Journal of Agriculture and Crops
ISSN(e): 2412-6381, ISSN(p): 2413-886X
Vol. 2, No. 1, pp: 9-13, 2016
URL: http://arpgweb.com/?ic=journal&journal=14&info=aims

Soil–Based Media for Seedling Emergence and Growth of African Oil Bean *(Pentaclethra Macrophylla Benth)* Seed at Owerri, Imo State

Onwubiko, N.C.* Department of Crop Science and Technology, Federal University of Technology, Owerri
Osobie, L.C. Department of Crop Science and Technology, Federal University of Technology, Owerri
Ibeawuchi, I.I. Department of Crop Science and Technology, Federal University of Technology, Owerri
Nwokoji, E.M. Department of Crop Science and Technology, Federal University of Technology, Owerri
Utazi, C.O. Department of Agricultural Management and Extension, Imo State Polytechnic, Umuagwo
C.P. Poly-Mbah Department of Agricultural Science, Alvan Ikoku Federal College ofEducation, Owerri

Abstract: An experiment using three different soil-based media on seedling emergence and growth of African oil bean seed (Pentaclethra macrophylla Benth) was carried out at the screen house of School of Agriculture and Agricultural Technology, Federal University of Technology, Owerri to determine the best soil-based media for mass production of oil bean seedlings. The top soil served as the control while the other three soil-based media; top soil+cow dung (TS+CD), top soil+rice hull (TS+RH), and top soil+saw dust (TS+SD) were prepared in 1:1, 1:2, 1:3 and 1:4 volume by volume (v/v). The treatments were laid out in a Completely Randomized Design (CRD) and replicated six times, giving a total of 72 observation units. Data were collected on days to emergence, plant height, number of root hairs and root length at 50 days after planting (DAP).The combination of top soil+saw dust at 1:3 v/v performed better than the other media combination in all the parameters studied; had least mean value of approximately 18 days to emergence, highest mean value of 23.50cm for plant height, and highest mean value of 119.30 and 26.60cm for number of root hairs and root length at 50 DAP.

Keywords: Soil-based media; African oil bean; seedling emergence; growth.

1. Introduction

Large-scale cultivation of some crop plants has been constrained by the availability of planting materials. Studies have shown that inherent low multiplication rate in cassava [1] and short longevity for seeds in *Vigna subterranea* on storage [2] are some factors responsible for lowavailability of planting materials. The problem of planting materials is more obvious in crops whose edible parts are cultivated. Seedling productions from such edible parts (like stem, root, seed etc) are often considered less important to the potential of the crop reducing the prevailing food problems.

African oil bean (*Pentaclethra macrophylla* Benth) is a multipurpose plant as almost all its parts are useful. Food wise, the seeds of oil bean can be eaten boiled or roasted. Fermentation of seeds can also be carried out to produce a snack or condiment with a meaty taste. The cooked, processed, and fermented seeds are used in the preparation of many delicious cuisine including African salad, soups and sausages [3, 4]. Furthermore, thehigh degree of saturated oil in the seed of this crop makes it suitable for cooking purposes.

In the farm, African oil bean is used in intercropping as an agroforest plant because it does not severely affect crop growth. Some species of this tree crop shade their leaves during the farming seasonwhich enhances adequate sunlight to crops planted along with them, and as the leaves fall and decay, they help in improving soil fertility.

Traditionally, the ripe fruits of this plant are applied externally for the treatment of wounds in both man and animals. Extracts from the leaf, stem bark, seed and fruit pulp have anti-inflammatory and anthelmintic activity. They are also used to treat gonorrhea, obesity, heart problems, high blood pressure, convulsion, and also as analgesic. The root bark is used as a laxative, as an enema against dysentery and as a liniment against itch. An infusion of the bark is used as an abortifacient in Cameroon [2]. *P. macrophylla* also plays a major role in various traditional ceremonies and festival.

Industrially, pestles, mortars, and wooden hoe handles including other wooden tools can be made from this tree crop. Wood gotten from African oil bean is hardand suitablefor making of electric poles if they are straight enough, railway sleepers, and general carpentry. Furthermore, oil extracted from the seeds can also be used as drying oil for

*Corresponding Author

cosmetics, paints and varnishes. Again, ash from wood or pods is used as mordant in dying industries, and the empty dry pods and branches used as fuel-wood for cooking.Also, bees forage the flowers of this tree crop for their nectar which helps them in the production of honey [5], making this tree most suitable in areas that are into apiculture.

Aesthetically, African oil bean is occasionally used in road beautification by planting them along the road. In spite of the numerous usefulness of the crop there is little information on research work carried out on its seedling production. At the immediate, this crop is not endangered by genetic erosion, however, it has greatly declined in number in some areas [2], and mostly found growing in the wild. Therefore, this study was set up to determine the optimum germination medium for *P.macrophylla* with the view to ensuring its domestication and sustainable management practices thereby saving it from possible future extinction.

2. Materials and Method

This research was carried out at the screen house of School of Agriculture and Agricultural Technology, Federal University of Technology, Owerri located between longitudes 70^0 00^1E- 07^0 07^1E and latitudes 05^0 20^1N – 05^0 27^1N, it is in the humid tropical agroecological zone of Nigeria with a mean annual rainfall range of 2250mm to 2500mm and a mean daily temperature range of 27^0C to 28^0C.

The materials used for this study were seeds of *P.macrophylla* (plate 1). Top soil, Cow dung from FUTO cattle ranch, Rice hull from rice mill at Abakaliki, and saw dust from Naze timber saw mill. Black nursery polyethylene bags of 25cm diameter were used. The bags were perforated to ensure proper drainage.

Plate-1. Seeds of *Pentaclethra macrophylla* used for the study.

2.1. Method

Top soil+cow dung, top soil+rice hull, and top soil+saw dust were used for the study at 1:1, 1:2, 1:3 and 1:4 volume by volume (v/v)for each media giving a total of 12 treatments. The control contained only top soil, and ¾ volume of each of the polyethylene bags was filled with these treatments and labelled properly. The experiment was arranged in Completely Randomized Design (CRD) and replicated six times. Two seeds were planted in each polyethylene which was later thinned down to one. The bags were watered once a week and phyto-sanitation carried out by hand picking.

Data was collected on days to emergence, plant height (cm), number of root hairs and root length at 50 DAP. All data collected were analysed using analysis of variance (ANOVA). Test of means of significance was done using Fisher's protected least significant difference at 5% level of probability.

3. Results

3.1. Days to Emergence

The analysis of variance showed that there was no significant difference ($P<0.05$) on days to emergence for media, their ratios and interaction (Table 1). However, the least number of days to emergence (DTE) of approximately 18 days was recorded for the medium TS+SD at 1:2 and 1:3 v/v, while the medium TS+CD at 1:2v/v

had the highest DTE of approximately 26 days. The media TS+SD recorded the least mean DTE of approximately 19 days while TS+CD recorded the highest DTE of approximately 23.

Table-1. The effect of media, media ratios and their interactions on DTE of African oil bean seed.

	Media ratios				
Media	1.1	1.2	1.3	1.4	Mean
TS+CD	21.20	25.30	22.00	21.80	22.58
TS+RS	21.70	24.50	20.00	18.50	21.18
TS+SD	21.20	18.00	17.50	18.70	18.85
Mean	21.37	22.60	19.83	19.67	

$LSD_{0.05}$Media = ns, Ratio=ns, Media x Ratio=ns
Where TS= Top soil
CD= cow dung
RH= Rice hull
SD= Saw dust

3.2. Plant Height at 50 Days after Planting (DAP)

The result on the effects of media, media ratios and their interaction on plant height at 50 days after planting (DAP)showed significant difference at 5% (Table 2).The medium TS+SD had the highest mean plant height 20.78 cm while the least 15.25 cm was for TS+CD. Similarly, media ratios v/v 1:3 and 1:4 recorded the highest plant height, 18.69 cm while v/v 1:1 had the least, 15.40 cm. This result also showed the highest plant height, 23.50cm for the medium TS+SDat v/v 1:3 while TS+CD medium at v/v 1:1 hadthe least, 13.60cm at 50 DAP.

Table-2. Effects of media, media ratios and their interaction on plant height at 50 DAP.

	Media ratios				
Media	1:1	1:2	1:3	1:4	Mean
TS+CD	13.60	16.70	15.88	14.80	15.25
TS+RH	15.20	14.20	16.70	21.36	16.87
TS+SD	17.40	22.30	23.50	19.90	20.78
Mean	15.40	17.73	18.69	18.69	

$LSD_{0.05}$ Media= 4.82, Ratios=3.09 Media× Ratios= ns

3.3. Number of Root Hairs at 50 DAP

Similar to the result on days to emergence showed no significant difference at 5% (Table 3) on the effect of media, media ratio and their interaction on the number of root hairs at 50 DAP. However, TS+SD medium at 1:3 v/v had the highest number of root hairs, 119.30 while the medium TS+CD at 1:2 v/vhad the least, 40.50 at 50 DAP. The highest mean ratio, 84.65 at 50 DAP on number of roots was recorded for TS+SD medium while the least, 50.43 was for TS+CD medium.

Table-3. Effects of treatment media, ratios and media ratio interaction on number of root hairs of *P. macrophylla at* 50 DAP.

	Media ratio				
Media	1:1	1:2	1:3	1:4	Mean
TS+CD	43.00	40.50	62.60	55.60	50.43
TS+RH	63.30	54.30	65.60	107.60	73.45
TS+SD	63.50	81.30	119.30	65.40	84.65
Mean	57.69	58.70	82.50	79.23	

$LSD_{0.05}$ Media= ns Ratios=ns Media× Ratios= ns

3.4. Root Length at 50days after Planting (DAP)

The result on root length at 50 DAP showed that there was no significant difference at 5 % on media and their interaction (Table 4). However, significant differences exist in the ratios of these different media. Summarily, the medium TS+SD recorded the highest mean value, 20.43cm for root length at 50 DAP while the least mean value 16.30cm was observed for the medium TS+CD. Medium TS+SD 1:3 v/v recorded the highest root length 26.60cm while the medium TS+CD 1:4 v/v had the least of 13.40 cm.

Table-4. Effects of treatment media, media ratiosand their interaction on root length of *P. macrophylla* at 50 DAP.

	Media ratios				
Media	1:1	1:2	1:3	1:4	mean
TS+CD	18.50	13.90	19.40	13.40	16.30
TS+RH	19.50	16.50	17.30	21.50	18.70
TS+SD	17.30	21.20	26.60	16.60	20.43
Mean	18.43	17.20	17.17	17.17	

$LSD_{0.05}$ Media= ns Ratios=1.06 Media× Ratios= ns

4. Discussion

The major consideration in choice of base materials used in formulating potting media for growing of cropsare nutrient, moisture, air and anchorage. Furthermore, the base materials of a potting media significantly determine its physicochemical properties [6, 7]. Therefore, potting media should be formulated as to create clear variability and marked differences. In this study, clear differences were observed in the formation of the media used: top soil mixed with rice hull, cow dung and saw dust, and these three soil-based media were formulated1:1, 1:2, 1:3 and 1:4v/v (Tables 1-4). In addition, the choice of materials used in formulating the media used in this study was based on the fact that research in recent times is shifting towards the use of alternatives, especially on the recycling of certain biodegradable waste products for crop production, a means of utilizing available waste which if allowed accumulating may constitute ecological hazard to man and his environment [8].

The result on seed emergence as displayed in Table 1 showed that there was no significant difference ($P>0.05$) on the effect of the three different soil-based media used in this study on days to emergence. Invariably, the number of days to emergence was statistically the same for the three different media used for the study. This result may have some implication on the physical nature of the different media used in the study. Apparently the basic condition necessary for germination to occur –availability of water, air and adequate temperature were not in short supply in any of the media. All the media used in the study were sufficiently aerated and had a good water retaining capacity; hence the numbers of days for the seeds to emerge were statistically the same. Physical observation made during the study did not reveal excessive water condition in any of the media, which undoubtedly would have adversely affected seed emergence. This result is in agreement with Ball [9] who reported that poor physical condition of a medium is a very common inhibitor of seedling development.

The effect of different media on plant height of *P.macrophylla* showed significant differences ($P<0.05$). The highest mean plant height of 20.78cm was recorded forTS+SD medium at 50 DAP. Furthermore, this medium at 1:3 v/v had the highest mean plant height value of 23.50cm. This may be due to the neutral pH of saw dust (7.05) [10] which aided fast nutrient mineralization and made nutrients in the medium readily available to the emerging seedling that resulted in vigorous increase in plant height. Also the result on plant height (Table 2) showed a minimum value of 13.60cm for the TS+CD medium 1:1 at v/v at 50 DAP. Thus this result may have some implication on slow release of nutrients in this medium. Nutrient immobilization of cow dung manure has been reported [11], invariably little nutrients were available to the seeds for their emergence and growth. However, this result is in disagreement with the work carried out by Osaigbovo, *et al.* [12] who reported highest value for plant height in top soil and cow dung mixture although the condition of the two experiments may not be same.

On root development of *P.macrophylla* at 50 DAP, there were no significant differences ($P<0.05$) on the number of root hairs and root length (Tables 3 and 4). The rate of root development as assessed by these two parameters were statistically not at variance in the three different media used for the study. This result is similar to that observed in seed emergence. Studies have shown that critical to plant growth is the relative balance of air and water within a soil's pore space [13, 14]. Low porosity and poor aeration are interwoven and these conditions will retard root development, on the contrary the physical condition of the three soil-based media used in the study were not poor rather they were sufficiently aerated, providing conditions that can facilitate root development.

5. Conclusion

Potting media can enhance mass production of African oil bean seedlings for agroforestry establishment. The medium saw dust+top soilat 1:3 v/v consistently performed better than the other media used in the study.Hence, this medium can support mass propagation of *P.macrophylla* seedlings.

References

[1] Okpara, D. A. and Baiyeri, S. O., 2006. "Effect of growth media on propagation of four varieties of cassava In:repositioning agriculture for sustainable millennium development goals in Nigeria (2006). Asumugha, GN, Olojede AO, Ikeorgu JG, Herbert U (editors)." In *Annual Conference of Agriculture Society of Nigeria (ASN).*National Root Crop Research Institute, Umudike.

[2] Oboh, G., 2007. "Pentaclethra macrophylla Benth In: Vander Vossen HAM, Mkamilo, GS (Editors). PROTA 14: Vegetable oils/ Oleagineux." (CD-ROM). PROTA Wageningen Netherland.

[3] Aju, P. C. and Okwulehie, I. C., 2005. "Pentaclethramacrophylla(Bentham): an important but neglected fruit tree species in south eastern Nigeria. In:Popoola L, Mfon P, Oni PI (editors)." In *30th Annual conference of the Forestry Association of Nigeria.*Kaduna.

[4] Enujiugha, V. N. and Akanbi, C. T., 2005. "Compositional changes in African oil bean (Pentaclethra macrophylla Benth) seeds during thermal processing." *Pakistan Journal of Nutrition*, vol. 4, pp. 27-31.

[5] Latham, P., 2008. "The oil bean tree (Pentaclethra macrophylla, Benth)." *Bees For Development Journal*, vol. 38,

[6] Sahin, U., Ors, S., Ercisli, S., Anapali, O., and Eristken, A., 2005. "Effect of pumice amendment on physical soil properties and strawberry plant growth." *J.CentralEurop. Agric.*, vol. 6, pp. 361-366.

[7] Baiyeri, K. P. and Mbah, B. N., 2006. "The effect of soilless media and soil-based nursery media on seedling emergence, growth and response to water stress of African breadfruit (Treculia Africana Decne)." *African Journal of Biotechnology*, vol. 5, pp. 1405-1410.

[8] Ogbede, K. O., Epidi, T. T., Ikpe, F. N., Osakwe, G. A., and Nwokeji, E. M., 2009. "Effect of tillage and municipal waste on the incidenceand severity of termites on cassava." In *5th National Conference of organic agric.*Owerri.

[9] Ball, V., 1975. *The ball red book*. 13th ed. Geo. J. Ball Inc.: USA. p. 500.

[10] Nwachukwu, I. O. I., Ngwu, N. E., and Achumba, C., 2011. "Characterization and evaluation of selected Nigerian Agricultural by- products for copper and Zinc sorption." *Journal of Environmental Sciences and Resource Management,* vol. 3, pp. 103-109.

[11] Gana, A. K., 2009. "Evaluation of the residual effect of cattle manure combinations with inorganic fertilizer and chemical weed control on the sustainability of chewing sugarcane production at Badeggi southern Guinea savana of Nigeria Middle." *East J. Sci. Res,* vol. 4, pp. 282-287.

[12] Osaigbovo, A. U., Nwaoguala, C. N. C., and Falodun, J. E., 2010. "Evaluation of potting media for the production of pepper fruit (Dennetiatripetala) seedlings." *Afr. J. Gen. Agric.,* vol. 6, pp. 47-51.

[13] Bruckner, U., 1997. "Physical properties of different potting media and substrate mixture- especially air and water capacity." *ActaHorticulturae,* vol. 450, pp. 263-270.

[14] Caron, J. and Nkongolo, V. K. N., 1999. "Aeration in growing media: recent developments." *ActaHorticulturae,* vol. 481, pp. 545-551.