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EFFECT OF POTTING MEDIA ON THE EARLY SEEDLINGS GROWTH OF *Treculia africana* Decne

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ABSTRACT

Potting media are important factors to the growth and development of plants. Some plants due to some morphological or physiological adjustments do not attain the necessary seedling growth level expected. This study examined the influence of potting media on the early growth of Treculia africana seedlings. The seedlings were subjected to three different treatments/potting mixtures namely: mycorrhizal soil, top soil and mycorrhizal soil mixed. Each treatment was replicated five times and laid in a Completely Randomized Design. The growth variables measured weekly include; plant height (cm), collar diameter (cm), leaf production and leaf surface area (cm^2). The data collected were subjected to analysis of variance and significant means were separated using Duncan multiple range test at 5% probability level. Results revealed that there were significance differences in the growth performance of Treculia africana in all the variables assessed. Seedlings grown in mycorrhizal mixed with top soil gave the best performance in collar diameter (0.199 cm), leaf number (4), leaf surface area (10.29 cm^2) and those grown in mycorrhizal soil gave the best performance in height (14.58 cm). The seedlings grown in top soil recorded the least performance in all the growth variables assessed. The study therefore recommended raising Treculia africana seedlings in the mixture of mycorrhizal and top soil for enhanced early growth as well as massive nursery production.

Keywords: Potting media, *Treculia africana* Decne, mycorrhizal, seedling growth, collar diameter

INTODUCTION

African breadfruit (*Treculia africana* Decne) from the family Moraceae is an important food crop in Nigeria. The extracted seeds have been found to be highly nutritious when adequately processed (Ejiofor, 1998; Okafor, 1998). This non-timber forest product which is commonly found in home gardens in south eastern Nigeria has formed an inherent part of the people's daily life for millennia. Generally, home garden provides perspective for conservation of plant genetic resources while contributing to improving livelihood (Gbedomon *et al.*, 2015). Accordingly, the non-timber forest products generally serve as sources of food and income (Shackleton, 2014; Udeagha, 2015).

Treculia africana is a widely grown leguminous, medicinal and nutritional fruit tree in tropical humid ecological zone of the southeastern Nigeria. The seeds of *Treculia africana* are used for making bread fruit cakes, snacks and cookies. The crushed leaves are applied on the tongue as a treatment for goiter, the leaf juice is used locally as ear drops and the leaf ash is used as a remedy for enlarged spleen (Meregini, 2005; Metuno *et al.*, 2007; Agbogidi and Onomeregbor, 2008).

However, despites the economic values derived from *T. africana*, it is still semi wild and mostly undomesticated plants. The basic silvicultural needs are only partially understood; their soil requirement, growth and management practices are not well documented (Achten, 2010; Dolor, 2013). Potting media/mixture are materials through which plants are grown and absorb substances such as nutrients and water. According to Peter-Onoh *et al.* (2014) good production of permanent tree crop seedlings in the nursery phase is highly influenced by the soil used. Studies have shown that potting mixtures influence the quality of seedlings produced at

nursery for plantation establishment (Peter-Onoh *et al.*, 2014; Omokhua *et al.*, 2015; Chukwu *et al.*, 2019)

According to Meregini (2005); Nuga and Ofodile (2010) *Treculia africana* is enlisted as endangered species of Southern Nigeria and among the scantly researched indigenous fruit trees of African origin (Awodoyin *et al.*, 2015). There is a general neglect on *T. africana* trees cultivation and only few attempts are made to domesticate them. Hence, the urgently need to prioritize growth and conservation measures for the species. The early growth of any plant, root system and quality of soil media are gamine to its conservation. Generally, mycorrhizal aids the plant roots to absorb water and nutrients from the soil, increases soil aggregation and stimulate microbial activities.

More so, Frank (1885) in a study on soil microbial-plant relationships introduced the Greek term 'mycorrhizal', which literally means 'fungus roots'. Mycorrhizal fungi forms symbiotic relationships with plant roots and make nutrient and water available to the plant root. Mycorrihizal also increase plant's pathogen resistance and tolerance to different environmental stress (Smith and Read, 2008). Mycorrhizal are of different types, this include; arbuscular, ecto, ectendo-, arbutoid, monotropoid, ericoid and orchidaceous mycorrhizae. Thus, the arbuscular and ecto mycorrhizae are the most abundant (Allen *et al.*, 2003). Hence, the need to investigate the growth of *T. africana* under different potting media is required, especially as its growth is affected by mycorrhizal. According to Chen *et al.* (2014) several forms of ectomycorrhizal (ECM) fungal inoculants have been established and verified for applications in plantation nurseries and field trials. There are many sources of ECM inoculants which can be classified largely as natural inoculants in the form of airborne spores or colonised soil, mycorrhizal seedlings, vegetative inoculants of ECM fungal mycelium and spores (Chen *et al.*, 2014) and the advantages among each kind of inoculum may differ. Thus, selection of appropriate types of inoculants for particular application was suggested. Chen *et al.* (2007) determined inoculation potential of ECM fungi in field soils from various locations in south China where Eucalyptus plantations are being established. Acacia, Eucalypts and Pine are good examples of mycorrhizal host genus especially ECM. It has been established that Acacias, Eucalypts and Pines plantations, mycorrhizal fungi are desirable as inoculants if they are compatible with the host tree and are effective in stimulating survival and production in the field (Chen *et al.*, 2007).

Therefore, this study was aimed to assess the influence of potting media on the early growth of *Treculia africana* seedlings with a view to providing baseline information for proper domestication and conservation.

MATERIALS AND METHODS

Study Area

This study was carried out in the screen house of the Department of Forestry and Wildlife, Faculty of Agriculture, Nnamdi Azikiwe University, permanent site in Awka, Nigeria. The University is located in the southeastern Nigeria and lies between latitude 6.245^{o} and 6.283^{o}N and longitude 7.115^{o} and 7.121^{o}E (Figure 1), with mean elevation of 136 meters above sea level. The climate of the area is tropical indicating that it is basically within the tropical rainforest ecological zone with mean temperature of 26.3°C. Awka has seasonal climatic conditions; the rainy and the dry seasons with a short spell of harmattan. It has a rainfall pattern ranging from 1828 mm – 2002 mm (Ezenwaji *et al.*, 2013; Chukwu *et al.*, 2020).

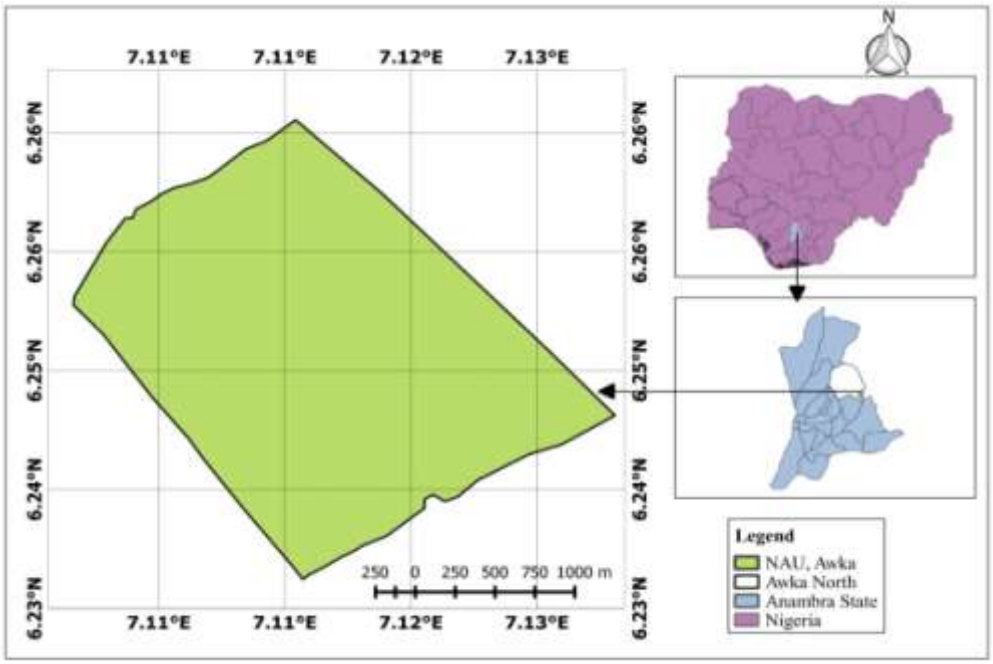

Figure 1: Map of Nnamdi Azikiwe University, Awka, Nigeria
Source: Chukwu *et al.* (2020)

Experimental Design and Layout

The mycorrhizal fungi used in this study were sourced from natural inoculants (colonised soil) obtained from a Pine plantation as described by Chen *et al.* (2007). The experiment was laid in a Completely Randomized Design (CRD), with 3 treatments (T), and 5 replications each. *T. africana* seedlings of the same height were used for this study. The seedlings were transplanted in fifteen (15) polythene-pots (26 cm by 21 cm) each containing; mycorrhizal soil (T1) that is, direct use of colonised soil, Top soil (T2), and Top soil mixed with mycorrhizal (T3) forming a total of forty-five (45) seedlings. Watering was carried out daily by adequate shower.

Data Collection

Data was collected for growth starting from the 7th day after transplanting *Treculia africana* into different potting mixture and seedlings growth variables measurement were taken at weekly interval for all the treatments. The measurement lasted for three months (12 weeks). The seedlings growth variables measured include; height, leaf number, leaf surface area and collar diameter. Height of seedlings was measured from the soil ground level to the tip of the seedlings by using meter scales. Diameter at collar region of seedlings was measured at the soil ground level using slide callipers. Leaf numbers were obtained by counting while leaf surface area was obtained by the linear measurement of leaf length and leaf width as designated by Clifton-Brown and Lewandowski (2000) and adopted by Adelani *et al.* (2020). The method is mathematically expressed as follows:

$$LA = 0.74\ (L \times W) \text{ ..... [1]}$$

Where,
LA= Leaf Surface Area (cm^2)
L= Leaf length (cm)
W= Maximum Leaf width (cm)
0.74 = constant

Analysis

Data collected on seedling growth variables under different potting mixture were statistically analyzed using one-way analysis of variance and significant means were separated using Duncan Multiple Range Test at 5% probability level.

RESULTS

The mean of the seedling growth performance of *Treculia africana* grown in different potting media at the end of the third month are presented in Table 1. The result showed that mycorrhizal soil gave the highest mean height of 14.58 cm and followed by top soil of 14.34 cm. The lowest mean height was

recorded in mixture of mycorrhizal and top soil of 13.10 cm. However, there was no significant difference ($p<0.05$) between the height of mycorrhizal soil and Top soil while significant difference existed between the height of mixture of mycorrhizal and top soil and others (mycorrhizal soil and Top soil).

The highest mean collar diameter was observed in mixture of mycorrhizal and top soil of 1.99 cm while mycorrhizal soil and top soil had same value of 1.84 cm. Thus, no significant difference exists between mycorrhizal soil and top soil. However, the results also revealed that there was a significant difference in the collar diameter of the seedlings raised under mixture of mycorrhizal and top soil among mycorrhizal soil and top soil respectively (Table 1).

The highest mean number of leaf observed in mycorrhizal soil and mixture of mycorrhizal and top soil with same value of 4 leaves. The lowest number of leaf (3) was obtained in Top soil. There was no significant difference in the number of leaf of mycorrhizal soil and mixture of mycorrhizal and top soil. However, the results revealed that there was a significant difference in the number of leaves of the seedlings raised under top soil between mycorrhizal soil and mixture of mycorrhizal and top soil respectively (Table 1).

The result of mean leaf surface area showed that mixture of mycorrhizal and top soil had the highest mean value of 10.29 cm^2. This was followed by mycorrhizal soil with mean of 8.61cm while top soil had the lowest mean of 8.01 cm. There was no significant difference between the leaf surface area of top soil and mycorrhizal soil. However, the results revealed that there was a significant difference in the leaf surface area of the seedlings raised under mixture of mycorrhizal and top soil among mycorrhizal soil and top soil respectively (Table 1).

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Table 1: Response of *Trecuclia africana* seedlings to different Potting media

Potting Media	Height (cm)	Collar Diameter (cm)	Number of leaf	Leaf surface Area (cm^2)
Mycorrahizal + Top soil	13.10 ± 0.138^a	0.199 ± 0.002^a	4.00 ± 0.052^a	10.29 ± 0.240^a
Top soil	14.34 ± 0.138^b	0.184 ± 0.002^b	3.00 ± 0.052^b	8.01 ± 0.240^b
Mycorrahizal soil	14.58 ± 0.138^b	0.184 ± 0.002^b	4.00 ± 0.052^b	8.61 ± 0.240^b

Means with the same alphabets are not significantly different (P>0.05)

DISCUSSION

From the results obtained in this study for the potting media, the highest mean height observed in the seedlings raised under mycorrhizal soil. This might be due to the presence of the mycorrhizal symbiotic inoculation which enhances the growth of a plant. This was similar to the findings of Oyun *et al.* (2010) who reported that mycorrhizal inoculation enhanced the growth of *Acacia senegal* both in the nursery and in the field. The mixture of mycorrhizal and top soil produced the highest mean values of collar diameter, leaf count of the seedlings and as well as leaf surface area. This was in line with the study of Martin *et al.* (2017) who reported that mycorrhizal inoculation increase the stem diameter. The result also corroborates the reports of Vogt (2003); Shinkafi and Aduradola (2009) who stated that mycorrhizal inoculation enhanced the morphological features of the plant including height, basal diameter, leaf number, leaf area, root length and dry weights as well as its moisture utilization efficiency of *Leucena leucocephala* and *Faidherbia albida*, respectively. The result was as well in line with the report of Chen *et al.* (2014) who stated that a mixed inoculum containing fungi with differing ecological strategies might give more consistent and permanent results in promoting plant growth. Generally, suitable mycorrhizal fungi integrated in forest nurseries for raising mycorrhizal seedlings and their transplanting to the field is an applied inoculation procedure presently appropriate in tree plantation establishments. The use of inoculated seedlings has revealed that responses to mycorrhizal inoculation are often greatest under the

best thrilling environments, especially in unproductive soils, drought, metal contamination or pathogens (Smith and Read 2008, Chen *et al.*, 2014).

CONCLUSION AND RECOMMENDATION

Based on this study, it was concluded that, the presence of mycorrhizal in soil influenced the growth performance of *Treculia africana* seedlings. The study further concluded that the mixture of mycorrhizal and top soil had the best performance when used as a potting medium for the seedling growth of *Treculia africana* and it is recommended for use to enhance the growth as well as in the massive production of the seedling of *Treculia africana*.

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