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INFLUENCE OF DIFFERENT COMPOST ON THE EARLY GROWTH OF *Detarium microcarpum* Guill & perr SEEDLINGS

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ABSTRACT

Detarium microcarpum commonly known as sweet detar is an African food crop tree belonging to Fabaceae family. Experiment was carried out to investigate the Influence of different compost (Leucaena leucocephala (Lam.) de Wit, Moringa olifera and Gliricidium sepium leaves) on the early growth of Detarium microcarpum Guill & perr seedlings. The seeds of D. microcarpum were collected, air dried and sowed into a germination box. After germination, fifty - two (52) healthy seedlings were carefully selected and were transplanted into polythene pots filled with 2kg of top soil and applied different quantities of compost The treatments used were(40g, 50g, 60g and 70g) and control without compost application. The experiment was laid out in a Completely Randomized Design (CRD). The parameters assessed were; plant fresh height (cm), stem diameter (mm), leaf dry weight, stem dry weight, root dry weight, leaf area and number of leaves. Data collected were subjected to Analysis of Variance (ANOVA) and the means were separated using Duncan Multiple Range Test (DMRT). The results showed that (T1) 40g of L. leucocephala compost with 2kg of top soil had the best performance in terms of height with mean value of 14.89cm, stem diameter with mean value of 5.23mm and number of leaves with a mean value of 8.97 and leaf area was 214.89 while the least performance was observed in T1 (2kg of top soil) having a mean value of 2.22cm^2 in number of leaves , stem diameter with mean value of 1.12mm and height with a mean value of 8.21cm and leaf area is 79.36 , Consequently mean value of biomass accumulation ,seedlings grown with (T1) 40 g of L. leucocephala compost produced the highest mean of 1.98g of while T13 gave the least value with mean of 0.40g in (LWD), seedlings with T1 had the highest mean value of 0.95g while T13 gave the least mean value of 0.15g in (SWD). Result from the Analysis indicated that there was significant difference in height, leaf number, stem girth and biomass accumulation of Root dry weight at 5% level of probability. It is therefore recommended that (T1) 40g of L. leucocephala compost should be adopted for raising of D. microcarpum in the nursery to have quality, healthy, good vigour and high production of the species.

Keywords: *Detarium microcarpum* seedlings, *Leucaena leucocephala* , *Moringa olifera* , *Giliricidium sepium* and Compost.

INTRODUCTION

Detarium microcarpum is a perennial woody plant indigenous to the semi-arid regions of Sub Saharan Africa belonging to fabaceae family which occurs predominantly in Benin, Burkina Faso, Cameroon, Central African Republic, Ghana, Guinea, Guinea Bissau, Niger, Niger, Senegal and Togo (*Oibiokpa et al.*,2014).

There are two reported species of the genus with *D. senegalensis* growing in riparian and dry forests areas ,whilst *D. microcarpum* grows in dry savannas, *D microcarpum* thrives in a wide variety of soils including degraded and rocky areas with annual rainfall of about 600-1000 mm (*Abreu et al*., 1999).

Although it is commonly found in fallow lands and wild bushes, it is sometimes retained on farmlands for soil improvement, fuelwood, food and medicinal purposes (*Oibiokpa et al*.,2014).

According to FAO (1995), *D. microcarpum* is a leguminous tree species which improves soil fertility when retained on farmlands through nitrogen fixation and leaf litter decomposition.

The edible fruits of *D. microcarpum* are consumed by human and wild animals in regions where the species is found (*Akpata and Miachi,* 2001). The fruit flour is reported to contain about 42% carbohydrates, 36% lipids and 11% protein (*Anhwange et al*., 2004). The fruit pulp is rich in minerals and essential and folic acid which serve as a major food supplement during the dry season (*Oibiokpa et al*., 2014). These nutritional properties highlight the potential contribution of *D. microcarpum* to food security in Africa.

The fruits are equally sold in local markets and contribute to economic empowerment in rural communities *(Akpata and Miachi,* 2001). Moreover, *D. microcarpum* is used in traditional medicine for the treatment of various ailments including tuberculosis, meningitis and diarrhea due to its antimicrobial properties *(Abreu et al*., 1998). The seed coat is also reported to possess antimicrobial activity which could be used in the control of infectious diseases (*Ebi and Afieroho*, 2011). It also serves as a major fuelwood species with charcoal produced from the wood delivering about 1968 KJ/kg of energy *(Kabore et al*.,2005) and ranked among the most preferred fuelwood species in its naturally growing areas (*Sawadogo*, 2007)

The multipurpose uses have resulted in overexploitation of the species to local extinction in some

Areas (Pauline *et al.,* 2017) mainly due to the high dependence on wild plant sources with little attention on domestication of the species. However, effective domestication will require knowledge on regeneration and other aspects of the plant biology (*Bohra et al*., 2018). Plants, like any other living thing need food, which is the major determinant for their growth and development. For their survival, plants require 16 essential elements, three elements (Carbon, Hydrogen and Oxygen) of which are gotten from the atmosphere and soil water. The remaining13 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. 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). 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). Hence, the objective of this study was to investigate the growth Influence of *Detarium microcarpum* seedlings under different compost

(*Leucaena leucocephala* (Lam.) de Wit, *Moringa olifera* and *Giliricidium sepium* leaves).

MATERIALS 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, while the minimum temperature 24.20C and the mean daily relative humidity is about 71.9% (FRIN 2015)

Seed Collection and Method

Processed seeds of *Detarium microcarpum* were collected from the seed section of FRIN and sown in germination tray containing river sand; three different compost materials (*Leucaena leucocephala* (Lam.) de Wit, *Moringa olifera* and *Giliricidium sepium*) which were used for this study were all collected at the FRIN. *L. leucocephala , M. olifera and G.sepium* leaves was harvested in the arboretum of FRIN, air-dried and grind into powdery form for easy application. The powdery from of the compost was measured into different quantities which were (40g, 50g, 60g and 70g) and mixed with 2kg topsoil, watered for 3 weeks for proper decomposition before pricking the uniform height seedlings of the *D. microcarpum* into the polythene pot filled with the mixtures of different compost material. The following parameters were taken after two weeks of planting: were plant height, collar diameter, number of leaves, leaf dry weight, stem dry weight , root dry weight and leaf area.

T1- 40 g of *L. leucocephala* leaves + 2 kg top soil
T2 - 50 g of *L. leucocephala* leaves + 2 kg top soil
T3 – 60 g of *L. leucocephala* leaves + 2 kg top soil
T4 – 70 g of *L. leucocephala* leaves + 2 kg top soil
T5 – 40 g of *M. olifera* + 2kg top soil
T6 – 50 g of *M. olifera* + 2kg top soil
T7 – 60 g of *M. olifera* + 2kg top soil
T8 – 70 g of *M. olifera* + 5kg top soil
T9 – 40 g of *G.sepium* + 2kg top soil
T10 – 50 g of *G.sepium* + 2kg top soil
T11 – 60 g of *G.sepium* + 2kg top soil
T12 – 70 g of *G.sepium* + 2kg top soil
T13 - Control 2kg top soil

Experimental design and Data Analysis

The experiments was laid out in Completely Randomized Design (CRD) .thirteen (13) treatments and were replicated four (4) times making fifty two (52) seedlings of *Detarium microcarpum* which swere used for this experiment and the data collected was subjected to the Analysis of Variance (ANOVA) and the means were separated using Duncan Multiple Range Test (DMRT).

Physical and Chemical Properties of Top Soil

Table 1 shows the characteristics of the soil which indicates that (pH=5.1) sandy loam was moderately acidic with the organic carbon (20.9%), organic matter of (36.0). soil available Phosphorus was 35 mg/kg when the exchangeable K, Ca and Mg were 0.8, 6.0 and 13.76 mol/kg respectively.

Table 1: Laboratory Analysis of chemical properties of Top Soil

Parameters	Quantity
P^H (H_20)	5.1
Organic carbon (%)	20.9
Organic Matter (%)	36.0
Total Nitrogen (%)	0.722
Available P (mg/kg)	35
Exchangeable cation (cmol/kg)	
K	0.8
Ca	6.0
Mg	13.76
Extractible micronutrient (mg/kg)	
Mn	456
Fe	60
Cu	12
Zn	308
Sand (%)	84.5
Clay (%)	9.9
Silt (%)	5.6
Textural classes: Loamy sand	

Table 2: Chemical analysis of the compost materials by Plant Species

Parameters	*L. leucocephala*	*M .olifera*	*G. sepium*
pH (H20)	6.5	6.2	6.0
Organic Carbon (%)	29.73	27.71	29.72
Organic Matter (%)	51.80	50.3	49.3
Total Nitrogen (%)	4.15	4.10	4.13
P (mg/kg)	3	1.6	0.41
K (%)	2	1	1.13
Ca (cmol/kg)	2.00	1.23	1.67
Mg (cmol/kg)	0.17	0.12	0.68

RESULTS

The result presented in Table 6 below showed the influence of different compost on the early early growth of *D. microcarpum* seedlings raised with 40g of *L. leucocephala* (T1) which performed best with the mean height of 14.89cm followed by *M.olifera* (T5) of 40g with the mean value of 14.15cm ,G. sepium (T9) of 40g had mean value of13.85 while the control (T13) performed least with the mean height value of 8.21cm The result from the Analysis indicated that there was significant difference among the treatment at 5% level of probability.

However, the results obtained in Table 4 revealed that leaf production of the seedlings vary as a result of the different levels of compost applied to them. However, increased number of leaves in compost of 40g of *L. leucocephala* (T1) had the mean value of 8.97, followed by *M.olifera* (T5) of 40g with the mean value of 8.60 and G. sepium (T9) of 40g had mean value of 6.16 while control (T13) performed least with the mean value of 2.22. The greater leaf production from (T1) 40g of *L. leucocephala* could be due to enhanced nutrient uptake probably as a result of increased root surface area that ultimately improved plant growth rate

The result presented in the table 6 below revealed the influence of different compost on the stem girthr of *D. microcarpum* seedlings. It was observed that seedlings raised with 40g of *L. leucocephala* (T1) performed best with the mean value of 5.23 followed by *M.olifera* (T5) of 40g with the mean value of 5.10 and *G. sepium* (T9) of 40g had mean value of4.22 while control (T13) performed least with the mean value of1.12 Therefore, increase in stem g irth recorded in this experiment can be attributed to *L. leucocephala* ability to improve soil with high level of organic matter as an important benefit. The result from the Analysis of Variance indicated that there was a significant difference among the treatments at 5% level of probability.

The result in the Table 6 below revealed that influence of different compost on the leaf area of *D. microcarpum* seedlings. It was observed that seedlings raised with 40g of *L. leucocephala* (T1) performed best with the mean value of 214.89 followed by M.olifera (T5) of 40g with the mean value of 201.42 and *G. sepium* (T9) of 40g had mean value of183.24 while control (T13) performed least with the mean value of79.36. The result from the Analysis of Variance indicated that there was no significant difference among the treatments at 5% level of probability. Consequently, Table 5 revealed that there was no significant difference (p≥0.05) on the biomass accumulation of *D. microcarpum* seedlings on Leaf dry weight and Stem dry weight while there was a significant difference (p≥0.05) on the root dry weight.

Table 7 showed the mean value of biomass accumulation, seedlings grown with T1 produced the highest mean of 1.98g while T13 gave the least value with mean of 0.40g in (LWD). However, seedlings with T1 had the highest mean value of 0.95g while T13 gave the least mean value of 0.15g in (SWD). Furthermore, the result shows that seedlings subjected to T1 recorded the highest (RDW) with mean value of 0.80g while the least was recorded from T13 with mean value of 0.18g. *L. leucocephala* leaves as manure is characterized by fast growing, ability to fix nitrogen, high nitrogen content and a vigorous tap root (Kabata, 1985).

Table 3 ANOVA result showing the influence of different compost on growth potential of d. microcarpum seedlings

Parameters	Treatment	D.F	Sum of squares	Mean square	F	Sig.
Height	Treatments	12	48.765	4.063	0.756	0.714
	Error	39	209.409	5.369		
	Total	51	258.174			
Stem	Treatments	12	3.234	0.269	0.728	0.697
	Error	39	14.261	0.365		
	Total	51	17.495			
Leaf production	Treatments	12	15.862	1.321	0.756	0.721
	Error	39	68.012	1.744		
	Total	51	83.874			
Leaf area	Treatments	65310.374	76432.543	6369.379	0.301	0.991
	Error	793628.418	826573.652	21194.196		
	Total	858938.792	903006.195			

Note *There is a significance difference at 5% of probability level for the height, stem and leaf production but not significant (p≥0.05) for leaf area.*

Table 4: Influence of different compost application on the height, collar diameter, leaf area and number of leaves of *D. microcarpum seedlings*

Treatment	Height	Collar	Leaf area	Leaf number
L. leucocephal	28.30 ±1.63^{a}	3.26±0.16^{a}	29.65 ±10.34^{b}	8.68 ±0.94^{a}
M olifera	26.75 ± 1.54^{b}	3.04 ±0.14$^{a\ c}$	28.74 ± 11.62^{a}	7.82 ± 0.70^{ab}
G. sepium	26.23 ± 0.65^{c}	2.8 ± 1.23$^{a\ b}$	28.21 ± 10.40^{a}	7.26 ± 0.68^{c}
Control	21.29 ± 1.53^{ab}	1.86 ± 0,87^{b}	19.81 ± 0.90^{a}	7.26 ± 0.68^{c}

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

Table 5: ANOVA result on influence of different compost on the biomass accumulation of stem, leaves and roots of D. microcarpum seedlings.

Parameters	Treatment	D F	Sum of Square	Mean square	F	Sig.
Leaf dry weight	Treatment	12	2.832	0.236	0.273	.998
	Error	39	33.673	0.863		
	Total	51	36.505			
Stem dry weight	Treatment	12	1.003	0.083	0.768	.969
	Error	39	4.210	0.108		
	Total	51	5.213			
Root dry weight	Treatment	12	1.532	0.127	1.095	.994
	Error	39	4.519	0.116		
	Total	51	6.051			

Table 6: Mean Influence of different Compost on Growth Potential of *D. microcarpum* seedlings.

Treatments	Height (cm)	Stem (mm)	Leaf production	Leaf area (cm^2)
1	14.89^{ab}	5.23^{bc}	8.97^{a}	214.89^{b}
2	14.49^{bc}	5.02^{b}	8.21^{b}	199.06^{c}
3	10.82^{d}	3.36^{c}	5.52^{cd}	168.34^{cd}
4	10.71^{cd}	3.70^{bc}	5.21^{b}	143.65^{cd}
5	14.15^{a}	5.10^{ab}	8.60^{ab}	201.42^{ab}
6	13.84^{b}	4.36^{ab}	7.62^{b}	188.48^{a}
7	10.85^{b}	3.24^{a}	5.43^{bc}	136.38^{ab}
8	10.26^{c}	3.11^{c}	5.21^{c}	121.42^{a}
9	13.85^{c}	4.22^{ab}	6.16^{c}	183.24^{c}
10	13.69^{c}	3.78^{bc}	5.88^{bc}	162.22^{b}
11	10.75^{cd}	2.99^{ab}	4.83^{cd}	143.68^{ab}
12	10.64^{cd}	2.85^{c}	4.49^{d}	129.29^{d}
13	8.21^{bc}	1.12^{ab}	2.22^{b}	79.36^{b}

Mean with the same alphabet in the column are not significantly different to each other.

Table 7: Mean value on the influence of different compost on the biomass accumulation of stem, leaves and roots of *D. microcarpum* seedlings.

Treatments	Leaf dry weight (g)	Stem dry weight (g)	Root dry weight(g)
1	1.98^{b}	0.95^{ab}	0.80^{ab}
2	0.88^{b}	0.86^{b}	0.61^{a}
3	0.70^{b}	0.69^{ab}	0.54^{a}
4	0.65^{ab}	0.50^{b}	0.43^{c}
5	1.03^{a}	0.93^{a}	0.71^{ab}
6	0.78^{b}	0.82^{b}	0.52^{ab}
7	0.68^{ab}	0.55^{ab}	0.42^{ab}
8	0.50^{a}	0.48^{ab}	0.30^{a}
9	0.70^{c}	0.58^{c}	0.51^{c}
10	0.66^{ab}	0.40^{c}	0.30^{b}
11	0.54^{c}	0.30^{c}	0.20^{c}
12	0.43^{b}	0.25^{ab}	0.20^{ab}
13	0.40^{ab}	0.15^{ab}	0.18^{ab}

Mean± with same alphabet in the table are not significant to each other

DISCUSSION

Height of D. *microcarpum* seedlings raised with 40g of L. *leucocephala* (T1) performed best with the mean value of 14.89cm. Therefore, these findings support the observations made by Allen and Boosalis (1983) on *Acacia*. auriculiformis, *Albizia* lebbeck. Also, *Read and Boyd* (1986) reported that addition of *L. leucocephala* compost increased plant growth, mostly in height and root growth development. Similarly Awotoye, (2019) worked on the growth response of the seedlings of Khaya senegalensis supported the finding. Also, increased number of leaves in compost of 40g of *L. leucocephala (*T1) had the mean value of 8.97, which is in accordance with (*Ortas and Ustuner* 2014; *Xie et al.* 2014). *Birhane et a*l (2012). This research work is in accordance with *Kareem*, (2012) agreed that there is a significant different in *Mansonia altissima* seedlings in leaf production.

However increase in stem girth recorded in this experiment can be attributed to *L. leucocephala* ability to improve soil with high level of organic matter as an important benefit. This finding of the research is in accordance with *Ogunwande, (*2010), Consequently, the result of root dry weight from this experiment supported the findings of *Imoro* et al (2012) who stated that the application of organic fertilizer significantly affected the biomass accumulation of Moringa oleifera seedlings.

CONCLUSION

The study clearly elucidated the importance of compost and how it influenced the growth studied of the plant. More importantly, the type of manure and form of application were also very crucial in order to promote vigorous seedlings growth and development. It was shown from this study that, it has been proven that the addition of *L. leucocephala* (Lam.) de Wit, *M. olifera* and *G. sepium* leaves can enhance the growth of *D. microcarpum* seedlings in the nursery stage. Addition of 40g of *L. leucocephala*, *M. olifera and G. sepium* leaves these manures to 2kg top soil performs best and better in improving the growth of *D. microcarpum* seedlings which can be used in raising the species in the nursery for production of vigorous seedlings.

RECOMMENDATION

From the results obtained in this research work on the early growth of *D. microcarpum* seedlings, it is therefore recommended that (T1) using 40g of *L.*

leucocephala leaves are best organic manure to be applied in raising *D. microcarpum* seedlings at the nursery stage for optimum growth.

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