PRINT ISSN 1119-8362
Electronic ISSN 2659-1502

Full-text Available Online at
https://www.ajol.info/index.php/jasem
https://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 27 (10) 2181-2187 October 2023

Effect of Poultry Manure Rates on Growth and Yield of Three Species of Pepper (*Capsicum spp.*) in Awka, Southeastern Nigeria

***[1]IHEATURU, DE; [1]AGU, LI; [1]OKOLI, NA; [2]IBEAWUCHI, II**

**[1]Nnamdi Azikiwe University, Department of Crop Science and Horticulture, Awka, Anambra State, Nigeria.*
[2]Federal University of Technology, Department of Crop Science and Technology, Owerri, Imo State, Nigeria

**Corresponding Author Email: de.iheaturu@unizik.edu.ng; Tel: +2348037958688*
Co-Authors Email: aguloveth138@gmail.com; na.okoli@unizik.edu.ng; izuchukwu1101@gmail.com

ABSTRACT: Pepper is one of the most important vegetable in the sub-sahara Africa, however, production is still limited by low soil fertility. Hence, the objective of this paper was to assess the effect of poultry manure rates on growth and yield of three Capsicum spp pepper (green pepper, nsukka yellow pepper, red bell pepper) species in Awka, Southeastern Nigeria using standard methods. The initial chemical composition of the soil and composition after the application of poultry manure was determined. Data collected include plant height (cm), number of leaf, leaf area (cm^2), stem girth (mm), number of days to 50% flowering, fruit per plant and fresh fruit yield (kg ha-1), fruit length, fruit circumference, fruit diameter, number of locus, number of seeds and fruit thickness. All the data were subjected to analysis of variance using the ANOVA method and difference between treatments means were determined using least significant difference test (LSD). Result showed that the application of poultry manure significantly increased soil fertility with a corresponding increase in growth and yield. Application rate of 8,000kg/ha is also recommended for optimum growth.

DOI: https://dx.doi.org/10.4314/jasem.v27i10.7

Cite this paper as: IHEATURU, D. E; AGU, L. I; OKOLI, N. A; IBEAWUCHI, I. I. (2023). Effect of Poultry Manure Rates on Growth and Yield of Three Species of Pepper (*Capsicum spp.*) in Awka, Southeastern Nigeria. *J. Appl. Sci. Environ. Manage.* 27 (10) 2181-2187

Dates: Received: 03 August 2023; Revised: 25 September 2023; Accepted: 04October 2023 Published: 30 October 2023

Keywords: manure rates; pepper; vegetable, yield

Pepper (*Capsicum* spp.) belongs to the family solanacea and genus *Capsicum* (Jamir et al., 2017). It is one of the most important vegetable in the tropical regions of the world. Globally, it is ranked as the third most available vegetable after tomatoes and onions (Olutumise, 2018). Before now, pepper was used majorly for seasoning, but now widely used as vegetable, spice, food dye, ornamentals and extracts in pharmaceutical and cosmetics industries. In Nigeria and many countries in the Sub-Sahara Africa, it is used as spices and condiments in making soups and processing meat. It is could also be eaten raw as salad or cooked as flavour for dishes. The leaves could also be used as salads especially with rice. Apart for culinary purposes, they also have medicinal and nutritional properties (Ikeh*et al.*, 2012). In pharmaceutical industries, they are used as stimulants and counter irritants. The active ingredient in pepper, capsaicin, could serve as analgesics and dermal spray for pain reliever (Saleh *et al*., 2018). It contains minerals and phytochemicals that could serve as antioxidants against free radicals. It is also rich in vitamins A and C, and have low calorie. Besides, it serves as a source of income to local farmers. The pepper market is estimated at over $5.8 billion in 2019 with China leading as the largest producer in the world. About 49.9 percent of global supply comes from Europe, 35.6 from North America, 10.4 percent from Asia, while only 2.7 percent come from the Africa region (Emejo and Alaran, 2020). This showed

a great disparity between Africa and other parts of the world. Although production in Africa has increased over the years, however, the average yield is still 30% lesser than those developed countries (Ansa and Woke, 2018). In Nigeria for instance, despite pepper been the second most cultivated vegetable in Nigeria (Abu *et al*., 2020), significant amount of pepper consumed still come from the United Kingdom and Netherlands (Indexbox, 2023). Some of the major factors identified as limiting the production of pepper in Africa include poor storage facilities, transportation, pests and diseases, and lack of access to improved varieties. Hence, the objective of this paper was to assess the effect of poultry manure rates on growth and yield of three Capsicum spp pepper (green pepper, nsukka yellow pepper, red bell pepper) species in Awka, Anambra State, Southeastern Nigeria.

MATERIALS AND METHODS

Experimental Site; The experiment was conducted in the Teaching and Research Farms, of the Department of Crop Science and Horticulture, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. the location is a rainforest with Latitudes 6º07' and 6º17N and Longitudes 7º00' and 7º10'E. The experimental site was located at an altitude of 46.3 meters above sea level (Google Earth, 2023) with average annual rainfall ranging from 1650 - 2000mm. The minimum and maximum temperatures are 27ºC and 30ºC respectively, while the relative humidity ranges between 75-80%.

Soil analysis: Soil samples were collected randomly from a depth of 0 -15 cm across the experimental field during dry season prior to transplanting. The soil samples were bulked, air dried, and sieved later for the analysis of the soil physicochemical properties. Particle size analysis was determined by using hydrometer method and the textural class determined using textural triangle. Soil pH was determined using pH meter (Black, 1965). Total nitrogen was determined by macro Kjeldahl digestion. Organic carbon was analyzed using the Black modified method (Black, 1965), while the available P was determinedwith Technicon, (1975). Exchangeable bases were determined in neutral NH4OAC extract (Black, 1965) by atomic adsorption for calcium and potassium and CEC was estimated by summation.

Experimental design and treatment application: The experiment was a 3x4 factorial in a Randomized Complete Block Design (RCBD) replicated three times. Treatments were three varieties of pepper: Green pepper, Nsukka Yellow pepper, Red Bell pepper. The four poultry manure rates were: 0.00kg/ha, 2000kg/ha, 6000kg/ha, 8000kg/ha which were combined to give 12 treatment combinations.

Nursery preparation and management: The seeds were first sown in nursery trays. The trays were filled with media compounded with top soil, poultry manure and river sand at the ratio of 3:2:1 respectively. The media was cured for one month before planting. The seeds were broadcasted on separate baskets, slightly covered with river sand and watered immediately. Shade was provided using aluminum zinc and palm fronds.

Land preparation and fertilizer application: The experimental sites were harrowed and later ridged 100 cm between rows. Manure was incorporated as per treatment after land preparation two weeks to transplanting and the manure applied according various rates by broadcasting and thereafter watered.

Cultural practices: Weeds were controlled by manual hoe weeding at week intervals after transplanting to keep the plots clean. The experimental field was irrigated by furrow irrigation system, to supply adequate moisture for the crop at daily interval during dry spell.

Harvesting: The green, yellow and red matured and ripe fruits were harvested during the cool hours of the day by hand picking. Care was taken not to damage or severe the fruiting branches in the course of the harvest. The fruits were also placed directly into well labeled field baskets before weighing. Harvest was done twice weekly interval.

Data Collection: The growth parameters collected include plant heights (cm), number of leaf, leaf area (cm^2), stem girth (mm), and number of days to 50% flowering. The yield parameters include number of fruit per plant and fresh fruit yield (kg ha-1), fruit length, fruit circumference, fruit diameter, number of locus, number of seeds and fruit thickness

Data analysis: GenStat statistical package was used in analyzing the data collected. All the data were subjected to analysis of variance using the ANOVA method and difference between treatments means were determined using least significant difference test (LSD).

RESULTS AND DISCUSSION

The result of soil analysis prior to planting and after the application of poultry manure is presented in table 1. Result indicated the soil is a sandy-loam and well aerated for planting. The chemical composition of N, P, K, also revealed the fertility of the soil was low and

that the application of poultry manure increased soil fertility.

The plant heights as presented in table 2 indicated significant difference between varieties. Result showed that the Yellow pepper recorded the highest plant height at 4WAT, 6WAT, 8WAT and 10WAT (12.74cm, 27.54cm, 43.2cm, and 55.1cm respectively) while Green pepper recorded the least plant height at 4WAT, 6WAT, 8WAT and 10WAT (11.23cm, 21.96cm, 28.0cm and 30.9cm respectively).There was no significant difference on the plant height based on poultry manure rates at all stages except at 10WAT where 0.00kg/ha recorded the least plant height (38.4) while 8000kg/ha recorded the least plant height (50.2) which was significantly higher than 0.00kg/ha. Based on the interaction between variety and poultry manure rates; the interaction differed significantly at all stages and Yellow pepper + 0.00kg/ha recorded the highest plant height (14,75cm, 30.30cm, 48.1cm, 62.0cm respectively) while Green pepper + 8000kg/ha recorded the least plant height(9.58cm, 17.58cm, 24.4cm, 26.2cm respectively).The number of leaves showed significant differences between the varieties at all stages except at 6WAT with the differences being highly significant at 10WAT. At 4WAT, Green pepper recorded the highest mean number of leaves (15.88) and Yellow pepper recorded the least mean number of leaves (11.96). At 6WAT, 8WAT and 10WAT, Red pepper recorded highest mean number of leaves (93.3, 177.5 and 289 respectively) and Green pepper recorded the least (79.2, 107.5 and 138 respectively).There was no significant difference in the mean number of leaves at all stages based on poultry manure rates. At 4WAT, 0.00kg/ha recorded the highest mean number of leaves (15.17) and 8000kg/ha recorded the least (12.67). At 6WAT, 6000kg/ha recorded the highest mean number of leaves (92.2) and 0.00kg/ha recorded the least (76.0).At 8WAT, 6000kg/ha recorded the highest mean number of leaves (156.9) and 2000kg/ha recorded the least (140.8). At 10WAT, 8000kg/ha recorded the highest mean number of leaves (243) which was not significantly different from 0.00kg/ha with the least number of leaves (220).

The interaction between variety and poultry manure rate differed significantly based on the mean number of leaves at all stages except at 6WAT.At 4WAT, Green pepper + 0.00kg/ha recorded the highest mean number of leaves (18.17) and Yellow pepper + 6000kg/ha recorded the least (9.17). At 6WAT, Red pepper + 6000kg/ha recorded the highest mean number of leaves (114.2) and Yellow pepper +6000kg/ha recorded the least (66.7). At 8WAT, Red pepper + 6000kg/ha recorded the highest mean number of leaves (211.5) and Green pepper + 6000kg/ha recorded the least (96.2). At 10WAT, Yellow pepper + 8000kg/ha recorded the highest mean number of leaves (324) and Green pepper + 8000kg/ha recorded the least (111). The means of the plant girth revealed a highly significant differences between the varieties at all stages. At 4WAT, Red pepper recorded the highest mean plant girth (4.750mm) and yellow recorded the least (3.775mm). At 6WAT, Yellow pepper recorded the highest mean plant girth (6.97mm) and Green pepper recorded the least (5.23mm).

At 8WAT, Yellow pepper recorded the highest mean plant girth (8.56) and Green pepper recorded the least (6.70mm). At 10WAT, Red pepper recorded the highest mean plant girth (10.07mm) and Green pepper recorded the least (7.76mm).Poultry manure rates showed significant differences based on plant girth at 4WAT and 10WAT but did not show significant difference at 6WAT and 8WAT. At 4WAT, 8000kg/ha recorded the highest mean plant girth (4.422mm) and 2000kg/ha recorded the least (3.994mm). At 6WAT, 0.00kg/ha and 2000kg/ha recorded the highest mean plant girth (6.43mm and 6.43mm respectively) and 6000kg/ha recorded the least (5.89mm). At 8WAT, 8000kg/ha recorded the highest mean plant girth (7.94mm) and 6000kg/ha recorded the least (7.51mm).At 10WAT, 8000kg/ha recorded the highest mean plant girth (9.7mm) and 0.00kg/ha recorded the least (8.1mm).The interaction between variety and poultry manure rate differed significantly based on mean plant girth at all stages. At 4WAT, Red pepper +8000kg/ha recorded the highest mean plant girth (5.200mm) and Yellow pepper + 6000kg/ha recorded the least (3.417). At 6WAT, Yellow pepper + 0.00kg/ha recorded the highest mean plant girth (7.85mm) and Green pepper + 6000kg/ha recorded the least (4.83mm). At 8WAT, Yellow pepper + 0.00kg/ha recorded the highest mean plant girth (9.37mm) and Green pepper + 6000kg/ha recorded the least (6.20mm). At 10WAT,Red pepper +8000kg/ha recorded the highest mean plant girth (10.77mm) and Green pepper + 2000kg/ha recorded the least (7.03mm).

The means of the leaf area represented in table 3 indicated highly significant difference between the varieties at all stages. At 4WAT, Red pepper recorded the highest leaf area (68.0cm^2) and Green pepper recorded the least mean leaf area (33.9cm^2). At 6WAT, Red pepper recorded the highest mean leaf area (89.4cm^2) and Green pepper recorded the least (39.9cm^2). At 8WAT, Yellow pepper recorded the highest mean leaf area (108.7cm^2) and Green pepper recorded the least (50.6cm^2). At 10WAT, Yellow

pepper recorded the highest mean area (117.7cm^2) and Green pepper recorded the least (53.9cm^2).Poultry manure indicated no significant differences based leaf at all stages. 8000kg/ha recorded the highest mean leaf area at all stages (59.9cm^2, 75.1cm^2, 98.0cm^2, and 104cm^2 respectively) . At 4WAT, 6000kg/ha recorded the least mean leaf area (48.9cm^2) and 2000kg/ha recorded the least at 6WAT, 8WAT, and 10WAT (60.0cm^2, 78.1cm^2, and 80.0cm^2 respectively).

The interaction between variety and poultry manure rate differed significantly based on leaf area at all stages.At 4WAT and 6WAT, Red pepper + 8000kg/ha recorded the highest mean leaf area (74.4cm^2 and 99.4cm^2 respectively) and at 8WAT and 10WAT, Yellow pepper + 8000kg/ha recorded the highest mean leaf area (127cm^2 and 136.1cm^2 respectively). Green pepper + 0.00kg/ha recorded the least mean area at all stages (28.6cm^2, 30.7cm^2, 42.9cm^2 and 46.7cm^2 respectively). The mean number of days to 50% flowering represented also showed significant difference between the varieties. Yellow pepper recorded the highest mean in number of days to 50% flowering (38.17DAT) and Green recorded the least (19.75DAT). Poultry manure rates showed significant difference based on the number of days to 50% flowering. 0.00kg/ha and 2000kg/ha recorded the highest mean in number of days to 50% flowering (31.2DAT and 31.2DAT respectively) and 8000kg/ha recorded the least (30.9DAT).The interaction between variety and poultry differed significantly based on number of days to 50% flowering. Yellow pepper + 8000kg/ha recorded highest mean in number of days to 50% flowering (40.0DAT) and Green pepper + 6000kg/ha and Green pepper + 8000kg/ha recorded the least (19.00DAT and19.00DAT respectively).

Table 4 showed the significant differences between the means of the fruit parameters between the varieties based on total number of fruits harvested, fruit weight, fruit circumference, fruit diameter, number of locus, fruit thickness and number of seeds per fruit, however, but not in fruit length. Green pepper recorded the highest means in fruit length (20.8cm), fruit circumference (49.6cm), fruit diameter (24.8cm), number of seeds (375.2), and fruit thickness (13.2mm) and Pepper recorded the least means (17.8cm, 31.6cm, 15.9cm, 182.1 and 5.4mm respectively.

Yellow pepper recorded the highest means in total number of fruits (54.3), fruit weight (264.1g), and number of locus (12.2). Green pepper recorded the least means in total number of fruits (4.3), and number of locus (10.6). Poultry manure rates showed significant difference in total number of fruits, fruit weight, fruit length, fruit diameter, fruit thickness and number of seeds where 2000kg/ha, 6000kg/ha and 8000kg/ha performed significantly better than 0.00 kg/ha. Result also showed there were no significant differences between the 2000kg/ha, 6000kg/ha and 8000kg/ha treatments for those parameters. In the number of locus, 8000kg/ha recorded the highest mean (18.5) which was significantly higher than other treatments. However, in the fruit circumference, there were no significant differences among the treatment rates. The interaction between variety and poultry manure rate showed significant difference in all the fruit parameters. Yellow pepper+2000kg/ha recorded the highest means in total number of fruits (58.7) and in number of locus (12.6) but Green pepper+8000kg/ha and Green pepper+0.00kg/ha recorded the least respectively (4.0 and 10.0).

Yellow pepper+0.00kg/ha recorded the highest mean in fruit (333g) and Red pepper+2000kg/ha recorded the least (119g). Green pepper +0.00kg/ha recorded the highest mean in fruit length (25.80cm) and Red pepper + 6000kg/ha recorded the least (16.8cm). Green pepper+8000kg/ha recorded the highest means in fruit circumference and fruit diameter (51.5cm and 25.7cm respectively) and Yellow pepper + 0.00kg/ha recorded the least (28.5cm and 14.2cm respectively).Yellow pepper+2000kg/ha recorded the highest mean in number of locus(12.6) and Green pepper +0.00kg/ha recorded the least (10.00). Green pepper+6000kg/ha recorded the highest mean in number of seeds (440) and Red pepper +8000kg/ha recorded the least (148). Green pepper +8000kg/ha recorded the highest mean in fruit thickness (14.9mm) and Yellow pepper +0.00kg/ha recorded the least (4.7mm).

Table1: Physical and Chemical properties of the soil sample before planting and after the application of poultry manure

Physical properties	**Initial soil composition**	**Poultry manure**
Sand (%)	69.6	
Silt (%)	22	
Clay (%)	8.4	
Textural class	Sandy-loam (SL)	
Chemical properties		
pH (H_2O)	5.14	6.42
Total N (%)	0.15	0.73
Organic carbon (%)	1.14	7.86
Organic matter (%)	1.98	2.61
Ca (Cmolkg-1)	2.27	5.96
Mg (Cmolkg-1)	1.33	4.08
K (Cmolkg-1)	0.25	9.64
Na (Cmolkg-1)	0.12	4.88
EA (Cmolkg-1)	1.63	2.75
ECEC (Cmolkg-1)	4.97	6.27
BS (%)	80.23	89.68
Available P (mgkg-1)	5.53	8.13

P-Phosphorus, N-Nitrogen, Ca-Calcium, Mg-Magnesium, K-Potassium, Na-Sodium, EA-Exchangeable acidity, ECEC- Effective Cations Exchange Capacity, BS- Base Saturation

Table 2: Plant Heights, Number of Leaves and Stem Girth at Different Weeks after transplanting (WAT)

	Plant Height (cm)				No of leaves				Stem Girth (cm)			
Treatment	4WAT	6WAT	8WAT	10WAT	4WAT	6WAT	8WAT	10WAT	4WAT	6WAT	8WAT	10WAT
Variety												
Green	11.23	21.96	28	30.9	15.88	79.2	107.5	138	3.929	5.23	6.7	7.76
Red	11.91	26.98	41.5	54	12.42	93.3	177.5	289	4.75	6.67	8.06	10.07
Yellow	12.74	27.54	43.2	55.1	11.96	84	159.1	267	3.775	6.97	8.56	9.72
$LSD_{0.05\%}$	**1.932**	**4.202**	**5.44**	**5.74**	**15.88**	**79.2**	**107.5**	**138**	**0.332**	**0.629**	**0.64**	**0.692**
Poultry Manure Rate												
0.00kg/ha	12.61	26.57	35.1	38.4	15.17	76	142.1	220	4.072	6.43	7.7	8.1
2000kg/ha	11.57	25.11	35.1	46.3	13.11	84.9	140.8	226	3.994	6.43	7.9	9.5
6000kg/ha	12.22	25.48	37.6	47.4	12.72	88.8	156.9	230	4.117	5.89	7.5	9.2
8000kg/ha	11.43	24.81	40.5	50.2	12.67	92.2	152.3	243	4.422	6.41	7.9	9.7
$LSD_{0.05\%}$	**2.231**	**4.852**	**6.281**	**6.631**	**3.233**	**27.81**	**44.71**	**60.4**	**0.384**	**0.726**	**0.739**	**0.799**
Variety +PM Interaction												
Green+0.00kg/ha	11.92	23.92	30.4	35.3	18.17	73.7	110.5	128	3.533	5.25	6.68	7.6
Green+2000kg/ha	11.33	22.92	28.6	31.1	17.83	84	111	178	4.017	5.83	6.87	7.03
Green+6000kg/ha	12.07	23.42	28.8	31.1	16	85.5	112.3	133	4.1	4.83	6.2	7.47
Green+8000kg/ha	9.58	17.58	24.4	26.2	11.5	73.5	96.2	111	4.067	5.07	7.03	8.93
Red+0.00kg/ha	11.17	25.5	41.9	53.2	12	67.8	145.7	282	4.7	6.2	7.1	9.47
Red+2000kg/ha	12.03	28.17	41.8	52.9	11.33	95.7	177.8	264	4.267	6.47	8.23	10.87
Red+6000kg/ha	12.22	25.17	42.1	57.7	13	114.2	211.5	317	4.833	6.77	8.4	9.2
Red+8000kg/ha	12.22	27	40.2	52.2	13.33	95.5	174.8	295	5.2	7.27	8.5	10.77
Yellow+0.00kg/ha	14.75	30.3	48.1	62	15.33	86.5	170	296	3.983	7.85	9.37	10.37
Yellow+2000kg/ha	11.35	24.25	34.8	46.1	10.17	75.2	133.7	219	3.7	7.07	8.65	9.25
Yellow+6000kg/ha	12.38	25.78	42.1	53.5	9.17	66.7	146.8	228	3.417	6.07	7.93	9.57
Yellow+8000kg/ha	12.48	29.83	47.9	58.7	13.17	107.7	185.8	324	4	6.9	8.3	9.68
$LSD_{0.05\%}$	**3.864**	**8.405**	**10.87**	**11.49**	**5.601**	**48.16**	**77.45**	**104.6**	**0.665**	**1.257**	**1.28**	**1.384**

Table 3: Leaf Area at Different Weeks after Transplanting and average Number of Days to 50% flowering.

	Leaf Area at Various Weeks after Transplanting (WAT)				**Average Number of Days to 50% Flowering**
Treatments	4WAT	6WAT	8WAT	10WAT	
Variety					
Green	33.9	39.9	50.6	53.9	19.75
Red	68	89.4	102.1	108.6	33.75
Yellow	58.3	78.4	108.7	117.7	38.17
$LSD_{0.05\%}$	**13.93**	**13.52**	**17.57**	**20.94**	**1.44**
Poultry Manure Rate					
0.00kg/ha	52.5	70.1	82.6	90.9	31.2
2000kg/ha	52.3	60	78.1	80	31.2
6000kg/ha	48.9	71.9	89.9	98.7	31
8000kg/ha	59.9	75.1	98	104	30.9
$LSD_{0.05\%}$	**16.09**	**15.61**	**20.28**	**24.18**	**1.662**
Variety +Poultry Manure Rate					
Green+0.00kg/ha	28.6	30.7	42.9	46.7	21
Green+2000kg/ha	32.6	36.6	47.5	50.1	20
Green+6000kg/ha	37.4	50.7	59.3	63.4	19
Green+8000kg/ha	36.9	41.6	52.8	55.6	19
Red+0.00kg/ha	68.9	91.4	97.9	100.4	34
Red+2000kg/ha	67.3	83.2	103.5	106.4	35
Red+6000kg/ha	61.3	83.8	93.6	107.1	34
Red+8000kg/ha	74.4	99.4	113.5	120.4	32
Yellow+0.00kg/ha	60	88.2	107	125.5	38.67
Yellow+2000kg/ha	56.8	60.1	83.2	83.5	38.67
Yellow+6000kg/ha	47.9	81.1	116.8	125.7	40
Yellow+8000kg/ha	68.5	84.3	127.8	136.1	35.33
$LSD_{0.05\%}$	**27.86**	**27.03**	**35.13**	**41.88**	**2.879**

Varietal response: This experiment indicates that varieties had a considerable influence on growth and yield of pepper. The three varieties showed significant varietal difference on growth and yield component which agrees with the report of Raghunauth *et al.*, (2023), which stated that there were varietal responses in different varieties of sweet pepper. Nsukka Yellow pepper variety had the highest plant height, highest number of leaves, highest stem girth, highest leaf area, and highest yield. For most crops there is a direct relationship between growth and yield. This was evident in this study as plant height, stem girth, leaf

area and number of leaves were positively and significantly correlated with number of fruits and weight of fruits harvested. Abu et al. (2013) reported a similar finding for field grown aromatic peppers. This could be due to the fact that Nsukka Yellow pepper had better Canopy developed to intercept solar radiation, hence more photosynthates were produced that enhance source and sink relationship which translates to higher yield. However, the low yield of Green pepper in this experiment might also have been as a result of less adaptability and low genetic performance of the variety to ultilize the temperature, relative humidity and nutrients in the experimental location.

Table 4: Mean Number of Fruits, Weight, Length, Circumference, Diameter, Number of Locus, fruit thickness, Number of Seeds and Number of Days to 50% flowering

Treatments	Total number of fruits	Fruit weight (g)	Fruit length(cm)	Fruit circumference (cm)	Fruit diameter (cm)	No. of locus	Fruit thickness (mm)	No. of seed
Variety								
Green	4.3	197.2	20.8	49.6	24.8	10.6	13.2	375.2
Red	38.4	141.9	17.8	31.6	15.9	12	5.4	182.1
Yellow	54.3	264.1	19.3	32.09	16.1	12.2	6.7	207.4
$LSD_{0.05\%}$	**16.4**	**73.7**	**3.72**	**4.08**	**2.004**	**1**	**0.908**	**55.5**
Poultry Manure Rate								
0.00kg/ha	14.6	72.6	14.9	36.46	16.23	11.3	7.21	198.1
2000kg/ha	31.4	186.4	19.2	38.35	19.21	12	9.1	290.8
6000kg/ha	36.2	202.8	20.1	38.66	19.72	11.7	9.27	297.4
8000kg/ha	34.2	210.1	21.8	37.72	19.86	18.5	10.32	283.6
$LSD_{0.05\%}$	**11.93**	**85.1**	**4.3**	**4.705**	**2.314**	**1.154**	**1.04**	**64.1**
Variety +Poultry Manure								
Green+0.00kg/ha	4.3	149	25.8	48.33	24.17	10	11.92	319
Green+2000kg/ha	4.3	247	19.63	49.65	24.83	11.67	13.07	430
Green+6000kg/ha	4.7	227	17.75	49.03	24.52	10.67	13.02	440
Green+8000kg/ha	4	167	20.03	51.53	25.77	10.33	14.93	310
Red+0.00kg/ha	35.3	147	17.83	32.57	16.28	12	5	159
Red+2000kg/ha	31.3	119	18.7	30.03	15.02	11.67	5.4	197
Red+6000kg/ha	45.3	121	16.87	32.4	16.53	12.33	5.87	223
Red+8000kg/ha	41.7	179	17.97	31.67	15.83	12.33	5.53	148
Yellow+0.00kg/ha	69	333	19.63	28.5	14.25	12	4.7	173
Yellow+2000kg/ha	58.7	237	19.4	35.37	17.79	12.67	5.83	243
Yellow+6000kg/ha	45.7	252	19.7	34.53	17.27	12.33	5.93	227
Yellow+8000kg/ha	44	235	18.63	29.97	14.98	12	10.5	184
$LSD_{0.05\%}$	**32.79**	**147.4**	**7.448**	**8.149**	**4.008**	**1.999**	**1.817**	**111**

Response to Poultry Manure Rate: The growth components such as plant leaf area, number of leaves, and stem girth were significantly affected by poultry manure rate at the end of the experiment (10WAT). Similar result with respect to increase in vegetative growth in the treatment that receives high poultry manure rates was reported by Snr *et al*., (2017). Their report showed that a significant increase that increase in growth as a result of application of poultry manure might be due to positive role in leaf area development and expansion, which means more assimilates were made available due to more nutrients because of the presence of the poultry manure in such plants. For instance, it could have made available more nitrogen which promotes vigorous foliage growth; increased meristematic and physiological activities in the plant resulting in production of more assimilate used in formation of fruits has been established. This result is also similar to the observation of Adesina *et al* (2014), that organic manure provides great nutritional need of pepper. Specifically, they concluded that poultry droppings have the ability to supply the nitrogen requirement of pepper plants for proper growth and yield. The Nitrogen present in poultry consist uric acid which is readily available to the crop and also promotes microbial activities necessary for mineralization of nutrients to plants for improved yield (Raghunauth *et al*., 2023). Notably, a great disparity was observed in the current study regarding the yield of plants treated with poultry droppings compared to the untreated. This is understandable as the soil analysis already showed an increase in soil nutrients as a result of poultry manure. Previous investigation by Chigozie *et al.* (2023), also reported a remarkable increase in pepper plants when poultry manure was applied. They therefore suggested that for long term nutrient availability in the soil to support pepper and other vegetables, poultry manure should constantly be applied.

Conclusion: This research showed that application of poultry manure at improved the growth and yield of pepper. Poultry manure is cheaper, environmentally safe, and could be easily accessed by local farmers which make it a potential alternative to inorganic fertilizers. We therefore recommend the use of poultry

manure especially in areas where there is low soil nutrient

REFRENCES

Abate, T; Dessie, A; Mekie, T (2019). Technical efficiency of smallholder farmers in red pepper production in North Gondar zone Amhara regional state, *Eth. J of Economic Structures*. 8. 10.1186/s40008-019-0150-6.

Abu, NE; Uguru, MI; Obi, UI (2013). Genotypic stability and correlation among quantitative characters in genotypes of aromatic pepper grown over years. *Afr.J. Biotechnology* 12(20) 2792-2801

Abu, NE;Chimdi, GO;Ojua, EO (2020) Nutritional and anti-nutritional evaluation of ten genotypes of pepper (Capsicum annuum L.) grown in a derived savanna ecology of Nigeria. *Ethiop. J. Sci. Technol.*, 13 (1): 17-30

Adesina JM; Sanni, KO; Afolabi, LA; Eleduma, AF (2014). Effect of Variable Rate of Poultry Manure on the Growth and Yield of Pepper (Capsicum annum) in South Western Nigeria Academ Arena 6 (1):9-13http://www.sciencepub.net/academia

Ansa, JEO; Woke, C (2018) Effect of spacing and poultry manure rates on growth, yield and quality of cayenne pepper (*Capsicum frutescens*. L) in Southern rain forest of Nigeria. *Int. Environ. Agric. Biotechnol;* 3 (4) pp. 1234-1240

Black C. A. (ed), (1965). Methods of soil Analysis. Agronomy No. 9 Part 2,

Chigozie, EC; Udo, AA; Osuji, ECP (2023). Effect of Poultry Manure Rates on the Growth and Yield of Pepper (*Capsicum annum*) in Umudike. *World J. of Agri. Sci. and Tech*. 1(2) 19-23

Emejo, J; Alaran, F (2020). FG to Harness Opportunities in $5.8bn Global Pepper Market. https://www.thisdaylive.com/index.php/2020/10/26/fg-to-harness-opportunities-in-5-8bn-global-pepper-marketGoogle Earth Desktop.

Ikeh, O; Ndaeyo, NU; Uduak, IG; Iwo, GA; Ugbe, LA; Udoh, EI; Effiong, GS (2012). Growth and Yield Responses of Pepper (Capsicum frutescens L.) to Varied Poultry Manure Rates in Uyo, Southeastern Nigeria. ARPN: *J. of Agri. and Bio. Sci*. 7: 735-742

Indexbox, (2023). Nigeria: Chili And Pepper Market 2023 Please mention the Source: https://www.indexbox.io/store/nigeria-chilies-and-peppers-green-market-report-analysis-and-forecast-to-2020/ https://www.indexbox.io/store/nigeria-chilies-and-peppers-green-market-report-analysis-and-forecast-to-2020/

Jamir, T; Rajwade, VB; Prasad, VM; Lyngdoh, C (2017) Effect of Organic Manures and Chemical Fertilizers on Growth and Yield of Sweet Pepper (Capsicum R. Raghunauth) Hybrid Indam Bharath in Shade Net Condition. *Inter J. of Current Micro. App. Sci.*, 6, 1010-1019.

Olutumise, AI (2022). Determinants of market participation and preference for production of pepper (Capsicum spp.) among farmers in southwest, Nigeria. Heliyon, 8(9), e10585. https://doi.org/10.1016/j.heliyon.2022.e10585

Raghunauth, R; Chandranauth, R; Bacchus, Z; Chibi, S; Singh, J (2023) Evaluating Two Varieties of Sweet Pepper Using Different Nutrient Sources to Increase Productivity. *J. of Agri. Sci.*, 14, 751-766.

Saleh BK, Omer A, Teweldemedhin B. (2018). Medicinal uses and health benefits of chili pepper (*Capsicum* spp.): a review. MOJ Food Process Technol. 6(4):325–328.

Snr, PAP; Kyere, CG; Jnr, PAP; Oppong, E; Twumasi, G (2020). Effects of Poultry Manure, N. P. K Fertilizer and Their Combination on the Growth and Yield of Sweet Pepper. *Asian J. Agri. and Hort. Res.* 5(1): 14-22

Technicon Instrument Corporation, (1975). Industrial method No. 155-71 W. Tarry.

Worldatlas, (2023). The World's Top Chili Pepper Producing Countries. https://www.worldatlas.com/articles/the-world-s-top-chili-pepper-producing-countries.html