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Effect of Developmental Media on Early Growth of Baobab (*Adansonia Digitata*) In Anyigba, Kogi State

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Abstract

Adansonia digitata L. is a major multipurpose tree species which has an important economic value not only for food but also medicine and fibre. The study was conducted at Prince Abubakar Audu University Student Research and Demonstration Farm, Anyigba in 2023 cropping season. The study evaluated the influence of growing media on seedling emergence and early seedling growth of Baobab (A. digitata). The experiment was laid out in a completely randomized design (CRD) with five treatments (growth media) each replicated 5 times. The five treatments involved topsoil (TS), poultry manure (PM), rice husk (RH), sawdust (SD) and oil palm bunch residue (OPBR). The treatment combinations were TS (100%), TS + PM + OPBR (2:1:3), TS + PM + OPBR + RH + SD (1:1:1:1:1), TS + PM + RH (2:1:3) and TS + PM + SD (2:1:3). Parameters measure were plant height (cm), number of branches, number of leaves and stem girth (cm). The results revealed a positive influence of nursery media on seedling emergence and growth parameters measured. Earliness to first seedling emergence, highest percent emergence rate and highest emergence index was associated with media TS+PM+RH. Media TS+PM+OPBR+SD+RH had the highest emergence index rate. Media TS + PM + OPBR had the highest mean values for plant height (52.66), number of leaves (59.86), number of branches (16.77) and stem girth (4.56) while the least value was obtained from media TS + PM + RH, with mean value for plant height (24.68), number of leaves (15.00), number of branches (3.91) and stem girth (2.04). Generally, seedling emergence and growth responses suggested that media TS+PM+RH and TS + PM + OPBR were the best.

Keywords: Media; Seedlings; Quality; Germination; Nutrient

Introduction

Baobab (*Adansonia digitata*) belongs to the family *Bombacaceae* Assogbadjo [1] and is indigenous to Africa where it is found in many countries [2]. It is a large iconic deciduous tree attaining a height of 12–20 m or more Bosch [3] and may live for thousands of years. *Adansonia digitata* has thick, angular, wide-spreading branches and short trunk which grows 4.5–14 m or more in diameter [4]. The bark is smooth, reddish brown or grey and later rough and wrinkled [5]. Leaves are alternate and hand shaped, with tapering leaflets (simple on young trees) at the end of branches. The wood is whitish, soft, spongy and light Venter [6] and has little use except for making fishing boats [7]. Flowers are large and white opening at night and their unpleasant-smelling nectar attracts pollinators such as bats [7]. The flowers do not live more than 24 hours [5].

Adansonia digitatais is a multipurpose tree species that is valued for food, fibre and medicine in Africa [2]. Baobab products are sold in markets and form an important source of income for thousands of rural people [8]. Leaves are sources of protein Gebauer [5] and minerals [9]. The fruit pulp contains vitamin C almost ten times that of orange, making it an excellent anti-oxidant [5,2]. The plant parts are used to treat various ailments such as diarrhoea, malaria and

microbial infections [2].

The successful production of quality seedlings in a nursery is largely dependent on the composition of the growing media [10]. A suitable potting medium should be well drained with the ability to retain sufficient water to reduce the frequency of watering as well as supplying nutrients to the seedlings [11]. The selection of proper media is critical to the successful production of seedlings. Media play an important role in seed germination and is a key determinant factor to successful tree planting programmes. The performance of seedlings in the field is determined by their performance in the nursery. Organic matter to potting media is important because it supplies essential nutrients required by seedlings. Organic matter determines the biological, physical and chemical properties of the media Grace [12] and is important in sustaining the productivity of many ecosystems [13].

Recently, there has been an increasing demand for multi-purpose trees such as Baobab and farmers' attempts to propagate them have not succeeded due to lack of information on suitable media to support emergence and early growth of the crop. Most indigenous species such as Baobab grow naturally in the wild and are popular for their multiple uses. Very few species have been raised in tree nurseries because their nursery requirements are not understood. Therefore, it is important to have the basic economically feasible strategy for crop development in nursery practices. If appropriate media is determined for raising Baobab seedling, it will encourage production of the crop in homes to improve the diet of the people and also improve the income of the grower. Therefore this study was to evaluate the influence of growth media on seedling emergence and early growth of Baobab (*Adansonia digitata*) in Anyigba, Kogi State.

In Africa, sawdust is popular and readily available, especially in forested areas such as Nigeria and other tropics. Sawdust is affordable compared to imported growing media, and it is suitable for use as a growing medium. Researchers have reported the favorable effect that organic growing media have on plant growth, as it increased the porosity and water retention of the growing medium. Organic growing media (sawdust and coir) did not have a significant effect on tomato yield. Positive physical properties such as biogradability at an acceptable rate, low superficial specific gravity, high porosity, high water retention, moderate drainage and high bacterial tolerance elevated the usage of sawdust as a plant growth medium in manufacturing industries. Despite the fact that sawdust has been commercially used for many years, data is lacking that describes whether sawdust is suitable for tomato production as a growth substrate.

In Africa, sawdust is popular and readily available, especially in forested areas such as Nigeria and other tropics. Sawdust is affordable compared to imported growing media, and it is suitable for use as a growing medium. Researchers have reported the favorable effect that organic growing media have on plant growth, as it increased the porosity and water retention of the growing medium. Organic growing media (sawdust and coir) did not have a significant effect on tomato yield. Positive physical properties such as biogradability at an acceptable rate, low superficial specific gravity, high porosity, high water retention, moderate drainage and high bacterial tolerance elevated the usage of sawdust as a plant growth medium in manufacturing industries. Despite the fact that sawdust has been commercially used for many years, data is lacking that describes whether sawdust is suitable for tomato production as a growth substrat.

Materials and Methods

Experimental Site

The experiment was carried out at Prince Abubakar Audu University Student Research and Demonstration Farm, Anyigba, which is in the Southern Guinea Savannah agro-ecological zone in Nigeria latitude $7^0$29N and longitude $7^0$11E Kogi State.

Treatment and Experimental Design

The experiment was laid out in a completely randomized design (CRD) with five replicates. The nursery media included topsoil (TS), poultry manure (PM), rice husk (RH), sawdust (SD) and oil palm bunch residue (OPBR). The treatment combinations included TS 100%, TS + PM + OPBR (2:1:3), TS + PM + OPBR + RH + SD (1:1:1:1:1), TS + PM + RH (2:1:3), TS + PM + SD (2:1:3),

Data collection and Analysis

Days to first emergence: It was determined by counting the number of days from planting to when the tender shoot protruded out of the media and the average recorded
Emergence percentage (E %), emergence index (EI) and emergence rate index (ERI). These were calculated based on formulae adopted by Fakorede and Ojo [14] as follows:

$$E\% = \frac{No\ of\ Seedlings\ emerged}{Total\ number\ of\ seeds\ planted} X\ 100$$

$$\frac{No\ of\ Seedlings\ emerged}{Total\ number\ of\ seeds\ planted} X\ 100$$

$$EI = \frac{\sum (Number\ emerged)\,(DAP)}{Total\ seedlings\ emerged} \frac{\sum (Number\ emerged)\,(DAP)}{Total\ seedlings\ emerged}$$

$$ERI = \frac{EI}{E\%\ (in\ decimal)} \quad \frac{EI}{E\%\ (in\ decimal)}$$

Plant Height (cm): Plant height (cm) was measured using a meter ruler from the soil level to the terminal bud.
Number of Branches per plant: The number of branches was measured quantitatively by counting.
Number of leaves per plant: The number of leaves was measured quantitatively by counting.
Stem girth (cm): Stem girth (cm) was measured at about 2.5 cm above the soil level using a calibrated digital caliper (0-150 cm).

Statistical Analysis

The data were collated and subjected to analysis of variance (ANOVA). Significantly different means was separated using fishers least significant difference test (F-LSD) at 5% level of probability.

Result and Discussion

Figure 1 shows the pattern of seedling emergence, percent seedling emergence, emergence index and emergence rate index as affected by nursery media. The least number of days to first seedling emergence, highest percent emergence rate and highest emergence index was attribute to media TS+PM+RH. Media TS+PM+OPBR+SD+RH had the highest emergence index rate. Longest days to first seedling emergence were obtained in sole topsoil. Seeds in TS+PM+OPBR+SD+RH gave the least percent emergence and emergence index while media TS+PM+RH gave the least emergence rate index. The superior performance of the media TS+PM+RH in enhancing seedling emergence as reported herein agrees with the results obtained by Baiyeri [15] in the weaning of banana/plantain plantlets where the rice hull based media were better than the saw dust based ones. The findings in this present work conforms with the results of Ugese [16] who found that rice hull based media enhanced seedling emergence in *Tamarindus indica.*

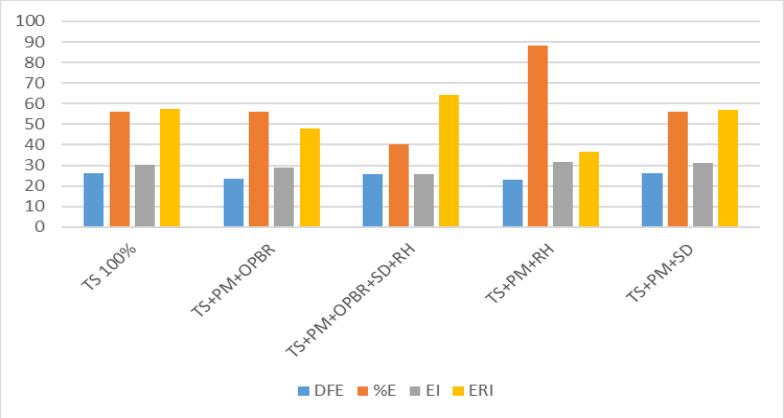

Figure 1: Days to first emergence (DFE), percent emergence (%E), emergence index (EI) and emergence rate index (ERI) of *Adansonia digitata* as influenced by nursery media. Vertical bar indicates LSD 0.05 value.

Media	Plant height (cm) in weeks after planting				
	4	6	8	10	12
TS 100%	16.00	29.70	34.30	47.70	60.00
TS+PM+OPBR(2:1:3)	26.00	36.00	51.30	67.00	83.00
TS+PM+OPBR+SD+RH(1:1:1:1:1)	19.30	35.70	49.30	61.30	76.00
TS+PM+RH(2:1:3)	13.00	14.00	25.00	32.70	38.70
TS+PM+SD(2:1:3)	12.30	24.30	38.70	52.30	66.70

Table 1: Effect of nursery media on plant height (cm) of Baobab (*Adansonia digitata*) in weeks after planting.
TS 100%, (Top Soil),
TS + PM + OPBR (Top Soil + Poultry Manure + oil palm bunch residue),
TS + PM + OPBR + RH (Top Soil + Poultry Manure + Oil palm bunch residue + Rice Husk),
TS + PM + RH (Top Soil + Poultry Manure + Rice Husk),
TS + PM + SD (Top Soil + Poultry Manure + Sawdust).

Plant height varied with the growth media as presented in Table 1. Media TS + PM + OPBR had the tallest plant throughout the sampling period with 26.00, 36.00, 51.30, 67.00 83.00 and 52.66 cm at 4, 6, 8, 10 and 12 weeks after planting (WAP), respectively. The shortest plant was obtained from media TS + PM + SD at 4 WAP with 12.30 cm while media TS + PM + RH had the least mean values (14.00, 25.00, 32.70 and 38.70 cm) at 6, 8, 10, and 12 WAP, respectively. For the total mean value, media TS + PM + OPBR had the highest of 52.66 cm, while the least was obtained from plants grown in TS + PM + RH with mean value of 24.68 cm. The use of media with sufficient essential nutrients is important for seedlings to attain maximum height [17]. The TS + PM + OPBR (Topsoil + Poultry manure + Oil palm bunch residue) medium increased plant height (Table 1) because the addition poultry manure and oil palm bunch residue increased the organic matter and nitrogen which improved plant height. The compost in the mixture could also have improved aeration and the water holding capacity Osaigbovo and Orhue [10] which enhanced plant height. Our results are consistent with other studies conducted elsewhere using different plants which recorded tall plants in mixtures of soils combined with organic manures such as farm yard manure [18].

Media	Number of leaves in weeks after planting				
	4	6	8	10	12
TS 100%	14.70	19.30	24.70	30.30	37.00
TS+PM+OPBR(2:1:3)	20.30	32.00	43.00	81.30	122.70
TS+PM+OPBR+SD+RH(1:1:1:1:1)	14.70	23.30	41.00	62.30	82.00
TS+PM+RH(2:1:3)	9.00	10.00	12.30	15.00	28.70
TS+PM+SD(2:1:3)	8.70	13.70	23.70	37.00	52.30

Table 2: Effect of nursery media on number of leaves of Baobab (*Adansonia digitata*) in weeks after planting.
TS 100%, (Top Soil),
TS + PM + OPBR (Top Soil + Poultry Manure + oil palm bunch residue),
TS + PM + OPBR + RH (Top Soil + Poultry Manure + Oil palm bunch residue + Rice Husk),
TS + PM + RH (Top Soil + Poultry Manure + Rice Husk),
TS + PM + SD (Top Soil + Poultry Manure + Sawdust).

Results presented in Table 2 indicated that number of leaves across treatments was affected by growth media. Media TS + PM + OPBR had more number of leaves throughout the sampling period with 20.30, 32.00, 43.00, 81.30 and 122.70 at 4, 6, 8, 10 and 12 WAP, respectively. The least number of leaves was obtained from TS + PM + SD at 4 WAP with 8.70. However, TS + PM + RH had the least at 6, 8, 10, and 12 WAP with respective values of 10.00, 12.30, 15.00 and 28.70. For the total mean value, media TS + PM + OPBR had the highest with 59.86, while the least mean value was obtained from media TS + PM + RH (15.00). The high number of leaves in the TS + PM + OPBR (Top Soil + Poultry Manure + oil palm bunch residue) could be due to higher production of photosynthesizing functional leaves Borah [19] enhanced by a well-balanced media with sufficient organic matter (Table 2 and 3).

Media	Number of branches in weeks after planting		
	8	10	12
TS 100%	2.67	8.30	10.00
TS+PM+OPBR(2:1:3)	9.00	16.30	25.00
TS+PM+OPBR+SD+RH(1:1:1:1:1)	8.00	14.30	22.00
TS+PM+RH(2:1:3)	2.33	2.70	6.70
TS+PM+SD(2:1:3)	2.33	7.30	12.00

Table 3: Effect of nursery media on number of branches of Baobab (*Adansonia digitata*) in weeks after planting.
TS 100%, (Top Soil),
TS + PM + OPBR (Top Soil + Poultry Manure + oil palm bunch residue),
TS + PM + OPBR + RH (Top Soil + Poultry Manure + Oil palm bunch residue + Rice Husk),
TS + PM + RH (Top Soil + Poultry Manure + Rice Husk),
TS + PM + SD (Top Soil + Poultry Manure + Sawdust).

This result is consistent with results from other experiments, which collectively found that using soil mixtures with organic substrates such as leaf manure Riaz [20] and farmyard manure enhanced the number of leaves [21]. Organic matter in potting mixtures regulates water and nutrient availability Peter-Onoh [22] and enhances seedling production Baiyeri [23] and the compost in our mixture may have released nutrients for seedling growth in addition to improving the water holding capacity.

Results presented in Table 3 showed that number of branches of Baobab was positively affected by growth media. Media TS + PM + OPBR had the highest number of branches throughout the sampling period with mean value of 9.00, 16.30, and 25.00 at 8, 10 and 12 WAP, respectively. The least number of branches was obtained in TS + PM + RH with mean value of 2.33, 2.70 and 6.70 at 8, 10 and 12 WAP. For the total mean value, plants that grew in media TS + PM + OPBR had more number of leaves (16.77), while the least was obtained from TS + PM + RH with mean value of 3.91. This result is consistent with results from other experiments. Collectively found that using soil mixtures with organic substrates such as leaf manure Riaz [20] and farmyard manure enhanced the number of branches [21]. A balanced growth medium that contains an adequate supply of nutrients is critical if seedlings raised in a tree nursery are to develop and attain maximum growth [24].

Media	Stem Girth (cm) in weeks after planting				
	4	6	8	10	12
TS 100%	2.53	2.77	2.87	3.50	4.17
TS+PM+OPBR(2:1:3)	2.20	3.37	4.00	6.07	7.17
TS+PM+OPBR+SD+RH(1:1:1:1:1)	2.53	3.30	3.90	5.60	6.43
TS+PM+RH(2:1:3)	1.70	1.73	2.03	2.23	2.53
TS+PM+SD(2:1:3)	1.97	2.70	3.03	4.87	5.17

Table 4: Effect of nursery media on stem girth (cm) of Baobab (*Adansonia digitata*) in weeks after planting.
TS 100%, (Top Soil),
TS + PM + OPBR (Top Soil + Poultry Manure + oil palm bunch residue),
TS + PM + OPBR + RH (Top Soil + Poultry Manure + Oil palm bunch residue + Rice Husk),
TS + PM + RH (Top Soil + Poultry Manure + Rice Husk),
TS + PM + SD (Top Soil + Poultry Manure + Sawdust).

Stem girth (cm) of Baobab was positively influenced by growth media as shown in Table 4. Sole topsoil (100%) and TS + PM + OPBR + RH had the widest stem girth with mean value of 2.53 cm at 4 WAP. Media TS + PM + OPBR gave the broadest stem at 6, 8, 10 and 12 with respective values of 3.77, 4.00, 6.07 and 7.17 cm. However, the tiniest stem girth was obtained from media TS + PM + RH with mean value of 1.70, 1.73, 2.03 2.23 and 2.53 cm at 4, 6, 8, 10 and 12WAP, respectively. Media TS + PM + OPBR the highest mean value of 4.56 cm, while the least was recorded in TS + PM + RH. Planting media has large effect on the plant growth characteristics [20]. *Adansonia digitata* seedling stem girth was positively affected by growth media (Table 4). The stem girth in the plants grown in TS + PM + OPBR increased as a result of the slow release of nutrients to the plants [25], thereby enhancing seedling development. Substrates used in this media has shown to improve the performance of a wide range of plants Peter-Onoh [22] because of enhanced nutrients supply Grigatti [26] which was probably the case with the TS + PM + OPBR (Table 4). The presence of compost in potting media has also been shown to suppress soil-borne plant pathogens [27], enhance microbial activity and mycorrhiza colony formation Cavender [28] and hence improve the plant growth.

Conclusion and Recommendations

It was evident that media TS+PM+RH enhanced seedling emergence. From the results, it was established that the media TS + PM + OPBR improved all the growth parameters. Based on the results, TS+PM+RH and TS + PM + OPBR are the most suitable medium for seedling emergence and early growth of *A. digitata*. It is recommended that the experiment be repeated and run for two growing seasons.

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