



Effects of Different Organic Manures on Early Seedling Growth of *Massularia acuminata* (G. Don) Bullock Ex Hoyle

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Authors' contributions

This work was carried out in collaboration among all authors. Author MOM designed the work and performed part of the field experiment. Authors BFA and JMA wrote the protocol, first draft of the manuscript and performed the statistical analysis while author TAB managed the statistical analysis of the study. Author AOO sought and collated the literature aspects of the study. The discussions were done jointly by all the authors according to the results gathered. All authors proofread and approved the final manuscript.

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ABSTRACT

Aims: Selection of suitable soil amendment is a very crucial attempt for improving seedling production and growth of *Massularia acuminata* as a forest nursery plants on a sustainable basis can be enhanced over a given period of time.

Study Design: Comparative effects of different organic manures on the seedlings growth of *Massularia acuminata*.

Place and Duration of Study: Forestry Research Institute of Nigeria, between February, 2019 and August 2019.

Methodology: Various concentrations of different types of organic manures; poultry manure, cow dung and horse dung were mixed with the topsoil separately to raise the seedlings of *Massularia acuminata*, comparative seedlings height growth, the stem diameter growth and the number of leaves per seedlings were examined to determine the development of the seedlings.

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Results: The results revealed that, organic manure application generally enhanced the growth of the seedlings, improved seedlings height, number of leaves and collar diameter. Also, with increasing rate of application of organic manures from 0 g to 50 g per seedlings, all seedlings growth parameters were improved. 10 g and 30 g manure had significant effects on plant growth with seedlings height 15.29 cm and 15.10 cm, number of leaves per seedlings (19.80 and 19.43) and collar diameter (6.58 mm and 6.57 mm) with Q2 and Q3 respectively as compared with the control (5.18 mm). Highest seedling growth was observed in poultry application with seedlings height 14.42 cm, number of leaves (19.63) and collar diameter (6.31 mm).

Conclusion: The use of poultry manure and cattle dung at increased concentrations of 10 g and 30 g are recommended to be beneficial for sustainable healthy seedling production.

Keywords: Collar diameter; greenhouse organic manures; parameters; seedlings.

1. INTRODUCTION

Massularia acuminata is a small growing shrub generally used as sewing stick for oral hygiene in Nigeria and other West African countries [1]. Its stem as well as roots are claimed to have aphrodisiac potential [2]. Aqueous extract of *M. acuminata* stem revealed the presence of alkaloids, saponins, anthraquinones, flavonoids, tannins, and phenolic [3,4]. It was evidenced that the plant has a tendency of increasing testosterone and libido (increased luteinizing hormone to 66%). It was also suggested that regular use of the species also promote strength especially for sport men and women [4]. Other uses of *M. acuminata* are the leave extract which can be applied directly on the skin to alleviate muscle pain. According to U.S National Library of Medicine, [5] who reported in their findings that regular intake of *M. acuminata* extract can provide the following health benefits: Better bone density, immune function against diseases, decreases fat acuminata, enhances sexual function, improve skin health, as aphrodisiac and anticancer, the fruit juice can be used in pharmaceuticals as antibiotic for eye drop [4].

M. acuminata is from the family of rubiaceae.it is otherwise known as chewing stick and has many local names: Yoruba; pako-ljebu or orin-ljebu, Igbo; atu-uhie. It is a small sized shrub that grows up between 5-9m but can be more if allowed in the natural forest for a long time [1]. It is a tropical plant primarily found in the under story of the closed forest of western Africa. It is distributed from Sierra Leone to Democratic Republic of Congo and other West African country [6]. The leaves are large practically stalk less, elliptic and acuminate in shape. The flowers are usually red, the fruit are narrowly ovoid, beaked and yellowish white. It is a shrub with a very slow growth pattern which is so discouraging for plantation establishment.

The use of organic manure in the garden is a popular practice in many urban and rural areas. This type of manure is not rich in nitrogen as many inorganic manual, however, the high ammonia level of organic manure can burn plant when freshly applied but this must be well composed to provide numerous benefits to the garden [7]. According to Fagbenro, [8] cattle and horse dung manure is basically made up of digested grasses and grains. They are high in organic materials and reach in nutrients which contain about, 3% N, 2% P and 1% K (3-2-1 NPK).

Low carbon contents and the rate of soil surface run-off especially in the south-western part of Nigeria accounted for leaching and high acidic content of the soil coupled with the deficiency of essential macro and micro nutrient suggested that most soils in this region will require the use of soil amendments for better crop performance. This improvement is attributed to the fact that organic manure, both plant and animal origins are good sources of certain nutrients that encourage better seedlings growth. This is in line with the earlier works of Adeniyani and Ojeniyi [9] and Ipinmoroti and Akanbi, [10] who reported that organic manure improve the growth performance and significantly increase crop yield and dry matter accumulation respectively. In addition, organic manure contains high level of ammonia and potentially dangerous pathogens like *E. coli*. For this reason, it is recommended that it must be well composted prior to its use as organic fertilizer. Composting organic manure has several benefits such as; improve the water holding capacity as this allows less frequent watering, better root penetration of plant for water and nutrients [11,8]. Additionally, it also improves aeration, helping to break down compacted soils. Application of organic manure can be made by mixing into the soil or used directly as top dressing.

According to Adejobi et al. [12] in a study he reported that all the organic fertilizer materials irrespective of their sources significantly ($P < 0.05$) improved forest seedling growth than that of control on all the growth parameters considered. Similarly, he summarized that the percentage increase in plant height range between 5.99 to 36.66%. The results of this study will go a long way as a panacea for optimum seedling growth of *M. acuminata* and promote the use of organic for raising of forest species especially the indigenous species hence ensure sustainable mass production of seedlings for forest plantation establishment.

The studies therefore aim to assess comparative effects of different organic manures to early seedlings growth of *M. acuminata* with a view to enhance the growth of the species for sustainable seedlings production.

2. MATERIALS AND METHODS

2.1 Experimental Plot

The experiment was carried out in the Tree Improvement Section of the Department of Sustainable Forest Management, Forestry Research Institute of Nigeria, Jericho, Ibadan, South-West, Nigeria. The seeds of *M. acuminata* were collected from the mother tree in the Tree Improvement nursery within the Institute. The seeds were extracted and processed. Top soil and River sand were used in sowing the seeds. The sowing medium was prepared by filling the germination tray with sterilized river sand, and the seeds broadcasted on the prepared sowing medium. Watering was done and the tray was placed in the propagator for germination to take place. Top soil collected was sieved to remove debris and stones and then filled into polythene Pots measured to an equal weight of 2 kg per pot.

2.2 Preparation of Organic Manure

The horse dung used for this study was collected from Polo field of Ibadan Polo Club, Eleyele Ibadan, Oyo State, Nigeria. The poultry droppings and cow dung was also collected from the poultry and cow ranch section of the Federal College of Forestry, Jericho, Ibadan, Oyo state, Nigeria. Each of the Organic materials were collected separately and allowed to cure for a period of 4 weeks, they were sun-dried, milled, sieved and stored for the study.

2.3 Organic Manure Application

After 4 weeks of germination of *M. acuminata*, the filled polythene pots were watered to field capacity and arranged on a raised platform in the green house to prevent any external interference. The seedlings were picked-out and transplanted into the prepared polythene pots, one seedling per pot and allowed them to be stabled for 2 weeks. After 2 weeks, varying grams of dried sample of manures were applied to each of the plant and they were well watered. The initial seedlings parameters which include plant height and number of leaves were taken. Watering of the plants continued at an interval of 3 times per week and readings was taken at an interval of four weeks throughout the experiment. The duration of the experiment was 24 weeks.

Ten (10) treatments were considered in this experiment. These include: Cattle dung, Horse dung and Poultry manure at a varying grams of 10 g, 20 g and 30 g respectively and 0 g (no manure application/control). The experiment was arranged in a Completely Randomized Design (CRD) with ten replicates. Parameters assessing include: number of leaves, seedling height (mm), collar diameter (mm). At the end of 24 weeks after transplanting, the seedlings were carefully rooted out, root-washed and separated into parts. Dry matter weight of leaves, stem and root was measured after drying in the oven at 80°C to a constant weight.

The data recorded was analyzed using Analysis of Variance (ANOVA) and the significant means differences were separated by Duncan Multiple Range Test at 5% level of probability.

2.4 Experimental Layout

Table 1. Experimental layout showing sample characteristics

M ₁ Q ₄	M ₂ Q ₁	M ₃ Q ₃	M ₃ Q ₄
M ₂ Q ₃	M ₃ Q ₄	M ₁ Q ₂	M ₂ Q ₂
M ₃ Q ₁	M ₁ Q ₂	M ₁ Q ₃	M ₂ Q ₁

2.4.1 Organic manure

M₁ = Horse Dung
M₂ = Poultry Dropping
M₃ = Cattle Dung

2.4.2 Quantity

Q₁ = 0 g
Q₂ = 10 g

Q₃ = 30 g

Q₄ = 50 g

2.5 Statistical Analysis

Quantitative data were expressed as Mean ±SD of triplicate measurement; analysis of variance (ANOVA) was used to test significant difference between the mean of the results, while specific differences were identified using Duncan Multiple Range Test, where p<0.05 was considered significant. IBM SPSS version 20 was used for the statistical analysis.

3. RESULTS AND DISCUSSION

The results obtained on the seedling of *Massularia acuminata* in response to the three different manure applications which include: horse dung, poultry manure and cattle dung are contained in the Table 2. Table 2 shows that over twenty four (24) week period on the seedlings growth parameters (leaf number, collar diameter and seedling height) showed an improved seedlings growth over time.

3.1 Seedlings Height

The results indicated there was no significant difference in different organic manure used on the seedlings seedling height both with horse dung (M1), cow dung (M2) and poultry manure (M3) application. Highest seedling height per seedlings was recorded in M3 (13.13 cm) while the least was observed in M1 (13.13 cm). However, the results of the quantities of manure indicated a remarkable increase in seedlings height irrespective of the manure types. Application of manures at 30 g (Q3) recorded the highest seedlings height of 15.29cm was not significantly different from application of 10 g (Q2) (15.10 cm). Followed by these was 50 g (Q4) manure application with the seedlings height of 14.25 cm while control (Q1) had the least seedling height of 10.99 cm and was significantly reduced to all other levels (quantities) of manure application. Increase in seedlings height with increased quantities up to 30 g manure application could be attributed to increase nutrients composition of the manure that promotes effective growth in plants as expressed by McNabb, [13]; Niyoka et al. [14]. The result was also in line with the findings of Aduradola et al. [7] who reported that application of organic manure significantly improves the growth of potted seedlings of *Treculia africana*.

Similarly. According to Asinwa et al. [1] who also reported that the use of organic manure and biochar not only improves the growth of *Massularia acuminata* but helps in sustainable soil management as it decreases soil environmental impacts. Similarity in seedling growth of *M. acuminata* in term of the height with organic manure application was related to the findings of Bello and Gada [15] who reported an increased seedlings growth of *Tamarindus indica* with cow dung application.

3.2 Seedlings Leaf Production

Leaf production per seedlings in related to the organic manure applications showed that there was no significant different in the number of leaf produced. Although there was a slight variation in the number of leaf production per the treatments during the course of seedlings development but the overall leaf production over the period indicated little or no changes. It was observed that seedlings with (M3) application had the highest number of leaf (19.63), followed by seedlings with (M1) application (19.38) and least in seedlings with cattle dung (18.40). Considering the quantities of various organic manure application, there was no significant different in leaf production of the seedlings However, manure application at the quantity of 10 g per seedling had the highest leaf number (19.8) while control on the other hands had the least leaf number of 18.50. The increase in seedling leaf production is in relation with the findings of Brar et al. [16] who reported that there was no significant difference in leaf production of seedlings raised with cow dung as compared with poultry droppings. Hence, this indicated that both manures play a significant role in early growth and seedling development of *M. acuminata*.

3.3 Seedlings Collar Diameter

The results of collar diameter indicated that there was no significant difference on the seedlings as influenced by different organic manure. The overall collar diameter reveals that seedlings with application of poultry manure had the highest collar (stem) diameter of 6.31 g, horse dung 6.04 g and cattle dung had the least (5.73 g). the results of non-significant in collar diameter of seedlings grown with different organic manure was not in relation to Onyema [17] who reported that there was a significant improvement in vine seedlings grown with poultry manure and cow dung although there was a great improvement when comparing with the control. The results of

Table 2. Results of seedlings growth parameters of *M. acuminata* in response to types and quantities of organic manure applications

Treatments	Height (cm)	Collar diameter (mm)	Number of leaves
Organic manure types			
M1	13.13 ^a	5.73 ^a	18.40 ^a
M2	14.18 ^a	6.04 ^a	19.38 ^a
M3	14.42 ^a	6.31 ^a	19.63 ^a
Quantities of manure			
Q1	10.99 ^a	5.18 ^a	18.50 ^a
Q2	15.29 ^b	6.58 ^b	19.80 ^a
Q3	15.10 ^b	6.57 ^b	19.43 ^a
Q4	14.25 ^{ab}	5.77 ^{ab}	18.80 ^a

*Mean with the same superscripts in the column are not significantly different from one another at $P < 0.05$

Table 3. ANOVA table showing the response of *M. acuminata* seedlings growth with different organic manures and different levels of application

Source	Dependent variable	Df	Sum of squares	Mean square	F	Sig.
Manures	Height	2	38.01	19.00	.463	.631
	Number of leaves	2	33.52	16.75	.629	.535
	Collar diameter	2	6.69	3.34	.777	.462
Quantities	Height	3	359.11	119.70	2.914	.038
	Number of leaves	3	31.40	10.46	.393	.758
	Collar diameter	3	41.53	13.84	3.211	.026
Manure * quantities	Height	6	135.81	22.63	.551	.768
	Number of leaves	6	71.55	11.92	.448	.845
	Collar diameter	6	11.53	1.92	.446	.847
Error	Height	108	4436.27	41.07		
	Number of leaves	108	2875.40	26.62		
	Collar diameter	108	465.66	4.31		
Total	Height	119	4969.21			
	Number of leaves	119	3011.87			
	Collar diameter	119	525.41			

a. R Squared = .107 (Adjusted R Squared = .016); b. R Squared = .045 (Adjusted R Squared = -.052)

c. R Squared = .114 (Adjusted R Squared = .023)

the seedlings collar diameter in response to the quantities of organic manure application showed a significantly increase in 10 g and 30 g manure application with collar diameter 6.577mm and 6.568 mm respectively. Manure application at 50 g had a significant reduction in collar diameter of 5.77 mm and control had the least value of 5.17 mm which was significantly different from all the levels or quantities of organic manure application. The result of equal response of seedlings collar diameter was in contrast with Moyinjesu [18] who reported a positive correlation between different organic manure application and quantities applications on seedlings production.

4. CONCLUSION

The results clearly showed that application of organic manures especially poultry manure and cattle dung significantly early growth

performances of *M. acuminata* under greenhouse condition. Also the results gathered that 10 g and 30 g manures applications give better response to seedlings height, number of leaves and collar diameter. Therefore, the results concluded that poultry manure and application at 10 g per seedling pot is recommended as the best application for optimum seedlings growth of *M. acuminata* on sustainable basis.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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