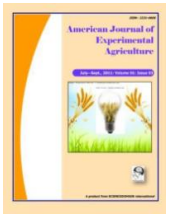

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Comparative Evaluation of Organic and Inorganic Manure on Sweet Pepper Performance in Two Ecological Zones of Nigeria

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Authors' contributions

This work was carried out in collaboration between all Authors. Authors FEF and ABO designed the study. Author ABO wrote the protocol and wrote the first draft of the manuscript. Author AJ reviewed the experimental design and all drafts of the manuscript. All Authors managed the analyses of the study. Author ABO performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

Organic (poultry manure) and inorganic (Urea) fertilizers were comparatively studied with the aim of improving the performance of sweet pepper, Capsicum annum (called 'Tatase' in Nigeria) in two ecological zones of Nigeria (Ado Ekiti, Ekiti state and Omu-Aran, Kwara State). Poultry manure applied at the rate of 8ton ha^{-1} gave higher fruit yield than urea at the rate of 0.2ton ha^{-1} twice equally at two weeks after transplanting (WAT) and at fruiting. Although higher leaf number and branches were produced in the plots that received inorganic fertilizer, the yield produced was lower. It is indicative from this study that pepper can be successfully produced organically using poultry manure in the two ecological zones under study. It also suggests that our soils can be protected from the level of acidity associated with synthetic fertilizer use. Pepper fruits produced from such will be purely organic and safer for human consumption.

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Keywords: Sweet pepper; organic manure; inorganic manure; yield.

1. INTRODUCTION

The provision of quality food starts with planting, production and preparation of food. Organic farming is one of the fastest growing sectors of agriculture worldwide. Its main objective is to create a balance between the interconnected systems of soil organisms, plants, animals and humans [1]. Plants need nutrients in specific proportions to be present in the soil [2] and fertilizer use is a key factor in soil fertility management and yield increase in crop production [3].

Pepper is one of the most important vegetable crops grown in Nigeria [4], where it is commonly used as condiments [5]. Pepper had even been reported to prevent and treat certain ailments like cold and fever, and also improve other food intake [6,7]. Among the various reported benefits resulting from the use of organic fertilizer in crop production includes; enhancement of soil productivity, increase in the soil organic carbon content, soil micro-organism activities, improvement of soil structure, increase in nutrient status balance of the soil and enhancement of crop yield [6,8,9].

Although the applications of organic and inorganic fertilizers have been reported to improve the growth and development of pepper [10], but superior performance of pepper and other plants under poultry manure had been reported than under the inorganic fertilizer application [11,12,4].

The trend in the world today is to produce food in the organic way for quality food that will promote good health of people. The present study was therefore carried out to evaluate the comparative effect of poultry manure and inorganic fertilizer on the growth and yield of sweet pepper in two ecological zones of Nigeria.

2. MATERIALS AND METHODS

The experiments were carried out at the experimental site of the of the Department of Plant Science, Ekiti State University, Ado Ekiti, Ekiti state, Nigeria (7º40′ N, 5º15′ E) and in Landmark University Teaching and Research Farm, Omu-Aran, Kwara State, Nigeria (8º25′ N, 4º40′ E). Both locations have a bimodal rainfall pattern with an annual mean of 1,400mm and 1232mm respectively. Ado Ekiti is in the rain forest zone of south-western Nigeria while Omu-Aran is in the derived savana of North-southern Nigeria. The experiments were carried out in the cropping season of 2012 between April and August in Ado Ekiti, and between February and July in Omu-Aran in 2014. The experiment in Omu-Aran started with irrigation between February and April and later rain fed for the remaining period.

The land was cleared manually with cutlass and ridges made with Nigerian hoe. The soil at the experimental site in Ado Ekiti was analysed to be a sandy clay loam with Soil Organic Matter content-4.3%, 0.48%N, 5.95mgkg^{-1}P, 0.08Cmol K, and a pH of 6.65. Each ridge was 4m long with 1m between ridges. Four ridges constituted a plot and the experiment was laid out in a randomized complete block. Each treatment was replicated four times. The treatments were: Urea; poultry manure; and control. Sweet pepper, *Capsicum annum (*commonly called Tatase in Nigeria) seedlings were transplanted at four weeks after sowing [13] at the spacing of 0.6 mx1 m. The poultry manure was applied on the ridge three weeks before transplanting at the rate of 8tha^{-1} [14]. Urea was applied at the rate of 200kgha^{-1} twice equally at two weeks after transplanting (WAT) and at fruiting. Weeds were manually removed by hand pulling.

The growth measurements include: plant height; stem girth; number of green branches at 8 WAT; number of leaves at 8 WAT while the yield parameters determined include: number of fruits per plant; fruit girth; and fruit weight (tha^{-1}). Assessments were made from ten randomly selected plants per plot and averaged for analysis.

Collected data were statistically analysed using the analysis of variance and means compared using the fisher's least significant difference (LSD).

3. RESULTS

Effects of organic and inorganic fertilizer on pepper height and stem girth are presented in Table 1. Pepper heights observed in poultry manure and Urea were not significantly different but higher than the one obtained in the control experiment. Stem girth obtained in the poultry manure applied plots were highest in both years except in 2014 when it was identical with those of urea applied plots. The control plots gave the lowest stem girth.

Table 2 shows the effects of organic and inorganic fertilizer on number of pepper branches and leaves. The highest number of branches and leaves per plant were obtained in the urea applied plots but not significantly different from the poultry manure applied plots. The control experiment consistently resulted to the lowest number of branches and number of leaves per plant.

The highest number of fruits per plant was obtained in the poultry manure applied plots in both trials while the least was observed in the control plots. Urea produced higher number of fruits than the control but lower than the poultry manure plots (Table 3). Fruit girth obtained from poultry manure plots and those of urea were identical but higher than the ones obtained from the control plots.

Table 4 shows the effects of organic and inorganic fertilizer on pepper yield. The highest fruit yield of pepper in both years was recorded in the plots that received poultry manure while the lowest was observed in the control plots. Poultry manure was significantly higher than urea in terms of fruit yield production.

Table 1. Effects of organic and inorganic fertilizer on pepper height and stem girth

Treatments	Plant height (cm)		Stem girth (mm)	
	2012	2014	2012	2014
Control	34.6b	33.4b	10.2c	12.0b
Poultry manure	45.3a	42.9a	18.3a	17.1a
Urea	43.4a	45.2a	16.1b	15.4a
LSD	5.55	6.81	1.64	2.28

Means with the same alphabet(s) within columns are not significantly different (P=.05)

Table 2. Effects of organic and inorganic fertilizer on number of branches and number of leaves of pepper

Treatments	Number of branches plant^{-1}		Number of leaves plant^{-1}	
	2012	2014	2012	2014
Control	9b	5b	109.1b	96.5b
Poultry manure	23a	21a	135a	129.5a
Urea	24a	23a	137a	129.0a
LSD	6.45	3.71	5.73	2.64

Means with the same alphabet(s) within columns are not significantly different (P=.05)

Table 3. Effects of organic and inorganic fertilizer on number of fruits and girth of fruits of pepper

Treatments	Number of fruits plant^{-1}		Fruit girth (mm)	
	2012	2014	2012	2014
Control	5c	7c	34.5b	31.7a
Poultry manure	21a	17a	40.1a	39.9a
Urea	15b	13b	40.2a	36.5a
LSD	3.51	2.76	4.63	NS

Means with the same alphabet(s) within columns are not significantly different (P=.05)

Table 4. Effects of organic and inorganic fertilizer on pepper yield (g per plant)

Treatments	Pepper Yield (t ha^{-1})	
	2012	2014
Control	7.40c	6.02c
Poultry manure	22.71a	20.09a
Urea	15.12b	13.17b
LSD	3.96	3.64

Means with the same alphabet(s) within columns are not significantly different (P=.05)

4. DISCUSSION

The results obtained from this study clearly showed that the organic manure (poultry manure) used in the two locations of the experiment substantially increased the performance of pepper in terms of growth and yield.

The highest growth parameters and yield obtained from the plots that received poultry manure application probably reflected high release of essential nutrients especially nitrogen and Phosphorous from this organic fertilizer (poultry manure). Reports from other researchers have shown that organic-amended soils have twice the level of N as conventional soils [15-17]. Poultry manure had been reported to possess essential nutrient elements which are associated with high photosynthetic activity capable of promoting root and vegetative growth of plants [18,4]. Higher but insignificant number of leaves and branches obtained from Urea applied plots than poultry manure in this work may suggest over supply of nitrogen which increased vegetative growth without a corresponding increase in yield. Similar vegetative growth in pepper had been reported when NPK fertilizers increased the number of leaves but lower yield than Tithonia diversifolia leaf biomass [19]. Similar report had shown that hairy vetch/rye mineralization allowed for a slower release of N and more efficient absorption by sweet corn [20].

5. CONCLUSION

The present work had clearly shown that pepper can be successfully produced organically using poultry manure in the two ecological zones under study. Since poultry manure is readily available as wastes from poultry farmers, it will be useful for farmers at very low cost and thus reduce the high cost associated with inorganic fertilizers. Our soils will also be protected from the level of acidity associated with synthetic fertilizer use. The pepper fruits produced from such will be purely organic and safer for human consumption.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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