

Germination and Growth response of *Tetrapleura tetraptera* (Shum and Thonn) Taub to Different Growth media.

Respuesta de germinación y crecimiento de *Tetrapleura tetraptera* (Shum y Thonn) Taub a diferentes medios de crecimiento.

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ABSTRACT

This study investigated the effect of growth media on the germination and early growth of *Tetrapleura tetraptera* (Shum and Thonn). This was assessed at the Forestry Nursery Federal University of Agriculture Makurdi, Benue State, Nigeria. Two hundred viable seeds were immersed in 50% sulphuric acid for 15mins. The seeds after pretreated were sown in five different media namely: Topsoil, sawdust, river sand, a mixture of topsoil and riversand and a mixture of riversand and sawdust. Completely Randomized Design (CRD) was adopted for this experiment. Data were collected on percentage germination on daily basis for 4 weeks. Growth parameters involving seedling height, number of leaves, girth and leaf length at 2 weeks interval for 8 weeks were also recorded. Analysis of Variance (ANOVA) was used to analyze the data collected. Mean separation was carried out to test for significant different among parameter using Duncan's Multiple Range Test (DMRT) to determine the suitable growth media. The result showed that germination percentage was significant as 5% level of probability ($p > 0.05$) and the highest germination percentage of 80% was recorded in riversand+sawdust. The highest number of leaves was observed in topsoil (10.05), seedling height (7.88cm) in riversand and sawdust, girth (0.57cm) in topsoil and leaf length (4.71cm) in sawdust. In raising the seeds of *Tetrapleura tetraptera*, riversand and sawdust should be used. To encourage domestication and conservation of *Tetrapleura tetraptera*, topsoil, mixture of riversand and sawdust should be adopted, this will ensure the production of vigorous seedlings for plantation establishment.

Keywords: Growth media, domestication, germination, *Tetrapleura tetraptera*

RESUMEN

Este estudio investigó el efecto de los medios de crecimiento sobre la germinación y el crecimiento temprano de *Tetrapleura tetraptera* (Shum y Thonn). Esto fue evaluado en el vivero forestal Universidad Federal de Agricultura de Makurdi, estado de Benue, Nigeria. Doscientas semillas viables se sumergieron en ácido sulfúrico al 50% durante 15 minutos. Las semillas después del tratamiento previo se sembraron en cinco medios diferentes, a saber: tierra vegetal, aserrín, arena de río, una mezcla de tierra vegetal y ríos y una mezcla de ríos y aserrín. Se adoptó un diseño completamente al azar (CRD) para este experimento. Los datos se recolectaron en porcentaje de germinación diariamente durante 4 semanas. También se registraron los parámetros de crecimiento que implican la altura de la plántula, el número de hojas, la circunferencia y la longitud de la hoja a intervalos de 2 semanas durante 8 semanas. El análisis de varianza (ANOVA) se utilizó para analizar los datos recopilados. La separación media se llevó a cabo para probar diferencias significativas entre los parámetros usando la Prueba de Rango Múltiple de Duncan (DMRT) para determinar los medios de crecimiento adecuados. El resultado mostró que el porcentaje de germinación fue significativo como un nivel de probabilidad del 5% ($p > 0.05$) y el porcentaje de germinación más alto del 80% se registró en ríos y aserrín. El mayor número de hojas se observó en la capa superior del suelo (10.05), altura de la plántula (7.88cm) en ríos y aserrín, circunferencia (0.57cm) en la capa superior del suelo y longitud de la hoja (4.71cm) en el aserrín. Al cultivar las semillas de *Tetrapleura tetraptera*, se deben usar ríos y aserrín. Para fomentar la domesticación y la conservación de *Tetrapleura tetraptera*, se debe adoptar tierra vegetal, mezcla de ríos y aserrín, esto asegurará la producción de plántulas vigorosas para el establecimiento de plantaciones.

Palabras clave: Medios de crecimiento, domesticación, germinación, *Tetrapleura tetraptera*

INTRODUCTION

In many developing countries, indigenous tree species are very important in human diets, income generation and traditional medicine. Nigeria indeed is rich in biodiversity with potential edible plant yet to be experimented. This often times was revealed by nature users who are well endowed with knowledge about the traditional and medicinal uses of some of these plants.

Tetrapleura tetraptera belong to the family Mimosaceae. It is commonly known as Aridan (fruit). It is a single stemmed, robust, perennial tree of about 30m (Aladesanmi, 2007; Odesanmi *et al.*, 2010). It has a grey/brown, smooth/rough bark with glabrous round branchlets. The flower is yellow/pink, the fruit has dark brown, four-winged pods 12–25 x 3.5–6.5cm. It is generally found in the lowland forest of tropical Africa. The plant *Tetrapleura tetraptera* (locally known as *Prekese*) is used as a spice, a medicine and as a dietary supplement

rich in vitamins (Cangao, 2011; Abugri and Pritchett, 2013). The fruit shell, fruit pulp and the seed of *Tetrapleura tetraptera* contain varying amounts of nutrients, such as protein, lipids and minerals, which are comparable with some popular spices, such as red pepper, onion, curry and ginger. So, it is used as spice to replace imported spices in meat products which may not affect consumer acceptance (Akin-Idowu *et al.*, 2011; Abugri and Pritchett, 2013).

The plant is commonly known in Nigeria as Aridan (Yoruba), Ighimiaka (Edo), Uhiokrihio (Igbo), Apapa (Ijaw), Dawo (Hausa) and Ikyho (Tiv). The fruit consists of a fleshy pulp with small, brownish-black seeds. The fruit possesses a fragrance, characteristically pungent aromatic odour, which is attributed to its insect repellent property. The fruit is used to prepare soup for nursing mothers from the first-day birth to prevent post partum contraction (Enwere, 1998). It is one of the molluscidal medicinal plants of Nigeria, also useful in the management of convulsions, leprosy, inflammation and/or rheumatoid pains. It has the properties of Emulsifying—birth control, food value and also the control of intestinal parasite. When put into vapour bath, the bark is used against rheumatism and fever and the root is used for the treatment of gastrointestinal clinical problem (Aladesanmi, 2007). It is also valued in timber as fairly hardwood (Orwa *et al.*, 2009).

T. tetraptera regenerate from seeds and dormancy of this species is due to the hard seed coat. Seed that exhibits dormancy can be eliminated by seed pretreatment which includes chemical, heat treatment, abrading or piecing the seed coat etc. which allow imbibition and germination to proceed. Potting media is one of the most important factors required for the survival and production of containerized seedlings because it is not only the growing place for seedlings. It also provides them with moisture and mineral nutrients (Kiran *et al.*, 2007; Indriyani *et al.*, 2011). A suitable potting media used in containerized seedlings should anchor or support them, provides nutrient and water and allow the diffusion of oxygen to the roots (Abad *et al.*, 2002). The potting media or mixture of soil having nutritional status influence seed germination, seedling quality (Wilson *et al.*, 2001; Agbo and Omaliko, 2006) and their subsequent survival as well as performance in the field.

In spite of the numerous value of *Tetrapleura tetraptera*, the population of the plant is declining at an alarming rate due to over exploitation (Nya *et al.*, 2000), and absence of sustained conservation measures. Ecological consequence of deforestation has also been reported by many authors as Jimoh, (2005). It has led to the extinction of much wildlife and destruction of some very important plant species such as *Tetrapleura tetraptera* which possess high economic values and which would have helped in restoring the ecological balance of the ecosystem. Therefore, the objective of the study is to ascertain the best growth media on the germination and early growth of *Tetrapleura tetraptera* in order to ensure optimum growth performance of the species.

MATERIALS AND METHODS

Study area: The research work was carried out in the Forestry Nursery of the University of Agriculture Makurdi. The Forestry Nursery, located adjacent to the University water works southcore Makurdi, Benue State Nigeria. It is located within the Guinea Savannah zone between latitude 8° 35"E and 8°41"E and longitudes 7° 45"N and 7° 52"N. The rainfall distribution is bimodal in the area occurring in June and September. Mean annual rainfall is between 1000mm-15000mm. Mean annual temperature is 29°C-30°C, relative humidity is between 60% and 80% but decreases in the early months of the dry season (Ikyaagba, 2008). Some of the species found in the area include; *Daniellia oliverri*, *Vitellaria paradoxa*, *Vitex doniana*, *Burkia africana* and *Khaya senegalensis*.

Seed Collection and Preparation: Eighteen fresh pods were collected in Otukpo main market in Otukpo Local Government of Benue state, of which 15 seeds were extracted from each pod with a sharp cutlass (Fig. 1). This was done carefully to avoid injuring the seed. Two hundred and fifty seeds were subjected to viability test through floatation method, the seeds that floated on water after few minutes of soaking were considered as not viable and were discarded. While the seed that sank in the beaker were collected and regarded as viable and further used for the study. Two hundred viable seeds were subjected to 50% concentration of sulphuric acid for 15 minutes in order to break the dormancy. Thereafter, the seeds were sown into different growth media. They were sown approximately 1cm deep in the polypot, due to the small size of the seed. Two hundred polypots of equal size (21 x 8cm) were filled with different growth media with the use of hand trowel. The filled polypots were arranged in vertical and horizontal rows. The growth media used for the study were: river sand which was obtained from river Benue, decomposed sawdust obtained from Timber Shed Wurukum Makurdi, topsoil sample taken at the depth of 0-10cm from the University of Agriculture Makurdi Research and Teaching farm, mixture of topsoil and river sand and mixture of riversand and sawdust.



Figure 1.

- A. *Tetrapleura tetraptera* pods
- B. *Tetrapleura tetraptera* seeds

Experimental design: The experiment was laid out in Completely Randomized Design (CRD) involving five growth media (topsoil, sawdust, riversand, a mixture of topsoil and riversand and mixture of riversand and sawdust) replicated four times.

Data collection and analysis: Data was collected on germination for 4weeks while the seedling height, number of leaves, and leaf length were collected at 2weeks for interval for 2months. These parameters were measured using meter rule and a veneer caliper. The cumulative data collected were computed and subjected to Analysis of Variance (ANOVA). Mean separation was carried out to test significant different among parameters using Duncan's Multiple Range Test (DMRT) to determine the most suitable growth media for the germination potential and seedling performance of *Tetrapleura tetraptera*.

RESULTS

Germination Percentage of *Tetrapleura tetraptera*: The effect of growth media on germination showed variations. Highest Germination percentage was observed in riversand and sawdust (80%) followed by riversand (70%) while the least was recorded in topsoil (control) (10%) (Figure 2).

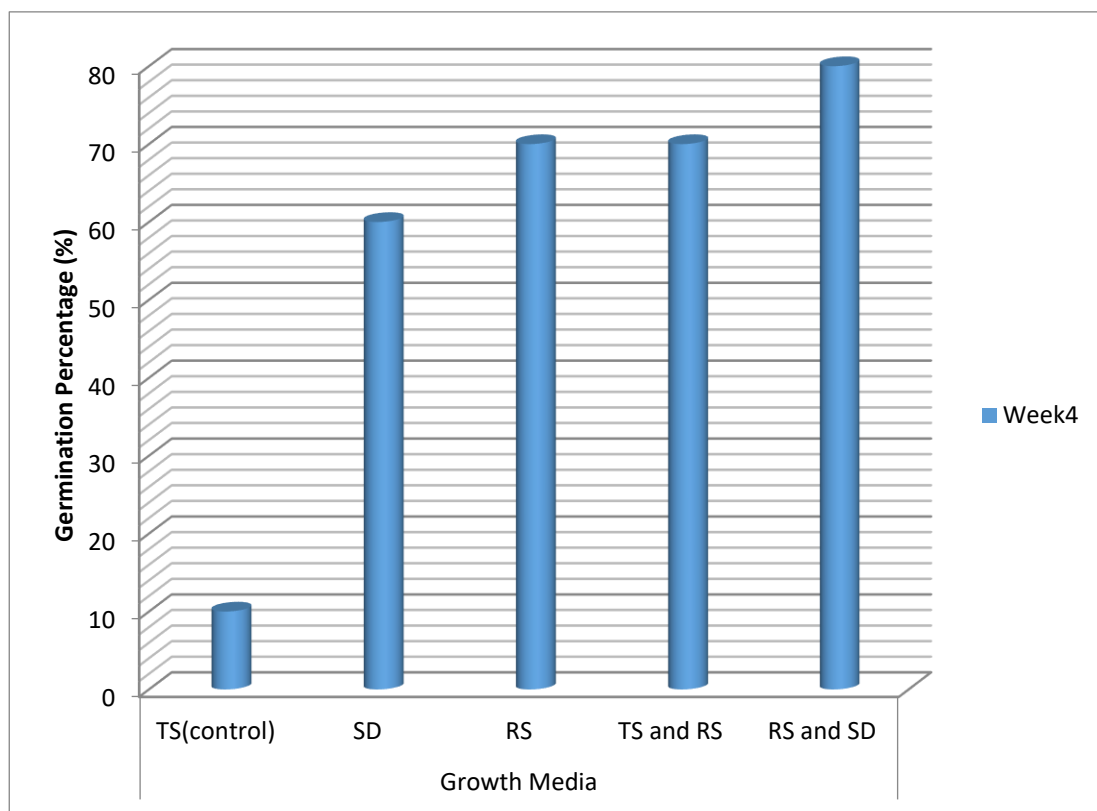
Effect of different growth media on the mean number of leaves, Height, Girth and Leaf length of *Tetrapleura tetraptera* seedlings

Number of leaves: Table 1 shows that the highest mean (10.05) in the number of leaves recorded was in Topsoil (control) and the least (6.83) was recorded in sawdust

Seedling Height: Table 1 shows that the highest mean (7.88cm) seedling height was recorded in riversand and sawdust and the least (4.96cm) was recorded in riversand.

Girth: It was recorded that the highest mean (0.57cm) in seedlings girth was recorded in topsoil (control) and the least (0.20cm) was in riversand.

Leaf length: It was also recorded that the highest mean (4.71cm) increase in leaf length was recorded in sawdust while the least (3.14cm) was in topsoil.



Key: TS=Topsoil, SD=Sawdust, RS=Riversand

Figure 2: Effect of growth media on germination percentage of *Tetrapleura tetraptera* seeds

Table 1. Effect of Different Growth Media on the Number of leaves, Seedling Height, Girth and Leaf length of *Tetrapleura tetraptera* Seedlings

Media	Variables			
	No of leaves	Seedling Height	Girth	Leaf length
Sawdust	6.83 ± 0.47 ^a	7.11±2.41 ^b	0.21±0.06 ^a	4.71±1.62 ^c
River sand	8.21 ± 0.89 ^{ab}	4.96±2.55 ^a	0.20±0.07 ^a	4.07±1.45 ^b
River sand and Sawdust	7.88 ± 0.43 ^{ab}	7.88±2.05 ^b	0.24±0.03 ^a	4.56±1.32 ^{bc}
Topsoil and River sand	7.78 ± 0.53 ^{ab}	6.38±1.46 ^{ab}	0.22±0.04 ^a	4.14±1.59 ^{bc}
Topsoil	10.05 ± 1.60 ^b	6.98±2.79 ^b	0.57±0.78 ^b	3.14±1.82 ^a
P-Value	0.007	<0.000	<0.000	<0.000

Means on the same column with different superscript are statistically significant (p<0.05)

DISCUSSION

Germination Percentage: The highest percentage germination recorded was in riversand and sawdust. This disagrees with the report of Ibe *et al.*, 2015 who observed highest germination percentage in topsoil in *Terminalia ivorensis*. The high percentage germination recorded in riversand and sawdust-might be due to the fact that riversand has better aeration potential and drainage. Similarly, the success could be the nature of sawdust with light weight, warmth, and holds a large amount of air and water which may enhance development of shoot and germination. And also corroborates with the findings of Omokhua *et al.*, (2015) who reported the highest germination responses of *Terminalia ivorensis* in sawdust and disagrees with Okunomo, (2010) who obtained higher germination percentage in top soil with *Persia americana* respectively and agrees with the work of Anber, (2010) who recorded that sand media allowed highest germination in *Delonix regia*.

Growth characteristics: The mean seedling height was significant among the media. The highest seedling height obtained in riversand and sawdust medium agrees with Ekeke (2018) who observed highest seedling in the mixture of riversand and topsoil and sawdust in *Allanblackia floribunda*. This could be due to the fact that materials like sawdust, riversand, rice hull and their mixtures allow seeds to sprout without forming a crust that will deter it from early sprouting. The report disagrees with the work of Usman *et al.*, (2016) who obtained seedling height in topsoil of *Albizia zygia*. The mean leaf length was observed in riversand and sawdust. The highest number of leaves and girth recorded in topsoil media supports the work of Okunlola, (2016) who observed highest number of leaves of grape in topsoil and Ede *et al.*, (2015) who reported the highest girth in topsoil on *Moringa oleifera*. Agboola, (2002) considered the topsoil as the blood life of the plant and possess better water holding capacity than other growing media. The finding disagrees with Peter *et al.*, (2014) who recorded that juvenile growth in topsoil and riversand media for *Monodora myristica*. 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.

As conclusion, the study showed that the germination percentage of *T. tetraptera* improved greatly among the media. The mixture of riversand and sawdust was found to be most effective in *T. tetraptera* seed germination. In terms of growth performance, topsoil gave the best result and so should be adopted in afforestation programmes, forest production as well as ensuring sustainable management.

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