

Effect of charcoal powder of bamboo on the growth of wild *Albizia lebbbeck* seedlings

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ABSTRACT

This study assessed the effect of bamboo charcoal powder on the growth of *Albizia lebbbeck*. The seedlings of *Albizia lebbbeck* were raised in polythene pots and subjected to different mass quantities of bamboo charcoal powder which were 0.001 kg, 0.002 kg, 0.003 kg and control (no bamboo charcoal powder). The treatments were replicated four times, fitted into a completely randomized design. The experiment was observed for twelve weeks. The growth parameters assessed were plant height, stem girth and leaf production. The data collected were subjected to analysis of variance in order to determine the effect of the different rates of bamboo charcoal powder application on the growth of *Albizia lebbbeck*. The results indicated that growth parameters were improved in distinct ways. Stem girth was the only growth parameter that reached statistical significance. The charcoal application rate of 0.003 kg significantly enhanced the growth more than other treatments, with stem girth of 2.83 cm. Similar trend was also observed on plant height and leaf production. It is therefore recommended that the use of charcoal at application rate of 0.003 kg should be encouraged for use at nursery stage for better growth performance of *Albizia lebbbeck*.

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INTRODUCTION

Generally, timber has been used throughout the history of mankind. From housing bridges and tools, timber has provided man with a broad of building products and materials for construction (FAO, 2002). Reports from product Development Council (1997) and National timber Development Council (2001) stated that wood is an environmentally friendly, housing material which is suitable for construction and building finishes. In most cases, engineered wood products are produced using fast growing and often underutilized wood pieces from managed forests and tree farms (Wood, 2013).

One of the underutilized wood species in Nigeria is *Abizia lebbeck*. It is a leguminous plant which belongs to the *mimoseaceae* family (Combie, 1960). The species was introduced to Tropical African from Asia to India. The specie can also be found in Malaysia, China North Australia and other tropical countries (Dalzia, 1964). *Abizia lebbeck* has a variety of vernacular names including, Vagai (India) tekik (Javanese). Kitoke, Ians (Sudanese), Khago, kase (Ihai) East India and Ayunre (Yoruba) (Anon, 1980). In Nigeria, the tree is grown mostly in Northern part and in a number of reserves in the south for instance, Olokemeji Forest Reserve in Ogun State and Onigambari forest Reserve in Oyo State, Nigeria. *Abizia lebbeck* grown to the height of 18-30 m width a trunk diameter of 50 cm in a maturity, the leaves are 7 to 15 cm long with one to four pairs of pinnae and each pinna has 6 to 8 leaflets. The flowers are white numerous stamen and very fragrant, the fruit pod has 15 to 30 cm long and 2.0 to 5.0 cm broad containing 6 to 12 seeds (Msanga, 2002).

Abizia lebbeck is one of the most promising fodder trees. It has leaves during a large part of the rainy season and digestibility of the twigs is considerably higher than that of most fodder trees. The concentration of crude protein is about 20% for green leaves 13% for leaf litter and 10% for twing (Msanga, 2002.) it is an excellent fuel wood and charcoal species, the wood is suitable for construction, furniture and veneer, the shallow root

system market a good soil binder and recommendable for soil conservation and erosion control (Khera and Singh, 2005). *Albizia lebbbeck* is also used for environmental management, tolerates light frost and drought, and also flourishes well in lateritic and mining site (Perveen *et al.*, 2012). Due to its significant multipurpose properties, the tree has been overexploited, which in turn has resulted in the severe depletion of its natural population (Troup, 1986). Bamboo charcoal fertilizers promote the continuous supply of rhizosphere soil and soil pH levels. Research by the Tokai University Hoshi Laboratory indicated that trees fertilized with crushed bamboo charcoal tend to grow 20% higher with 40% more volume than those that are not (Charmayne, 2004). Bamboo charcoal can be broken up and mixed into soil to provide natural organic pesticide and fertilizer at the same time. It is full of nutrients that are necessary for healthy soil, these are: - Potassium, Calcium, Nitrogen, Iron and Phosphorus. Moreover, bamboo charcoal is antifungal and antimicrobial and this is capable of repelling bugs and other pests. Some Japanese farmers have started using bamboo charcoal instead of chemical fertilizer and have seen 40% increases on yields compared to crops without any fertilizer inputs (Taiwan, 2009). This study is to investigate the effect of bamboo in the growth of *Albizia lebbbeck*.

MATERIALS AND METHOD

The experiment was carried out within the Federal College of Forestry Jericho, Ibadan. The college is situated in Jericho Hill, in Ibadan North West Local Government area of Oyo State. The Area lies between the latitude 7^o26 N and Longitude 3^o54 E. The climate condition of the area is tropically dominated by rainfall pattern from 1400 mm – 1500 mm per annual. The average temperature is about 30^oC, average humidity of about 80 – 85%. The area is characterized by distinct season usually from October to November (FRIN, 2012). The following materials were used during the experiment; *Albizia lebbbeck* seeds, sieve, water, top soil (collected from ETF premises) Bamboo charcoal (powder), spoon, Tread, ruler, field note book, weighing

balance, Polythene pot, and Hand trowel.

The seeds of *Albizia lebbbeck* were collected from a mother tree at Federal College of forestry Jericho hill, Ibadan. River sand was collected from the stream within the Federal College of Forestry Jericho Hill, Ibadan. The sieve and the plastic spoon were bought in Dugbe market, Ibadan. Top soil was collected at the front of Crop Production farm premises in the college. The bamboo tree was collected and burned close to a stream within the college premises. Polythene tree was collected and burned close to a stream within the college premises. Polythene pots, pencil, river, field note book Tread, hand trowel was bought at Dugbe market, Ibadan. The weighing balance was collected from the FRIN material store.

The seeds of *Albizia lebbbeck* were sown into the germination tray filled with river sand which was properly washed. Watering was done twice in a day in the absence of rain. After germination, sixteen growing seedlings were carefully selected from the germination tray and then transplanted into the polythene pots.

Treatments:

- T₁ - 1 kg of topsoil
- T₂ - 0.001 kg of grinded bamboo charcoal + 1 kg of top soil
- T₃ - 0.002 kg of grinded bamboo charcoal + 1 kg of topsoil
- T₄ - 0.003 kg of grinded bamboo charcoal + 1 kg of top soil

The experimental was arranged in Completely randomized Design (CRD) with four treatments and four replicates with T₁ as control, the CRD model is given as $\gamma_{ij} = \mu + ai + eij$, where γ_{ij} is General observation, μ is General observation, μ is Grand mean, ai is treatment and eij is Error term

Stem girth (cm), seedling height (cm) and leaf production were the different parameters that were measured. Information on the soil physico-chemical and bamboo charcoal analyses were obtained from International Institute of Tropical Agriculture, Ibadan.

Table 1: The analysis of topsoil

Element	Soil
pH	6.1
Ca (mol)	1.25
Mg (mol)	0.45
Na (mol)	0.07
K (mol)	0.42
N (%)	0.075
Oc (%)	0.77
Zn (ppm)	117.3
Cu (ppm)	1.4
Mn (ppm)	70.4

Source: IITA Laboratory (2014)

Table 2: The analysis of bamboo charcoal

ELEMENT	BAMBOO CHARCOAL
pH	8.2
N (%)	0.29
P (%)	0.44
Ca (%)	2.1
Mg (%)	0.29
K (%)	0.68
Kn (ppm)	65.75
Fe (ppm)	1115.86
Cu (ppm)	91.53

Source: IITA Laboratory (2014)

Table 3: The stem girth of *Albizia lebbek*

TREATMENT	SGWK2	SGWK4	SGW6	SGW8	SGW10	SGW
T1	0.85	1.075a	1.25ab	1.4b	1.475b	1.625b
T2	0.875a	1.1a	1.425a	1.65a	2.1a	2.375a
T3	0.825a	0.95a	1.25a	1.25a	1.5a	1.775b
T4	0.8a	1.175a	1.525a	2a	2.375a	2.825a
F-Value	0.269	0.261	0.28	0.4	0.592	0.477

Table 3 shows the stem girth of *Albizia lebbbeck* with the treatment of bamboo charcoal from week two to week twelve. Week two and week four show that there is no significant difference with respect to the effect of bamboo charcoal on the stem girth of *Albizia lebbbeck*. The highest mean at week 2 was observed in T2 (0.001 kg of bamboo charcoal + 1 kg of top soil) having 0.875 mm and the least mean was observed as T4 (0.003 kg of bamboo charcoal + 1 kg of top soil) having 0.8 mm. The highest at week 4 was observed at T₄ (0.003 kg of bamboo + charcoal + 1 kg of top soil) having 1.175 mm and the least value was T3 (0.002 kg of bamboo charcoal + 1 kg of top soil) having 0.9 mm. Week 6 to 12 show that there is significant difference of bamboo charcoal effect on the stem girth of *Albizi lebbbeck*. The highest value was observed at week 6 and T4 (30 kg of bamboo charcoal + 1 kg of topsoil) with mean value of 1.525 mm and the least was recorded as T3 (0.002 kg of bamboo charcoal + 1 kg of top soil) with the mean value of 1.125 mm. The highest value was observed at week 12 as T4 (0.003 kg of bamboo charcoal + 1 kg of topsoil) with mean value of 2.825 mm and the least was recorded as T1 (1 kg of top soil) with the mean value of 1.625 mm.

Table 4: Treatment of the plant of *Albizia lebbbeck*

TREATMENT	PHWK2	PHWK4	PHWK6	PHWK8	PHWK10	PHWK12
T1	10.275a	11.325a	13.2a	13.85a	14.525a	15.3a
T2	13.5a	14.475a	16.25a	19.025a	20.85a	22.62a
T3	10.85a	11.02a	11.85a	13.4a	16.7a	18.65a
T4	12.4a	14.67a	16.825a	20.025a	22.175a	23.075a
F-Value	4.64	5.12	6.71	10.9	11.13	11.8

Table 4 shows the plant height with treatment bamboo charcoal from week 2 to week 12 shows that there is no significant difference of bamboo charcoal on the plant height. The highest value at week 2 was recorded at T2 (0.001 kg of bamboo charcoal + 1 kg of topsoil) with the mean value of 10.275, the highest mean value of plant height week 4 was recorded at T4 (0.003 kg of bamboo charcoal + 1 kg of topsoil) with the mean vale of

14.675 with the least mean value of T3 (0.002 kg of bamboo charcoal + 1 kg of topsoil) having 11.025. The highest mean at week 6 was T4 (0.003 kg of bamboo charcoal + 1 kg of topsoil) with the least mean value of 11.85. The highest at week 8 was T4 (0.003 kg of bamboo charcoal + 1 kg of topsoil) with the least mean value of 13.4. Also at week 10 and week 12 perform best in plant height was recorded as T4 (0.003 kg of bamboo charcoal + 1 kg of topsoil with the value of 22.175 and 23.075 and least performance was T1 (1 kg of topsoil which is control) having 14.525 and 15.3.

Table 5: leaf production of *Albizia lebbeck*

TREATMENT	LPWK2	LPWK4	LPWK6	LPWK8	LPWK10	LPWK12
T1	11a	14.75a	15.5a	15.5a	16a	13.5a
T2	7.75a	9.75a	13.75a	15.25a	16.5a	18.5a
T3	5.75a	8.25a	10.5a	13.25a	15.75a	19.25a
T4	7.25a	9.25a	12a	14.25a	17a	21.25a
F-Value	7.45	9.471	11.1	11.39	11.69	11.67

Table 5 above shows that the leaf production of *Albizia lebbeck* shows that there is no significant difference of treatment of bamboo charcoal on the leaf production of *Albizia lebbeck*. The highest mean value was recorded from week 2 as T1 (1 kg of topsoil) having 11 and the lest value was recorded as T3 (0.002 kg of bamboo charcoal + 1 kg of topsoil) having 5.75. The highest mean value was recorded from week 4 as T1 (1 kg of topsoil) having 14.75 and the least value was recorded as T3 (0.002 kg of bamboo charcoal + 1 kg of topsoil having 8.25. The highest mean value was recorded as T3 (0.002 kg of bamboo charcoal + 1 kg of topsoil having 8.25. The highest mean value was recorded from week 6 as T1 (1 kg of topsoil) having 15.5 and the least value was recorded as T3 (0.002 kg of bamboo charcoal + 1 kg of topsoil having 10.5. the highest mean value was recorded from week 8 as T1 (kg of topsoil) having `15.5 and the least value was recorded as T3 (0.002 kg) of bamboo charcoal + (1 kg of topsoil) having 13.25. The highest plant height mean from week 10 was observed at T4 (0.003 kg of bamboo charcoal + 1 kg of topsoil)

having '17 and he least valued was recorded as T3 (0.002 kg of bamboo charcoal + 1 kg of topsoil) having 15.75. The highest plant height mean from week 12 was observed at T4 (0.003 kg of bamboo charcoal + 1 kg of topsoil having 21.25 and the least valves was recorded as T1 (1 kg of topsoil) having 13.5.

CONCLUSION

From the study it was observed that treatment T4 which is the 0.003 kg of bamboo charcoal + 1 kg of to soil performed best in term of stem girth and plant height and T1 performed best in leaf production. Based on the result obtained, it is therefore recommended that the use of 0.003 kg of bamboo charcoal should be encouraged for use at nursery stage for raising of *Albizia lebbeck*. Further studies should be carried out in order to determine the lasting impact of bamboo charcoal on the growth of *Albizia lebbeck* and to quantify this impact.

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