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The Effect of Soil Amendment on the Performance of *Gambaya albida* (Linn) Seedlings

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Abstract: A study on the effect of soil amendments on the performance of *G. albida* was conducted at the teaching and research farm of Delta State University, Asaba Campus. A Randomized Complete Block Design (RCBD) with three replicates was employed to assess the effect of these soil amendment options namely cowdung, poultry droppings, Ash and topsoil on growth performance in seedlings of *Gambaya albida* (Linn). Results showed that there was significant difference between the treatments ($p<0.05$) from 2-12 Weeks After Transplanting (WAT). As regards the plant height and collar difference between the treatments from the 2-12 WAT. The result indicated that the soil amendment materials had significant effect on leaf number and leaf area of the species ($p<0.05$) throughout the duration of the study except at 4WAT. The highest mean height valuesof17.17cm was recorded under poultry dropping treatment at 12WAT, while mean leaf number and leaf area values were 8.7 and 55.22 cm2, respectively. The highest leaf dry weight of 1.7 g was obtained undercowdung treatment while poultry dropping sand ash had the highest stem and root dry weights of 1.9and 1.6 g, respectively. It is recommended that poultry droppings should be adopted by our local farmers for the establishment of *Gambaya albida* seedling.

Key words: Seedling growth, soil analysis, tree seedlings

INTRODUCTION

Gambaya albida (Lum) formerly known as *Chrysophyllum albidum* (G. Don) is a lowland ranforest tree that is usually planted in the village extending from sierra-leome in West Africa to Countries such as Uganda and Kenya in East African. The distribution is rare in savanna or most of the Northern zones of Nigeria hence its name in Hausa language is unpopular[1].

G*ambaya albida* belongs to the family of Sapotaceaea, which is relatively large in Nigeria alone. All members of the family are trees or shrubs occurring mostly in the rainforest with very few in forest outliners and riparian forests in the savannah regions.

The African star Apple (*Gambaya albida*) fruit is a large berry containing four to five flattened seeds or sometimes fewer due to seed abortion[1]. It fruit pulp, which is sweet, is slightly acidic but edible. Within the hard seed coat is the whitish cotyledon, which is for medicinal purpose including the leaves and fruits. The plant has in recent times become a crop of commercial value in Nigeria. The fleshy pulp of the fruit is eaten especially as snack and relished by both young and old Cenrad[2].

It is reported as an excellent source of vitamins, irons, flavours to diets and raw materials to some manufacturing industries[3-5]. In addition, its seeds are a source of oil, which is used for diverse purposes. The seeds are also used for local games[4].

Traditionally, the fruits are considered as blessings to humanity especially in its potential to effectively improve the reproduction capability. *Gambaya albida* is not only one of t he well known indigenous fruit trees but it is also among the known multipurpose forest tree species as the wood of the matured tree is converted for utilization purposes in the construction of houses and hut. In certain studies the wood is used in household articles and tool handles.

G. albida is a very important fruit which people cherish as an important forest fruit plant resource threatened with extinction. Our local farmers have their attention concentrated on arable crops that are early maturing and encounter relatively little or no problem in their growth as compared to tree crops. Consequently, there is a general neglect of fruit trees cultivation due primarily to dearth of information on their growth., the tree crops are harvested from the wild with only little attempt at domesticating them and the erroneous impression that

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they will continue to grow in perpetuity. In other words, their species are endangered and if no attempt is made to domesticate and enhance their acceptability tot local farmers, the future generation maybe deprived of inherent benefits of the forest tees. However, the population and domestication of *G. albida* can be increased through the use of soil amendments. This is due tot the fact that farmers and interested individuals can now plant the species using local technologies and in a short time start to harvest and extract its fruits and seeds. The usual unavailability and difficulty of getting chemical fertilizers alongside its high prices and potential polluting ability place soil amendments as a veritable alternative above inorganic fertilizer.

Cooke[6] reported that plants growth with soil amendments grow faster and produce in a shorter time. According to him, soil amendments improve soil structure, through good soil water holding capacity, aeration and drainage. This study is to determine the actual soil amendments that is most suitable for the performance of *G. albida*.

MATERIALS AND METHODS

Study area: The experiment was carried out in the Teaching and Research farm of Faculty of Agriculture Delta State University, Asaba Campus, Asaba. Asaba is located at 06°4^{1}N and 06°49^{1}E of the equator. Asaba lies in the tropical rainforest zone, a region of moderate rainfall. Rainy season is between April and October, with annual rainfall range of 1500 to 1849:3 mm. The mean temperature is 23.3°C while maximum temperature is 28.3°C.

Procedure: Seeds of *Gambaya albida* were sown on a nursery bed after they were extracted from the fruit pulp. They were watered twice daily. Representative samples of the amendment materials utilized and that of topsoil were analysed.

The samples were cowdung, poultry droppings Ash and topsoil (control). The samples were passed through 2mm sieve for phosphorus, potassium and total Nitrogen determination. Total Nitrogen was determined using Microkjedhal method. Available phosphorus was extracted using the Bray-P extracting solution and determined using Navaspec spectrophotometer. The exchangeable cations were extracted with ammonium acetate[7]. The exchangeable potassium was evaluated using flame photometer. The sizes of the Polypots used was 15 cm by 30 cm which was bottom perforated to prevent water logging. Representative samples of the soil amendment materials were mixed with topsoil and the mixtures were prepared as follow: 1kilogram of top soil was mixed with 10 grams of poultry droppings, cowdung and Ash was mixed with 1 kilogram of topsoil respectively and a control with 1 kilogram of top soil only. The poultry dropping was incubated for two weeks so as to prevent the nutrient loss especially ammonia. The cowdung and the topsoil were air-dried, the cowdung. Poultry droppings were ground separately and passed through 2 mm sieve. The germinated seedlings were transplanted into the polypots containing the planting media. The treatments were replicated three times in a Randomized Complete Bock Design (RCBD). They were watered at two days interval and the, growth parameters were measured at 2, 4, 6, 8, 10 and 12 WAT. The growth parameters were plant height, collar diameter, leaf number, leaf area and dry weights the parameters measured were separated using least significant difference.

The height was measured with a metre rule, the collar diameter was measured with vernier caliper while the leaf area was determined graphically.

RESULTS

Initial nutrient status: Table 1, poultry droppings had the highest nitrogen concentration while topsoil had the least. As regards phosphorus concentration, cowdung produced the highest while the least was recorded under topsoil (control). Highest concentration of potassium was recorded under the ash treatment while the least was in top soil.

Table 1: Nutrient station of amendment materials

	Nutrient concentration		
Treatments	Total nitrogen	Phosphorus	Potassium
Topsoil	0.8%	0.4%	0.08%
Cow dung	0.10%	0.20%	0.18%
Poultry droppings	0.12%	0.18%	0.12%
Ash	011%	0.08%	1.05%

Table 2: Mean values of plant height (cm) of *G. albida* as affected by the soil amendment materials

	Weeks after transplanting					
Treatments	2	4	6	8	10	12
Topsoil	9.5b	9.83b	11.03b	13.92b	14.67b	15.17b
Cow dung	14.50a	15.08a	15.67a	16.00a	16.33a	16.67a
Poultry droppings	10.08a	13.17a	13.80b	14.5b	14.83b	17.17a
Ash	12.5a	13.17a	13.56b	14.17b	14.67a	15.83b

Means of the same letters are not significantly different at p=0.05 and

Table 3: Mean values of collar diameter (cm) of *G. albida* affected by soil amendment materials

Treatments	Weeks after transplanting					
	2	4	6	8	10	12
Topsoil	0.70a	0.72b	0.80a	0.83a	0.87a	0.90b
Cow dung	069b	0.70b	0.73b	0.75b	0.87a	0.92b
Poultry droppings	067b	0.70b	0.75b	0.78b	0.80b	0.95a
Ash	0.72a	0.77a	0.80a	0.85a	0.87a	0.93b

Mean of the same letters are not significantly different at p=0.05%

Plant height: Poultry droppings gave the best performance on plant height of *G. albida*, followed by cowdung; ash and top soil respectively (Table 2) no significant difference were observed among the treatments. However at 12 WAT, main height values of cowdung and poultry dropping were not statically different.

Collar diameter: The analysis of variance showed that there was significant difference between the treatments from the 2nd to the 12th WAT. However, the highest mean collar diameter values of 0.95 was recorded under poultry dropping (Table 3).

Leaf number: Table 4, gives the mean values of leaf numbers of *G. albida* as affected by soil amendments. Significant difference were observed among the treatments through the diameter of the study except at 4WAT. The values ranged between 7.3 and 8.7 at 12WAT.

Leaf area: The mean leaf area values follow the same trend with that of leaf number values as not significant difference was observed at 12WAT, (Table 1).

Dry weight: The mean dry weight values of leaf, stem and root of *G. albida* seedling are clearly stated in Table 6. Significant differences were observed among the treatments as to their influence on leaf dry weight and stem dry weight. However, under the stem dry weight; significant difference was recorded among the treatments except control.

Table 4: Mean values of leaf Numbers of *G. albida* as affected by soil amendments

Treatments	Weeks after transplanting					
	2	4	6	8	10	12
Topsoil	3.8a	4.2a	4.7a	6.5a	6.5a	7.3b
Cow dung	3.5a	4.0a	4.7a	5.5b	6.3a	7.5b
Poultry droppings	2.8a	3.3a	3.8b	4.8b	5.3b	8.7a
Ash	3.3a	3.8a	4.7a	5.3b	6.7a	7.5b

Means of the same letters are not significantly different from each other at p=0.05

Table 5: Mean values of leaf area (cm^2) of *G. Albida* as affected by soil amendment materials

Treatments	Weeks after transplanting					
	2	4	6	8	10	12
Topsoil	13.8b	19.03b	21.58b	28.50b	30.83b	36.20b
Cow dung	17.04a	19.14a	20.36b	26.13b	34.25b	54.67a
Poultry droppings	17.98a	21.76a	27.23a	31.17a	43.67a	55.22a
Ash	14.78a	17.19a	25.33a	32.54a	41.65a	52.64a

Mean of the same letters are not significantly different at p=0.05%

Table 6: Mean dry Weight values of *G. Albida* seedlings as affected by soil amendment materials

	Nutrient concentration		
Treatments	Total nitrogen	Phosphorus	Potassium
Topsoil	1.2b	1.0b	1.3b
Cow dung	1.7a	1.6a	1.4b
Poultry droppings	1.8a	1.9a	1.5a
Ash	1.4b	1.5a	1.6a

Means of the same letters are not significantly different at p=0.05%

DISCUSSION

Poultry dropping gave the best performance with regards to plant height (17.17 cm) of *G. albida* seedlings (Table 5). However, this was not significantly difference from the influence of craw duay treatment on *G. albida* seedlings. This is an agreement with the findings of Opeke[8] that cowdung and poultry manure exerted similar influence on the growth of cocoa and okra, receptively.

Kramer and Kozlowski[9], reported that yield implants is increased by irrigation and fertilization (such as application of organic manure, ash (etc) because they increase the rate of photosynthesis per unit of leaf area. This observation is in accordance with the findings reported here for leaf area as cowdung, poultry dropping and Ash gave higher leaf area values than the control.

As regards the effect of soil amendments on collar diameter their was significant difference between Ash and the other treatments at 4WAT, which was due to the higher concentration of potassium in Ash than the rest of the treatments (Table 1). This corroborates the observation of ether (171) that newly germinated conifer seedling, contain adequate nutrient and show little response to different levels of external nutrient supply up to 6 weeks after planting.

The highest mean leaf number values obtained at 12WAT under poultry dropping could be an indication of better growth and development as a result of addition of the soil amendment materials. The result obtained by various workers on food crops lend credence for this assertion[10,11].

The higher leaf dry weight obtained in all the treatments as compared to the control was indicative of the amount of nitrogen present. However, their was no significant difference observed between the leaf dry weight of cowdung and poultry droppings which invariably underscores their importance for good growth and development of tree seedlings.

Finally, among the soil amendment materials adopted in this study, poultry droppings appeared most suitable for growth and development of *G. albida* seedlings. This finding agrees with that of Aduradola[12], that poultry droppings is the richest and most concentrated manure of soil amendment on farm. This is because urine and faeces are mixed together contributing to the very high nitrogen and phosphorus contents. Poultry dropping ferments easily and releases ammonia in the process.

CONCLUSION

From the analysis of the data, the following conclusion were drawn. Soil amendment positively influenced the growth and development of *G. albida.* The performance of the species increased in order of magnitude as follows: Poultry droppings, cowdung, ash and topsoil, Poultry droppings performed better than the other treatments vis-à-vis plant height, collar diameter, leaf number, leaf area and mean dry weight of the species and therefore strongly recommended for adoption by local farmers who are not financially buoyant to afford the inorganic fertilizer. Furthermore, it is hope that the study will stimulate local farmers interest to embark on cultivation of these species.

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