots.

Pig and goat droppings were obtained from nearby farm (Farm Settlement Odogunyan, Ikorodu, Lagos State). The droppings were cured and applied two weeks before planting to allow for mineralization (Eifediyi and Remison, 2010).

Five (5) treatments was used throughout the study which are; Goat droppings(5 and 10 tons ha^{-1}), pig droppings(5 and 10 tons ha^{-1}) and the control plot, which were replicated three times. In addition, the goat droppings and pig droppings were applied to the plots two weeks before planting by broadcasting method.

Crop establishment and maintenance

Cucumber seeds was obtained from agro-allied store Sabo market Ikorodu, Lagos State. Planting was done directly on the main field at a spacing of 60cm x 75cm (Chude etal., 2004) at two seeds per hole then thinned to one stand each at one week after planting and

transplanting was also done to supply missing stands to give a total of 8 plants per plot and a total of 120 plants. Manual weeding was carried out on a weekly basis with the use of hoe, which was due to the high grasses infestation and the high rains during the course of the project. Spraying of insecticides and fungicide was done at biweekly intervals to ensure effective chemical control of insects and fungi attacks at seedling stage.

Soil sampling, preparation and Analysis

The soil of the experimental site was analyzed twice, the first one before planting (pre-planting soil analysis) and the second after harvesting (post- planting soil analysis). Soil sample from the top soil 0-20 cm were randomly collected with soil auger from the experiment site for laboratory analysis.. The samples for the experiment were composited, air dried, ground and sieved to pass through a 2mm sieve. The soil sample was analyzed for soil texture, pH, organic carbon, organic matter, total N, exchangeable p, and Exchangeable levels of Ca, Mg, k, Na, Fe, Cu, Mn, Zn, and cation exchange capacity. The two types of manure samples were air dried for and ground to pass through 2mm sieve. The samples were then applied to the plot

Harvesting

Matured fruits were selected for harvest at seven weeks after planting. Harvesting was done by carefully cutting the fruits free from the stalk with the use of sharp knife. The harvested fruits were then taken for data collection.

Data collection and Statistical Analysis

Four (4) plant stands was randomly sampled and tagged per plot for data collection. Data that were collected include:

Growth Parameters; number of leaves. vine length (cm), and number of branches. Yield Parameters; number of days to 50% flowering, number of fruits per plot, length of the fruits (cm), fruits diameter (mm), weight of fruits per plot (kg).

Data collected were subjected to Analysis of Variance (ANOVA), and means of treatments were compared using Duncan Multiple Range Test (DMRT) at 5% level of probability using SAS (version 9.4).

Results

Effect of goat and pig droppings on number of leaves of *Cucumis sativus*

Table 4.1 showed that the number of leaves of cucumber was not significantly affected by different rate of application of goat and pig droppings at 5% level of significance.

At 2 WAP, the highest mean number of leaves (4.83) was observed from *Cucumis sativus* grown with 10tons/ha of pig droppings. However, at 4 WAP the highest mean number of leaves (14.11) was observed from *Cucumis sativus* grown with 10 tons/ha of goat dropping. Meanwhile, at 6 WAP the least mean number of leaves (19.67) was observed from Cucumis sativa grown without manure application (control 0 ton/Ha).

Effect of goat and pig droppings on vine girth (cm) of *Cucumis sativus*

Table 4.1 revealed that at 2 WAP, the thickest stem girth of 0.87 cm was achieved with 5 tons/ha of pig droppings, while the thinnest stem girth of 0.21cm was observed from *Cucumis sativus* grown without manure application (control 0 ton/ha). Whereas, at 4 WAP the thickest stem girth of 0.72 cm was 1.19 obtained from *Cucumis sativus* grown with 10 tons/ha of pig droppings. However, at 6 WAP the thickest stem girth of 1.19cm was also obtained from *Cucumis sativus* grown with 10 tons/ha of pig dropping.

Effect of goat and pig droppings on number of branches of *Cucumis sativus*

Table 4.1, revealed that at 4 WAP the treatments means were significantly different from one another, where the highest mean value of branches (10.58) was produced by *Cucumis sativus* grown with no manure goat droppings while the least was observed from *Cucumis sativus* grown with pig droppings of 5 tons/ha of 5tons/ha and it was also observed that *Cucumis sativus* grown with goat droppings at 5tons/ha had same mean value (8.0) with *Cucumis sativus* grown with 10 tons/ha of pig droppings. However, at 6 WAP *Cucumis sativus* grown without manure application (control 0 ton/ha) had the highest (19.5) number of branches when compare to *Cucumis sativus* grown with 10 tons/ha of pig droppings (16.0) and *Cucumis sativus* grown with goat droppings of 10 tons/ha (13.89).

Effect of goat and pig droppings on vine length (cm) of *Cucumis sativus*

From table 4.1, the vine length of cucumber was not significantly affected by different rate of application of goat and pig droppings at 5% level of significance.

At 4 WAP the longest vine of 12.21 cm was obtained from Cucumis sativa grown with Goat droppings 10 tons/ha and it was observed that *Cucumis sativus* grown with goat dropping of 5 tons/ha and pig droppings of 10 tons/ha had same mean value of 11.58 cm while the shortest vine length (8.00) was obtained from *Cucumis sativus* grown without manure application (control 0 tons/ha). At 6WAP the longest vines (22.20) was observed from *Cucumis sativus* grown without manure application (control 0 tons/ha).

Effect of goat and pig droppings on days to 50% flowering of *Cucumis sativus*

Table 4.2, the different rate of application of goat and pig droppings at 5% level of significance has no significant effect of 50 days to flowering. *Cucumis sativus* grown with Goat droppings at 5tons/ha had the highest (35.58) days to 50%flowering while the least days (32.17) was obtained from *Cucumis sativus* grown with Goat droppings at 10 tons/ha.

Effect of goat and pig droppings on number of fruits of *Cucumis sativus*

According table 4.5, Cucumber grown with 5 tonnes/ha of goat droppings significantly produced the highest fruits with mean value of 8.10 than 7.47 mean number of fruits obtained from Cucumber grown with 10 tonnes/ha of goat droppings which was also significantly different from Cucumber grown with 5 tonnes/ha of pig droppings (7.22), 10 tons/ha of pig droppings (7.15) and 6.41 mean number of fruits obtained from Cucumber grown with no manure application.

Effect of goat and pig droppings on fruits length (cm) of *Cucumis sativus*

From table 4.5, the application rate of goat and pig droppings had no significant effect on the fruit length of cucumber. Cucumber grown with 5 tonnes/ha of goat droppings produced the longest fruits with mean value of 19.78 cm, followed by 19.45 cm mean fruit length obtained from cucumber grown with 5 tonnes/ha of goat droppings while the shortest fruit with mean value of 12.72 cm was obtained from cucumber grown without manure application.

Effect of goat and pig droppings on fruits diameter (cm) of *Cucumis sativus*

According to table 4.5, Cucumber grown with 5 tonnes/ha of goat droppings produced the fattest fruit with mean value of 23.55cm, followed by 20.40 cm mean fruit width obtained from Cucumber grown with 10tonnes/ha of goat droppings which was significantly different from 5.74 cm, 15.14 cm and 3.96 cm mean fruit width obtained from Cucumber grown with 5

tonnes of pig droppings, followed by Cucumber grown with 10 tonnes of pig droppings and Cucumber grown without manure application.

Table 4.1. *Effect of goat and pig droppings on growth of Cucumis sativus at 2 weeks after planting (WAP).*

Manure Types and Quantity	No. of leaves	Vine girth (cm)
5 tons/ha Goat dropping	1.83	0. 28
10 tons/ha Goat dropping	3.42	0.29
5tons/ha Pig dropping	4.75	0.87
10 tons/ha Pig dropping	4.83	0.29
Zero manure application	4.33	0.21
	ns	ns

Table 4.2. *Effect of goat and pig droppings on growth of Cucumis sativus over the period of 4 weeks after planting (WAP).*

Manure Types and Quantity	No. of leaves	Stem girth (cm)	No. of branches	Vine length (cm)
5 tons/ha Goat dropping	13.25	0.62	8.00ab	11.58
10 tons/ha Goat dropping	14.11	0.65	6.94ab	12.21
5tons/ha Pig dropping	11.33	0.61	5.50b	9.88
10 tons/ha Pig dropping	12.17	0.72	8.00ab	11.58
Zero manure application	9.750	0.59	10.58a	8.00

Values represent treatment means. Means were separated using Duncan multiple range test and means within a column followed by different letters are significantly different at P≤0.05.

Effect of goat and pig droppings on fruits yield (kg) of *Cucumis sativus*

From table 4.5, the fruits weights of cucumber were not significantly affected by different rate of application of goat and pig droppings at 5% level of significance. Cucumber grown with 5 tons/ha of goat droppings produced the highest fruits weight of 0.67 kg/plot while least fruits weight with mean value of 0.40 kg/plot was obtained from Cucumber grown without manure application.

Table 4.3. *Effect of goat and pig droppings on growth of Cucumis sativus over the period of 6 weeks after planting (WAP).*

Manure Types and Quantity	No. of leaves	vine girth (cm)	No. of branches	Vine length (cm)
5 tons/ha Goat dropping	45.42	1.17	12.25b	15.68
10 tons/ha Goat dropping	25.03	1.03	13.89ab	12.61
5tons/ha Pig dropping	20.67	1.11	11.00ab	12.10
10 tons/ha Pig dropping	22.17	1.19	16.00ab	12.50
Zero manure application	19.67	1.09	19.50a	22.20

Values represent treatment means. Means were separated using Duncan multiple range test and means within a column followed by different letters are significantly different at P≤0.05.

Table 4.4. *Effect of goat and pig droppings on yield component Cucumis sativus (L).*

	Number of days to 50% flowering	NF	FL (cm)	FD (mm)	FW (kg/ plot)
5 tons/ha Goat dropping	35.58	8.10	19.78	23.55	0.67
10 tons/ha Goat dropping	32.17	7.47	19.45	20.40	0.55
5tons/ha Pig dropping	33.58	7.22	15.33	15.14	0.53
10 tons/ha Pig dropping	33.17	7.15	14.16	5.74	0.53
Zero manure application	33.08 ns	6.41 ns	12.72 ns	3.96 ns	0.40 ns

NF = Number of fruit, FL = Fruit length, FD= fruit diameter, FW= fruit weight

Discussion

Statistical analysis indicated that number of branches of cucumber was significantly affected by the different rate of application of goat and pig droppings. In terms of yield, Goat droppings at 5 tonne per hectare performed best in most growth parameters followed by 10 tons/ha of pig droppings, although there was no significant different in terms of yield but however yield parameters had best performance from 5 tons/ha of goat manure, This result is contrary to the findings of Chiezey and Odunje (2009) who observed that application of organic manure gives significant improvement in crop growth and yield.

Soil analysis of pre-data and post planting of the experimental site

The physiological properties of the experimental soil were presented in table 6. It was shown that the soil was sandy clay loam in texture, with high portion of sand (70.5%). This implies that basic cation such as Ca, k, Na and Mg could be leached more easily as texture determines the degree of retention or ease of leaching of basic cations according to Wapa and Oyetayo, 2014.

The pre-soil analysis shows that pH was 5.51, while in the post soil analysis the soil was slightly acidic which varied from 5.15-6.13 for the treated plots. The soil pH for the control was 5.49. Soil treated with pig droppings at 10 tons/ha had the least pH value of 5.15 while plot treated with goat droppings at 5tons/ha had the highest value of 6.13. Soil acidity has been reported as one of the major constraints to crop growth in tropical region. This implies that organic manures could serve as good materials for ameliorating acidic soil to 6-7 as reported by Sanni.and Adenubi, (2015) that pH requirement for optimum growth and yield of eggplant being pH 6.4.

The pre-soil analysis revealed that the soil was low in organic carbon (0.42%), organic matter (0.72%), total N (0.04%), Ca (3.79cmol/kg) available p was higher (34.80mg/kg), but increased in the post-soil analysis. Organic carbon for control was 1.7%, it varied between 1.30%-2.03% for treated plots, and plot treated with goat droppings at 5tons / ha had the highest value of 2.03% while the lowest value (1.30%) was observed from soil treated with pig dropping at 5tons /ha.Total N for control was 0.15%, it varied between 0.11-0.18 for

treated plot, plot treated with goat droppings at 5 tons/ha had the highest value (0.18%) while the least value (0.11%) was observed from soil treated with pig droppings at 5tons/ha.

Available p for control plot was 10.61 mg/kg, it varied between 9.57-21.05 for treated plot, goat droppings at 5 tons/ha had the highest value of 21.05mg/kg while the least value(9.57mg/kg) was observed from plot treated with pig droppings at 5tons/ha.

Exchangeable Ca for control was 6.76 cmol/kg) while plot treated with goat droppings at 5tons/ha had the highest value with 7.96 and plot treated with pig droppings at 10 tons/ha had lowest value of 5.67cmol/kg.

Table 4.5. *Soil properties at experimental site and soil physio-chemical as influenced manure*

Sample label	Pre field trial soil analysis	Post field trial soil analysis				
		Goat 5t/ha	Goat10t/ha	Pig 5t/ha	Pig10t/ha	Control (0t/ha ha)
pH(H20)	5.51	6.13	5.35	5.57	5.15	5.49
O.C (%)	0.42	2.03	1.84	1.30	1.44	1.76
O.M (%)	0.72	3.51	3.16	2.34	2.48	3.03
TN (%)	0.04	0.18	0.16	0.11	0.12	0.15
Na (Cmol/kg)	0.131	8.09	8.21	7.96	7.96	8.35
Ca (Cmol/kg)	3.79	7.96	5.67	6.39	7.10	6.76
Mg (Cmol/kg)	0.67	2.95	2.39	2.37	2.74	3.13
K (Cmol/kg)	0.10	3.15	5.37	3.15	3.53	3.84
H (Cmol/kg)	1	1	1.5	2	1	1
AL (Cmol/kg)	0.4	0.3	0.2	0.3	0.1	0.2
CEC (Cmol/kg)		23.34	23.34	22.17	22.82	23.41
Fe (mg/kg)	44	133.7	103.7	124.9	133.7	138.2
Cu (mg/kg)	1.8	20.11	3.73	3.16	3.68	5.45
Mn (mg/kg)	41.8	246	276	164	440	480
Zn (mg/kg)	4.9	30.02	31.52	21.10	44.16	49.72
P (mg/kg)	34.8	21.05	15.14	9.57	20.71	10.61
% Sand	70.5	72.5	72.5	72.5	74.5	74.5
% Clay	21	21	21	21	19	19
% Silt	8.5	6.5	6.5	6.5	6.5	6.5
TC	SCL	SCL	SCL	SCL	SL	SL

treatment

Source: Forestry research institute of Nigeria, Ibadan
Soil and tree nutrition department

However, Akinrinde and Obigbesan, (2000) recommended appropriate organic carbon, organic matter, TN, Ca, Available P for sustainable crop production in agro-ecological zones of Nigeria as these components (OC, OM, TN, Ca, and P) are important nutrients required for plant growth, development and yield formation. Therefore, the soil requires amendment from

different sources of nutrients to ameliorate their deficiencies and responses to organic manure applied was highly anticipated.

The pre-soil analysis shows that Fe (44mg/kg), Cu (1.8mg/kg), Mn (41.8mg/kg), Mg (0.67Cmol/kg), k (0.10Cmol/kg) and Zn (4.9mg/kg) were low, meanwhile they were far more higher in post field trial soil analysis. Abdul-Allah *et al*. (2001); Boyoumi, (2005) and Ehaliotis *et al*. (2005) had reported that Fe, Zn, and Mn encourages vegetative growth, total chlorophyll and the photosynthetic rate of plants which enhance flowering and fruiting thus leading to an increase early maturity. More so, Abou-Hussein (2001) reported that cucumber fruit made used of more K and Mg than major nutrients in the soil which helps in increasing fruit sets, encourage root growth, promotes leaf growth and reduces plant respiration.

Exchangeable H was 1Cmol/kg in the pre-soil analysis while it was observed in the post soil analysis that the control plot, plot treated with 10 tonnes/ha of pig droppings and plot treated with 5 tonnes/ha of goat droppings had same value of 1Cmol/kg with the pre-soil analysis, which was also observed has the lowest values while the highest value was obtained from plot treated with 5 tonnes/ha of pig droppings. Exchangeable Al was high (0.4Cmol) in the pre-soil analysis but low in post-data analysis, it varies from 0.1-0.3 for treated plot while control plot was 0.2 Cmol/kg. However, Aluminum toxicity is potential growth-limiting factor of plant grown in acid soil worldwide. Acid soils (with a pH of 5.55 or lower) are most prone to aluminium toxicity to limit agricultural production. The total Al concentration in the soil and the forms of Al species depends on soil pH and the chemical environment of the soil solution (Kisnierinene and Lepeikaite, 2015).

The pre-soil analysis shows that sand, clay, silt are 70.5%, 21% and 8.5% respectively meanwhile post-data analysis revealed that plot treated with goat at 5tons/ha , goat at 10tons/ha followed by pig at 5tons/ha had same value of sand, clay, silt with 72%, 21%, 6.5% and same textural class(SCL) respectively, similarly plot treated with pig at 1otons/ha and plot without treatment(control 0ton/ha) had same percentage of sand (74%), clay(19%), silt(6.5%) and same textural class(SL)respectively. Control has CEC of 23.41 which was improved in plot treated with goat droppings at 5 ton/ha with value 23.45 This implies that basic cation such as Ca, k, Na and Mg would be leached more easily as texture determines the degree of retention or ease of leaching of basic cations (Wapa and Oyetayo, 2014)

Conclusion

In terms of growth parameters 5 and 10 tonnes per hectare goat droppings had the best performance even if there was no significant difference but however, in terms of yield 5 tonnes per hectare of goat droppings had a better performance

Recommendation

Based on the outcome of the study, 5 tonnes of goat droppings per hectare should actually be adopted for farmers in Ikorodu Local Government Area of Lagos State.

However, further research should be carried out to determine the rate of manure suitable for the optimum yield of cucumber (*Cucumis sativus).* Farmers are advised to used more tones of manure at a higher rate to improve soil physio-chemical properties and to enhance crop growth and yield.

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