Original Research Article

Comparative Evaluation of the effect of organic and inorganic fertilizers on the growth of the seedlings of Deinbolia pinnata Schum. & Thonn: An underutilised multipurpose species

ABSTRACT (ARIAL, BOLD, 11 FONT, LEFT ALIGNED, CAPS)

Aims: A pot experiment conducted to assess the effects of organic fertiliser (cow dung) and inorganic fertiliser (urea) on the growth of *Deinbolia pinnata* Schum. & Thonn seedlings
Study design: The experimental design was A Complete Randomized Design replicated ten times..
Place and duration of study: The study was carried out at the Multipurpose Tree Species Multiplication and Improvement Unit Nursery at Forestry Research Institute Of Nigeria (FRIN) for a period of sixteen weeks
Methodology: The design include 2.5kg of cow dung + 5kg of soil,5.0kg of cow dung + 10kg of soil,7.5kg of cow dung + 15kg of soil and urea 0.5g of urea +5kg of soil 1.0kg of urea +10kg of soil and 1.5kg of urea = 15kg of soil with control (no fertilizer application).
Results: It was found out that fertilizer application had a significant effect on all the growth variables at 0.05 probability level. The best performance was recorded in the seedlings raised with cow dung with a mean value in plant height (20.59cm), a number of leaves (36) and a number of branches (32) while the control has the highest mean value in collar diameter (6.96mm).respectively.
Conclusion: It is recommended that organic fertilisers should be applied in raising D*einbolia pinnata* seedlings. These research advocates for the use of naturally produced fertilisers as products from such is safe for human consumption. this can also reduce the harmful effect of an inorganically produced crop on mankind.

keywords: *Deinbolia pinnata,* organic, inorganic fertilisers, growth variables

1.0 INTRODUCTION

Medicinal plants are gaining popularity among urban dwellers as a result of an inability of orthodox medicine to unravel cure for some intractable diseases like HIV AIDS, diabetes, sickle cell anaemia and host of other deadly diseases. Medicinal plants have produced therapeutic drugs in the pharmacy. Besides, indigenous medicinal plants are used as spices and food by man; some are added as food supplements for pregnant and nursing mother's medication (11,12).As a result, identifying these beneficial plants is highly imperative as a guide for gaining all the benefits they offer. One of these essential beneficial plants is the *Deinbolia pinnata* Schum. & Thonn., also known locally as Ogiri-egba.

Ethnobotanical information revealed that the roots and leaves of *D. pinnata* are used as a remedy for febrifuge, analgesic, bronchiasis intercostal, intestinal pains, jaundice, cough, asthma, aphrodisiac infections (1,14). Besides, reports abound in the literature on an accumulation of micro and macro elements in various morphological parts of flowering plants, reported for various active medicinal therapies (3).

Most tropical soils and forests are deficient in nitrogen and phosphorus nutrients and uptake of these limited quantities of nutrients by plant roots from litter is difficult (13,10). Soil fertility and plant nutrition are essential aspect of cropping system and these include an adequate supply of essential nutrients for soil productivity, plant nutrition and qualitative crop yield. The availability of these nutrients to plant contributes a lot to its growth and yield. Deficiency of mineral elements essential for plant crop is evident in poor yield and yield quality. An adequate supply of mineral elements is of importance in the tropics where the soil is poorly formed and continuous cropping is on the increase. For any sustainable crop production, soil fertility amelioration is essential. Tropical soils are inadequate in soil nutrients. Thus, the application of fertiliser or manure for amelioration of soil fertility is an integral part of suitable production (2)

Despite numerous folkloric utility of *D. pinnata* in traditional medicine, there are no known scientific studies on its silvicultural assessment and fertiliser application. Hence, to ensure the proper domestication, sustainable use and management of this species, efforts must be made to ascertain fertilizer preference to this crop with reference to its efficient use by the plant.

2.0 MATERIALS AND METHOD

2.1 Experimental Site

The experiment was carried out in the Multipurpose Tree Species multiplication and Improvement Unit Nursery at Forestry Research Institute of Nigeria (FRIN) Ibadan, Oyo state which is located within the Jericho Government Reserve Area (GRA) of Ibadan South-West Local Government area. The area lies within Latitude $7^0$23'15"N; $3^0$51'00"E and $7^0$24'00"N; $3^0$52'15"E. The climatic pattern of the area is tropical, annual rainfall ranges from 1,300-1,500mm and average relative humidity of about 71.9% while the average temperature is about 26^0C (7).

2.2.Procurement of seed and processing

Matured fresh fruits of *Deinbolia pinnata* were collected from the wild. Selections were made for desirable fruit and seeds were later extracted from the pulp, washed and air dried at room temperature for three (3) days before sowing. These were germinated in washed and sterilized river sand for two weeks in a propagator. After two weeks of germination, seedlings with desirable vigor were randomly selected and transplanted into polythene-pots (2 x 6cm) filled with mixture of top soil and the fertilizers.

2.3.*Preparation of potting mixtures and Experimental lay-out design*

Topsoil used in this experiment was collected at the Forestry Research Institute of Nigeria arboretum. The soil was air dried, visible roots, leaves and other debris were removed from the sand by sieving through a 2mm sieve size and then analyzed in the laboratory to determine the its physico-chemical properties (Table 1).

S/N	PH	SAND %	SILT %	CLAY %	P(MG/KG)	CA(CMOL/KG)	MG(CMOL/MG)	NA(CMOL/MG)	K(CMOL/KG)	MN (MG/KG)	ZN(MG/KG)	FE(MG/KG)	CU(MG/KG)
TA	7.28	73	9	18	0.09	3.3	0.4	0.04	0.12	82	28	40	22

Table 1: Pre-planting analysis of soil sample.

Cow dung amendments analysis was also carried out to determine its nutritional composition (Table 2). Two fertilizer treatments were applied i.e cow dung and urea with the control (without ant treatment). The Cow dung was collected from Federal College of Forestry cattle ranch. It was air-dried and allowed to decompose for 4 weeks. It was later grounded into powdery form. In addition to cow dung, urea was also used in the research. Eighty seedlings were transplanted into polythene bags using ten seedlings for each treatment.

PARAMETERS	VALUES
C	18.23 CMOL/KG
N	1.34CMOL/KG
P	1.5CMOL/KG
K	0.6701CMOL/KG
NA	1.34CMOL/KG
CA	2.34CMOL/KG
MG	0.21CMOL/KG
CU	20.4MG/KG
ZN	120.6MG/KG
FE	340MG/KG
MN	115MG/KG

Table 2: Laboratory Analysis of the used cow dung

A Completely Randomized Design was adopted for the work. Watering was done once a day. The amendments were weighed with a bean analytical balance into different ratio and mixed with the soil according to respective treatments. The amounts of nutrients added to each potting mix and the experimental combinations were as follows:

2.4.Treatments

2.5kg of cow dung + 5kg of soil

5.0kg of cow dung + 10kk of soil

7.5kg of cow dung + 15kg of soil

0.5g of urea +5kg of soil

1.0g of urea + 10kg of soil

1.5g of urea = 15kg o f soil

Control (no fertilizer application)

2.5. Data collection

After establishment of the experiment data were collected monthly for a period of four months and the following growth variables were assessed. Plant height (cm) was taken from the ground level to the tip of the seedlings using a graduated meter rule. Measurement of diameter at collar region was taken at the ground level using a digital venire caliper. The number of leaves produced by seedlings was counted and number of branches by counting the branches. Analysis of variance (ANOVA) was conducted to analyze the data. Where

significant differences occurred, least significant difference (LSD) was employed to separate the means.

3. RESULTS AND DISCUSSION

3.1. RESULT AND DISCUSSION

3.1.1 Growth variables of *Deinbolia pinnata* seedlings as influenced by cow-dung and urea

Analysis of variance showed the effects of fertilizers application on all the growth variables of *D. pinnata* seedlings. It was found out that fertilizer application had a significant effect on all the growth variables at 0.05 probability level (Table 3). The two organic and inorganic fertilizers affect the vegetative growth of D. pinnata.

HEIGHT	SV	SS	DF	MS	S
	TIME	3246.662	3	1082.221	.000
	TRT	1984.218	3	283.460	.000
	TIME * TRT	629.755	9	29.988	.002
	Error	3787.018	304	13.288	
	Total	81874.530	319		
CD	TIME	768.706	3	256.235	.000
	TRT	83.565	3	11.938	.000
	TIME * TRT	67.833	9	3.230	.000
	Error	341.779	304	1.195	
	Total	14719.292	319		
NL	TIME	13135.26	3	4378.42	0.00
	TRT	9607.94	3	1372.56	0.00
	TIME * TRT	775.69	9	36.94	0.90
	Error	16996.60	304	59.02	
	Total	242420.00	319		
NB	TIME	4126.73	3	1375.58	0.00
	TRT	17898.20	3	2556.89	0.00
	TIME * TRT	4526.34	9	215.54	0.00
	Error	2738.90	304	9.51	
	Total	80169.00	319		

Table 3: ANOVA for the Effect of Fertilizers on the Growth of *Deinbolia pinnata* seedlings

However, the highest plant height was observed when 5.0kg (20.59cm) of cow-dung was used and this was followed by 2.5kg with a mean of 14.85cm (Table 4). For collar diameter, highest mean value was recorded in control with a mean value of 6.96cm followed by 6.70 at 7kg of cow dung fertilizer application (Table 4). Furthermore, number of leaves and number of branches recorded highest mean values of 36 and 32 at 5.0kg level of application followed by 30 and 11 at 2.5kg respectively (Table 4).

	HT	CD	NL	NB
CD1	14.85bc	5.36a	30c	11bc
CD2	20.59e	6.17b	36d	32d
CD3	13.44ab	6.70bc	24b	10bc
CD4	13.97bc	6.96cd	19a	7a

Table 4: Average mean value of growth variable under the influence of cow dung.

In terms of urea application 0.5g/pot gave the highest mean value of 17.15cm for height followed by 1.5g/pot (15.34) table 4. However, seedlings with 1.5kg/pot level of application gave the highest mean value for collar diameter of 7.22mm followed by 6.61mm at 0.5g/pot (Table 5). Number of leaves has the highest mean values of 28 followed by 23 at 0.5kg/ha and 1.5kg/ha respectively. Moreover, number of branches also has it highest value of 11 followed by 10 at 1.0kg/ha, control and 1.5kg/ha respectively (Table 5).

TRT	HT	CD	NL	NB
UR1	17.15d	6.61bc	28c	9b
UR2	13.45ab	6.37b	22ab	11bc
UR3	15.34c	7.22e	23ab	10bc
UR4	11.92a	6.58bc	19a	11c

Table 5: Average mean value of growth variable under the influence of urea

Comparing cow dung and urea fertilizers application, cow dung produced seedlings that have the highest height and number of leaves while urea fertilizer application produces plant with the highest collar diameter. The two types of fertilizer were able to produce highest number of branches.

3.2. Growth variables of *Deinbolia pinnata* seedlings as in influenced by time of planting.

Analysis of variance also showed the effects of time on all the growth variables of *D. pinnata seedlings.* And it was discovered that time had a significant effect on all the growth variables at probability level of 0.05% (Table 3).

Plant height increases with time of planting and the greatest effect of time on height was achieved at the fourth month after planting with a mean height of 19.85 cm (Table 6).

For collar diameter, time of planting also had a significant effect, as it increases progressively with the time of planting and the highest mean recorded was at four months after planting 8.72mm (Table 6).

Furthermore, both number of leaves and number of branches increases with the increasing months of planting as highest mean value was also recorded at the fourth month, 33.43 and 16.76 respectively.

TIME	HEIGHT	CD	NL	NB
T1	10.83a	4.43a	16.36a	7.09a
T2	14.51b	5.88b	22.41b	12.05b
T3	16.94c	6.98c	28.53c	14.53c
T4	19.85d	8.72d	33.43d	16.76d

Table 6: Average number of growth variables under the influence of time.

3.3. Effect of Fertilizer application on growth of *Deinbolia Pinnata* seedlings months after planting.

However, in the effect of time and treatment, Analysis of variance showed a significant effect at (p>0.05) probability level (Table 3). But it is exceptional in the case of effect of time and treatment on number of leaves which is not significantly different at (p>0.05) level of probability (Table 3).

3.3.1. *Effect of fertilizer application on height of Deinbolia pinnata seedlings months after planting.*

Fertilizer application increases with time from the first month through to the last month but highest value was recorded for cow-dung in the fourth month at 5.0kg level of application and this was followed by control also in the fourth month (Fig. 1).

Urea application also increases with time throughout the month. Highest mean value was recorded in the fourth month at 0.5g/pot level of application which is followed by 1.5kg also at the fourth month (Fig. 1). Urea has the highest mean value with 0.5g/pot level of application at the fourth month when compared with cow dung (Fig. 1).

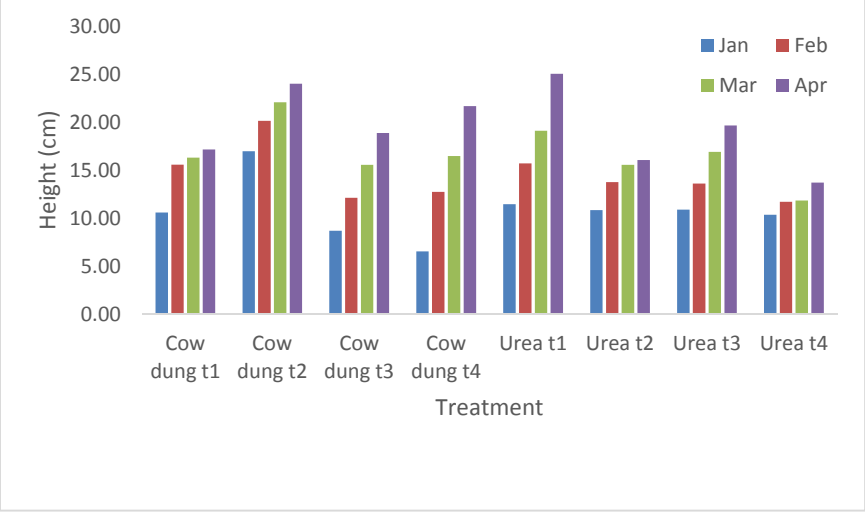

Fig. 1: **Effect of fertilizer application on height of *Deinbolia pinnata* seedlings months after planting.**

3.3.2. Effect of fertilizer application on collar diameter of *Deinbolia pinnata* seedlings months after planting

For cow dung 7.5kg and control both has the same mean value of collar diameter being the highest at the fourth respectively but in the case of urea at 1.5kg level of application the mean value recorded was also high at the fourth month. in comparison urea also gave the highest value of collar diameter at the fourth month (Fig 2).

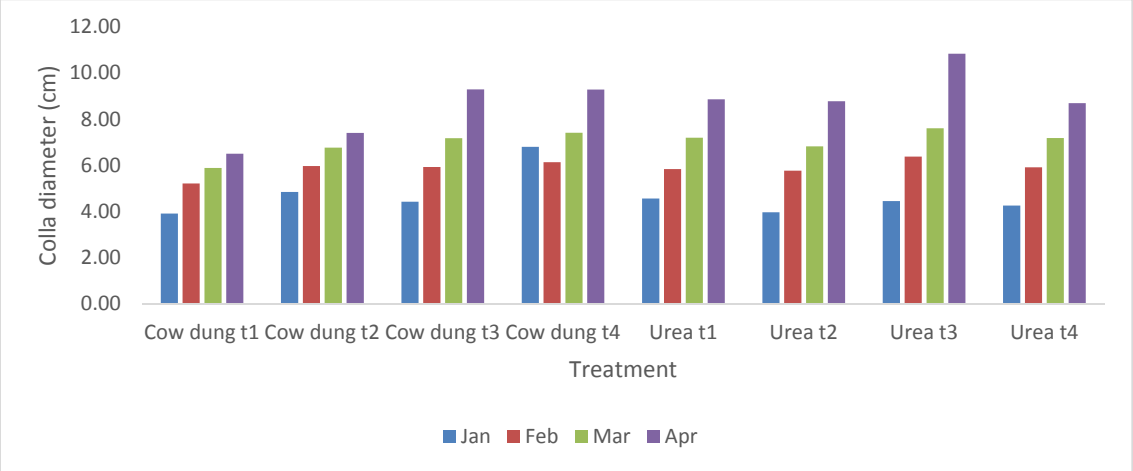

Fig. 2: Effect of fertilizer application on collar diameter of *Deinbolia pinnata* seedlings months after planting

3.3.3. Effect of fertilizer application on number of leaves of *Deinbolia pinnata* seedlings months after planting.

At the fourth month highest value for number of leaves with cow-dung at 5.0kg level of application was recorded.

Urea has it highest value achieved at the fourth month also with 0.5g/pot level of application. But cow-dung treatment still performs best than urea (Fig 3).

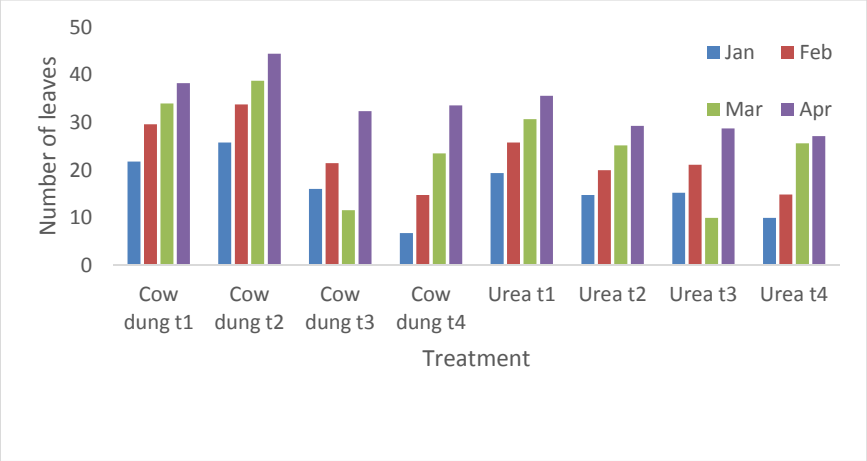

Fig. 3: **Effect of fertilizer application on number of leaves of *Deinbolia pinnata* seedlings months after planting.**

3.3.4. Effect of fertilizer application on number of branches of *Deinbolia pinnata* seedlings months after planting

There was a drastic reduction in the effect if treatment and time of planting on the number of branches a there was a great difference in the time of panting with cow-dung at 5.0kg. as compared to urea treatment. Highest value was recorded in the fourth month with cow-dung at 0.5g/pot level of application (Fig 4).

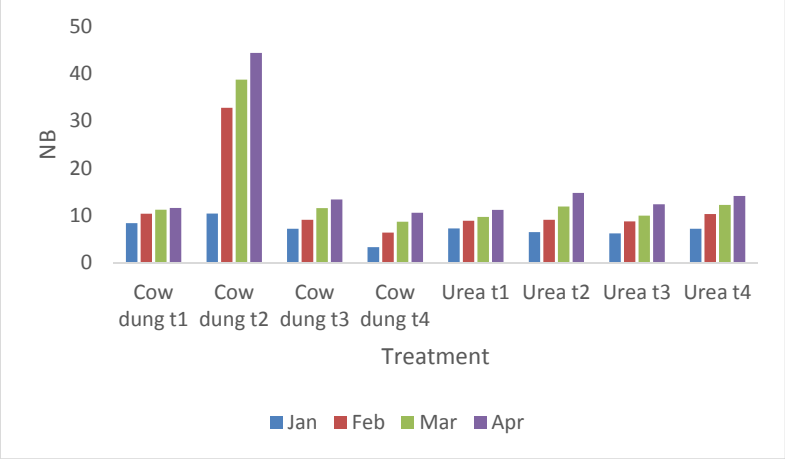

Fig 4: **Effect of fertilizer application on number of branches of *Deinbolia pinnata* seedlings months after planting.**

4.0 DISCUSSION

It was observed from this experiment that the amendments, especially the organic fertilizer have further enhanced better growth performance of the seedlings in all the parameters measured compared to the inorganic

urea. The addition of organic matter content resulting from organic fertilizer application helps to improve nutrient availability to plants, especially in tropical soils that are generally low in soil organic matter and clay (15).

The highest growth parameters of *D. pinnata* occurred in organic manure more than inorganic urea did. This might be as a result of the highest release of essential nutrients from the organic fertilizer. This was in accordance with (4) who reported that higher rate of plant growth in organic fertilizer application reiterates the fact that organic fertilizers steadily release available nutrients overtime and not like inorganic fertilizers that release nutrients within a short period to plant, then leaches away from the root zones. Research reports had shown that *coffee arabica* (5,9) and Anacardium occidentale were successfully produced organically with animal manure. Also (16) reported that *Dennetia tripetala* seedlings had a superior performance in a combination of top soil and Cow dung medium. Furthermore, (8) reported that application of different rates of cow dung to Okra led to significant increase in growth and yield over the control. The positive growth response of the *Deinbolia pinnata* seedlings to organic and inorganic soil amendments than control indicated that the soil collected for this research is inherently low in some essential nutrients (Table 1), hence the level of many essential nutrients in these soils is lower and was readily available and supplied from the organic and inorganic amendments.

The *Deinbolia pinnata* seedlings were more responsive to the animal sourced (organic manure) amendments compare to the inorganic fertilizer, thus indicating there were some important nutrients that were being supplied to the *Deinbolia piñata* seedlings by the organic manures which were not available in the inorganic fertilizer urea. Organic and inorganic sourced fertilizers were competitive in the growth pattern of D*einbolia pinnata* seedlings, and after four months of their application, they resulted to a general significantly higher plant growth.

Animal manure is readily available as waste from farmers. It cost less than the synthetic inorganic fertilizers. It is environmental friendly as it does not damage the soil as against the inorganic fertilizer which can cause soil acidity due to continuous use. The organic fertilizer does not require expertise for its application (6). It is recommended that *D. pinnata* can be cultivated with organic fertilizers. The fruits produced through this medium will be safer for mankind to avert the likely diseases derived from the consumption of foods produced through inorganic fertilizers.

CONCLUSION

It could be deduced from this study that application of nutrient supplements as soil amendments enhanced the growth performance of *Deinbolia pinnata* seedlings resulting in rapid plant height, leaf production and increased plant stem girth that are inevitable for vigorous plant growth. Composted cow-dung fertiliser showed higher significant differences on stem girth, plant height. The use of organic fertilisers from animal source was significant in this experiment and hence, capable of cushioning the hardship faced by farmers on high costing and scarcity of inorganic fertilisers in Nigeria. The use of organic manure especially cow dung in producing *D. pinnata* for consumption as fruit will further support the global advocacy for organic farming.

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