# Effect of Variable Rate of Poultry Manure on the Growth and Yield of Pepper (*Capsicum annum*) in South Western Nigeria

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**Abstract:** A trial was carried out in 2010 rainy season to study the effects of different levels of poultry manure (PM) at the rates of 0, 2.0, 2.5, and 3.0 ton/ ha$^{-1}$ on growth and yield of *Capsicum annum,* in Owo, Ondo State, Nigeria. Pepper growth and fruit yield were assessed and subjected to Analysis of Variance. The growth parameters such as plant height, leaf area and number of leaves showed increasing response to all the treatments as the rates increased. The study revealed that growth and yield of pepper fruit in the south western Nigeria could significantly ($P<0.05$) be improved by the application of PM at 3.0 tons/ ha$^{-1}$.

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## Introduction

*Capsicum annuum* (L.) locally called 'tatase' is a very important fruit vegetable in the tropics and the world second most important vegetable after tomatoes (Olaniyi and Ojetayo, 2010). Pepper has increased in popularity, value and importance over a long period, thus making it an indispensable part of the daily diet of millions of Nigerian. Pepper is normally used as a spice in the preparation of soup and stew when cooked with tomatoes and onions. It can also be used as a condiment and extensively in flavouring of processed meat, colouring certain food preparation and also used for medicinal purposes (Alabi, 2006; UGCE, 2009).

Nigeria produces 50% of total production in Africa. FAO (2008) reported that Nigeria produced 695,000 metric tons from total area of 77,000 ha. The bulk production of pepper is found in the drier Savanna zone and derived Savanna areas of the south western Nigeria (Anon, 2006). In Southern Nigeria, four types of chilli pepper are recognised on the basis of fruit form namely, "Atarodo", "Sombo", "Tatase" and "Atawewe".

Pepper is a heavy feeder of NPK and therefore required a liberal application of 450 kg/ha N, 220 kg/ha P and 400 kg/ha K. Forty percent of the N should be applied as basal fertilizer before transplanting. The remaining 60% should be side-dressed in three equal amounts at 2, 4, and 6 weeks after transplanting (WAT). Half of the P and K should be applied as basal fertilizer, and the remainder should be side-dressed at 4 WAT (Berke, *et.al.* 2005).

However there is need to increase production as indicated by the demand for pepper throughout the year, but this has been hampered as result low soil fertility. In order to obtain high yield of pepper, there is need to augment the nutrient status of the soil to meet the crop's need and thereby maintaining the fertility of the soil. One of the ways of increasing the nutrient status is by boosting the soil nutrient content either with the use of organic materials such poultry manure, animal waste, and use of compost or with the use of inorganic fertilizers (Dauda *et al.*, 2008). In the past inorganic fertilizer was advocated for crop production to ameliorate low inherent fertility of soils in the tropics. Despite the effectiveness of these chemical fertilizers, their adoption and uses has been characterized by several problems such as inadequate supply or even unavailability of fertilizer at the time of need, adulteration and high cost (Adekiya and Agbede, 2009). Also, cultivation with persistent application of mineral fertilizers increases soil acidity and soil physical degradation which may reduce crop yield (Ojeniyi *et al*., 2007; Adeinyan and Ojeniyi, 2003). The use of organic manure cannot be over emphasized because of its usefulness in the improvement of physical conditions of soil and the nutrients it supplies for soil productivity. Apart from the role of organic manure as a store house for plant nutrient it acts as a major contributor to cation exchange capacity and as a buffering agent against undesirable pH fluctuation (Ngeze, 1998). The use of organic manure cannot be over emphasized because of its usefulness in the improvement of physical conditions of soil, microbial properties and the

nutrients it supplies for soil productivity, also and eliminate pollution of underground water (Akinfasoye and Akanbi, 2005). According to Yai and Radav (2004), crops cultivated with organic manures are not only free from harmful chemicals; they are also safer, healthier and tastier. They are of high nutritional quality and are devoid of all forms of pollution that arise from agricultural techniques.

The present study was therefore, designed to evaluate the impact of different levels of poultry manures on the growth and yield of pepper in Owo, South-west Nigeria.

## Materials and Methods

### Experimental site

The experiment were carried out at the Teaching and Commercial Farms of Rufus Giwa Polytechnic, Owo, Ondo State, latitude $5^o$ 12' N and longitude $5^o$ 35' E within the forest zone of southwest Nigeria. The site has been previously cropped with maize. The dominant weeds at the site are Milk weed (*Euphorbia heterophylla)* and Guinea grass (*Panicum maximum*) The site was manually cleared and debris parked after which 1 m × 5 m size bed were made with 1 m in between the bed as discard. The experiment was laid out on a Randomised Complete Block Design (RCBD) with three replicates. The treatments were: $T_1$ = 15kg/1 m × 5 m bed (Equivalent of 3.0t/ha), $T_2$ = 12.5kg/1 m × 5 m bed (Equivalent of 2.5t/ha), $T_3$ = 15kg/1 m × 5 m bed (control treatment) and $T_4$ = 10kg/1 m × 5 m bed (Equivalent of 2.0t/ha). The poultry manure was incorporated into the soil 2 weeks before transplanting to allow for mineralization. Pepper seed used for the experiment were sourced from NIHORT, Ibadan. The seed were sown in the nursery and were transplanted at 4 weeks after sowing with a spacing of 90 cm × 90cm given a total of 12 plants per bed and total of population of 144 plants. Supplying was done a week after transplanting. Other cultural practices, such as weeding and pest control by using cypermethrin were carried out on the plot as required

### Soil analysis

Surface (0-15 cm) soil sample were collected randomly over 10 spots before commencement of the experiment. Samples were bulked, air dried and grounded to pass through 2 mm sieve. The soil samples were analyzed for physico and chemical properties as follows: Soil particle size was determined by Bouyoucos method (Bouyoucos, 1962). Soil pH in H2O (1:1) was determined using the custom laboratory apparatus (IITA, 1982). Soil organic carbon was determined by Walkley black modified method (Black, 1965). Available phosphorus and total nitrogen were determined separately by Technicon A All method (Technicon, 1975), while exchangeable Ca, Mg, K, Na and effective C.E.C in soils by use of atomic absorption spectrophotometer (Tel and Hargerty, 1984).

### Poultry manure analysis

The poultry manure used for the experiment were collected from the poultry section of the Teaching and Commercial Farms, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria. The manure were shade dried, crushed and analysed for its chemical properties (Table 1).

### Data collection and data analysis

Four plants were randomly selected and tagged from each plot for data collection, the following growth parameter (plant height, number of leaves and leaf area) were collected at 4 and 6 weeks after transplanting (WAT), while numbers of fruits were collected at 10 weeks after transplanting (WAT). The meter rulers was used for the measuring of the pepper plant height from base to the tip of the main shoots while the number of leaves were counted and recorded, leaf area was measured by tracing the margins of the leaf on a graph paper and the total leaf area/plant was obtained by counting the leaf number of 1-cm squares at 4 and 6 WAT. The number of fruit per plant was counted recorded at harvesting.

All data collected were subjected to analysis of variance (ANOVA) using SAS-GLM procedure (SAS, 1989). The differences between treatment means were evaluated using the least significant different at 5% level of probability.

## Result and Discussion

### *Pre-planting soil analysis*

The result of the pre-planting soil analysis showed that the soil is loamy sand; it could be inferred that the soil used for the study was of good drainage and well aerated for good root penetration. The soil pH showed that the soil was slightly acidic in reaction with pH value of 6.25. The organic matter content, total N, available phosphorus was low also the exchangeable cation of $Ca^{++}$, $MG^{++}$ , $K^{+}$ and $N^{+}$ were low, and this infers that the soil had low fertility and there is needs for soil amendment.

### *Plant height*

The result obtained from the study shows that plant height was significantly affected by different levels of poultry manure (PM). The comparison of treatments' means at 4 WAT (Table 2) reveals that maximum plant height (21.36 cm) was recorded from plots where 3.0t/ha (PM) was applied, followed by T2 (17.53 cm) which happen to be NIHORT recommended rate and the lowest value 11.13 cm recorded for control treatment, while at 6 WAT (Table 3) T1 recorded the highest value (49.82 cm) and the lowest T3 (25.78). The increase in plant height with PM was mainly due to the low organic

matter and N, P and K content of the experimental site which has been made available to the growing pepper seedlings, thus influence the growth of the plant. These results are in accordance with the findings of Alabi (2006), Adewale, *et al* (2011) Ewulo *et. al* (2008) that the plant height of pepper, garlic and tomato increased significantly as the fertilizer rate increased.

***Leaf area***

Table 2 and 3 shows that leaf area increases with the level of PM applications, at 4 and 6 WAT T1 recorded the highest value 76.92 $cm^2$ and 133.95 $cm^2$ respectively and the lowest value recorded by control experiment. The observed increase in the size of leaf area implies that there is effective utilization of nutrients from the soil. This result is in consonance with Aliyu (2002, 2003) and this confirm the ability of poultry droppings to supply the required N contents needed by pepper plants to enhance their growth and general performance (Alabi, 2006).

***Number of leaves***

Number of leaves at 4 and 6 WAT was significantly influenced by the different dosages of PM, the highest value was recorded for PM at 3.0t/ha and the least in control treatment Table 2 and 3. This conforms with the findings of Frank (2000) that a general increase in vegetative growth was obtained when manures are applied to plants. Moreover, poultry manure is known to rich in N, P and K, which when decomposed add nutrients to the soil resulting in better growth and development.

***Yield***

The three application rates were statistically higher than the control. Pepper plant that received 3.0 ton/ha PM recorded the highest yield (265 fruits), followed by 2.5 ton/ha application rate (250.33 fruits) and the lowest yield observed in control treatment (Table 4). The yield increase with an increase in PM rates suggest that PM supplies nutrients which enhances vigorous growth which are important indices that culminate in increase in fruit yield. This result tallies with that of Nicholson *et al*. (1999); Dileep, (2005); Dauda *et.al* (2005a,b); Ajayi (2009) who reported significant response in yield to different types of manure rate applications.

**Table 1: Soil physiochemical and poultry manure properties before the trial**

| **Soil Composition Values** | | **Poultry manure** |
|---|---|---|
| Clay g/kg | 12.60 | |
| Silt g/kg | 10.20 | |
| Sand g/kg | 77.20 | |
| Textural classification (USD) | Loamy Sand | |
| **Chemical Classification** | | |
| pH | 6.25 | 7.20 |
| % Organic Carbon | 1.20 | 6.75 |
| Available P (ppm) | 1.008 | 63.00 |
| Total N % | 0.12 | 0.68 |
| **Exchangeable Cations (mol/Kg)** | | |
| Ca (mol/kg)[1] (meg/100g) | 1.55 | 4.40 |
| Mg (meg/100g) | 1.03 | 2.68 |
| Na (meg/100g) | 0.35 | 10.89 |
| K (meg/100g) | 0.59 | 24.94 |
| CEC | 3.62 | 42.91 |
| Base % | 97.00 | 100.00 |

**Table 2: Treatment means of growth parameters at 4 weeks after transplanting**

| **Treatments** | **Plant height (cm)** | **leaf area ($cm^2$)** | **no of leaves** |
|---|---|---|---|
| T1 | 21.36 | 76.92 | 86.00 |
| T2 | 17.53 | 73.20 | 70.67 |
| T3 | 11.13 | 49.97 | 43.33 |
| T4 | 13.67 | 69.49 | 59.33 |
| LSD (0.05) | 1.51 | NS | 15.86 |

**NB:** $T_1$ = 15kg/1 m × 5 m bed (Equivalent of 3.0t/ha), $T_2$ = 12.5kg/1 m × 5 m bed (Equivalent of 2.5t/ha), $T_3$ = 15kg/1 m × 5 m bed (control treatment) and $T_4$ = 10kg/1 m × 5 m bed (Equivalent of 2.0t/ha).

**Table 3: Treatment means of growth parameters at 6 weeks after transplanting**

| Treatments (cm) | Plant height ($cm^2$) | leaf area | no of leaves |
|---|---|---|---|
| T1 | 49.82 | 133.95 | 362.33 |
| T2 | 44.21 | 112.99 | 324.67 |
| T3 | 25.78 | 101.17 | 204.00 |
| T4 | 39.00 | 104.91 | 317.00 |
| LSD (0.05) | 5. 39 | NS | 15.40 |

$T_1$ = 15kg/1 m × 5 m bed (Equivalent of 3.0t/ha), $T_2$ = 12.5kg/1 m × 5 m bed (Equivalent of 2.5t/ha), $T_3$ = 15kg/1 m × 5 m bed (control treatment) and $T_4$ = 10kg/1 m × 5 m bed (Equivalent of 2.0t/ha).

**Table 4. Treatment means of number of fruits at 10 weeks after transplanting**

| Treatment | no of fruits |
|---|---|
| T1 | 265.67 |
| T2 | 250.33 |
| T3 | 172.00 |
| T4 | 227.00 |
| LSD (0.05) | 20.37 |

$T_1$ = 15kg/1 m × 5 m bed (Equivalent of 3.0t/ha), $T_2$ = 12.5kg/1 m × 5 m bed (Equivalent of 2.5t/ha), $T_3$ = 15kg/1 m × 5 m bed (control treatment) and $T_4$ = 10kg/1 m × 5 m bed (Equivalent of 2.0t/ha).

**Conclusion**

From the results generally, it is suffice to suggest that application of poultry manure albeit at higher application rates improves pepper yield and production. Increasing yield and production of pepper can thus translate in an increase in the standard of living of farmers who engaged in pepper cultivation. Also, there is a global trend towards organic farming, the use of poultry manure as a substitution for inorganic fertilizer will help to achieve this aim.

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