

Green Pepper (*Capsicum Annum L.*) Performance As Influenced By Poultry Mature Treatment.

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ABSTRACT

Green Pepper (*Capsicum annum L.*) is cultivated as a vegetable for its aroma, spices use in seasoning food and medicinal purposes. The commercial production is mostly in northern Nigeria with limited supply in Southern Nigeria. This study was conducted to provide agronomic information needed for optimum growth and yield of green pepper in Southern Nigeria where its demand and uses is very high. Thus, the evaluation of green pepper cultivation under nine poultry manure rates (0, 1, 1.5, 2, 2.5, 3, 3.5, 5, 7, and 9) t/ha were conducted in Teaching and Research Farm, Obubra Campus Cross River University of Technology, Cross River State, Nigeria in 2020 and 2021 cropping seasons.

The experimental design was a Randomized complete block design with nine rates of poultry manure replicated four times.

Result indicated that plant height, number and dry weight of leaves, branches and stem increased significantly ($P > .05$) with

increasing rates of poultry manure translating to high fruits number and weight. Plots that received 5.0 t/ha poultry manure produced the highest (7.04 and 7.11) t/ha fresh fruits yield of green pepper in 2020 and 2021 seasons respectively.

The use of 2.0 t/ha poultry manure prolonged post harvest (shelf life) of green pepper by delayed time of shrinkage, onset of ripening and rot of fruits.

Farmers are advised to use 2.0 – 5.0 t/ha poultry manure to cultivate green pepper for maximum fruit yield and prolong post harvest shelf life of the fruits.

Keywords: Green pepper, Poultry manure, growth, yield, postharvest life.

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I. INTRODUCTION

Green pepper (*Capsicum annum L.*) is grown for its fruits that are used as vegetables, for food, culinary and medicinal purposes especially in Nigeria (Eze, and Baiyeri 2019). It is eaten raw in salad, either in the green, yellow or red form where it adds colour, taste, tangy and improves the food flavor and palatability (Fitday 2016.) Green pepper has high economic importance. It is used for pickling in brine, stuffing and brine.

Studies by Brucket and Rosebaum (2011) reported that green pepper has phytochemicals and vitamins (A, B6, B9 and C) that are good antioxidants useful in neutralizing free radicals in the human body.

United States Department of Agriculture (USDA) National Nutrition database (2011) reported that green pepper contains more vitamin C than citrus fruits.

There is also high fibre in pepper that has the ability to reduce exposure of colon cells to infection and speed up digestion of food (Fitday, 2016).

Despite the economic importance of green pepper, its commercial cultivation is restricted to Northern Nigeria due to weather conditions, pests and diseases that attack it, limiting high output in Southern Nigeria.

There is high demand for green pepper in Southern Nigeria and other countries for local consumption and export for foreign exchange earners.

Therefore, this study was conducted to provide agronomic information needed for commercial cultivation, and output of green pepper in Southern Nigeria and other places with high rainfall.

Several factors affect high crop productivity. Some of these are: Soil fertility practices, application of poultry manure among others. Studies have shown that manure types and rates and planting dates are vital.

Nigeria like most humid tropics has low inherent fertility status of arable soils are major challenges of optimum crop cultivation (Islam *et al.*, 2010).

Eze and Baiyeri (2019) reported that maintenance of soil fertility by application of poultry manure is a prerequisite for sustainable crop production and increase yield.

Thus, the aim of this study are to determine growth and yield of green pepper to different rates of poultry manure and also the appropriate rate that gives longest green fruits life of pepper.

II. MATERIALS AND METHODS

2.1 Description of Experimental Site (Study Area)

Two experiments were conducted in 2020 and 2021 at Teaching and Research Farm, Department of Agronomy, Faculty of Agriculture, Obubra, Cross River University of Technology, Cross River State, Nigeria. Located at latitude 08° 59'N and longitude 05° 16'E. The area was under two years bush fallow when the study was carried out.

2.2 Nursery Preparation:

Green pepper seeds (*Capsicum annum Yolo Wonder*) were collected from seed multiplication unit, Crop Science Department, University of Nigeria, Nsukka, Enugu State.

There green pepper seedlings were raised in Nursery containers before field transplant was done at 6 – 8 weeks after planting (WAP).

Nursery media used were prepared at the ratio of 3: 2:1 of top soil, poultry manure and river sand respectively on volume basis.

The nursery media was properly composted for some days (5 -7 days) before being transferred into the nursery boxes.

Green pepper seeds were sown in the seed boxes. The nursery was watered as required. Seedling emergence was noticed at nine (9) days after sowing and full emergence 5 days later.

2.3 Field Preparation

The filed measured 60m x 10m – 60m² by 10m (600m²) was cleared, stumped, packed, ploughed, harrowed, sunken seed beds were prepared using hoe.

Four blocks were made and each block demarcated into nine (9) plots giving a total of 36 plots of 2m x 2m (4m²) each. Adjacent plots and blocks were separated by 50cm alleys.

Well cured poultry manure at the rates of 0, 1.0, 1.5, 2.0, 2.5, 3.0, 5.0, 7.0 and 9.0 t/ha were randomly incorporated into the beds in each block during field preparation.

Transplanting of green pepper seedlings into the beds was done in the cool period of the day (evening) after which watering was done to reduce transplanting shock.

2.4 Soil and manure analysis

Soil samples were randomly collected from representative spots on the experimental site and thoroughly mixed to make a composite soil sample before poultry manure application.

It was analysed to determine pre-planting soil physical and chemical properties of the experimental area in the laboratory using standard laboratory procedures.

Samples of the poultry manure used for the experiment was also collected and analysed to determine its physicochemical properties.

Analyses were carried out at the laboratory of the Department of Soil Science, University of Calabar, Nigeria, using standard laboratory procedures.

2.5 Experimental Design and Treatments

The experiment were laid out in a randomized complete block design (RCBD). The treatment was poultry manure applied at nine different rates of 0, 1.0, 1.5, 2.0, 2.5, 3.0, 5.0 7.0 and 0.9 t/ha replicated four times.

2.6 Horticultural Practices

Green pepper seedlings raised in nursery box were transplanted to the prepare seed beds in the field at a spacing of 60 cm x 30 cm inter and intra row respectively at 4 weeks after planting in the nursery.

Weeding was done manually using small hoe at 4 weeks after planting (WAP) 8, 15 and 20 WAP to keep the experimental plots weed free.

Insect pests were controlled by hand picking and farm sanitation.

Harvesting:

Mature green pepper fruits were harvested at physiological maturity while fruits were still green and had not change colour. Harvesting lasted for two months.

Data Collection

Data were collected on both growth and yield parameters such as plant height (cm, number of leaves and branches per plants, dry matter of plant fractions (leaves and stem) dry weight per plant.

Destructive sampling was done by uprooting one plant per plot, it was oven dry at 80°C to constant weight that was recorded using sensitive weighing balance scale.

Fruits weight were determined using weighing balance.

Statistical Analysis

Data collected were statistically analysed using analysis of variance (ANOVA) for randomized complete block design using Genstat Release 10 3DE software (Genstat, 2010). Separation of treatment means that showed significant difference was done using Fishers least significant differences. (F-LSD) at 0.05 probability level according to Obi, (2020).

III. RESULTS AND DISCUSSION

Pre-planting soil analysis of the experimental site showed that it was sandy loam acidic with pH in water values of 5.29 in 2020 and 5.31 in 2021 (Table 1). Soil organic matter, macro essential plant nutrients such as nitrogen, phosphorus, potassium, calcium and magnesium were low.

Eze and Baiyeri (2019) worked on similar soils of low fertility status and recommended the application of soil amendment especially poultry manure to improved the soil and increase crop yield.

The poultry manure laboratory analysis result in Table 2 indicated that it was high in organic matter, nitrogen, phosphorous and other exchangeable plant nutrient (minerals).

Poultry manure treatment significantly ($P < 0.05$) increased plant height, number of leaves and branches per plant (Table 3). Tallest plants with highest number of leaves, branches were recorded in 9.0 t/ha poultry manure rate at 8 weeks after plant and 50% flowering in 2020 and 2021.

The high growth in green pepper branches, leaves and height recorded could be attributed to large quantity of poultry manure applied which invariably influenced the adequacy of essential nutrient elements available in the soil. Baiyeri *et al.*, (2016) reported similar observations. These researchers proved that organic manure has ability to release nutrient elements and improve soil physical and chemical properties (Dauda *et al.*, 2008, 1 Keh *et al.* 2012).

Table 4, showed that dry matter of leaves, stem and roots were significantly increased especially in plots with higher manure rates of 7-9 t/ha poultry. The increase in vegetative growth parameters in plots treated with high poultry manure is probably as result of high nitrogen percentage released into the soil that was available to crops.

Earlier researchers in pepper reported that nitrogen is an important constituent of chlorophyll and physiological activities vital.

Earlier researches in pepper reported that nitrogen is an important constituent of chlorophyll and physiological activities vital for aerial growth, leaf area, branches and fruiting in crops (Ikeh *et al.*, 2012, Akon *et al.*, 2010).

Result on Table 5 shows that poultry manure application significantly increased yield of pepper. Green pepper fruit yield recorded as weight of fruits harvested on weekly basis increased until the maximum peck yield was obtained at 6th week harvest, thereafter began to decline. The application of 5.0t/ha poultry manure gave fruits weight per plant and hectare that were highest (302.56 g and 309.24 g per plant at 6 weeks and (7.04 t/ha and 7.11 t/ha) in 2020 and 2022 cropping seasons respectively. Above this, poultry manure rate (5.0 t/ha) fruit yield per plot and hectare tend to decrease with increase in poultry manure rate.

This confirm the report by Ikeh *et al.*, (2021) that excess poultry manure application results in excessive vegetative growth and reduced fruit yield in most fruit vegetative crops.

There was also delay in flowering and fruiting because most of the plant assimilate is potentially channel towards foliage formation. Similarly, Eze and Baiyeri (2019) noted that the use of organic manure above agronomic rates, sometimes result in accumulation of heavy metals in plants and soils with adverse, effects on crop growth and productivity. In this study, the same observation were recorded in some growth parameters in plots that received higher rates of poultry manure.

The used of poultry manure had significant effect on the on set (days to first, 50% and 100%) ripening and on set of rot in green pepper fruits (Table 6).

Plots treated with 2.0 t/ha poultry manure rate gave longest days to the onset of shriveling 50% and 100% rotting.

While 9.0 t/ha poultry manure rate had the least number of days to shriveling and rot (Faster) than other rates.

This result corroborate with the findings of Eze and Baiyeri (2019) who reported that large quantities or higher rates of organic manure may result to the release of excess nitrogen that can shorten the shelf life or post harvest life of many fruits vegetables.

IV. CONCLUSION AND RECOMMENDATION

The result of this study showed that green pepper performance (growth, yield and post harvest shelf life and quality can be affected positively by poultry manure treatment.

The use of 2.0 – 5.0 t/ha poultry manure can increase optimum growth yield and nutritional quality of green pepper production in Utisols condition of Obubra, Cross River State South-South Nigeria and generate more farm income.

Recommendation

The application of not more than 5 t/ha poultry manure is recommendable as this rate is profitable for green pepper yield, quality and post harvest life.

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Table 1: Physio-chemical charateristics of pre -planting soil of the study area 2020 and 2021 at 0-40cm depth.

Soil Properties	Value	
Physical Composition		
Sand (%)	77.48	78.37
Slit (%)	9.33	8.56
Clay (%)	14.88	15.25
Texture class	Sandy loam	Sandy loam
Chemical Composition		
pH in water	5.29	5.31
pH in KCL	4.31	4.42
Organic Matter (%)	2.38	2.25
Organic Carbon (%)	1.26	1.30
Total Nitrogen (g/kg)	1.34	1.42
Available Phosphorus (mg/kg)	13.59	12.88
Exchangeable Bases (cmol/kg)		
Potassium	1.88	1.59
Calcium	2.03	2.11
Magnesium	0.14	0.16
Sodium	0.34	0.32
Copper	0.62	0.58
Effective Cation Exchange Capacity (ECEC)	3.08	3.12

Exchangeable acidity	24.29	23.46
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Table 2: Chemical properties of poultry manure used for the Experiment

Properties	Value	
pH (in water)	6.3	6.4
Total Carbon (%)	16.53	16.78
Total Organic Matter (%)	30.37	28.97
Total Nitrogen (g/kg)	1.62	1.58
Phosphorus (mg/kg)	0.11	0.72
Potassium (g/kg)	0.973	0.985
Calcium (cmol/kg)	0.159	0.164
Magnesium (mg/kg)	0.187	0.194
Sodium (mg/kg)	0.651	0.587

Table 3: Effect of poultry manure on number of leaves, branches per plant and height (cm) of green pepper in 2020 and 2021 cropping seasons.

Poultry manure rate (t/ha)	No of leaves per plant				No of Branches per plant				Plant Height (cm)			
	8WAP		50% flowering		8WAP		50% flowering		8WAP		50% flowering	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
0	8.23	7.14	12.12	13.23	0.31	0.32	2.1	2.2	4.21	4.36	6.53	6.63
1.0	12.14	10.33	16.24	15.15	0.42	0.41	2.5	2.4	5.32	5.41	8.41	8.55
1.5	13.22	13.14	19.31	21.32	0.47	0.48	3.0	3.2	6.12	6.35	8.65	8.74
2.0	14.31	15.21	23.13	25.11	0.53	0.55	3.1	3.3	6.74	6.55	10.34	11.28
2.5	16.15	17.12	26.25	27.32	0.62	0.64	3.3	3.4	7.23	8.36	15.18	16.32
3.0	19.22	20.11	28.14	30.12	0.68	0.66	4.1	4.3	10.31	11.18	17.24	18.15
5.0	23.14	22.33	32.22	34.23	1.03	1.02	5.2	5.4	12.56	12.72	20.18	21.26
7.0	25.32	26.21	36.11	41.21	1.11	1.13	6.3	7.2	14.32	13.15	23.32	24.53
9.0	28.17	29.15	40.34	43.15	1.23	1.33	8.2	9.1	15.48	17.15	25.43	24.14
LSD(0.05)	1.11	1.12	2.11	2.01	0.001	0.001	0.02	0.02	0.03	0.03	0.12	0.13

Table 4: Effect of poultry manure on dry matter leaves, stem and root (g) per plant of green pepper in 2020 and 2021 cropping seasons.

Poultry manure rate (t/ha)	Leaf dry (weight (g) per plant)				Stem dry weight (g) per plant				Root dry weight (g) per plant			
	8WAP		50% flowering		8WAP		50% flowering		8WAP		50% flowering	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
0	3.12	3.24	6.23	6.34	4.31	4.27	13.43	13.52	1.17	1.28	5.21	5.32
1.0	5.34	5.17	10.12	10.13	7.22	7.34	17.58	17.71	3.24	3.31	8.56	8.71
1.5	6.23	6.34	11.15	11.34	9.15	9.42	23.71	23.82	4.12	4.32	9.71	10.16
2.0	6.78	6.81	14.15	15.15	9.58	9.71	28.42	29.14	7.43	7.34	10.34	11.25
2.5	8.13	8.22	17.41	18.13	10.21	11.14	33.38	32.46	7.68	7.82	13.17	13.68
3.0	9.24	9.35	21.24	20.58	12.17	12.52	39.57	40.21	8.25	9.11	17.25	18.17
5.0	11.35	12.17	24.18	23.79	15.86	16.18	43.14	45.17	10.16	11.24	21.32	22.41
7.0	14.13	15.11	26.33	28.14	19.15	20.23	56.63	53.18	13.37	14.15	27.82	28.13
9.0	17.46	18.32	31.27	33.35	22.37	23.15	72.29	71.95	16.25	17.13	33.55	34.21
LSD(0.05)	0.05	0.04	0.11	0.12	0.21	0.22	1.21	1.31	0.02	0.03	0.01	0.02

Table 5: Effect of poultry manure on fruit yield of green pepper in 2020 and 2021 seasons

Green Pepper (Capsicum Annum L.) Performance As Influenced By Poultry Mature Treatment.

Poultry manure rate (t/ha)	Fruit weight per plant (g) on weekly basis																Fruit yield per hectare (t/ha)	
	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6		Week 7		Week 8		2020	2021
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021				
0	30.34	31.17	42.71	45.31	53.23	60.97	71.81	73.44	70.23	71.14	62.45	61.85	44.20	42.39	36.52	33.26	1.28	1.31
1.0	45.78	46.24	48.46	57.19	68.14	66.31	89.78	82.31	98.57	97.33	94.11	92.93	51.42	53.37	46.11	48.38	3.16	3.52
1.5	56.14	54.30	61.52	60.25	74.11	76.23	92.33	94.13	116.25	118.46	131.23	140.16	121.32	125.42	92.17	95.38	4.31	4.46
2.0	58.35	59.13	68.34	67.11	81.32	83.14	102.11	104.77	129.36	132.51	159.42	161.25	133.46	137.15	101.25	104.19	4.67	4.81
2.5	65.12	64.24	73.12	72.35	86.13	82.33	122.33	125.11	153.73	159.21	181.51	189.31	147.51	151.82	115.74	118.25	5.11	5.23
3.0	71.36	70.45	81.33	83.42	113.22	93.45	135.45	137.27	182.24	185.72	222.34	231.56	162.33	164.25	123.72	120.36	6.21	6.32
5.0	82.47	84.38	90.25	92.11	111.31	109.21	151.24	156.14	195.37	201.42	307.56	309.24	174.11	178.42	149.35	147.41	7.04	7.11
7.0	67.23	65.19	72.34	70.76	83.17	85.35	97.13	94.35	101.22	107.34	145.18	152.31	166.42	165.82	87.91	85.53	4.11	4.16
9.0	55.71	53.14	60.22	62.17	73.72	75.16	81.46	83.14	95.31	98.26	109.37	112.45	139.37	136.44	72.58	76.39	2.36	2.47
LSD(0.05)	2.11	2.12	3.13	3.14	4.01	4.11	6.21	6.32	5.13	5.11	7.12	7.21	4.31	4.22	2.13	2.02	0.02	0.03

Table 6: Effect of Poultry manure on the post harvest (shelf) life of green pepper fruits in 2020 and 2021 cropping seasons.

Poultry manure rate (t/ha)	No of Days to													
	Onset of shrinkage		Onset of Ripening		50% Ripening		100% Ripening		Onset of Rot		50% Rot		100% Rot	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
0	18.11	17.23	18.14		25.44		27.12		29.12		32.62		38.42	
1.0	17.13	16.32	17.41		23.34		29.14		28.51		31.51		38.15	
1.5	15.14	15.23	16.22		23.41		29.12		26.32		31.44		37.34	
2.0	20.1	18.21	18.23		26.21		24.33		30.11		33.14		39.45	
2.5	14.12		15.21		19.31		26.12		24.21		30.11		33.13	
3.0	13.21		14.10		18.24		24.23		24.32		28.51		32.24	
5.0	12.14		13.24		16.32		23.34		22.15		26.13		30.31	
7.0	11.12		12.32		15.21		21.11		21.24		24.29		29.15	
9.0	10.13		11.14		14.32		19.22		19.53		18.31		23.12	
LSD(0.05)														

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