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Comparative effect of different soils on the emergence and early growth of *Albizia lebbbeck* (Linn)

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Abstract

This study was conducted to investigate the effect of different soils on the germination and early growth of *Albizia lebbbeck* (Linn). The seedlings of *Albizia lebbbeck* were pre-treated by mechanical method using 'Nicking' with secateurs. The experiment was laid out in a Completely Randomized Design (CRD). The three treatments were used with five replicate per treatment. Soil type had three levels (river, loamy and clay sands) as media for propagation and treatments. The emergence of the seeds were studied for a period of two weeks before transplanting was done into polythene pots of the same treatments for further studies within a period of ten weeks. Sixty seedlings were transplanted into the different soils each. Germination percentage, Plant height, Collar diameter and Leaf production were subjected to Analysis of Variance (ANOVA). The result showed that River sand has the highest percentage (75%) and Clay having the least (61.7%). There was no significantly different ($p > 0.05$) in the height and leaf production except in the collar diameter of *Albizia lebbbeck*. Loamy soil had the highest value in all the parameters (11.24cm, 15cm, and 1.78mm) respectively. It is therefore concluded that River sand is best for the germination of *Albizia lebbbeck* as it gave the highest emergence percentage while Loamy soil had the best performance on the growth is best for raising vigorous seedlings of *Albizia lebbbeck*.

Keywords: *Albizia lebbbeck*, soil type, seed pre-treatment, germination and emergence

Introduction

Albizia lebbbeck is hermaphrodite. In its natural habitat, flowering occurs from September to October; mature pods remain on the tree for long periods and are available May-July. In Sudan, it flowers from March to May. It can be planted in exposed coastal situations and as quick-growing shelter for less hardy plants. It copies well, respond to pollarding, pruning and looping, and will produce root sucker if the roots are exposed. Due to its extensive, fairly shallow root system, *Albizia lebbbeck* is a good soil binder and is recommended for eroded lands and erosion control, for example, along river embankments (Troup, 1986) [12].

Albizia lebbbeck is grown in some areas primarily as fodder for camels, water Buffalo and Cattle. The leaves are reported to be good fodder, with 17-26% crude protein; 100kg of leaves yield 11kg-12kg of digestible protein and 37kg of digestible carbohydrates. The pods contain Saponin and are not eaten in large amounts by sheep, although cattle eat them readily. The species is commonly grown as a shade in pastures, tea, coffee, and cardamom plantations and along avenues (Falsal *et al.*, 2012) [8].

Albizia lebbbeck is not rhizobium specific and native strains are nearly capable of producing an abundance of nodules. The nitrogen- rich leaves are valuable as much as green manure. In apiculture, its whitish flowers are fragrant, attracting bees, highly regarded by bee keepers for the light-colored honey its nectar provides.

As a timber; sap wood is pale and heart wood is dark brown

with black streaks and very decorative. It is moderately heavy and hard, strong and fairly durable with a specific gravity of 0.5-0.6 kg/m³. The wood seasoned well works and polishes easily, can be used for interior molding, parquet, furniture, paneling turnery and general construction. It is also used for making agricultural implements and mine pros. The trunk yields an adulterant of gum Arabic. The bark is used locally in India for tanning fishing nets (tannin content of 7-115), leaves and seeds are for eye problem and the bark to treat boils. When dried and pounded the bark can be used for soap. Saponin from pods and roots has spermicidal activity (Cook *et al.*, 2005) [3].

Materials and method

Study area

The experiment site is located within the premises of Federal College of Forestry Ibadan (behind the school library). The college is located within latitude 7°23'N and longitude 3°54'E with an annual rainfall from 1300mm-1500mm, the temperature of 37°C and average relative humidity of about 80-85% (FRIN Metrological station, 2014) [9].

The experiment was carried out behind the college library. The seed of *A. lebbbeck* were collected from mother tree within the premises of the College. Ripe fruits were collected from all parts of the crown since they might have been pollinated by different pollen sources. Collecting fallen seeds was avoided because of uncertainty and great risk of

contamination with soil-borne pathogenic fungi. The seeds were extracted by de-winged and pretreated by mechanical method using “Nicking” with secateurs. Sixty seeds each were sown into sieves of different soils (clay, loamy and river sands). The germination percentage was determined after 14 days from planting day and data collected were subjected to descriptive analysis. It was determined using the following formula:

$$\text{Emergence \%} = \frac{\text{Number of seeds emerged}}{\text{Total number of seeds sown}} \times 100$$

The Seedlings later were transplanted into black polythene bags of 2kg filled with equal amounts of growing medium, that is, clay, loamy and river sands as treatments. The experiment was laid out in a Completely Randomized Design (CRD). The three treatments were used with five replicate per treatment. The parameters assessed are number of leaves, stem girth and plant height of seedlings after transplanting of the first seedling. The data collected were subjected to Analysis of Variance (ANOVA). The least significant difference (LSD) was used for separation of treatment means at 5% significance level.

Result

There was hypogeal germination observed in the seeds with

a significant interaction (p<0.05) among the soil types and seeds. The river sand had the highest germination percentage (75%), loamy soil had (70%) and clay had the least of 61.7% (Figure 1).

Analysis of Variance (ANOVA) revealed that there was no significant difference (p>0.05) in the height of the seedlings of *Albizia lebbbeck*. However, the mean value showed that the seedlings grown using loamy soil had gave the highest height (11.24 cm) followed by the seedlings grown using river sand (9.82 cm) while seedlings grown using clay soil gave the least height (9.48 cm) (Table 1).

But there was significant difference (p≤0.05) in the collar diameter of the seedlings of *Albizia lebbbeck*. The mean value showed that the seedlings grown using loamy soil had given the highest collar diameter(1.78 mm) followed by the seedlings grown using clay soil (1.64mm) while seedlings grown using river sand gave the least collar diameter (1.45 mm) (Table 2).

Analysis of Variance (ANOVA) revealed that there was no significant difference (p>0.05) in the leaves production of the seedlings of *A. lebbbeck*. However, the mean value showed that the seedlings grown using loamy soil produced 15 leaves which is the highest followed by the seedlings grown using river sand 13 leaves, while seedlings grown using clay soil produced the least 11 leaves (Table 3).

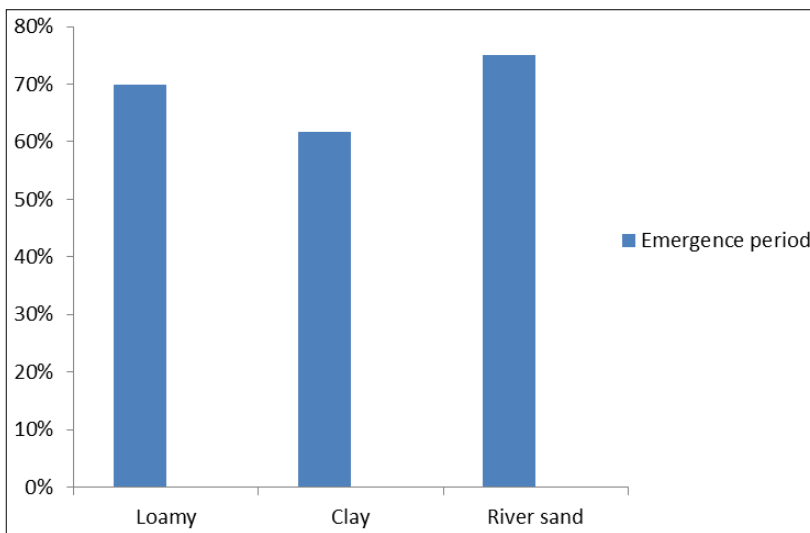


Fig 1: Emergence trend of *Albizia lebbbeck* seeds in different soils

Table 1: ANOVA for the effect of growth media on the plant height of *Albizia lebbbeck* seedlings

Parameter	SV	Df	SS	MS	F	Sig.
Height	Growth Media	2	8.772	4.386	1.267	0.317ns
	Error	12	41.532	3.461		
	Total	14	50.305			

NS-Not significant (p>0.05)

Table 2: ANOVA for the effect of growth media on the plant collar diameter of *Albizia lebbbeck* seedlings

Parameter	SV	Df	SS	MS	F	Sig.
Collar Diameter	Growth Media	2	0.275	0.138	5.173	0.024*
	Error	12	0.32	0.027		
	Total	14	0.595			

*significant at (p≤0.05)

Table 3: ANOVA for the effect of growth media on the leave production of *Albizia lebbbeck* seedlings

Parameter	SV	Df	SS	MS	F	Sig.
Leaves Production	Growth Media	2	41.337	20.669	3.58	0.06ns
	Error	12	69.28	5.773		
	Total	14	110.617			

ns-not significant ($p>0.05$)

Discussion

Soil type had a significant effect on the emergence with river sand having the highest percentage compared to loamy sand and Clay sand having the least. This could be because of the physical and chemical characteristics of clay. Dey S.C. (2001) ^[4] highlighted that clay can pose a major challenge to germination and emergence due to its poor drainage, and it tends to clod easily. An ideal propagation media must be sufficiently porous so that excess water drains away, permitting adequate penetration of oxygen to the seed, of which all these attributes are lacking in clay soils, (Hartmann, *et al.*, 2007) ^[6].

River sand has loosely aggregated particles that allow free exchange of gases between the germination medium and the embryo. Oxygen is essential for respiratory purposes in germinating seeds and oxygen uptake is proportional to the amount of metabolic activity taking place (Hartmann, *et al.*, 2007) ^[6]. River sand soil is the most suitable germination medium for tropical tree seed germination due to its availability, low cost, capacity to hold moisture and suitability for large tree seeds (Spicer, *et al.*, 2004) ^[11]. This agrees with Haque *et al.* (1992) ^[7] who obtained a greater seedling emergence rate of rice (*Oryza sativa*) in seedbeds with coarse aggregates and concluded that crop establishment was not affected by soil structure. According to Diaz-Zorita *et al.* (2005) ^[5], and Cernac *et al.* (2006) ^[2] they stated that germination and seedling emergence is independent of soil nutrient status, but rather depends totally on the cotyledons still attached to the seedling which are rich in stored food reserves until the seedling becomes autotrophic and the ability of the seedlings to utilize these food reserves.

In the height and leaf production except in the collar diameter of *Albizia lebbbeck*. Loamy soil had the highest value in all the parameters respectively Soil type and seed treatment had no significant effect on the subsequent seedling height in the twenty one days of observation from planting. This could be because, soils with high clay content provide a much greater surface area for cations to adsorb onto; as long as the nutrient cations and anions are absorbed into the soil particles, they cannot be absorbed by plant or leached from the soil. These works therefore support the observation of Venator, 1993 ^[13]; that plant ability to absorb of soil nutrients has effect on the proper growth of tree seedlings.

And also, this could be because during this period, all the seedlings that were transported still drawing their nutrients from the seed endosperm, thus eliminating the effect of soil on their growth rate thus giving a shoot height that is not significantly different from each other (Bewley, *et al.*, 1994) ^[1].

Conclusions

Based on these research findings on the emergence, it could be concluded that river sand is the most ideal propagation

media for *A. lebbbeck* seeds. Because it gave comparatively highest germination percentages and has proved to be a competent and superb alternative propagation media.

The result of this study also showed that *A. lebbbeck* seedlings performed best in loamy sands in terms of height, stem girth and leaf production and its seedlings also look healthier. And, the least performance was observed in clay sands.

Recommendation

Based on the results of the study, it is therefore recommended that river sand should be used for the pre-germination of *A. lebbbeck*. A healthy soil that is stable and friable and contains a reasonable level of organic matter and varied population of soil organisms such as loamy soil is best compared to other soil types should be used for raising *A. lebbbeck* seedlings.

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