

**Comparative Evaluation of Organic and Inorganic Fertilizers on the Growth of
Deinbolia pinnata Schum. & Thonn seedlings: An underutilised MULTIPURPOSE
SPECIES.**

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

Aims: : A pot experiment conducted to assess the effects of organic fertilizer (cow dung) and inorganic fertilizer (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), number of leaves (36) and number of branches (32) while control has the highest mean value in collar diameter (6.96mm).respectively.

Conclusion: It is recommended that organic fertilizers should be applied in raising *Deinbolia pinnata* seedlings. this research advocates for the use of naturally produced fertilizers as products from such is safe for human consumption. this can also reduce the harmful effect of inorganically produced crop on mankind.

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

1.0 INTRODUCTION

Medicinal plants are gaining popularity among urban dwellers as a result of 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 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 remedy for febrifuge, analgesic, bronchiasis intercostal, intestinal pains, jaundice, cough, asthma, aphrodisiac infections (1,14). In addition, reports abound in literature on 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 important aspect of cropping system and these include 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. 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 fertilizer 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 fertilizer 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 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°23'15"N; 3°51'00"E and 7°24'00"N; 3°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°C (7).

2.2. Procurement of seed and processing

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

61

62 **2.3.Preparation of potting mixtures and Experimental lay-out design**

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

S / N	P H	SA N D %	SI L T %	CL AY %	P(MG /KG)	CA(C MOL/ KG)	MG(C MOL/ MG)	NA(C MOL/ MG)	K(C MOL /KG)	M N (M G/ KG)	ZN(MG/ KG)	FE(MG/ KG)	CU(MG/ KG)
T A 2 8	7	73	9	18	0.09	3.3	0.4	0.04	0.12	82	28	40	22

67

68

69 **Table 1: Pre-planting analysis of soil sample.**

70

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

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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

81

82 **Table 2: Laboratory Analysis of the used cow dung**

83

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

88 **2.4.Treatments**

- 89 2.5kg of cow dung + 5kg of soil
90 5.0kg of cow dung + 10kg of soil
91 7.5kg of cow dung + 15kg of soil
92 0.5g of urea + 5kg of soil
93 1.0g of urea + 10kg of soil
94 1.5g of urea + 15kg of soil
95 Control (no fertilizer application)

96 2.5.Data collection

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

103 3. RESULTS AND DISCUSSION

107 3.1. RESULT AND DISCUSSION

108 3.1.1 Growth variables of *Deinbolia pinnata* seedlings as influenced by cow- 109 dung and urea

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

Comment [D1]: Statistical tool/instrument employed should be clearly stated in the methodology

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

Comment [D2]: Wrong placement of the titles of tables. The titles should precede the tables.

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.

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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

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166

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

168

169 **3.3. Effect of Fertilizer application on growth of *Deinbolia Pinnata* seedlings** 170 **months after planting.**

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

175 **3.3.1. Effect of fertilizer application on height of *Deinbolia pinnata* seedlings** 176 **months after planting.**

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

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

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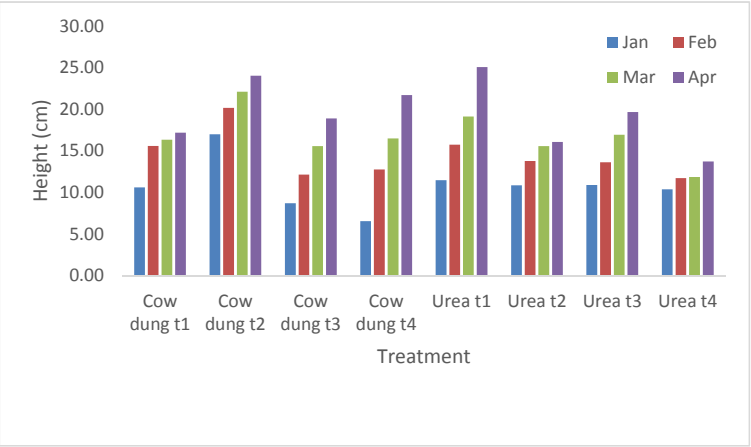


Fig. 1: Effect of fertilizer application on height of *Deinbolia pinnata* seedlings months after planting.

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).

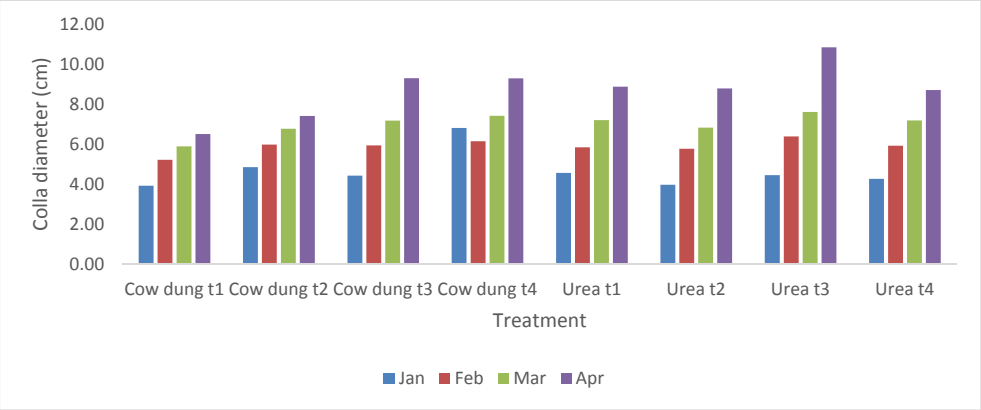


Fig. 2: Effect of fertilizer application on collar diameter of *Deinbolia pinnata* seedlings months after planting

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).

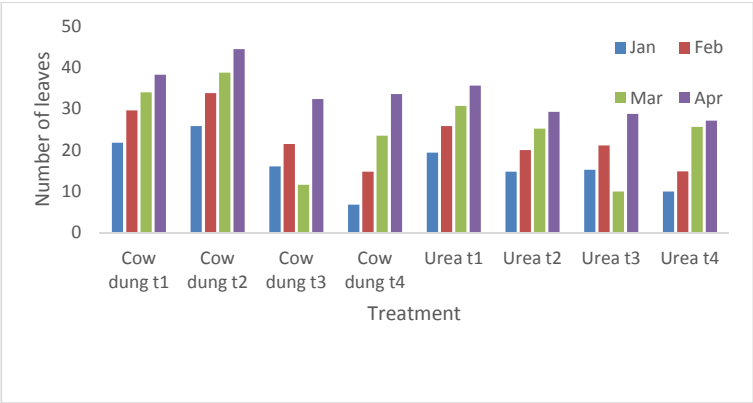


Fig. 3: Effect of fertilizer application on number of leaves of *Deinbolia pinnata* seedlings months after planting.

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).

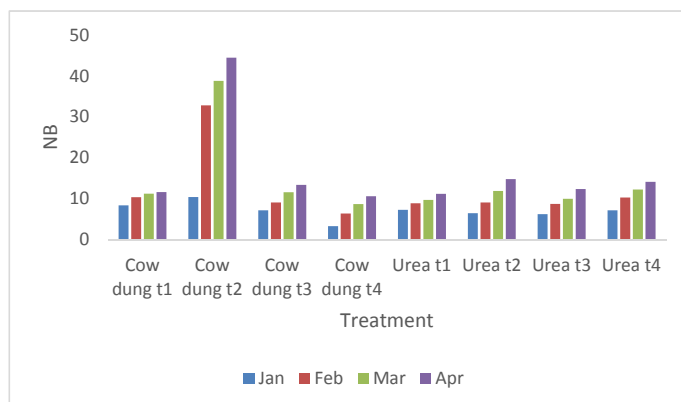


Fig 4: Effect of fertilizer application on number of branches of *Deinbolia pinnata* seedlings months after planting.

4. 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 *Denetia 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 pinnata* 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 *Deinbolia 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 plant vigorous growth. Composted cow-dung fertilizer showed higher significant differences on stem girth, plant height. The use of organic fertilizers from animal source was significant in this experiment and hence, capable to cushion the hardship faced by farmer's on high costing and scarcity of inorganic fertilizers in Nigeria. The use of organic manure especially cow dung in producing *D. pinnata* for consumption as a fruit will further support the global advocacy for organic farming.

REFERENCES

1. Agboola, O.I., Ajayi, G.O., Adesegun, S. and Adesanya, S.A., 2012. Investigating molluscidal potentials of some Nigerian Sapindaceae family, Archives of Applied Sci. Res., 4(3): 1240-1243.
2. Aluko, O.A., Olanipekun, T.O., Olosoji, J.O., Abiola, I.O., Adeniyani, O.N., Olanipekun S.O., Omenna E.C., Kareem K.O. and Douglas A.I., 2014. Effect of Organic and Inorganic

Comment [D3]: All Journal names are supposed to be written in full to avoid one being misconstrued for another

285 Fertilizer on the Yield and Nutrient Composition of Jute Mallow. Published by European
286 Centre for Research Training and Development UK.
287

288 3. Baker and Brooks 1989. Plants as natural sources of concentrated mineral nutritional
289 supplements. Food Chemistry, Michael Blaylock. Elsevier, Science Ltd., p. 81.

290 4. Carl R. and Roger E. (2005). Nutrient management for commercial fruit and vegetable
291 Crops in Minnesota, published by University of Minnesota, extension service, pp 6-11.

292 5. Daniel, M.A., and Obi, O.A. (2006). The effect of three organic fertilizers on the growth
293 Coffee Canephora seedlings. Proceedings of the 21st international conference on coffee
294 Science 11-15 September, 2006, Montepella, France, pp. 1206 1208, 1209-1211.
295

296 6. Fabiyi E.F, Ademiluyi B.O and Abiodun J. 2015: Comparative evaluation of organic and
297 inorganic manure on sweet pepper performance in two ecological zones of Nigeria. American
298 Journal of experimental Agriculture. 6(5):305-309.
299

300 7. FRIN, (2017): Forestry Research Institute of Nigeria Annual Metrological station data
301 report.

302 Gudugi I.A.S. 2013: Effect of cow dung and variety on the growth and yield of Okra
303 (*Abelmoschus esculentus* (L.). European Journal of Experimental Biology, 2013, 3(2):495-
304 498
305

306 8. Ipinmoroti, R.R., Adebowale, L.A., Ogunlade, M.O., Iremiren, G.O. and Adeoye, G.O.
307 (2006). Effect of inorganic and organic nutrient sources on growth, dry matter yield and
308 nutrient uptake of coffee seedlings. Proceedings of international coffee (ASIC) conference,
309 France, 13-19 September, 2006, pp. 1196-1198.

310 Jose LM (2003). Nitrogen and Phosphorus resorption in tree of Neotropical rain forest J.
311 Trop. Ecol., 19: 465-468.

312 9. Joy P.P, Thomas J, Mathew S & Skaria BP 2001. Medicinal Plants. Tropical Horticulture
313 Vol. 2. (Eds. Bose TK, Kabir J, Das P & Joy PP). Naya Prokash, Calcutta, pp. 449-632.
314

315 10. Ladeji O, Ahin CU & Umaru HA 2004. Level of antinutritional and nutritional factors in
316 vegetables commonly eaten in Nigeria, African J. Natural Sci., 7: 71-73.
317

- 318 11. Lawrence D (1998). The response of tropical tree seedlings to nutrient supply: Meta-
319 analysis for understanding a changing tropical landscape. *J. Tropical Ecol.*, 16: 239-242.
- 320 Margaret OS, Florance OJ, Adamu AA, Anthony JA, Oluwakemi AO & Oluwole BF 2011.
321 Evaluation of antioxidant and antibacterial properties of six Sapindiceae. *J. Medi. Plant Res.*,
322 6(1): 154-160.
- 323
- 324 12. Ogunwale, J. A., J. O. Olaniyan and M. O. Aduloju, 2002. Morphological, physico-
325 chemical and clay mineralogical properties of soils overlaying basement complex rocks in
326 Ilorin East, Nigeria. *Moor Journal of Agricultural Research*, 3 (2): 147 – 154.
- 327 13. Osaigbovo, A. U., Nwaoguala, C. N. C. and J. E. Falodun 2010: Evaluation of potting
328 media for the production of pepper fruit (*Dennetia tripetala*) seedlings. *African Journal of*
329 *General Agriculture* Vol. 6, No. 2.