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Short Communication

EVALUATION OF GROWTH RESPONSE OF *Parkia biglobosa* (JACQ) UNDER DIFFERENT LEVELS OF ORGANIC MANURES

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ABSTRACT

An investigation was carried out to evaluate early growth of Parkia biglobosa under different levels of organic manures in the nursery in order to promote its sustained utilization and regeneration. Seeds were sown in the germination bed at the nursery of Department of Forestry and Fisheries of KSUST, Aliero which took average of three days to germinate and at two weeks after germination, seedlings were transplanted into polythene bags (16 × 14 × 12 cm) filled with cow dung, poultry manure and farmyard manure at 40, 70 and 100 g kg^{-1} of top soil and top soil only was used as control. The experiment was laid in a completely randomized design with nine replications. Data collection commenced two weeks after transplanting and was done fortnightly for 12 weeks on stem height, collar diameter and number of leaves. Biomass was assessed at twelve weeks and the data were analysed using analysis of variance and follow up tests were conducted with Duncan Multiple Range Tests. The result revealed significant effect on all the variables (stem height, collar diameter and number of leaves) assessed, where poultry droppings at 40 g kg^{-1} and cow dung at 100 g kg^{-1} gave the highest growth and cow dung was recommended.

Key words: seedlings growth, *P. biglobosa,* organic manure, potting mixture

INTRODUCTION

Forest resources are reported to be decreasing at an alarming rate (Mukhtar, 2016), and this may be attributed to lack of proactive measures by different stakeholders to regenerate many indigenous tree species due to lack of awareness and implementation of sustainable forest resources management approaches. There is no doubt that, one of the challenges of indigenous tree species regeneration is inadequate knowledge of the condition necessary for their germination and seedling production techniques (Sale, 2015; Mukhtar, 2016). *P. biglobosa*is an important indigenous multipurpose tree species providing food, medicines and shade while stabilizing degraded environment and playing ecological role in nutrient cycling (Olorunmaiye *et al*., 2011; Adejumo *et al.,* 2013; Oluwafemi *et al.,* 2014). Information on growth and development of indigenous tree species is an important pre-requisite for sustainable utilization and regeneration of multipurpose tree species like *P. biglobosa.* Therefore, this study was aimed at evaluating early growth responses of *P. biglobosa* under different levels of organic manures in the nursery.

MATERIALS AND METHODS

The study was conducted in Aliero town of Kebbi State (Latitude 12°16′42″ N; Longitude 4°27′6″ E), Nigeria, with an area of 350 km^2. This location has two dominant seasons, the wet (May to Sep.) and the dry season (Oct. to Apr) with mean annual rainfall of about 800 mm and temperature of 26°C. Seeds we retreated with H_2SO_4 for 15 min. and sown in the germination bed (topsoil only) in the nursery at the end of rainy season of the year 2015. The treated seeds took average of three days to germinate and at two weeks after germination, seedlings were transplanted into medium-sized polythene bags of 16 × 14 × 12 cm dimension which contained a mixture of topsoil (TS) with cow dung (CD), poultry droppings (PD) and farm yard manure (FY) each at levels of 40, 70 and 100 g kg^{-1} TS, giving nine treatments that were coded to reflect the combination of TS and CD at a given level. The mixture of TS and CD at 40 g CD kg^{-1} TS was coded TS+CD40, for instance. The TS alone was used as a control, bringing the number of treatments to 10. There were nine replications in a completely randomized design. Nine seedlings were allocated per treatment.

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Data collection commenced two weeks after transplanting on stem height, collar diameter and number of leaves fortnightly for 12 weeks. The seedlings stem height was measured with a meter rule, collar diameter with micro-meter screw gauge and number of leaves was counted. Biomass was assessed at 12th week of the experiment where seedlings were sampled and separated into root, stem and leaves. Leaf area was measured by tracing the area covered on graph sheet. Fresh weight of root, stem and leaves were measured before they were oven dried at 80°C to constant weight (Mukhtar, 2020a). Data were analysed with analysis of variance and significantly different means were separated with Duncan Multiple Range Tests using SPSS package version 20.

RESULTS

Stem Height

The concentration of organic manures had a significant effect on seedlings height at 12 weeks after emergence with the best height (5.42 cm) observed in TS+PD40 and was significantly different ($p < 0.05$) from the lowest mean height (1.88 cm) obtained from TS+PD70 (Table 1).

Collar Diameter

A significant ($p < 0.05$) effect was observed on seedlings diameter in relation to different levels of organic manure applied (Table 1). The TS+CD100 gave the largest diameter (3.78 mm) which was followed by TS+PD40 (3.50 mm) and TS+FY70 (3.46 mm) and differed significantly from the control (TS) which had 2.13 mm and TS+PD70 with the lowest mean diameter (1.25 mm) (Table 1).

Number of leaves

The level of manure application had a significant effect on seedlings leaf production where TS+CD100 had the highest mean number of leaves (17) followed by TS+CD40 (14) and TS+PD40 (13) which were significantly ($p < 0.05$) different from TS+PD70 (3) (Table 1).

Leaves Dry Weight (LDW)

The effects of type and level of organic manure (CD, PD and FY) on LDW of *P. biglobosa* are shown in Table 2. The types and levels of organic manure applied significantly affected LDW where TS+PD40 had the highest LDW (1.20 g) which differed significantly ($p < 0.05$) from the rest of the treatments. The treatment TS+FY100 had the lowest LDW (0.15g) (Table 2).

Stem Dry Weight (SDW)

The SDW was significantly affected by the types and concentrations of the three organic manures (CD, PD and FY) at 12 weeks after emergence. The highest SDW was obtained from TS+CD40 and TS+PD40 which was significantly ($p < 0.05$) different from TS+PD70 (0.00) (Table 2).

Root Dry Weight (RDW)

A significant effect of the organic manure type and concentration was observed on RDW of *P. Biglobosa* seedlings. The TS+CD40 gave the highest RDW of 1.05 g followed by TS (1.00 g) and both differed significantly ($p < 0.05$) from TS+FY100 (0.15 g) and the lowest RDW (0.00 g) obtained in TS+PD70 (Table 2).

Total Dry Weight (TDW)

The TDW was significantly ($p < 0.05$) affected by the types and levels of organic manure applied. The highest TDW (2.10 g) from TS+PD40 was not significantly different from TS+CD40 (1.70 g) and the TS (1.55 g), but differed significantly ($p < 0.05$) from TS+PD100 (0.40 g) and the lowest TDW of 0.10 g from TS+PD70 (Table 2).

Leaf Area

Type and rate of organic manure affected seedlings leaf area. Seedling that were exposed to TS+PD40 treatment had the highest mean leaf area of 21.00 cm^2 followed by TS+FY70 (14.00 cm^2) which were significantly ($p < 0.05$) different from TS+PD70 with the lowest (3.00 cm^2) (Table 2).

Table 1: Effect of different levels of organic manure on seedlings growth of *P. biglobosa*

Treatment	Stem height (cm)		Collar diameter (mm)		Number of leaves	
	2WAE	12WAE	2WAE	12WAE	2WAE	12WAE
TS+CD100	3.93	5.25^{a}	5.78^{a}	3.78^{a}	7^{ab}	17^{a}
TS+CD70	3.92	4.57^{ab}	2.94^{b}	3.42^{a}	9^{ab}	11^{ab}
TS+CD40	4.00	5.22^{a}	2.51^{b}	3.38^{a}	8^{ab}	14^{a}
TS+PD100	3.64	4.14^{ab}	2.67^{b}	2.30^{ab}	6^{b}	11^{b}
TS+PD70	3.33	1.88^{b}	2.48^{b}	1.25^{b}	7^{ab}	3^{b}
TS+PD40	3.71	5.42^{a}	2.85^{b}	3.50^{a}	1^{a}	13^{a}
TS+FY100	4.12	3.88^{ab}	2.50^{b}	2.28^{ab}	9^{a}	8^{ab}
TS+FY70	3.56	5.07^{a}	2.20^{b}	3.46^{a}	8^{ab}	13^{a}
TS+FY40	3.81	4.41^{ab}	2.42^{b}	2.55^{ab}	9^{ab}	12^{ab}
TS	4.12	3.93^{ab}	2.32^{b}	2.13^{ab}	9^{a}	9^{ab}
S.E.±	0.337	0.805	0.733	0.490	0.908	2.549

Key: TS - topsoil; CD - cow dung; PD - poultry droppings; FY - farmyard manure; WAE - weeks after emergence
Means followed by the same letter(s) within a column are not significantly different ($p > 0.05$).

Table 2: Effect of different levels of organic manure on seedlings dry weight of *P. biglobosa*

Treatment (g kg^{-1})	LDW (g)	SDW (g)	RDW (g)	TDW (g)	L.A (cm^2)
TS+CD100	0.55^{b}	0.05^{ab}	0.65^{abc}	1.25^{abc}	13.00^{abc}
TS+CD70	0.25^{b}	0.05^{ab}	0.55^{abc}	0.85^{bcd}	9.50^{bc}
TS+CD40	0.50^{b}	0.15^{ab}	1.05^{a}	1.70^{ab}	17.50^{ab}
TS+PD100	0.20^{b}	0.05^{a}	0.10^{bc}	0.40^{cd}	7.00^{bc}
TS+PD70	0.10^{b}	0.00^{b}	0.00^{c}	0.10^{d}	3.00^{c}
TS+PD40	1.20^{a}	0.15^{a}	0.75^{ab}	2.10^{a}	21.00^{a}
TS+FY100	0.15^{b}	0.10^{ab}	0.15^{bc}	0.40^{cd}	8.00^{bc}
TS+FY70	0.40^{b}	0.10^{ab}	0.75^{ab}	1.25^{abc}	14.00^{abc}
TS+FY40	0.45^{b}	0.10^{ab}	0.50^{abc}	1.05^{bcd}	15.00^{ab}
TS	0.50^{b}	0.07^{ab}	1.00^{a}	1.55^{ab}	12.00^{abc}
S.E.±	0.076	0.137	0.091	0.152	

TS, CD, PD and FY as explained in Table 1.
LDW - leaves dry weight, SDW - stem dry weight,
RDW - root dry weight, TDW - total dry weight, LA - leaf area.
Means followed by the same letter(s) within a column are not significantly different ($p > 0.05$).

DISCUSSION

Tree species differed in their manure requirements and preference as such effort must be made to evaluate the appropriate fertilizer preference of any tree species for enhanced growth and development. The genetic characteristics of any plant determine its nutritional uptake and manipulation for growth. It was found in this study that, the type and level of organic manure application improved the growth of *P. biglobosa*. Both poultry manure and cow dung were found effective in improving its early growth. This confirms the findings of Imoro *et al.* (2012), Owolabi *et al*. (2013), and Agbo-Adediran and Oso (2014) who reported increased seedlings growth by poultry droppings, cow dung or a combination of both manures. Treatment TS+PD40 improved early growth (stem height, collar diameter and leaves) and biomass (dry weight) of *P. biglobosa* seedlings. This indicates that seedlings of *P. biglobosa* do not require large quantities of poultry manure in the potting mixture due probably to its high content of essential nutrients (Mukhtar, 2020b). The data shown here suggest that little quantity of poultry manure is needed to enhance growth of *P. biglobosa* seedlings, but a higher quantity of cow dung is needed for same. Poultry manure is known to mineralise faster than cow dung in nursery media (Adubasim *et al*., 2018), and this would partially explain the observed effects of these manures on early growth of *P. biglobosa*.

From the relative levels of poultry manure and cow dung having similar effects on *P. biglobosa*, it appears that increasing the quantity of cow dung in nursery media could increase their content of essential nutrients for enhanced seedling growth. This may undermine any cost-related horticultural benefits of cow dung over poultry manure. Instead, the potential of cow dung to replace poultry manure and for recalcitrant plant wastes to replace riversand 'aerator' or completely displace poultry manure in conventional nursery media should be explored (Adubasim *et al*., 2018; Ugwu *et al*., 2020).

CONCLUSION

The levels (or concentrations) and types of organic manure affected early growth of *P. biglobosa.* The seedlings of *P. biglobosa* require smaller quantity of poultry manure compared to other organic manures. The study suggests that small quantity of poultry manure or higher quantity of cow dung is required for enhanced seedlings growth of *P. biglobosa.*

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REFERENCES

Adejumo A.A., Azeez I.O., Geply J.J. and Oboite F.O. (2013). Processing, utilization and challenges of African locust bean (*Parkia biglobosa,* Jacq Benth) in Arigidi Akoko, Ondo State, Nigeria. *Nigeria J. Agric. Soc. Res.,* **13 (1),** 39-49

Adubasim C.V., Igwenagu C.M., Josiah G.O., *et al.* (2018). Substitution of manure source and aerator in nursery media on sandy-loam topsoil and their fertility indices 4 months after formulation. *Int. J. Recycl. Org. Wastes Agric.,* **7 (4),** 305-312. DOI: 10.1007/s40093-018-0216-8

Agbo-Adediran O.A. and Oso A.O. (2014). Comparative effect of poultry manure and cow dung on the growth of *Entandrophragma angolensis* (WELW) C.D.C. Proc. 37th Annual Conf. Forestry Association of Nigeria held in Minna, Niger State, pp. 731-735

Mukhtar R.B. (2020a). Response of *Parkia biglobosa* (Jacq) seedlings to reduced water supply at Aleiro Kebbi State, A semi-arid region of Nigeria. *Environtropica - An Int. J. Trop. Environ.,* **16 (1),** 21-28

Mukhtar R.B. (2020b). Effect of organic manure on seedlings growth of *Balanites aegyptiaca* in Aliero area of Kebbi State, Nigeria. *Afr. J. Earth Environ. Sci.*, **2 (2),** 517-523

Mukhtar R.B. (2016). Response of *Adansonia digitata* seedlings to organic manure in Aliero area of Kebbi State. *Nigeria J. Agric., Food Environ.*, **12 (4),** 120-122

Olorunmaiye K.S., Fatoba P.O., Adeyemi O.C. and Olorunmaiye P.M. (2011). Fruit and seed characteristics among selected *Parkia biglobosa* (JACQ) G. Don population. *Agric. Biol. J. North Am.*, **2 (2),** 244-249

Oluwafemi A., Adenubi A., Adebayo O., *et al*. (2014). Genetic diversity of *Parkia biglobosa* from different agro-ecological zones of Nigeria using RAPD markers. *Int. J. Biodiversity*, **1 (1),** 1-6

Owolabi J.F., Opoola E., Taiwo M.A., Foby I.D. and Olarwaju J.D. (2013). Effect of poultry manure on the growth and development of oil palm (*Elaeis guineensis*) seedling in a screen house. *Standard Scientific Res. Essays*, **2 (1),** 001-004

Imoro A.W., Sackey I. and Abubakar A.H. (2012). Preliminary study on the effect of two different sources of organic manure on the growth performance of *Moringa oliefera* seedlings. *J. Biol. Agric. Health Care*, **2 (10),** 147-158

Sale F.A. (2015). Evaluation of watering regime and different pot sizes on the growth of *Parkia biglobosa* seedlings under nursery condition. *Europ. Sci. J.*, **11 (12),** 313-325

Ugwu V.U., Nnadi A.L, Adubasim C.V., *et al.* (2020). Organic-waste aerator could completely displace poultry-droppings manure in nursery media based on coarse-textured soil: evidence with cashew seedlings. In: Baiyeri K.P. and Aba S.C. (eds.), *Sustainable Horticulture Production System Intensified* (pp. 941-951), Proc. 38th Annual Conf. Horticultural Society of Nigeria (HORTSON), University of Nigeria Nsukka, 25-31 Oct. 2020