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GROWTH RESPONSE OF *KHAYA SENEGALENSIS* (DESR.) A. JUSS. SEEDLINGS TO DIFFERENT COMPOST MATERIALS

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ABSTRACT: *With the continuous use of land over time, the nutrients in the soil tend to depletion, therefore, there is the need to supplement the nutrients in the soil to increase its productivity. Addition of organic matter to increase soil productivity is a good soil management practice because it enhances the soil fertility through the modification of soil physical, chemical and biological properties. An experiment was carried out at the green house of the department of sustainable forest management to study the growth response of Khaya senegalensis (Desr.) A. Juss. Seedlings to different compost materials. Four different organic materials (Leuceana leucocephala, kitchen waste, household waste and pond sediment) were composted separately and used as soil amendment for K. senegalensis seedlings, these were compared with seedlings without soil amendment (control). The effects of soil amendments on seedling growth were clear and noticeable as there were significant differences (P≤0.05) between seedlings with soil amendments and those without soil amendment.*

KEYWORDS: compost, soil amendment, *Leuceana leucocephala*, kitchen waste, pond sediment

INTRODUCTION

Plants, like any other living thing need food, which is major determinant for their growth and development. For their survival, plants require 16 essential elements, three (Carbon, Hydrogen and Oxygen) of which are gotten from the atmosphere and soil water. The remaining 13 essential elements (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, zinc, manganese, copper, boron, molybdenum, and chlorine) are supplied either from soil minerals and organic matter or by organic or inorganic fertilizers (Silva and Uchida, 2000). When these essential elements are lacking in the plant, they show different symptoms which include; slow and stunted growth, chlorosis, delayed maturity, poor seed and fruit development etc. Also, if soil has an inappropriate proportion of nutrient requirement for a given plant species, then, that plant will not thrive (or may not grow at all) on that soil. These challenges can however be avoided by adequately supplying the plants the needed nutrients through fertilizer application (organic or inorganic). The use of mineral or inorganic fertilizer however is being discouraged due to its effect on human, soil water, soil microorganisms, and the environment at large. Organic fertilizers in form of green manure, animal manure and composts are therefore better supplements for inorganic fertilizers. Application of organic materials such as animal manure, green manure, plant residue and composted organic matter have been reported to produce high yield and quality food crops (Shokalu *et al*., 2010).

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Compost production, apart from being an economic and environmentally friendly way of reducing waste going into landfill also serves as soil amendment. Compost application can improve soil quality and productivity as well as sustainability of agricultural production by replenishing soil organic matter and supplying nutrients. Organic matter is a very vital component of a healthy soil as it plays an important role in soil physical, chemical and biological fertility (Duong, 2013). Different organic materials such as plant materials, food waste etc can be used for compost making. With the continuous use and increased crop yield over time, there would be need to provide supplementary nutrient sources for the soil to meet the nutrient requirement of plants, in addition to maintaining soil fertility. Addition of organic matter to increase soil productivity is a good soil management practice because it enhances soil fertility through the modification of soil physical, chemical and biological properties (Haeringand Evanylo, 2005).

Various works had been done on the use of organic fertilizer to raise *K. senegalensis* seedlings. Awotoye, (2019) worked on the growth response of the seedlings of *K. senegalensis* to cow dung and *Gliricidia sepium* and the author recommended that more work be done on the subject using other sources of manure to raise the seedlings. Also, Agera *et al*., (2019) worked on the same subject using poultry dung and recommended that more research be carried out. Hence, the objective of this study was to evaluate the growth response of *K. senegalensis* seedlings to different compost materials (Fruit waste, household waste, Fish sediment and *Leucaena leucocephala*(Lam.) de Wit).

MATERIAL AND METHODS

Study area

The experiment was set up at the green house of the Department of Sustainable Forest Management, Forestry Research Institute of Nigeria (FRIN), Ibadan, Oyo State. FRIN is located on the longitude 07023'18"N to 07023'43"N and latitude 03051'20"E to 03051'43"E. The mean annual rainfall is about 1548.9 mm, falling within approximately 90 days. The mean maximum temperature is 31.90C, minimum 24.20C while the mean daily relative humidity is about 71.9% (FRIN 2015).

Collection and Preparation of sample

Processed seeds of *Khaya senegalensis* were collected from the seed section of FRIN and were sown in germination tray containing river sand. Four different compost materials (Fruit waste, household waste, Fish sediment and *Leucaena leucocephala*(Lam.) de Wit) were used for this study, Fruit waste used for compost are banana peels, orange waste, water melon peels and pineapple peels which were collected from fruit sellers at BodijaMarket,Ibadan. Household wastes used are vegetable stalk, plantain peels, potato peels, crushed eggshells, collected at the FRIN canteen. Fish sediment was collected from FRIN fish pond after the fishes had been harvested and air dried. *L. leucocephala* leaves were collected from FRIN arboretum. The treatments were mixed with soil at ratio 1:1 (treatments:soil) and left for 4 weeks for proper decomposition.

Chemical analysis of soil and compost
Samples of soil and the compost materials were collected and analyzed and the result is presented in table 1.

Experimental design and treatments
The experiment was laid out in a Completely Randomized Design (CRD). Four treatments were used for the experiment and they include: 2kg of soil with decomposed household waste, 2kg of soil with decomposed fruit waste, 2kg of soil and fish sediment, 2kg of soil with decomposed *L. leucocephala* leaves and the control (topsoil only). The experiment was replicated seven (7) times. Thirty five (35) seedlings of *Khaya senegalensis* with two leaves were carefully pricked from the germination tray and planted in the polythene pots.

Data Collection and Analysis
Data collection on the seedlings commenced three Weeks After Planting (WAP). Parameters taken were plant height using meter rule, collar diameter with venier caliper and number of leaves by counting. The data collected was subjected to the Analysis of Variance (ANOVA) and the means were separated using Duncan Multiple Range Test (DMRT).

RESULTS

The result of the analysis (N, P and K) of the soil and the compost material is presented in table 1. *L. leucocephala* had the highest value of nitrogen (3.86%) and Potassium (1.29 mg/kg) while the lowest value of N (0.08%) was recorded in fruit waste and K (0.06 mg/kg) was recorded in fish sediment. The highest and lowest values of P were recorded in fish sediment and household waste respectively.

Table 1: Chemical analysis of soil and compost

Parameters	Soil	Fruit W	Household W	Fish S	*L. leucocephala*
Nitrogen (%)	0.12	0.08	0.14	0.67	3.86
Phosphorus (mg/kg)	0.70	1.18	0.05	20.9	0.08
Potassium (cmol/kg)	0.05	0.10	0.11	0.06	1.29

*Fruit W= fruit waste
Household W= household waste
Fish S = fish sediment

Seedling Height (cm)
Analysis of Variance (ANOVA) indicated significant difference (P≤0.05) among the height of *Khaya* seedlings subjected to different fertilizer application (Table 2). The mean seedlings height ranged from 20.15 to 30.49 cm with the highest mean height from seedlings subjected to *L.leucocephala* while seedlings without fertilizer application had the least mean height (Table 3). Mean separation result revealed that height of seedlings subjected to *L. leucocephala*, household waste, fish sediment and fruit waste were not significantly different from each other but were all significantly different from the height of seedlings without soil amendment (Table 3).

Table 2: ANOVA result for the effect of fertilizer application on the growth of *Khaya* seedlings.

Parameter	SV	Df	SS	MS	F	Sig.
Height (cm)	Treatment	4	325.74	81.43	9.75	0.00*
	Error	20	167.12	8.36		
	Total	24	492.86			
Collar diameter (mm)	Treatment	4	5.75	1.44	14.28	0.00*
	Error	20	2.02	0.10		
	Total	24	7.77			
Number of leaves	Treatment	4	35.85	8.96	4.68	0.01*
	Error	20	38.30	1.92		
	Total	24	74.15			

- significant ($p<0.05$)

Table 3: Effect of fertilizer application on the height, collar diameter and number of leaves of *Khaya* seedlings

Treatment	Height (cm)	Collar Diameter (mm)	Number of leaves
L. leucocephala	30.49 ± 1.72^{a}	4.36 ± 0.19^{a}	10 ± 0.48^{a}
Household W	28.64 ± 1.75^{a}	3.92 ± 0.18^{a}	11 ± 0.61^{a}
Fish S	28.85 ± 0.66^{a}	4.15 ± 0.10^{a}	12 ± 0.99^{a}
Fruit W	27.59 ± 1.35^{a}	4.18 ± 0.14^{a}	11 ± 0.55^{a}
C	20.15 ± 0.91^{b}	3.01 ± 0.03^{b}	8 ± 0.13^{b}

Mean ± standard error in parenthesis. Values sharing the same alphabet in the column are not significantly different ($p \leq 0.05$) using Duncan Multiple Range Test.

*Household W= household waste
Fish S = fish sediment
Fruit W= fruit waste

Seedling Collar Diameter (mm)

There is significant difference ($P \leq 0.05$) among the collar diameter of *Khaya* seedlings subjected to different fertilizer application (Table 2). The mean seedlings collar diameter ranged from 3.01mm to 4.36 mm with the highest mean collar diameter from seedlings subjected to *L. leucocephala* while seedlings without compost had the least mean collar diameter (Table 3). Mean separation result revealed that collar diameter of seedlings subjected to *L. leucocephala,* household waste, fish sediment and fruit waste were not significantly different from each other but significantly different from collar diameter of seedlings without fertilizer application (Table 3).

Seedling Number of Leaves

The result of ANOVA showed that there is significant difference (P≤0.05) among the number of leaves of *Khaya* seedlings subjected to different compost sources(Table 2). The mean seedlings number of leaves ranged from 8 to 12 with the highest mean number of leaves from seedlings subjected to fish sediment while seedlings without compost application had the least mean number of leaves (Table 3). Also, mean separation result revealed that number of leaves of seedlings subjected to *L. leucocephala*, household waste, fish sediment and fruit waste were not significantly different from each other but were all significantly different from the number of leaves of seedlings without compost application (Table 3).

DISCUSSION

Khaya senegalensis seedlings responded to the application of different organic fertilizers in terms of plant height, collar diameter and leaf production, this is because the seedlings were able to take up the nutrients released into the soil by the soil amendments. The plant height of K. senegalensis seedlings increased with the application of compost, this might be attributed to the increased nitrogen level in the soil as nitrogen is the most imperative element for proper growth and development of plant (Leghari *et al*., 2016). The result of soil and compost analysis (Table 1) showed that N is highest in *L.leucocephala* and it gave the highest mean plant height, his further show the importance of N in plant growth. The result of this study agrees with the findings of Ogunsiji and Ibrahim (2019) where amongst other treatments, *L. leucocephala* gave the highest mean height of *Pterocarpus erinaceus*.

The seedlings on which *L. leucocephala* was applied also gave the highest collar diameter while the seedlings without soil amendment has the least mean value of collar diameter, this is as a result of the high N level in *L. leucocephala* compared to the other treatments (Table 1). The results of this study agree with the findings of other researchers, Sharma *et al*. (2001) observed that air-dried *Leucaena* leaves applied as surface mulch at 2 t ha^{-1} and incorporated into the soil 30 days after harvest of maize significantly increased wheat grain yield.

In terms of leaf production, compost application had a significant effect on the number of leaves produced by the seedlings as the seedlings on which no soil amendment was applied were not comparable to the seedlings on which soil amendments were applied. Seedlings subjected to fish sediment treatment had the highest mean number of leaves, this might be attributed to the high level of phosphorus in fish sediment (Table 1) which in addition to nitrogen is essential for leaf production in plants. This result support the report of Ogunsiji and Ibrahim (2019) that fish waste is a good soil conditional for proper development of leaves and branches. Prein, 2002 also recorded that pond sediment increased crop yield in Thailand and Vietnam.

CONCLUSIONS AND RECOMMENDATION

The four different compost materials: *Leuceana leucocephala*, Kitchen waste, household waste and fish sediment improved the seedling growth of *Khaya senegalensis*. *Leuceana leucocephala* performed best among the four treatments and is therefore recommended as soil amendment for raising khaya seedlings. More research on the use of the treatments is recommended.

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