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EFFECTS OF VARYING LEVELS OF ORGANIC MANURE AND FERTILIZER APPLICATION ON THE GROWTH PERFORMANCE OF *Mansonia altissima* (A. Chev.) SEEDLINGS

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ABSTRACT

Mansonia altissima is a good source of timber usually known for its natural durability and medicinal potentials. This study is undertaken to investigate the effects of varying levels of organic manure and fertilizer application on the growth performance of Mansonia altissima seedlings. The organic manure used for this experiment is poultry manure, while the fertilizer application used is urea. The two treatments used are poultry manure and urea, at the levels of 0g (control), 0.1g, 0.3g, 0.5g, and 1g. Each of the levels for both poultry manure and urea was replicated 10 times. Result shows that poultry manure and urea applied improved the growth characteristics but varied significantly among the treatments. For poultry manure, leaf number, plant height and collar diameter, the highest mean value obtained are 11.20g, 22.76g and 10.04g when applied at 1g while 0.1g has the lowest value in all the parameters checked. The same parameters were also checked for urea and 1g performed best with the mean value of 10.80g, 22.08g and 9.32g. The study indicated that Mansonia altissima seedling responded well to the treatments applied and also suggest that the application of 1g of poultry manure and urea is the best for the optimum growth of Mansonia altissima.

Keywords: Organic Manure, *Mansonia altissima*, Fertilizer, Urea, Poultry manure

1. INTRODUCTION

Trees require nutrients to live and thrive. Fertilizer is any substance that releases nutrients in proper proportions to the soil to increase fertility and growth (Craven *et al.*, 2006; Gbadamosi, 2006). Fertilizer also helps in changing maturity time, plant growth rate, size of plant part and plants biochemical content and seed capabilities. Fertilizer application to the soil beneath trees and shrubs are needed sometimes to replenish essential mineral elements and to promote them. A tree will not reach its maximum landscape potential if one or more of these nutrients are deficient in the soil and these can make them susceptible to disease and insect problems to give shorter life than well-fertilized one. Organic fertilizer mostly used are compost, household waste and composted animal manure which provide nutrients and contribute to the soil quality by improving the chemistry, biological activity and structure of the soil. Organic fertilizer release nutrients gradually in other to increase the organic matter content of the soil (Omidire *et al.*,

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2015). The soil organic matter improvement is favoured when decomposition is low however, organic material decomposition is affected strongly by soil moisture and temperature.

Inorganic fertilizers are also known as chemical and mineral fertilizers. In chemical fertilizer, the nutrients in it are relatively high and these nutrients release is quick because no need for decomposition. Inorganic fertilizers are highly costly and have a negative impact on the environment if poorly managed (Morris *et al*., 2007). It uses causes soil structure and texture destruction which leads frequently to soil acidity and erosion as a result of the leaching effect of nutrients. The elements mostly present in inorganic fertilizer are phosphorus, potassium and nitrogen which influence the reproductive and vegetative phase of plant growth. *Mansonia altissima* is a semi-deciduous forest species which belongs to the family *Sterculiaceae*. It is 37m high, trunk with 2½2m girth and has cylindrical to tapering with plank buttresses up to 2⅔m (Irvine, 1961). As an indigenous tropical hardwood in Nigeria, its exportation has greatly increased and this has caused the natural forest to be exhausted due to over-exploitation. Growth medium generally has been known as a major factor to determine the quality of seed in the nursery (Baiyeri and Mbah, 2006). Physical properties of this growth medium affects the supply of air and water to the growing plant (Baiyeri, 2005). In the nursery, nutrients required for tree species differ with the environmental conditions (Pinkard, 2007). If a forest nursery soil lacks a particular nutrient, the seedling may forage along with root to a certain level and picks up the element through leaf pores from the atmosphere (Hoque *et al.*, 2004). *Mansonia altissima* has been listed among the endangered species in the International Union for Conservation of Nature (IUCN) Red List. This particular plant has a slow growth rate, therefore the use of fertilizers to enhance its seedling stock in the nursery is of high necessity. This research would give an insight on how quality seedlings of *M. altissima* specie can be raised for afforestation by researching on the effects of varying levels of organic manure and chemical fertilizer application on the growth performance of *Mansonia altissima* seedlings.

2. METHODOLOGY

2.1 Study area/ Collection

The experiment was conducted in the Tree Improvement Section of Forestry Research Institute of Nigeria. *Mansonia altissima* seeds were picked from the ground after natural fall from the arboretum site of the Forestry Research Institute of Nigeria (FRIN), located at Jericho, Ibadan, Oyo State, Nigeria. After collection, the seeds were de-winged and sown in a germination tray filled with river sand. After germination, the seedlings were transplanted into a polythene bag filled with topsoil and left to acclimatize before the fertilizers were applied.

2.2 Processing of Poultry manure and Urea

The poultry manure used for this study were collected from Federal College of Forestry Ibadan. It was sun-dried for some weeks then crushed into smaller particles and sieved. Sample of the poultry manure and the topsoil used in this study were analyzed in the laboratory to determine the amount of nitrogen (N), phosphorus (P) and potassium (K) nutrients present in them. The

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analyses were conducted in the soil department of Forestry Research Institute of Nigeria. Little quantity of the sieved portion was weighed on an electric weighing scale according to the requirements to be used for the experiment. Samples of soil and the poultry manure to be used for this experiment was taken to the soil department for analyses. Urea to be used was bought at the market.

Table-1: Pre-planting growing media analysis

Growing Media	Nutrients level		
	Nitrogen	**Phosphorus(mg/kg)**	**Potassium**
Soil	6.25	102.45	2.82
Poultry manure	21.43	560.91	49.34

2.3 Experimental Procedure

100 healthy uniform seedlings from the transplanted ones were taken to be used for the experiment. The poultry manure was measured at (0g, 0.1g, 0.3g, 0.5g and 1g) and Urea at (0g, 0.1g, 0.3g, 0.5g and 1g) levels. Each level was replicated 10 times. The treatments were applied at the side of each polythene pot. Watering was done thrice a week throughout the experiment. The seedling growth performance was monitored for 8weeks. The parameters considered were leaf number (cm), heights (cm) and collar diameter (cm). Numbers of leaves were determined by manually counting the number of leaves on the seedlings. Seedling height was measured from the collar region to the apical bud of the seedlings using a meter rule. Collar diameter was measured using a veneer calliper.

2.4 Data Analysis: The data collected were subjected to two-way analysis of variance (ANOVA) to compare the effect of the treatments at a varying level on *Mansonia altissima* seedlings. Treatment means found to differ significantly ($P<0.05$) was separated using Duncan Multiple Range Test (DMRT) and their result was summarized in Tables

3. RESULTS

The results obtained on *Mansonia* seedlings with the application of 5 levels of poultry manure are expressed in Table 1. Leaf number, plant height and collar diameter have the highest mean value at 1g followed by 0.3g respectively. In leaf number, 0g and 0.5g are not significantly different from each other while, 0.1g, 0.3g, 0.5g, and 1g are significantly different. In-plant height, 0.1 and 0.5 are not significantly different at ($p<0.05$), while, other levels are significantly different. In Collar diameter, the control (0g) and 0.3g are not significant, and 0.1, 0.5 and 1g are significantly different. However, the lowest mean was detected in 0.1g across the parameters.

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Table 2: Mean Result for the Poultry manure application

Treatments	Parameters	Levels	Results
Poultry Manure	Leaf Number	0	7.20±0.02[a]
		0.1	7.00±0.04[b]
		0.3	8.10±0.18[c]
		0.5	7.30±0.12[a]
		1	11.20±0.1[d]
	Plant Height	0	20.49±0.67[a]
		0.1	19.59±0.52[b]
		0.3	21.69±0.61[c]
		0.5	19.89±0.23[b]
		1	22.76±0.62[d]
	Collar Diameter	0	7.34±0.38[a]
		0.1	6.97±0.16[b]
		0.3	7.35±0.26[a]
		0.5	7.02±0.13[c]
		1	10.04±0.14[d]

*Results are expressed as mean+ standard error in triplicate

Table 2 shows the mean results obtained for urea treatment and all the varying levels for urea application on *M. altissima.* All the levels in leaf number and plant height are significantly different while the 0g, 0.1g and 1g levels are significantly different while 0.3 and 0.5 are not significantly different for collar diameter.

Table 3: Mean Result for the Urea application

Treatments	Parameters	Levels	Results
Urea	Leaf Number	0	7.20±0.02[a]
		0.1	7.40±0.07[b]
		0.3	6.10±0.18[c]
		0.5	5.80±0.07[d]
		1	10.80±0.27[e]
	Plant Height	0	20.49±0.48[a]
		0.1	19.57±0.28[b]
		0.3	15.64±0.13[c]
		0.5	16.41±0.18[d]
		1	22.08±0.29[e]
	Collar Diameter	0	7.34±0.19[a]
		0.1	6.84±0.05[b]
		0.3	5.72±0.04[c]
		0.5	5.78±0.02[c]
		1	9.32±0.12[d]

*Results are expressed as mean+ standard error in triplicate

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4. DISCUSSION

Table 1 shows the effect of varying levels of poultry manure on *M. altissima* seedlings. The highest and lowest value for leaf number, plant height and collar diameter was at 1g and 0.1g with values 11.20g and 7.00g, 22.76g and 19.59g, 10.04g and 6.97g respectively. The results obtained on the seedlings of *M. altissima* in response to poultry manure and urea applications shows an improved growth rate on different parameters checked. Application of organic and inorganic fertilizer to forest nursery soils is of utmost importance to increase the value and quality of seedlings produced. Table 2 indicates the results for fertilizer application. 1g of urea has the highest value in leaf number 10.80g, plant height 22.08g and collar diameter 9.32g. 1g of poultry manure and urea applied to the seedling shows a significant difference in the leaf production compared to other urea and poultry manure levels. As the growth period and the fertilizer level increases, the number of leaves also increased marginally. Addition of fertilizer shows a significant difference increase in height of *M. altissima*. The increase observed in the seedling growth has to do with the plant receiving adequate nitrogen which proves vigorous stem elongation Mariswamy *et al.,* (2011) and thus promotes stems and leaves vegetative growth. Similarly, Agera *et al.,* (2019) reported *Khaya senegalensis* seedlings treated with poultry manure has the highest mean height, this positively affects growth characteristics and in conformity with my result. Egbe *et al.,* (2018) in his research on *Lophira alata* proves that 9g of urea shows the lowest value of height. Maximum collar diameter in this research was at level 1g of poultry manure and urea (9.32g and 10.04g) respectively. 0.3 g of urea has the lowest value of (5.72g) and 0.5 g of poultry manure was the lowest value of (7.02g). The increment in collar diameter seen is due to richness of nitrogen in poultry manure. The slow and gradual release of nutrients from fertilizer gives the opportunity for maximum utilization of nutrients for cell enlargement, division and building of seedlings stem. The nutrients released prevents nutrient leaching out as well as allowing sufficient time for nutrient uptake to the root for biomass increment Mariswamy *et al.,* (2011). This result is in contrast with the findings of Egbe *et al.,* (2018) who reported the lowest collar diameter of *Pterocarpus soyauxii* seedlings at 9g of urea application. The morphological characteristics ascribe to timber seedlings are collar diameter, height, no of leaves etc. These are the determinant factor to qualify good and healthy seedlings for nursery establishment. This experiment shows an increase in seedling yield due to the adequate application of fertilizer than the control (without fertilizer). This conforms with the reports on the plantation of trees like *Michelia chapaca*, *Tectonia grandis*, and *Entandrophragma cylindricum* (Hall *et al.,* 2003; Rafiqul *et al.,* 2004). A similar result was reported by Focho *et al.*, (2011) on the effect of organic and inorganic fertilizer on early growth of *Khaya ivorensis.* Application of fertilizers differs in species because different fertilizers are suitable for different species. The intraspecific genotypes and inherent characteristics of the species plays an important role in enhancing the efficiency of plant uptake usage and tolerance to the mineral elements Offiong *et al.*, (2010). Seedlings treated with organic fertilizer tend to grow faster. Comparatively, a higher concentration of nitrogen in poultry manure significantly improves the vegetative growth of the plant.

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5. CONCLUSION

From all aspects, it was observed that poultry manure and chemical fertilizers had beneficial effects. In this study, it has been revealed that 1 g of urea and poultry manure applied performed best for *M. altissima* growth for the number of leaves, height and collar diameter. Poultry manure shows clearly better growth attributes at all the parameters investigated than urea. For successful seedling growth and plantation establishment, application of 1g urea or poultry manure is to be considered.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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