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Propagation Pattern of Machaerium Lunatum (Linn F) Ducke in Five Different Soil Types

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ABSTRACT: *Machaerium lunatum* is a perennial shrub that grows in aquatic environment especially on the banks of fresh, brackish and marine habitats especially in tidal zones. A study of the possibility of the propagation of this plant outside its natural aquatic environment, what part of the stem will grow and what soil type will be most suitable for it was carried out. Mature, medium and very young stem propagules and five soil types were used for this purpose and include (a) riverbed soil, from the natural habitat of the plant, (b) sandy soil, (c) clay soil, (d) Humus soil and (e) a mixture of sandy + Humus soil. The study was carried out for five weeks at the University of Port Harcourt Ecological Centre. The parameters used to measure the performance were plant height, leaf number, leaf area, and the number of sprouted nodes. At the end of the study, it was found that humus soil had the highest figure for plant height (4.6±1.14) closely followed by riverbed soil (4.5±2.4). For number of leaves riverbed soil performed better than the other soil types (19.1± 7.1). Sandy soil performed better than others (1.5±0.3) for leaf area while for sprouted node Humus soil was higher (1.75± 0.8) than the others. This result shows that *M. lunatum* can be propagated outside its natural environment, and humus soil can support the growth better than the other soil types. This study will also provide a template for further studies on this plant since its importance in the Niger Delta cannot be overemphasized.

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Keywords**:** *Machaerium lunatum*, Propagation, Humus soil, River-bed soil, Sandy soil, Aquatic environment

Machaerium lunatum is a perennial plant that is found growing on tidal banks of freshwater, brackish water and marine habitats (Airy-Shaw, 1985; Nyananyo, 2006). It is an erect, glabrous shrub distributed across Central America, West Indies and coastal West Africa (Airy-Shaw, 1985). Out of all the species, only *M. lunatum* is found in the west coast of Africa (Klitgaard and Lavin, 2005).

The people of the Niger Delta find *Machaerium* useful in a myriad of ways which include - as fishing bait, hedge plant and most importantly in medicaments for the treatment of ailments. This shrub has not been sighted inland but only in the wild at the banks of fresh, brackish and marine habitats especially in tidal areas (Keay, 1985; Airy Shaw, 1985; Nyananyo, 2006) being dispersed solely by water.

The plant is not cultivated but only found in the wild. With urbanization and city development, the species survival at most of the sites where it thrives is threatened. It becomes imperative to look for ways to aid the propagation to preserve this important economic plant through simulated propagation.

MATERIALS AND METHODS

Study Area: This propagation study was carried out at the Centre for Ecological Studies, University of Port Harcourt. The centre is located at GPS: longitude 04^o 54’, 16.1’’ N and latitude 6^o 55’, 23.3’’ E. The area has year round high temperature with mean daily and annual values of 36^o C and 28^o C (Tamunonobereton-Ari, 2013) and mean annual rainfall of 2400 mm (Dike and Nwachukwu, 2003) with double maxima which peaks in July and September (Uko and Tamunobereton-Ari, 2013). The rainfall of the area increases from March and begins to reduce towards the dry season months of November to February, thus the area has a warm wet climate.

*Sampling and Sample Preparation***:** Five different soil types - riverbed soil, sandy soil, clay soil, Humus soil and a mixture of sandy and Humus soil in equal proportion were used for this study. Riverbed soil was obtained from Omohuechi, Aluu, sandy soil was obtained from the dredged sand from the New Calabar River, clay soil from beside the culvert before the University gate, humus soil was collected from the center, the humus and sandy soils were mixed in equal proportions to make up the last batch.

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Five black polyethene bags with dimensions: 20 cm by 50 cm were procured from Rivers State Agricultural Development Program (RSDAP) Port Harcourt.

The bags were each filled with 2 kg of soil and labeled A – E. Bag A was filled with river bed soil, bag B with sandy soil C clay soil D humus soil and E a combination of sandy + Humus soil in equal proportion. Each bag was replicated four times. Two stem cuttings 25 cm long/bag of *Macherium lunatum* used as propagation material obtained from parent plants at Omohuechi, Aluu in Ikwerre Local Government Area were planted in each bag each. The bags were watered with 1 litre of water daily, and the experiment was allowed for five weeks.

Data Collection and Analysis: Number of sprouted nodes, shoot length, leaf number and leaf area were used as parameters of the study. Number of sprouted nodes were counted and recorded weekly. Shoot length of the sprouted shoots were measured with metre rule from the node to the sprouted shoot apex. Leaf number was counted per plant weekly. Leaf area was by graph paper method. Data generated were subjected to statistical analysis using Analysis of Variance (ANOVA) and the results presented in bar charts.

RESULTS AND DISCUSSION

Number of Sprouted Nodes: Result for mean number of sprouted nodes is shown in Fig. 1. This ranged from 0.3± 0.7 to 1.6±0.9. The least values were recorded in sandy + humus soil (0.3 ± 0.7) and followed by clay soil (0.7± 0.9). These two soil types remained constant till the end of the study. Humus soil and riverbed soil were significantly higher in the second week (1.5 ± 1.9 and 1.0±0.8). Riverbed soil increased significantly from the second week and remained constant at the third and fourth weeks (1.6 ± 0.54). Humus soil also recorded no change in the third and fourth weeks and only a slight change in the fifth week (1.75± 0.8 and 1.7± 1.0.7). There was an increase in sandy soil in the first three weeks and a decrease in the fifth week. Regarding initiation of leaf buds, humus soil had a progressive increase from the second week to the fifth week and brought out the highest number of leaves in the second week followed by clay soil. This could be because humus soil is known to be richer in organic matter (Havlin *et al*., 2005) and other nutrients required for plant growth. Sandy + humus soil had the least number of leaves. Humus soil had the highest number of leaves in the second week followed by clay soil.

Riverbed soil did not initiate buds as much in the second week but in the third week the buds were enormous and increased till the fifth week. All the nodes had initiated buds and had the highest number of leaves. This can be explained because the riverbed soil is from the natural habitat of the plant and may contain the essential nutrients needed for initiation of growth. The other soil types progressed more slowly. A number of sprouted nodes displayed a pattern in its sprouting. It was expected that the riverbed soil would produce the highest number of nodes because it is the soil from the natural habitat of the plant and therefore comes with all the nutrients required by the plant. Apparently, that was not a requisite for the plant to flourish.

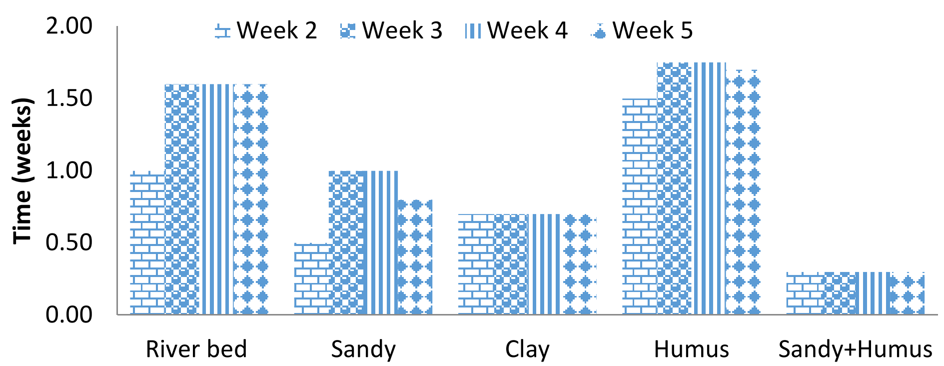

Fig.1: Number of sprouted Nodes on Planted Stems

Plant Height: Plant height result is shown in Fig. 2. The riverbed soil gave a significantly higher plant growth at the second and third weeks (4.4±1.2 cm and 4.5±2.4 cm). Sandy soil was considerably lower in the second week (0.5 ± 0.06 cm) along with sandy + humus soil (0.7±0.4 cm). Clay soil had its highest at the fifth week (3.0 ±1.0 cm). Humus soil was highest in the fourth week (4.6±1.1 cm). It is possible that the nutrients in the riverbed and humus soil types were released faster while those of sandy, clay and sandy + humus were released more slowly especially in the second week. Shoot height result obtained in the five weeks of the study showed that river bed soil was significantly higher. The rate of increase was high in the second week of study which means that the nutrients in the soil may have been released faster than the other soil types to achieve this. This soil came from the natural habitat of the plant and may contain the nutrient required by the plant as well as being best suited for its needs. It may also be that it is better conditioned to the needs of the plant than the other soil types since macro and micro nutrients are utilized by the plants as growth requirements and vary in their availability both in spatial and temporal variability as reported by Bilal *et al.* (2007). Humus soil also showed an accelerated increase from week 2 to 4 for shoot height. This may also be because humus soil is known to contain more nutrients than sandy and clay soil and possess higher water retention capacity and other soil properties that are conducive for plants.

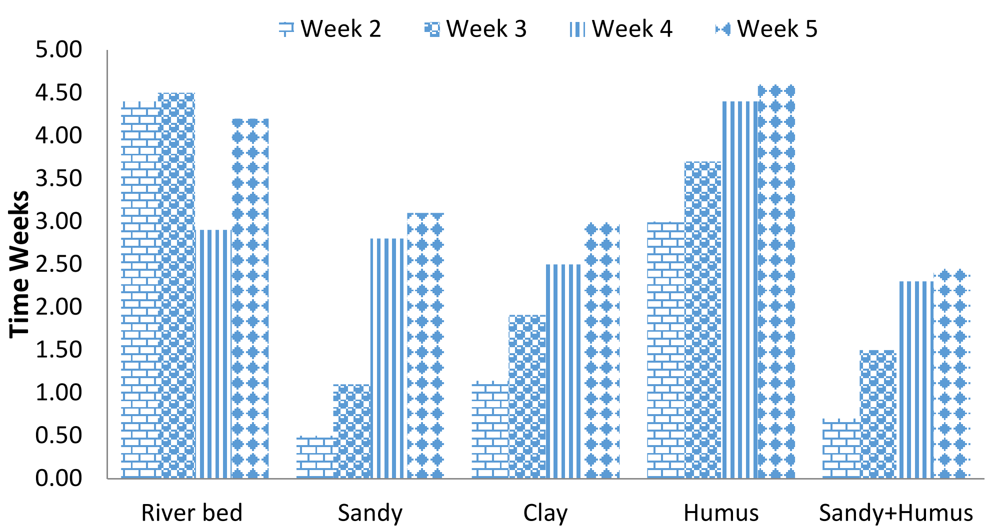

Fig. 2: Shoot length of sprouted stems

*Number of Leaves Produced***:** The number of leaves produced in the five weeks growth period is presented in Fig 3. There was a significant increase in all the soil types used, but the highest was obtained in riverbed soil (19.1±7.1) at the fifth week. The least number of leaves produced (7.4±3.1) was in the fifth week in sandy + humus soil combination. Riverbed soil brought out no leaf by the second week, the highest leaf number in the second week was found in humus soil (5.25 ± 2.0) while the sandy soil was the lowest (0.6± 0.1). Leaf buds initiation in humus soil increased between week 2 and 5. The highest number of leaves produced was recorded at the second week in the humus soil and this was followed by clay soil. This could be because humus soil is known to be richer in organic matter (Havlin *et al.*, 2005) and other nutrients required by the plant. Sandy + humus soil had the least number of leaves. Humus soil had the highest number of leaves in the second week followed by clay soil.

Riverbed soil did not initiate buds in the second week but in the third week and the buds were enormous and increased till the fifth week all the nodes had initiated buds and had the highest number of leaves. This can be explained because the riverbed soil is from the natural habitat of the plant and may contain all the essential nutrients needed for initiation of growth. The other soil types progressed more slowly.

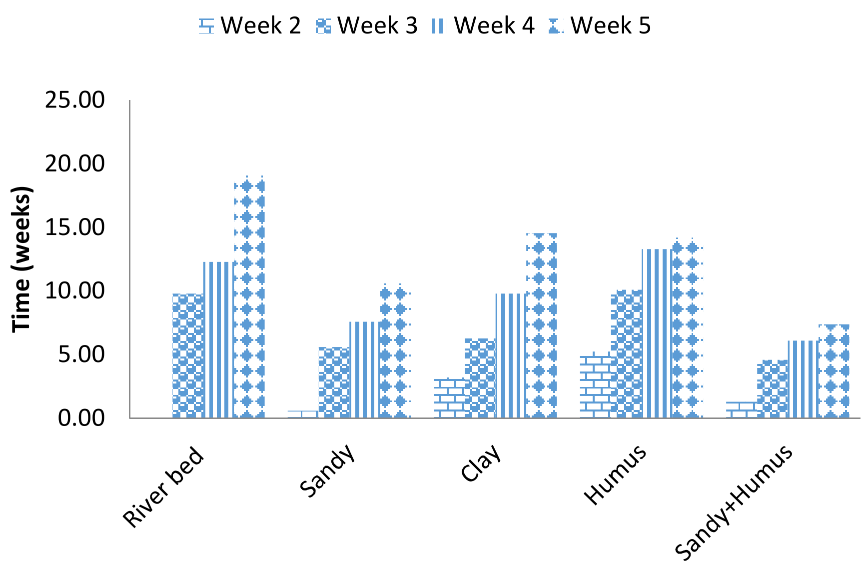

Fig. 3: Number of Leaves produced by stems propagated in different soil

*Leaf Area***:**
Leaf area ranged from 0.1± 0.2 cm^2 to 1.5 ± 0.2 cm^2 (Fig. 4). Sandy + humus soil had the least values for leaf area (0.1 ± 0.2cm^2 – 0.4± 0.2cm^2). Riverbed soil had a significant increase in the 5th week (1.1± 0.9cm^2) as against 0.58 ± 0.2cm^2 of the fourth week. The value for sandy soil was significantly higher in the last two weeks of study (1.2±0.2cm^2 and 1.5 ± 0.3cm^2). There was a steady increase in clay soil from week 2 to week 5 (0.3±0.29cm^2 – 1.05 ±0.5cm^2) and also in humus soil. The leaf area for sandy soil was significantly higher than the other soil types in the last two weeks of study. There was an increase in the fifth week in other soil types except sandy + humus soil where there was steady increase across the five weeks of the study. The growth rate of leaf area was consistent with all the soil types used in the experiment. Sandy soil performed better than all the other soil types closely followed by riverbed soil. Sandy + Humus soil gave the least performance for each and all the weeks put together.

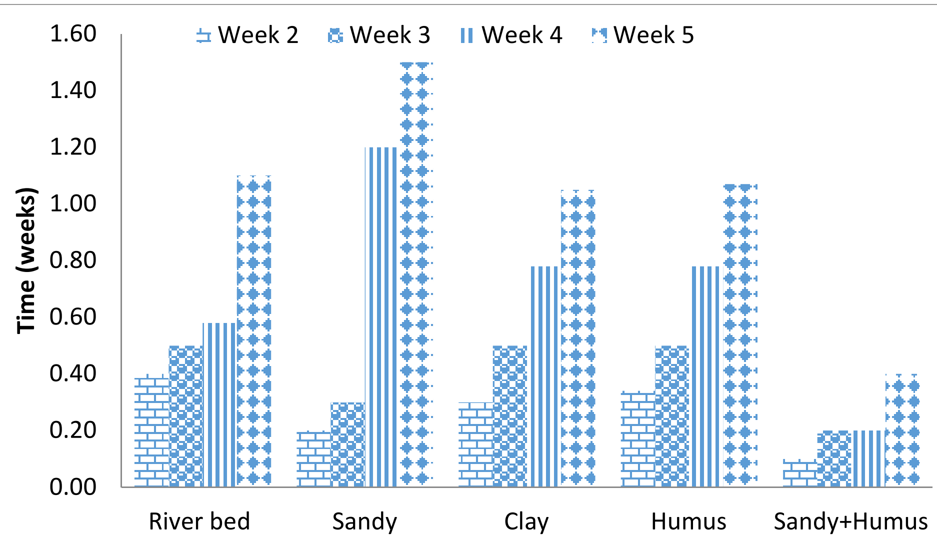

Fig. 4: Leaf Area during the propagation study

Generally sandy soil was porous as such drained water easily. This affected moisture availability for plant growth. Clay soil did not perform any better but is known to have greater strength especially when dry (Mullins *et al.,* 1990) making it more susceptible to water logging due to poor infiltration which results in poor aeration. It becomes too compacted to provide nourishment and reduces root growth and proliferation (Mackenzie *et al.,* 2001) for the continuous survival of the plant however it performed better than the combination of Sandy + Humus soil. The mix of sandy plus Humus soil gave the least performance from the beginning of the experiment to the end, maybe because the proportion of the combination was not well suited to the plant and so there was no change in values. Humus soil gave the best performance for this study. The trend shows that there was an increase from the time of sprouting (2nd week) till the 4th week when the values began to decrease. This pattern was seen for riverbed soil, sandy soil, and sandy + Humus soil, and there was no difference in the type of stem cuttings used. It is possible that the nutrients in the pot may have been exhausted, and so there was termination of growth since this was a potted experiment. It may also be as a result of low regenerative power in agreement with (Ebigwai *et al.*, 2014).He found that *M. lunatum* with other species has the regenerative potential of less than 45%. It could also be because this plant needs the presence of other aquatic plants to flourish since different species adapted to the same kind of conditions will tend to occur together whenever such conditions are met to form communities (Krebs, 1994). Naturally, the presence of the salt in and around the waters where they flourish cannot be overemphasized, since it is a plant that thrives in brackish and salt waters (Keay, 1985; Airy Shaw, 1985; Nyananyo, 2006). Krebs, (1994) had posited that individuals of a species cannot do everything in the best possible way and that adaptations to life in one ecological habitat make it difficult to live in a different one. This plant, however, survived to grow on land without the tidal action of its natural habitat even for a short time and so may be, run contrary to this belief. From this study it has been seen that *M. lunatum* can be propagated outside of its natural environment and the best soil suited for it from this study is humus soil with a regular regime of watering to enable it to survive in an environment alien to its natural aquatic habitat.

REFERENCES

Airy-Shaw, H K (1985). *A dictionary of the flowering plants and ferns.* 8th edition. Cambridge: University Press.

Bilal, C; Mustafa, G; Kenan, K; Yusuf, D; Haka, A (2007). Assesment of Spatial Variability in some soil Properties as related to soil salinity, alkalinity in Biafra plain in Northern Turkey. *Environ.Monit Asses* 124: 223 – 234.

Dike, BU; Nwachukwu, BA (2003). Analysis of Nigerian Hydrometeorological Data. *Nigerian Journal of Technology,* 22 (1): 29 – 382.

Ebigwai, JK; Akomaye, F (2014). Species Diversity and Regeneration potential of some mixed Mangrove Forest in Escravos communities Delta state, Nigeria. *Research Journal of Forestry*, 8(2):34 – 47.

Havlin, J L; Beaton, JD; Tisdale, SL; Nelson, WL (2005). Soil fertility and fertilizers: An Introduction to nutrient management, 7th Edition Prentice Hall, Upper Saddle River, NJ:

Keay, RWJ (1985). Flora of west tropical Africa.Edition 2 Volume I part 2, National Germplasm Resources Laboratory Beltsville, Maryland.

Klitgaard, BB; Lavin, M (2005). Dalbergieae pp. 307-335 in legumes of the world, eds. G.B. Lewis, B. Schirre, B. Mackinder, and M. Lock. Kew: Royal Botanic Gardens.

Krebs, C (1994). Ecology The Experimental Analysis of Abundance and Distribution, 4th edition, Harper Collins, New York. 801 pp.

Mckenzie, DC; Greenhalgh, SE; Koppi, AJ; Macleod, DA; McBratney, AB (2001). Cotton root growth in compacted vertisol (Grey Vertisol) 11. Correlation with image analysis parameters. *Australian Journal of Soil Research* 39, 1169 – 1181.

Mullins, C; Macleod, DA; Northcote, KH; Tisdall, JM; Young, IM (1990). Hardsetting Soils: Behaviour, Occurrence and management. Advances in soil science 11, 37 – 108.

Nyananyo, BL (2006). Plants from the Niger Delta. Port-Harcourt: Onyoma publications

Tamunobereton-Ari, I; Uko, ED; Davies, DH (2013). Prediction of Water Resource Potentials and Susutainable Supply of Water in Port Harcout, Nigeria from Meteorological Data. *The International Journal of Engineering and Science,* 2(01):222-231..

Uko, ED; Tamunobereton-Ari, I (2013). Variability of Climatic Parameters in Port Harcourt, Nigeria. *The International Journal of Engineering and Science,* 4(5):727 – 730.