

GROWTH AND YIELD PERFORMANCE OF BELL PEPPER (*Capsicum annuum*) TO LEVELS OF GOAT MANURE IN RIVERS STATE, SOUTHERN NIGERIA.

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ABSTRACT- Field experiment was carried out between June and October, 2019, at the Teaching and Research farm of the Department of Agriculture, Ignatius Ajuru University of Education, Ndele campus to evaluate the growth and yield response of Bell pepper (*Capsicum annuum*) to goat manure rates (0, 5, 10, 15 and 20 ton per hectare; given at the dose of 0, 2, 4, 6 and 8kg per 4m² plot) laid out in a completely randomized design, replicated three times giving 15 experimental plots. Growth and yield parameters measured were plant height, number of leaves, leaf area number of branches, number of fruits, fruit girth and fruit weight. Results indicate all growth parameters (plant height, number of leaves number of branches and leaf area) increased significantly with increasing levels of goat manure. 15 tons per hectare rate of application recorded the highest values. Plant height and number of leaves at 15 tons per ha application rate were more than three times (3x) over those of the zero-application rate. Leaf area and number of branches were 2.4 times and 3 times respectively higher than the control plants. The reproductive product yield also varied progressively with addition of goat with 15 kg application producing the best yield. The number of fruits of the control plants were one third less in number than fertilized at 15kg rate while fruit length were 3.5 times less. The 15kg rate of application had fruit weight 56 % heavier than the control bell pepper plants. 15kg of Goat manure per hectare is recommended to produce bell pepper (*Capsicum annuum*) in Rivers state.

Keywords: Bell pepper, Goat manure, Growth, Yield, southern Nigeria'

1. INTRODUCTION

Organic Manure (O.M) use is vital in tropical crop production and fertility management particular in the southern rainforest of Nigeria where the environmental factors has cause leaching, loss of soil nutrients, destruction of structure and generally impoverishing the soil [1]. Organic manures supply both micro and macro- nutrients to the soil, they provide means by which soil micro-organisms (whose microbial activities lead to decomposition of organic material and hence nutrient release) get attached to the soil. Addition of O.M causes the soil to recover and improves its physical and chemical status. ([2],[3]).

Peppers (*Capsicum annum* L.) have been cultivated for over six thousand years and are considered important fruity vegetable crop. The peppers including sweet bell pepper belong to the *Solanaceae* family [4]. Sweet bell pepper contains minerals and vitamins and are valuable medicinal plants in pharmaceutical industry because active ingredients, capsaicin and capsanthin which confers high antioxidant characteristic in the fruit when consumed [5]. It is included in medicinal preparation to manage vomit, gout and paralysis [6].

The consumption of sweet bell pepper not only contributes nutritionally to the human diet. It is rich in other nutrient lacking in other food, is increase palatable and hence improves food intake and digestion. As reported by [7], sweet pepper fruits are good sources of many essential nutrients, including vitamins A, C, and E, carotenoids, minerals (e.g., calcium and iron). Sweet bell pepper can be cooked or eaten raw salad. The leaves are also consumed in soups. One of the major yield factors in pepper production, bell pepper inclusive optimum soil fertility with high nutrient status.

In the recent times, attention has been focused on the use of organic manure in tropical crop production and fertility maintenance due to the high cost of inorganic fertilizer in addition to not been able to provide the soil with fertility improvement measures that can provides nutrients for growing crops. Organic manures on the other hand are high in organic matter that supplies nutrients, hold, or retains nutrient in the soil (making it available nutrients for plant growth) and also improves the physicochemical conditions of the soil [8]. The chemical composition of manure such as goat manure, show that they contain more than one plant nutrients, particularly ([9], [10]) as against only one or a few in chemical fertilizers.

Presently, most farmers use any organic fertilizer at blanket or indiscriminate rates. The use of goat droppings is not as popular as the use of poultry manure or cow dung, literature is also limited in the use of goat manure as a fertilizer in bell pepper in Rivers state, Nigeria. There is the need to determine the influence of goat manure on the growth and yield of bell pepper as to justify its use as a manure required in pepper production in Rivers state, Nigeria.

The general objective of the study was to determine the effect of goat manure in bell pepper production. The specific the objectives were to determine if there is significant difference

- i. in using goat manure or not using it in bell pepper production.
- ii in the different rates of goat manure on plant height in bell pepper production.
- iii in the rates of goat manure on leaf production in bell pepper production
- iv in the rates of goat manure on bell pepper fruit yield

II. MATERIALS AND METHODS

A. Study Area

The experiment was conducted at the Teaching and Research Farm of Ignatius Ajuru University of Education, Rivers State, Ndele Campus. Ndele is in the Southern rainforest of Nigeria and is characterized by high rainfall in the rainy season of at least between 250mm to 1000mm and heavy sunshine in the dry season [11].

B. Experimental Materials.

Seeds of bell pepper were obtained from the National Institute for Horticultural Research, Ibadan. The goat manure used were obtained from the mile 3 goat market in Port Harcourt Rivers, Nigeria. The goat dropping was dried and put into bags by the attendants. The manure was further left for one week before application.

C. Experimental Design

The factor of the experiment was goat manure at rates of, 0 ton per hectare; 5 tons per hectare.; 10 tons per hectare; 15 tons per hectare and 20 tons per hectare. These rates were replicated three times arranged in a complete randomized design, giving experimental plot of $(5 \times 3 = 15)$ fifteen.

D. Nursery practice.

The seeds of bell pepper were planted in polybags. The polybags were first filled with soil mixed with poultry manure. The mixture was 1:1 ratio of soil and manure before sowing of the pepper seeds. The seedlings were ready for transplant at 5 leaf stage at a uniform height of 5cm.

E. Land preparation and layout.

The experimental site was cleared and slashed manually using cutlass. Stumps and other slashed materials were gathered and burnt. The soil was tilled breaking up clods and the soil pulverized into fine tilt. Seed bed were prepared from the tilled soil to construct the beds. The dimension of the beds was 2m x 2m.

F. Transplanting and treatment application.

The bell pepper seedlings at 5 leaf stage, three weeks after germination, were hardened off before transplanting into the 2m x 2m plots. The seedlings were spaced 50cm by 50cm. The goat manure treatment applications equivalent for the 0 ton, 5 tons, 10 tons, 15 tons and 20 tons per hectare treatment were 0kg, 2kg, 4kg, 6kg and 8kg and they were applied to the soil before transplanting to the corresponding allotted plots.

G. Data collection and analysis.

The growth parameter measured were, plant height, number of leaves and leaf area; while the reproductive parameters measured were, number of fruits, fruit length and fruit weight.

Data collected were statistically analyzed by analysis of variance table of the completely randomized design and means separated using Least Significant Difference (LSD) at 5 percent level of significance; using the PASW 18th edition statistical package.

III. RESULTS

A. Plant Height

The influence of goat manure rates on the growth rate (plant length) of bell pepper is presented in Table 1. At all periods of measurement, plant height increased with addition of poultry

manure. Plants that received goat manure were significantly taller than the no application control plants. Among the goat manure fertilized plants, growth rate increased with increasing rates of poultry manure till the 15 tons per hectare, then it declined. Therefore, plants that received 15tons per hectare had the highest plant height or growth rate at all period of measurement. Analysis of variance of the complete randomised design show that the treatment effect was significantly different, meaning that the variation in plant height were due to the different rates of goat manure applied.

Table 1: Effect of Goat Manure Rates on Plant height (cm) of bell Pepper.

PM Rate(ton/ha)	Week after transplanting					
	2	4	6	8	10	12
0	8.3a	13.3 a	17.3 a	20.0 a	23.0 a	25 ^a
5kg	13.7 b	18.0 b	20.3 b	23.3 b	29.0 b	35 ^b
10kg	16.0 c	21.0 c	29.4 c	35.0 c	46.3 c	67 ^c
15kg	18.5 d	25.0 d	32.3 d	46.7 d	65.0 d	85 ^d
20kg	13.0.0 ^b	19.3 ^b	21.3 ^b	24.7 ^b	30.7 ^b	57 ^c
SE	6.455	4.410	9.039	4.235	4.333	6.43
Fcal	*	*	*	*	*	*

Mean with different alphabets in the same column are significantly different at p.05 by LSD * = significant.

B. Vegetative growth

The vegetative growth response of bell pepper to application of poultry manure is highlighted in Table 2. The number leaves produced by addition of goat manure increased with increasing levels of goat manure. The plants that received the least rate of the goat manure (5 tons/ha) produced about twice the number of leaves as the control plants. Among the bell pepper plants that goat manure, application rate of 15 ton/ha had plants with highest leaf production. In the same vein leaf area and number of branches increased with increasing rates of goat manure. 15 tons per hectare had plants with highest number of leaves, leaf area and number of branches. The goat manures effects on number of leaves number of branches and leaf area were obviously varied and the statistical analysis indicated that the variation observed were due to the different rates of the manure applied.

Table 2: Influence of Rate of Goat manure on vegetative Characteristics of bell Pepper.

Poultry manure Rates (ton/ha)	Vegetation characteristics		
	No of leaves	Leaf area (cm ²)	No of branches
0	12.4 ^a	73.6 ^a	2 ^a
5	24.3 ^b	120.7 ^b	4 ^b
10	31.0 ^c	142.c	5 ^{bc}
15	39.0 ^d	176.7 ^d	6 ^d
20	21.3 ^b	125.0 ^b	4 ^b
SE	0.557	1,655	0.895
Fcal	*	*	*

Mean with different alphabets in the same column are significantly different at p.05 by LSD * = significant.

C. Yield Characteristic

The reproductive yield outcome of bell pepper to different goat manure application rates is displayed in Table 3. Number of fruits, fruit girth and fruit weight all increased with addition of goat manure. All levels of manure application produced significantly higher yield values in parameters mentioned above than the control plants. Among the goat manure fertilized plants, the rates of application positively increased the number of fruits, fruit girth and fruit weight. This variation and increase were significant at Fcal $P \leq 0.05$., thus indicating that the different values of number of fruits, fruit girth and fruit weight were all due to the different levels of goat manure applied.

In all the three yield parameters measured, 15 tons per hectare rate of application produced the highest values followed by 10 tons per hectare. The zero application or control plants produced the least values. After the 15 tons application level, the values obtained declined by almost half.

Table 3: Influence of Rate of Goat manure on vegetative Characteristics of bell Pepper.

Poultry manure Rates (ton/ha)	Yield characteristics		
	No. of fruits	Fruit girth (cm)	Fruit weight (g)
0	2 ^a	6 ^a	13.5 ^a
5	5.0 ^b	10.0 ^b	18.6 ^b
10	7.0 ^c	14.0 ^c	28.5 ^c
15	10.0 ^d	16.7 ^d	40.0 ^d
20	4.0 ^b	10.3 ^b	18.2 ^b
SE	0.557	1,655	0.983
F _{cal}	*	*	*

Mean with different alphabets in the same column are significantly different at p.05 by LSD * = significant.

IV. DISCUSSIONS

A. Vegetative Growth.

It was observed in this study that the growth rate or plant length together with number of leaves of bell pepper increased with addition of goat manure, similar findings were seen in Akure, Ondo state, western rainforest of Nigeria and reported by [10] with rates of goat dung on bell pepper. Working on sweet corn in Calabar, south-eastern rainforest of Nigeria [12], published their finding of increasing plant height and number of leaves to increasing doses of goat manure. Similar finding was reported by [13] for *Lycopersicon esculentum* in guinea savanna region of Nigeria with the use of organic manure.

B. Fruit Yield Response

The number of fruits per plant, fruit size and fruit weight were found to be higher in the plants that received goat manure fertilization. This was the same report of with pepper grown Akure,

the high availability of Organic matter, Nitrogen and Phosphorus in the goat can be adduced for the high fruit yield of the bell pepper in response to levels of goat manure over the control plants [10]. This is alike to the findings of [1] that found in their study that the yield of cayenne pepper was favoured directly with rates of organic manure and markedly were higher than the control plants that did not receive manure treatment. It was observed in this study that beyond 15 tons per hectare yield and indeed all growth and yield parameter were depressed, this might be because of excess Nitrogen content, which may lead to nutrient imbalance that is expressed in a negative effect on growth and yield [14].

V. CONCLUSION AND RECOMMENDATIONS

The experiment was conducted to determine the effect of rates of goat manure of the growth and yield of bell pepper (*Capsicum annum*). 15 tons per hectare produced the best performance in bell pepper.

There was significant difference between either using of goat manure or not using it bell pepper production.

There was significant difference among different rates of goat manure on bell pepper plant height.

There was significant difference in the different rates of goat manure on bell pepper vegetative production.

There was significant difference in the different rates of goat manure on bell pepper fruit yield characteristics

Fifteen tons per hectare (15 tons/ ha) of goat manure recommended to produce bell pepper in river state, southern rain forest zone of Nigeria.

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