Morphological and Yield Performances of Okra (*Abelmoschus Esculentus*) as Influenced by Soil Ammended With Poultry Manure and N.P.K 15-15-15 Fertilizer in Ikorodu, Nigeria

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Abstract

Soil fertility depletion in small holder farm is the fundamental cause of declining per capital food production. This study was carried out to determine the performance of poultry manure (PM) and NPK 15-15-15 fertilizers on the growth and yield of okra (*Abelmoschus esculentus*) in Ikorodu agro ecological zone, Lagos, Nigeria. The experiment was laid out in Randomized Complete Block Design (RCBD), replicated three times. Okra growth parameters were assessed taking data on plant height at 3, 6, and 9 WAS, number of leaves at 3 and 6 WAS, while yield performance was assessed at harvest (number of fruit, fruit weight). The result showed that application of PM significantly (P<0.05) enhance plant height growth, number of leaves at 6 and 9 weeks after sowing (WAS) and number of fruits; while the average weights of the fruits was significantly (P<0.05) influenced by NPK fertilizer compared to other treatments. Comparatively both PM and NPK fertilizer significantly increase the growth and yield of okra compared with the control. PM performed better than NPK fertilizer. Therefore, PM could be used as alternative source of plant nutrient in Ikorodu agro ecological zone for continuous and sustainable okra production on degraded soil.

Keywords

Agro ecological; Fruit weight; Growth and yield; Performance; Plant height
crops but its use is hampered by its inaccessibility to majority of the farmers due to high cost and infrastructural problems in developing country like Nigeria (Webber et al., 1999). Other problems include most inorganic fertilizer does not replace trace nutrients in the soil which become gradually depleted by crop (Lawrence, 2004). Its application on highly weathered soil leads to pollution of ground water after harvest, it does not improved soil structure (Gordon et al., 1993), decline in organic matter content, nutrient imbalance, soil acidification (Ojeniyi, 2000). Organic manures can be used as an alternative for the inorganic fertilizers. The need to use renewable forms of energy and reduce costs of fertilizing crops has revived the use of organic fertilizers worldwide. Improvement of environmental conditions and public health are important reasons for advocating increased use of organic materials (Seifritz, 1982; Ojeniyi, 2000; Maritus and Vlelc, 2001). Consumers have an increasing interest in organic products because they are thought to be environmentally sound or of high quality. Organic manure application sustains cropping system through better nutrient recycling and improvement of the soil physical attributes (El-Shakweer et al., 1998).

In recent years in Ikorodu area of Lagos state, Nigeria many poultry farms have been established while abandoned ones are resuscitated due to the prohibition on importation of poultry products into the country and there has been the attendant problem of disposal of the waste from these farms. This waste which is poultry manure can be a source of organic fertilizer for cultivation of vegetable crops such as okra.

In Nigeria, various studies have been conducted on nutrients requirements of okra with inorganic fertilizers (Kogbe, 1976; Akin-Taylor, 1996) while very little have been reported on sole use of organic manure in comparison with inorganic fertilizer. In view of these facts, this paper is aimed at investigating the response of okra to inorganic fertilizer (NPK 15-15-15) and poultry manure for the morphological performances and yield of okra.

Result and Discussion

Soil and poultry manure analysis

Pre-cropping soil analysis revealed that the soil is slightly acidic and was within the pH range that is good for better performance of vegetable crops production (Purseseglove, 1991) and most nutrients were below critical level (Adeoye and Agboola, 1985). Soils below these critical levels are regarded as being low in these nutrients (Ibude et al., 1988). This revealed that the soils in the area are largely deficient in major essential nutrients. This observation re-affirmed Akanbi et al (2010) who reported that most of our agricultural soils are improvised due to intense weathering, leaching and extensive cultivation. Consequently, optimum growth and yield cannot be achieved without supplementary nutrients through soil amendment in form of organic manures and/or inorganic fertilizer to improve growth and yield of okra.

The result of poultry manure analysis showed that it was high in some plant nutrients and organic matter. The high organic matter improves the soil structure leading to improvement of soil physical conditions. This was in agreement with FAO (1983) who highlighted the role of organic matter in sustaining the fertility of the soil for good production of vegetables by binding the soil to form good soil structure.

Okra Morphological and Yield Performances

Nutrients supplied in the form of PM and NPK fertilizer affected okra plant height at 3, 6 and 9 weeks after sowing (WAS). Okra plant treated with PM produced tallest plants at 3, 6 WAS and at flowering, followed by plot improved with NPK and plots with no manure or fertilizer application produced the shortest okra plants (Figure 1). Statistically plant height recorded were not significantly different at 3 WAS, while at 6 WAS and flowering okra plants from the control plot had significantly shorter plants than from any of the fertilizer types. The enhanced plant growth following application of poultry manure has also been observed by Pavan Yadav et al. (2003) in okra. The performance of NPK could be attributed to high leaching rate as a result of heavy downpour recorded during the experiment.

![Figure 1 Influence of soil amendment on okra plant height at 3, 6 and 9 weeks after sowing](image-url)
Number of leaves at 6 and 9 (at flowering) WAS shows that plot with no fertilizer application recorded the lowest number of leaves, while PM produced the highest number of leaves at 6 WAS and NPK had more leaves than other treatments at 9 WAS (Figure 2). This could be due to mineralization of poultry manure which served as a source of readily available nutrients and also accumulated in form of humus (Ali et al., 2007); and the fast growth rate observed in plants treated with mineral fertilizer might be due to early and persistence release of nitrogen for crops since it had immediate release of its nutrient at early state. This was in line with study by Shortal and Lubhardt (1995). While the poor result obtained from the control was an indication that no significant production could be made without fertilizer application.

This was in line with study by Shortal and Lubhardt (1995). While the poor result obtained from the control was an indication that no significant production could be made without fertilizer application. PM released nutrients into the soil during decomposition, improving soil fertility. The increased soil fertility led to significant increase in growth and yield of okra. In addition, improvement of the physical properties of the soil due to supply of plant nutrient and improvement in the soil properties, thereby, resulting in the synthesis of more photo-assimilates, which is used in producing fruits. (Dauda et al., 2008).
the soil, supplying both macro and micronutrient not contained in mineral fertilizer (Mbagwu and Ekwealor, 1990). While result from NPK amended soil in the study could be attributed to high rate of mineralization of the fertilizer that makes its nutrient readily available and also, can easily be leached out as could be affected by heavy precipitation (Onwudike, 2010). Above all, the findings from this study support the earlier report by Singh and Kawu (2002) that PM influenced okra growth and yield better than NPK fertilizer.

Conclusion
Results obtained from this study showed that both PM and NPK fertilizer significantly increase the growth and yield of okra compared with the control. PM performed better than NPK fertilizer. Therefore, with the global trend towards organic farming,

Poultry manure could be used as alternative source of plant nutrient to achieve this aim; in Ikorodu agro ecological zone for continuous and sustainable okra production on degraded soil.

Materials and Methods
Experimental location
The experiment was conducted on 133m² land at the Teaching and Research Farms, Lagos State Polytechnic, Ikorodu, Nigeria (latitude 5°1' and longitude 3°) in the wet season of 2012. The area has a humid tropical climate with marked wet and dry season, high diurnal temperature coupled with high humid and evapotranspiration rate (Lasptotech Meteorological station, 2012). The land has been under cultivation for many years with occasional fallow period.

Soil and poultry manure analysis
Prior to the commencement of the experiment core soil samples were collected at random from the site at a depth of 0–15 cm using soil auger. The soil was air dried, crushed and sieved through a 2 mm sieve mesh. It was then analysed for its physiochemical properties using standard laboratory procedures as outline by Mylavapus and Kennelley (2002) and Okalebo et al (2002). The result of the pre-plant soil analysis showed that the soil is sandy loam in texture (Sand 74%, Silt 14%, Clay 12%) and slightly acidic (pH (H2O) 5.73) low in organic matter (OM 1.18%), Total N 11%, Available Phosphorus 12.3 mg/kg, 0.51cmol/kg⁻¹K, 1.20 cmol/kg⁻¹Ca, and 1.54 cmol/kg⁻¹Mg. The poultry manure (PM) used was collected from the poultry unit of Teaching and Research Farms, Lagos State Polytechnic, Ikorodu, Nigeria, shade dried to avoid decomposition, pulseritized and analysed for its nutrients composition following standard procedure of Juo (1979) and Okalebo et al (2002). The result indicates that the poultry manure composed of the following nutrients: Organic Carbon 12.7%, Total Nitrogen 2.13%, and C: N ratio 6.0, available P 0.28, K 2.02, Ca 1.35 and Mg 0.58.

Experimental Design and Agronomic practices
The site was ploughed twice, stumped manually and debris packed. Thereafter raised bed were constructed using hand hoe, each plot was 1m x 5m with a discard of 1m between treatment plots. There were 3 treatments namely: 25tons/ha⁻¹ of poultry manure (PM), 80kg/ha⁻¹ NPK 15-15-15 fertilizer and control treatment with no manure or chemical fertilizer application, replicated three times in randomized complete block design (RCBD) giving a total of 9 treatment plots. PM was incorporated into the soil a weeks before planting and watered heavily to allow for proper decomposition while NPK 15-15-15 fertilizer was applied to the plant 10cm radius using ring method at 3 WAP (Sanni and Adesina, 2012).

The okra seed, V35 variety used was sourced from National Horticultural Research Institute (NIHORT), Ibadan, Nigeria and prior to planting seed viability test was carried out using floating method and thereafter 2 seeds were planted per hole at a spacing of 60cm×50cm but later thinned to one per stand 2 WAP (Adesina and Idoko, 2013), while supplying was carried out 1 WAP. Weeding was done three times, 3, 6 and 9 WAP, insect pest control were carried out using crude extract of neem leaves while light watering was carried out as at regular interval.

Data collection and analysis
Five plants were randomly sampled per plot to determine plant height, number of leaves at 3, 6 and 9 weeks after planting (WAP). The meter rule 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. The number of pods per plant was counted while the pod weight per plant and fruit yield per hectare were weighed using an Electronic Balance and the averages of their respective weights were taken for each treatment and recorded at harvesting (Olaniyi and Ojetayo, 2010).
Harvesting was done at a 4 days interval with 6 harvests, when the tips of the pods could easily be broken with the finger-tip (Adesina and Idoko, 2013). As fruits are harvested, more flowers are initiated and more fruits formed in 5 and 7 days. There can be as many as 10 harvests, depending on frequency of harvest and water availability. 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).

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