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COMPARATIVE EFFECTS OF ORGANIC AND INORGANIC FERTILIZERS ON THE GROWTH PERFORMANCE OF CHILLI PEPPER (*Capsicum annum* L.*)*

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Abstract
Plastic pot experiments were conducted to compare the effects of organic and inorganic fertilizers on the growth of Capsicum *annum* L. at Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt. The treatments were three (3) organic fertilizers (poultry, cow dung, household waste and inorganic fertilizers (NPK 10:10:10). Organic and inorganic fertilizers were applied at the rate of 20,40, 60g with 0 as control. The experiment was set up in a Completely Randomized Design (CRD) with four (4) replications. Data generated were analysed using Analysis of Variance (ANOVA), and means were compared using the least significant difference (LSD) at a 0.05% level of probability. Plant growth and development were assessed using plant height, stem girth, root length, leaf area and the total number of fruits. Results obtained showed that household wastes produced the tallest plants with a mean of 34.4±4.2cm, at 40 and 60g rates; longest stem girth (3.9±0.5cm), at 20g, longest root length (18.3±4.8cm) at 60g respectively. Poultry waste produced the highest broad-leaved area, at 60g (97.08±.63cm) with 28 fruits. Based on the data analysed, household and poultry waste resulted in increased plant height, stem girth, root length, broad-leaved area, and the total number of fruit as compared to cow dung, NPK and control. It is, therefore, recommended that household and poultry wastes be used as a better option in the cultivation of *Capsicum annum* by farmers.

Keywords: *Capsicum annum;* household; poultry; cow dung; NPK

Introduction

Capsicum is commonly known as pepper, and belongs to the family Solanaceae. Peppers are cultivated worldwide and used in many cuisines (Wells, 2008). Different varieties are cultivated all over the world. The fruit berries in the strict botanical sense of *Capsicum* plants have a variety of names depending on place and type. The more pungent varieties are commonly called chilli peppers or simply chillis (that is used for this research). *Capsicum* fruits of several varieties with commercial value are called various names in English; many of these are usually sold pickled. Both whole and powdered chilli are frequent ingredients in dishes prepared throughout the world and are characteristics of several cuisine styles in Nigeria and other countries. *Capsicum* consists of 20-27 species (Walsh & Hoot, 2001; & Normah et al., 2013), five of which are domesticated *C. annum*, *C. baccatum*, *C. fruitescens*, *C. pubescens* and *C. chinense*. Fruits of *Capsicum* vary tremendously in colour, shape and size both between and within species. Chemosystematic studies have helped in distinguishing the differences between varieties and species (Walsh and Hoot; 2001). The fruits of most species of *Capsicum* contain capsaicin, a lipophilic chemical that produces a strong burning sensation in the mouth of an unaccustomed eater. The secretion of capsaicin protects the fruits from consumption by insects and mammals (Danilo., 2019), while the bright colour attracts birds that disperse the seeds. The amount of capsaicin in the fruit is highly variable and dependent on genetics and environments, giving almost all types of capsicum varied amounts of perceived heat.Chilli peppers are widely used in many cuisines as a spice to add heat to dishes. Chilli pepper pods are berries and are often prepared and eaten like vegetables. They contain a large amount of vitamin C (Rodrigvez-Burruez et al., 2010).

Activities of men on land are of global significance, therefore soil nutrient depletion is one of the most serious problems affecting plant growth and agricultural productivity in developing countries including Nigeria. Intensive cultivation with little or no fertility management has been one of the major factors contributing to the decline in

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the ecological conservation balances in the landscape. This leads to soil nutrient loss which has negatively affected crop growth and productivity to feed the rising global population. The problems of urbanization, the land tenure system, outdated government policies and industrialization make farmland scarce and inaccessible to farmers. While chemical fertilizers may quickly release nutrients into the soil for plant use, they have negative effects on the soil's physical and chemical properties, soil fauna and the ecosystem as a whole when they are present in large quantities.

The use of organic fertilizers in place of synthetic fertilizers is gaining momentum in recent years and this has led to what is known as organic farming. This process involves the use of biological materials, and avoiding synthetic substances to maintain soil fertility and ecological balance thereby minimizing pollution. The application of organic fertilizers contributes to the stabilization of soil aggregates hence improving soil structure and density. It also increases soil holding capacity and plant–water availability, soil runoff and erosion, thereby creating a better plant root environment (Saison et al., 2006; Arthur et al., 2011). Therefore, the research was designed to compare the effects of inorganic and organic fertilizers on the growth and development of chilli pepper (*Capsicum annum L.)* in Rivers State, Nigeria.

Materials and Methods

The experiment was carried out at the Science Village, behind the Biology Department Research laboratory of Ignatius Ajuru University of Education in Obio/Akpor Local Government Area. (Latitude 4,08514N"48'18,492 and longitude 6,92912 E6"55'44,832") Obio/Akpor is in Rivers State, Nigeria. Cultivated soil was collected from the New Haven site of Ignatius Ajuru University of Education and was put in the planting pots. Soil analysis was carried out and the soil was analysed to be sandy loam with soil organic matter of 0.75%, 0.02%N, 38.12mg/g P, 0.12 (ml/kgK and a pH of 3.20). The pots for the experiment were laid in a Completely Randomized Design (CRD) with the treatments replicated four (4) times. A control experiment without any fertilizer was also replicated four times. The parameters assessed were plant height, stem girth, root length, leaf area and the total number of fruits. Leaf area was determined according to Blanco and Folegatti (2003). Organic fertilizers (poultry, cow dung and household wastes) and inorganic fertilizers were used to treat the plants. Inorganic fertilizer (NPK) was obtained at the Agricultural Development Project (ADP) office, Rumuodomaya, Obio/Akpor Local Government Area. The NPK and three organic fertilizers were applied at different concentrations of 20,40 and 60g. The organic fertilizers were obtained from poultry and slaughterhouses while the household materials were from roadside dealers on the materials. The organic fertilizers were mixed with the soil three weeks before transplanting while the inorganic fertilizers were applied into the soil two weeks after transplanting the seedlings using the ring method. The seedling had earlier stayed in the nursery for four weeks. The data collected from the experiment were subjected to Analysis of Variance (ANOVA) using SPSS IBM version 20 and the treatment means were compared using the Least Significant Difference (LSD) test at a 5% significant level to separate the means.

Results

The effects of poultry, cow dung, household wastes and synthetic fertilizer on the height of the chilli pepper plant are presented in figure 1. From the figure, plants grown on soil amended with household wastes were the tallest, followed by poultry waste. Statistical analysis of the plant heights showed a significant difference at a 95% confidence interval (α=0.05) between the heights of the plants grown on soils amended with the organic wastes and synthetic fertilizer at the different quantities applied. Thus, the relative plant height of chilli pepper treated with different quantities of organic amendments was significantly higher than those treated with synthetic fertilizer and the control as shown in Fig. 1.

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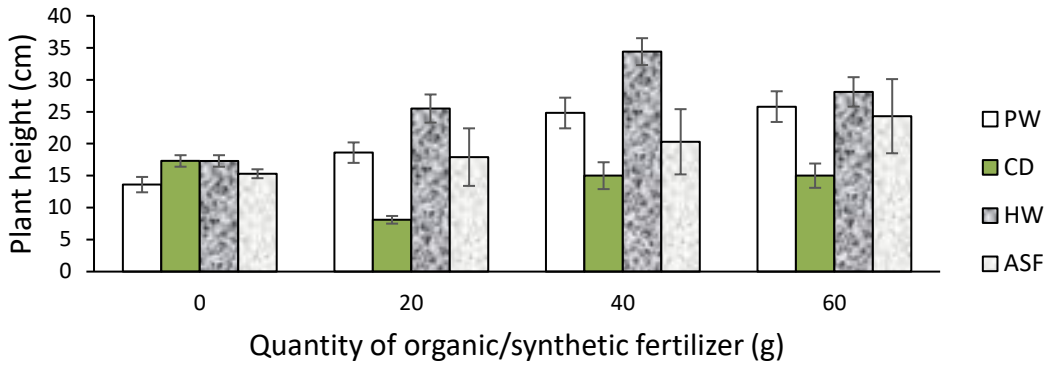

Figure 1: Height of chilli pepper plant on soils amended with organic wastes and synthetic Fertilizer.
PW: poultry waste, CD: cow dung, HW: household waste, ASF: Artificial synthetic fertilizer.

The effects of poultry, cow dung household wastes, and synthetic fertilizer on the stem girth of the chilli pepper (*C. annum)* plant are presented in figure 2. The figure showed that the stem girth of the plants grown on soil amended with household waste was the widest at 20g application; while the stem girth of the plants grown on soil amended with poultry waste was the widest at 40 and 60g concentrations. There was a significant difference at a 95% confidence interval (α=0.05) between the stem girth of the plants grown on soils amended with the organic wastes and synthetic fertilizer at the different quantities applied. Thus, the relative differences in stem girth of the plants at the different concentrations of organic and synthetic fertilizers were statistically significant.

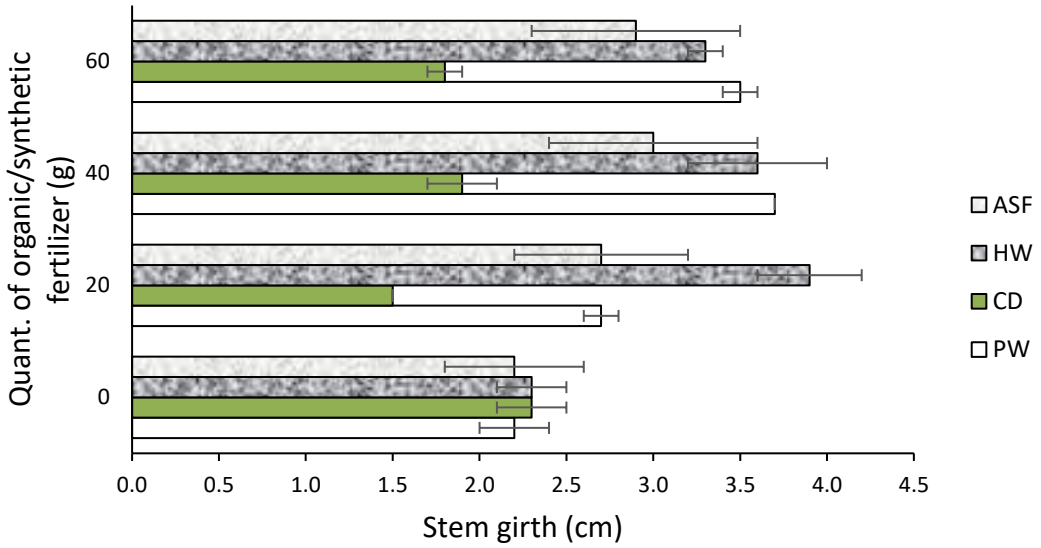

Figure 2: Stem girth of chilli pepper plant on soils amended with organic wastes and synthetic fertilizer.

PW: poultry waste, CD: cow dung, HW: household waste, ASF: Artificial Synthetic fertilizer

The effects of poultry, cow dung, household wastes and synthetic fertilizer on the root length of the chilli pepper plant are presented in Figure 3**.** It was observed that the root length of the plants grown in soil amended with household wastes was the longest with the different concentrations applied. However, the differences in the root

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length of chilli pepper treated with both organic and synthetic fertilizers were not statistically different at the 95% confidence limit.

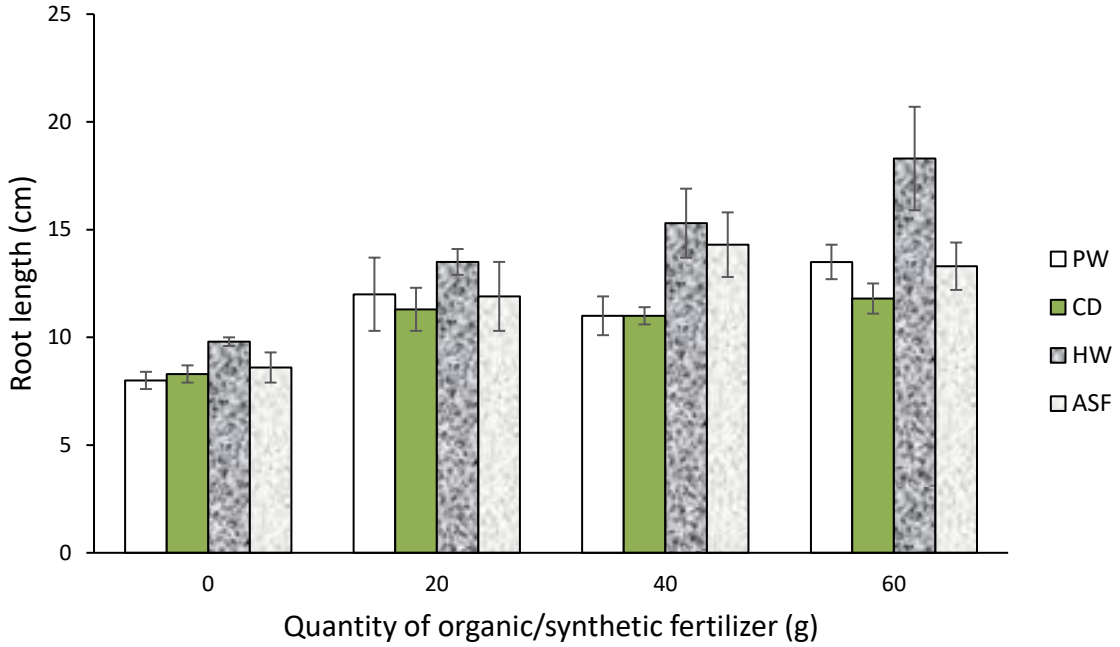

Figure 3: Root length of chilli pepper plant in soils amended with organic wastes and synthetic fertilizer.

PW: poultry waste, CD: cow dung, HW: household waste, ASF: Artificial, synthetic fertilizer

Figure 4 shows the effects of organic and inorganic fertilizers on the leaf area (cm^3) of the chilli pepper plant. The result shows that the leaves of plants grown on soil amended with poultry waste had broad leave with the different concentrations applied. The difference in the leaf area of plants treated with organic fertilizers was statically significant from those treated with inorganic fertilizer.

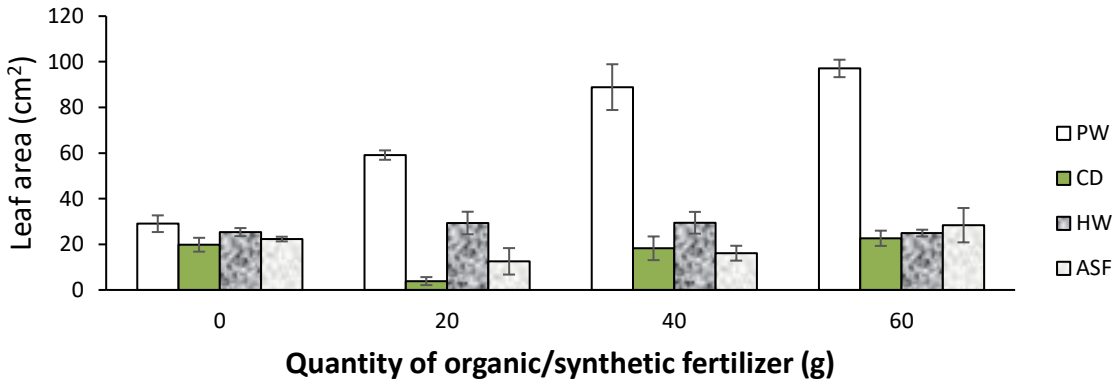

Figure 4: Leaf area of a chilli pepper plant in soils amended with organic wastes and synthetic fertilizer.
PW: poultry waste, CD: cow dung, HW: household waste, SF: Synthetic fertilizer.

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The effects of poultry, cow dung, household wastes and synthetic fertilizers on fruit production in chilli pepper plant is presented in figure 5. The result showed that the plant grown on soil amended with poultry waste produced more fruit than the plants grown on soil amended with cow dung, household wastes and synthetic fertilizer at the different concentrations.

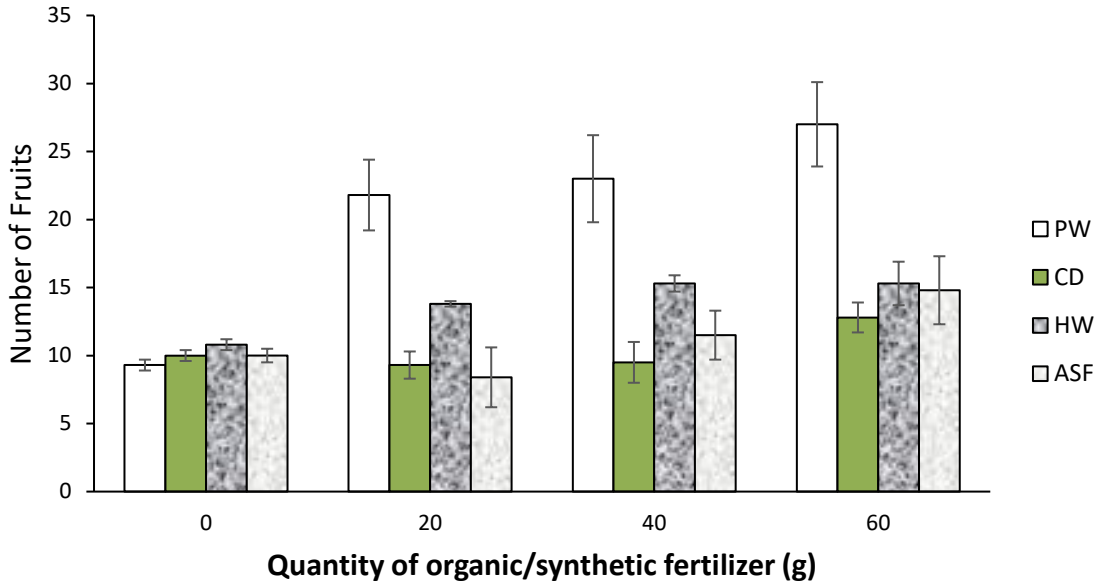

Figure 5: Number of fruits on chilli pepper plants on soils amended with organic wastes and synthetic fertilizer.

PW: poultry waste, CD: cow dung, HW: household waste, SF: synthetic fertilizer

Discussion

The effects of poultry, cow dung, household wastes and synthetic fertilizers on the height of chilli pepper plants, showed that plants grown on soil amended with household wastes were the tallest followed by the soil amended with poultry, cow dung and fertilizer respectively. Similar results were obtained by (Adhikari, et al., (2016) and Vasnie, et al., (2018) who reported increased pepper plant height treated with poultry waste.Effects of the three (3) organic amendments and fertilizer showed that plants grown on soil amended with household waste had the widest stem girth with 20g application, while that of the poultry was widest at 40 and 60g, the wide stem girth observed with household and poultry waste treatment was supported (Vasnie et al. 2018; Nwafor (2019). The result obtained also indicates household waste as having the largest root length followed by cow dung, poultry wastes and fertilizer. The findings are in agreement with that of Robert, et al. (2021), who reported that pepper *(Capsicum fruitescens L.)* amended with eggshell produced significantly longer roots. Also, the broad increase in the leaves of the chilli pepper plant with poultry waste at the different quantities applied confirmed the role of poultry waste in promoting vigorous vegetative growth in leafy vegetables as reported by Nwafor (2019) and Adesina et al.(2014).

Furthermore, concerning fruit production in chilli pepper, those grown in soil amended with poultry waste had a higher number of fruits. This following earlier reports that soil amended with poultry waste on sweet pepper had higher fruit yield (Fabiyi et al., 2015; Oyewole & Aleehile, 2020). Organic fertilizers are readily available as waste from poultry farmers, abattoirs and roadside food vendors. It is environmentally friendly as it does not damage the soil against inorganic fertilizers which can cause soil acidity due to continuous use (Adhikari et al., 2016). In the present research, the treatment with household and poultry wastes was found to be the best, while that with cow dung was better than that treated with NPK fertilizers and the control. Hence, the use of organic waste in the

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production of vegetables like *Capsicum annum* for consumption should be encouraged as this will support the global advocacy for organic farming.

Conclusion

The result obtained from this study suggests that poultry, household or cow dung (organic fertilizers) will be a good option in the cultivation of chilli pepper (*Capsicum annum L.)*. The vegetables produced through this medium will be safer for mankind to avert the likely diseases that are contracted from the consumption of foods produced through inorganic fertilizers.

References

Adesina, J., M.., Sanni, K.O., Afolabi, L.A., & Eleduma, A.F. (2014). Effect of variable rate of poultry manure on the growth and yield of pepper *(Capsicum annum)* in south Western Nigeria. *Academia Arena, 6*(1),9-13.

Adhikari, P., Khanal, A., & Subedi, R. (2016). Effect of different sources of organic manure on growth and yield of sweet pepper. *Advances in plants and Agricultural Research, 3*(5), 158-16.)

Arthur, E., Cornelis, W.M., Vermang, J., & De Rocker, E. (2011. Amending a loamy sand with three compost types: Impact on soil quality. *Soil Use Management27*(1),116-123.

Blanco, F. F., & Folegathi, M. V. (2003). A new method of estimating the leaf area index of cucumber and tomato plants. *Horticultural Brasileira, 21*(4), 666 – 669.

Danilo, Alfaro (2019). All about capsaicin in Chili Peppers. The spruce eats, dotdash publishing. www.the spruceeats.com Retrieved 26-3-2020.

Fabiyi, E.E., Ademuligi, B.O., & Abiodun, J. (2015). Comparative evaluation of organic and inorganic manures, on sweet pepper performance in two (2) Ecological Zones of Nigeria. A*merican Journal of experimental Agriculture, 6*(5), 305-309.

Normah, M.N., Chin, H.F. & Reed, B.M. (2013). Conservation of tropical plant species New York. Springer p. 397. ISBN 9781461437758.

Nwafor, O.E. (2019). Effect of different organic fertilizer types on the growth and yield of *Celeosiaargentea* (Lagos-spinach). *Nigerian Agricultural Journal, 50* (2), 188 – 192.

Oyewole, C. I., & Aleehile, O.J., (2020). Comparative effect of cowdung and poultry manure on the growth development and yield of chilli pepper (*Capsicum frutescens). International Journal of Agriculture and Biological Sciences,* ISSN (2522-6584). *4*, 33 – 43.

Robert, D. A., Rafvenia, M. &Luthps, S. (2021). The effect of egg shell (house hold waste) on vegetative growth of Cayenne Pepper (*Capsicum frutescense* L). IOP Conference series. *Earth and Environmental Science*s 755. 012001 DOI 10.1088/1755 – 1315/755/1/012001.

Rodriguez-Burruozo, A., Gonzalez-Mas Mdel, C., &Nuez, F. (2010). "Carotenoid composition and vitamin A value in ayi (*Capsicum baccatum* L) and rocoto (C. pubscens R & P) 2 pepper species from the Andean region". *Journal of Food Science,75* (8), 5446-53.

Saison, C., Degrange, V., Oliver, R., Millard, P., Commeaux, C., Montange, D., & Le Roux, X. (2006).Alteration and resilience of the soil microbial community following compost amendment: Effects of compost level and compost-borne microbial community .*Environmental Microbiol*ogy *8*(2),247-257.

Vasnie, G., Sirpaul, J., & Abdullah, A. (2018). The effects of Vermicompost and other fertilizers on the growth and productivity of pepper plants in Guyana http://dx.doi.org/10.5772/intecopen.73262.

Walsh, B.M., & Hoot, S.B., (2001). Phylogenetic relationship of Capsicum(Solanaceae) using DNA sequences from two noncoding regions. *International Journal of Plant Sciences, 162*(6),1409-1418.

Wells, John C. (2008). Longman pronunciation Dictionary (3rd ed.) Longman p 123. ISBN97814405881180.