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Effects of Different Soil Potting Mixture on the Early Growth of Mahogany (*Khaya Senegalensis*) A. Juss

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Abstract

The study investigates the effects of different soil potting mixtures on the early growth of *Khaya senegalensis* (Mahogany). Two (2) potting mixtures, cow dung and poultry dropping were used. In addition, a control was also set up to check for variations existing between the two potting mixtures. The treatments were replicated ten times. Data were collected on seedling height and girth, while the number of leaves were counted and recorded. There was a significant difference among the treatments in the seedlings height and girth. ($p < 0.05$). Despite the differences in the number of leaves produced by the seedlings, there was no significant difference among the treatments ($p > 0.05$). Addition of supplements to the potting mixtures, most especially, poultry droppings is necessary for tree growth development at the early stage of germination.

Keywords: *Khaya senegalensis*, potting mixture, supplement, treatment, development

1.0 Introduction

Plant requires favourable soil texture to grow and reproduce in response to an interaction of dynamic and over changing components in their environment. According to Russel (1989), the reduction or excess of any of these growth factors affects the plants growth.

A potting medium is a mixture of various raw materials designed in horticulture practices, as a substrate to support the roots of cultivated plants in pots and or containers. A good potting mixture offered the plant a substratum for stability, high water capacity, good nutrients supply and sufficient air space for ample root respiration, which allows water and nutrient uptake. The balance of these needs varies, depending on the plant being grown and the stage of growth. *Khaya senegalensis* (Mahogany) belong to Meliaceae family, and is known as the most suitable indigenous tree species for timber production in Africa. It grows up to 35 m in height and 1.5 m in diameter on a fertile soil, with a clean bole of 8 -16 m height, it's wood is hard, dense and red, resistant to fungi and termites. It is valued for carpentry, joinery, furniture making, cabinet work, ship building and in the production of' decorative veneers (Nikierna & Pasternak, 2008).

Traditionally, *Khaya senegalensis* is found to be one of the most useful indigenous species which provide the local community with range of benefit. However, the benefits are not properly and economically harnessed as most of the trees are indiscriminately felled. The present and future demand for African mahogany was increasing in the later part of the 20th century, large individual trees of Mahogany species in natural stands started becoming increasingly rare. This has reputedly resulted in a decline in the volume in international markets in the last few years and many West African countries have imposed limits on raw log exports (UNEP, 2002). Apart from being regarded as one of the extinct indigenous wood species in the society, its natural regeneration is also poor, due to shoot borer (*Hypsipyla robusta*) attacks, which prevent it's success in plantations within the native area in West Africa (Newton *et. al.,*1993; Nikierna & Pasternak, 2008).

In Nigeria, *Khaya senegalensis* provides cattle fodder, edible and cosmetic oils, medicinal products, shade and shelter as well as providing fuel wood and valuable timber. The bark of *Kyaha sengalensis* can be used for curing and preventing a range of livestock diseases such as liver fluke, ulcer and internal ailments associated with mucous diarrhoea (World Agroforestry Centre, 2004). It is also regarded as the fever remedy, vermifuge, germicide, depurative and as syphilis treatment (World Agroforestry Centre, 2004). In addition to the bark, both the seeds and leaves have also been used as medicine for treating fever and headache, whilst preparations made from the roots have been used against syphilis, leprosy and as an aphrodisiac (World Agroforestry

Centre, 2004). Aside from its medicinal values, the bark can be used for tanning of leather as it is quite high in tannins (Boffa, 1999).

In terms of chemical components, *Kyaha senegalensis* have about 67% oil content by weight (Rozalin *et. al.,* 2015). This oil is quite rich in oleic acid (66%) and is used in West Africa for cooking and for cosmetics production. For a successful establishment of tree plantation, it is necessary to find ways of producing healthy and vigorous nursery stock, so as to ensure good survival in the field.

It is now time for the multiplicity propagation of mahogany species in order to assist in combating desertification and to reduce green gas emission in the savannah zones, this can only be achieved through imperative study of the effect of different soil potting mixture on the early growth of the specie (*Khaya senegalensis*).

2.0 Materials and Method

2.1 Study Site

The experiment was conducted in the Department of Forestry and Wildlife Management Nursery, Modibbo Adama University of Technology, Yola, Adamawa State Nigeria. It is located on Latitude 9^0 $20^{'}$ $30^{''}$N and 9^0 21'05''N, and Longitude 20^0 29' 4''E and 12^0 30' 25''E. The minimum average temperature seasonally changes from January to April, while, maximum temperature occurs as low as 15^0 during the rainy season. The average annual rainfall is about 972mm, with an average of 62 rainy days. The highest occurrence of rain in the study area is around August and September (Adebayo and Tukur, 1999). The soil in the study area is sandy loam, classified as Typic Haplustalf (Musa, 2005). The major vegetation formations in the state are the southern Guinea savannah, Northern Guinea Savannah, and the Sudan Savanna (Adebayo, 2010).

2.2 Experimental Layout and Procedure

To achieve the stated objective, Ninety (90) seeds were selected from the seed lots and treated with hot water and planted in a polythene pot of 25cm x 13cm x 6cm in size, the polythene pot were filled with three (3) different soil treatments, Viz: T_1 (Cow dung + Top Soil + River Sand), T_2 (Poultry dropping + Top Soil + River Sand). and T_3 (Top Soil + River Sand)

Treatments, T_1 and T_2 were mixed in ratio 1:2:1, while, that of T_3 is in ratio 2:1. The planted seeds were kept under shade for two weeks to prevent scotching before being transferred into open space for proper establishment. Out of the germinated seedlings, thirty seedlings were randomly selected, ten from each of the three (3) treatments which serves as a replicate for each treatments. Watering was done twice a day (Morning and Evening).

2.3 Data Collection

At the emergent of two leaves, growth assessment was carried out on the following parameters:

i Seedling Height: This was assessed by placing ruler at the bottom (soil brim) of the seedling up to the apex.

ii Number of Leaves: this was done by counting the number of germinated leaves

iii Stem girth: this was done using micrometer screw gauge, by placing the screw gauge anvil face and the spindle face at the seedling girth and took the reading on the calibrated side.

At each observation periods, Height and the collar diameter of the seedlings were measured and recorded, while the number of leaves of the study specie (*Khaya Senegaleusis*) was counted. This lasted for eight weeks.

2.4 Data Analysis

The mean value of data obtained from various measurements was subjected to one way analysis of variance (Adesoye, 2004). Least Significant Difference was used to separate the means. The Mathematical model for Completely Randomized Design is of the form:

$$Yij = \mu + ti + \sum ij$$

where:

Y_{ij} = Individual Observation

μ = General Mean

t_i = Treatment effect

$\sum_{ij}$ = Error term associated with the experiment

3.0 Results and Discussion

3.1 Seedling Height

It was observed that the specie's height increases at a normal rate, the highest mean height (8.1cm) was observed in the control, this was followed by soil treated with poultry dung, with a mean height of (6.7cm), while the least mean height was observed in the seedlings treated with cow dung (6.1cm). Table 1 shows the result of the analysis of variance conducted, and it was revealed that, there was a significant difference among the treatment on the seedling of *Khaya senegalensis* ($p < 0.05$). Fisher's Least Significant Difference indicates a significant difference on the control over the cow dung and poultry dropping (Table 2). This implies that, the addition of either cow dung or poultry dropping to the potting mixture has no effect on the seedling height of *Khaya senegalensi.s* This result is in conformity with that of Danther *et. al*., 2003, in an experiment conducted on micro propagationn of *Khaya senegalensis* seedlings.

Table 1. Analysis of Variance for Seedling Height for *Khaya senegalensis* seedling

Sources of variance	D.F	S.S	M.S	F_{Cal}	F_{Crit}
Treatment	2	16.56	8.28	18.34	3.354*
Error	27	12.19	0.45		
Total	29	28.76			

Table 2. Post mortem result for *Khaya senegalensis* seedling height

Treatments	Means (cm)
Control	8.1[a]
Poultry dung	6.7[b]
Cow dung	6.5[b]

Means followed by the same alphabet are not significantly different ($p > 0.05$)

3.2 Seedling Girth

The seedling girth proceeded at a slower pace and gradually picked up in the soil treated with Poultry dropping having the highest mean girth of 1.15 mm, while the cow dung had the least mean girth of 0.95 mm. The Anova result (Table 3) shows a significant difference among the treatment ($p < 0.05$). LSD conducted shows a significant difference on poultry droppings over the control and cow dung (Table 4.). This implies that, poultry dropping is of importance in biomass formation (accumulation of growth) in stem growth. This is in agreement with the findings of Saka (2008) on effect of watering regimes on early germination *Parkia biglobosa* seedling.

Table 3. Analysis of Variance for *Khaya senegalensis* Seedling Girth

Sources of variance	D.F	S.S	M.S	F_{Cal}	F_{Crit}
Treatment	2	0.235	0.117	3.56	3.354*
Error	27	0.892	0.033		
Total	29	1.127			

Table 4. Post mortem result for *Khaya senegalensis* Seedling Girth

Treatments	Means (mm)
Poultry dung	1.15[a]
Control	0.99[b]
Cow dung	0.95[b]

Means followed by the same alphabet are not significantly different ($p > 0.05$)

3.3 Number of Leaves

The highest mean number of leaves (5) was observed for seedling without treatment, i.e. control while, the seedlings treated with cow dung had the least mean number of leaves (4) The Anova results (Table 5) shows that the addition of cow dung and poultry dropping has no significant effect on the number of leaves of *Khaya senegalensis*

seedlings. This indicates that the specie can thrive well in ordinary soil without addition of manure/supplement for its germination.

Table 5. Analysis of Variance for *Khaya senegalensis* Number of leaves

Sources of variance	D.F	S.S	M.S	F_{Cal}	F_{Crit}
Treatment	2	0.441	0.221	0.716	$3.354^{n.s}$
Error	27	0.313	0.308		
Total	29	8.754			

4.0 Conclusion

Soil vary considerably in structure and in physical, chemical and biotic properties, the distribution and rate of growth of trees are influenced mainly by those physical, chemical and biological characteristics of the soil, which form their availability of water, nutrient and air to the trees. The relative availability of these factors in particular, determines the rate at which tree grows in the soil. The finding of this study shows that, addition of supplement, most especially, poultry droppings to the potting mixtures is necessary for tree growth development at the early stage of germination.

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