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INFLUENCE OF DIFFERENT COMPOSTED PLANT MATERIALS ON GROWTH AND YIELD OF BELL PEPPER (*Capsicum annum* L.) IN LAPAI, NIGER STATE, NIGERIA

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ABSTRACT

A field experiment was conducted at the Botanical Garden of Biological Science Department, Ibrahim Badamasi Babangida University during the 2023 cropping season to investigate the influence of different composted plant materials on growth and yield of bell pepper. The three plant materials used were *Moringa oleifera* fruits, neem fruits and locust beans fruits which were collected and composted. The composted materials were applied each at the rate of 0, 10, 20 and 30kg corresponding to 0, 10, 20 and 30t/ha respectively. These treatments were arranged in a completely randomized block design (RCBD) in three replications. Bell pepper growth and yield attributes measured included plant height, stem girth, number of leaves per plant, leaf area, length of branches, number of flowers per plant (NOFL/PLT), number of fruits per plant (NOF/PLT), fruit diameter (FDM) and fruit weight per plot (FW/PLOT). Data collected on all the mentioned parameters were subjected to analysis of variance (ANOVA) using Minitab statistical software version 2017. Means that showed significant differences were separated using Tukey Pairwise Comparison at 5% probability level. Results from the ANOVA indicated that composted plant material (CPM) produced a significant effect on plant height, stem girth, leaf area, number of leaves per plant and length of branches with composted locust beans fruits showing superiority in growth attributes of pepper compared to *Moringa oleifera* and neem fruits. Composted neem fruits consistently recorded the least effect on all the growth and yield parameters of bell pepper evaluated. It was also observed to produce a significant influence on NOFL/PLT, NOF/PLT, FDM, WFF and FW/PLT. Rate of CPM on the other hand showed a significant effect on NOFL/PLT and NOF/PLT, FDM, WFF and FW/PLT. Generally, composted locust beans fruits applied at 30kg (30t/ha) exhibited superiority in growth and yield although not significantly different form 20kg (20t/ha) with 0 kg (0 t/ha) which is the control, producing the least effect on growth and yield.

Keywords: composted, fruit, attributes, superiority, parameters, separated

INTRODUCTION

Pepper (*Capsicum annum* L.) is a vegetable crop from the family *Solanaceae* and reported to be indigenous to Central and South America (Anthony, 2023). Some of the five domesticated species include *C. annum*, *C. baccatum* L., *C. chinensis* L., *C. pubescens* L., and *C. frutescens* (Bosland and Vatava, 2002). Although vast differences in trait exist but most commercially cultivated cultivars of pepper in the world belongs to the species *C. annum* L. Bell pepper is one of the most widely used fruit vegetable in Nigeria (Kumar and Swarupa, 2007). Almost every Nigerian eats pepper and it is regarded as one of the most lucrative farming ventures in Nigeria (Adaobi, 2023). Its fruits are harvested and are consumed at different maturity stages; green, red and not fully ripe. Bell pepper (*Capsicum annum* L.) is a very important vegetable in the tropics and in the world. It is second most important vegetable after tomatoes (Olaniyi and Ojetayo, 2019). Similarly, bell pepper has increased in value and importance over time, making it an indispensable part of the daily diet of millions of Nigerians. It is normally used as a spice in the preparation of soup and stew when cooked with tomatoes and onions. It can also be used in flavorings of processed meat, coloring certain food preparation and also used for medicinal purposes (Khan *et al*, 2010). Muhamman and Auwalu (2016), reported that sweet pepper contribute substantially to Nigerian diet, because it serves as a good source of vitamin A, B1, B2, C, D and E. Also obtained from bell pepper are potassium, phosphorus, and calcium. Pepper is used in making vegetable curry and salad as well as for various medicinal values in the treatment of different ailment such as paralysis and fever. Sweet or bell pepper was believed to have been introduced to Africa and Asia by Columbus from the new world (Altaf *et al*., 2020). Due to increasing human population which has exerted a high demand on food, the quantity of the crop produced is found not to be enough to meet human demand. This low production stems from declining soil fertility especially in the savannah region of Nigeria where most of the pepper production takes place. In order to obtain high yields of bell pepper, there is need to augment the crop's soil nutritional requirements. Because of the high cost of inorganic fertilizers and its attendant negative implications on the environment, organic sources of soil amendments needed to be explored because of their environmental friendliness, affordability and availability (Emeka *et al.*, 2023). It is therefore expedient to determine the effects of composted plant materials and rates of application on the growth and yield of bell pepper in Lapai, Niger State.

MATERIALS AND METHODS

Experimental Location

This research was conducted at the Department of Biological Science Botanical Garden, Faculty of Natural Sciences, Ibrahim Badamasi Babangida University main campus, Lapai, Niger State, Nigeria which lies between the latitude of 9.0493ºN and longitude 6.5797ºE.

Experimental Materials

The bell pepper seeds were bought from Ideal Agro Ventures Nig. Ltd. Bida, while the *Moringa oleifera* fruits, neem fruits and locust beans fruits were collected from the research farm of the Faculty of Agriculture, Ibrahim Badamasi Babangida University, Lapai.

Preparation of the Compost

Fresh fruits of the various plants (*Moringa oleifera* fruits, neem fruits and locust beans fruits) were collected and 100kg each of the material was deposited separately in a compost pit. Water was added to the pile and the pit covered to give room for limited supply of air and heat generation. Turning of the pile was done weekly using a pitchfork to facilitate decomposition process. The decomposed compost is collected and kept in the open to allow for cooling before application (Anurag, 2019).

Experimental Design and Procedure

The experiment was a 3 x 4 factorial combination of treatments that consisted of three (3) composted plant materials (*Moringa oleifera* fruits, neem fruits and locust beans fruits) applied at 4 different rates (0, 10, 20 and 30 Kg equivalent to 0, 10, 20 and 30 tons per hectare). Bell pepper seeds were sown in well prepared nursery beds and seedlings transplanted to the permanent plots after 21 days of sowing. The experimental area measuring 16.5m x 11.5m was cleared and ridged. Each plot measured 5m x 3.5m with 0.5m between plots to serve as alley ways. The different rates of composted *Moringa oleifera* fruits, neem fruits and locust beans fruits were applied to the plots at the rate of 0, 10, 20 and 30 Kg, equivalent to 0, 10, 20 and 30 t/ha respectively. This was done two weeks before transplanting (Anurag, 2019). Treatments which included composted *Moringa oleifera* fruits, neem fruits and locust beans fruit and rate of application of 0, 10, 20 and 30 Kg, equivalent to 0, 10, 20 and 30 t/ha were arranged in a randomized complete block design (RCBD) with three replicates

Data collection

Data was collected on plant height, length of branches **s**tem girth, leaf area, number of leaves per plant, length of branches, number of flowers per plant, number of fruits per plant, fruit diameter and fruit weight per plot**.**

Data Analysis

Data collected on all parameters were subjected to analysis of variance (ANOVA) using Mintab statistical software version 2017. Significant means were separated using Tukey Pairwise Comparison at 5% probability level.

RESULTS AND DISCUSSION

Mean effect of composted plant materials on growth attributes of bell pepper is shown in Table 1. The result indicated that composted locust bean fruits recorded significantly tallest plants than composted *Moringa oleifera* and neem fruits with the least plant height observed in composted neem fruits. A similar trend was observed for stem girth, number of leaves per plant, length of branches and leaf area. Table 2 showed the mean effect of rate of composted plant materials on growth attributes of bell pepper. The result of the table indicated that 30 kg (30 t/ha) produced the tallest plants compared to 0kg (0 t/ha), 10kg (10 t/ha) and 20 kg (20 t/ha). Although, there were no significant differences between 20t/ha and 30t/ha application. The shortest plants were observed in 0 t/ha which serves as the control. Plant height, stem girth, number of leaves per plant, leaf area and length of branches were observed to follow the same trend. Interaction effect of composted plant material and rate of application on growth attributes of bell pepper is presented in Table 3. The table indicated that composted locust beans fruits applied at the rate of 20 and 30t/ha recorded superior growth in terms of plant height, length of branches **s**tem girth, leaf area, number of leaves per plant compared to composted *Moringa oleifera* and neem fruits at the different rates of application. Mean effect of composted plant materials on yield attributes of bell pepper is indicated in Table 4. The table showed that number of flowers per plant (NOFL/PLT) was significantly highest in composted locust bean fruits than in composted *Moringa oleifera* and neem fruits. Composted neem fruits however recorded the least NOFL/PLT. Number of fruit per plant (NOF/PLT), fruit diameter (FDM), weight of fresh fruit (WFF) and fruit weight/plot (FW/PLOT) was observed to follow a similar trend. Mean values for rate of composted plant materials on yield attributes of sweet Pepper is indicated in table 5. The result indicated that as the rate of composted plant material increased from 0 to 30t/ha, the yield attributes also increased. 30t/ha produced significantly highest number of flowers per plant (NOFL/PLT), number of fruits per plant (NOF/PLT), fruit diameter (FDM), weight of fresh fruit (WFF) and fruit weight per plot (FW/PLOT) even though it was not significantly different from 2t/ha application. The lowest values for NOFL/PLT, NOF/PLT, FDM, WFF and FW/PLOT were observed in 0 t/ha application. Table 6 showed the interaction effect of composed plant material and rate of application on yield of bell pepper. The result indicated that composted locust beans fruits applied at 20 and 30t/ha recorded the highest NOFL/PLT, NOF/PLT, FDM, WFF and FW/PLOT compared to composted *Moringa oleifera* and neem fruits at various rates of application.

Table 1: Mean Effect of Composted Plant Materials on Growth Attributes of Bell Pepper

Composted Plant Material	Plant Height (cm)	Stem Girth (cm)	Number of Leaves/plant	Leaf Area (cm^2)	Length Branches (cm)
Moringa oleifera Fruits	57.23b	4.12b	72.98b	30.66b	17.65b
Neem Fruits	48.87c	4.78b	69.45b	31.67b	19.98b
Locust Beans Fruits	82.45a	6.98a	87.34a	41.56a	25.87a

* Means with the same letter in a column are not significantly different

Table 2: Mean Effect of Rate of Composted Plant Materials on Growth Attributes of Bell Pepper

Rate of Composted Plant Material (Kg)	Plant Height (cm)	Stem Girth (cm)	Number of Leaves/plant	Leaf Area (cm^2)	Length Branches (cm)
0 (0 ton/ha)	32.12c	2.43d	23.45d	25.00c	13.67c
10 (10 ton/ha)	52.34b	5.15b	40.11c	36.43b	19.12b
20 (20 tons/ha)	56.56b	8.23a	53.12b	35.98b	25.98a
30 (30 tons/ha)	86.12a	9.56a	63.81a	46.50a	27.01a

* Means with the same letter in a column are not significantly differen

Table 3: Interaction Effect of Composted plant Material and Rate of Application on Growth Attributes of Bell Pepper

CPM	X RATE (kg)	Plant Height (cm)	Stem Girth (cm)	Number of Leaves/plant	Leaf Area (cm^2)	Length Branches (cm)
	0	35.45d	2.71c	27.20c	24.56d	12.23d
Moringa oleifera	10	42.65c	2.98c	31.09c	28.67c	17.11c
Fruits	20	52.71b	5.12b	54.78b	36.76b	21.45b
	30	62.89b	5.23b	57.32b	39.87b	22.56b
	0	34.56d	2.03c	25.97c	23.74d	13.42d
Neem	10	40.42c	3.00c	29.78c	26.97c	18.32c
Fruits	20	56.02b	4.67b	56.76b	34.89b	23.16b
	30	60.98b	5.04b	54.95b	37.58b	23.67b
	0	33.76d	2.23c	25.00c	21.56c	11.98d
Locust	10	58.62b	4.63b	41.78b	36.89b	24.34b
Beans	20	68.31a	6.98a	68.98a	43.67a	28.69a
Fruits	30	67.78a	7.19a	71.04a	45.21a	27.89a

* Means with the same letter in a column are not significantly different

KEY

CPM = composted plant material

Table 4: Mean Effect of Composted Plant Materials on Yield Attributes of Bell Pepper

Composted Plant Material	NOFL/PLT	NOF/PLT	FDM (cm)	WFF (g)	FW/PLOT (Kg)
Moringa oleifera Fruits	47.44d	30.25b	11.03b	69.11b	1.93b
Neem Fruits	45.76b	28.67b	12.71b	71.78b	1.70b
Locust Beans Fruits	67.11a	42.10a	16.67a	78.97a	2.98a

* Means with the same letter in a column are not significantly different

KEY:

NOFL = number of flowers per plant

NOF/PLT= number of fruit per plant

FDM =fruit diameter

WFF = weight of fresh fruit

FW/PLOT = fruit weight per plot

Table 5: Mean Effect of Rate Composted Plant Materials on Yield Attributes of Bell Pepper

Rate of Composted Plant Material (Kg)	NOFL/PLT	NOF/PLT	FDM (cm)	WFF (g)	FW/PLOT (Kg)
0 (0 ton/ha)	42.45b	25.23b	11.92b	65.67b	1.33b
10 (10 ton/ha)	47.34b	27.65b	12.09b	66.98b	1.55b
20 (20 tons/ha)	66.56a	42.95a	17.52a	71.78a	2.74a
30 (30 tons/ha)	69.34a	45.76a	17.71a	73.97a	3.07a

* Means with the same letter in a column are not significantly different

Table 6: Interaction Effect of Composted plant Material and Rate of Application on Yield Attributes of Bell Pepper

CPM	X RATE (kg)	NOFL/ PLT	NOF/PLT	FDM (cm)	WFF (g)	FW/PLOT (Kg)
	0	30.10d	11.78e	7.78d	47.33c	1.06d
Moringa oleifera	10	43.78c	16.67d	9.10c	48.12c	1.45c
Fruits	20	53.87b	30.34b	12.56b	56.70b	2.76b
	30	54.78b	31.45b	12.13b	57.00b	2.07b
	0	29.77d	10.45e	8.00d	45.79c	1.11d
Neem	10	41.45c	18.00d	10.78c	45.45c	1.78b
Fruits	20	52.56b	29.32b	12.34b	54.67b	1.58b
	30	53.53b	30.19b	12.89b	58.52b	1.88b
	0	31.11d	10.02e	7.23	46.32c	1.07d
Locust	10	42.78c	22.34c	11.31b	53.56b	1.86b
Beans	20	64.23a	45.67a	15.67a	69.43a	2.98a
Fruits	30	63.23a	44.89a	16.07a	70.12a	3.14a

* Means with the same letter in a column are not significantly different at
KEY:
NOFL = number of flowers per plant
NOF/PLT= number of fruit per plant
FDM =fruit diameter
WFF = weight of fresh fruit
FW/PLOT = fruit weight per plot

Discussion

The significant effect of composted plant material and rates of application on growth and yield of bell pepper is an indication that organic manure addition to the soil is important in supplying soil nutrients necessary for plant growth and yield. Increasing rate of application of composted plant material is very essential in supplying plant nutrients for optimum plant growth and yield. This is evident in the increased plant height, stem girth, number of leaves per plant, leaf area and length of branches when rate of application increased. This agrees with the findings of Lekasi *et al.* 2018) who in his study reported superior performance of pepper when organic manure was applied. Diaz-Perez *et al*. 2020) also reported that increasing rates of application of composted manure increased growth and yield in pepper. Ajayi (2017) in his study reported that farmyard manure is rich in nitrogen phosphorus and potassium which are essential for growth and development of vegetables crops such as bell pepper. Composted locust beans fruits consistently produced superior growth and yield compared to composted *Moringa oleifera* and neem fruit. This could be due to formation of more humic substances by composted locust beans compared to composted *Moringa oleifera a*nd neem fruits which result from the degradation of more organic substrates over time by the microorganisms. Aisha *et al*. (2014) corroborated the findings that increasing humic acid, increased growth and yield parameters in crops.

CONCLUSIONS

Results of this study showed that composted plant materials and rates of application had a significant effect on growth and yield attributes of bell pepper. Composted locust beans fruits applied at 20 and 30 t/ha produced superior growth and yield of bell pepper compared to composted *Moringa oleifera* and neem fruit at 0, 10, 20 and 30t/ha. Composted neem fruits consistently had the least effect on growth and yield of bell pepper.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

REFERENCES

Adaobi, O. (2023). The different types of peppers we have in Nigeria.www.pulse .ng

Aisha H., Shafeek, M. R., Asmaa R.M. and ElDesuki, M. (2014). Effect of various levels of organic fertilizer and humic acid on the growth and roots. *Current Sci. Inter*., **3 (1),** 7-14

Ajayi, O.C. (2017). User Acceptability of Sustainable Soil Fertility Technologies: Lessons from Farmers' Knowledge, Attitude and Practice in Southern Africa. *Journal of Sustainable Agriculture 30: 21-40*

Altaf, M.A.; Shu, H.; Hao, Y.; Zhou, Y.; Mumtaz, M A.;Wang,Z.(2022).Vanadium toxicity induced changes in growth, antioxidant profiling,and vanadium uptake in pepper (*Capsicum annuum* L.) seedlings. Horticulturae ,8, 28.

Anthony, E. (2023). A story of pepper, the world's most important and underappreciated specie. New lines magazine. newlinesmag.com.

Anurag D. (2019). Effect of compost on soil and water properties used in crop productivity.JETIR,Volume 6, Issue 1. www.jetir.org (ISSN-2349-5162**).**

Bosland, P. W. and E. J. Vatava (2002). Peppers, Vegetables and Spices, *Capsicum* CABI publishing. Walling Ford; United Kingdom. Pp. 204

Diaz-Perez, J.C., Germishuizen, P and Da Silva, A.L.(2020). Effect of compost application at transplant stage and before planting to the field on plant growth and fruit yield in bell pepper (Capsicum annuum L.). Com. Soil Sci. Plant Anal. 52, 2793–2802

Emeka, C.C., Akpan, A. U and Emeka, C. P. O. (2023). Effect of Poultry Manure Rates on the Growth and Yield of Pepper (*Capsicum annum*) in Umudike. *World Journal of Agricultural Science and Technology.*Vol. 1, No. 2, pp. 19-23. doi: 10.11648/j.wjast.20230102.11

Lekasi, J. K., Ndugu K.W and Kifuko M.N. (2018). Organic Research Management in Kenya Perspective and Guidelines, forum for organic Research Management and Agricultural Technology (FORMAT)

Khan, M. S. I., Roy, S. S. and Pall, K. K. (2010). Nitrogen and phosphorus efficiency on the growth and yield attributes of *Capsicum. Academic Journal of Plant Sciences*. 3 (2): 71-78 pp

Kumar, T. S. S and Swarupa, P. U. (2007). "Cultivation practices of black pepper in India–a Review,"*International Journal of Innovative Research In Management Studies (IJIRMS)*, vol. 2, no. 5, pp. 21–27

Muhamman, M.A. and Auwalu, B.M. (2016). Nursery performance of sweet pepper (*capsicum annum* L) under Different Growth Medium and fertilizer Sources in Northern Guinea savanna zone of Nigeria, held at Adamawa state University, Mubi Nigeria.

Olaniyi, J.O and Ojetayo, A.E. (2019).The effect of organomineral and organic manures on growth, fruit yield and quality of pepper (Capsicum frutescences),8(3),1070-1076.