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***Short Communication***

# Effect of different levels of NPK fertilizer on the growth and yield of Roselle (*Hibiscus sabdariffa L*) in Yola Adamawa State of Nigeria

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## Abstract

*The research was conducted to study the effect of different levels of NPK 15:15:15 fertilizer on growth and yield of Roselle (Hibiscus sabdariffa L) at the Teaching and Research Farm of the Department of Crop Production and Horticulture, Modibbo Adama University of Technology Yola, Adamawa State, during the annual rainy season from May–June 2015, with six different levels of NPK fertilizer (0, 50, 100, 150, 200, and 250kg/ha). The treatment was laid in Randomized Complete Block Design (RCBD). Results obtained from this research showed that application of 200 and 250kg/ha has a significant impact as seen in the number of leaves and branches per plant as well as plant height, leaf length and fresh weight of Roselle compared to 0, 50, 100, and 150kg/ha.*

**Keywords:** Roselle, hibiscus sabdariffa, NPK fertilizer, randomized complete block design.

## Introduction

*Hibiscus sabdariffa* commonly known as Roselle Is native to India and Malaysia where it is commonly cultivated, and must have been carried at an early date to Africa[1]. It is a popular crop in the Middle Eastern countries and it is known with different names such as Sorrel, Mesta and Karkade[2]. Roselle is being cultivated in other parts of the world which includes Central America, West Indies and Africa. It has been widely distributed in the tropics of both hemisphere and in many areas of the West Indies[3]. In 1954 Roselle was still being grown by individuals in Midwest for its edible herbage. By 1959 and 1960 due to wide spread alarm concerning coal far food dyes it was easy to arouse interest in Roselle as a coloring source but difficult it became difficult to obtain seeds in Florida as it had by then become nearly extinct in Puerto-Rico. Today Roselle is attracting the great attention of food, beverage and pharmaceutical industries due to rising concerns that feel it may have exploitable possibilities as natural food product; and as a colorant to replace some synthetic dyes. Roselle (*Hibiscussabdariffa L*) belong to the family malvaceae, the pattern of growth of Roselle is an erect bushy herbaceous annual crop which can grow up to a height between 2.4m and 3.0m, with smooth or nearly smooth cylindrical red or green main stem depending on landrace and distinct branches[4]. The leaves are alternate 7.5 - l2.5cm long green with reddish vein and long or short petiole[5] research revealed that Roselle is a short day's annual shrubs of which the flower buds are actually seed pods of Roselle enclosed in their fleshy calyces[6] described the red pods as the fruits and calyces being fused together and difficult to distinguish from one another.

Roselle production is mainly in the Guinea and Sudan Savanna zones of the Nigeria where the calyx are prevalent with the green calyx types predominantly found in South-western part of the country. Roselle is tolerant to wide range of environmental conditions as it is being cultivated both hot and dry region on a wide range of soils. Roselle requires good drained, well textured and aerated soil with soil pH ranging from 4.5 to 8.0. Roselle despite its food and high medicinal value is classified as a minor crop as farmers in Nigeria plant it without due consideration to spacing sowing date, fertilizer and water requirement of the plant etc. NPK Fertilizer is an important requirement of the Roselle because it cause yield reduction when low although it is produced in Nigeria in relatively low quantities due to subsistence farming. Mahadevan *et al.*[7] and Majid[8] reported that Roselle is cultivated in the tropical and subtropical for it popular edible calyx, stem, fibre, leaves and seeds. Roselle contain higher amount of ascorbic acid and its rich in riboflavin, niacin calcium and iron[3,8,9] young leaves are consumed as salad with mature leaves used in preparing of palatable soups. The fruit of Roselle is used in making local drink called Zobo drink. N.P.K.

fertilizer is a limiting nutrient in Nigeria soil particularly in savanna zone where the soils is predominantly in the coarse texture and characterized with low organic matter. Enwezo *et al.*[11] in adequate N.P.K. limit crop production in the tropics[12] N.P.K. Nitrogen deficiency is recognized by pale green to light yellow color (Chlorosis). Phosphorus deficiency delays maturity, poor seed and fruit development; while potassium deficiency causes slow and stunted growth may occur. Nigerian soil is predominantly low in natural fertility and therefore cannot sustain high crop yield under continues cultivation. And to achieve high yield production of Roselle, NPK fertilizer needs to be applied. Most consistent farming system practiced in Nigeria is subsistence farming where farmers grow crops for family consumption with few percentages having to sell. In view of this Roselle is one of most important vegetable crop with several nutritional and medicinal uses, it also serves as source of income to the farmer despite all the uses and importance of Roselle, it production is very low due to the fact that mostly farmers cultivate it for subsistence with little or no NPK fertilizer applications. This research work was carried out to determine the growth and yield of Roselle subjected to different level of NPK fertilizer which are; 0, 50, 100, 150, 200, and 250kg/ha respectively. The objective of the research therefore is; to study the effect of NPK on the growth and yield of Roselle.

## Methodology

**Site Location:** Field experiments were conducted using plot at the Teaching and Research Farm of the Department of Crop Production and Horticulture, Modibbo Adama University of Technology, Yola Adamawa state, Nigeria. Yola is located between latitude 909' North and longitude 12030' East[13]. The annual rainfall is 900 to 1100mm. the length of rainfall ranges between 150 to 160 days and mostly from May to October. The annual minimum and maximum temperature of the area ranges between 20°C to 48°C.

**Source of Materials:** The seeds of Roselle and inorganic fertilizer NPK 15:15:15 were obtained from Jimeta ultra-modern market, Yola.

**Experimental Design:** The experimental treatment consist of different level of NPK fertilizer as (0, 100, 150, 200 and 250) respectively. The treatment was laid out in a Complete Randomize Block Design (CRBD) with three replications. The plots size was measured 2mxlm ($2m^2$), lm alley was allowed between replication and 0.5m between treatments where the experimental area has 18 plots.

**Land Preparations:** The land was cleared and tilted to obtain tine tilt. The field was marked out in 6 plots per block, given a total of 18 plots for the site. Plot size was 1.5mX1.5m ($2.25m^2$) and a distance of 50cm between replicates and plots. The plot was laid out with using hoe and tape. The sowing of Roselle seeds is mostly done by planting or broadcasting, after germination the plant is thinned to reduce to the required population for better yield.

**Sowing/Planting:** Roselle seed was sown directly to the soil with the spacing of 30cm intra row and 20cm inter row spacing, for greater branches 40cm intra row and 30cm inter row spacing. Sowing was done by hand using of hoe.

**Fertilizer application:** NPK fertilizer was applied in two equal dozes; first; three weeks after sowing and the second after six weeks of sowing, method of application was by site dressing and covered to facilitate dissolution and minimized volatilization losses of the fertilizer.

**Data analysis:** Data were analyzed using analysis of variance (ANOVA) as described by Gomez and Gomez 1984 and means would be separated using the least significant difference (LSD) at 5%.

## Results and discussion

Plant height was significantly ($p<0.05$) influenced by the application of NPK. At fourth week after sowing (WAS) 250kg/ha recorded the tallest plant of 36.5cm followed by 200kg/ha with the plant height of 25.0cm and 0kg/ha with 17.0cm and the shortest plant height of 14.7cm was obtained from the application of 100kg/ha. At sixth week after sowing (WAS) the tallest plant of 60.1cm recorded from application of 250kg/ha followed by 200kg/ha with plant height of 48.3cm and l50kg/ha with plant height of 36.4cm while the shortest plant of 25.8cm was obtained from 0kg/ha. At the fourth week after sowing (WAS) the highest number of leaves of 18.6 was obtained from the application of 250kg/ha followed by 16.4 leaves with 200kg/ha and 10,5 leaves with 150kg/ha. At the sixth week after sowing (WAS) the highest number of leaves of 35.3 was obtained from the application of 250kg/ha followed by 33.3 leaves with 200kg/ha.

Number of branches and leaf length was significantly ($p<0.05$) influenced by the application of NPK. At fourth week after sowing (WAS) the highest mean of 17.1 (branches) was obtained from 250kg/ha followed by 15.2 branches obtained from the application of 200kg/ha and the least branches was obtained from the application of 50kg/ha. At sixth week after sowing (WAS) the highest mean of 28.9 and 23.6 (branches) was obtained from the application of 250kg/ha and 2001<g/ha respectively. At the sixth week alter sowing (WAS) the highest leaf length of 19.2cm and 18.1cm was obtained of 250kg/ha and 200kg/ha. At sixth week after sowing (WAS) the highest leaf length of 37.4cm with the application of 250kg/ha followed by 27.7cm with the application of 200kg/ha. The effects of NPK (15:15:15) fertilizer on the Establishment Count and fresh weight. Fresh weight on Roselle were significantly ($p<0.05$) influenced by the application of NPK. The highest fresh weight of 26.8kg/ha was obtained from the application of 250kg/ha. At sixth week after sowing (WAS) followed by the 16.3kg/ha with 200kg/ha at six weeks after sowing (WAS). The least fresh weight of 6.2kg/ha was obtained from the application of 50kg/ha at 6 weeks (WAS).

**Table-1:** Effects of NPK on plant height and number of leaves of Roselle.

| Effect | Plant height (cm) | | | Number of leaves | | |
|---|---|---|---|---|---|---|
| Weeks / Treatments | 2 | 4 | 6 | 2 | 4 | 6 |
| 0 | 9.6 | 17.0 | 25.8 | 5.0 | 7.6 | 15.0 |
| 50 | 8.7 | 15.8 | 26.8 | 6.5 | 9.6 | 14.2 |
| 100 | 9.8 | 14.7 | 26.2 | 6.8 | 9.9 | 16.9 |
| 150 | 8.7 | 16.6 | 36.4 | 6.1 | 10.5 | 18.9 |
| 200 | 10.2 | 25.0 | 48.3 | 5.5 | 16.4 | 33.3 |
| 250 | 14.2 | 36.5 | 60.1 | 8.7 | 18.6 | 35.3 |
| LSD (0.05) | 1.5 | 5.1 | 9.9 | 2.8 | 5.1 | 9.9 |

**Table-2:** Effect of NPK fertilizer on number of branches and leaf length.

| Effect | Number of branches | | | Leaf length | | |
|---|---|---|---|---|---|---|
| Weeks / Treatments | 2 | 4 | 6 | 2 | 4 | 6 |
| 0 | 4.1 | 8.0 | 12.7 | 4.7 | 8.5 | 12.5 |
| 50 | 4.5 | 7.9 | 12.0 | 6.5 | 9.0 | 14.6 |
| 100 | 4.1 | 8.8 | 13.7 | 7.1 | 10. | 16.3 |
| 150 | 5.5 | 9.7 | 17.0 | 8.8 | 12.3 | 18.5 |
| 200 | 4.0 | 15.2 | 25.6 | 7.2 | 18.1 | 27.7 |
| 250 | 6.1 | 17.1 | 28.9 | 7.9 | 19.2 | 37.4 |
| LSD (0.05) | 4.1 | 11.7 | 17.5 | 3.2 | 4.7 | 11.1 |

**Table-3:** Effect of NPK fertilizer on establishment count and fresh weight.

| Effect | Establishment count | | Fresh weight (kg) | |
|---|---|---|---|---|
| Weeks / Treatments | 2 | 4 | 6 | 6 |
| 0 | 16.6 | 23.0 | 31.6 | 7.9 |
| 50 | 17.3 | 28.3 | 38.6 | 6.2 |
| 100 | 25.6 | 33.3 | 40.6 | 7.9 |
| 150 | 24.3 | 34.6 | 44.0 | 9.5 |
| 200 | 28.3 | 39.0 | 51.6 | 16.3 |
| 250 | 21.0 | 45.6 | 60.3 | 26.8 |
| LSD (0.05) | 10.8 | 11.1 | 12.2 | 10.9 |

At the second week after sowing (WAS) the highest establishment count of 28.3 was obtained followed by the 25.6. at 4 weeks (WAS) the highest establishment count of 45.6 and 39.0 was obtained with 250kg/ha and 200kg/ha followed by 34 and 33.3 with 150kg/ha. At the sixth week after sowing (WAS) the highest establishment count of 60.3 and 51.6 obtained with the application of 250kg NPK/ha.

**Discussion:** For establishment count, it has a significance difference at 5% level of significance suggesting that NPK fertilizer has an effect on the weight of the Roselle plant. In the plant height a significance difference ($p<0.05$) indicated that Roselle responded to the fertilizer by increasing the height. For every increase in NPK fertilizer level, there was a significance increase in the height at 200kg/ha and 250kg/ha. This implies that higher application of NPK could improve these parameters. This study correlates with that of Bake and Futuless[14] who suggested the need to apply fertilizer to replenish depleted soil nutrients. However, HTA (2002) in similar manner reported that crop productivity in rain fed agriculture is limited mainly by low availability of` mineral nutrient especially nitrogen fertilizer at planting and vegetative stage of the development or at both these stages is commonly associated with increase yield. This finding is supported by Olufoktmbi[15] who observed that improved crop productivity could be achieved through fertilizer usage.

For number of leaves per plant, it has a significance difference at 5% level of significance. Indicating that higher number of leaves could be obtained by increasing the level of the NPK fertilizer which is the most important of part of the Roselle plant needed. For the number of branches and leaf length, number of branches has a significance difference at 5% level of significance. This result agreed with the findings of Sanousi et al.[16] who reported that NPK fertilizer increases the number of branches per plant as well as leaf length. In the yield component parameters which are the least weight per plot it has a significance difference at 5% level of significance due to the effect induced by the treatments. From the data analysis, it shows that all the parameters measured response on Roselle were significant indicating that NPK fertilizer can increase the growth and yield of Roselle in the study area.

## Conclusion

At the end of the research, results showed that Roselle growth in terms of establishment count, plant height, number of leaves, leaf length, number of branches and fresh weight were all significantly influenced by the application of NPK fertilizer at 200kg/ha and 250kg/ha. Data collected on the establishment count, plant height, number of leaves, leaf length, number of branches and fresh weight. Data after being analyzed using analysis of variance (ANOVA) and the mean significance difference (LSD) with the result of the analysis showing that the significant differences ($p<0.05$) were observed among the treatments (0, 50, 100, 150, 200 and 250kg/ha) in terms of growth parameters establishment count, plant height, number of branches, leaf length, number of branches and fresh weight and application of 250kg/ha give the best result followed by 200kg/ha. Therefore, farmers should grow Roselle with the application of 200 and 250kg/ha.

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