European Journal of Agriculture and Forestry Research
Vol.8, No.3, pp.17-26, July 2020
Published by *ECRTD-UK*
Print ISSN: ISSN 2054-6319 (Print), Online ISSN: ISSN 2054-6327(online)

GROWTH RESPONSE OF *DENNETTIA TRIPETALA* (G. BAKER) TO DIFFERENT ORGANIC MANURE AT THE EARLY STAGE

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ABSTRACT: *Early stage of plants is the major determinant of its growth and yield. This is directly linked to the nature of soil, nutrient availability and climatic conditions the plants were exposed to at its early stage. The experiment was conducted at the screen house of the Department of Forestry and Wildlife, Faculty of Agriculture, Nnamdi Azikiwe University Awka, Anambra State from February to August 2018. The study evaluated the growth response of Dennettia tripetala to different organic manure. Four treatments were used for the experiment and were replicated four times with four seedlings per replicate. The treatments were: T1 (Control; Top soil only), T2 (Mineralized cow dung), T3 (Mineralized pig dung) and T4 (Mineralized fish pond sediment). The experiment was laid in Completely Randomized Design. Parameters assessed includes: Seedling height (cm), Collar diameter (cm) and Number of leaves. Watering was done daily. Results showed that T4 had the best performance in seedling height, and number of leaves with a mean value of 8.966071cm and 3.01 respectively while T3 had the best performance in collar diameter with mean value of 0.226473cm. The least performance was recorded in T2 in number of leaves with mean value of 2.81 while T1 had the least performance in height with mean value of 8.366964cm. However, there were significant differences among the treatments at 5% level of probability in number of leaves and height and Duncan Multiple Range Test was used to separate significant means but collar diameter was not significant. Hence, Dennettia tripetala seedlings thrives excellently in fish pond sediments and should be adopted as the best media for the early establishment of the seedlings to increase its early growth and development.*

KEYWORDS: dennettia tripetala, organic manure, early growth, seedling, potting mixture, growth parameters.

INTRODUCTION

Tropical forest is very rich in species diversity as well a home for variety of microorganisms and wild animals due to the unique micro climate it creates. *Dennettia tripetala* (Baker .F.) is one of the indigenous economic floras of Africa, predominantly

found in West Africa especially in the rainforest zones of Nigeria. Early stage of plants is the major determinant of its growth and yield. This is directly linked to the nature of soil, nutrient availability and climatic conditions the plants were exposed to at its early stage. In other to meet these requirements, the soil are supplemented with different mixtures often known as growth media. A potting mixture is a composition of organic or inorganic materials formulated to achieve a desirable chemical and physical needs required by the crop to attain its potential growth. It provides physical support to the plant, promotes aeration, supplies mineral nutrients and water. A suitable potting media should be well drained with the ability to retain sufficient water to reduce the frequency of watering (Unal, 2013; James and Micheal, 2009). Quality of a growth media used to raise containerized seedlings is a key determinant factor to successful tree planting program (Monenoi *et al.*, 2009). Adding organic manure to potting media is important because it supplies essential nutrients required by seedlings (Khan *et al.*, 2006). Soil organic matter determines the physical, biological and chemical properties of soil (Merino *et al.*, 2004; Grace *et al.*, 2006) and it is important in the productivity of many ecosystems (Hirschel *et al.*, 1997; Kirchmann e *et al.*, 2004). The selection of a proper media component is critical to the successful production of seedlings because it directly affect the development and later maintenance of the extensive functional system (Bhardwaj, 2014; James and Michael, 2009).

LITERATURE

Dennettia tripetala belongs to the family Annonaceae and commonly known as pepper fruit. It is called different names in Nigeria; *nmimi* in Igbo, *ako* in Edo, *umako* in Urhobo, *nkarika* in Efik and *ata igbere* in Yoruba. A highly nutritive and medicinal spicy and condiments used in dishes and delicacies. Pepper fruit is a good antioxidant, high in Vitamins (A, C, E), carbohydrates and protein. Other phytochemical properties of *D. tripetala* include anti-inflammatory, antimicrobic, antihyperglycemic and also used as insect repellant by so many. The leaves are used to treat mild fever with other herbs such as mango leaves (Gill, 1992).The leaves and fruits together with other herbs are used for the treatment of cough, infantile convulsion, vomiting, worm infestation and typhoid (Ejechi and Akpomedaye, 2005; Ukeh *et al.*, 2012). The young stems of this plant are used as chewing stick by patients with fever to improve their appetite (Nwinuka and Nwilo, 2009). The seeds are consumed singly or taken with kolanut, garden egg or palm wine particularly during entertainment of guests (Enwere, 1998; Okwu *et al.*, 2005) and traditional ceremonies such as weddings, festivals and naming ceremonies. *Dennettia tripetala* seeds are applied in diets of pregnant and post-partum women to aid uterine contraction (Okwu and Morah, 2004). The essential oil extracted from the seed has been reported to inhibit the growth of tomato-rot fungi (Ejechi *et al.*, 1999). The oil extracted from the seed has effectively been used for the preservation of grains such as cowpea and maize without negatively affecting their viability (Akinwumi, 2011). The fruits have also been used in the formulation of herbal tablets by direct compression (Onyechi *et al.*, 2013). The important nutritive substances of *Dennettia tripetala* fruits/seeds are minerals,

vitamins and fiber whereas the major phytochemicals are thiamine, riboflavin, niacin and alkaloids (Okwu and Morah, 2004; Okwu *et al.*, 2005).

Despite the apparent economic importance of *D. tripetala* in Nigeria, its existence is being threatened. Increased deforestation, urbanization, over exploitation and other industrial developments are major threat to forest species in Nigeria (Anozie and Oboho, 2019). According to Chukwu *et al.* (2018) forest has become obstacles to infrastructural advancement in the developing countries. Nigerian forests suffer poor management which has resulted to low yield of trees and other products as regards their potentials. The high rate of deforestation and a decline in afforestation of the species has led to annual decrease in establishment and effective management of forest (Rotowa *et al.*, 2020). Thus, resulting to constant erosion and reduction of natural gene pool of important forest tree species including *Dennettia tripetala* (Egharevba and Ikhatua, 2004).

Application of mineral fertilizer continuously on the soils has been found to reduce soil pH, microbial populations and activities, organic matter content, buffering capacity and cation exchange capacity of the soils (Olomilua, *et al.*, 2007). It is necessary therefore to look for another alternative way of improving the soil properties and quality for sustainable plant growth. Organic manures could ameliorate these adverse effects of inorganic fertilizers. It is a reservoir for various essential elements, a source of cation exchange capacity (CEC) and soil buffering, and is a large geochemical reservoir of carbon (Bohn *et al.*, 2001). Indigenously available organic sources of nutrients have enhanced the efficiency and reduced the requirements of chemical fertilizers (Bhat *et al.*, 2007). Although a lot of studies have been carried out on *Dennettia tripetala*, much work has not been done on its response to different organic matter as potting mixtures. Hence, this study was aimed at finding out the growth response of *Dennettia tripetala* to different organic manure at the early stage with a view to ascertaining the best media for promoting its growth and sustainability.

MATERIALS AND METHOD

Study Area Description

This study was carried out in the green house of Department of Forestry and Wildlife Management, Faculty of Agriculture, Nnamdi Azikiwe University Awka, Anambra State. The University is located in the eastern part of Nigeria and lies between latitude $6^0$06'N and $6^0$16'N, longitude $7^0$01'E and $7^0$10'E. The climatic condition of the area is tropically dominated by rainfall pattern ranging from 1828mm-2002mm.

Seed Procurement and Media Preparation

About 100 ripe fruits of *Dennettia tripetala* were procured from Anambra State Ministry of Environment, Forestry Department, Amawbia. The ripe fruits were depulped and the seeds extracted, washed and dried at room temperature for 24 hours.

The growth media (cow dung, pig dung and fish pond sediment) were mineralized for two weeks. This was done by mixing them respectively with top soil and river sand in the ratio 1:2:1(one media: two top soil: one sharp sand). The mixture was made moist and covered with black nylon to enable micro-organisms act on the media and in the process liberate the nutrients in usable form by the plant roots, to increase aeration and light reflection. The mineralized media were then sieved and filled into sixteen 5×3 inches poly pots each. The top soil that was used as control was also sieved and filled into sixteen 5×3 inches poly pot using a hand trowel.

Experimental design and Layout

The experiment was laid out in Completely Randomized Design (CRD). There were 4 treatments in all; T1 (control) = Top soil only, T2 = Mineralized cow dung mixture, T3 = Mineralized pig dung mixture, T4 = Mineralized fish pond sediments mixture. Each treatment was replicated 4 times and each replicate had 4 potted seedlings making a total of 64 potted seedlings of *Dennettia tripetala.* The seeds of *Dennettia tripetala* were broadcasted on germination bowl filled with sieved top soil and kept in the screen house. After germination at 2-leaf stage, 64 healthy seedlings were selected and pricked into the already filled 3 × 5 inches poly pots in the screen house. Watering was done daily using a watering can and parameters were assessed weekly.

Data Collection

Data collection on seedlings growth started one week after acclimatization and was done for a period of eight weeks. The parameters that were assessed include leaf count, collar diameter and plant height. The parameters were assessed weekly using ocular estimation for leaf count, veneer calipers for collar diameter (cm) and meter rule for plant height (cm).

Data Analysis

Analysis of variance (ANOVA) was used to analyze the data collected. The hypotheses were tested at 5% level of significance and Duncan Multiple Range Test was used to separate significant means.

RESULTS

Results of the effect of different growth media on the early growth and development of *Dennettia tripetala.*

Table 1 shows the result of the one way analysis of variance (ANOVA) for seedling height, collar diameter and leaf production under different potting growth media. The results showed that there were significant differences in mean seedling heights and leaf counts ($p<0.05$). However, there were no significant difference in the mean seedling collar diameter ($p>0.05$).

Table 1: ANOVA results for *Dennettia tripetala* seedlings height, collar diameter and leaf number under different growth media

Parameters	Source of Variation	Sum of Squares	Df	Mean Square	F	Sig.
Height	Treatment	20.725	3	6.908	3.282	0.021[s]
	Error	934.609	444	2.105		
	Total	955.334	447			
Collar diameter	Treatment	0.001	3	0.000	0.787	0.501[ns]
	Error	0.167	444	0.000		
	Total	0.168	447			
Leaf number	Treatment	9.500	3	3.167	3.755	0.011[s]
	Error	374.464	444	0.843		
	Total	383.964	447			

s = significant at p<0.05; ns = not significant at p >0.05

Table 2 presents the results of Duncan mean separations for seedling leaf production and height under different potting mixtures (T1, T2, T3 and T4). The seedlings raised under T4 produced the highest height of 8.9661±0.1548, followed by T3 with a height of 8.6902±0.1211. Seedlings under T1 produced the least height of 8.3670±0.1301. The result showed that there were significant differences in height between T1 and T4. However, there were no significant differences were between seedling heights of T1, T2 and T3 and also between T2, T3, and T4 plants. Table 2 also revealed that there were significant differences in leaf production between T1 and T2. The result further indicated that no significant differences were observed between seedlings raised under treatments T1, T3 and T4 and also between T2, T3, and T4. The seedlings raised under T1 produced the highest leaf number with mean of 3.22±0.095, followed by T4 seedlings with mean of 3.01±0.090. Seedlings raised under T2 produced the least number of leaves with mean of 2.81±0.072.

Table 2: Duncan mean separation test result for leaf number and seedling height of *Dennettia tripetala* under different growth media.

Parameters	Treatment	N	Subset for alpha = 0.05	
			A	B
Seedling height	T1	112	8.3670± 0.1301	
	T2	112	8.5912	8.5911± 0.1402
	T3	112	8.6902	8.6902±0.1211
	T4	112		8.9661±0.1548
	Sig.		0.116	0.067
Leaf production	T2	112	2.81±0.072	
	T3	112	2.99	2.99±0.088
	T4	112	3.01	3.01±0.090
	T1	112		3.22±0.095
	Sig.		0.132	0.074

Means ± standard error under the same column are significantly the same

The result in table 3 indicates that the T3 seedlings had the highest collar diameter with mean value and standard error of 0.2265±0.0019, followed by the T1 with mean value of 0.2250±0.0020 while T4 had the least collar diameter with mean value of 0.2226±0.0017.

Table 3: Descriptive statistics result of the effect of different potting media on the seedling collar diameter of *Dennettia tripetala*.

Treatment	N	Mean	Standard Deviation	Standard Error	Minimum	Maximum
T1	112	0.2250	0.0214	0.0020	0.1750	0.3200
T2	112	0.2244	0.0183	0.0017	0.1680	0.2780
T3	112	0.2265	0.0202	0.0019	0.1670	0.2990
T4	112	0.2226	0.0175	0.0017	0.1800	0.2690
Total	448	0.2246	0.0194	0.0009	0.1670	0.3200

DISCUSSION

The highest mean height of seedlings in T4 may be due to the presence of high organic matter in fish pond sediments which stimulated the growth of the plant. This study supported the findings of Nemati *et al.*, (2000), who stated that high content of organic matter play a major role in soil aggregate formation and this improve physical and chemical soil conditions to facilitate plant growth. Also Adedeji *et al.*, (2012) stated that bottom sediments contain large number of heterotrophic bacteria as a result of the process of

mineralization of organic matter and this is helpful in the flourishing of rich biodiversity. This was followed by seedlings raised under T2. This might be due to the low C:N ratio of pig dung. Because of its relatively low C:N of 19.8 compared to goat, poultry and cow manure, it is expected to decompose faster (Ano and Ubochi, 2007). Hu *et al.*, (2013) asserted that application of pig manure increased the organic carbon and total nitrogen of soil significantly. Least mean seedling heights were observed on seedlings raised under T1. This could be due to insufficiency of some essential nutrients necessary for plant growth. This is similar to Pandey *et al.*, (2000) who reported that organic manures improved the soil physical, chemical and biological properties and also increase the efficiency of the applied nutrients especially in light soils. It is in line with Merino *et al.*, (2004) and Grace *et al.*, (2006) which states that soil organic matter determines the physical, biological and chemical properties of soil.

The highest number of leaves produced by T1 might be due to the fact that plants generally concentrate their roots in top soil and obtain most of their vital nutrients from it. This contradicts the study of Olawuyi *et al.*, (2016) who concluded that fish pond sediment had the best performance in number of leaves. This was followed by seedlings raised under T4, which did not vary significantly from number of leaves produced by T1, T2 and T3 respectively. It could be due to the presence of high organic matter in fish pond sediments which stimulated the production of plant leaf. It supported the work done by Olawuyi *et al.*, (2016) which stated that fish pond sediment is very rich in organic matter, hence can be used as a soil conditioner for the raising of both forestry and agricultural crops. Although there were no significant difference on the number of leaves produced between T2, T3, and T4, T2 seedlings produced the least leaf number. This could be attributed to the fact that nutrients in cow dung are slowly infused into the soil allowing the plants to enjoy the benefits over longer periods. (Ajah, 2017).

The collar diameter of T1, T2, T3 and T4 does not vary significantly, however, T3 had the highest mean collar diameter. This work also agrees with the findings of Ojeniyi *et al.* (2007), which states that pig manure is valuable for maintaining the humid content of soil, it increases soil bacterial population thus arousing the soil nitrogen, phosphate and potassium level. The slight differences in the collar diameters among the treatments could result from some physiological processes like the reallocation of plant resources and rate of mineralization.

CONCLUSION

The result of this study showed that *Dennettia tripetala* seedlings performed best in organic manures. Furthermore, the data obtained from this study indicated that T4 (fish pond sediment) gave the best performance in seedling height, and leaf production except in collar diameter. However, it was also observed that T2 (cow dung) had the least performance in all parameters assessed except in seedling height. Furthermore, the result of this study also revealed that fish pond sediment was very rich in organic matter, hence could be used as a soil conditioner for the raising of both forestry and agricultural crops. Therefore, fish pond sediment should be adopted for raising *Dennettia tripetala* seedlings in order to increase

the growth and development of the species. However, in the absence of fish pond sediment, pig dung can be used as an alternative.

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