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Research Article

Effects of Four Different Levels of Goat Manure on Growth and Yield of Christmas Melon (*Laganaria breviflorus*) in Abraka, Delta State, Nigeria

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ABSTRACT

The present study was carried out at the Experimental Farm of Delta State University, Abraka in 2022 and repeated in the 2023 planting season to assess the effects of four different levels of goat manure on the growth and yield of Christmas melon (*L. breviflorus*) in Abraka area of Delta State, Nigeria. It was a randomized complete block experiment with three replicates. Rates of goat manure applied in tons per hectare were 0, 5, 10 and 15, while the parameters investigated were initial soil physicochemical properties, vine length, number of leaves/plant, number of branches/plant and weight of fruits of Christmas melon obtained after maturity. The study results showed that the parameters assessed were significantly influenced by the application of goat manure, except for the number of branches/plants. At 5, 10 and 15 weeks after planting, plants with a manure application rate of 15that^{-1} were superior to other treatments. Based on the study's findings, it is recommended that farmers in the study area apply 15that^{-1} of goat manure for increased growth and yield of Christmas melon.

Keywords: Growth and yield; Christmas melon; Rates; Goat manure; Abraka; Nigeria

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INTRODUCTION

Christmas melon *(Laganaria breviflous)* is a variety of melon family *cucurbitaceous* (Schmidt, 2003) originating in Spain. It is usually planted in mid-march and it grows to at least 30cm long depending on the fertility of the soil and is ovoid, with a diameter of 15cm. It matures in about 110 days and is harvested between mid-June to mid-July. It has a thick, green-striped outer rind and pale green-to-white inner flesh with a mild melon flavour and sweetness close to honeydew melons. It has a blotched green peel after which it is named in Spanish *Piel de Sapo* meaning "toad skin". The attractive green and gold-to-bright yellow-striped colour resembles a small watermelon. Inside is a melon and mildly flavoured, pale-greenish flesh very similar to that of a honeydew. When ripe, it has a soft blossom end that yields to gentle pressure and a vibrant yellow hue. The melon was named in English as recognition of its long-keeping qualities (Schmidt, 2003) that is "Until Christmas". It is grown all year round and the flesh of uncut Christmas melon is juicer and softer if kept at room temperature one or two days before serving. An excellent keeper, this hardy melon can be kept up to six weeks longer than other varieties.

It is used to ward off viral diseases such as chicken pox and measles in humans, Marek's disease, and Newcastle disease in livestock and boost their immune system. It is also used in the treatment of hepatitis, Lassa fever and COVID-19, as well as infertility issues in females. It served to cure gonorrhea and cancer and to remove unwanted hairs from the human body. The whole fruit of *Laganaria breviflous* showed potential in the inhibitory effect of toxigenic fungal isolates in Ofade rice (Amin and Yetunde, 2021).

In spite of the increasing relevance of Christmas melon to humans and livestock species, declining soil fertility due to continuous cropping and leaching of soil nutrients caused by torrential rainfall, limits its production, especially in Nigeria. Enujeke *et al*. (2022) posited that organic fertilizers improve soil fertility, and

quality, enhance soil available nutrients as well as microorganism population and diversity. The researcher further indicated that the application of organic manure, such as goat manure, to the soil improves soil health concerning its ability and sustainability to function as a living ecosystem. Batubara (2021) argued that aside from slowly releasing plant nutrients overtime, organic matter also improves soil structure and water retaining capacity which eventually increases (Enujeke *et al.*, 2022). Goat manure contains such macronutrients as N, P, K, Ca, Mg and S, as well as micronutrients like Zn, Cu, Mo, Co, B, Mn and Fe although in small amounts (Juarsah, 2014), which contribute in enhancing soil fertility for increased crop productivity. Goat manure contains 46.58% organic C, 1.34% N, 0.54 P and 1.56% K (Batubara *et al*, 2021). However, the NPK content of the manure used in this study was 1.2%N, 0.4%P and 1.3%K. Also, there is a paucity of information on the rate of organic manure required to enhance its production in Abraka area of Delta State. The objective of this research work therefore was to determine the effects for four different levels of manure on the growth and yield of Christmas melon in Abraka, Delta State, Nigeria.

MATERIALS AND METHODS

Description of Experimental Site, Fieldwork and Laboratory Studies

The research work was done at the Experimental site of Delta State University, Abraka which is located between Latitude 6°4°E and Latitude 5°54′N. Two distinct seasons are usually observed in Abraka: the rainy season (April-October) and dry season (November-March). The annual rainfall ranges from 2000mm to 3000mm per annum, while the temperature ranges from 25°-31°c (Efe and Aruegodore, 2003).

A land measuring 323.2m^2 (32.0m x 10.1m) was ploughed and harrowed using tractor and marked out according to the experimental layout. Fifteen plots, each measuring 6.0m x 2.7m were made and soil samples were collected from the plots at a depth of 0-15cm with a view to assessing the initial physico-chemical properties.

The soil samples collected from the individuals plots were air-dried at room temperature of 27oc for three days, crushedand filtered using 2mm sieve. Particle size distribution was ascertained using hydrometer method as suggested by Gee and Bauder (1986), while Pye Unican model Mk 2 pH meter was used to know the pH in a 1:2:5 soil/water suspension ratio. The Walkley-Black wet oxidation method recommended by Nelson and Sommers (1982) was used to determine the organic carbon, while micro-kjedahl distillation technique recommended by Breminer and Mulvaney (1982) was used to know the total nitrogen. Bray No. 1 method indicated by IITA (1979) was used to ascertain the available phosphorus, exchangeable potassium was obtained using flame photometer while ammonium acetate saturation method suggested by Roades (1982) was used to determine the cation exchange capacity (CEC). The goat manure used for the study was analyzed as recommended in IITA manuals (1979).

Experimental Design

It was a Randomized Complete Block experiment with three replicates. Rates of goat manure applied in tons per hectare were 0, 5, 10 and 15. The manure was incorporated into the soil two weeks before planting.

Seed Collection and Planting

Seeds of Christmas melon were collected from Ago-allied Company, Ibadan, and sown on the plots at 4 seeds per stand at 2.5cm depth, using a spacing of 90cm x 75cm, with Alley pathways of 1m.

Weeding

Careful regular weeding was done around the base of the plant, along and ahead of the vines using hoe.

Data Collection

Data was collected from fourteen middle stands. Data collected were vine length, number of leaves/plant, number of branches/plant, and weight of fruits at maturity. Measuring tape was used to measure the vine length from the base to the growing tip of the plant. Number of leaves/plant and number of branches/plant were known by counting, while weight of fruits were determined, after harvesting at 110days using a weighing scale.

Data Analysis

Data collected were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan Multiple Range Test (DMRT) according to Wahua (1999).

RESULTS AND DISCUSSION

Particle Size Distribution

The particle size fractions (Table 1) indicates that the soils were sandy loam with low fertility status as shown by the low organic matter content (14.7 gkg^{-1}), and total nitrogen of 0.85 gkg^{-1}. Soil pH was strongly acidic with values of 5.1. The available phosphorus (P) and water soluble potassium (K) with values of 5.20 mgkg^{-1} and 0.15 cmolkg^{-1}, respectively were low with respect to FMANR (1996) rating for the ecological zone. The low fertility status of the soil could be attributed to effects of torrential rainfall associated with erosion and leaching in most ultisols of humid environment that strongly weathers off low activity clay mineralogy leading to high acidity.

Effects of four different levels of goat manure on growth and yield parameters of Christmas melon

Significant difference ($P \leq 0.05$) were observed in vine length of *L. breviflorus* planted in plots that received different levels of goat manure. Seeds grown in plots that received 15 tha^{-1} of manure had the highest vine length of 68.6cm in 2022 and 70.4cm in 2023 at 15 weeks after planting and were significantly different ($P \leq 0.05$) from those that received other rates of manure (Table 2). Seeds that received 10 tha^{-1} of manure also had appreciable vine length of 60.6cm in 2022 and 62.2cm in 2023, which differed significantly ($P \leq 0.05$) from those of plots that received 5 tha^{-1}, which had vine lengths of 54.2cm and 54.8cm in 2022 and 2023, respectively. Seeds that did not receive manure (0 tha^{-1}) had the lowest vine length of 46.4cm in 2022 and 46.8cm in 2023.

The number of leaves/plant and weight of fruits of *L. breviflorus* planted in plots that received 15 tha^{-1} of goat manure were significantly ($P \leq 0.05$) higher when compared with those that received other levels of manure at 15 weeks after planting (Tables 3 and 5) respectively. For instance, highest number of leaves/plant of 36.4 and 36.8 were recorded in 2022 and 2023, respectively, while weight of fruits were 720kg and 728kg in 2022 and 2023, respectively.

The number of branches/plants of *L. Breviflorus* obtained from plants which received the four different levels of manure were not significantly ($P \leq 0.05$) different at 5, 10 and 15 weeks after planting though the values obtained increased as the rate of manure increased (Table 4).

The outstanding performance of plants that received goat manure application rate of 15 tha^{-1} with respect to vine length, number of leaves/plant and branches/plant suggests that application rate resulted in higher carbon content which enhances the activities of beneficial micro-organisms that improve soil fertility and make nutrients available for plant's use. This is similar to the findings of Eifediya and Remison (2010) who reported increased growth parameters of cucumber due to improved supply of nutrients, better utilization of carbon and subsequent synthesis of assimilates. It could also be attributed to the release of nitrogen from the mineralization of ammonia contained in the manure. This is consistent with the findings of Enujeke (2022) who traced the increased vine length, number of leaves and branches of watermelon to release of nitrogen from applied cow dung. It is also in consonance with the findings of Akande *et al*. (2005) and Stevens *et al*., (2018) which reported that nitrogen released from organic fertilizers enhanced vegetative growth of vegetables.

The superiority in fruit weight of plants that received 15 tha^{-1} of goat manure over other rates of application suggest that the plant received the most appropriate level of goat manure needed for increased fruit weight of *L. breviflorus* in the study area. This is similar to the findings of Fikadu-Labeta and Refisa-Jabessa (2019) who posited that highest rate of manure to carrot had better growth and marketable yield. It is also consistent with the findings of Juarsah (2015) who reported that goat manure contains such micronutrients as N, P, K, Mg and S, as well as micronutrients like Zn, Cu, Mo, B, Mn and Fe which contribute to enhancing soil fertility for increased crop productivity. Similar report was published by Batubara *et al*., (2021) which posited that goat manure contains 46.58% C, 1.34% N, 0.54% P and 1.56% K all of which contribute to improving soil fertility for enhanced yield of benefitting crops.

Table 1: Initial physico-chemical properties of soil used for the study

Parameters measured	Values obtained
Particle size fractions (%)	
Sand	86.0
Silt	9.8
Clay	4.2
Textural class	Sandy loam
pH (H_2O)	5.1
Organic matter (gkg^{-1})	14.7
Total nitrogen (gkg^{-1})	0.85
Available P ($mgkg^{-1}$)	5.20
Exchangeable K ($cmolkg^{-1}$)	0.15
CEC ($cmolkg^{-1}$)	10.15

Table 2: Effects of four different rates of goat manure on vine length of Christmas melon (cm) in 2022 and 2023

Weeks after planting	5			10			15		
	2022	2023	Mean	2022	2023	Mean	2022	2023	mean
Rate of goat manure (tons/ha)									
0	14.0_d	14.8_d	14.4	28.2_d	28.6_d	28.4	46.4_d	46.8_d	46.6
5	24.2_c	26.6_c	25.4	38.6_c	38.4_c	38.5	54.2_c	54.8_c	54.5
10	30.6_b	32.8_b	31.7	46.2_b	48.8_b	47.5	60.6_b	62.2_b	61.4
15	38.2_a	40.0_a	39.1	58.4_a	60.2_a	59.3	68.2_a	70.4_a	69.3

Means with the same alphabets under the same column are not significantly different ($P \leq 0.05$) using Duncan Multiple Range Test (DMRT)

Table 3: Effects of four different rates of goat manure on number of leaves/plant of Christmas melon in 2022 and 2023

Weeks after planting	5			10			15		
	2022	2023	Mean	2022	2023	Mean	2022	2023	mean
Rate of goat manure (tons/ha)									
0	6.4_d	6.6_d	6.5	10.2_d	10.6_d	10.4	14.2_d	14.6_d	14.4
5	10.4_c	10.8_c	10.6	14.4_c	14.8_c	14.6	20.4_c	20.8_c	20.6
10	17.6_b	17.8_b	17.7	24.2_b	25.6_b	24.9	32.2_b	32.6_b	32.4
15	26.2_a	26.8_a	26.5	28.6_a	28.8_a	28.7	36.4_a	36.8_a	36.6

Means with similar letters under the same column are not significantly different (≤ 0.05) using Duncan Multiple Range Test (DMRT)

Table 4: Effects of four different rates of goat manure on number of branches/plant of Christmas melon in 2022 and 2023

Weeks after planting	5			10			15		
	2022	2023	Mean	2022	2023	Mean	2022	2023	mean
Rate of goat manure (tons/ha)									
0	1.20_a	1.42_a	1.31	2.46_a	2.64_a	2.55	3.82_a	3.88_a	3.85
5	2.42_a	2.60_a	2.51	3.54_a	3.66_a	3.60	4.54_a	4.76_a	4.65
10	3.20_a	3.44_a	3.32	4.62_a	4.84_a	4.73	5.60_a	5.82_a	5.71
15	4.10_a	4.46_a	4.28	5.42_a	5.92_a	5.67	6.56_a	6.88_a	6.72

Means with similar letters under the same column are not significantly different P (≤ 0.05) using Duncan Multiple Range Test (DMRT)

Table 5: Effects of four different rates of goat manure on fruit weight (kg) of Christmas melon in 2022 and 2023

	2022	2023	Mean
Rate of goat manure (tons/ha)			
0	492_d	498_d	495
5	562_c	576_c	569
10	684_b	692_n	688
15	720_a	728_a	724

Means with the same alphabets under the same column are not significantly different ($P \leq 0.05$) using Duncan Multiple Range Test (DMRT).

CONCLUSION

The study evaluated the effects of four different rates of goat manure on the growth and yield of Christmas melon. The experiment was conducted in a randomized complete block design with three replications. To achieve the objectives of the study, parameters assessed were vine length, number leaves/plant, number of branches/plant and weight of fruit of *L. breviflorus*. The results revealed that plants which received 15 tha^{-1} manure application rate were outstanding in all the parameters investigated. Hence, it

was recommended that farmers adopt application of 15 tha^{-1} of goat manure for growth and yield enhancement of Christmas melon in Abraka, Nigeria.

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