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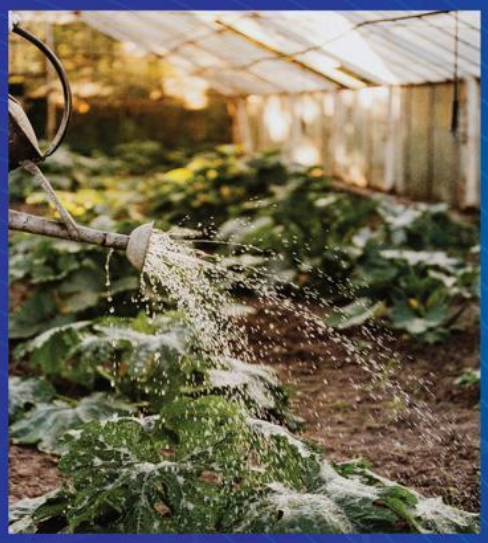

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EFFECT OF SHEEP DROPPING MANURE APPLICATION RATE AND METHODS OF PROPAGATION ON THE GROWTH AND YIELD COMPONENT OF CUCUMBER (*Cucumis sativum*) IN ANYIGBA, KOGI STATE, NIGERIA

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ABSTRACT

This study was conducted at Crop Production Nursery Farm, Faculty of Agriculture, Kogi State University Anyigba. The study area which is Kogi State, to determine the effect of sheep dropping rate and staking on the yield and yield component of cucumber. Staked and unstaked and four treatment levels (0, 10, 20 and 30 kg per hectare) were evaluated. The study was conducted as a 2x1 factorial laid out in randomized complete block design (RCBD) with three replications. Treatment means were separated using least significant difference ($LSD_{0.05}$). The result generated from the study showed that number of fruits, number of marketable fruits and weight of fruits. Staking had no significant effect on number of fruits, but showed significant effect on number of branches, number of leaves and plant height. The staked treatment constantly performed better with higher values than the non-staked treatment. Result obtained from data analysis shows that Cucumber growth, yields and yield components were enhanced with the incorporation of Poultry droppings across various treatment rates. Hence for maximum production of cucumber staking and optimum sheep dropping should be adopted.

Keywords: Cucumber, Growth, Staking, Sheep dropping, Yield.

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INTRODUCTION

The Cucumber (*Cucumis sativus*) is a creeping vine that roots in the ground and grows up trellises or other supporting frames, wrapping around supports with thin, spiralling tendrils. It is of the monoecious annual crops in the Cucurbitaceae family and genus *Cucumis*. The Cucurbitaceae family is reasonably large and has around 130 genera and 900 species (Bidein, *et al.*, 2017) of these, around 30 species out of 9 genera are cultivated. In a similar way to the melon, watermelon and squash, cucumber (its botanical name is *Cucumis Sativus L*.) belongs to the family Cucurbitaceae (Jiménez-Ballesta, *et al.*, 2018). Crop physiologists have established that high yields in crop production by adapted cultivars can largely be explained by increased solar interception achieved by larger and longer-living canopies (Ayoola and Adeniran, 2006). The use of organic manures has been recommended for long term cropping in the tropics as slow mineralization of these manures is known to promote crop yield for a long period of time. Though organic manures are usually very bulky and the costs of transportation from one location to another very high, they are not only safer sources of plant nutrients but are also environmentally friendly (Eifediyi and Remison 2010). They release their nutrients in a slow and steady manner to crops in the field thereby activating soil microbial activities (Ayoola and Adediran 2006). Again, they sustain cropping systems through better nutrient recycling and improvement in soil physical, chemical and biological properties (Ojeniyi, *et al.*, 2010).

Organic manure has long been used by ancient farmers as a source of nutrition and its benefits have been fully realized because it is cheap and readily available (Makinde, *et al.*, 2007). With the increase in poultry production annually, there is a large quantity of poultry refuse which can be an alternative to chemical fertilizer. A lot of researches have been carried out to determine the effect of organic materials on the growth and yield of crops (Akin-Taylor, 1986), it is important to observe that the nutrient value of different organic manure is not the same. A study by Enujeke (2013) indicated that a variety of cucumber that received the highest rate of poultry manure (20 tha^{-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. Komolafe (1980) reported that the richest manure is poultry droppings, followed by cattle dung, goat dung, pig dung, and horse dung. Several research have been conducted on sheep-manure vermicompost to determine its nutrient effect on cucumber plants. Arancon *et al.* (2004) has attributed the effect of sheep manure vermicompost on cucumber plant growth to the presence of plant growth regulators and humic acid in vermicompost, which is produced by increased activity of microbes such as fungi, bacteria, yeasts, actinomycetes and

algae. In a research by Azarmi *et al.* (2009) to determine the effects of vermicompost produced from sheep manure on growth, yield and quality of cucumber varieties, leaf number, plant height and chlorophyll content of cucumber varieties increased with increasing sheep manure vermicompost at 30, 60 and 90 days after transplanting. He further reported that 30t/ha gave the highest yield in terms of leaf area, stem and dry leaf weight, leaf numbers, plant height, chlorophyll content and total fruit yield. Such result has been confirmed in other reports which were attributed to different factors such as varying rates of release of growth-promoting substance, improvement in soil physical properties, soil fertility and uptake of mineral nutrient (Rajbir *et al.*, 2008; Azarmi *et al.*, 2008).

MATERIALS AND METHODS

Experimental Location

The experiment was conducted at Crop Production Nursery Farm, Faculty of Agriculture, Kogi State University Anyigba. The study area which is Kogi State lies between latitude 5^0 15^1 to 7^0 45^1N and longitude 5^0 45^1 and 8^0 45^1 East of the equator. mean annual rainfall ranges from 1,560 mm at Kabba in the West to 1,808 mm at Anyigba in the East. The dry season generally extends from November to March. During this period, rainfall drops drastically to less than 12.0 mm in any of the months. Temperatures show some variations throughout the years, with average monthly temperature varying between 17^0C and 36.2^0C. The state has two main vegetation: the forest savanna mosaic zone and the southern guinea zone. It also has two main geological formations, they are: The Basement complex rocks to the west while the other half is on Cretaceous sediments, to the north of the confluence and east of River Niger (Amhakhian, *et al.*, 2010). The soils like most soils in north-central agricultural zone of Nigeria have high erodibility, structurally weak, coarse textured with low organic matter status (Amhakhian, *et al.*, 2010).

Experimental Material and Design

"Market More" Variety of cucumber used for this experiment was obtained from Techni Seeds Limited, Kano State while sheep droppings were obtained from Lokoja, Kogi State.

The experiment was carried out in polythene bags. Each was filled with garden soil. Holes in the containers were made to allow for airflow. In arriving at the sheep dropping manure rates, each pot was field with a well-mixed soil and weighed. Each pot, therefore, contains soil weighing 10kg, using a furrow slice weight of 2.24 x 10^6kg.

i.e. 1 furrow slice soil weighs 2.24 x 10^6kg

2.24 x 10^6kg soil requires 0tons

2.24 x 10^6kg soil requires 10tons

2.24 x 10^6kg soil requires 20 tons

2.24 x 10^6kg soil requires 30tons

Factorial combination of sheep dropping rates of 0, 10, 20 and 30t/ha with propagation method (Staked "S" and Unstaked "U") gave a total of eight (8) treatments (table 1) which was replicated 3times to give a total of twenty-four treatment units. This was laid out in a Randomized Complete Block Design (RCBD).

Sheep dropping rates (tha^{-1})	Propagation Method	
	Staked (S)	Unstaked (U)
0	S_0	U_0
10	S_{10}	U_{10}
20	S_{20}	U_{20}
30	S_{30}	U_{30}

Seeds were sown 2.5cm deep at the rate of 3/stand with a spacing of 60cm apart. Seedlings were thinned to 1/stand, after emergence, giving a plant population of 24plants. Alley pathways of 1m was made for easy access to each block. Sheep dropping was applied to the soil inside pots two weeks prior to planting to enable proper decomposition and release of nutrients that would serve as starter dose for the crop. Each pot was spaced with a 1m pathway. Staking was done for pots that require staking 10days after emergence.

Cultural Practices and Data Collection

Regular weeding was carried out around the plant base in each pot, along and ahead of the vines using hand, while insecticides were applied at 3 days interval.

Growth and yield data on plant height, number of leaves per plant, stem girth, leaf area, number of branches per plant, fruit diameter, and number of fruits per pot.

Data Analysis.

Data collected were subjected to Analysis of Variance according to (ANOVA) to detect the real differences among the treatment means as described by (Snedecor and Cochran 1967).

RESULT AND DISCUSSION

Table 1 and 2 shows the effect of sheep dropping rates and propagation methods on growth and yield characters of cucumber in Anyigba environment.

Effect of Sheep Dropping Rates and Propagation Methods on Growth characters of cucumber plants in Anyigba, Kogi State.

Staked cucumber plants (55.32) performed better than the unstaked plants (37.13) in terms of height (table 1). Application of sheep droppings at 6 and 9WAP increased significantly ($P < 0.05$), heights of staked cucumber plant. Application of 30tha^{-1} of sheep droppings gave the tallest plant of 59.6 cm followed by 20 tha^{-1} sheep dropping application (58.15 cm) which was not significantly different from other rates at 9WAP. However, at 6WAP, application of 20 tha^{-1} sheep dropping gave the tallest plant height (44.75 cm) which was significantly different from other rates, although control pots (0 tha^{-1}) consistently produced shortest plants across all sampling periods. This result can be attributed to the fact that the leaves on the staked plants were all exposed to greater light interception leading to a higher accumulation of photosynthesis for vegetative growth. Hanna and Adams (2011) reported that staking cucumber increased the fruit yield because of better light interception. The non-staked treatment consistently produced lower values in all the vegetative parameters evaluated. Interactions between sheep droppings and propagation methods was significant ($P < 0.05$) at 9WAP (table 3). Staked cucumber plants were able to maximize sheep dropping application to produce the tallest plants. At 10 tha^{-1} sheep dropping application, the tallest plant (64.8 cm) was produced. However, this was not significantly different from heights of plants produced when 20 tha^{-1} and 30 tha^{-1} sheep dropping was applied. The unstaked plants produced the shortest plant when zero sheep dropping was applied. This however implies that application rate at 10 tha^{-1} is sufficient for optimum plant heights of cucumber (table 3), possibly because higher rate of manure improves moisture availability which enhanced the release of more nutrient elements for increased vine growth. This is consistent with the findings and reports of Adekiya and Ojeniyi (2002) and Ewulo *et al.*, (2008) who attributed increased growth of crop plants to the release of more nutrient elements through the moisture that has been made available by the manure. It is also in harmony with the report of John *et al.*, (2004) who indicated that poultry manure released essential elements which promoted high photosynthetic activities that enhanced growth and yield of watermelon.

Table 1: Effects of Sheep dropping rate and staking on plant height, Number of leaves and stem girth of cucumber in Anyigba, during 2020 dry season.

Treatments	Plant height (cm)			Number of leaves			Stem girth (cm)		
	Week after Planting (WAP)								
	3	6	9	3	6	9	3	6	9
Propagation method									
Unstaked	24.74	36.25	37.13^{b}	10.33^{b}	16.42^{b}	23.5^{b}	1.07	1.47	1.58

Staked	12.75	27.90	55.32[a]	11.66[a]	66.09[a]	33.49[a]	1.28	1.76	1.76
$LSD_{0.05}$	ns	ns	5.30	1.2	2.3	9.2	ns	ns	ns
Sheep droppings									
0tha^{-1}	12.00	26.25[b]	53.70[b]	8.83[b]	16.84[b]	27.00[b]	1.22	1.80	1.84
10 tha^{-1}	12.00	28.45[ab]	53.75[b]	11.33[a]	19.17[a]	41.67[a]	1.23	2.32	1.95
20 tha^{-1}	13.00	44.75[a]	58.15[ab]	11.66[a]	19.33[a]	43.67[a]	1.17	2.29	1.97
30 tha^{-1}	12.25	28.85[ab]	59.60[a]	12.17[a]	17.16[ab]	26.67[b]	1.07	2.16	2.62
$LSD_{0.05}$	ns	17.30	5.30	1.2	2.3	9.2	ns	ns	ns
Interactions									
PM x SD	ns	ns	*	ns	ns	ns	ns	ns	ns

* *Significant at 0.05 level of probability* *ns* *not significant*

Means followed by the same letter(s) within a sampling period is statistically not significant at 5%level of probability using N-Duncan multiple range test.

Staked cucumber plants produced more leaves (11.66, 66.09, 33.49) than unstaked plants across all sampling periods (table 1). Application of 30 tha^{-1} sheep dropping produced the highest number of leaves (12.17) at 3WAP, which was not significantly different from 10 tha^{-1} and 20 tha^{-1} application rates respectively. Application of 20 tha^{-1} sheep dropping produced the highest number of leaves (19.33 and 43.67) at 6 and 9WAP respectively. These was however not significantly different from number of leaves produced at 10 tha^{-1} and 30 tha^{-1} at 6WAP while 20 tha^{-1} and 10 tha^{-1} sheep dropping rate at 9WAP were statistically at par, 30 tha^{-1} application of sheep dropping appears to reduce leaf production. However, plants with the least number of leaves were produced by control pots (zero sheep dropping). Interactions between sheep droppings and propagation methods on number of leaves were not statistically significant (P>0.05) across all sampling periods. Higher number of leaves produced by cucumber plants that received 20tha^{-1} of sheep droppings could possibly be because the sheep droppings had established and maintained effective soil physical condition for plant growth. This is consistent with the reports of Mangila *et al.,* (2007), and Enujeke *et al.,* (2013) which indicated that manure is essential for establishing and maintaining the optimum soil physical condition for plant growth. It is also synonymous to the findings of Agbede *et al.,* (2017), and Ewulo *et al.,* (2008) who reported that organic manure is not only cheap, but also an effective source of N for sustainable crop production, but improves soil physical properties by reducing temperature, bulk, density, and increasing total porosity, if higher rates are applied.

Sheep dropping rates and propagation method showed no significant influence (P>0.05) on stem girth at all sampling periods (table 1). However, Interactions between sheep droppings and propagation methods on stem girths of cucumber plants was not statistically significant (P>0.05) also across all sampling periods.

Table 2: Effects of sheep dropping rate and staking on Leaf area per plant, Number of branches/plant, fruit diameter and number of fruits/pot of cucumber at Anyigba, during 2020 dry season

Treatments	Leaf Area (cm)			No of Branches		Fruit diameter (cm)	No of fruits per pot
	WAP			WAP		At harvest	At harvest
	3	6	9	6	9		
Propagation method							
Unstaked	13.64^{b}	21.96^{b}	61.05^{b}	0.91	1.49^{b}	5.1^{a}	9.0^{b}
Staked	26.27^{a}	40.04^{a}	83.92^{a}	1.33	2.75^{a}	4.3^{b}	20.0^{a}
$LSD_{0.05}$	1.29	10.26	7.30	ns	0.53	0.7	0.6
Sheep droppings							
0tha^{-1}	22.47^{b}	23.38^{b}	67.63^{b}	1.00	1.67^{bc}	1.8^{c}	3.0^{d}
10 tha^{-1}	23.03^{ab}	32.5^{ab}	74.04^{ab}	1.51	2.17^{b}	2.60^{ab}	5.0^{c}
20 tha^{-1}	23.89^{a}	32.9^{ab}	78.94^{a}	1.16	3.00^{a}	3.00^{a}	10.0^{b}
30 tha^{-1}	22.4^{b}	35.2^{a}	69.35^{b}	1.16	1.6^{c}	2.00^{bc}	11.0^{a}
$LSD_{0.05}$	1.29	10.26	7.30	ns	0.53	0.7	0.6
Interactions							
PM x SD	ns	ns	ns	ns	ns	*	**

* *Significant at 0.05 level of probability* ** *Significant at 0.01 level of probability* *ns* *not significant*
Means followed by the same letter(s) within a sampling period is statistically not significant at 5%level of probability using N-Duncan multiple range test.

Sheep dropping rates and propagation method showed a significant influence ($P<0.05$) on leaf area of cucumber plants at all sampling periods (table 2). Staked plants produced a larger leaf area (26.27, 40.04 and 83.92cm^2) at 3, 6 and 9WAP respectively. Application of 20t/ha sheep dropping gave the largest leaf area (23.89, 79.98 cm^2) at 3 and 9WAP respectively which are not significantly different from application rate of 10 tha^{-1}. 30 tha^{-1} sheep dropping gave the largest leaf area at 3WAP, this was not significantly different from those of 10 tha^{-1} and 20 tha^{-1} applications. However, the control pots gave the least leaf area across all sampling periods.

Sheep dropping rates and propagation method showed no significant influence ($P>0.05$) on number of branches at 6WAP (table 3). However, at 9WAP, staked cucumber plants performed better than the unstaked counterpart, 20 tha^{-1} application of sheep dropping produced the highest number of branches (3.0) while 30 tha^{-1} application produced the least number of branches (1.6). Significant effect of sheep dropping on cucumber plants have been reported by Azarmi *et al.* (2009). They attributed the effect of vermicomposting on cucumber plant growth to the presence of plant growth regulators and humic acid in vermicomposting, which are produced by increased activity of microbes such as fungi, bacteria yeasts, actinomycetes and algae. This assertion has been supported by Arancon *et al*., (2004), Brown (1995), Tomati *et al*. (1990).

Effect of Sheep dropping rates and Propagation Methods on Yield characters of cucumber plants in Anyigba, Kogi State.

The diameter of cucumber fruits harvested was statistically influenced (P<0.05) by both propagation methods and sheep dropping rates (table 2). The unstaked cucumber plants produced fruits with largest fruit diameter (5.1cm) which was influenced by 20 tha^{-1} application of sheep dropping. However, control pots gave the least yield in terms of fruit diameter. Interactions between sheep droppings and propagation methods was significant (P < 0.05) on fruit diameter at harvest (table 4). Unstaked plants responded well to sheep dropping rates as 20tha^{-1} application produced fruits with the highest diameter. However, this result was not significantly different from those obtained when 10tha^{-1} and 30tha^{-1} of sheep dropping was applied. Staked plants consistently produced fruits with the least diameters.

Table 3: Interaction of Propagation Method x Sheep Dropping application rate on the Heights of cucumber plants at 9WAP in Anyigba, Kogi State Nigeria.

	Sheep Dropping			
Propagation method	0	10	20	30
Staked	51.6ab	64.8a	53.8ab	58.2ab
Unstaked	40.4b	51.4ab	53.6ab	55.9ab
SE (±)	6.7			

Means followed by the same letter(s) within a sampling period is statistically not significant at 5%level of probability using N-Duncan multiple range test.

Table 4: Interaction of Propagation Method x Sheep Dropping application rate on Fruit Diameters of cucumber plants in Anyigba, Kogi State Nigeria

	Sheep Dropping			
Propagation method	0	10	20	30
Staked	1.0bc	1.3ac	1.1ac	0.9c
Unstaked	1.0bc	1.3ac	1.6a	1.2ac
SE (±)	0.2			

Means followed by the same letter(s) within a sampling period is statistically not significant at 5%level of probability using N-Duncan multiple range test.

Table 5: Interaction of Propagation Method x Sheep Dropping application rate on Number of Fruits of cucumber plants in Anyigba, Kogi State Nigeria

	Sheep Dropping			
Propagation method	0	10	20	30
Staked	3.0ab	4.5ab	6.5a	6.0ab
Unstaked	2.0b	2.1b	2.9ab	2.0b
SE (±)	1.4			

Means followed by the same letter(s) within a sampling period is statistically not significant at 5%level of probability using N-Duncan multiple range test.

Number of fruits harvested/pot was significantly influenced (P<0.05) by both propagation methods and sheep dropping rates (table 2). Staked plants produced the highest number of fruits (20.0) than the unstaked plants (9.0). The peak fruit production was obtained when 30tha^{-1} of sheep dropping was applied. However, control pots produced the least fruit numbers. Interactions between sheep droppings and propagation methods was significant (P < 0.05) on number of fruits harvested (table 5). Staked plants produced the highest number of fruits at 20tha^{-1} sheep dropping rate which was not statistically different from other treatment means. However, unstaked plants produced the least fruit numbers consistently. The above yield parameters assessed were found to be higher on the staked plants than that vine on the ground. The result agreed with the findings of Hardy and Rowell (2002) who observed that the yield of super select cucumbers was higher for the trellised treatment than for the non-trellised treatment. Hanna and Adams (2011) reported that staked cucumber gave an average marketable yield of 25 tons/acre as against 16.4 tons/acre of the non-staked cucumber. While Jansen (1985) concluded that staked cucumber produced fruits that double the quantity of the ones on the ground. The number of non-marketable fruit was higher in the non-staked than the staked treatment. This could be attributed to the poor quality in the colour of the fruit, reduced length of fruit and development of yellow bellies on the fruits, which predisposes them to spoilage. Hanna and Adams (2011) reported that staking brings about an increase in colour quality, fruit length and sugar content of the fruits. Also, Hardy and Rowell *et al*, (2002) affirmed that staking improves the colour and lower the incidence of yellow bellies in cucumber. The improvement of fruit quality has been attributed to better growth of plant at different rate of vermicomposting (Azarmi *et al.* 2009), this he indicated to have favored the production of better colored and quality fruit (Rajbir *et al.*, 2008). Significant effect of sheep dropping on cucumber plants has been reported by Azarmi *et al.* (2009) where vermicomposting increased number of fruits and total fruit yield of cucumber.

CONCLUSION

The use of sheep dropping and staking lead to improvement in some growth and yield characters in cucumber plants. Application of 20 th^{-1} of sheep dropping appears to be optimum for growth and yield of cucumber. Staking of cucumber appears to lift the plant above the growth and therefore help to reduce excessive impart of wetting the soil which helps increase the growth of cucumber vines. However, this is a pot trial and given the fact that most farmers grow this crop in the field, there is the need for more intensive field research. For any serious conclusion to be made.

Recommendations

Even though there was significant growth and yield with staking and sheep dropping rate, more intensive work needs to be carried out before any cogent recommendation could be made.

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