Economic Anaylsis of Okra (*Abelmoschus esculentus l. Moench*) Production under Different Rates of Organic Manure in Okigwe, Southern Nigeria

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ABSTRACT— ***Field experiments were carried out at the research experimental site of National Horticultural Research Institute, Mbato sub-station Okigwe, Nigeria between November 2011 and February 2012 under irrigation conditions, to evaluate the economic application of different rates of poultry manure on Okra production. The treatments consisted of four rates, 0, 4, 8 and 12t/ha of poultry manure. The experimental design was randomized complete block design with three replicates. Data collected were analyzed using analysis of variance with means separated using LSD at 5% level of probability and budgetary analysis. The three agro-economic indicators; increased yield, increased net returns and benefit: cost ratio were employed to determine the most suitable, economic rate of application of poultry manure. Results showed that 8t/ha gave the highest growth (Plant height, 33.5cm; number of leaves, 8.9; leaf area 84.4 and number of branches; 2) and yield of 8.62t/ha. 8t/ha of poultry manure also is the most profitable and cost-effective. The treatment produced a favorable 2.1:1 benefit: cost ratio, net return of ₦130, 800.00 and gave maximum profit per naira above the other treatments, hence its recommendation as a modest cultural practice. Thus 8t/ha of poultry manure application is economically suitable for okra production in Mbato zone of Okigwe, Southeastern, Nigeria.***

Keywords--- Economic analysis, Okra, Poultry manure, Rates

1. INTRODUCTION

In the tropics, Okra (*Abelmoschus esculentus L. Moench*) is grown mainly for its edible immature pods but in most African countries, young leaves and mature seeds are consumed as vegetable. Okra grows best in warm climates as a tropical plant (Prota, 2004). Okra cultivation and production has been widely practiced because of its importance to the economy development and can be found in almost every market in Africa. Okra is one of the commonly grown vegetable crops in the tropics and also ranks first before other vegetable crops.

Okra as an important fruit vegetable crop and a source of calorie (4550Kcal/kg) for human consumption (Edet and Etim, 2010), contains 86% of water, 2.2% of protein, 10% of carbohydrate, 0.2% of fat and vitamins A, B and C (Christo and Onuh, 2005); it is documented by Katung and Kashina that okra is consumed throughout Nigeria. Okra is grown for its tender fresh pods which are rich in vitamins, minerals and protein (Martin, 1982; Mbah et al, 2009). Vitamin A and C, protein, calcium and iron in diet are found in the tender leaves while the mature seeds can be roasted, ground and added to coffee as an adubiant (Njoku and Ebeniro, 2009).

Despite the enormous potentials of okra fruits production, its level of production and crop yield per hectare has been greatly hampered by the low fertility status of most soils in the growing areas and low organic matter contents of the soils which translate into low productivity and consequently reduced income for the famer. The low return to farmers is further enhanced by the exorbitant nature of inorganic fertilizer, which most farmers depend upon as source of nutrient for their crops, considering it's negative environmental impact and the fact that the issue of inorganic fertilizer has been highly politicize, there is then, the need to find an alternative source of nutrient which is affordable and less harmful to the environment. Poultry manure has been reported to be a good source of plant nutrients since it contains a substantial amount of N.P.K and other micronutrients that are essential for crop growth and development (Jibrin, A.D., 2011). Jibrin A.D. 2011 reported that poultry manure as a form of organic manure has the potential of increasing the fertilizer use efficiency of soils thereby improving the physical and chemical properties of the soil by making better utilization of nutrient. The quantity of organic manure applied determines the level of productivity of the plant. Jibrin (2011) states poultry manure levels significantly increased plant height, number of leaves, number of branches, and seed yield per hectare at the rate of 7.5t/ha. It was observed by Odeleye et al (2005) that the application of 8t/ha of poultry manure as the optimum rate required for Okra production compared to 0.4 and 12t/ha. Ani and Baiyeri (2011) reported that

application of poultry manure at the rate of 15t/ha gave the best growth indices and fruit yield but application of 10t/ha gave the largest quantity of juice in yellow passion fruit production. Tomato growth and yield performances was enhances when 4t/ha of poultry manure was applied instead of 0 and 2t/ha (Saidu et al, 2011). In view of the enormous benefit of poultry manure and rates of application in crop production, this study therefore seeks to determine the most cost-effectiveness means of producing Okra using different rates of poultry manure and identify the most profitable rate of application of poultry manure.

2. MATERIALS AND METHODS

The experiment was conducted during the late season of 2011 and early 2012 at the research farm of National Horticultural Research Institute (NIHORT) Mbato, Okigwe (Lat 5^0 33^1N; Long 7^0 23^1E and 130m above sea level) to evaluate the economic of Okra production using different rates of poultry manure. The soil is classified as ultisol derived from shale/sandstone. The soil was sandy loam (743g/kg sand, 155g/kg silt and 122g/kg clay) characterized by low organic matter, low CEC and are highly leached. The area enjoys a bimodal rainfall distribution pattern with peak in June and September. Annual rainfall ranges from 1200 and 1400mm spanning over eight months (March to October) and the dry season from November to March.

The site was cleared manually, ploughed and harrowed before laying out the plots. The experimental design was randomized complete block with three replications. Plants were spaced out at 60cm x 30cm to give a population density of about 55, 555.56 plants per hectare. The treatments consist of four rates of poultry manure 0, 4, 8 and 12t/ha corresponding to 0, 6.9, 13.8 and 20.7kg/17.28m^2 ground area. Poultry manure was obtained from a private farm and to ensure proper decomposition and prevent toxicity effects on the seedlings, it was applied four weeks before the okra seeds were sown, the seeds were of NHAe47-4 variety obtained from NIHORT, Ibadan, three seeds per hole of okra seeds were sown and latter thinned at 2WAP to one. The plots were maintained weed free throughout the duration of the trial. Weeding was done manually likewise watering of the plants in the field.

Data Analysis

Plant parameter data collected include; plant height, number of leaves leaf area, number of branches and yield. Fruits were harvested at 4-day intervals and yields were assessed and estimated as number of fruit per plant, fruit weight per plant and fruit yield per hectare. Data on fresh okra fruit yield was estimated from cumulative fresh weight per plant of okra harvested. All collected data were subjected to analysis of variance (ANOVA) using SAS statistical package and means separated by LSD at 5% level of probability.

Economic Analysis

Economic analysis was carried out to determine the net farm income, benefit/cost ratio and naira outlay for Okra production. The net farm income or return (NR) is the differences between total revenue (TR) obtained based on the average market retail prices for the period considered and total cost of production (TC), Olukosi and Erhabor, 1988.

Net Return (NR) = TR - TC

Total Return (TR) = P x Q

Where P = prevailing market price and Q = quantity of produce

While benefit/cost ratio;

B/C = TR/TC

Return per naira invested = NR/TC

3. RESULTS

The application of poultry manure increased plant height, number of leaves, and number of branches and leaf area of okra per plant. There was a significant difference between the plots with poultry manure application and the unmanured plots in all the parameters measured. Maximum plant height, number of leaves and number of branches were attained with the application of 8t/ha poultry manure with values of 33.5cm (Plant height), 8.9 (number of leaves) and 2 (number of branches) while the least values were recorded in the unmanured plots with values of 28.7cm (plant height), 5.6 (number of leaves) and 1 (number of branches) shown in Table 1.

Table 1: Effect of Poultry Manure rates on growth of Okra

Treatments	Plant height (cm)	Number of leaves	Leaf area(cm^2)	Number of Branches
0	28.7	5.6	76.5	1.00
4	31.3	6.8	82.6	1.66
8	33.5	8.9	84.4	2.00
12	32.6	7.2	80.6	1.00
Mean	31.53	7.13	81.03	1.42
$LSD_{(0.05)}$	1.28	1.26	15.7	1.08

Average values of 2 cropping seasons

The average okra fruit yield responded to the various rate of application of poultry manure. Tables 2 however revealed the fresh pod yield of okra with application of various rate of poultry manure. The application of 8t/ha of poultry manure gave the highest fruit yield and weight with a value of 8.26t/ha compared to 3.48t/ha gotten from unmanured plots. Application of 12t/ha poultry manure actually caused a decrease in pod yield of the crop with a value of 6.66t/ha.

Table 2: Effect of Poultry Manure rates on fresh pod yield of Okra

Poultry manure (t/ha)	Number of Fruit/Plant	Estimated Fruit yield (g/stand)	Estimated Fruit yield(t/ha)
0	10.35	69.10	3.84
4	11.18	80.61	4.48
8	12.65	148.70	8.26
12	11.78	119.92	6.66
Mean	11.49	104.58	5.81
$LSD_{(0.05)}$	3.89	64.82	2.40

Average values of 2 cropping seasons

Data presented in Table 3, showed the cost of production of okra under different rates of poultry manure. The result showed that the application of 12t/ha of poultry manure accounted for 28.6% of the total cost of production followed by 27.2% for 8t/ha application of poultry manure while the least was 20.4% for the unmanured plots.

Table 3: Cost of Production of Okra under different rates of Poultry Manure (Naira Per hectare)

Average value of 2 cropping season

Treatments t/ha	Land preparation	Poultry manure	Application of manure	Seeds	Planting	Weeding	Watering	Harvesting	Total
0	12,000	-	-	5000	10,000	25,000	28,000	8,000	88,000.00
4	12,000	8,000	6,000	5000	10,000	25,000	28,000	8,000	102,000.00
8	12,000	20,000	9,000	5000	10,000	25,000	28,000	8,000	117,000.00
12	12,000	25,000	10,000	5000	10,000	25,000	28,000	8,000	123,000.00

With regards to economic performance, the result obtained from the application of 8t/ha of poultry manure treatment indicated a maximum gross returns of ₦247, 800.00/ha, net returns of ₦130,800.00/ha and benefit: cost ratio of 2.1:1. The highest profit of ₦1.12 per naira invested among the various rates of poultry manure application was also recorded in the treatment (8t/ha). The unmanured treatment gave the least gross return of ₦115, 200.00/ha, net returns of ₦27, 200.00/ha and benefit: cost ratio 1.3:1 and a profit of ₦ 0.31 per naira invested.

Table 4: Economic analysis of Okra production under different rates of poultry manure

Treatments	Yield (kg/ha)	Gross return (₦/ha)	Total cost of production (₦/ha)	Net returns (₦/ha)	Benefit / cost ratio	Returns / naira outlay
0	3840	115,200	88,000	27,200	1:3:1	0.31
4	44800	134,400	102,000	32,400	1:3:1	0.32
8	82600	247,800	117,000	130,800	2.1:1	1.12
12	6660	199,800	123,000	76,800	1.6:1	1.00

Averages of 2 cropping season Okra retail price was ₦30/kg over the period of the experiment.

4. DISCUSSION

Okra growth and yield were enhanced at the various rates of poultry manure applications which is an indication that okra plants were able to utilize the nutrients in the poultry manure, this is in agreement with the findings of Lawal et al (2011) and Saidu et al (2011) both reported that different rates of poultry manure affects the performance of okra and tomato. It was observed that the okra plant responded differently to the various rate of poultry manure resulting in optimum performance in growth and yield of okra when 8t/ha of poultry manure was applied which is an indication that availability of nutrients to each treatment differs in terms of quantity, although the nutrient requirement are the same for all the treatments. The study also showed that application of 12t/ha poultry manure was supra-optimal for okra growth and development. This is so, because application of poultry manure beyond the optimum rates promotes structural development at the expense of reproductive growth.

The differences in the variable cost observed are attributable to the different rates of poultry manure used. This is supported by the findings of Yakubu et al (2000) on urban vegetable production in Zamani Lekwot Army barracks Ibadan. Application of 12t/ha of poultry manure in okra production was not very beneficial, since okra production with this treatment was expensive. This is as a result of high cost of production. The yield (8.26t/ha) obtained with the

application of 8t/ha of poultry manure was high enough to compensate for the cost of production incurred and also the higher net return of ₦130, 800.00/ha associated with it. This is in agreement with the report of Akanbi et al (2006) that the yield obtained from the optimum application of organo-mineral fertilizer on okra was high enough to compensate for the high cost of production incurred.

The benefit: cost ratio obtained from the application of 8t/ha of poultry manure (2.1:1) revealed that it is the most profitable since the rule of benefit: cost ratio states that for a business to break even, the value for the benefit: cost ratio must be one, if the value is greater than one, then it is making profit and if less than one, then the business is running at a loss. From the above, it can be showed that all the treatments were profitable with 8t/ha poultry manure being the most profitable. The return per naira outlay revealed that all application of 8t/ha of poultry manure was cost-effective compared to the other treatments.

5. CONCLUSION

The study showed that 8t/ha of poultry manure was the optimum rate of producing okra which would support the demand placed on the soil to produce higher growth and yield without deleterious effect on the crop and the environment. Likewise it is the most profitable and cost-effective rate of producing okra that would be beneficial to the farmer in Mbato zone.

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