

EFFECT OF DIFFERENT NPK RATES ON THE EARLY GROWTH PERFORMANCE OF *KHAYA SENEGALENSIS* (MADACCI) IN ALIERO, KEBBI STATE, NIGERIA

BY

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ABSTRACT

This study was conducted at Tree Seedling Nursery of Kebbi State University of Science and Technology Aliero (KSUSTA) to assess the effect of different NPK rates on the early growth performance of Khaya senegalensis in Aliero, Kebbi State, Nigeria. The treatments used consist of four (4) NPK (15:15:15) rates; Control (0g), treatment1 (10g), treatment 2 (15g) and treatment 3 (20g). The treatments were laid out in Randomized Completely Block Design (RCBD) replicated six times. The result showed that there were significant differences in the early growth performance of K. senegalensis between the different NPK (15:15:15) rates. Height of K. senegalensis seedlings differ significantly ($p < 0.05$) with the highest height obtained from 15g NPK (22.92cm) and the lowest was observed from 20g NPK (14.58cm). Number of leaves from 15g NPK treatment was significantly ($p < 0.05$) higher (19) compared with the rest of the treatments. Significant ($p < 0.05$) differences on collar diameter occurred in K. senegalensis treated with three levels of NPK fertilizer also. It was observed that 15g NPK level produced the highest collar diameter (23cm). For the successful K. senegalensis seedling production, 15g NPK rate produced best result and it's therefore, recommended and further research should be conducted with lower rates of NPK application to minimized its toxic effects.

Key words: Growth performance, NPK, *Khaya senegalensis*, Aliero

INTRODUCTION

Khaya senegalensis belongs to the Meliaceae family that is native to Africa. Common names include African mahogany, dry zone mahogany, Gambia mahogany, khaya wood, Senegal mahogany. It is locally named Madacci in Aliero. African mahogany is a fast-growing medium-sized tree which can obtain a height of up to 15–3m and 1m in diameter.

The tree is native to Benin, Burkina Faso, and Cameroon, Chad, Ivory Coast, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone, Sudan, Togo, and Uganda. Within its first year, the seedling develops a deep root system that makes it the most drought resistant member of its genus.

The wood is used for a variety of purposes. It is often used conventionally for carpentry, interior trim, and construction. The bitter tasting bark is used for a variety of medical purposes.

Khaya senegalensis has experienced high amounts of exploitation, and little regeneration takes place once disturbance occurs. Because of this, the International Union for Conservation of Nature (IUCN) Red List of Threatened Species considers it a vulnerable species. The only conservation which takes place is log export bans and legal protection in some countries. Though, there is *K. senegalensis* in abundant in Africa particularly Nigeria, only few people knows its silvicultural requirements in the nursery especially inorganic fertilizer requirement. This study evaluates the inorganic fertilizer requirement of *K. senegalensis* at seedling stage.

Nitrogen (N), phosphorous (P) and potassium (K) are most limiting nutrients in tropical soils due to various factors like acidity, continuous cropping and continuous broadcasting of NPK where 60% is lost through volatilisation (Savant and Stangel, 1990). During the early stages of growth of *K. senegslensis*, it is very well dependent on soil nutrient supply, therefore if seedlings of this tree species is to grow efficiently and healthy, it has to be supplied with adequate and balanced nutrition. Therefore, this study determined the levels of N.P.K that could be a better option for the growth performance of *K. senegslensis* during nursery establishment.

Materials and Methods

The study area

The study was conducted in Kebbi State University of Science and Technology Aliero, Kebbi State at trees seedling nursery, located at approximately latitudes 12°3061N, and 4°4929E (Singh, 2013). The area enjoys a typical climatic condition, generally characterized by wet and dry seasons. The rainfall begins in April with the heaviest rainfall recorded in the month of July and August. The cold harmattan periods characterized by dust laden wind prevails in the month of November to January while the month of February and March are extremely hot. The mean annual temperature varies considerably but usually stand at 42°C, the mean annual rainfall is 500mm (Singh, 2013). However, the vegetation of the area is Sudan savannah with the topography of flat and slightly undulating compact stony brown soil.

Materials

The materials used include the following;

- Weighing balance.
- Watering can.
- Diameter tape.
- Ruler.
- Vernier caliper.
- *Khaya senegalensis* seedlings; Height 13cm with 7 leaves per seedling.
- Different NPK fertilizer (15:15:15) rates

Methodology

The treatments consist of four (4), NPK (15:15:15) rates; Control (0g), treatment1 (10g), treatment 2 (15g) and treatment 3 (20g). The treatments were laid out in Randomized Completely Block Design (RCBD). Ring method was used in applying NPK fertilizer (15:15:15). Tree height was determined by measuring tree from the collar region up to the tip of the tallest leaf, fortnightly for twelve weeks and recorded. Leaf count was done by physical counting of leave numbers. Collar diameter (cm/dm) was determined by the stem at collar region using vernier caliper.

Data analysis

Data obtained on seedling height, number of leaves and collar diameter was subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS) computer package at 5% level of significance to determine treatment means difference. Where significance differences occur between treatments means, Least Significant Difference (LSD) test was performed to separate mean differences among treatments (Robertson, et al., 2012).

Results

Table 1 shows that the height of *K. senegalensis* varied significantly ($p < 0.05$) between treatments. The highest height of *K. senegalensis* (22.92cm) was recorded where 15g of NPK was added into potting medium and the lowest (14.58cm) was recorded where 20g NPK was added in the potting medium. The result appeared similar ($p > 0.05$) between 10g NPK and control (0gNPK) with 21.42 cm and 21.58 cm respectively.

Number of leaves of *K. senegalensis* where 15g of NPK was added was found high (19) and varied significantly ($p < 0.05$) between 20g, 10g and control (0g), but the result between control (0g) and 10g appeared similar ($p > 0.05$).

Seedling collar diameter value varied significantly ($p < 0.05$) between the treatments applied. The highest collar diameter value (23cm) was obtained in 15g NPK while the lowest value (15cm) was obtained in 20g NPK.

Table 1: Height, number of leaves and collar diameter of *K. senegalensis* grown in different NPK fertilizer rates.

NPK Rates	Height (cm)	Number of leaves	Diameter (cm)
0g	21.42 ^b	15.67 ^b	20 ^c
10g	21.58 ^b	16.83 ^b	22 ^b
15g	22.92 ^a	19.33 ^a	23 ^a
20g	14.58 ^c	5.33 ^c	15 ^d
LSD 0.05	0.983	0.817	0.078

Means followed with different letters in the same column are significantly different ($p > 0.05$)

Discussion

Height, number of leaves and collar diameter of *K. senegalensis* grown in different NPK rates

The study showed that there were significant differences in growth performance of *K. senegalensis* between various NPK(15:15:15) rates namely; control(0g),10g,15g and 20g used in this research. However, the highest mean plant height (22.92cm) was obtained in 15g NPK while the lowest value was recorded in 20g NPK. This may be as a result of high concentration of NPK application content in 20g NPK which causes some burning effect on some seedlings. This study agrees with the report of Agera *et al.* (2019) who recorded similar burning effect to *K. senegalensis* due to the application of high dose of inorganic fertilizer. But the result contradicted Afa, *et al.* (2011) who recorded no toxic effect during their assessment.

The highest number of leaves (19) obtained in 15g NPK could be inferred that, 15g NPK fertilizer provided adequate nutrient that further enhanced growth performance of *K. senegalensis* seedling. This research result agrees with the work of Ogunwale *et al.* (2002) and Roger (2004) who asserted that the addition of fertilizer to the growth media improved nutrient availability to the tree seedlings, especially in tropical soils that are generally low in nutrients.

These results (Table 1) show that varying levels of NPK fertilizer significantly increased collar diameter of *K. senegalensis* seedlings. According to Ajari *et al.* (2003) varying levels of fertilizer did not significantly increase collar diameter of *K. senegalensis* seedlings. This implies that there could be no need for varying levels of fertilizer when raising *K. senegalensis* seedlings.

Conclusion

This research work concluded that 15g of NPK fertilizer rate is the best in raising *Khaya senegalensis* in the nursery probably due to adequate minerals content that allowed the best growth performance indicated in the result.

Recommendations

For the successful *Khaya senegalensis* seedling production, 15g NPK fertilizer rates produced best result and it's therefore, recommended and further research should be conducted with lower rates of NPK application to minimized it toxic effects.

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