Evaluation of Organic Fertilizers Treatments on the Early Growth Performance of *Prosopis Africana* Seedlings

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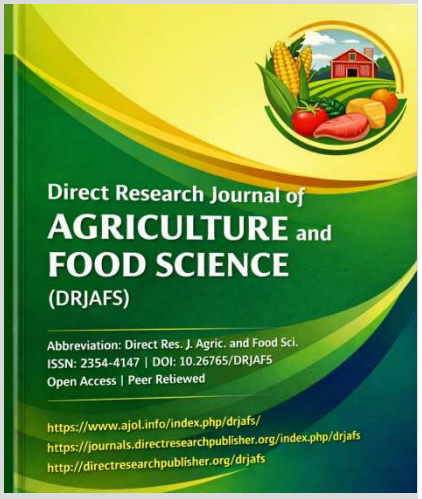
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ABSTRACT

The Experiment was conducted in Department of Forestry, Wildlife and Ecotourism Nursery, Nasarawa State University Shabu-Lafia Campus. The research aim to determine the influence of organic fertilizers on the growth performance of Prosopis africana seedlings in order to enhance the growth and development. The experiment was laid in a Completely Randomized Design with five treatments; Biochar =10.5g, poultry manure =10.5g, cow dung =10.5g, NPK 15:15:15 =10.5g, and control =1.5kg topsoil. Each treatment consisted of fifteen experimental pots replicated three times. Seeds were raised on germination beds after which they were transplanted into the polythene pots filled with 1.5kg of topsoil. After two weeks of seedlings stabilization, treatments were applied. Data on seedlings variables were collected on fourth night basis and subjected to analysis of variance. Significant means was separated using Duncan multiple range test (DMRT) at p<0.05 significant level. Result revealed that seedlings treated with biochar recorded the highest (19.36±4.17a) plant height compared to other treatments. Results on plant girth showed that there was significant differences (p<0.05) between the treatments with poultry manure had the highest mean (0.84±0.25a) plant girth. Seedlings treated with biocher had the highest (11.83±4.40a) number of seedlings branches as compared to the other treatments. These results attest to the fact that Prosopis Africana can be best grown with the application of biocha.



Keywords: *Prosopis Africana, biocha, seedlings, growth, development*

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INTRODUCTION

Prosopi`s Africana is a tree species with domestic and foreign uses that are of inestimable importance. It is a genus of flowering plants in the family of *fabaceae.* Is a fairly slow-growing, deciduous tree with an open crown and drooping branches which grow from 4-20m tall (Aremu, *et al.,* 2006). The tree species often thrives in arid soil and are resistant to drought. The pulp of the pods contains 9.6% protein, 3% fat, and 53% carbohydrate and provides energy value 1168 J (FAO 2003). The wood has a high calorific value and highly valued for charcoal production (Sotelo-Montes *et al* 2011). Its enriches the soil by fixing nitrogen into the soil, leaves are rich in protein, and sugar pods are used as foodstuffs for feeding ruminants (Annongu *et al.,* 2004). The leaves, roots and the bark are used in traditional medicine. The tree species is becoming scarce in it natural range because of excessive exploitation by harvesting the stems and branches of the tree, which limits its natural regeneration capacity (Pasiecznik, 2004). Fermented seeds of *Prosopis africana* are used in Nigeria to prepare a delicacy called Daddawa and Okpeye, and also used as food condiments (Aremu, *et al.,* 2006). The wood is very resistant to decay and is used to make household tools such as mortars and pestles, which is highly appreciated by blacksmiths, and poles for construction (Faye *et al*, 2011). The quality of nursery seedlings depends largely on the growing media. The performance of seedlings when planted out in the field is determined by their performance in the nursery (Agbo, *et al.,* 2006). The quality of a growing media to raise seedlings is a key determinant factor to successful tree planting program (Manenoi, 2009). According to Faye *et al*, (2011|), *Prosopis africana* is a particularly vulnerable species, which is not cultivated and therefore facing the danger of going into extinction. The tree species is facing a regeneration problem mainly due to slow growth rate, hardness of the seed and a low fruit production. It is therefore necessary to determine the best growth media and fertilizer type to enhance propagation of the tree species.

MATERIALS AND METHODS

Study Area

The Experiment was conducted in Department of Forestry, Wildlife and Ecotourism Nursery, Nasarawa State University Shabu-Lafia Campus situated at Longitude 08^0, 35N and Latitude 08^0 33E in the Guinea savannah zone of North Central Nigeria at an altitude of about 177m above the sea level (Figure 1). Mean monthly maximum and minimum temperature range between 35.06^0 C to 36.40^0C and 20.16^0C to 20.50^0C respectively while the mean monthly relative humidity and rainfall are 74.67% and 168.90mm respectively (Jayeoba, 2013).

Experimental design

The experiment was laid in a Completely Randomized Design with five treatments; biochar =10.5g, poultry manure =10.5g, cow dung =10,5g, NPK 15-15-15 = 10.5g and the control =1.5g topsoil. Each treatment consisted of fifteen experimental pots replicated three times. Seeds were raised in germination beds after which they were transplanted into the polythene pots filled with 1.5g of topsoil. After two weeks of seedlings stabilization, treatments were applied.

Data collection

Data on seedlings variables were obtained on fourth night basis. Plant height was collected using meter rule. Collar girth was taken with the aid of digital veneer caliper while data on seedlings branches was enumerated manually on each of the seedlings

Data Analysis

Data was analyzed using analysis of variance (ANOVA). Significant means was separated using Duncan multiple range test (DMRT) at 0.05 significant level.

RESULTS

Results in (Table 1) indicated that seedlings treated with biochar yielded the highest mean (19.36 ± 4.17^a) plant height followed by control with mean height value of 19.05 ± 4.72^a while cow dung had a mean plant height value of 15.99 ± 4.695^b lower than that of poultry manure (16.74 ± 5.08^b) and NPK (16.61 ± 3.78^b). Thus there was significant difference ($p<0.05$) between seedlings treated with biochar, poultry manure and cattle dung. No significance differences ($p>0.05$) between seedlings treated with biochar and control. Results on plant girth showed that there was significant differences ($p<0.05$) between the treatments. Seedlings treated with Poultry droppings had the highest mean 0.84 ± 0.25^a mm followed by control which had a mean of 0.74 ± 0.22^b mm, while seedlings raised with cow dung had the least mean value of 0.54±0.18mm. The effect of fertilizers application on the number of seedling branches indicated that there was significance difference ($p<0.05$) between the treatments. Seedlings raised with biocher had the highest mean 11.83 ± 4.40^a followed by control with a mean value of 11.79 ± 4.26^a. Poultry manure had the least mean value on the number of seedlings branches (10.35 ± 3.74^b). Results in (Table 2) showed that there was significance difference ($p<0.05$) on growth performances of seedlings between the weeks. The highest plant height (21.98 ± 4.16^a) was recorded at week 14. This is followed by week 12 with mean value of 19.64 ± 3.92^b while week 6 had the least plant height (13.36 ± 2.95^e). More so, the highest girth (0.89 ± 0.20^a mm) and the number of seedlings branches

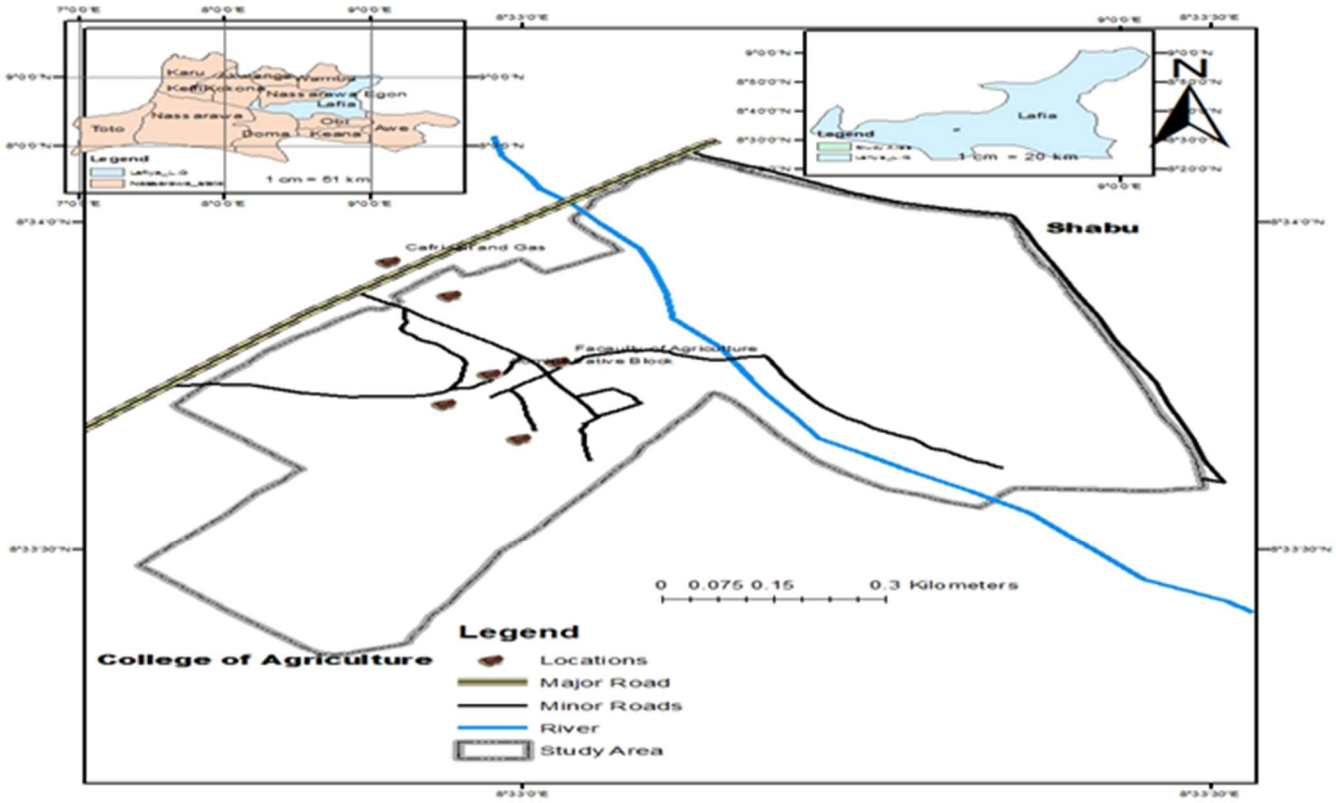


Figure 1: Map of Lafia showing the Study Area

Table 1: Influence of Organic Fertilizers on the Growth of Prosopis Africana Seedlings

Treatment	Plant height (cm)	Girth (mm)	Seedlings branches
Poultry	16.74±5.08^{b}	0.84±0.25^{a}	10.35±3.74^{b}
Cowdung	15.99±4.695^{b}	0.54±0.18^{d}	11.44±4.12^{a}
NPK15:15:15	16.61±3.78^{b}	0.63±0.19^{c}	11.23±3.18^{a}
Biochar	19.36±4.17^{a}	0.71±0.21^{b}	11.83±4.40^{a}
Control	19.05±4.72^{a}	0.74±0.22^{b}	11.79±4.26^{a}
Mean	17.55±4.69	0.69±0.23	11.33±3.98

Mean on the same row bearing the same alphabet are not significantly different ns=not significant

Table 2: Influence of organic fertilizers on the growth performance of Prosopis Africana Seedlings on weekly basis

Treatment Weeks	Plant height (cm)	Girth (mm)	Numbers of Branches
6.00	13.36±2.95^{e}	0.49±0.16^{e}	6.96±1.79^{e}
8.00	15.18±3.03^{d}	0.59±0.19^{d}	8.87±1.91^{d}
10.00	17.59±3.60^{c}	0.70±0.19^{c}	11.17±2.24^{c}
12.00	19.64±3.92^{b}	0.79±0.19^{b}	13.45±2.42^{b}
14.00	21.98±4.16^{a}	0.89±0.20^{a}	16.17±2.91^{a}
Mean	17.55±4.69	0.69±0.23	11.33±3.98

Mean on the same row bearing the same alphabet are not significantly different ns=not significant

(16.17±2.91^{a}) was recorded in week 14 while the least plant girth (0.49±0.16^{e}) and number of seedlings branches (6.96±1.79^{e}) was obtained in week 6. Result of correlation analysis in (Table 3) revealed that there was significant correlation between the treatments and plant height (0.242**), between treatment and number of branches (0. 116*), between weeks and plant height (0.655**), between weeks and plant girth (0.605**), between weeks and number of branches (0.819**), between plant height and girth (0. 730**), between plant height and number of branches (0. 623**), and also between plant girth and number of branches (0. 513**).

Table 3: Correlation Analysis for Parameters Assessed

	Treatment	Replicate	Weeks	Plant height	Girth	Numbers of Branches
Treatment	1					
Replicate	.000	1				
Weeks	.000	.000	1			
Plant height	.242**	.005	.655**	1		
Girth	-.026	.042	.605**	.730**	1	
Numbers of branches	.116*	.070	.819**	.623**	.513**	1

*Note: **=correlation is significant at 1% level p<0.01, *=correlation is significant at 5% level p<0.05*

DISCUSSION

Prosopis africana seedlings responded significantly (p<0.05) accordingly to treatments specification. Seedlings raised with biochar recorded the highest (19.36±4.17^{a}) plant height compared to seedlings raised with poultry manure, cow dung, NPK15:15:15 and control. This could be that biochar is capable of improving soil physical, chemical and biological properties desirable for optimum plants growth and development. This also agrees with the work of Lehmann *et al.,* (2009) that important macro (N, P, K, Ca, Mg) and micro-nutrients (Cu, Fe, Mn, Zn) which are essential for plant growth and development are reported to increase upon the application of biochar. Results on plant girth shows that there was significant differences (p<0.05) between the treatments. Seedlings treated with Poultry manure had the highest plant girth (0.84±0.25^{a}) whereas seedlings raised with cow dung recorded the least (0.74±0.22^{b}) plant girth. This finding was in line with Kuje *et al.,* (2019) who reported that the application of poultry manure improved the availability of nutrients to plants, especially in tropical soils where organic matter of soil is low. Focho *et al.,* (2011) also reported that when seedlings are supplied with sufficient nutrient, the yield is always higher than when fertilizer is not applied. Result also shows that there was significance difference (p<0.05) in the number of seedlings branches. Seedlings raised with biocher had the highest (11.83±4.40^{a}) mean number of branches compared to the other treatments. This was in line with the conclusions of Riziki *et al.,* (2020) who found that the addition of biochar improved the availability of soil nutrients which in turn promotes seedlings growth and development. There was significance difference (p<0.05) on growth performances of seedlings on weekly basis. The highest plant height (21.98±4.16^{a}), seedlings girth (0.89±0.20^{a}) and number of seedlings branches (16.17±2.91^{a}) was recorded in week 14 while the least plant girth (0.49±0.16^{e}) and number of seedlings branches (6.96±1.79^{e}) was obtained in week 6.This shown that there was progressive growth in *Prosopis africana* seedlings as long as the seedlings remain in the nursery for long period of time. The finding was in line with Egbewole *et al.,* (2021), who reported that when seedlings stay in the nursery for longer period, they increase in height and other growth parameters. Similarly, Uka, *et al.,* (2013) and Kuje *et al.,* (2019) found related results in their experiment.

Conclusion

The research revealed that plant height, girth and number of seedlings branches significantly differed between the treatments. The highest plant height was obtained in seedlings raised with biochar as well as the number of seedlings branches as compared to the other treatments. Cow dung, poultry manure, NPK 15: 15:15 fertilizer and control also varied in terms of seedlings parameters assessed. These results attest to the fact that *Prosopis Africana* can be best grown with the application of biochar.

Recommendations

i *Prosopis africana* can be best grown for successful plantation establishment with the application of biochar

ii. For successful *prosopis africana* seedling production, further research should be undertaken with varying rates of biochar fertilizer application.

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