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**SHORT COMMUNICATION**

# INFLUENCE OF SELECTED ORGANIC FERTILIZERS ON THE EARLY GROWTH OF *BAILLONELLA TOXISPERMA* (EN) (AFRICAN PEAR WOOD / MOABI) SEEDLINGS AT UMUAHIA ABIA STATE NIGERIA

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## ABSTRACT

The growth response of *Baillonella toxisperma* seedlings to the application of wood-ash, cow dung and poultry manure was investigated. The experiment was laid out in a completely Randomized Design (CRD) with three replications. Eighteen (18) seedlings were used per treatment. The seedlings were watered at 2 days-interval; poly pots were weeded as at when due. There was no evidence of major insect pest infestation and disease attack during the study period. The selected organic fertilizers (wood-ash, cow dung and poultry manure) were applied at the rate of 0.4g/kg soil on each seedling once. Treatments were applied after 6weeks of growth. Growth parameters (plant height, collar diameter and leaf number) were assessed for 24weeks at 4weeks interval after organic fertilisers were applied. Results revealed that growth parameters were most observed from seedlings with poultry manure, followed by those with cow dung and the least influence was recorded among seedlings with wood-ash manure. However, there was no significant difference between the heights, leaf production and collar diameters of seedlings with the three forms of fertilizer application ($P > 0.05$) from the experiment, except the control. Appropriate recommendations were made to concerned farmers and scientists.

Keywords: Organic fertiliser, *Baillonella toxisperma*, treatments, growth parameters.

## INTRODUCTION

*Baillonella toxisperma* also called African pearwood djave nut or moabi is a tree species in the family sapotaceae and the only species in the genus *Baillonella*, its natural habitat is subtropical or tropical moist lowland forests; the distribution covers Angola, Cameroun, the Republic of Congo, Gabon and Nigeria but the species is threatened by habitat loss (White, 1998; John, 2008). The fruit pulp is eaten fresh although it contains latex, the seed kernel contains fatty oil that is used in cooking, for cosmetic purposes and in traditional medicine, the oil is applied as pomade to the hair and used in soap making. It is applied externally to treat rheumatic pains while residues of its oil extraction are sometimes used as fish poison; its bark decoctions are used to treat kidney problems, toothache, rachitis, vaginal infections, respiratory and digestive tracts infections. The tree has several ritual uses but wood from it is used for joinery and carpentry for exterior applications of doors, windows, garden furniture and marine construction. (Ken, 2014).

The primary purpose of forest nurseries is to produce and supply quality seedlings to fix afforestation and reforestation purposes (Afa *et al.,* 2011). Healthy seedlings must be supplied with all the nutrients in the proper proportions for efficient growth (Craven *et al.*, 2006; Gbadamosi, 2006). The proper application of organic fertilizer to forest nursery soils is of considerable importance since it may profoundly influence the value of seedlings produced. For healthy growth and optimal yield, nutrient must be available to

plants in sufficient and balanced quantities and in a usable form at the right time (Ramesh *et al.,* 2011). Fertilizers are used to supplement the nutrients already present in the soil. Fertilizer is any organic or inorganic material of natural or synthetic origin that is added to a soil to supply one or more plant nutrient essential to the growth of plants (Soil Science Society of America, 2011). Application of organic materials as fertilizers, improve soil fertility in terms of organic C and N content, permeability, plant available water capacity and air-filled porosity (Esawy *et al.,* 2009; Mohammed, 2013).

Overexploitation of *B. toxisperma* has continued on a large scale and the species is now widely threatened at the provenance level and is being categorized in the IUCN red list as vulnerable (White, 1998). In spite of the great economic importance of this tree crop in Nigeria, its large scale cultivation has not been attained partly due to shortage of its seedlings and the practice of planting its seeds directly on the field by farmers. The treat to *B. toxisperma* and the potentials it holds in terms of timber supply have prompted this study. The objective was to determine the effects of different organic fertilizer on the growth of *B. toxisperma* seedlings in the nursery for optimum production. The study used growth parameters of heights, diameters and leaf numbers among the seedlings in the nursery to evaluate the performance of poultry manure (PM), wood ash (WA) and cow dung (CD) treatments on the seedlings.

## MATERIALS AND METHODS

**Study Area:** The study was carried out in the tree nursery unit of Forestry Research Institute of Nigeria, Humid Forest Research Station, Umuahia. The research station is located between latitude $5^0$N and $7^0$ N of the equator, longitude $7^0$E and $9^0$E Greenwich meridian.

**Procedures:** The study was carried out for a period of 24weeks. The organic manure and top soil used were tested for their nutrient contents before the experiment was set up. (Table 1). The poultry manure and cow dung were allowed to decompose before application. They were air dried, ground separately and passed through 2mm sieve. The manure was applied around the collar region, six (6) weeks after germination. Four different treatments were imposed. (Table 1)

**Table 1: Treatment Combinations**

| Treatment | Nutrient applied (g/kg soil) |
|---|---|
| $T_1$ | 0.4g of poultry manure (PM) |
| $T_2$ | 0.4g of cow dung (CD) |
| $T_3$ | 0.4g of wood ash (WA) |
| $T_4$ | Control (No fertilizer) |

The experiment was laid out in a completely Randomized Design (CRD) with three replications. Eighteen (18) seedlings were used per treatment. Seedlings were watered at 2 day-interval; poly pots were weeded as at when due. There was no notice of major insect pest and disease during the study period.

## DATA COLLECTION AND ANALYSIS

Data on the plant height, collar diameter and number of leaf were taken at 4weeks interval for a period of 24 weeks. The height was measured with a metre rule; collar diameter was determined through a pair of vernier calipers while leaf number was recorded by visual count
The data collected were subjected to analysis of variance (ANOVA) and Fischer's Least

Significance difference FLS-D was used for mean separation at (P>0.05).

**Physico-chemical analysis of soil and manure samples**

Total Nitrogen component (N) was determined by the micro-Kjeldahl method (Jackson, 1962). Total Phosphorus content (P) was determined calorimetrically by the Bray No. 1 method (Bray and Kurtz, 1945); K and Na were determined by the flame photometric method (Black, 1965), Ca and Mg were determined by the ethylene diaminetetra-acetic acid (EDTA) method (Allison, 1973) and organic C by the wet oxidation method (Black, 1965) while organic matter was obtained as organic CX 172 (Broadbent, 1965).

## RESULTS

## Initial Nutrient Status

Table 2 below shows the initial nutrient status of the top soil used. Phosphorus was 23.50 mg/kg, nitrogen was 0.04% potassium was 0.20cmol/kg$^{-1}$ organic carbon and organic matter were 1.06% and 1.83% respectively. Table 3 shows the initial nutrient status of manure used. Phosphorus was 0.35%, 0.38% and 0.59% respectively for poultry manure (PM), cow dung (CD) and wood ash (WA). Nitrogen was 3.30%, 3.70% and 0.28% respectively for poultry manure (PM), cow dung (CD) and wood ash (WA). Potassium was 0.62%, o.51% and 1.70% respectively for poultry manure (PM), cow dung (CD) and wood Ash (WA).

**Table 2: Physico-chemical properties of the experimental soil**

| Physico-chemical properties | Amount ( %/ mg/kg) |
|---|---|
| Sand % | 77.0 |
| Silt % | 7.60 |
| TEX clay | 16.40 |
| pH in $H_20$ | 5.19 |
| pH in Kcl | 4.90 |
| Phosphorus (Mg / Kg) | 23.50 |
| Nitrogen % | 0.04 |
| Organic carbon % | 1.06 |
| Organic matter % | 1.83 |
| Calcium cmol Kg-1 | 2.80 |
| Magnesium | 1.60 |
| Potassium | 0.20 |
| Sodium | 0.26 |
| Exchangeable acidity | 1.28 |
| ECEC | 6.14 |
| Base saturation % | 79.02 |

**Table 3: Nutrient contents of the fertilizers**

| Nutrient element | Poultry Manure | Cow Dung | Wood Ash |
|---|---|---|---|
| Nitrogen | 3.30 | 3.70 | 0.28 |
| Phosphorus | 0.35 | 0.38 | 0.59 |
| Calcium | 3.40 | 2.80 | 6.83 |
| Magnesium | 1.58 | 1.39 | 2.80 |
| Potassium | 0.62 | 0.51 | 1.70 |
| Sodium | 0.34 | 0.11 | 0.65 |

Table 4 below shows the effect of fertilizer treatment on the height of seedlings of *B. toxisperma***.** Fertilizer significantly ($p< 0.05$) influenced the height of B. seedlings. The height growth of seedlings to which poultry manure (7.68cm) and wood ash (7.27cm) were applied were not significantly different ($p<0.05$). The control (5.34cm) gave the least mean heights. All the Fertilizer treatments resulted in significantly ($p<0.05$) taller seedling when compared with the Control.

**Effect of Fertilizer Treatments on Number of Leaf and Collar Diameter.**

Table 4 shows the effect of the fertilizer treatments on the number of leaf of the seedlings. -Cow-dung gave significantly the highest leaf production. Wood-ash was significantly higher than poultry manure but statistically similar to the control with no fertilizer. It also shows the effect of fertilizer treatments on the collar diameter of the seedlings-. Poultry manure gave significantly the highest mean diameter increment. While the control with no fertilizer gave the least. Cow-dung and Wood-ash were statistically similar but significantly higher in terms of diameter increment than the control.

**Table 4: Effect of fertilizer treatments on the growth of *Baillonella toxisperma* seedlings**

| Fertilizer | Height(cm) | Leaf Number | Diameter (cm) |
|---|---|---|---|
| Poultry manure (PM) | 7.68[a] | 0.62[d] | 1.47[c] |
| Cow dung (CD) | 7.01[a] | 1.31[c] | 1.07[c] |
| Wood Ash (WA) | 7.27[a] | 0.87[d] | 0.96[d] |
| Control | 5.34[b] | 0.74[d] | 0.70[d] |
| F-LSD (0.05) | 0.65 | 0.25 | 0.19 |

Means with similar alphabet within the same column of any set of treatment are not significantly different at p=0.05.
Effect of fertilizer treatments on Plant Height Growth

## DISCUSSION

Results from this study show that seedlings of *B. toxisperma* responded positively to fertilizer treatments. This agrees with the findings of Afa *et al.* (2011) on *Khaya ivorensis* and Hall *et al*, (2003) on *Entandrophragma cylindricum*. The least value (5.34cm) of height growth in the control might be due to the low micro nutrient status of the soil. There was significant increment in height and diameter among all fertilizers over the control. This could be attributed to the fact that the fertilizer was rich in the primary macro nutrients (nitrogen, phosphorus and potassium). From Table 3 the level of calcium in poultry manure is greater than the value of other nutrient (N, P,Mg,K and Na).Calcium is primarily responsible for the healthy growth, cell wall formation and activation of enzymes (Sarojini, 2010). Growth has to do with formation of new cells and it was this calcium in poultry manure that led to the growth in height. The level of calcium in poultry manure was higher than that of cow dung from table 3 that is why the height of poultry manure was higher than that of cow dung (Table 4).

The leaf production that is leaf produced from each treatment is higher in cow dung than other treatment. This may be because the higher level of Nitrogen which is present in cow dung make the cells that is responsible for leaf production to be more active and hence lead to the production of more leaves than others. Nitrogen is one of the essential macro element which is responsible for ammonia acid production, proteins, nitrogenous bases and chlorophyll (Sarojini, 2010). From Table 3 the level of nitrogen and calcium in poultry manure were almost equal but comparatively, the level of Nitrogen to the level of calcium in cow-dung varied. Also the levels of Nitrogen to that of calcium in wood-ash were not correlated. Poultry manure produced greater height of seedlings, this might occur due to moderate interaction between N and Ca. The interaction within the elements in poultry manure modulated the radial cells that are responsible for collar diameter growth.

The addition of the organic fertilizer (wood ash, cow dung and poultry manure) improved the growth of *Baillonella toxisperma* seedlings from the study. This can be attributed to the improved nutrients contents which increased the nutrient status of the top soil and translated to increased nutrients and water uptake by the seedlings. This work agreed with the result obtained for seedlings of *Khaya ivorensis* (Afa *et al.,* 2011) *Cupressus arizonica* and *C. sempervirus* (Ahmadloo *et al.,* 2012), *Solanum melongena* (Ulla *et al.,* 2008). For healthy growth and optimal yield, nutrients must be available to plants in sufficient and balanced quantities and in a usable form at the right time (Ramesh *et al.,* 2011). Organic manure, though increases crop yield improves soil fertility in terms of organic C and N content, permeability, plant available water capacity and air-filled porosity (Esawy *et al.,* 2009). However, the nutrient contained in organic manures are released more slowly and are stored for a longer time in the soil thereby ensuring a long residual effect (Ayoola and Makinde 2009; Esawy *et al.,* 2009).

## CONCLUSION

The height parameters within the treatment were not significant but there was significant difference between treatment and control. Also in the area of leaf production it was only cow dung that did better but others that is poultry manure, wood ash and control were not significant. In terms of collar diameter, the effect of poultry manure and cow dung were significant to control but wood ash on the other hand with control are not significant. It is therefore recommended that for height modulation and collar diameter production in *Baillonella toxisperma*, it is better to use poultry manure at 0.4g/kg soil which produced the highest height value or means.

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