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EFFECT OF DIFFERENT ORGANIC MANURE ON THE GROWTH OF *Cedrelaodorata*l. (red cedar)

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ABSTRACT

This study investigated the effect of organic manure (cow dung, poultry and pig manure) on the growth of *Cedrelaodorata* in order to determine the most suitable fertilizer for the plant growth. Cow dung manure (CM), poultry manure (PM) and pig manure (pig waste) (PIM) were used as fertilizers. Manure were weighed and applied as treatment to the soil at 50g of CM (TI), 50g of PM (T2), 50g of PIM (T3), 50g combination of CM, PM and PIM (T4) and topsoil as control (T5). The experiment was laid in a completely randomized Design (CRD) and replicated six times and heights stem diameter and leaf production parameters were assessed for 8weeks. The result of study showed that seedlings raised with the combination of all the manures (T5) had the highest mean value of 13.30 cm followed by 12.75) while T3 has the lowest mean height value of 11.55cm. The mean number was higher in the seedlings raised in T5 (73.70) and lowest in T1 with mean of 45.62 leaves.The stem diameter values of *Cedrelaodorata* seedling raised with treatment 5 had the mean highest stem diameter 3.78 -5.01 mm for the period of study followed by treatment 2 (3.67- 4.36 mm) while treatment1 has the lowest mean value of 2.50- 3.45mm. Application organic fertilizer had significant effects on all the growth parameters considered. This study has shown that organic manure enhanced the growth of *Cedrelaodorata* seedlings and production.

Keywords: Organic manure, *Cedrelaodorata*, growth, Production

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INTRODUCTION

The alarming rate at which trees are being depleted in the natural forest without adequate replacement calls for an urgent attention. The natural forests in Nigeria are fast diminishing in both size and density of trees due to extensive human influences. It was estimated that about 230 km" of the forest estate are lost annually (Umeh, 1986). However, forests as renewable natural asset that requires effective policy and planning for sustainability.

The importance of *Cedrela odorata*as one of the exotic tree species has resulted in its high demand wherever it is grown. Such exotic species growth depends on the quality of soils upon which they are grown (Oni and Bada, 1992). *Cedrela odorata* is a native of the West Indies and from Central America to South Africa, including the Amazon rain forest. It has been introduced to many pacific islands and South Africa. It is a genus of seven species in the Mahogany family of Meliaceae (Condit *et al*., 2011). They are evergreen and dry season deciduous trees with pinnate leaves (Pennington and Styles 1981, Peden *et al*., 1996). The name is derived from a diminutive form of Cedrus which is generally known as Spanish-Cedar in English commerce. *Cedrela odorata* is one of the tree species that are used for numerous purposes. It is often used for honey production (beekeeping) and humid construction. It is also occasionally used for top or veneer on some kind of electric guitars. It is widely planted as a timber species for the fabrication of furniture, doors and window

(Pacific Island Ecosystems at Risk: PIER, 2003) and the bark is used for medicinal purpose. In spite of its wide native range, the trees are not very common in natural forests and are mostly spread in mixed semi evergreen or semi deciduous forests dominated by other species (Ashton and Hall, 2011). In order to maintain and increase the quantity and quality production of this species, there is need to introduce new strategies to its development and establish policies that would ensure balanced management and preservation of the tree species to meet its ever-increasing demand.

Fertilizer is one of additives that is added to soil for enhancement of agricultural productivity and sustainability. Soil fertilization with organic manure comprises a practice that also improves the soil physical, chemical and biological properties (Orozco-Aceve*et al*., 2017). The use of nitrogenous, phosphatic and pottassic fertilizer is needed for achievement of desirable production, soil maintenance, health and environmental sustainability (Alan and Khan 1999). Study has shown that fertilizer contributes about 50% increase to crop and timber productivity (FAO, 2004). Thus, this work aimed at investigating the effect of different usage of organic manures as fertilizer additives to the soil for the growth of *Cedrelaodorata.*

MATERIALS AND METHODS

Study area

The experimental site was located within the Federal College of Forestry Jericho, lbadan, Oyo State. It lies between Latitude 7026'N and Longitude 3054'E. The climate of the area is tropical. The annual rainfall ranges from 1400 mm – 1500 mm and average relative humidity of about 65%, the average temperature is 31.80C. The area is dominated by two seasons: the dry season and rainy season. The rainy season usually begins from November to March while the dry season starts from April to October (FRIN Meteorological Station, 2015)

Sample collection and Experimental design

The topsoil was also crushed and sieved to facilitate easy mixing. Seeds were planted into germination box with sterilized river sand. The manures: poultry (PM), cow dung (CM) and Pig manure (PIM) were collected at the Agricultural Extension and Management Farm (AEM) in the College. They were dried and mixed thoroughly with 5 kg of topsoil at different treatment levels of poultry (PM), cow dung manure (CM) and Pig manure (PIM) for two weeks before transplanting the seedlings. The different manure were weighed and applied to the 5 kg of topsoil at 50 g of the type of manure and control (topsoil without application of manure (T5). The sprouted seedlings (2 each) were transplanted into polythene pots at different five treatment levels replicated six times and were arranged in a completely randomized design. Inter-culture operation such as weeding and watering was done every day. The experiment lasted for 8 weeks (2 months). The seedlings were watered twice a day. The parameters measured were Stem diameter, Height and Leaf count. Data were collected weekly for the period of the experiment.

Data analysis

Data collected were subjected to Analysis of Variance (ANOVA) andmeans were separated using Duncan multiple range test.

RESULTS

Properties of the soil and Manure used in the study

The physicochemical properties of the topsoil used are presented in Table 1. The top soil ~~is~~ was sandy loam consisting of 78.50% of sand, 8.50% of silt and 3.0% of clay. The pH of the soil is slightly acidic (6.45) while the values of the soil organic matter, total nitrogen and available phosphorous are 1.89 %, 0.11 % and 2.89 mg/kg respectively which is good for the growth of the plants. The values of cation exchange capacity in Cmol/kg are Na (0.45), K (0.21), Ca (1.21) and Mg (0.11) while the values of Fe, Cu, Zn and Mn are 51.09 mg/kg, 4.56 mg/kg, 7.21 mg/kg and 78.22 mg/kg respectively. These values are moderate for plant growth.

The elemental compositions of the manures used in this study are presented in Table 2. The elemental composition determined in poultry manure were N (2.11%), P (1.68%), K (2.48%), Ca (1.92%), Mg (0.98%), Na (1.21 %) while those of cow dung manure were N (1.45%), P (0.40%), K (0.52%), Ca (0.35%). The pig manure consisting of the following: N (1.26%), P (1.30%), K (1.47%), Ca (1.88%), Mg (1.11%), Na (0.97 %). It was observed that poultry manure has the highest values of the

determined composition, followed by pig manure while cow dung manure has the lowest.

Growth parameters of *Cedrela odorata* seedlings.

It was observed from Table 3 that *Cedrela odorata* seedling raised with treatment 5 had highest mean plant height of 13.30 cm at 8 weeks, followed by treatment 2 (12.75) while treatment 3 has the lowest mean height value of 11.55cm. The highest mean height recorded in T5 is expected since the three manures were mixed with the soil, thus the presence of high nutrient contents in the soil contributed to the high performance. Also, the mean seedling height recorded in Ts is also attributed to the nutrients content that are high in the poultry manure than pig and cow dung manure (Table 2). Significant difference was observed among the treatments at $p \leq 0.05$

Table 1. Physical and Chemical Properties of Topsoil used

Parameters	Topsoil
Sand (%)	78.50
Silt (%)	8.50
Clay (%)	3.00
Textural class	Sandy loam
pH	6.45
Soil organic matter (%)	1.89
Total nitrogen (%)	0.11
Available phosphorus (mg/kg)	2.89
Na (Cmol/kg)	0.45
K (Cmol/kg)	0.21
Ca (Cmol/kg)	121
Mg (Cmol/kg)	0.11
Fe (mg/kg)	51.09
Cu (mg/kg)	4.56
Mn (mg/kg)	78.22
Zn (mg/kg)	7.21

Table 2. Results of Elemental composition of the manures used in this study

Elements (%)	Poultry manure	Cow dung manure	Pig manure
N	2.11	1.45	1.26
P	1.68	0.40	1.30
K	2.48	0.52	1.47
Ca	1.92	0.35	1.88
Mg	0.98	-	1.11
Na	1.21	-	0.97

Note: Means with the same letter are not significantly different from each at $p \leq 0.05$

Table 3. Mean Height (cm) of *Cedrelaodorata* after 8 weeks of transplanting

Treatment	WAT 2	WAT 4	WAT6	WAT 8
Cow dung manure	8.48^{c}	9.95^{b}	11.01^{b}	11.62^{c}
Poultry manure	8.71^{b}	10.15^{ab}	11.52^{a}	12.75^{b}
Pig manure	7.83^{d}	9.10^{c}	10.10^{c}	11.55^{c}
Cow dung + Poultry + Pig manure	8.61^{b}	9.93^{b}	10.90^{b}	12.45^{b}
Topsoil (control)	9.28^{a}	10.31^{a}	11.55^{a}	13.30^{a}

WAT: weeks after transplanting

Table 3 shows that *Cedrela odorata* seedlings raised with treatment 5 had the mean highest leaves of 73.70 at 8 weeks, followed by treatment 2 (60.75 leaves) while treatment 1 has the lowest mean value of 45.62 leaves. Significant difference was also observed among the treatments at $p \leq 0.05$

Table 4. Mean number of leaves of *Cedrelaodorata* after 8 weeks of transplanting

Treatment	WAT 2	WAT 4	WAT6	WAT 8
Cow dung manure	21.00^{b}	26.50^{c}	34.25^{cd}	45.62^{d}
Poultry manure	22.25^{a}	30.50^{a}	37.52^{b}	60.75^{b}
Pig manure	19.50^{c}	28.00^{bc}	35.25^{c}	57.55^{c}
Cow dung + Poultry + Pig manure	19.55^{c}	28.75^{b}	35.45^{c}	60.00^{bc}
Topsoil (control)	22.26^{a}	30.52^{a}	38.50^{a}	73.30^{a}

WAT: weeks after transplanting

It was observed that *Cedrela odorata* seedling raised with treatment 5 had the mean highest stem diameter 3.78 -5.01 mm for the period of study, followed by treatment 2 (3.67- 4.36 mm) while treatment1 has the lowest mean value of 2.50- 3.45 mm (Table 5). Significant difference was also observed among the treatments at $p \leq 0.05$.

Table 5. Mean stem diameter (mm) of *Cedrela odorata* after 8 weeks of transplanting

Treatment	WAT 2	WAT 4	WAT6	WAT 8
Cow dung manure	2.50^{b}	2.59^{c}	3.05^{cd}	3.45^{d}
Poultry manure	3.678^{a}	3.71^{b}	4.15^{b}	4.36^{b}
Pig manure	3.01^{c}	3.34^{bc}	3.78^{c}	3.89^{c}
Cow dung + Poultry + Pig manure	3.15^{c}	3.58^{c}	3.81^{c}	3.911^{c}
Topsoil (control)	3.78^{a}	4.01^{a}	4.87^{a}	5.10^{a}

WAT: weeks after transplanting

DISCUSSION

It was also observed that seeds grown in soil with poultry manure performed better than those with pig and cow dung manure. This is attributed to the nutrient composition in poultry manure being richer than the others. The significant growth patterns observed when compared to those from controlcan be attributed to theincreased nutrient availability that occurred by the availability of other essential nutrients and improvements in the quality of the soil due to increase in pH. Studies carried by Murmu *et al*. (2013) and Tomati *et al*. (1988) on vermicompost, an organic manure indicated that apart from major elements and trace elements that are necessary for the plant growth, organic manure also provides plant growth regulators and humic acid, which enhance the plant growth. The values of seedling heights and number of leaves obtained in this study were higher than the values obtained by Akintola and Bodede (2019) and this could be attributed to the little or no amount of heavy metals in the growing media used that could have resulted to reduction in the growth parameters. Generally, the highest growth parameters recorded in the seedlings grown in soils with organic manures than control soil may be attributed to the fact that organic manure are rich in nutrients. It has been reported that organic matter content in organic manure increases the values of nitrogen, phosphorus, potassium, and main cations in the soil and thus allows plants to use the nutrients for a long time due to slow rate of decomposition, and reduces the loss of those that are not utilized by the plants (Bhandari *et al*. 2002). This has also been demonstrated by several researchers that use of organic inputs such as crop residues, manures and compost has great potential for improving soil productivity and crop yield through improvement of the physical, chemical and microbiological properties of the soil as well as nutrient supply (Dauda *et al.,* 2008; Bakht *et al.,* 2009; Sun *et al.,* 2015; Zhang *et al.,* 2016; Li *et al.,* 2017; Akintola *et al*., 2021). This study has shown that organic manure enhanced the growth of *Cedrela odorata* seedlings.

CONCLUSION

The growth parameters of *Cedrela odorata* showed significant performance with the mixture of the three organic fertilizers (poultry, cow dung and pig manures) used in this study. Thus, this study has shown that organic manure stimulates the growth of *Cedrela odorata* seedlings and enhance its production.

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