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GROWTH PERFORMANCE OF *ALLANBLACKIA FLORIBUNDA* OLIV SEEDLINGS IN VARIOUS NURSERY GROWTH MEDIA IN NIGERIA

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ABSTRACT

The growth performance of *Allanblackia floribunda* oliv seedlings in various nursery growth media was studied. Six nursery growth media were prepared in 1:1 ratio as follows: (1) washed river sand +forest topsoil (SdTsST1) (2) Washed river sand +heat sterilized decomposed sawdust (SdSwST1) (3)heat sterilized decomposed sawdust + top forest soil (SwTsST1) (4) Washed river sand + forest topsoil + heat sterilized decomposed sawdust(SdTsSwST1) (5) heat sterilized decomposed sawdust only (SwST1) (6) forest topsoil only (TsST1). Polythene containers (16cm x 14cm) were filled with each of the growth media. One predecoated seedling (ST1) was pricked into each container and there were five seedlings for each growth medium replicated three times. Observation was for 24 weeks. The highest seedling height ($6.7\text{cm} \pm 0.65\text{cm}$), diameter at collar ($2.53 \pm 0.5\text{mm}$), number of leaves (6.0 ± 0.9) and leaf area ($54.3 \pm 4.5\text{cm}^2$) were observed in growth media containing a mixture of washed river sand, forest topsoil and sterilized decomposed sawdust. Growth media containing these three items are recommended as appropriate growth media for *Allanblackia floribunda* seedlings in the nursery, in Nigeria.

Key Words: *Allanblackia floribunda*; seedlings, nursery growth media

INTRODUCTION

Natural forest regeneration relies absolutely on successful establishment of seedlings from seeds dispersed from fruiting mother trees in the forest. Similarly, artificial forest regeneration relies on nursery - raised seedlings of the preferred tree species. A common feature is that the seedlings must be healthy and vigorous in growth to be able to establish in the plantation microenvironment (Nwoboshi 1982). In any case the growth media besides other factors

appears to be a major contributor to the health and growth vigour of the seedlings (Nwoboshi 1982).

In Nigeria today, tree seedlings are no longer raised on nursery beds. This has been substituted with polythene containers. These containers are filled with various soil mixtures to serve as growth media into which the tree seedlings are pricked as they germinate and in which they grow till they are planted out in the field. Each tree species may have its growth media preference.

Allanblackia floribunda (oliv), known as vegetable tallow tree, is one of the forest species obtained from the wild whose natural regeneration has proved difficult owing to inherent dormancy in seeds of the species. The species is popularly known as 'Icha' in Igbo, 'Orogba-eriri' in Yoruba, 'Ediang' in Efik, 'Obobi-obo' in Ijaw and it belongs to the family Guttiferae (Keay, 1989). Apart from seed dormancy, the seedlings have slow growth and may be easily suppressed by weeds and this may also contribute to the very low density of the species in the forest. The tree is an under-utilized, multi-purpose, media-sized tree of humid forest zone of Africa, producing berry-like fruits that are suspended on long pedicles with recalcitrant seeds (Atangana, 2010).

A floribunda is mostly recognized for the edible oil from the seeds which is useful for the manufacture of some industrial products such as margarine, chocolates and soap, to mention a few. Manufacturing and other food industries have found the oil very attractive and are exploring the possibility for the sustainable management of the species in order to sustain the food processing industry in Nigeria. Apart from the edible oil from the species, it is also highly valued for its wide range of uses including medicinal uses. Ayoola et al, (2009) highlighted that all the parts of the plant are useful for various purposes including poultry, livestock and fish feeds. The species will provide an alternative source of income to farmers if sustainably managed in a plantation.

Nuga (2012) successfully germinated *A.floribunda* by mechanical scarification pre-germination treatment given that other nursery micro-environmental factors are provided. What appears to be a critical factor in the production of healthy and vigorous seedlings for a plantation establishment is the nursery growth media. Moreso, the seedlings are to be raised in polythene containers and determination of a proper growth media that will sustain the seedlings for at least one year appears to be the relevant factor to investigate.

MATERIALS AND METHODS

Six different growth media were prepared. These were:

- (1) Mixture of washed river sand and forest topsoil (1:1)- SdTs
- (2) Mixture of washed river sand and heat sterilized decomposed sawdust (1:1)-SdSw
- (3) Mixture of heat sterilized decomposed sawdust and forest topsoil (1:1)-SwTs
- (4) Mixture of washed river sand, forest topsoil and heat sterilized decomposed sawdust (1:1:1) SdTsSw
- (5) Heat sterilized decomposed sawdust only- Sw
- (6) Forest topsoil only –Ts

Each mixture was prepared using a ratio of 1:1 for each constituent. Each treatment was replicated three (3) times and all were arranged in a completely randomized design in the nursery. A *floribunda* seeds with the testa completely removed (ST1) were sown in germination trays at forestry research institute of Nigeria (FRIN) nursery, Onne, Rivers State in accordance with Nuga (2012). As the plumule emerged and produced the first pair of

leaves in the nursery germination medium, five vigorously growing seedlings were pricked into medium sized polythene containers (16cm x 14cm x 14cm) filled with each growth medium. The transplanted seedlings were kept under the nursery weaning shed. The following growth parameters were assessed weekly:

- (1) diameter at the collar,
- (2) seedling height
- (3) number of leaves and
- (4) Leaf area.

The leaf area of each seedling was determined by the leaf length multiplied by maximum leaf width correlation method (Gunasena and Gunasena, 2011).

The forest topsoil and decomposed sawdust were analyzed for physicochemical properties and elemental contents respectively. The forest soil topsoil particles sizes were determined by the hydrometer method as described by Gee and Bauder (1986). Soil pH was determined in a 1:2.5 soil/water suspension. The soil organic carbon was determined using the Walkley and Black method described by Wilde et al (1972). Exchangeable cations and the cation exchange capacity (CEC) were also determined. The element analysis of the decomposed sawdust was done using the digestion method. According to Prota (2010), a prerequisite for the seedling survival and establishment is that growth medium should be inoculated with soil from under a mature tree. This is because *A. floribunda* appears to survive and grow in a mycorrhizal system and so all the growth media were accordingly inoculated.

RESULTS

The Seedling cumulative height growth trends are shown in fig. 1.

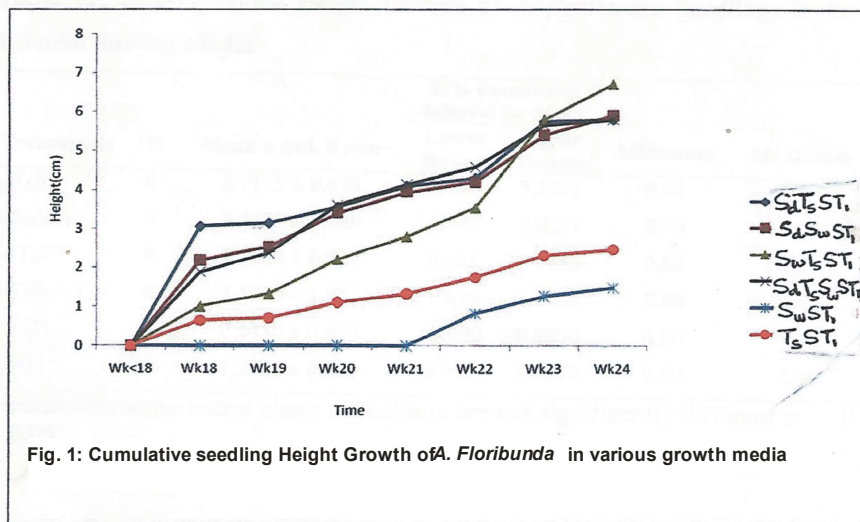


Fig. 1: Cumulative seedling Height Growth of *A. floribunda* in various growth media

KEY:

- Mixture of washed river sand and forest topsoil (1:1) - S_dT_sST₁
- Mixture of washed river sand and boiled decomposed sawdust (1:1) - S_dS_wST₁
- Mixture of boiled decomposed sawdust and forest topsoil (1:1) - S_wT_sST₁
- Mixture of washed river sand, forest topsoil and boiled decomposed sawdust (1:1:1) - S_dT_sS_wST₁
- Boiled decomposed sawdust only - S_wST₁

The results showed at the end of the study that seedlings in the growth medium SwTsST1 were the tallest with cumulative mean height of 6.70cm. The analysis of variance result was significant at $p \leq 0.01$. The result also showed that a mixture of heat sterilized decomposed sawdust and forest topsoil (SwTsST1) appear to provide the necessary nutrient for vigorous seedlings height growth in the nursery (Table 1).

Table 1: Physical and chemical properties of forest topsoil used (0-15cm depth)

Properties	unit	level
Ph(H2O)	-	6.6
Ph(Kcl)	-	5.9
Ca	Cmol/kg	1.40
Mg	Cmol/kg	0.04
Na	Cmol/kg	0.34
K	Cmol/kg	0.12
Exchangeable acidity	Cmol/kg	0.80
Cation Exchange Capacity (CEC)	Cmol/kg	230
Available phosphorus	Mg/Kg	29.91
Base Saturation	%	70.37
Organic carbon	g/kg	19.7
Total Nitrogen	g/kg	4.8
Mn	Mg/kg	5.80
Fe	Mg/kg	46.8
Cu	Mg/kg	1.77
Zn	Mg/kg	4.56
Sand	g/kg	858
Silt	g/kg	35
Clay	g/kg	107

Table 2: Nutrient composition of sawdust

Nutrient	Level (%)
C	23.28
N	1.41
P	0.03
Ca	0.16
Mg	0.06
Na	0.002
K	0.006
Mn	0.002
Fe	0.0018
Cu	0.002
Zn	0.004

DIAMETER AT COLLAR INCREMENT

The diameter increments of the seedlings were observed to be highest in seedlings growing in the SdSwST1 growth medium with mean diameter $3.03 \text{ mm} \pm 0.50 \text{ mm}$ and SdT_sST₁, with mean diameter of $3.03 \pm 0.50 \text{ mm}$.

Figure 2: Shows the diameter at collar growth trend

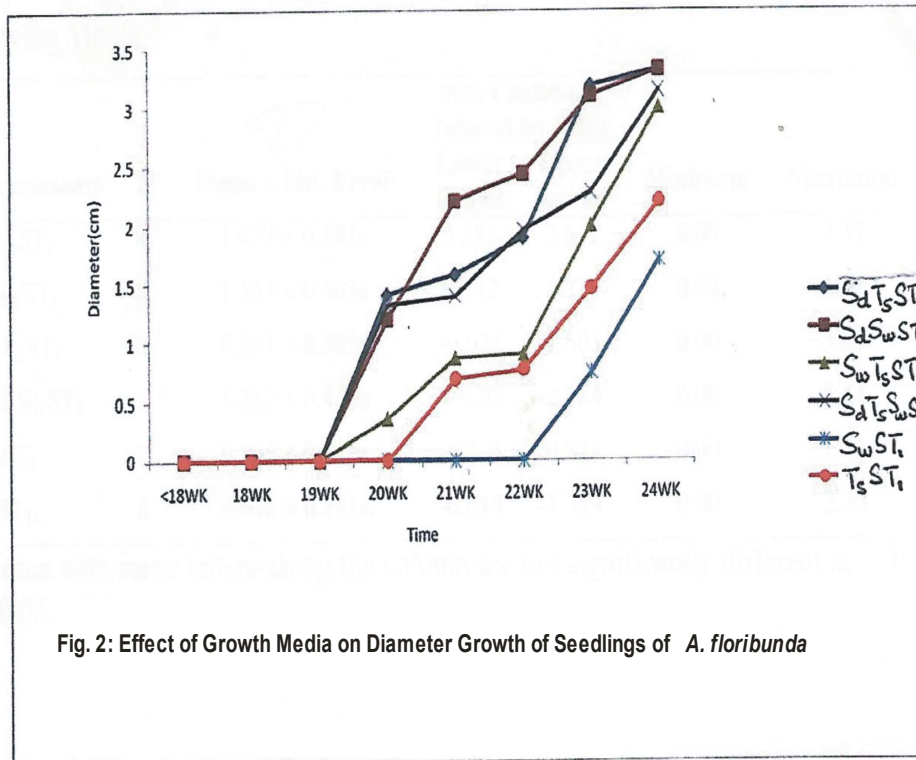


Fig. 2: Effect of Growth Media on Diameter Growth of Seedlings of *A. floribunda*

KEY:

- Mixture of washed river sand and forest topsoil (1:1) - S_dT_sST₁
- Mixture of washed river sand and boiled decomposed sawdust (1:1) - S_dS_wST₁
- Mixture of boiled decomposed sawdust and forest topsoil (1:1) - S_wT_sST₁
- Mixture of washed river sand, forest topsoil and boiled decomposed sawdust (1:1:1) - S_dT_sS_wST₁
- Boiled decomposed sawdust only - S_wST₁
- Forest topsoil only - T_sST₁

LEAF PRODUCTION

The leaf production trends in the various growth media are shown in fig. 3. Except TsST1 alone and SwST1 alone that recorded low number of leaves within the observation periods the rest of the growth media showed some promise.

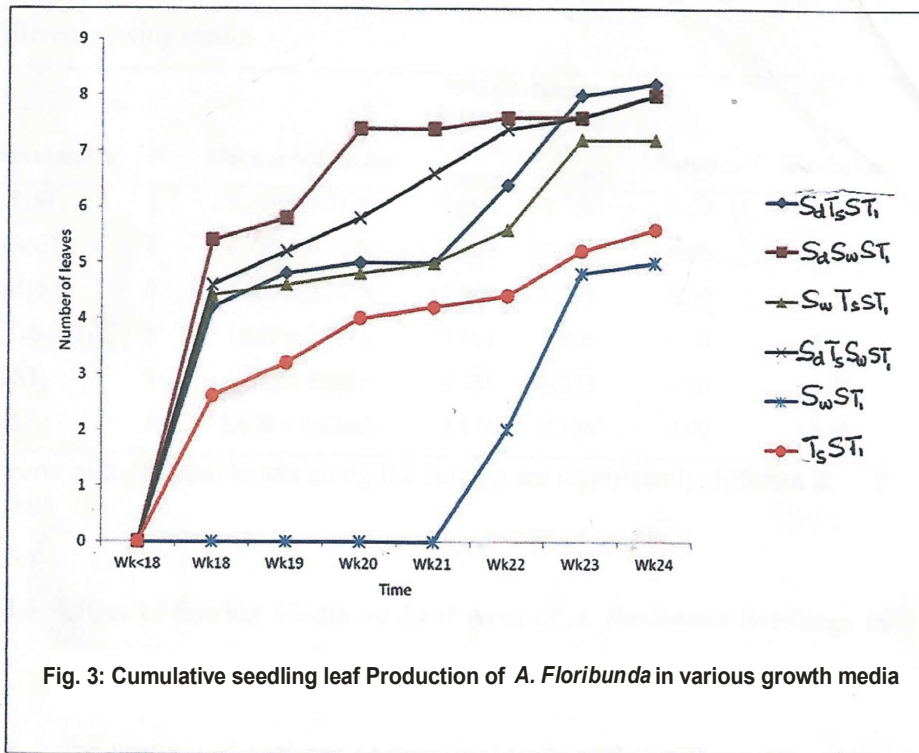


Fig. 3: Cumulative seedling leaf Production of *A. Floribunda* in various growth media

KEY:

- Mixture of washed river sand and forest topsoil (1:1) - SdTsST1
- Mixture of washed river sand and boiled decomposed sawdust (1:1) - SdSwST1
- Mixture of boiled decomposed sawdust and forest topsoil (1:1) - SwTsST1
- Mixture of washed river sand, forest topsoil and boiled decomposed sawdust (1:1:1) - SdTsSwST1
- Boiled decomposed sawdust only - SwST1
- Forest topsoil only - TsST1

However, growth media SdTsST1, SdSwST1, SdTsSwST1, and STST, showed good vigour and promise in leaf production. The analysis of variance of the results was significant at $P < 0.05$. A common factor in the growth media in which the seedlings produced more leaves was washed river sand which appear to have provided good drainage.

Leaf Area:

The results presented in Table 3 show the growth medium effect on the leaf area of *Allanblackia floribunda*.

Table 3: Mean leaf Area of *Allanblackia floribunda* seedlings in various growth media

Treatment	mean ± (95% confidence limit (cm ²))
SdTsST1	16.008±3.734a
SdSwST1	26.055±3.244ab

SwTsST1	34.957±7.002b
SdTsSwST1	37.902±6.749b
SwST1	54.345±4.507c
TsST1	26.194± 6.358a

Means with different letters along the column are significantly different at $P \leq 0.05$

As the results showed the growth medium SwST1 had highest leaf area with mean of $54.3 \pm 4.5 \text{ cm}^2$ although leaf areas in other growth media were quite encouraging. Considering the physicochemical properties of the forest topsoil and decomposed sawdust (Tables 1a and 1b) it is pertinent to observe that the high organic carbon content of the decomposed sawdust could be responsible for the good leaf area. The analysis of variance of the result was significant at $P \leq 0.05$. The LSD (least significant difference) results also informed that growth media containing sawdust (Sw) produced promising leaf area.

DISCUSSION

Poor natural seed germination of *Allanblackia floribunda* had been attributed to seed dormancy (Nuga 2012). However by total seed coat removal mechanical pregermination treatment Ekeke and Nuga (2016) obtained 50% germination of pretreated seeds. Germination started 2 weeks after sowing and completed in 24 weeks after sowing. This is by far an improvement on the germination of *Allanblackia stuhlmannii* which took 12 weeks (3 months) to start germinating and 18 months to complete germination (PROTA, 2010).

A standard *Allanblackia floribunda* mature fruit contains about 50 seeds and a fruiting mother tree bears many fruits for most seasons (Keay 1989). With at least 50% germination of all mature seeds produced by a tree in the year there should be good stocking density of the species in the forest but the stocking density of the species in Nigeria as observed by the author is 0 to 1 stem per hectare.

Nwoboshi (1982) observed that the most critical stage of tropical tree seedlings is the establishment phase of when initial losses of seedlings are heavy due to competition in the growth environment. Tropical seedlings are slow growing as observed by Nwoboshi (1982), Ehiagbonare and Onyibe (2008). Results of this study indicated that the growth soil medium contributes a lot towards the vigour and competitive height growth of the slow growing *Allanblackia floribunda*.

Leaf area is important in the photosynthesis of dry matter in trees. So decomposed sawdust should be an important component of nursery growth medium for proper development of the seedling leaves.

Generally results of this study confirmed the overriding necessity for seedling development after seed germination. Seedling health and vigour ensure successful plantation establishment. For raising *Allanblackia floribunda* seedlings in nursery polythene containers a growth medium that includes decomposed sawdust, forest topsoil and washed river sand in 1:1:1 mixture produces healthy and vigorous seedlings.

CONCLUSION

Results of this study indicated that the growth medium of *Allanblackia floribunda* seedlings in the nursery as an important element for the production of vigorous healthy seedlings capable of withstanding the initial post-planting adverse condition in the field, should be carefully composed to ensure successful establishment of a plantation of species. Containerized post-germination growth medium for *Allanblackia floribunda* therefore should include forest topsoil, decomposed sawdust and washed river sand.

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