"OWO MADE"

UNLOCKING THE POTENTIALS OF AGRICULTURAL VALUE CHAINS FOR SUSTAINABLE ECONOMIC DEVELOPMENT IN NIGERIA

PROCEEDINGS

55TH ANNUAL CONFERENCE

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Rufus Giwa Polytechnic, Owo, Ondo State

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Effect of Organic Fertilizer Rates on Productivity of Hot Pepper (*Capsicum chinense* (Jacq.) Varieties in Minna, Nigeria

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ABSTRACT

A study was conducted to evaluate the effect of organic fertilizer rates on productivity of hot pepper (Capsicum chinense Jacq.) varieties, under screen house at Federal University of Technology, Gidan Kwano Campus Minna, and in a farmers' field in Minna, Nigeria, in the 2019/2020 dry season. A 3 x 3 factorial treatment was laid out in a Completely Randomized Block Design (CRD) in the screen house and Randomized Completely Block Design (RCBD) in the field, with four replications in the screen house and three replications in the field. The treatment consisted of three organic fertilizer rate (0, 1.5 and 3.0 t ha^{-1}) and three hot pepper varieties (Mbgakpa, Dan-Sokoto and Dan-Zaria). Data were recorded on plant height, number of branches per plant, fruit length, fruit diameter and yield. Results showed that under screenhouse and field conditions the application of 1.5 and 3.0 t ha^{-1} of organic fertilizer recorded significantly similar taller plants, more branches, longer fruits than the application of organic fertilizer at 0 t ha^{-1}. Bigger fruits were recorded with the application of organic fertilizer at the rate of 1.5 t ha^{-1} than the control and 3.0 t ha^{-1} organic fertilizer. The application of 3.0 t ha^{-1} of organic fertilizer recorded higher fruit yield in the screenhouse, but under field situation the application of 1.5 and 3.0 t ha^{-1} organic fertilizer recorded similar higher fruit yield than the control. The use of Mgbakpa variety recorded significantly taller plants and higher number of branches, similar with Dan-Sokoto under field condition. The use of Dan-Sokoto produced longer fruits than the other varieties. Dan-Zaria and Dan-Sokoto produced significantly similar bigger fruits than Mgbakpa. Dan-Sokoto and Dan-Zaria recorded significantly similar higher fruits yield than Mbgakpa which recorded the lowest fruit yield. It can be concluded that sowing of Dan-Sokoto or Dan-Zaria with the application of 1.5 t ha^{-1} organic fertilizer can be used to obtain higher fruit yield of hot pepper in this Agro-ecological zone of Nigeria.

Keywords; Hot pepper, Screenhouse, Farmers field, Organic fertilizer, Varieties.

INTRODUCTION

Hot Pepper (*Capsicum chinense*) is a specie of pepper native to the Americas and belongs to the family Solanaceae. Its varieties are well known for their exceptional heat (Nabhan, 2014). The hottest pepper of the world are members of this species. Seeds of C. *chinense* have been found in cave dwellings in Central America that indicates the natives have been consuming chili since 7,000 years ago, but have only been available in areas outside Americas for about 400-500 years following the Columbia exchange (Nabhan, 2014). In Nigeria, four types of pepper are recognized on the basis of fruit form namely, "Atawere" - Bird peppers (*Capsicum frutescens*), Atarodo" – Scotch bonnet (*Capsicum chinense*), "Sombo" - Cayenne pepper or red pepper (*Capsicum frutes*cens) and "Tatase" (*Capsicum annuum*) (Adesina *et al.*, 2014). The *Capsicum* fruits are an excellent source of natural, micronutrient antioxidants (vitamins

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C and E and carotenoids) which is important in preventing or reducing chronic and age-related diseases (Palevitch and Craker, 2012).

The use of organic fertilizer is important in the maintenance of soil fertility and crop productivity (Verma, 2004). Organic fertilizers increase soil water retention, slow release of nutrients and contributes to the residual pool of organic nitrogen and phosphorus in the soil (Kassa *et al.*, 2018). Organic fertilizers can enhance efficiency and reduce the need for chemical fertilizers, to improve the soil fertility and soil health (Myint *et al.*, 2010). In Nigeria, pepper production is low due to poor genetic potentials of most cultivars available to farmers, use of poor-quality seeds, pest and disease infestation, restriction of production to a single farming season, low income and pervasive poverty among small holder farmers (Omotayo *et al.*, 2015). Another major problem attributed to the underperformance of pepper production is due to the technical inefficiencies of crop production system in terms of large-scale irrigation schemes, (Adelodun *et al.*, 2020), and lack of effective irrigation systems in developing countries (Walters and Jha, 2016). And the high-water scarcity currently being experienced globally (Walters and Jha, 2016), which is seriously affecting agricultural production, especially in arid and semi-arid areas (Abdelkhalik *et al.*, 2020).

Studies identified that in the past decades the use of various kinds of chemical fertilizers, has caused undesirable effect on the soil environment, both structural and microbial (Singh *et al.*, 2020), and has resulted in soil acidification and changes in soil chemical properties, leading to soil degradation, environmental pollution and reduce crop yield (Su *et al.*, 2021), and there is urgent need to restore it by implementing organic agriculture (Singh *et al.*, 2020).

Intensive inorganic fertilizer usage in agriculture causes so many health problems and unrecoverable environmental pollution. To reduce and eliminate the adverse effects of Synthetic fertilizers on human health and environment, new agricultural practices have been developed called organic agriculture (Sharma and Chetani, 2017). Organic farming is an alternative to sustainable agriculture that is more inclusive and has become a widespread phenomenon (Rahmaniah *et al.*, 2020), and as a sustainable agriculture it integrates three main objectives - environmental health, economic profitability, and social-economic justice (Rahmaniah *et al.*, 2020). Organic farming maximizes reliance on farm-derived renewable resources for managing ecological and biological processes and integrations, to provide acceptable crop production and an appropriate return to the human and other resources employed (Hartatik and Setyorini 2021), and it can significantly increase the log of productivity and crop income and reduce total household expenditure, food expenditure, and poverty (Yang, 2020).

MATERIALS AND METHODS

The experiment was conducted in the screen house and under field condition simultaneously, at the Federal University of Technology, Gidan Kwano, Minna, in the 2019/2020 dry season. A 3 x 3 factorial treatment was laid out in a Completely Randomized Block Design (CRD) in the screen house and Randomized Completely Block Design (RCBD) in the field, with four replications in the screen house and three replications in the field. The treatment consisted of three organic fertilizer rate (0, 1.5 and 3.0 t ha^{-1}) and three hot pepper varieties (*Mbgakpa, Dan-Sokoto and Dan-Zaria).*

Three nursery beds of 1m x 1m were prepared with the use of simple hand hoe and the three varieties of pepper seeds were broadcasted each on it identified bed with a mixture of fine sand and firmed with some soils. These seeds were raised in a nursery bed for six weeks. A shade was made using palm fronds on top of the nursery beds to protect the seedlings from harsh weather conditions and subsequently removed for hardening before transplanting. Organic fertilizer was incorporated into the experimental pots and plots at the rate of 0, 1.5 and 3 t ha^{-1} two weeks before transplanting the pepper seedlings. Seedlings of six week's old were transplanted after sowing, at 5-6 true leaf stage with their root ball each at a depth of 5

cm, one plant was maintained in each of the pot, in the screen house experiment and the pots were well watered before transplanting the seedlings.

The field was irrigated a day before transplanting and irrigated immediately after transplanting. Seedlings were transplanted out on the field at a plant spacing of 50 cm x 50 cm between plants, alley of 50 cm between treatment plots and 1 m between replicates. Plants were irrigated in the screen house with the use of watering-can at regular interval to maintain moisture throughout the growth period. And in the field experiment, a controlled amount of water was distributed under low pressure, through a piped network and applied to each plant in the experimental plots, the water was supplied at regular interval as required by the pepper plant to ensure it optimum growth. Data were recorded on plant height, number of branches per plant, fruit length, fruit diameter and yield. Data collected was subjected to Analysis of Variance (ANOVA) using statistical analysis system (SAS version 9.0) 2012. Treatment means were separated using least significant difference (LSD) at 5 % level of probability.

RESULTS AND DISCUSSION

All growth parameters and yield parameters test differed significantly due to the different varieties tested under different locations as shown by the analysis of variance. All parameters showed significant results.

Plant Height

There was a significant increase in plant height at both locations. In the screen house at 6 and 9 WAT, the application of organic fertilizer at 3.0 ha $^{-1}$ recorded taller plants than 0 and 1.5 t ha $^{-1}$ which had similar shorter plants, but under field condition, the application of 1.5 and 3.0 t ha^{-1} organic fertilizer showed similar taller plants than 0 t ha^{-1}. In terms of landraces response, under the screenhouse condition *Mgbakpa* recorded taller plants than the other landraces. But under filed condition, at 6 WAT, *Mgkakpa* recorded taller plants similar with *Dan-Sokoto* at 9 WAT, than *Dan-Zaria* which had the shortest (Table 1).

The taller plants produced by *Mgbakpa* pepper varieties could be attributed to the inherent genotype characteristics coupled with its adaptability to the environmental condition which supported its utilization of available growth factors and hence the production of taller plants. This result is in agreement with the findings of Nkansah *et al.* (2017) who reported that Kukulkan pepper variety had the highest height of (93.7cm) under green house and (43.9cm) under field condition than Caribbean, Crusader, Califonia, Embella, F1 Nobili, Guardian, pepper 1 and yellow pepper varieties in Ghana.

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Table 1: Effect of organic fertilizer on plant height of some pepper varieties under field and screen house conditions at 6 and 9 WAT

	Plant height (cm) Screen house Weeks after transplanting		Plant height (cm) Field Weeks after transplanting	
	6	9	6	9
Fertilizer (F)				
0	32.92b	53.42b	14.11b	21.81b
1.5	33.83b	59.08b	18.70a	30.76a
3.0	40.67a	68.92a	18.73a	33.09a
LSD (0.05)	5.35	6.89	2.26	5.99
Variety (V)				
Dan Zaria	33.50a	57.33b	15.19b	24.82b
Dan Sokoto	37.67a	57.92b	17.95a	29.39ab
Mgbakpa	36.25a	66.17a	18.40a	31.44a
LSD (0.05)	5.35	6.89	2.26	5.99
Interaction				
F x V	NS	NS	NS	NS

Means with the same letter(s) under the same column are not significantly different from each other at ($P \leq 0.05$) by LSD.

Numbers of Branches

Significant differences were observed among the number of branches both in the screenhouse experiment and the field experiment. Number of Branches. Under screen house, the application of organic fertilizer at the rate of 3.0 t ha $^{-1}$ recorded higher branches similar with the application of organic fertilizer at the rate of 1.5 t ha $^{-1}$ than the 0 t ha $^{-1}$ which had the lowest at 6 and 9 WAT respectively. In field condition, similar higher number of branches were obtained in plots given 1.5 and 3.0 t ha $^{-1}$ organic fertilizer than 0 t ha-1 at 6 WAT. But at 9 WAT plot treated with 1.5 t ha $^{-1}$ organic fertilizer had higher number of branches similar with 3.0 t ha $^{-1}$ than 0 t ha-1 which recorded the lowest.

The Landraces *Mgbapka* recorded higher number of branches than the other landraces under the screenhous condition. But in the field at 6 WAT *Dan-Sokoto* and *Mbapka* recorded similar higher number of branches while at 9 WAT *Dan-Sokoto* recorded the highest similar to *Mgbapka* compared to *Dan-Zaria* which had the lowest number of branches (Table 2). The higher number of branches produced by *Mgbakpa* variety may be due to taller plants, higher number of leaves and wider stems produced by the genotype which supported it photosynthetic processes and utilization of soil water and nutrients for the development of branches in our study.

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Table 2: Effect of organic fertilizer on number of branches of some pepper varieties under field and screen house conditions at 6 and 9 WAT

	Number of branches		Number of branches	
	Screen house		Field	
	Weeks after transplanting		Weeks after transplanting	
	6	9	6	9
Fertilizer (F)				
0	6.0b	18.0b	7.0b	21.0b
1.5	8.0ab	22.0ab	11.0a	32.0a
3.0	10.0a	27.0a	10.0a	26.0ab
LSD (0.05)	3.20	4.63	3.21	7.99
Variety (V)				
Dan Zaria	8.0a	20.0b	6.0b	21.0b
Dan Sokoto	9.0a	19.0b	11.0a	30.0a
Mgbakpa	7.0a	28.0a	12.0a	28.0ab
LSD (0.05)	3.20	4.63	3.21	7.99
Interaction				
F x V	NS	NS	NS	NS

Means with the same letter(s) under the same column are not significantly different from each other at ($P \leq 0.05$) by LSD.

Fruit Length

Significant differences were observed among the landraces both in the greenhouse and field experiment. The application of the organic fertilizer at 1.5 t ha $^{-1}$ and 3.0 t ha $^{-1}$ recorded similar longer fruits than 0 t ha $^{-1}$ which had the lowest in both condition. In terms of the landraces, *Dan-Sokoto* produced longer fruits that the other landraces under both conditions. The longer fruits produced by *Dan-Sokoto* variety may be due to it genetic constituent which allow the partitioning of the utilized growth factors (solar radiation, water and nutrients) towards fruit production rather than towards it growth development (Table1.2).

Fruit Diameter

The application of 1.5 t ha $^{-1}$ organic fertilizer recorded bigger fruits than the other the other rates in the field. The landraces of *Dan-Zaria* and *Dan-Sokoto* recorded similar bigger fruits than *Mgbapka* under both conditions (Table1.2). The wider stems produced by *Mgbakpa* varieties could be attributed to it genetic make-up, its adaptability to the environment and the production of the taller plants and higher number of leaves which enhanced it photosynthetic ability and in turn led to the production of bigger stems. This finding is in line with the work of Nkansah *et al*. (2017) who reported that Kakulkan pepper variety recorded thicker stems of (1cm) under green house and (0.89cm) in open field than the pepper 1 variety which recorded thinner stems in Ghana.

Fruit Yield

The application at 3.0 t ha $^{-1}$ organic fertilizer recorded higher fruit yield than the other rates in the screenhouse condition. Under the field condition, application at 1.5 and 3.0 t ha $^{-1}$ recorded similar higher fruit yield than 0 t ha $^{-1}$ which had the lowest. The landraces *Dan-Zaria* and *Dan-Sokoto* produces similar higher fruit yield than *Mgbapka* in the screenhouse and *Dan-Sokoto* produced higher fruit yield similar with *Dan-Zaria* compared to *Mgbapka* which recorded the lowest in the field (Table1.2). The higher fruit yield produced by *Dan-Zaria* and *Dan-Sokoto* varieties might be attributed to their genetic characteristics and adaptation to the environmental conditions.

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Table 3: Effect of organic fertilizer on number of fruit per plant, fruit length, fruit diameter and fruit yields of some pepper varieties under field and screen house conditions at 6 and 9 WAT

	Screen house			Field		
	Fruit length (cm)	Fruit diameter (cm)	Fruit yield (kg ha^{-1})	Fruit length (cm)	Fruit diameter (cm)	Fruit yield (kg ha^{-1})
Manure (M)						
0	2.05b	2.76a	2041.90c	2.06b	2.46b	1225.40b
1.5	3.19a	2.69a	4148.70b	3.26a	2.69a	3938.10a
3.0	3.36a	2.50a	6044.80a	3.17a	2.43b	3795.00a
LSD (0.05)	0.46	0.42	1404.20	0.29	0.23	426.28
Variety (V)						
Dan Zaria	2.40b	3.31a	4262.80a	2.25b	2.95a	2952.20ab
Dan Sokoto	3.86a	3.17a	5537.50a	4.14a	2.97a	3262.40a
Mgbakpa	2.34b	1.48b	2435.20b	2.11b	1.66b	2743.80b
LSD (0.05)	0.62	0.42	1404.20	0.29	0.23	426.28
Interaction F x V	NS	NS	NS	NS	NS	NS

Means with the same letter(s) under the same column are not significantly different from each other at ($P \leq 0.05$) by LSD.

CONCLUSION

The application of organic fertilizer at 1.5 and 3.0 t ha $^{-1}$ increase plant height, number of branches, fruit length, fruit diameter and fruit yield than 0 t ha-1 (control). In both screenhouse and field condition, the landrace *Mgbapka* was superior in the production of taller plants and higher number of branches than the other landraces which had the lowest under both conditions. *Dan-Zaria* and *Dan-Sokoto* produced longer fruits, bigger fruit and higher fruit yield than *Mgbapka* which had lowest in both screenhouse and field conditions.

It is recommended that small holder farmers should grow *Dan-Sokoto* landrace with the application of 1.5 t ha $^{-1}$ organic fertilizer for optimum yield of pepper in this Agro-Ecological Zone of Nigeria.

REFERENCES

Abdelkhalik, A., Pascal, B., Najera, I., Domene, M., Baixauli, C., & Pascual-Seva, N. 2. (2019). Effects Of Deficit Irrigation on the Yield and Irrigation Water Use Efficiency of Drip-Irrigated Sweet Pepper (*Capsicum annuum* L.) Under Mediterranean Conditions. *Irrigation Science*, 38(1);89 – 104.

Adelodun, B., Mohammed, A. A., Akani, K., Akanbi, S. O., & Abdulkadir, T. S. (2020).Comparative Assessment of Technical Efficiencies of Irrigated Crop Production Farms : A Case Study of the Large-Scale Kampe-Omi Irrigation Scheme,. *Nigeria. African Journal of Science, Technology, Innovation and Development*, 1 - 10.

Myint, A.K., Yamakawa, T., Kajihara, Y., Myint., K.K.M., and Zenmyo, T. (2010). Nitrogen Dynamics in a Paddy Field Fertilized with Mineral and Organic Nitrogen Sources. *American-Eurasian Journal of Agricultural and Environmental Sciences*, 7, 221-231.

Nabhan, G (2014). Chili Peppers First Cultivated in Mexico.

Nkansah, G. O., Norman, J. C & Martey, A. (2017). Growth Yield and Consumer Acceptance of Sweet Pepper (*Capsicum annum* L.) as Influnced by open Field and Green house Production Systems. *Journal of Horticulture* 4(4), 1 - 8.

Ogbodo, E. N. (2009) Changes in the of Acid Soil amonded with Rice Husk and Effect on Growth Yield of Pepper at Abakaliki South Estern Nigeria. American - Eurasia Journal of Sustainable Agriculture, 3, 579 - 586.

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Omotayo. A., Ribeiro, C., Oluleye, A, K., and Fajinmi, A. (2015). Introduction and Participatoryevaluation of Exotic Cultivars of Pepper (*Capsicum Spp.*) Among Small Holder Farmers in SouthWestern Nigeria. *2nd International Conference on Geological and Civil Engineering*, 80 (16); 1 - 6.

Palevitch, D., &. Craker, L. E. (2012). Review - Nutritional and Medical Importance of Red Pepper (Capsicum spp.). Journal of Herbs, Spices & Medicinal Plants, 55 – 83.

Rahmaniah, HM. Darma, R. Asrul, L and Taufik, D., K. (2020). The Potential of Organic Agriculture, Soil Structure and Farmers Income for Inclusive Agriculture Sustainability: a Review. *Earth and Environmental Science*, 575(1).

Sharma, A., Chetani, R. (2017). A Review on the Effect of Organic and Chemical Fertilizers on Plants. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, 1-4.

Singh, T. B., Bubakar, A. P., Mirinalini, S., Preksha, G. D., Dantum, P. K. (2020). Role of Organic Fertilizer in Improving Soil Fertility,. *Contaminant in Agriculture*, 61 - 77.

Su, L., Bai, t., Qin, X., Yu, H., Wu, G., Zhao, Q., & Tan, L. (2020). Organic Manure Induced Soil Food Web of Microbes and Nematodes Drive Soil Organic Matter Under Jackfruit Planting. *Applied Soil Ecology,* , 166(1).

Walters, s. a., & Jha, A. K. (2016). Sustaining Chili Pepper Production in Afghanistan Through Better Irrigation Practices and Management, *Agriculture*, 1-10.

Yang, Y. (2020). Social Capital and the Use of Organic Fertilizer : An Empirical Analysis Of Hubei Province Chinna. *Environmental Science and Polution Research*, 27.

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