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The yield and profitability of roselle (*Hibiscus sabdariffa* L.*)* at varying poultry manure and nitrogen fertilizer rates in the southern guinea savanna of Nigeria

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The study examined the yield and profitability of roselle under organic manure and inorganic fertilizer applications. The result showed that the application of 60kg/ha of nitrogen fertilizer and 5t/ha of poultry manure significantly increased the yield and profitability of Roselle. However, though the yield and profitability were highest with the application of 60kg/ha of nitrogen, there was no significant difference in the yield and profitability of roselle for the two treatments.

Key words: fertility, calyx, fruit number, gross margin, gross returns

Introduction

Roselle (*Hibiscus sabdarjffa L.)* belongs to the *malvaceae* family, and is an annual or biennial plant cultivated for its stem, fiber, edible calyces, leaves and seeds (Rao, 1996). The crop is used in a variety of ways for home consumption, medicinal and industrial uses. The crop is however most suited for tropical climate with high humidity and temperature of about 25°C to 35°C (Hacket and Carolene, 1982). The plant requires an optimum PH of 6-7 and rainfall of about 450-500mm which should be well distributed over 90-120 days during the growing season (Morton, 1987).

The high cost of inorganic fertilizer, their non availability at the right time, adulteration associated with them, and other set backs such as decreasing soil productivity leading to nutrient inbalance, calls for integrated, use of both organic and inorganic fertilizer in a balanced proportion for sustainable crop production to meet the demand of the teaming population (Hedge, 1998);

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(Deshmuk *et al*., 2002,`Aliyu, 2003). Rahman *et al.* (2002) reported that food production, farm incomes and food prices are vulnerable to inadequate supply and high cost of inorganic fertilizers in Nigeria.

In the light of the above, this study seeks to examine the yield and profitability of Roselle under organic manure and inorganic fertilizer.

Materials and methods

Field experiments were conducted at the research farm of College of Agriculture, Lafia in the Southern Guinea Savanna zone of Nigeria (08° 30 N and 08° 30 E, 18 m above sea level) on a sandy soil (0.02% N total) during the rainy seasons of 2007 and 2008 to evaluate the yield and portability of Roselle under varying poultry manure and nitrogen fertilizer rates.

The experiment consisted of three levels of nitrogen (0, 60 and 120 kg/ha) and three levels of poultry manure (0, 2.5 and 5 t/ha). The nine treatment were laid out in a randomized complete block design (RCBD) replicated three times, the soil of the experimental sites was sandy with nutrient content of 0.02% N in both years, Organic carbon was 0.32% and 0.30% and available P at 12.25 and 10.25 PPM in 2007 and 2008 respectively. A fresh site was used in each year. In previous seasons, cowpea and sorghum were grown on the sites .Total annual rainfall was 1319.9 and 1279.6 mm in 2006 and 2007 respectively. 4-5 seeds of Roselle were sown on plots consisting of six ridges, 75cm apart and 6m long at a spacing of 60 cm apart (intra-row spacing). After crop establishment, the plants were thinned to 2 plants per stand. Poultry manure was incorporated into the soil at the rate of 0, 2.5 and 5.0 t/ha before planting. Half of the nitrogen rates were applied at 3 weeks after sowing (WAS) and the remaining half (Second dose) at 7 WAS. Weeds were manually controlled using hoe at 3, 7 and 12 WAS. Calyces from each were harvested from the four inner rows (net plot) of each plot. The value obtained was converted to per hectare basis.

Data collected were subjected to analysis of variance (ANOVA) as described by Snedecor (1967) and the statistical difference among the treatment means were evaluated using Duncan's Multiple Range Test (DMRT) as described by Duncan (1955). Gross margin for each treatment was calculated as follows:

Gross Margin/ha = Gross returns per/ha - Total variable cost/ha

The total variable cost includes cost items such as seed, nitrogen fertilizer, poultry manure and the cost of labor for farm operators (US $ = ₦150:00).

Results and discussion

The effects of nitrogen and poultry manure applications on the calyx yield (kg/ha) are presented in Tab1e 1. The application of 60 kgN/ha gave significantly higher calyx yield per hectare compared with treatment without nitrogen fertilizer. Increasing the rate of nitrogen application to l20 kgN/ha gave no further increase in yield/ha. (i.e was statistically at par with 60 kgN/ha). Application of 2.5 t/ha of poultry manure gave significantly higher calyx yield/ha compared with the treatments with 0 t/ha of poultry manure. Further increase in poultry manure rate to 5.0 t/ha led to decrease in yield, but was not statistically different from 2.5 t/ha application.

Table 1. Calyx yield of Roselle at varying poultry manure and nitrogen fertilizer rates (data pooled for 2006 and 2007).

Treatments	Calyx Yield	Yield Gain
Nitrogen (kg/ha)	Kg/ha	%
0	388.48^{c}	-
60	611.91^{a}	58
120	533.17^{ab}	10
SE ±	28.01	-
Poultry Manure		
0	349.67^{c}	-
2.5	600.77^{a}	72
5.0	585.02^{ab}	3
SE ±	28.01	-

Values with the same letters in a treatment group and column are not statistically different at 5%

The significantly higher calyx yield per hectares recorded by the application of moderate rates of nitrogen and poultry manure (i.e 60 kgN/ha and 2.5t /ha) and not the highest rate of nitrogen fertilizer and poultry manure (l20 kgN/ha and 5t/ha could be due to the fact that excessive nitrogen and manure have been reported to reduce fruit number and yield but increased vegetative growth (Aliyu *et al*., 1996). Also, the significant response of calyx yield to both nitrogen and manure application could be due to the fact that both contain nutrients, essential for plant growth and development (Brady, 1984). Though the calyx yields from the application of 60 kgN/ha was higher than that with the application of 2.5 N/ha of poultry manure, they were statistically similar.

Furthermore, the result of the economics evaluation using the Gross margin analysis (Table 2) shows that Roselle production is profitable with either nitrogen fertilizer or poultry manure. However, an increase in both nitrogen fertilizer and poultry manure rates beyond 60 kgN/ha and 2.5 N/ha

respectively led to a reduction in gross margin. This could be attributed to a reduction in yield. Higher gross margins were obtained with the application of 60 kgN/ha and 2.5 t of poultry manure. The highest gross margin was obtained with the application of 60 kgN/ha of nitrogen fertilizer. Since there was no significant difference in the average yield obtained for both treatments (60 kgN/ha and 2.5 t/ha of poultry manure), there will be no significant difference in the gross margin obtained for the treatments (IITA, 2002).

The yield and economic performance of Roselle was impressive with the application of 60 kgN/ha of nitrogen fertilizer or 2.5 N/ha of poultry manure.

Table 2. Partial budgeting analysis for roselle production at varying poultry manure and nitrogen fertilizer rates.

Variables	Treatments					
A. Gross Farm Benefit	**Nitrogen Fertilizer (kg/ha)**			**Poultry Manure (t/ha)**		
1. Average Yield	0	60	120	0	2.5	5.0
2. Price (₦/kg)	388.84	611.91	553.17	349.67	600.77	585.02
3. Gross Returns (N/ha) (2 x1)	97120	152977.5	138292.5	87417.5	150192.5	1462.55
B. Variable input costs (₦/ha)						
4. Fertilizer/Manure (₦/ha)	N/A	4144	8294	N/A	7,776	15,555
5. Seeds	150	150	150	150	150	150
6. Labour (land preparation, weeding, fertilizer application and harvesting)	35918	41667	43618	35918	41667.0	41667.0
7. Total Variable Cost N (4+5+6)	36068	45961	52062	36068	49593	57372
C. Net Benefit (N/ha) (3-7)	61052	10701.65	86230.5	51349.5	100599.5	88883

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