Effects Of Different Sowing Media On Germination And Early Seedling Growth Of *Terminaliaivorensis* (A.Chev.)

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ABSTRACT: *Terminaliaivorensis* A. Chev.is an important tropical timber species, but poor germination and inadequate silvicultural information are important factors militating against its regeneration.A study on the effects of four sowing media on germination and early seedling growth of *T. ivorensis* was assessed at the Forest Nursery of the Department of Forestry and Wildlife Management, University of Port Harcourt, Port Harcourt, Nigeria. The experiment was arranged in a completely Randomized Design (CRD) with three replicates. Viable seeds were sown into germination trays filled with four sowing media (Topsoil, sawdust, fine sand and coarse sand). Fifty seeds were sown into each germination tray. Data were collected on germination percentage and early seedling growth parameters involving seedling height, collar diameter and monthly leaf production. Analysis of variance was used to analyze the data collected. Means separation were carried out using the Least Significant Difference (LSD). The result revealed that germination percentage was significant at 5% level of probability. The highest germination percentage was recorded for treatment B (sawdust) which had 50.67±17.90% while treatments A (topsoil) and D (coarse sand) had 35.33±9.62% and 30±13.99 respectively. The least was treatment C (fine sand) which had 22±10.84%. There was significant difference at 5% level of probability in seedling height and collar diameter but was not significant in leaf production. The highest mean height was recorded in treatment A (topsoil) which has 16.13±0.80. Treatments B (sawdust), D (coarse sand), C (fine sand) had 14.02±0.37, 7.75±0.47 and 6.79±0.99 respectively. The result showed that the highest diameter growth was recorded for treatment A (topsoil) which has 4.13±0.53. Treatments D (coarse sand), B (sawdust) and C (fine sand) had 3.67±0.57, 3.47±0.48 and 3.43±0.52 respectively. Leaf production in *T. ivorensis*was not significant between the treatments. The study has shown that the germination percentage of*T. ivorensis* improved significantly with sowing media especially sawdust and topsoil. The use of sawdust and topsoil as sowing media for small and large scale propagation of the species is recommended.

Keywords: Sowing media, germination, early seedling, growth, *Terminaliaivorensis*, propagation

1INTRODUCTION

*Terminaliaivorensis*A. Chev.is a tree species found in lowland rainforest zone in Nigeria but is predominantly a tree of seasonal forest zones (Keay, 1989). The species is one of the most important of some 200 species belonging to the genus *Terminalia* (Avery *et al*., 2002). *T. ivorensis* occurs from Guinea-Bissau east to western Cameroon. The species is a good colonizer of abandoned farm land and is a strong light demander (Aphalo and Lehton, 2001). It has been planted in many tropical countries as a promising timber plantation species in Senegal, Uganda, Tanzania, India, Malaysia, the Solomon Islands, Fiji, coast Rica, Panama, Brazil and Nigeria (Katende*et al*., 1995). The tree is used in agro-forestry systems as a shade tree in cocoa, banana and coffee plantations and it is also planted as roadside tree (Mbakwa, 1990).Firstly, deforestation, exploitation and encroachment of farmers into forest areas have made the species threatened. Rapid increase in population growth and agricultural activities in most tropical countries have resulted in the disappearance of most tree species including *T.ivorensis* thereby making seed collection not to be done or carried out at the appropriate time and season (McCork, 2004).

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Secondly, there is inadequate information on effects of sowing media on germination and early growth of the tree species for development of growth models and other silvicultural requirements. However, some studies on the germination and early seedling growth of T. ivorensis have been carried out (Adewusi and Ladipo, 2000; Ibrahim and Otegbeye,2004; Takayama*et al*., 2005; Corbineau and Come, 1993; McDonald *et al*., 2002; Matin and Rashid, 2000).In spite of these efforts on the germination and early seedling growth of *T.ivorensis*, there is still on adequate information on effect of sowing media on germination and early seedling growth of the species. Hence, there is a growing concern as to what can be done to develop a silvicultural technique for regeneration of *T. ivorensis* and provide adequate information on germination and early seedling growth of the species. This therefore, creates the need for the study and evaluate some aspects of germination and early seedling growth of *T. ivorensis* using different sowing media namely fine sand, sawdust, topsoil and coarse sand with special interest on germination percentage, seedling height, collar diameter and leaf production of the species*T. Ivorensis*.

2MATERIALS AND METHODS

2.1Experimental Site

This study was carried out at the Forest Nursery of the Department of Forestry and Wildlife Management, Faculty of Agriculture, University of Port Harcourt, Port Harcourt Nigeria. The nursery site lies on Latitude 04°53' 38.3"N and longitude 00.6°54'38"E.

2.2Fruit Collection and Seed Processing

The fruits were collected from three (3) mother trees in an arboretum in Benin. The seeds were processed manually

by dewinging and mixed thoroughly to form a seed lot.The floatation method was used to test for viable seeds before sowing. The seeds of *T. ivorensis* were soaked in cold water for 6 hours, the ones that floated where regarded as not viable and therefore discarded while the ones the sank were used for the study.

2.3Experimental Design and Treatment Procedure

The design used in this experiment was a Completely Randomized Design (CRD). The study involved the use of four (4) sowing media with three (3) replicates. The treatments were fine sand, coarse sand topsoil and sawdust. Fifty seeds were 500m pretreatment and a total of 600 seeds were used for the study.The seeds were broadcast in germination trays and kept in a humidified propagator. The germination trays were watered daily.At the end of the germination experiment, 12 seedlings were randomly selected per sowing media, and transplanted into polypots of 40 x 30 x 30cm in size. Each polypot was regarded is individual replicate.

2.4Data Collection

Daily observations were made to determine the effects of the four sowing media on the germination of seeds of *T.ivorensis*.Germination recordings were discontinued and considered to have been completed when no additional germination took place in two weeks.Data were also collected for early seedling growth parameters: seedling height, collar diameter, number of leaves produced monthly and leaf area. The growth parameters were measured for 6 months.The height of seedling in each germination tray was measured using a graduated meter rule.The vernier caliper was used to measure the collar diameter of seedling in each germination tray.The production of new leaves was recorded by visual counting number of leaves produced monthly.

2.5Data Analysis

All collected data on germination and early seedling growth were analyzed using analysis of variance (ANOVA) in a Completely Randomized Design (CRD).Percentage germination of seed was calculated as:

$$\% \text{ Germination} = \frac{x}{y} \times 100$$

Where x = number of seeds germinated
y = number of seeds sown

3RESULTS

3.1Seed Germination

The result on effect of four (4) different sowing media on the germination of *T.ivorensis* is shown in Table 1. The result shows that the highest mean germination percentage was recorded for treatment B (sawdust) which had 50.67±17.90%. Treatment A (topsoil) and D (coarse sand) had 35.33±9.62% and 30±13.99 respectively. The least was treatment C (fine sand) which had 22±10.84%. The mean germination percentageof the species with the four sowing media at 5% level of significance is shown in Table 1.

TABLE 1: Mean germination percentage of *T. ivorensis* using four sowing media

		95% confidence interval for mean			
Treatment	Mean ± S.E	Lower bound	Upper bound	Minimum	Maximum
Topsoil	29.776 ± 5.55[a]	5.883	53.671	18.67	35.33
Sawdust	40.000 ± 10.34 [ac]	4.476	84.476	19.33	50.67
Fine sand	13.553 ± 6.26 [b]	13.375	40.482	1.33	22.00
Coarse sand	19.110 ± 8.08 [b]	15.676	53.866	3.33	30.00

Mean with same superscripts along the column are not significantly different from one another at p< 0.05 level of significance

3.2Early Seeding Growth

3.2.1Seedling Height

The result on early seedling growth of *T.ivorensis* using four (4) different sowing media is shown in Table 2. The result therefore shows that the highest mean height was recorded in treatment A (topsoil) which has 16.13±0.80. Treatment b (sawdust), D (coarse sand), C (fine sand) had 14.02±0.37, 7.75+0.47 and 6.79±0.99 respectively. The mean seedling height of the species with the four sowing media at 5% level of significance is shown in Table 2.

TABLE 2: Mean monthly seedling height of *T. invorensis*(cm) using 4 sowing media

		95% confidence interval for mean			
Treatment	Mean ± S.E	Lower bound	Upper bound	Minimum	Maximum
Topsoil	5.905 ± 0.80[ab]	3.857	7.953	2.71	8.13
Sawdust	7.162 ± 0.37 [b]	6.212	8.111	6.36	8.42
Fine sand	4.178 ±0.99 [a]	1.620	6.736	0.00	6.79
Coarse sand	5.058 ± 1.14 [a]	2.121	7.996	0.00	7.75

Mean with same superscripts along the column are not significantly different from one another at p< 0.05 level of significance

3.2.2Collar Diameter

The result on diameter growth of *T. ivorensis*using 4 different sowing media is show in Table 3 below. The result shows that the highest diameter growth was recorded for treatment a (topsoil) which has 4.13±0.53. Treatment D (coarse sand), B (sawdust) and C (fine sand) had 3.67±0.57, 3.47±0.48 and 3.43±0.52 respectively. The mean collar diameter of the species with the four sowing media at 5% level of significance is shown in Table 3.

TABLE 3: Mean monthly diameter of *T.ivorensis* using 4 sowing media

		95% confidence interval for mean			
Treatment	Mean ± S.E	Lower bound	Upper bound	Minimum	Maximum
Topsoil	2.488±0.53[ab]	1.131	3.846	1.000	4.130
Sawdust	2.423±0.48[b]	1.179	3.667	1.000	3.470
Fine sand	1.920±0.52[a]	0.571	3.269	0.00	3.430
Coarse sand	2.117±0.57[c]	0.653	3.581	0.00	3.670

Mean with same superscripts along the column are not significantly different from one another at p< 0.05 level of significance

3.2.3Leaf production per month

The mean monthly result on leave production of *T. ivorensis* using four (4) different sowing media is shown in Table 4. The result shows that the highest production of leaves was recorded for treatment A (topsoil) which has 12±1.53 and treatment B (sawdust) had 12±1.53. Treatment D (coarse sand) had 10±1.53 and the least was treatment C (fine sand) which had 10±1.53.

TABLE 4:Mean monthly leaf production of *T.ivorensis* using 4 sowing media

		95% confidence interval for mean			
Treatment	Mean ± S.E	Lower bound	Upper bound	Minimum	Maximum
Topsoil	7.000 ± 1.53[b]	3.073	10.927	2.00	12.00
Sawdust	7.000 ± 1.53[b]	3.073	10.927	2.00	12.00
Fine sand	5.000± 1.53[a]	1.073	8.927	0.00	10.00
Coarse sand	5.000 ± 1.53[a]	1.073	8.927	0.00	10.00

Mean with same superscripts along the column are not significantly different from one another at p< 0.05 level of significance

4DISCUSSION

This study shows that *T. ivorensis*seeds are difficult to germinate if sown in unsuitable media because it has hard seed coat which can only be over-come by pre-treatment or favourable medium. This supports the work of McDonald and Omoruyi (2003), which reported that acid treatment is an efficient method to increase and accelerate seed germination of species with hard impermeable seed coat. In this study different germination responses were observed for the various sowing media. Treatment B (sawdust) had the highest germination percentage (Table 1). This assertion contrasted sharply with the findings of Okunomo (2000; 2004) who obtained a higher germination percentage in topsoil with *Dacryodesedulis*and*Persia americana* respectively. Okunomo (2010) recorded a higher germination percentage in topsoil with *Parkia bicolor*. Agboola*et al*. (2001) also reported in his study, the highest germination percentage in topsoil with *T.ivorensis*. The result disagrees with the work of Dickens (2011), who reported apparent high germination in river sand with *Irvingiawombolu*. Similarly, Anber (2010) obtained highest germination percentage in sand media (sharp river sand) with *Bauhinia variegate* and *Delonixregia*. The highest height of 16.13cm was recorded in treatment A (topsoil) followed by treatment B (sawdust) which has 14.02cm, treatment D (coarse sand) which had 7.75cm and 6.79cm for treatment C (fine sand) respectively (Table 2). This disagrees with the work of Okunomo (2010) who obtained higher seedling height in poultry droppings than other treatments (topsoil, sharp sand, sawdust, clay soil, caw dung and pig manure) with *P. bicolor*. The result agrees with the work of Anber (2010) who also obtained highest seedling heights in sand medium (topsoil) with *B.variegata* and *D.regia*.Diameter was highest in treatment A (topsoil) which had 4.13mm followed by treatment D (coarse sand) 3.67mm, treatment B (sawdust) 3.47mm and C (fine sand) 3.43mm respectively. This result disagrees with Okunomo (2010) who obtained highest diameter in poultry droppings with *P.bicolor*.Leave production is highest in treatment A (topsoil) and B (sawdust), followed by treatment C (fine sand) and D (coarse sand). The number of leaves produced per month using the four different sowing media is the same. The results revealed that tree species (*T.ivorensis*) produced two (2) leaves per month. This disagrees with the work of Okunomo (2010) who obtained highest number of leaves in poultry droppings with P. bicolor.This study has contributed to some knowledge on the silvicultural techniques *T. ivorensis*. In addition, an understanding of some aspects of the biology of the species through this study is vital for large scale production of seedlings of the species to meet afforestation programme. The seedling growth attributes revealed in this study are relevant in the development of growth models for the species, since tree height and diameter are among the important growth characteristics relevant in useful plants needed by man.

5 CONCLUSIONAND RECOMMENDATION

The study has shown that the germination percentage of *T. ivorensis*improved significantly with sowing media especially sawdust and topsoil. This will play an important role in ensuring uniform and maximum germination of the species in the nursery and any subsequent afforestation or

re-vegetation programme using the species stand successful. This result will be most useful to forest nursery practitioners and other scientists working for sustainable management of this species.

REFERENCES

[1] Adewusi, H. G. and Ladipo, O. O. (2000). Some germination and early seedling growth of *Enterolobiumlyclocarpim* (jacq0.Griesch and Eucanea Linn De Witt Nig J. for, 30: 71-75 International *Journal of Agricultural Research* 2 (11): 952-958.

[2] Agboola, P.A. and Adedire, M.O. (2002). Response of treated dormant seeds of tropical tree species of germination promoters.*Nigerian Journal of Botany* 11: 103-110.

[3] Anber M. A. Hassanein (2010). Improving seed germination and seedling growth of some economically important trees by seed. Forest Sci., 7(3): 371-382.

[4] Aphalo, P.J. and Lehto, T. (2001). Effect of lateral for red light supplementation on the growth and morphology of birch seedlings and its interaction with mineral nutrition. Tree 15(5):297-303.

[5] Avery, T. E. and Burkhart, H. E. (2002). Forest management.5th Ed. MeGraw-Hill Higher Education.New York, USA p. 408.

[6] Baskin, C. C. and Baskin, J. M. (2001). Seed: Ecology, biogeography and evolution of dormancy and germination. Academic press, California, USA.

[7] Corbineau, F.and Come D., (1993). Improvement of germination of *Terminaliaivorensis*seeds for Genetic Resources. Info.No. 21.

[8] Dickens Dolor (2011). Effect of propagation media on the germination and seediing performance of *Irvingiawombolu* (Vermoesen).American JournalBiotechnology and Molecular Sciences. ISSN print: 2150-3698, ISSN online:2159-3701, doi:10 525/ajbms.2011.1.2.51.56© 2011, scienceHuβ, http://www.scihub.org/AJBMS.

[9] Ibrahim, A., and Otegbeye, G. O. (2004). Method of Achieving optimum germinationin*Adasoniadigitata*. Bowen J. Agidi 1:177-182. *International Journal of Agricultural Research* 29 (11): 952-958.

[10] Matin, M. A. and M. H. Rashid, (2000). Seed germination and seedling growth performance at nursery stage of three multipurpose tree species in Bangladesh.Khulna University Studies, 2: 141-181.

[11] McCork, J.K. (2004).Principles and practices of seed harvesting process and storage: an organic seed production manual for seed growers. Creative commons, Stanford California 94305, USA, p.28.

[12] McDonald, I., Omonhinmin, A C., Ogboghodo I. A. (2002). Germination ecology of two species *Tamarindusindica*and *Terminaliaivorensis*.*Seed techno*l. 24:103-107.

[13] McDonald, I., Omoruyi, O. (2003). Effect of seed pre-treatment on germination of two surface types of *Dialiumguineensis.Seed Tchnol*. 25:41-44.

[14] Okunomo, K. (2010). Germination and Seedling growth of Parkia bicolor (A. Cheu) as influenced by nursery techniques.*African Journal of General Agriculture*.Vol.6. No. 4.

[15] Okunomo, K. and E.C. Orji (2004). Agroforestry Technology: an environmental-friendly initiative. *Nigerian J. Res. Prod.* 4: 38-47.

[16] Okunomo, K., U.N. Ureigho and H.O. Opute (2000). The effect of soil amendment on the performance of *Gambayaalbida* (Linn) seedlings.*European J. Sci. Res*., 13: 244-250

[17] Oni, O. and Bada, S. O. (1991). Effect of seed size on the seedling vigour of Idigbo (*Terminaliaivorensis*).Journal of Trop for Science . 4 (3) 215-224.

[18] Takayama, S., Isogai, A (2005). "Self-incompatibility in plants".Annu Rev Plant Biol 56:467-87. DOI:10. 1146/annurev.arplant.56.032604. 144249. PMID 15862104. Wikipedia (2012).www.wikipedia.comthefreeencyclopedia