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(Dehnh) Seedlings

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## INFLUENCE OF SOIL AMENDMENTS ON THE GROWTH PERFORMANCE OF *EUCALYPTUS CAMALDULENSIS* (Dehnh) SEEDLINGS

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**ABSTRACT:** Soil fertility status of savannah soil, easy leaching of nutrient by different agents and impact of anthropogenic activities on the forest floor and salvage forests called for restoration and seedlings improvement. The research was carried out in the Forest Nursery in the year 2019 at the Department of Forestry and Wildlife Management, Federal University Dutse, Jigawa State, Nigeria to determine the impact of the soil amendment on growth performance of *Eucalyptus camaldulensis* seedlings at Nursery Stage. Morphological parameters measured include: shoot height (cm), stem diameter (mm), number of leaves and root length (cm). The study contained three (3) treatments with ten (10) replicates making thirty (30) samples all together. The growth experiment was laid out in Completely Randomized Design. Data collected were subjected to Analysis of Variance (ANOVA) at 0.05 probability level. T1 (top soil, river sand and poultry manure) had the best growth performance in terms of all the growth parameters. Analysis of Variance showed that there was no significant difference ( $p < 0.05$ ) for all the parameters except root length. Therefore, poultry manure is recommended as the most suitable organic manure for nurturing young seedlings of *Eucalyptus camaldulensis* in the nursery for plantation purposes.

**Keywords:** *Eucalyptus camaldulensis*, growth performance, Morphological parameters, seedlings and soil amendments.

### 1. INTRODUCTION

*Eucalyptus camaldulensis* is a diverse genus of flowering trees with an average height of 20m, family Myrtaceae. Members of the genus dominate the tree flora of Australia, and include *Eucalyptus regnans*, the tallest known flowering plant on earth (Salami and Lawal, 2018a). *Eucalyptus* of different varieties has been found to have potentials in the savanna region of Nigeria. Notable among these species are *Eucalyptus camaldulensis*, *Eucalyptus tereticornis*, *Eucalyptus citrodora* and *Eucalyptus torrelliana*. These species are very attractive for use in afforestation programmes because of their fast growth which makes them very

productive on the volume basis (Salami and Lawal, 2018a; Otegbeye, 2007). However, *Eucalyptus camaldulensis* and *Eucalyptus tereticornis* are the two most widely grown. The former species exhibits better growth performance than the later in the region (Otegbeye, 2007). Apart from fast growth rate, it coppices very well. Thus proper coppice management can be used for sustainable production of wood products from the species Salami and Lawal (2018a).

It has phytochemicals that are known to possess anti-termic repellent activities (Cheng *et al.*, 2007; Geoff, 2007) and releases compounds which inhibits the germination or growth of other potential competitor's

plants. Outside their natural ranges, eucalyptus is both lauded for their beneficial economic impact on poor populations (Luzar, 2007). It is the most common short fibre source for pulp wood to make pulp (Nanko *et al.*, 2005). The fibre length of Eucalyptus is relatively short and uniform with low coarseness compared with other hard woods commonly used as pulpwood. The fibres are slender, yet relatively thick walled. This gives uniform paper formation and high capacity that are important for all types of fine papers. Farms and nurseries use various seedling and potting media in the production of field transplants, container plants, and greenhouse crops. Such media may contain a wide range of natural and synthetic materials. In certified organic production and inorganic, there are limitations on the materials that may be used, either as base substrates or for supplemental fertilization.

Micro and macro nutrient in the soil are materials taken by a cell from its environment and used in catabolic or anabolic reaction with soil to the plant (Salami *et al.*, 2020; Patel *et al.*, 2008). It is the physical properties of forest soils developed under natural conditions by the influence of permanent vegetation over a long period of time. Physical properties of forest soils may be its permanent properties unless modified by harvesting operations, shifting cultivation and forest fires Salami *et al.* (2020).

Application of both organic and inorganic fertilizers during forest seedling culture is one of the most important factors with a positive effect on seedling quality, performance and establishment. Environmental conditions also influence nutrient requirements for plant species in nursery and in the field (Kraiser *et al.*, 2011). Tropical soils and forests are deficient in Nitrogen and Phosphorus nutrients and uptake of these limited quantities of nutrients by plant roots from litter is difficult (Lawrence, 1998; Jose, 2003). Therefore, inadequate management of nursery soil can result in depletion of soil fertility and a corresponding reduction in seedling growth (Hoque *et al.*, 2004). However, a healthy seedling must be supplied with all the nutrients in the proper proportion for efficient growth (Craven *et al.*, 2006; Gbadamosi, 2006) and development following out planting. One way to improve soil fertility is the application of fertilizer which obviously is a means required for optimum crop yield (Dania *et al.*, 2004). It has been reported that organic manure can serve as soil amendment to improve soil nutrient status and the growth of crops (Stoffella *et al.*, 1997).

Efficient nutrient management programs supply plant nutrients in the adequate quantities to sustain maximum plant growth and yield while minimizing environmental impacts of nutrient Salami *et al.*, (2020). The present study aimed to determine the influence of the Soil amendment on Growth performance of *Eucalyptus camaldulensis* seedlings at nursery at stage on the morphological characters (shoot height, stem diameter and number of leaves) in order to prescribed for the nursery officers, growers, and for plantation establishment.

## 2. MATERIALS AND METHOD

### 2.1. Description of the study area

The study was carried out at nursery department of Forestry and Wildlife Management, Faculty of Agriculture, Federal University Dutse, Jigawa State Nigeria. It is situated in the North-Western geopolitical zone of the town. It lies between latitudes 11.00°N to 13.00°N and longitudes of 8.00°E to 10.15°E. It covered by Sudan savannah, also area characterized by hot wet summer and cool dry winter with average raining season of 3-5 months (644 mm) (Salami and Lawal, 2018b). The location makes the study site vulnerable to drought and unfavorable weather condition. Sunshine hours indicate that the town enjoys 10-11 hours of sunshine depending on the season (JARDA Metrological data, 2015) and the total population of 153,000 at 2006 census (Jigawa State Ministry of Agriculture and Natural Resources, 2016; Jibo *et al.*, 2018). It has two major distinct seasons, raining seasons from April to October and dry season November to March. Farming is one of the most crucial land use types in the study area (Usman, 2018).

The vast majority of the population of the area engaged in agricultural activities and a substantial percentage of the land area is under agricultural uses. The major agricultural activities carried out include cropping, grazing, and wood chopping, among others. Most of the crops grown are pearl millet, groundnut, sorghum, cowpea, sesame and date palm seed. The vegetation of the study area is mainly shrubs such as Acacia, Baobab, Neem and Date Palm (Dabino). The primary economic activities include farming, grazing, wood chopping and mining of rocks (Usman, 2018).

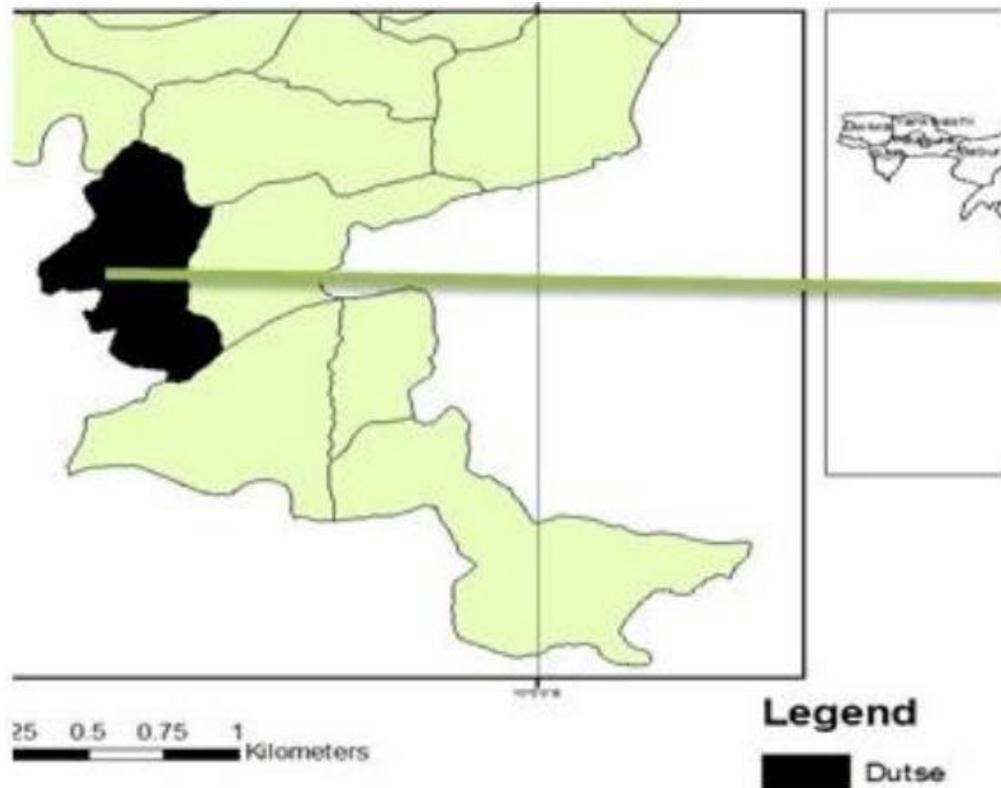


Fig 1: Showing the map of Dutse (Salami *et al.*, 2019)

## 2.2. Plant materials and sampling procedure

Mature seeds of the species were collected from mother tree in the University Campus, Federal University Dutse, Jigawa State, dried under normal atmospheric condition. Top soil collection was made from the Forestry Nursery Unit of the same University. Soil was sieved with 2mm and sterilized. The plastic germination boxes were used in raising the seeds. The seeds extracted were distributed and planted at the same proportion of top soil, river sand and poultry manure of all the samples. The proportions of the potting mixture are stated below:

T1= Top soil, river sand and Poultry manure (2:1:1)

T2= Top soil, river sand and Cow dung (2:1:1)

T3= Top soil and river sand soil (2:1)

Key: 1 portion = 1 head pan

## 2.3. Potting mixture and assessment of growth parameters

The potting mixture was done using the above proportion on 27 June 2019. The potting mixture was watered for a week before planting. On 4 July 2019 the seed was planted early in the morning. The measurement was done at two weeks' interval. The main morphological parameters measured were: shoot height, stem diameter,

number of leaves, root length and root-shoot length ratio. Shoot height of seedling measured from collar to the tip of the terminal bud and this was achieved with the aid of a metric ruler. The collar diameter of each seedling was measured with the aid of a venire calliper. Number of leaf was counted and also root length was also measured with aid of metric ruler.

## 2.4. Experimental design and Data analysis.

The treatments were arranged in a Completely Randomized Design with three (3) treatments and ten (10) replicates making thirty (30) seedlings all together. Data collections were subjected to two ways Analysis of Variance (ANOVA) with the aid of statistical package for social sciences (SPSS) version 19 and also descriptive statistics. Means were compared with the use Duncan Multiple Range Test (DMRT).

## 3. RESULTS

Result from figure 1 revealed that treatment 1 had the highest stem diameter of 0.95mm followed by 0.7mm while treatment 3 had the least stem diameter.

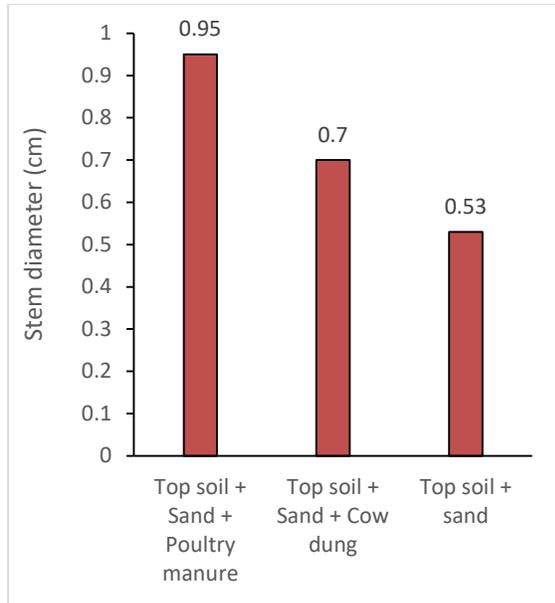


Figure 1: Showing the stem diameter (cm) of the treatments

Result from Figure 2 showed that treatment 2 and 3 had the same leaf production of 22 while treatment 3 had least value of 20 leaves.

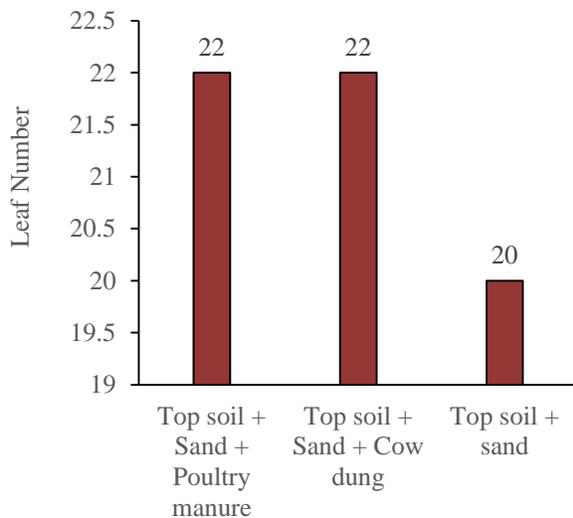


Figure 2: showing the leaf number of the treatments

The result from figure 3 showed that treatment 1 had the highest root length of 0.73cm followed by treatment 2 (0.57) while least the value was 0.48cm.

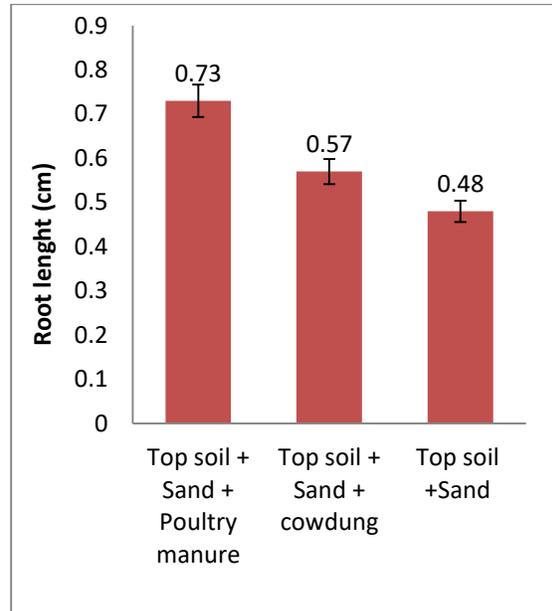


Figure 3: showing the root length (cm) of the treatments

The result from figure 3 showed that treatment 1 had the highest shoot length of 26.1cm followed by treatment 2 (25) while least the value was 17.4cm.

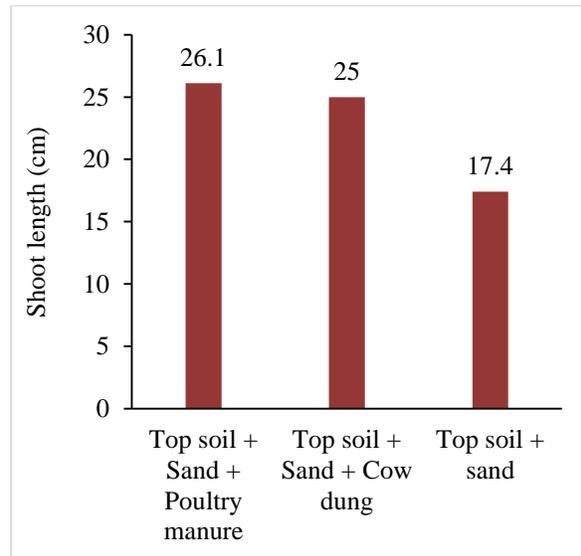


Fig 4: showing the shoot length (cm) of the treatments

#### 4. DISCUSSION

The physical attributes of plant species which is the morphological make up of plant are the determinable attributes in tree seedlings to understand the effect of type of fertilizer applied in order to adopt them into agroforestry systems desired (Duguma and Tonye, 1994) as reported by Uddin *et al.*, (2012). The study had been

conducted on the impact of the soil amendment on growth performance of *Eucalyptus camaldulensis* seedlings at the nursery stage. The observations from study displayed in Fig 1 showed that T1 had the highest stem diameter (0.95mm) followed by T2 with (0.70mm) while the least was T3 after six weeks of planting. Furthermore, T1 showed the highest shoot height (26.10cm) followed by T2 (25.00cm). Control had the least shoot height (17.4cm) at the end of study. Figure 2 also showed that T1 and T2 had the best growth performance in term number of leaves (22) at the end of the experiment. The control had the least number of leaves (20). The result from Figure 3 also showed that T1 had the highest root length (25.13cm) followed by T2 with the value of 21cm while the least root length was generated from control. At the end of the experiment, all the growth parameters were not significantly difference except root length. Shoot-Root ratio also had a better performance with Treatment 1 (0.85) while the least treatment was (T3) with 0.63. This implies that Poultry manure had great chances of improving the quality of the decline soil media and increased the productivity of this tree seedling at a nursery stage. This agrees with Mokaya, (2016) that nutrients are released more slowly from organic manure than inorganic fertilizers stay longer and improve the growth vigour the tree species. According to Agera *et al.*, (2019), treatments with poultry droppings gave the greatest plant height, number of leaves and stem diameter (girth) followed by the mixture of poultry droppings and cow dung while top soil (control) recorded the lowest growth. Poultry droppings had the highest nitrogen concentration (3.2%), cow dung (2.9%) and top soil (0.070%). Weeradej *et al.*, (2016) also concurs that *Eucalyptus camaldulensis* treated with organic fertilizer experienced the best shoot height (39 cm and 3.8 cm) and biomass production (2.0 g and 3.3 kg) in greenhouse and field experiments respectively.

## 5. CONCLUSION

1. The research revealed that application of Poultry manure played the best role on the impact of soil amendment on the growth performance of *Eucalyptus camaldulensis* seedlings at Nursery stage compare to Cow dung and control. At the end of the study, treatment 1 (top soil + river sand + Poultry manure) had the best growth performance in terms of stem diameter, shoot height, number of leaves, root length, root diameter and root shoot ratio.
2. The experiment revealed that best treatment recorded is a step towards for conservation in nursery. It is therefore recommended that T1 is best for nursery and plantation development. Also, enhanced fast germination and sustained vigorous growth of *Eucalyptus camaldulensis* seedlings.
3. The role of organic fertilizer on the seedlings development cannot be over-emphasized as they influence: healthy seedlings growth as well as tree productivity

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