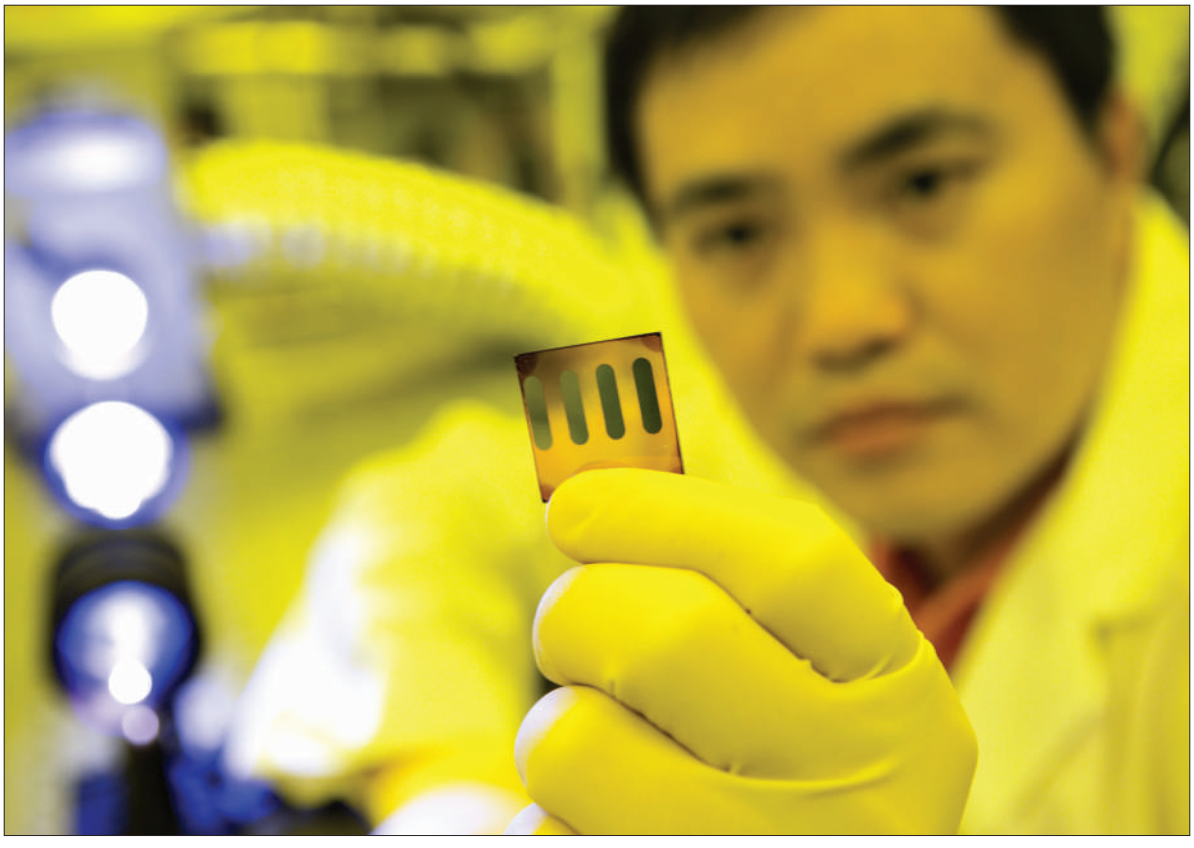

Singapore Journal of

Scientific Research

ISSN: 2010-006x

science alert

http://scialert.net/sjsr

OPEN ACCESS Singapore Journal of Scientific Research

ISSN 2010-006x
DOI: 10.3923/sjsres.2019.100.104

Research Article
Effect of Sowing Media on the Germination of *Pentaclethra macrophylla* Benth Seeds

O. Chukwu, A.E. Ibe and M.A. Udekwe

Department of Forestry and Wildlife, Nnamdi Azikiwe University, Awka, Nigeria

Abstract

Background and Objective: Germination refers to the process by which an organism grows from a seed or a spore. It is a critical stage in the life cycle of weeds and crop plants and often controls population dynamics, with major practical implications. The rate of germination and quality of seedlings is greatly affected by the sowing media. There is scarcity of information on the sowing medium that promotes the germination of *Pentaclethra macrophylla* seeds. This study was aimed at assessing the germination of *Pentaclethra macrophylla* seeds sown in different media namely, river bank sand, sawdust, topsoil and mixture of sawdust and topsoil. **Materials and Methods:** Seed germination count data collected were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan multiple range test (DMRT). **Results:** The ANOVA result showed that the germination was significant at 5% probability level. Sawdust had the highest transformed germination percentage of 46.90±3.17, followed by sterilized river bank sand, topsoil and mixture of sawdust and topsoil produced lower germination of (21.78±2.44). The DMRT result showed no significant difference ($p \geq 0.05$) between sawdust and sterilized river bank sand. **Conclusion:** The study therefore recommended the use of sawdust as sowing media for improved seed germination and enhanced production of *Pentaclethra macrophylla*.

Key words: African oil bean, sawdust, sowing media, *Pentaclethra macrophylla*, silviculture

Citation: O. Chukwu, A.E. Ibe and M.A. Udekwe, 2019. Effect of sowing media on the germination of *Pentaclethra macrophylla* benth seeds. Singapore J. Sci. Res., 9: 100-104.

Corresponding Author: O. Chukwu, Department of Forestry and Wildlife, Nnamdi Azikiwe University, Awka, Nigeria

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Germination refers to the process by which an organism grows from a seed or a spore. The most common forms of germination include a seed sprouting to form a seedling and the formation of a sporeling from a spore. Germination is a critical stage in the life cycle of weeds and crop plants and often controls population dynamics, with major practical implications[1,2]. During the germination, seeds require water, oxygen, adequate temperature and light. However, some seeds require full light to germinate while some others do not need light to do so. Water and oxygen are taken in through the seed coat when the seed is exposed. In the germination of seeds, germination and dormancy are affected which brings about diverse effects in the seed growth and development[3,4]. Sowing media is a substance through which plants grow and extract water and nutrients. Selecting a good sowing medium is fundamental to good nursery management and is the foundation of a healthy root system[5]. The use of suitable media for the sowing of seeds directly affects the germination, development and functional rooting system[6]. The rate of germination and quality of seedlings is greatly affected by the sowing media[7].

African oil bean (*Pentaclethra macrophylla* Benth.) is a tropical forest tree which is a relatively fast-growing evergreen tree growing from 20-40 m tall. It is a large leguminous, nodule-forming multipurpose tree species occurring naturally in the humid lowlands and some parts of the sub-humid zones of West and Central Africa[8]. It is known as Apara apagha (Yoruba), Okpaghan (Urhobo), Okpagha (Bini), Ugba or Ukpaka (Igbo) and Ugbe (Esan) as it is a popular condiment and meat analogue among consuming populations[9]. *Pentaclethra macrophylla* is a low-acid food which could be processed into flour and explored in food fortification and confectionaries and highly nutritious[10]. The seed is a source of edible oil and is used for candle making, lubricant and soap[11]. There is controversy on which sowing media best promote seeds germination[12-14]. This study was done to assess the effect of sowing media on the germination of *Pentaclethra macrophylla* seeds thereby determining the best media for germination.

MATERIALS AND METHODS

Description and location: This study was carried out from the 12th of July, 2019 to the 23rd of August, 2019 in the Prof. E.L.C. Nnabuife screen house of the Department of Forestry and Wildlife, Faculty of Agriculture, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. The University is located in the South-eastern geopolitical zone of Nigeria and lies between latitude 6.245-6.283°N and longitude 7.115-7.121°E. It has an average annual temperature of 26.3°C with a rainfall pattern ranging from 1828-2002 mm. The topography is characterized by rugged relief and it lies completely on the Awka-Orlu upland[15].

Experimental design: The experiment was laid in a completely randomized design (CRD) with 4 treatments and 4 replicates, each replicate had 15 seeds each making a total of 240 seeds for germination. The seeds of *Pentaclethra macrophylla* in the germination tray contained the following treatments (T), sterilized river bank (T1) sand as control, sawdust (T2), topsoil (T3) and mixture of sawdust and topsoil (T4).

Data collection and analysis: The seeds were soaked for about 24 h as described by Basu and Pal[16]. Data collection on seeds started 14th day after planting and lasted for about 6 weeks. Seed germination counts under different sowing media were analyzed using descriptive statistics and analysis of variance (ANOVA). For the purpose of analysis of variance, the percentage values were transformed into arcsine values[17,18]. The means with significant difference were separated using Duncan multiple range test (DMRT) at 5% probability level.

RESULTS

Summary statistics and germination trend of *Pentaclethra macrophylla*: The result for the mean percentage germination of *P. macrophylla* under different sowing media was presented in Fig. 1. The result showed that T_2 (sawdust) had the highest mean germination (87%), followed by T_1 (river bank sand) = 67%, T_3 (topsoil) = 40% and T_4 (mixture of topsoil and river bank sand) had the lowest mean germination (33%). The result of the germination also showed that *P. macrophylla* sown in topsoil (T_3) was first to germinate (7th day) and the seed sown in the mixture of topsoil and river bank sand (T_4) was the last to germinate (Fig. 2). However, germination continued for all the treatments with T_1 and T_2 ending on the 22nd day, T_3 ended on the 27th day and T_4 ended on the 32nd day, the germination trend for all the treatments was shown in Fig. 2.

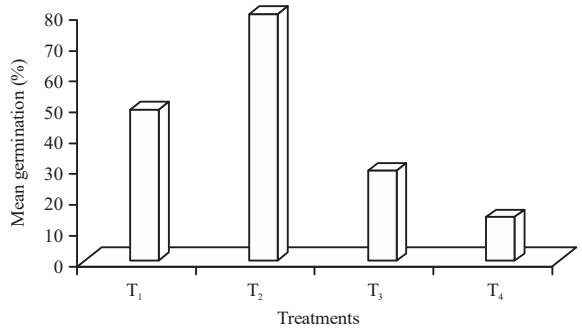

Fig. 1: Mean germination of *P. macrophylla* subjected to different sowing media

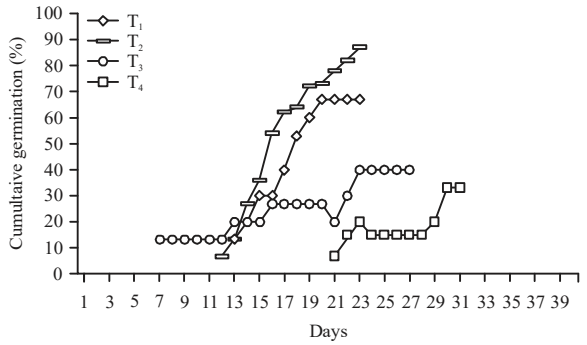

Fig. 2: Germination trend of *P. macrophylla* subjected to different sowing media

Table 1: Result of analysis of variance carried out on *P. macrophylla* under different sowing media

Source of variation	Sum of squares	df	Mean square	F	Significant
Treatment	1608.022	3	536.007	14.275	0.000*
Error	450.578	12	37.548		
Total	2058.600	15			

*Significant at 5% probability level, df: Degree of freedom

Table 2: Duncan result for seed germination of *P. macrophylla* under different sowing media

Treatments	Number	Mean±Standard error
Sawdust and topsoil (T_4)	4	21.775±2.439[c]
Topsoil (T_3)	4	32.578±2.621[b]
River bank sand (T_1)	4	44.355±3.835[a]
Sawdust (T_2)	4	46.900±3.165[a]
Significant		0.568

Means with the same alphabets have no significant difference at 5% probability level

Effect of different sowing media on germination of *Pentaclethra macrophylla*: The result of descriptive statistics for the arcsine transformed cumulative germination percentages showed that T_2 produced the highest germination with mean±standard error of 46.8995±3.1653, followed by T_1 with 44.3548±3.8352 and T_4 produced the lowest germination (21.7753±2.4391).

The result of ANOVA carried out on *P. macrophylla* raised under different sowing media revealed that there was no significant difference in the effect of T_1 and T_2 on the germination of *P. macrophylla*, but there was a significant difference between T_3 and T_4. Since there was a significant difference in the result a mean difference separation was carried out using Duncan multiple range test (*post hoc*) to signify the exact differences between the treatments as can be seen in Table 1.

The result of mean separations for seed germination which was obtained after the conversion of the cumulative germination to the arcsine values is presented in Table 2. The seeds which were raised with T_2 (sawdust) produced the highest germination with mean±standard error of 46.900±3.165, followed by the control T_1 (Sterilized river bank sand) with a germination of 44.355±3.835, T_3 (topsoil) and T_4 (mixture of sawdust and topsoil) produced the least germination with T_3 having 32.5784±2.621 and T_4 having 21.7753±2.439.

The result of the one-way analysis of variance (ANOVA) showed that there was significant difference ($p<0.05$) in the germination of *P. macrophylla* seeds sown in the four sowing media (Table 1).

***Post hoc* test for seed germination of *P. macrophylla*:** The DMRT result revealed that there was no significant difference ($p>0.05$) between T_1 and T_2 indicated with the alphabet a, but there was a significant difference between T_3 and T_4 indicated with the alphabets b and c, respectively (Table 2).

DISCUSSION

The highest germination was observed in T_2 (sawdust) which might be as a result of the fact that sawdust is lighter in weight than soil and provides high water-holding capacity, good aeration and stimulates warmth which facilitates germination. Wood residues contain the entire minor elements essential to plant growth[19]. Seed germination and seedling emergence results from a sequence of biological events initiated by water inhibitions followed by enzymatic metabolism of stored nutrients[20]. All these processes are regulated by the environment and the quality of the seed[21].

This study therefore, supported the findings of Omokhua *et al.*[22] on the germination of *Terminalia ivorensis* (A. Chev.), who reported that the highest germination percentage was recorded for sawdust which had 50.67±17.90 while topsoil and coarse sand had 35.33±9.62 and 30±13.99, respectively. The least was fine sand which had 22±10.84. This study also supported the findings of Peter-Onoh *et al.*[23]

on the seedling emergence of *Monodora myristica* (African nutmeg, Ehuru). They recorded that most seeds of *Monodora myristica* emerged in sawdust (68.2%) ($p \geq 0.05$) with variations among other treatments. The least mean value (37.50%) was recorded in topsoil, followed by a mixture of topsoil and sawdust (50:50).

This study however, does not agree with the findings of Yerima *et al.*[24] on the germination of a sunflower (*Helianthus annuus* L.), who reported that the highest germination rate was recorded on soil substrate (75%) while the lowest rate (25%) was recorded on sawdust substrate. Germinated seeds were counted daily for a 15 days' period. The result showed that germination started 8 days after sowing for all the substrates.

It is recommended that sawdust as a sowing media should be used to enhance the germination of *Pentaclethra macrophylla* seeds to increase production and ensure perpetuity. Also, in the absence of sawdust, sterilized riverbank sand can be used as an alternative as it is free of impurities. It should also be tried on other species to ascertain how well they will perform with sawdust.

CONCLUSION

The result of this study showed that *Pentaclethra macrophylla* seeds have the highest germination in sawdust and this is as a result of high water-holding capacity, good aeration and stimulated warmth which facilitate germination. This concludes that the effect of sawdust on the germination of *Pentaclethra macrophylla* when used as a sowing media is the best. Furthermore, a mixture of sawdust and topsoil showed the least effect on the germination of *Pentaclethra macrophylla* as a sowing media.

ACKNOWLEDGMENT

The authors appreciate the Department of Forestry and Wildlife, Nnamdi Azikiwe University, Awka, Nigeria for providing technical and material support toward the success of this research work.

SIGNIFICANCE STATEMENT

This study provided information on sowing media suitable for the germination of *Pentaclethra macrophylla* seeds. The study discovered that sowing *Pentaclethra macrophylla* seeds in sawdust will enhance their rate of germination. However, the study also showed that riverbank sand can also be used for economic reasons as there was no significant difference between sawdust and riverbank sand.

REFERENCES

1. Huang, Z., Z. Xinshi, Z. Guanghua and G. Yitzchak, 2003. Influence of light, temperature, salinity and storage on seed germination of *Haloxylon ammodendron*. J. Arid Environ., 55: 453-464.
2. Yang, Q.H., X. Wei, X.L. Zeng, W.H. Ye, X.J. Yin, W. Zhang-Ming and Y.S. Jiang, 2008. Seed biology and germination ecophysiology of *Camellia nitidissima*. For. Ecol. Manage., 255: 113-118.
3. Goldberg, R.B., G. De-Paiva and R. Yadegari, 1994. Plant embryogenesis: Zygote to seed. Science, 266: 605-614.
4. Koornneef, M. and C.M. Karssen, 1994. Seed Dormancy and Germination. In: Arabidopsis, Somerville, C.R. and E.M. Meyerowitz (Eds.). Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York, pp: 313-334.
5. Landis, T.D. and N. Morgan, 2009. Growing Media Alternatives for Forest and Native Plant Nurseries. In: National Proceedings: Forest and Conservation Nursery Associations-2008, Dumroese, R.K. and L.E. Riley, (Eds.)., U.S Department of Agriculture, Fort Collins, CO., pp: 26-31.
6. Meena, A.K., O.P. Garhwal, A.K. Mahawar and S.P. Singh, 2017. Effect of different growing media on seedling growth parameters and economics of papaya (*Carica papaya* L.) cv. *Pusa* delicious. Int. J. Curr. Microbiol. Applied Sci., 6: 2964-2972.
7. Agbo, C.U. and C.M. Omaliko, 2006. Initiation and growth of shoots of Gongronema latifolia Benth stem cuttings in different rooting media. Afr. J. Biotechnol., 5: 425-428.
8. Enujiugha, V.N., 2008. *Pentaclethra macrophylla* African Oil Bean. In: The Encyclopedia of Fruit and Nuts, Janick, J. and R.E. Paull (Eds.)., CAB International, Oxfordshire, UK., ISBN: 9780851996387, pp: 398-400.
9. Enujiugha, V.N. and C.T. Akanbi, 2005. Compositional changes in African oil bean (*Pentaclethra macrophylla* Benth) seeds during thermal processing. Pak. J. Nutr., 4: 27-31.
10. Enujiugha, V.N. and O. Ayodele-Oni, 2003. Evaluation of nutrients and some anti-nutrients in lesser-known, underutilized oilseeds. Int. J. Food Sci. Technol., 38: 525-528.
11. Olotu, I., V. Enujiugha, A. Obadina and K. Owolabi, 2014. Fatty acid profile of gamma-irradiated and cooked African oil bean seed (*Pentaclethra macrophylla* Benth). Food Sci. Nutr., 2: 786-791.
12. Defoer, T., 2002. Learning about methodology development for integrated soil fertility management. Agric. Syst., 73: 57-81.
13. Lima, J.J., J.D. Mata, R. Neto and C.A. Scapim, 2007. Influence of organic fertilization on chemical properties of oxisol and dry matter yield of *Brachiaria brizantha* C.V. Marandu. Acta Sci. Argon., 29: 715-719.
14. Gudugi, I.A.S., 2013. Effect of cow dung and variety on the growth and yield of okra (*Abelmoschus esculentus* L.). Eur. J. Exp. Biol., 3: 495-498.

15. Ezenwaji, E.E., P.O. Phil-Eze, V.I. Otti and B.M. Eduputa, 2013. Household water demand in the peri-urban communities of Awka, Capital of Anambra State, Nigeria. J. Geogr. Reg. Plann., 6: 237-243.
16. Basu, R.N. and P. Pal, 1980. Control of rice seed deterioration by hydration-dehydration pretreatments. Seed Sci. Technol., 8: 151-160.
17. Akindele, S.O., 1996. Basic Experimental Designs in Agricultural Research. Montem Paperbacks, Akure, Nigeria, Pages: 122.
18. Onyekwelu, J.C. and S.O. Akindele, 2002. Effect of pre-treatments on the germination of the seeds of *Chrysophyllum albidum*. Applied Trop. Agric., 7: 23-28.
19. Owston, P.W., 1972. Cultural techniques for growing containerized seedlings. Proceedings of Joint Meeting, Western Forest Nursery Council and Intermountain Nurseryman's Association, August, 1972, US Department Agriculture Forest Service Intermountain and Range Experiment Station, Olympia, WA., Ogden UT., pp: 32-41.
20. Maroufi, K., H.A. Farahani and A.M. Aghdam, 2011. Effect of Nanopriming on germination in sunflower (*Helianthus annus* L.). Adv. Environ. Biol., 5: 3747-3750.
21. Kondra, A.P., D.C. Campbell and J.R. King, 1983. Temperature effects on germination of rapeseed (*Brassica napus* L. AND *B. campestris* L.). Can. J. Plant Sci., 63: 377-384.
22. Omokhua, G.E., A. Ogu and B.A. Oyebade, 2015. Effects of different sowing media on germination and early seedling growth of *Terminaliaivorensis* (A. Chev.). Int. J. Sci. Technol. Res., 4: 119-122.
23. Peter-Onoh, C.A., J.C. Obiefuna, A.A. Ngwuta, P.A. Onoh and I.I. Ibeawuchi *et al*., 2014. Efficacy of five different growth media on seedling emergence and juvenile phenology of *Monodora myristica* (African nutmeg, Ehuru) in the nursery. J. Agric. Vet. Sci., 7: 60-63.
24. Yerima, B.P.K., Y.A. Tiamgne, T.C.M.A. Tziemi and E. van Ranst, 2015. Effect of substrates on germination and seedling emergence of sunflower (*Helianthus annuus* L.) at the Yongka Western Highlands Research/Garden Park, Bamenda-Cameroon. Tropicultura, 33: 91-100.