Effect of Etymology on Early Growth Performance of Dialium *guineense.* Wild and Biomass Accumulation

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Abstract:- **The development of seed and its biomass accumulations is subject to a highly complex and particular regulation mechanism, which brings into play both the yield and biological expectancy to each species. Effect of etymology on early growth performance and biomass accumulation of Dialium *guineense* was established in this study. The seeds were collected across four different locations viz: Lagos, Ogun, Anambra and Abuja. Their seeds were raised into seedlings and data was collected on growth performance and biomass accumulation. The results were analyzed using Completely Randomized Design (CRD). The result of the leaf count indicated no significant differences (P≤0.05) throughout the 12 weeks of observation. There are significant differences in collar diameter for week 2, 4 and 8 while treatment four (T4) proved best. For leaf area there is significant difference on week 4, 6 and 8 while Treatment 1 (T1) had the highest value for week 4, 6 and 8 respectively. Wet root weight obtained shows significant difference (P<0.05) in week 4, 6, 8, 10 and 12 while week 2 shows no significant difference respectively. Total dry root weight shows significant difference (P<0.05). The relationship between wet and dry biomass of *D. guineense* is an indication that there is positive linear relationship between the wet and dry biomass.**

Keywords: **Accession, growth, Biomass, *Dialium guineense***

I. INTRODUCTION

Dialium guineense also known as Black Velvet Tamarind (BVT) is an indigenous tropical forest fruit tree of the family Fabaceae. BVT serves as food supplement, herbal medicine and as source of energy are well documented by Nwaoguala and Osaigbovo, (2009). According to Ogbe and Egharevba, (1992), BVT is a lesser known tropical forest fruit with high consumption but given a less priority in terms of research, production, improvement, storage and hence not domesticated. The world's forests are declining at unprecedented rates. Losses are resulting directly from clearing land for agriculture, roads, settlements, logging timber and cutting for fuel. As the number of individuals and populations that comprise a species are reduced and its gene pool eroded, the species can be pushed to extinction. According to Hettash *et al., (*2009) is a major concern of breeder's world-wide. Once the genes of populations or species are extinct, they can never be brought back to aid their adaptation to changing environmental or to be used in developing improved varieties. Growers work to provide the right conditions for planting: preparing a proper seedbed (moisture and texture), selecting an appropriate variety, planting at the right time and depth, using a seed treatment, etc. Unfortunately there are aspects over which farmers have no control and they must rely on the Seeds to emerge rapidly and evenly from the soil. Nonogaki, *et al.* (2010) notes that germination starts with water imbibition followed by physiological changes in the seed and is complete with the appearance of the radicle through the seed structures. The seed must be properly processed and stored using available resources (Xiao-Xia *et al*., 2008). Indigenous forest fruits have been recognized as food supplements which contribute to food security and livelihood in the rural areas. These fruits are gradually going to extinction and this call for attention of researchers for sustainability of the fruits and its establishment.

The study aims at evaluation of the importance of seed source on seedling growth and biomass accumulation of *Dialium guineense*. This will inform the strategies and scope of the seed collection, establishment and effective management of the seedlings of the fruit tree species.

II. METHODOLOGY

Study area

Matured fruits of *D. guineense* were collected and extracted from four different locations as shown below;

SN	Fruit/seed source	State	Country	Latitude	Longitude
1.	Badagry	Lagos	Nigeria	6^o 25N	2^o 55E
2.	Ijebu Ode	Ogun	Nigeria	6^o 47N	3^o 52E
3.	Nnewi	Anambra	Nigeria	6^o 0N	6^o56E
4.	Gwagwalada	Abuja	Nigeria	9^o 16N	7^o 2E

Experimental Site

The experiment was carried out at Forestry Research Institute of Nigeria located in Jericho Hill Ibadan North West Local Government Area of Oyo State, Nigeria. It lies between latitude 7^o 24'N and longitude 3^o 55'E. The climate is typically dominated by rainfall pattern ranging between 1400mm- 1500mm and the average temperature of 32^o C with two distinct seasons. Dry season (usually between November and March) and Rainy season (from April to October), (FRIN Annual Metrological Report, 2001).

Seed Extraction

300 fruits of *D. guineense* were collected under four different trees from each of the locations. Aggregately, making One thousand two hundred (1200) fruits in all. Extraction of the seeds from the collected fruits was done in nursery. Seed extraction involved the manual depulping of the fruits. All the depulped seeds from each of the locations were thoroughly mixed before selection was done. One hundred (100) seeds were selected randomly to simulate genetic representation of each location.

Data collection

The seeds of *D. guineense* were soaked for 48hrs as pre-treatment before planting. Germination trays was filled with washed sterilized river sand, 30 seeds were put in each according to the following label. Lagos (A1), Ogun (A2), Anambra (A3), Abuja (A4). This was replicated 4 times and placed under humid propagator. Watering was done daily, germination was recorded and analysed. From each location, 10 (Ten) vigorous and uniformly growing seedlings were transferred into medium size polythene pots already filled with 1kg of topsoil. The growth assessment begins two weeks after transplanting when the seedlings have been stabilized. This was done fortnightly for twelve weeks.

Growth variables and biomass was measured at the stated intervals. Biomass assessment was carried out using two seedlings from each location at two weeks interval for twelve (12) weeks. Two seedlings from each source were carefully uprooted by lowering in water and all soil particles carefully removed. The seedlings were then separated into roots, stems and leaves components. The fresh weight of the different seedling components was determined for each seedling using an electronic meter balance, (H 35). The different components were then oven dried at 60^oC for forty-eight (48) hours and then weighed again to determine the dry weight.

Data Analysis

The data collected was subjected to Analysis of Variance (ANOVA) in completely randomized design (CRD). Duncan Multiple Range Test (DMRT) was used to separate the means (P≤0/05).

III. RESULTS AND DISCUSSION

Results

Table 1. Duncan Multiple Range Test (DMRT) for growth parameters on provenance of D.guineense based on observation weeks

Treatment	**Observation weeks for leaf count**					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	5.00±0.47a	5.30±0.67a	6.30±0.67a	6.70±0.82a	7.80±0.78a	9.10±1.19a
T2	5.10 ±0.99a	5.10±0.99a	5.90±0.99a	6.50±0.97a	7.80±0.91a	8.60±1.26a
T3	4.70 ±0.48a	4.90±0.58a	5.90±0.73a	6.80±1.03a	7.40±1.17a	8.40±1.57a
T4	5.30± 0.67a	5.40±0.69a	6.60±1.07a	6.50±1.08a	8.10±1.10a	9.50±0.97a
P-value (Sig)	0.28	0.46	0.23	0.13	0.49	0.22
	Ns	ns	ns	ns	ns	ns
Treatment	**Observation weeks for collar diameter (cm)**					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	1.10±0.12c	1.22±0.09b	1.39±0.08a	1.49±0.01b	1.65±0.04a	1.93±0.08a
T2	1.25±0.21b	1.08±0.35d	1.43±0.04a	1.49±0.04b	1.60±0.05a	1.82±0.04a
T3	0.87±0.14d	1.13±0.08c	1.38±0.09a	1.43±0.01c	1.60±0.03a	1.99±0.09a
T4	1.41±0.24a	1.44±0.18a	1.55±0.39a	1.60±0.04a	1.72±0.02a	1.92±0.04a
P-value (Sig)	0.00	0.00	0.15	0.03	0.27	0.40
	Sig	sig	ns	sig	ns	ns
Treatment	**Observation weeks for leaf area (cm^2)**					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	3.33±0.11a	3.44±0.10a	3.29±0.08a	3.40±0.08a	3.32±0.07a	3.14±0.10a
T2	2.91±0.05a	3.04±0.07b	2.76±0.11b	2.88±0.07d	2.84±0.12a	2.57±0.15c
T3	3.10±0.20a	3.02±0.18b	3.14±0.17b	3.07±0.13b	3.19±0.17a	3.05±0.13a
T4	2.83±0.17a	2.72 ±0.18c	2.75±0.15b	2.98±0.10c	2.87±0.18a	2.72±0.13b
P-value (Sig)	0.10	0.01	0.01	0.00	0.06	0.01
	Ns	sig	sig	sig	ns	sig

	Observation weeks for stem height (cm)					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	16.20±7.98a	8.51±0.20b	8.98±0.22b	9.79±0.32b	10.74±0.36b	12.54±0.61b
T2	6.44±1.16 b	7.18±0.42c	7.43±0.39d	8.46±0.45c	8.51±0.44d	10.29±0.53d
T3	7.44±1.00b	7.95±0.32c	8.28±0.36c	9.23±0.49b	10.70±0.46c	11.89±0.70c
T4	8.56±1.00b	9.79±0.45a	10.15±0.43a	10.69±0.53a	12.34±0.54a	13.55±0.63a
P-value (Sig)	0.31	0.00	0.00	0.01	0.00	0.01
	Ns	sig	sig	sig	sig	sig

Significant (P≤0/05).

Table 2. Duncan Multiple Range Test (DMRT) for D.guineense wet biomass

Treatment	Observation weeks for leaves wet weight (g)					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	$0.12±0.01^{c}$	$0.18±0.01^{b}$	$0.26±0.03^{b}$	$0.45±0.00^{b}$	$0.65±0.01^{b}$	$0.72±0.00^{c}$
T2	$0.11±0.14^{c}$	$0.17±0.01^{b}$	$0.26±0.03^{b}$	$0.38±0.01^{c}$	$0.58±0.03^{c}$	$0.71±0.00^{c}$
T3	$0.20±0.00^{a}$	$0.15±0.00^{c}$	$0.20±0.00^{c}$	$0.34±0.01^{d}$	$0.56±0.02^{c}$	$0.74±0.00^{b}$
T4	$0.14±0.00^{\mathbf{b}}$	$0.31±0.00^{a}$	$0.53±0.11^{a}$	$0.64±0.07^{a}$	$0.77±0.05^{a}$	$0.83±0.05^{a}$
P-value (Sig)	0.00	0.00	0.00	0.00	0.03	0.05
	Sig	sig	sig	sig	sig	sig
Treatment	**Observation weeks for plant shoot wet weight (g)**					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	0.06±0.01a	0.08±0.01a	0.13±0.03a	0.26±0.02a	0.35±0.02a	0.39±0.01b
T2	0.05±0.00a	0.07±0.01a	0.13±0.03a	0.22±0.01b	0.31±0.01a	0.38±0.01b
T3	0.06±0.00a	0.07±0.01a	0.13±0.03a	0.22±0.01b	0.31±0.01a	0.36±0.01c
T4	0.06±0.00a	0.06±0.02a	0.16±0.03a	0.27±0.01a	0.36±0.01a	0.43±0.01a
P-value (Sig)	0.20	0.83	0.85	0.05	0.06	0.00
	Ns	ns	ns	sig	ns	sig
Treatment	**Observation weeks for plant root wet weight (g)**					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	0.06±0.00a	0.09±0.01b	0.10±0.00c	0.24±0.01a	0.34±0.01a	0.39±0.00a
T2	0.05±0.00b	0.06±0.00d	0.10±0.01c	0.27±0.02a	0.32±0.03a	0.36±0.02a
T3	0.05±0.01b	0.07±0.01c	0.11±0.01b	0.29±0.04a	0.33±0.02a	0.37±0.02a
T4	0.07±0.00a	0.10±0.01a	0.20±0.01a	0.27±0.01a	0.33±0.01a	0.38±0.01a
P-value (Sig)	0.05	0.01	0.00	0.69	0.93	0.59
	Sig	sig	sig	ns	ns	ns

Significant (P≤0/05).

Table 3. Duncan Multiple Range Test (DMRT) for D.guineense dry weight biomass

Treatment	Observation weeks for leaves dry weight (g)					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	0.01±0.00a	0.02±0.00a	0.07±0.00a	0.13±0.01c	0.19±0.01a	0.21±0.01d
T2	0.01±0.00a	0.02±0.00a	0.06±0.00a	0.11±0.01d	0.17±0.01c	0.23±0.01c
T3	0.01±0.00a	0.02±0.00a	0.26±0.19a	0.15±0.01b	0.18±0.01b	0.26±0.01b
T4	0.02±0.00a	0.02±0.00a	0.15±0.02a	0.20±0.01a	0.19±0.01a	0.34±0.01a
P-value (Sig)	0.76	0.15	0.49	0.00	0.00	0.00
	Ns	ns	ns	sig	sig	sig

Treatment	Observation weeks for plant shoot dry weight (g)					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	0.01±0.00a	0.02±0.00a	0.04±0.00b	0.10±0.01a	0.11±0.00b	0.12±0.00b
T2	0.01±0.00a	0.02±0.00a	0.03±0.01c	0.09±0.00a	0.11±0.01b	0.12±0.00b
T3	0.01±0.00a	0.01±0.00a	0.04± 0.00b	0.08±0.01a	0.11±0.00b	0.12±0.00b
T4	0.01±0.00a	0.01±0.00a	0.07±0.00a	0.10±0.01a	0.12±0.00a	0.14±0.01a
P-value (Sig)	0.20	0.23	0.05	0.62	0.03	0.04
	Ns	ns	sig	ns	sig	sig
Treatment	**Observation weeks for plant root dry weight (g)**					
	Wk 2	**wk4**	**wk6**	**wk8**	**wk 10**	**wk 12**
T1	0.01±0.00a	0.01±0.00a	0.02±0.00b	0.02±0.00c	0.03±0.00b	0.03±0.00b
T2	0.01±0.00a	0.01±0.00a	0.02±0.00b	0.03±0.00b	0.03±0.01b	0.03±0.00b
T3	0.01±0.00a	0.01±0.00a	0.01± 0.00c	0.02±0.00c	0.03±0.00b	0.04±0.00a
T4	0.01±0.00a	0.01±0.00a	0.03± 0.00a	0.04± 0.00a	0.04± 0.00a	0.04±0.00a
P-value (Sig)	0.22	0.77	0.00	0.00	0.00	0.00
	Ns	ns	sig	sig	sig	sig

Significant (P≤0/05).

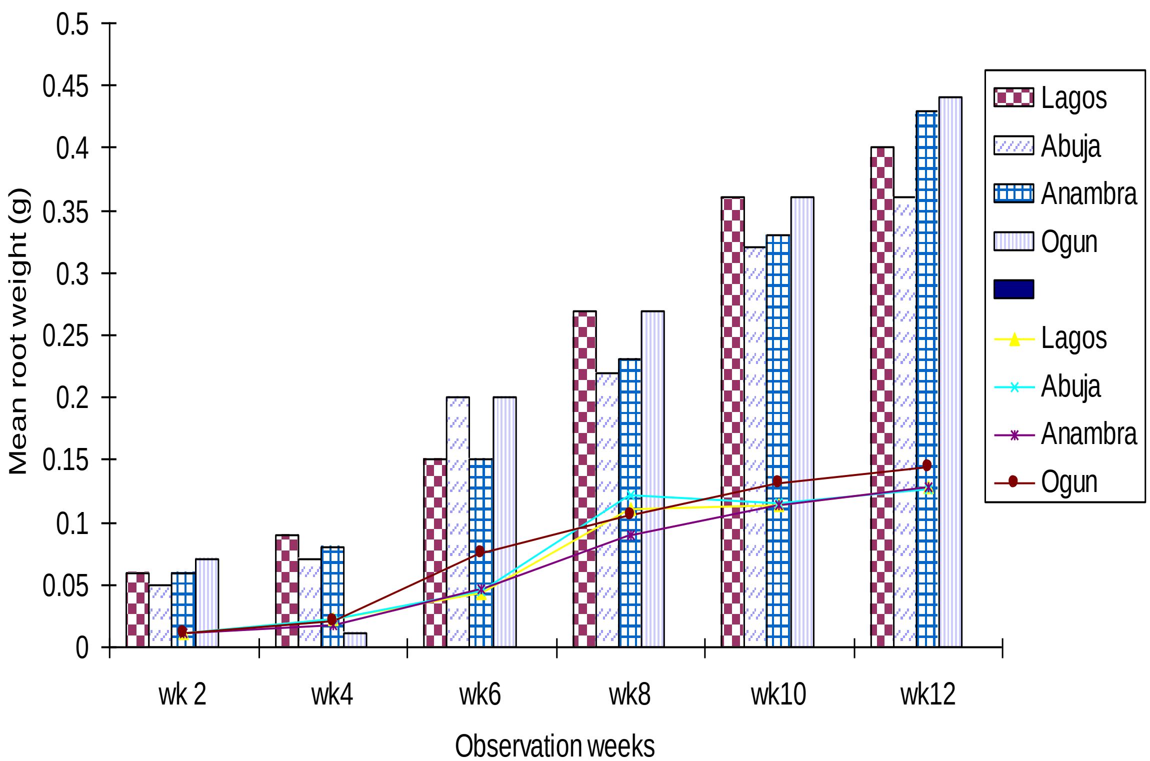

Fig 1. Relationship between mean wet and dry root weight

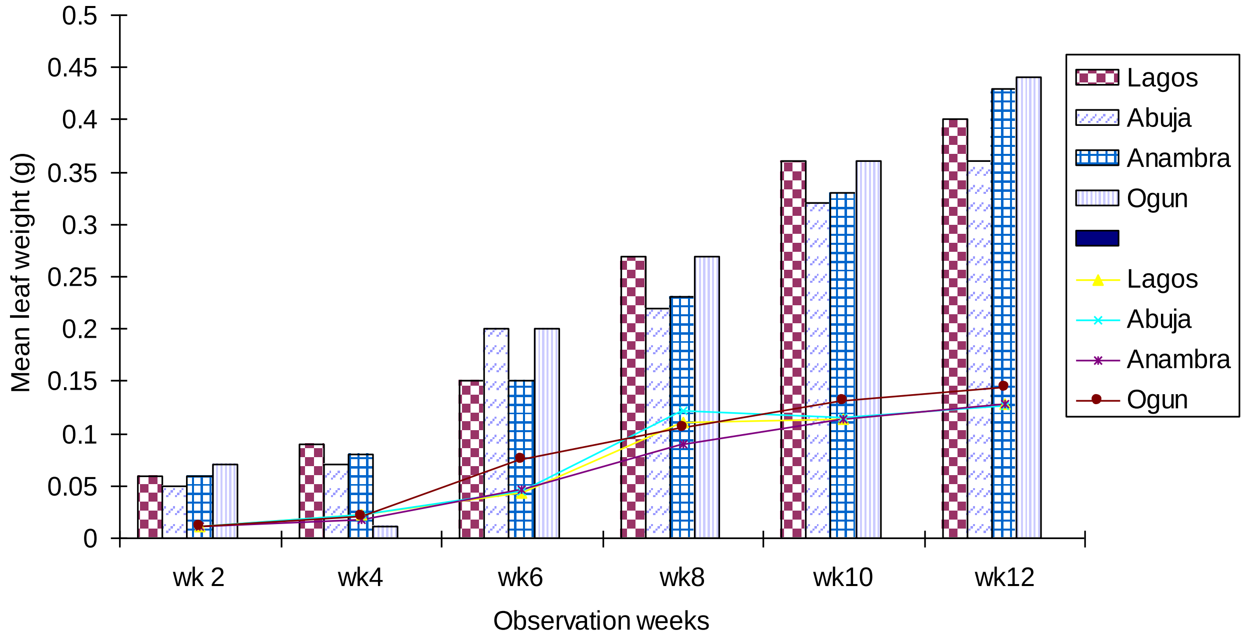

Fig 2. Relationship between mean wet and dry leaf weight

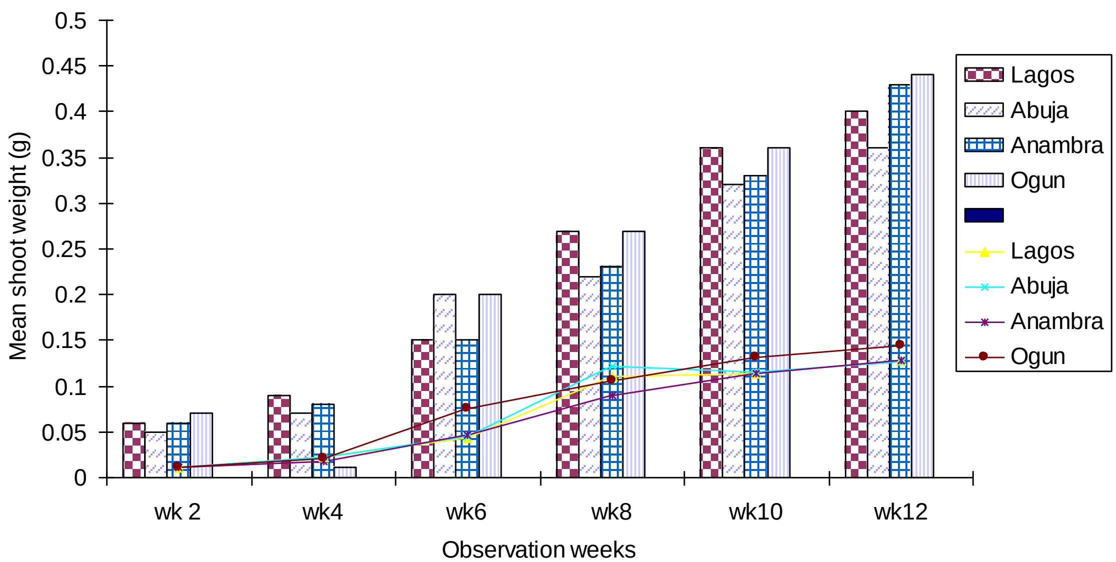

Fig 3. Relationship between mean wet and dry shoot weight

Discussion

The variation of accessions on early growth performance and biomass accumulation of *Dialium guineense* Wild was established in this study. The analysis of variance conducted for leaf count showed no significant different ($P<0.05$). Hence, there was increase in leaf count on weekly basis (table 1). There are significant differences in collar diameter for week 2, 4 and 8 while treatment four (T4) proved best. This is an indication that *D. guineense* does not depend solely on location but rather on potting medium and nutrients availability for striving. Leaf area of *D.guineense* indicated significant difference ($P<0.05$) on week 4, 6, 8 and 12 while week 2 and 10 showed no significant different ($P> 0.05$). There is significant difference ($P< 0.05$) on stem height across the weeks of observation expect for week 2 which shows no significant difference ($P> 0.05$). The follow up test conducted for the stem height indicated that location or seed source has significant effect on seedling performance of *D. guineense.*

For the observation weeks, week 4 to week 12, highest stem height were found in Abuja followed by Lagos, Anambra and Ogun state respectively. This is an indication that apart from potting medium, location and seed source could also influence the growth performance of *D. guineense* as observed in this study. It has also been found that frequent watering of the seedlings of some tropical rain forest tree species reduced their growth rates and encouraged damping- off (Oni and Bada, 1991; Jimoh and Okali, 1999). Abugre and Oti-Boateng (2011) reported that cause in difference of seedling growth could be attributed to the difference of water holding capacity and differences of nutrient status in the media.

Consequently,biomass accumulation on wet weight basis increases as plant ages. Table 2 shows the wet total biomass for leaves, root and shoot respectively. There was significant difference ($P < 0.05$) across the observation weeks. This may be due to some environmental conditions prevailing in accession variation of *D. guineense* seeds.

In terms of seed source, highest leaf weight (wet) were found in Abuja followed by Lagos, Ogun and Anambra for week 2, 4, 8 and 10 respectively. While week 6, the highest leaf weight (wet) were found in Abuja followed by Ogun, Lagos and Anambra respectively. Week 12 indicates highest leaf weight (wet) in Abuja followed by Anambra, Lagos and Ogun having the best leaf weight. Wet shoot weight also shows significant differences ($P< 0.05$) at week 2, 4 and 12 while 6, 8 and 10 shows no significant difference. The variation in *D. guineense* wet weight with respect to their observation weeks could be attributed to their morphological and climatic distribution in the seed source. Similar findings were reported by Abugre and Oti –Boatergi, (2011), they observed that the amount of rainfall and its distribution varies widely in the country thus resulted into variation in growth performance of seedlings. Since the seeds were collected from different areas, differences observed in the parameters studied could be genetic in nature or modified as a result of exposure and consequent adaptation to the different environmental conditions prevailing in their areas of collection. Vakshaya *et al*., (1992) stated that differences observed in phenotypic values are genetic in nature because randomization, replication and uniform environmental conditions must have dealt with any outside effects that might influence the evaluation.

Total dry biomass for leaves, roots and shoots were presented in table 3. From the result, Weeks 6, 8, 10 and 12 shows significant difference while weeks 2 and 4 shows no significant difference. Dry leaf weight obtained is an indication that plant age influences variation in accession of plant. This implies that the more the plant ages the more it displays their phenotype or morphological variations. Turnbull and Griffin (1986) have reported that different varieties and accessions often perform differently when tested together under one site. The influence of this assertion cannot be ruled out. Wet root weight obtained (table 2) shows significant difference ($P<0.05$) in week 4, 6, 8, 10 and 12 while week 2 shows no significant difference respectively. Total dry root weight shows significant difference ($P<0.05$). The differences observed could be attributed to differences in environmental and climatic distributions. Misra and Jaiswal (1993) reported that provenance have effect on the lateral root and tap root of *jatropha curcas.* However, dry shoot weight shows significant difference at week 6, 8, 10 and 12 while week 2 and 4 shows no significant difference. This indicates that accession might not be necessarily accepted as major factor that influences the plant shoot growth or biomass accumulation. The relationship between wet and dry biomass of *D. guineense* is an indication that there is positive linear relationship between the wet and dry biomass (fig1-3). The result also indicated that plant biomass increases as the plant ages. Therefore, the more the plant ages the more increase in biomass accumulation.

IV. CONCLUSION AND RECOMMENDATIONS

Provenance impact on early growth and biomass accumulation of *D. guineense* was established in this study. The study reveals that growth parameters of *D. guineense* increases as plant ages, the significant difference obtained in growth parameters could be genetic in nature or modifies as a result of exposure and consequent adaptation to different environmental conditions prevailing in their area of collection. Accession might not be necessarily accepted as major factor that influences the plant growth or biomass accumulation other factors such as genetic make-up, environmental and climatic factors could also influence. In addition, significant differences obtained in accession indicated the highest in Abuja followed by Lagos, Ogun and Anambra. Hence, all the seeds from different sources were found to be very responsive to good growth but seeds from Abuja proved best. More research should still be carried out covering the six geopolitical zones of Nigeria in order to apprehend spectrum of the variability of the accessions of *D.guineense. The plant D.guineense* seeds should be pre-treated before sowing to ensure good and even germination. Ex situ cultures of the accessions from different geopolitical zones should be established.

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