# COMPARATIVE STUDIES OF ORGANIC FERTILIZERS APPLICATION OF *Diospyros mespiliformis* (HOCHST) SEEDLINGS GROWTH PERFORMANCE.

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**Abstract**

This study examine comparative studies on nutrients needs and uptake in Diospyros mespiliformis seedlings to evaluate effect of organic manure (Cow dung; 20g, 10g; Poultry manure: 20g, 10g; Water hyacinth 20g, 10g and control). The variables measured were plant height, collar diameter and leaf numbers. The experiment was laid out in a Completely Randomized Design (CRD), the data collected were subjected to Analysis of Variance (ANOVA) and Means separation using Least Significant Difference (LSD). The results showed that seedlings grown with cow dung of 20g produced the highest mean height (12.45cm), collar diameter (5.68mm) and leaf production (7). The best performance was observed in seedlings grown with cow dung at the rate of 20g. 20g of cow dung mixed with 2kg of forest top soil can be used to raise Diospyros mespiliformis seedlings for good growth in the Nursery.

***Keywords*:** *Diospyros mespiliformis*, Collar Diameter, Leaf Production, Seedling Height.

## Introduction

*Diospyros mespiliformis is* commonly known as the African Ebony which belongs to the family Ebenaceae. It is a large deciduous tree found mostly in savanna ecological zone that can live for more than 200 years (Coates, 2002). Mature trees have dark gray fissured bark. An adult tree reaches an average of 4 to 6 meters in height, though occasionally trees reach 25 meters. The foliage is dense and dark green with elliptical leaves, which are often eaten by grazing animals such as elephants and buffalo. The tree flowers in the rainy season; the flowers are imperfect with gender on separate trees, and are cream-colored (Albrecht, 1993). The female trees bears fruit in the dry season and these are eaten by many wild animals; they are oval-shaped, yellow and about 20-30mm in diameter. When the fruits ripen, they turn purple and it is a traditional food plant in Africa. This fruit has potential to improve nutrition, boost food security, foster rural development and support sustainable land care (Coates *et al.,* 1988).

The fruit is edible for humans; its flavor has been described as lemon-like, with a chalky consistency. The seeds can be dried and ground into a flour, and are often used for brewing beer and brandy. The leaves, bark and roots of the tree contain tannin, which can be used as a styptic to staunch bleeding (Coates, 2002). The roots are consumed to purge parasites and are thought to be a remedy for leprosy. The wood is almost impervious to termite damage. The heart wood is fine-grained and strong, and is often used for making wood floors and furniture. Trunks of the tree are used for canoes. The wood ranges in color from light reddish-brown to a very dark brown (Venter, 1996).

Apart from the fact that this species is slow growing in the field, it has been recorded by Coates, (2002), that it has dormancy problem which result in an uneven germination and a major setback in re-afforestation programme. In South Africa, the tree is not specifically protected or threatened, but because of its role in the ecosystem and the food web in which it is involved, it definitely deserves some form of protection (Merwe, 2001).This studies is to investigates the nutrients requirements that will enhance the rapid seedling growth performance for optimum development which will help in the production of healthy seedlings of this species in the nursery for possible plantation establishment in Nigeria.

## Materials and Methods

The experiment was carried out at the Silviculture nursery in Department of Sustainable Forest Management, Forestry Research Institute of Nigeria (FRIN), Ibadan, Oyo State. FRIN is located on the longitude 7.3919° N and latitude 3.8630° E. Mean annual rainfall is about 1548.9 mm, falling within approximately 90 days while the mean maximum temperature is 31.9$^0$C, minimum 24.2$^0$C while the mean daily relative humidity is about 71.9% (FRIN 2015).

The experiment was laid out in Completely Randomized Design (CRD) with 7 treatments replicated 15 times. The statistical model is:

$Y_{ij} = \mu + Ti + eij$…….. Equation I

Where;

$Y_{ij}$ = individual observation

$\mu$ = overall mean

Ti = Effect of Treatment

$E_{ij}$ = Experimental error.

**Experimental Procedure**

One hundred and five seedling of relatively uniform growth with good vigour were randomly selected and subjected to different organic manures (poultry manure, cow dung and use of water hyacinth as organic manure).The different organic fertilizers were weighed into 10g and 20g respectively and was added into the polypots containing soil, they were watered daily for period of four weeks for mineralization of organic fertilizer to take place after which the seedlings of *Diospyros mespiliformis* were transplanted into the growth media. Fifteen (15) seedlings were allocated to each treatment. Water hyacinth 10g (T1), Water hyacinth 20g (T2), Cow dung 10g (T3) Cow dung 20g (T4), poultry manure 10g (T5), poultry manure 20g (T6) and control (T7), were the treatment used for this experiment. The experiment was monitored for the period of 16weeks. Soil, water hyacinth, cow dung and poultry manure were analyzed before the setting up of the experiment. The data obtained were subjected to Analysis of Variance.

**Results and Discussion**

**Effect of Different Fertilizers on the Growth of *Diospyros mespiliformis* Seedlings**

The growth trend in height after two weeks of planting revealed that there was continuous increase in height of the seedlings grown with the application of fertilizers but the growth in height of seedlings grown without the application of fertilizer was slow compared to seedlings in other treatments (Fig. 1).

The mean seedlings height ranged from 7.08 to 12.45 cm, with the highest mean height obtained from the seedlings grown with 20 g of cow dung (CD) while seedlings grown without the addition of fertilizer (control) gave the least mean height (Table 1). Analysis of Variance (ANOVA) indicated that there were significant differences ($p \leqslant 0.05$) in height of *Diospyros mespiliformis* seedlings subjected to different application of fertilizers (Table 2).

Mean separation result revealed that the mean height of seedlings of *Diospyrosmespiliformis* grown with 10 g of Water hyacinth (WH), 20 g of WH, 10 g of CD, 20 g of CD, 10 g of Poultry manure (PM) and 20 g of PM were not significantly different ($p>0.05$) from each other but significantly different ($p \leqslant 0.05$) from the seedlings grown with only degraded soil (control) (Table 1).

The growth trend in collar diameter after two weeks of planting revealed that there was continuous increase in collar diameter of the seedlings in all the treatments. However, growth in collar diameter of seedlings grown without the application of fertilizer was slow compared to seedlings in other treatments (Fig. 2).

The mean seedlings collar diameter ranged from 3.35 to 5.68 mm with the highest mean collar diameter obtained from the seedlings grown with 20 g of CD while seedlings grown without the addition of fertilizer (control) gave the least mean collar diameter (Table 1). Analysis of Variance (ANOVA) indicated that there were significant differences ($p \leqslant 0.05$) in collar diameter of *Diospyros mespiliformis* seedlings subjected to different application of fertilizers (Table 2).

Mean separation result revealed that the mean collar diameter of *Diospyros mespiliformis* seedlings grown without the application of fertilizer (control) is significantly different ($p \leqslant 0.05$) from the collar diameter of the seedlings of other treatments. However, collar diameter of *Diospyros mespiliformis* seedlings grown with 10 g of WH, 20 g of WH, 10 g of CD, 10 g of PM and 20 g of PM were not significantly different ($p>0.05$) from each other. Also collar diameter of seedlings grown with 10 g of WH, 10 g of CD, 20 g of CD and 10g of PM were also not significantly different ($p>0.05$) from each other (Table 1).

The leaves produced after two weeks of planting maintained a continuous increase in the production in all the treatments. However, leaves produced in seedlings grown without the application of fertilizer was slow compared to seedlings in other treatments. It was also observed that the leaves production stopped from the 10th week to 12th week in the seedlings of all the treatments. Production of leaves continued after the 12th week (Fig. 3).

The mean seedlings leaf production ranged from 5 to 7 with the highest mean leaves production obtained from the seedlings grown with 20 g of CD and 20 g of PM while seedlings grown with 20g of WH and without the addition of fertilizer (control) gave the least mean leaves production (Table 1). Analysis of Variance (ANOVA) indicated that there were significant differences ($p \leqslant 0.05$) in leaf production of *Diospyros mespiliformis* seedlings subjected to different application of fertilizers (Table 2).

Mean separation result revealed that the leaves produced by the seedlings grown with 20g of WH and control were not significantly different ($p>0.05$) from each other, leaves produced by seedlings grown with 10 g of WH, 20 g of WH, 10 g of CD and 10 g of PM were not significantly different ($p>0.05$) from each other while leaves produced by seedlings grown with 10 g of WH, 10 g of CD, 20 g of CD, 10 g of PM and 20 g of PM were not significantly different from each other ($p>0.05$) (Table 1).

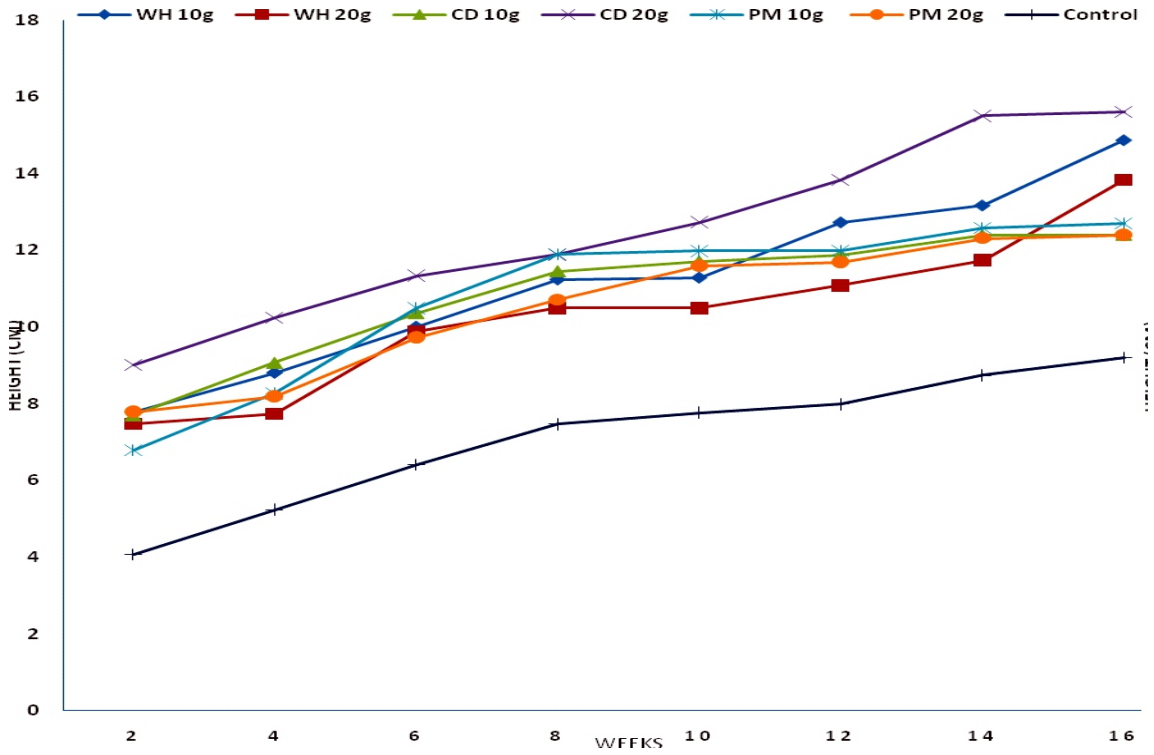


**Figure 1: Effect of Different Fertilizers on the Growth Trend in Height of *Diospyros mespiliformis* Seedlings**

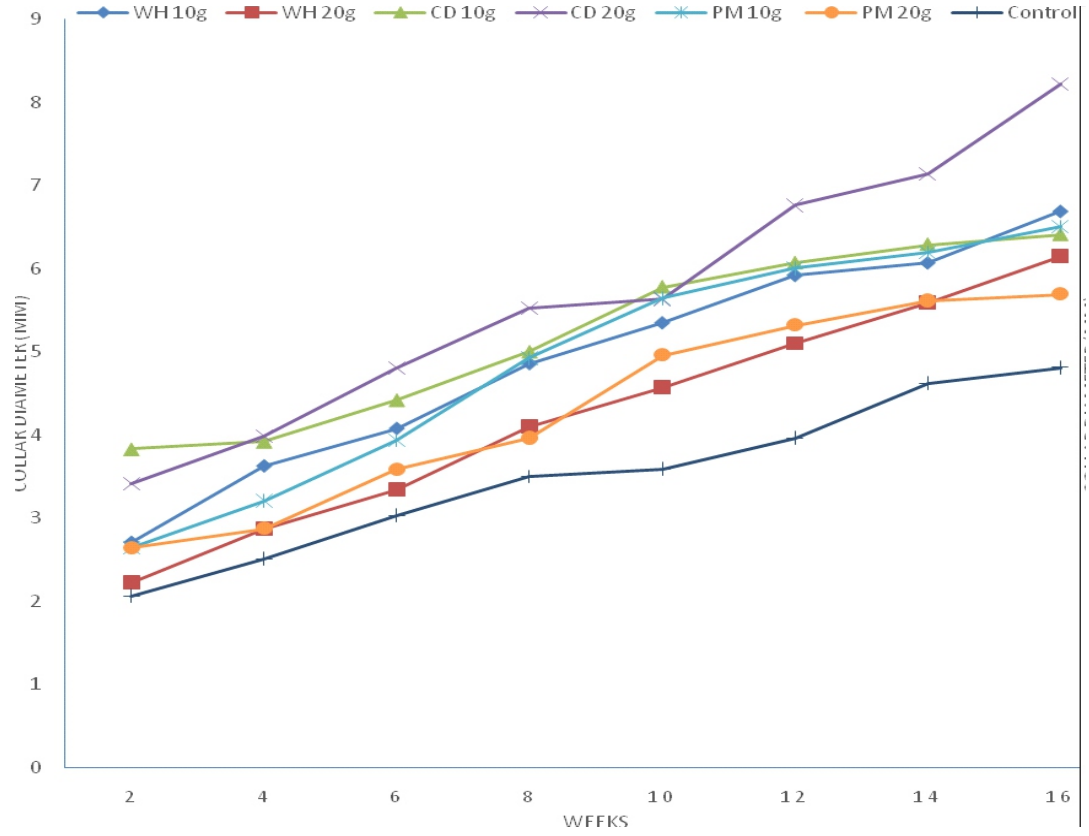


**Figure 2: Effect of Different Fertilizers on the Growth Trend in Collar Diameter of *Diospyros mespiliformis* Seedlings**

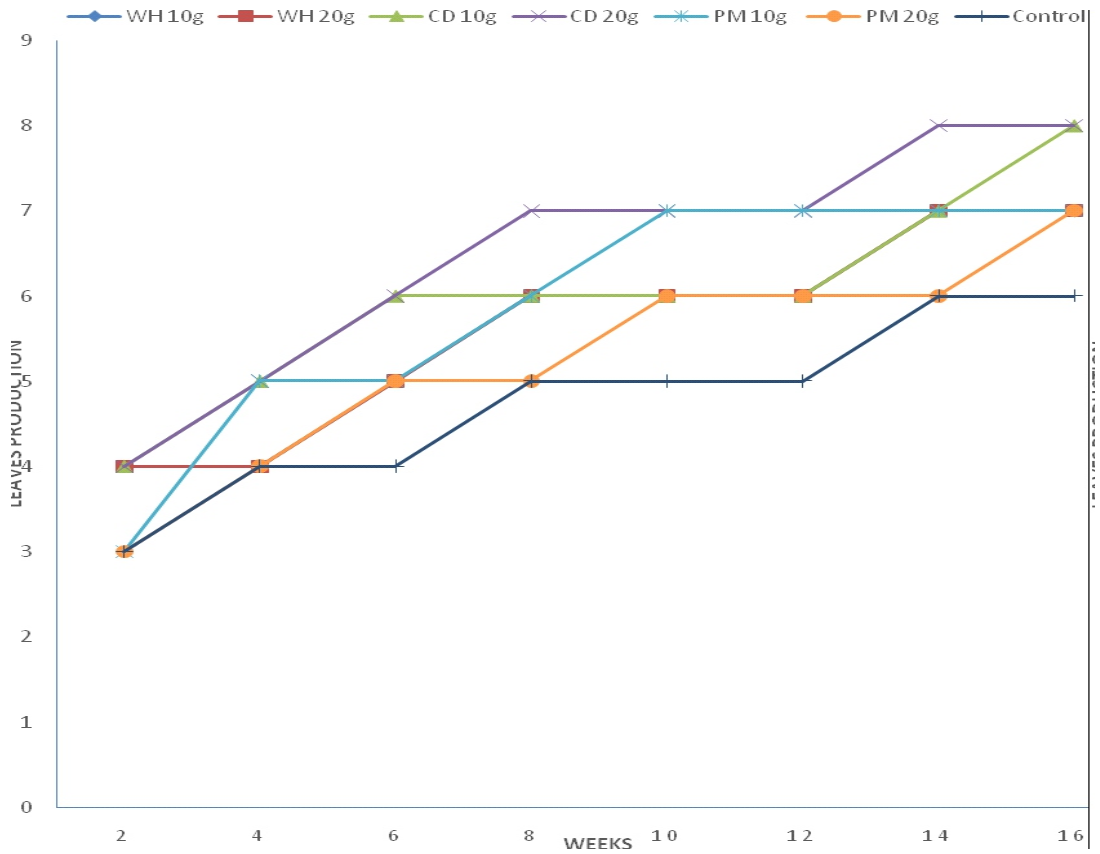


**Figure 3: Effect of Different Fertilizers on the Growth Trend in Leaf Production of *Diospyros mespiliformis* Seedlings**

**Table 1: Mean Separation Result for the Effect of Fertilizers on the Growth of *Diospyros mespiliformis* Seedlings**

| Fertilizer | Height (cm) | Collar Diameter (mm) | Leaf Production |
|---|---|---|---|
| WH 10g | $11.24 \pm 0.67^{a}$ | $4.91 \pm 0.31^{ab}$ | $6 \pm 0.37^{ab}$ |
| WH 20g | $10.33 \pm 0.61^{a}$ | $4.24 \pm 0.28^{b}$ | $5 \pm 0.39^{bc}$ |
| CD 10g | $10.78 \pm 0.72^{a}$ | $5.08 \pm 0.31^{ab}$ | $6 \pm 0.35^{ab}$ |
| CD 20g | $12.45 \pm 0.73^{a}$ | $5.68 \pm 0.30^{a}$ | $7 \pm 0.42^{a}$ |
| PM 10g | $10.78 \pm 0.53^{a}$ | $4.88 \pm 0.28^{ab}$ | $6 \pm 0.32^{ab}$ |
| PM 20g | $10.50 \pm 0.85^{a}$ | $4.32 \pm 0.35^{b}$ | $7 \pm 0.42^{a}$ |
| Control | $7.08 \pm 0.59^{b}$ | $3.35 \pm 0.15^{c}$ | $5 \pm 0.30^{c}$ |

**Table 2: ANOVA Result for the Effect of Fertilizers on the Growth of *Diospyrosmespiliformis* Seedlings**

| Variable | SV | Df | SS | MS | F | Sig. |
|---|---|---|---|---|---|---|
| Height (cm) | Fertilizer | 6 | 243.43 | 40.57 | 5.90 | 0.00* |
| | Error | 98 | 674.40 | 6.88 | | |
| | Total | 104 | 917.82 | | | |
| Collar Diameter (mm) | Fertilizer | 6 | 50.11 | 8.35 | 6.30 | 0.00* |
| | Error | 98 | 129.98 | 1.33 | | |
| | Total | 104 | 180.08 | | | |
| Leave Production | Fertilizer | 6 | 49.01 | 8.17 | 4.33 | 0.00* |
| | Error | 98 | 184.80 | 1.89 | | |
| | Total | 104 | 233.81 | | | |

***significant at ($p \leq 0.05$)***

**Conclusion**

The highest mean values for the three morphological traits that were observed were recorded in seedlings treated with 20 g of cow dung manure and followed closely by 10 g of water hyacinth and 10 g of poultry manure. This could be attributed to the presence of higher content of the three essential minerals required for optimum plant growth and development in these fertilizers. This gives an indication that organic manure improves growth and development of *Diospyros mespiliformis* seedlings in the nursery. The performance of cow dung manure over poultry manure and water hyacinth might be due to the fact that the cow dung manure contains concentrated nutrients and hence, led to enhanced plant growth in those seedlings treated with 20 g of cow dung manure. The nutrient quality in cow dung manure might surpass the ones in poultry and water hyacinth, leading to more enhanced plant growth in those treated with cow dung manure.

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