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Comparative effects of different organic manure on agronomic performances of *Corchorus olitorus* in rainforest agro-ecological zone of South Western Nigeria

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Abstract

Low soil fertility is one of the main factors for the low productivity of vegetables in Nigeria. The effect of different organic manures on the agronomic performance of *Corchorus olitorus* was carried out in a Randomized Complete Block Design (RCBD) at the Teaching, Commercial and Research Farms of Rufus Giwa Polytechnic, Owo, Ondo State. Four treatments namely: poultry manure (PM) 50kg/20m², pig dung (PD) 50kg/20m², cow dung (CD) 50kg/20m² and control (with no manure) were evaluated and replicated 4 times. Results shows that plant height, stem girth, number of leaves, and leave area index at 2, 4 and 6 weeks after planting (WAP) and yield were significantly influence by the application of organic manures compared to control. *C. olitorus* responded to the manure application in the following order; PM, PD, CD and plot with no manure amendment (control). The higher major nutrients constituents in PM and PD has influence on the growth and yield of *C. olitorus*. Therefore, the cultivation of *C. olitorus* in South West Nigeria could be a profitable enterprise as against popular belief if emphasis is placed on the use of fertilizers from organic sources.

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Introduction

Recently, there has been a global shift from chemical fertilizer to organic fertilizer that is renewable, quite easily accessible, cheap and less harmful (Ehiagiator, 1988; Omueti *et al.*, 2000). Although the organic manures contain plant nutrients in small quantities as compared to the fertilizers, the presence of growth promoting principles like enzymes and hormones, besides plant nutrients make them essential for improvement of soil fertility and productivity (Bhuma, 2001).

A lot of organic manures lies waste in rural and semi-urban areas of Nigeria and even in developing urban centres and mega-cities like Lagos and Ibadan. They are usually dumped around farmsteads and saw-mills. Some of these organic wastes are burnt periodically while others are just dumped on the ground surface, increasing the problem of environmental pollution and constituting health hazards. Many workers have tried to assess the importance of organic manures in crop production. Senjobi *et al.,* (2010) reported that the use of poultry, plant and sheep/goat manures improved all the growth parameters of the leaf vegetable they worked with. Although, there is a wealth of information on the dietary importance of *C. olitorus*, a leafy vegetable which is extensively grown in south western Nigeria, little is known about its nutritional requirements generally. This is because in West Africa's farming system, leafy vegetables are regarded as backyard crops. However, this idea is changing, with the development of private and government vegetable gardens on a large scale. This, coupled with the scarcity and high cost of obtaining mineral fertilizer, calls for search for alternatives (Akanbi et al., 2006). Organic fertilizers can be used to reduce the amount of toxic compounds (such as nitrates) produced by conventional fertilizers in vegetables like *C. olitorus*, hence, improving the quality of leafy vegetables produced as well as human health . There is paucity of information on the use of organic fertilizers for *C. olitorus* production and thus necessitate this research. Specifically, this work focuses on the assessment of effect of organic amendment on the growth and performance of *C. olitorus*.

Materials and methods

Experimental location

The experiment was carried out on 225m^2 land at the Teaching and Commercial Farms of Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria (7^o 11' 43" N 5^o 33' 57" E). The land has been under cultivation for many years with no history of fertilizer application.

Soil analysis

Prior to the commencement of the experiment core soil samples were collected at random from the site at a depth of 0-15cm. The soil was air dried, crushed and filtered through a 2mm sieve mesh. It was then analyzed in a laboratory as follows: Soil pH was determined in water using a 1:1 soil/water suspension ratio (Mclean 1965). Particle size distribution, (%sand, %silt and %clay) was determined by the hydrometer method (Bouyoucos, 1962).Organic carbon content was determined by Walkey Black method (Nelson and Sommers (1982). Total nitrogen content was determined by the macro-Kjeildahal method (Bramner and Mulranag 1982). Exchangeable bases (Na, K, Ca and Mg) were determined after leaching with 1 N ammonium acetate (NH_4OAC) and were read from the spectrometer while K and Na were read from the flame photometer (Jackson 1967). Available phosphorus was determined with the Bray I method (Bray and Kurtz 1965). The result of the pre-cropping soil analysis revealed that the soil is sandy loam in texture (Sand 76.20%, Silt 10.40% and Clay 13. 40% respectively) and acidic (pH 6.2) with low organic carbon (1.78%), total nitrogen (0.39%), available P (18.61ppm), 1.48 cmol/kg^{-1} Ca, 0.19 cmol/kg^{-1}, 0.81 Mg cmol/kg^{-1}, 0.19 cmol/kg^{-1} K and 0.07 cmol/kg^{-1} Na.

The manures used was collected from the livestock section of the Teaching and Research Farms, of Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria; shade dried and pulverized and later analyzed for

total N, total P and total K following standard procedures (Juo, 1979).

Table 2. Laboratory analysis of major nutrients present in the manure used.

Manure type (g/kg)	Nitrogen (g/kg)	Phosphorus (g/kg)	Potassium
Poultry manure	60.09	23.05	45.95
Pig manure	50.27	21.90	32.17
Cattle dung	38.54	20.06	22.87

Land preparation and propagation

The land was manually cleared, stumped and debris packed. Thereafter the plot was marked out for seed bed preparation and each bed was 1m x 5m with 1m discard between and within beds. Fifty (50kg) kilogram of dried poultry manure (PM), pig dung (PD) and cattle dung (CD) obtained from the livestock section of Rufus Giwa Polytechnic, Teaching, Research and Commercial Farms were spread on the seedbed and incorporated into the soil using hoe. Oniyaya seed cultivar of *C. olitorus* was obtained from Ondo State Agricultural Development Project, Akure, the seeds were scarified in warm water for about 10 minutes to aid prompt germination. The seeds were sown by drilling method on the seedbed at a spacing of 30cm inter rows, to give room for easy farm operation like weeding, manure application, insecticide application, etc.

Experimental design and treatment

The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 different manures namely: PM 50kg/20m^2, PD 50kg/20m^2 and CD 50kg/20m^2. There is also control treatment with no manure application. All the treatments were replicated 4 times to make a total of 16 treatment plots.

Data collection and analysis

Five plants were randomly sampled per plot to determine plant height, stem girth, number of leaves at 2, and 4 weeks after planting (WAP). The meter rulers was used for the measuring of the 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 (Agbogidi and Nweke, 2005). At harvest the shoot were harvested fresh by cutting the plant at 10cm above surface at 7 WAP and weighed using an Electronic Balance and the averages of their respective weights were taken for each treatment. This was extrapolated to evaluate total yield per hectare (Sanni and Adesina, 2012). Data collected were subjected to analysis of variance (ANOVA) using SAS-GLM procedure (SAS, 1989) and where the f-values were found to be significant the significant among treatment means were evaluated using the least significant different at 5% level of probability (Steel *et al.,* 1984).

Results

Results indicated significant differences in growth parameters amongst treatments. Plant height exhibited a significant ($P<0.05$) difference in all treatments (Figure 1 and 2). The poultry manure fertilized plants were the tallest followed in decreasing order by pig manure; cattle manure and lastly plant with no manure application exhibited the least plant height. Similarly, the results showed significant ($P<0.05$) differences in average number of leaves per plant. The plants fertilized with poultry manure had relatively higher average number of leaves per plant, followed by pig manure and cow dung which exhibited a non-significant difference in the average number of leaves per plant (Figure 2). Same trend was observed in stem girth development. The *C. olitorus* plants without fertilization (control) exhibited the least number of leaves amongst treatments. However, all treatments showed a non-significant difference in the plant height, stem girth and average number of leaves from the second week after transplanting (2 WAT) to the fourth week after transplanting. Yield obtained from poultry manure amended plot had the highest (27.04kg) closely followed by pig manure fertilized plant (24.7kg), cow dung plot (22.02kg) and least yield recorded in control (20.2kg) plant (Figure 3). However, yield

from poultry manure and pig manure showed a non-significant difference but was significantly different compared to control.

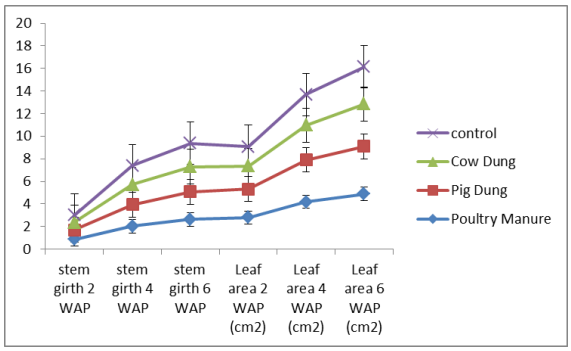

Fig. 1. Effect of organic manure on stem girth and leaf area at 2, 4 and 6 WAP.

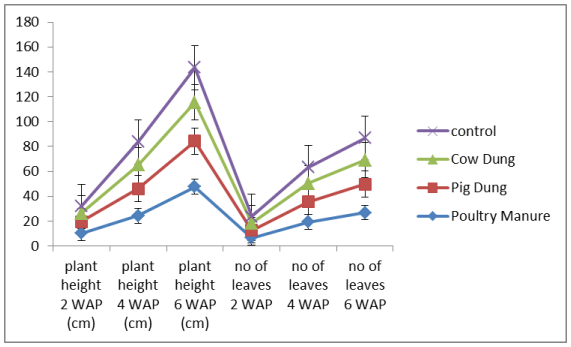

Fig. 2. Effect of organic manure on plant height and number of leaves at 2, 4 and 6 WAP.

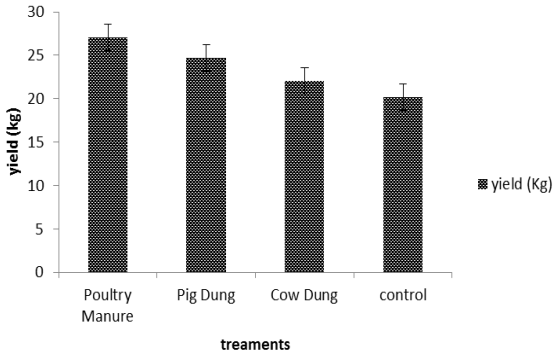

Fig. 3. Effect of organic manure on *C. olitorus* yield.

Discussion

C. olitorus being a widely grown and consumed leafy vegetable crop in south western Nigeria, with nutrient requirement for its effective growth and productivity, requires that a sustainable and easily available source of nutrients be sought to ease the twin problems of scarcity and cost associated with inorganic fertilizer. The results from this study showed that nitrogen, phosphorus and potassium has significant role to play in *C. olitorus*. The result obtained from the study showed that plot with no manure application had lowest number of leaves than other treatment; the difference in number of leaves affected growth and yield. This supports the findings of Lucas and Lawani, (1985). The non-significant difference recorded in growth parameters evaluated might be due to the slow release of nutrients in the organic as a result of decomposition. This supports the findings of Masarirambi *et al.,* (2010). Animal manures, when efficiently and effectively used, ensure sustainable crop productivity by immobilizing nutrients that are susceptible to leaching. Nutrients contained in manures are released more slowly and are stored for a longer time in the soil ensuring longer residual effects, improved root development and higher crop yields (Sharma and Mittra, 1991; Abou El Magd *et al.,* 2005).

This findings clearly shows that soil amendment with organic manure (Poultry and pig manures) is veritable alternatives in improving soil fertility by resource-poor farmers thus ensure food sustainability/ or security and would also minimize partially and/ or totally the environmental pollution effects caused by the indiscriminate disposal of poultry droppings in town and cities.

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