



PERFORMANCE OF SWEET PEPPER (*Capsicum annuum* L.) AS AFFECTED BY CULTIVAR AND POULTRY MANURE IN THE SUDAN SAVANNA ECOLOGY OF NIGERIA

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Article History

Received: 06.01.2024

Accepted: 27.01.2024

Published: 09.02.2024

Abstract: Two field trials were conducted at the Teaching and Research Farm Bayero University Kano (11°58 N, 8°25 E, and altitude 458 m) and Kadawa Irrigation Scheme Bunkure (11°42 N, 8°33 E, and altitude 476 m) to evaluate the performance of sweet pepper as affected by cultivars and poultry manure (PM). The trials involved a factorial combination of three cultivars (Tattasai Dan Damasak, Yolo wonder and Nsukka yellow) and four levels of PM (0, 1.0, 2.0, and 3.0 t ha⁻¹) in a randomized complete block design and were replicated four times. The gross plot was 3 x 4 m (12 m²) while the net plot size was 1.5 m x 3 m (4.5 m²) with a discard of 0.5 m and 1.0 m between the plots and replications, respectively. The trial's results showed that, with the exception of Yolo Wonder, which produced wider fruits (40.02 & 38.62 mm) and a total number of marketable fruits (11.40 & 12.55) at BUK and BKR but on par with Dan Damasak (11.19) at BUK, the Dan Damasak cultivar outperformed other cultivars in terms of growth and yield attributes. The growth and yield characters of the sweet pepper under study were markedly enhanced by the administration of the maximum rate of PM (3 tha⁻¹). Similarly, in both locations, combining the Dan Damasak cultivar with 3.0 tha⁻¹ of PM led to a notable increase in sweet pepper growth and marketable yield. In order to ensure a greater marketable yield and promote sustainable sweet pepper production, farmers in the study area could be recommended to cultivate Yolo Wonder and Dan Damasak cultivars utilizing 3.0 tha⁻¹ of PM.

Keywords: cultivar, performance, poultry manure, sweet pepper, Sudan savanna.

INTRODUCTION

In order to maintain ecosystem health and provide associated benefits for human health, organic farming goods are becoming increasingly important in today's globe. Demand for organic products is rising everywhere in the world. Worldwide, there were 37.5 million hectares of organic land; however, in Nigeria, there were 3,154 hectares and 11,979 hectares of cultivated organic land in 2007 and 2010, respectively (GAIN, 2014). In terms of organic crop output, this is significantly less than what can be achieved in the top five African nations: Tanzania, Tunisia, Ethiopia, Uganda, and Sierra Leone (FiBL and IFOAM, 2014). Among the foods consumed most often per person worldwide are vegetables. Furthermore, growing per capita income among rural inhabitants globally is primarily attributed to the cultivation of vegetables (Mukaila *et al.*, 2022; Raaijmakers *et al.*, 2018). Members of the solanaceous vegetable group include sweet peppers (*Capsicum annuum* L.). According to Brezeanu *et al.* (2020) and FAOSTAT (2019), it is one of the most significant, well-liked, and popular vegetable crops grown in Africa and other parts of the world for export and local retail.

One of the main goals of the Sustainable Development Goals (SDGs) is to combat hunger by producing enough food to feed the world's growing population. In order to achieve a higher yield, production per unit area must be increased, which calls for

using more other inputs like fertilizer, seeds, pesticides, and so on. On the other hand, overuse of chemical fertilizers and other agrochemicals has been shown to have some negative impacts on the soil and over all on the ecosystem (Sharma *et al.*, 2024; Sharma *et al.*, 2022). Therefore, in addition to chemical fertilizer, other sources of plant nourishment are required. Organic farming recycles animal waste back into the farm, uses less pesticides than conventional agriculture, lessens soil erosion, and reduces nitrate leaching into surface and groundwater. Crop productivity, drainage water quality, soil health, and nutrient levels were all significantly impacted by the extended usage of chicken manure (PM), according to Hoover *et al.* (2019). Li *et al.* (2019) similarly demonstrated that PM can effectively enhance soil health attributes like soil fertility and organic matter in a variety of soil situations.

Around the world, there are several kinds of sweet pepper, each with different yields and quality characteristics (Jankauskienė *et al.*, 2023). Selecting the cultivar that would provide a higher yield while being ecosystem-adaptable is therefore crucial. This goal led to the experiment's inception and design, which assessed the performance of sweet pepper as affected by cultivar and poultry manure levels.

MATERIALS AND METHODS

Two field experiments were conducted at the Faculty of Agriculture Research and Teaching Farm, Bayero University

Kano, and Kadawa Irrigation Scheme Bunkure local government area, Kano State . The BUK research farm was located in the northern part of Kano at a latitude of 11°58' N and a longitude of 8° 25' E, and Bunkure Farm was located in the southern part of Kano at a latitude of 11°42' N and a longitude of 8° 33' E. All of the research sites were situated in the Sudan Savanna agro-ecological zone of Nigeria, which is characterized by a monomodal rainfall pattern with a mean annual rainfall of 739.80 mm and a daily range of temperature between 17.89°C to 31.83°C. After the land was sufficiently prepared by ploughing and harrowing it to a fine tilt, a section was set aside for the purpose of raising the seedlings of the three sweet pepper cultivars that would be employed. In nursery beds, the seeds were drilled in separate rows spaced 10 cm apart. The seed beds were covered with rice straw to avoid the displacement of the seeds and keep the soil moist. Watering was carried out every day in the morning and in the afternoon. The nursery lasted for 39 days. The land for the experiment was further ridged following the initial ploughing and harrowing and then plots were laid out as per the specifications quoted in the experimental design. These were all completed one week prior to the seedlings being moved into the field. The gross plot was 3 x 4 m (12 m²) while the net plot size was 1.5 m x 3 m (4.5 m²) with a discard of 0.5 m and 1.0 m between the plots and replications, respectively. A week prior to transplanting, poultry manure was manually put into the soil in accordance with the treatment at a depth of 5 and 8 cm away from the locations where the seedlings would be transplanted. Prior to the experiment starting, the sample chicken excrement was gathered and its mineral content examined. In a similar manner, soil samples were taken at 0–30 cm depths from the two experimental sites, and their physical and chemical characteristics were examined. The other agronomic procedures,

which include weeds, pests, and diseases control, were appropriately carried out as at when due. The crop was harvested by hand picking it when it reached the physiological maturity.

Data were collected on plant height, number of leaves plant⁻¹, leaf area, stem diameter, number of days to 50% flowering, chlorophyll content (SPAD), fresh fruit diameter, total number of fruits per plant, fruit weigh per plant and total fruit yield plant⁻¹ (t ha⁻¹). Data collected was subjected to Analysis of variance (ANOVA) using Genstat (17th edition). Significant treatment means were separated using Student's New Man's Kuel at 5% probability level.

RESULTS

The result of the soil analysis is presented in Table 1. The soil at BUK was sandy loam, with a particle size distribution of 73.90, 14.80, and 11.30% for sand, clay, and silt, respectively. The soil nutrient status was 0.68% organic carbon, 0.42% total nitrogen, 9.89 mg kg⁻¹ of available phosphorus, and 0.33 cmol kg⁻¹ of potassium. Exchangeable bases were 2.27 cmol kg⁻¹ Ca, 1.17 cmol kg⁻¹ Mg, and 0.11 cmol kg⁻¹ Na, with a pH range of 6.22–6.77. While at Bunkure, the soil was also characterized as sandy loam, with a particle size distribution of 77.80, 12.70, and 9.50% for sand, clay, and silt, respectively. The soil nutrient status was 0.45% organic carbon, 0.34% total nitrogen, 10.17 mg kg⁻¹ available phosphorus, and 0.20 cmol kg⁻¹ potassium. Exchangeable bases were 2.18 cmol kg⁻¹ Ca, 1.37 cmol kg⁻¹ Mg, and 0.12 cmol kg⁻¹ Na, with a pH of 6.54–6.93. Similarly, the chemical compositions of poultry manure used in two locations are presented in Table 1. The composition of poultry manure nutrients showed 4.27% of total nitrogen, 949.21 mg kg⁻¹ of total phosphorus, and 6919.37 mg kg⁻¹ of potassium, with organic carbon of 6.37%.

Table 1: Physical and Chemical properties of soil of the experimental sites and Chemical composition of Poultry manure during trial in 2018 Rainy Season

Properties	BUK	Bunkure	Analytical value of poultry manure
Physical (%)			
Sand	73.90	77.80	
Clay	14.80	12.70	
Silt	11.30	9.50	
Textural class	Sandy loam	Sandy loam	
Chemical composition			
pH in water	6.77	6.93	
pH (CaCl ₂)	6.20	6.54	
Organic carbon (%)	0.68	0.45	6.37%
Total nitrogen (%)	0.42	0.34	4.27%
Available phosphorus (mg kg ⁻¹)	9.89	10.17	949.21
Exchangeable bases (cmol kg ⁻¹)			
Ca ⁺⁺	2.27	2.18	
Mg ⁺⁺	1.17	1.37	
K ⁺	0.33	0.20	6919.37
Na ⁺	0.11	0.12	

Effect through growth characters

Plant height

Table 2 presents the effect varieties and poultry manure rates on plant height of sweet pepper at 3, 6 and 9 weeks after transplanting (WAT) during 2018 rainy season in BUK and Bunkure. The results showed a significant difference between varieties, PM and the interaction between variety and PM on plant height across the sampling regimes. The Dan Damasak variety significantly ($P < 0.05$) outgrow the other two varieties (Yolo wonder and Nsukka yellow). The shortest plants were obtained from Nsukka yellow at both location and sampling periods, respectively. The significantly tallest plants were exhibited by the application of 3 tons ha^{-1} of PM while the shortest plants were exhibited by the control (0 t ha^{-1}) at all sampling periods at both locations.

Interactions between variety and PM on plant height at 3 and 6 WAT at BUK and Bunkure is presented in Table 3. Significantly tallest plants were obtained from the combination of 3 t ha^{-1} with Dan Damasak variety at 3 and 6 WAT at both locations, respectively compared to other interaction combinations.

Table 2: Plant height of Sweet pepper as affected by Cultivar and Poultry manure at BUK and Bunkure during 2018 rainy season

Treatment	Weeks after transplanting (WAT)					
	3	6	9	3	6	9
	BUK			Bunkure		
Cultivar (C)						
Dan Damasak	17.19 ^a	22.55a	28.95a	17.04a	21.92a	28.87a
Nsukka yellow	13.17b	18.32c	24.37c	12.94c	18.50b	23.95c
Yolo wonder	13.65b	19.04b	25.22b	13.59b	18.79b	25.23b
SE±	0.022	0.076	0.076	0.038	0.108	0.463
Poultry Manure (PM) (tha⁻¹)						
0	11.43d	16.53d	21.93d	11.35d	16.39d	22.49d
1	13.68c	18.91c	24.68c	13.42c	18.36c	24.37c
2	15.94b	21.27b	28.10b	15.96b	20.61b	27.96b
3	17.63a	23.17a	29.99a	17.38a	23.60a	29.26a
SE±	0.026	0.087	0.087	0.044	0.124	0.534
Interaction						
V x PM	<0.001	<0.001	<0.001	<0.001	<0.001	0.663

Means followed by the same letters in a column are not significantly different at $p < 0.05$ using Student Newman Keuls (SNK)

Table 3: Cultivar and Poultry manure interaction on Plant height of sweet pepper at 3 & 6 WAT at BUK and Bunkure during 2018 rainy season

Cultivar	Poultry manure (tha^{-1})							
	0	1	2	3	0	1	2	3
	BUK at 3 WAT				Bunkure at 3 WAT			
Dan Damasak	13.07g	16.75c	18.58b	20.38a	13.29g	16.40c	18.33b	20.15a
Nsukka yellow	10.14k	11.92i	14.58f	16.04e	9.95k	11.65i	14.40f	15.75d
Yolo wonder	11.09j	12.38h	14.66f	16.46d	10.80j	12.20h	15.15e	16.24c
SE±	0.045				0.077			
Cultivar	BUK at 6 WAT				Bunkure at 6 WAT			
	0	1	2	3	0	1	2	3
	BUK at 6 WAT				Bunkure at 6 WAT			
Dan Damasak	18.27f	22.05c	23.78b	26.10a	17.62e	21.48c	23.07b	25.50a
Nsukka yellow	15.04j	17.02h	19.88e	21.34d	15.79g	16.47f	19.19d	22.55b
Yolo wonder	16.29i	17.67g	20.16e	22.06c	15.75f	17.12e	19.56d	22.76b
SE±	0.152				0.216			

Means followed by different letter(s) in a column and row differ significantly at $p \leq 0.05$ using SNK

Number of leaves per plant

The effect of cultivar and poultry manure rates on the number of leaves plant⁻¹ of sweet pepper at 3, 6, and 9 WAT during the 2018 rainy season in BUK and Bunkure is shown in Table 4. The results revealed that Dan Damasak produced significantly more leaves compared to other cultivars, while Nsukka yellow resulted in fewer leaves at 3, 6, and 9 WAT at both locations. The significantly higher number of leaves per plant was exhibited by the application of 3 tons ha⁻¹ of PM, while the lowest number of leaves per plant was produced by the control (0 t ha⁻¹) across the sampling periods at both locations, respectively. Table 5 presents the effects of variety and PM on number of leaves per plant at 3, 6 and 9 WAT at BUK and Bunkure. When compared to other interaction combinations, the combination of 3 t ha⁻¹ with the Dan Damasak cultivar produced noticeably more leaves per plant at 3, 6, and 9 WAT at both locations.

Table 4: Number of leaves plant⁻¹ of Sweet pepper as affected by Cultivar and Poultry manure at BUK and Bunkure during 2018 rainy season

Treatment	Weeks after transplanting (WAT)					
	3	6	9	3	6	9
	BUK			Bunkure		
Cultivar (C)						
Dan Damasak	17.59a	48.29a	60.86a	17.33a	46.85a	60.11a
Nsukka yellow	15.84c	43.04c	55.60c	15.29c	42.88c	55.95c
Yolo wonder	17.26b	46.75b	59.31b	16.77b	46.09b	59.29b
SE±	0.051	0.043	0.042	0.142	0.174	0.119
Poultry Manure (tha ⁻¹) (PM)						
0	14.17d	36.06d	46.06d	13.95d	35.46d	45.84d
1	16.71c	43.61c	57.01c	16.01b	42.51d	59.15c
2	17.76b	50.32b	63.73b	17.51c	49.34bc	63.55b
3	18.96a	54.12a	67.55a	18.38a	53.79a	67.82a
SE±	0.059	0.049	0.048	0.164	0.200	0.138
Interaction						
G x PM	0.004	0.002	<0.001	<0.001	<0.001	<0.001

Means followed by the same letters in a column are not significantly different at p<0.05 using Student Newman Keuls (SNK).

Table 5: Cultivar and Poultry manure interaction on Number of leaves plant⁻¹ at 3, 6 & 9 WAT at BUK and Bunkure during 2018 rainy season

Cultivar	Poultry manure (tha ⁻¹)							
	0	1	2	3	0	1	2	3
	BUK at 3 WAT				Bunkure at 3 WAT			
Dan Damasak	14.89f	17.25d	19.01b	20.32a	15.46h	18.25c	18.67b	19.75a
Nsukka yellow	13.72 g	14.97f	17.01d	17.66c	13.07k	14.25i	16.75g	17.08f
Yolo wonder	13.90 g	16.14e	19.01b	18.89b	13.32j	15.43h	18.28c	18.45d
SE±	0.992				0.285			
Cultivar	BUK at 6 WAT				Bunkure at 6 WAT			
	0	1	2	3	0	1	2	3
	BUK at 6 WAT				Bunkure at 6 WAT			
Dan Damasak	38.14j	44.39h	53.26c	57.38a	36.85 i	43.08g	51.93c	55.57a
Nsukka yellow	33.91l	40.17i	47.21f	50.86d	34.11k	39.58h	46.37e	51.49c
Yolo wonder	36.14k	46.25g	50.50e	54.13b	35.43j	44.89f	49.73d	54.32b
SE±	0.086				0.347			

BUK at 9 WAT					Bunkure at 9 WAT			
Dan Damasak	48.14j	57.82h	66.69c	70.78a	47.20i	57.52g	66.57b	69.15a
Nsukka yellow	43.91l	53.57i	60.61f	64.31d	44.88j	53.13h	60.38e	65.43c
Yolo wonder	46.13k	59.65g	63.89e	67.56b	45.45j	59.15f	63.70d	68.89a
SE±	0.084				0.239			

Means followed by different letter(s) in a column and row differ significantly at p≤ 0.05 using Student Newman Keuls (SNK).

Leaf area per plant

Table 6 presents the effect of cultivar and poultry manure rates on leaf area per plant of sweet pepper at 3, 6, and 9 weeks after transplanting (WAT) during the 2018 rainy season in BUK and Bunkure. The results show that Dan Damasak significantly produced larger leaves compared to other cultivars, while Nsukka yellow resulted in a narrower leaf area at 3, 6, and 9 WAT at both locations. The significantly larger leaves per plant were exhibited by the application of 3 tons ha⁻¹ of PM, while the lowest number of leaves per plant was produced by the control (0 tha⁻¹) across the sampling periods at both locations, respectively. Table 7 presents the effects of variety and PM on leaf area per plant at 3, 6, and 9 WAT at BUK and Bunkure. When compared to other interaction combinations, the combination of 3 t ha⁻¹ with the Dan Damasak cultivar produced noticeably larger leaves per plant at 3 WAT at BUK and Bunkure, at 6 and 9 WAT at BUK alone, and at 6 and 9 WAT at both locations, the combination of 3 t ha⁻¹ with the Dan Damasak and Yolo Wonder cultivar significantly produced larger leaves per plant compared with rest of the interaction combination.

Table 6: Leaf area plant⁻¹ of Sweet pepper as affected by Cultivar and Poultry manure at BUK and Bunkure during 2018 rainy season

Treatment	Weeks after transplanting (WAT)					
	3	6	9	3	6	9
	BUK			Bunkure		
Cultivar (C)						
Dan Damasak	625.30a	2327.25a	3530.00a	607.35a	2195.00a	3462.00a
Nsukka yellow	532.50c	1901.40c	2999.50c	503.60c	1883.00c	3034.50c
Yolo wonder	595.65b	2177.30b	3316.50b	572.85b	2120.00b	3307.50b
SE±	1.85	2.94	11.45	5.84	13.50	17.75
Poultry Manure (tha⁻¹) (PM)						
0	452.25d	1410.85d	2184.50d	444.90d	1368.50d	2172.00d
1	563.24c	1899.45c	3001.50c	528.75c	1793.00c	2952.00c
2	623.60b	2429.65b	3726.00b	605.50b	2329.00b	3700.00b
3	698.80a	2801.35a	4216.50a	665.90a	2773.00a	4248.50a
SE±	2.14	3.39	13.20	6.75	15.60	20.50
Interaction						
C x PM	<0.001	0.001	<0.001	0.001	<0.001	0.002

Means followed by the common letters in a column are not significantly different at p<0.05 using Student Newman Keuls (SNK).

Table 7: Cultivar and Poultry manure interaction on Leaf area plant⁻¹ (cm²) at 3, 6 and 9 WAT at BUK and Bunkure during 2018 rainy season

Cultivar	Poultry manure (t ha ⁻¹)							
	0	1	2	3	0	1	2	3
	BUK at 3 WAT				Bunkure at 3 WAT			
Dan Damasak	495.00h	626.50e	678.00c	767.00a	514.50i	525.50h	653.50c	735.00a
Nsukka yellow	421.00j	493.50h	589.00f	635.00d	394.50l	460.00j	570.00f	589.50e
Yolo wonder	441.00i	561.50g	635.00d	703.00b	425.00k	550.50g	642.50d	673.00b
SE±	3.71				11.68			

BUK at 6 WAT						Bunkure at 6 WAT		
Dan Damasak	1560.00i	2017.50g	2647.00c	3085.00a	1473.00h	1912.50f	2495.00c	2899.00a
Nsukka yellow	1260.50k	1658.50h	2193.50f	2493.00d	1277.00j	1562.50g	2116.00e	2576.00b
Yolo wonder	1412.00j	2022.50g	2448.50e	2826.50b	1356.00i	1904.00f	2376.50d	2844.50a
SE±		5.88				7.01		

BUK at 9 WAT						Bunkure at 9 WAT		
Dan Damasak	2370.00i	3155.00g	4032.00c	4563.00a	2287.00g	3110.50e	4021.50b	4428.50a
Nsukka yellow	1996.50k	2696.50h	3467.50f	3838.00d	2090.50h	2650.5f	3431.50d	3965.50b
Yolo wonder	2187.50j	3152.50g	3678.50e	4248.00b	2138.00h	3094.5e	3646.50c	4351.50a
SE±	22.85					35.01		

Means followed by different letter(s) in a column and row differ significantly at $p \leq 0.05$ using Student Newman Keuls (SNK)

Stem diameter per plant

The impact of cultivar and rates of poultry manure on sweet pepper stem diameter at 3, 6, and 9 weeks after transplanting (WAT) in BUK and Bunkure during the 2018 wet season is shown in Table 8. The findings indicated that Dan Damasak had noticeably broader stems than other cultivars, although Nsukka yellow produced a narrower stem at 3, 6, and 9 WAT at both sites. In comparison to the control (0 t ha⁻¹), which produced narrower stems than the application of 3 tons ha⁻¹ of PM which resulted in noticeably larger stems per plant throughout the sample periods at both locations.

Table 8: Stem diameter of Sweet pepper as affected by Cultivar and Poultry manure at BUK and Bunkure during 2018 rainy season

Treatment	Weeks after transplanting (WAT)					
	3	6	9	3	6	9
	BUK			Bunkure		
Cultivar (C)						
Dan Damasak	12.00a	14.70a	17.75a	8.19a	14.25a	17.44a
Nsukka yellow	6.60c	11.20c	14.63c	6.28c	11.44c	14.88c
Yolo wonder	7.60b	13.20b	16.50b	7.66b	13.19b	16.25b
SE±	2.120	0.069	0.119	0.122	0.102	0.199
Poultry Manure (tha⁻¹) (PM)						
0	7.00d	9.50d	12.92d	6.04d	9.54d	12.96d
1	8.20c	12.10c	15.33c	6.79c	12.04c	15.04c
2	9.00b	14.40b	17.67b	8.08b	14.08b	17.50b
3	10.60a	16.10a	19.25a	8.58a	16.17a	19.25a
SE±	2.450	0.080	0.138	0.141	1.780	1.990
Interaction						
C x PM	0.531	0.052	0.401	0.262	0.101	0.470

Means followed common letters in a column are not significantly different at $p < 0.05$ using Student Newman Keuls (SNK).

Number of days to 50% flowering and Leaf chlorophyll content (SPAD)

Table 9 presents the effect of cultivar and poultry manure rates on the number of days to 50% flowering and chlorophyll content of sweet pepper during the 2018 rainy season in BUK and Bunkure. The results show that the Nsukka yellow cultivar flowered earlier compared to other cultivars, while Yolo Wonder flowered at a later date at both locations. Significantly earlier flowering was exhibited by the application of control (0 t ha⁻¹) compared to the application of 3 tons ha⁻¹ of PM, which flowered lately across the sampling periods at both locations, respectively. Conversely, compared to the other cultivars at BUK, the Dan Damasak cultivar exhibited a noticeably higher chlorophyll content. Similarly, the application of 1.0 tons ha⁻¹ of PM and control produced, respectively, higher and lower levels of chlorophyll. At Bunkure, there was, however, no significant ($p > 0.05$) variation in PM rates and cultivars with respect to chlorophyll content

Table 9: Number of Days to 50% flowering and Chlorophyll content (SPAD) of Sweet pepper as affected by Cultivar and Poultry manure at BUK and Bunkure during 2018 rainy season

Treatment	Number of days to 50% flowering		SPAD	
	BUK	BKR	BUK	BKR
Cultivar (C)				
Dan Damasak	37.25b	38.25b	52.48a	54.42
Nsukka yellow	38.25a	38.88a	49.80c	53.65
Yolo wonder	34.69c	35.44c	50.64b	53.52
SE±	0.153	0.082	1.219	1.154
Poultry Manure (tha⁻¹) (PM)				
0	45.58a	46.25a	49.14d	54.88
1	37.58b	38.42b	52.64a	52.82
2	33.00c	33.75c	51.13b	53.61
3	30.75d	31.67d	50.98c	54.15
SE±	0.177	0.094	1.407	1.332
Interaction				
C x PM	0.051	0.101	0.771	0.747

Means followed by the same letters in a column are not significantly different at $p < 0.05$ using Student Newman Keuls (SNK).

Effect through yield and yield related parameters

Fresh fruit diameter, Total number of marketable fruits per plant, Fruit weight per plant and Fruit yield per hectare

The impact of cultivar and rates of poultry manure on sweet pepper fresh fruit diameter, total number of marketable fruits per plant fruit weight and total fruit yield in BUK and Bunkure during the 2018 wet season is shown in Table 10. Results revealed that the Yolo Wonder cultivar produced noticeably more broader fruits and total marketable fruits per plant than other cultivars at BUK and BKR, respectively. On the other hand, the Dan Damasak cultivar outperformed the other cultivars in terms of both total fruit yield and fresh weight per plant. In addition, compared to the control (0 t ha⁻¹), which produced lower values, the application of 3 tons ha⁻¹ of PM produced noticeably wider fruits, the total number of marketable fruits, fruit weight per plant, and the overall fruit yield.

Table 10: Fresh fruit diameter, Total number of marketable fruits plant⁻¹, Fruit weight plant⁻¹ and Total fruit yield of Sweet pepper as affected by Cultivar and Poultry manure at BUK and Bunkure during 2018 rainy season

Treatment	Fresh fruit diameter (mm)		Total number of marketable fruits plant ⁻¹		Fruit weight plant ⁻¹ (g)		Total fruit yield (t ha ⁻¹)	
	BUK	BKR	BUK	BKR	BUK	BKR	BUK	BKR
Cultivar (C)								
Dan Damasak	35.06c	34.27c	11.19a	11.40b	369.80a	377.10a	9.861a	10.06a
Nsukka yellow	36.90b	36.11b	9.95b	9.96c	270.00c	278.60c	7.199c	7.43c
Yolo wonder	40.02a	38.62a	11.40a	12.55a	341.70b	371.70b	9.11b	9.91b
SE±	0.497	0.677	0.317	0.314	8.850	13.310	0.236	0.353
Poultry Manure (tha⁻¹) (PM)								
0	32.98d	31.48d	4.90d	5.30d	81.70d	86.80d	2.178d	2.31d
1	36.47c	35.69c	9.35c	9.90c	239.10c	252.90c	6.375c	6.74c
2	38.80b	37.98b	13.67b	13.62b	457.10b	461.70b	12.191b	12.32b
3	41.06a	40.17a	15.47a	16.40a	530.80a	568.50a	14.154a	15.16a
SE±	0.574	0.782	0.366	0.363	10.220	15.370	0.273	0.408
Interaction								
C x PM	0.060	0.110	0.949	0.954	0.397	0.648	0.392	0.684

Means followed by the same letters in a column are not significantly different at $p < 0.05$ using Student Newman Keuls (SNK)

DISCUSSION

The observed variations in growth, production, and yield-related characteristics across the investigated cultivars of sweet pepper could be ascribed to genetic polymorphisms within the cultivars. This is consistent with research by Voss-Fels *et al.* (2019), who found that crop varieties' growth and yield characteristics are influenced by their genetic makeup. Consequently, the Dan Damasak cultivar may have been able to intercept more light for the production of photosynthates and its partitioned production of dry matter due to its noticeably taller plants, more leaves per plant, wider leaf area, and wider stems. The present study supports the findings of Raza *et al.* (2019) and Wu *et al.* (2017), who observed that plants exhibit extraordinary resilience to abrupt environmental changes due to their increased genetic diversity. Due to its distance from its centre of cultivation, Nsuka yellow may be less adapted to the study area than the other cultivars, which could have led to environmental stress causing it to flower earlier than the other cultivars. This result is consistent with findings published by FAO (2017), Deutsch *et al.* (2018), and Stokstad (2019), who discovered that climate variability is endangering the subpar performance of specific crop genotypes, posing a serious challenge to food security.

The treatment with the maximum of PM (3.0 t ha⁻¹) administered likely had a higher release of vital nutrients, particularly nitrogen and phosphorus, as seen by the notable improvement in growth and yield parameters. This is consistent with the findings of Agba (2019), who found that the application of PM at 3-4 t ha⁻¹ enhanced *Ocimum gratissimum* growth and yield characters. Similar improvements were noted in the growth, yield, and quality of cayenne pepper by Ansa & Woke. (2018). Increased nitrogen availability and better soil characteristics (moisture retention, soil structure, and aeration) after the PM application may be the cause of this. The synthesis of photo-assimilates is known to be improved by nitrogen through its ability to boost physiological activities in crops. The results of Iqbal *et al.* (2020) are corroborated by this, since they show that applying manure in the form of PM and CD enhances rice's nitrogen metabolism, post-anthesis biomass yield, and soil health.

CONCLUSION

The trial's results showed that, with the exception of Yolo Wonder, which produced wider fruits and a total number of marketable fruits at BUK and BKR but on par with Dan Damasak at BUK, the Dan Damasak cultivar outperformed other cultivars in terms of growth and yield attributes. The growth and yield characters of the sweet pepper under study were markedly enhanced by the administration of the maximum rate of PM (3.0 t ha⁻¹). Similarly, in both locations, combining the Dan Damasak cultivar with 3.0 t ha⁻¹ of PM led to a notable increase in sweet pepper growth and marketable yield. In order to ensure a greater marketable yield and promote sustainable sweet pepper production, farmers in the study area could be recommended to cultivate Yolo Wonder and Dan Damasak cultivars utilizing 3.0 t ha⁻¹ of PM.

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