Effect of Organic Manure and Potting Media on Germination and Early Growth of *Eucalyptus torelliana* F. Muell

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Abstract: A field experiment was carried out to determine the growth response of *Eucalyptus torelliana* F. Muell. to organic manure and potting media. The experiment was conducted within the Nursery site of the Department of Forestry and Wildlife Management Nasarawa State University Lafia. Sampled seedlings were systematically numbered and tagged for easy identification and enumeration, the experiment was laid out in a 4×2×5 factorial experiment in a randomized completely block design (RCBD). Analysis of variance was used to show the comparative performance of each the treatment and Duncan multiple range test (DMRT) to locate where the significant differences occur among the means. The plant variables assessed are; collar girth, plant height, number of leaves, leaf length, leaf width and leaf area. The result of growth with respect to treatment revealed that poultry dropping performed better with mean value of 31.26±8.78 in plant height, 2.02±0.99 in collar girth, 10.42±2.38 leaf count, 7.04±0.91, in leaf length 4.26±0.88 in leaf width and 30.68±9.30 for leaf area. It was further revealed that big size polythene pot (16 by 10cm) with mean value (plant height 29.86±9.51, collar girth 2.05±1.14, leaf count 10.26±2.82, leaf length 7.25±1.32, leaf width 4.56±0.92 and leaf area 33.99±11.36) recorded the highest and best germination. It is recommended that big size pot and poultry droppings should be adopted in raising *Eucalyptus torelliana* F. Muell.

Keywords: *Eucalyptus torelliana* F. Muell, Collar Girth, Potting Media, Leaf Count and Plant Height

1. Introduction

*Eucalyptus torelliana* F. Muell. belong to the family Myrtaceae. It is a large genus of aromatic trees far known to be indigenous to Australia, Tasmania and the neighbouring islands but today can be found growing in subtropical regions of the world [1]. It is a tall evergreen and a dense shade plant with an irregular crown, a very hard tree with smooth, tight and grey-green bark with persistent scaly, sub-fibrous base and tessellated. The leaves has a simple, leathery, variable but usually ovate, wavy margin, green above or with a pink tint, generally pubescent when young and with a wider leaf than other Eucalyptus [2]. It possesses attractive flowers with large creamy white clusters and numerous with valves well below rim of the fruit. Stamens, the creamy fruit is large and ovoid shape and with valves well below rim of the fruit. Eucalyptus has over 800 species and it is the second most widely planted multipurpose woody tree species in the world occurring under a wide range of environmental conditions [3, 4]. The remarkable adaptability of Eucalypts coupled with their fast growth and superior wood properties has driven their rapid adoption for plantation forestry in more than 100 countries [4]. There are several Eucalyptus tree improvement programs, but Eucalyptus domestication can still be considered as being at an early stage. Their general
importance are described as short rotation hardwoods for a variety of products and ornamentals with specific emphasis on existing and emerging markets as energy products [5].

Eucalyptus plants are frequently useful in food preservation, in pharmaceuticals, physiotherapies, as pesticides, as temporary relief to minor aches and pains [1, 6]. Researches from Nigeria, Mali, Australia and Congo-Brazzaville have reported that the essential oils of *E. torelliana* are rich in hydrocarbon monoterpenol, spathulenol and-pinenes, ocimene, aromadendrene and carophyllene oxide as its characteristic constituents [7]. Essential oils from leaves and seed of the plant were reported to have possessed antibacterial activities against enteric pathogens [8], antiviral, anti-inflammatory, anti-oxidant antifungal antimicrobial antibiotic and anti-carcinogenic properties. Analyses of the seed essential oils extracts resulted in the identification of 70 compounds representing 98% of the oil [6]. In Nigeria, *E. torelliana* is used to treat gastrointestinal disorders; decoction of the leaves is used for sore throat remedy and other bacterial infections of respiratory and urinary tract. The poultice of the leaves is applied over wounds and ulcers. It decreases gastric acid production and used for the treatment of gastric and duodenal ulcers, cough associated with most pulmonary diseases. The essential oil of the leaves have been used in treatment of lung diseases, and were stated to have anti-inflammatory and remedies cancer-related symptoms, and intestinal disorders [2, 7, 9].

*E. torelliana*, is one of the most important tropical tree species, with varying uses and great economic values. In view of the potential of this species, the rate at which the tree species is being felled for commercial and other purpose is high whereas the regeneration and afforestation of the tree species is low or does not exist. This therefore give rise to the need to find a suitable solution to this problem by devising means of multiplying this specie on a large scale.

2. Materials and Method

2.1. Study Area and Materials

This experiment was carried out in Nasarawa State University, Faculty of Agriculture Lafia, located between longitude 0°39N and latitude 0°33E, in the Guinea Savannah zone of North Central Nigeria at an altitude of about 177m above the sea level. The mean monthly maximum temperature range is between 35.06°C to 36.40°C and 20.16°C to 20.50°C respectively [10]. The material and equipment used in carrying out the experiment are polythene pots, Hand trowel, wheel barrow, cutlass, spade, weighing balance, head pan, watering can, tags, meter rule, knife, hoes, veneer calliper, sack bags, marking pen and field note book.

2.2. Site Preparation and Sowing Media

A portion of land allocated for the experiment was cleared manually and the site was fenced with a rope. The polythene pots were perforated at the base in order to allow drainage of water. Top soil was collected from the Faculty of Agriculture, Nasarawa state University teaching and research farm after which the polythene pots were filled with the mixed soil. (Two full head pan of organic manure i.e. poultry droppings, cow dung and one full head pan each for poultry dropping + cow dung mixed with four head pan of top soil which is ratio 2: 4)

2.3. Seed Collection, Processing and Sowing

The seeds of *E. torelliana* were handpicked from a plus trees within the premises of College of Agriculture, Lafia, Nasarawa State. The seeds was manually extracted from the seeds pods after sun drying for two days. The seeds were sown first on germination bed, and then transplanted into polythene pots (one seedling per pot) at 4cm depth.

2.4. Silvicultural Operation and Treatment Combination

Watering was carried out morning and evening for two (2) days before seeds was sown. Watering of seeds was done continuously even after sowing for another two (2) weeks after which the watering was done only in the morning. Manual weeding was carried out in other to reduce competition between weeds and Eucalyptus seedlings for water, sunlight and nutrient, and also to prevent pest infestation.

For each polythene pot size, a total of 60 seedlings were transplanted for each treatment which are: cow dung + poultry droppings, cow dung, poultry droppings and control as treatment T1, T2, T3 and T4 respectively.

2.5. Experimental Design

The study was laid out in a 4×2×5 factorial experiment in a Randomized Completely Block Design (RCBD). The experiment had four different treatments (cow dung + poultry droppings, cow dung, poultry droppings and control) with two pots sizes (large and small pot sizes 16 by 10 and 12 by 8cm respectively). Each treatment consist of twenty-four (24) experimental pots, replicated five times per treatment given a total of 120 seedlings per treatment (Figures 1 and 2).
2.6. Parameter Assessed and Data Collection

Ten seedlings were randomly selected from each treatment and the following variables were determined: Plant height, collar girth, number of leaves, leaf length and leaf width. Plant height was measured from the collar region to the top of the seedlings by using metre rule, collar diameter was measured using veneer caliper, number of leaves were determined by manually counting the number of leaves on the seedlings and leaf length and leaf width were measured using metre rule.

2.7. Germination Assessment and Data Analysis

The germination rate of each test was examined to determine the best treatment for the germination of *E. torelliana* between T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> respectively. Below is the formula for calculating seeds germination percentage.

\[
\% \text{ Germination} = \frac{\text{Number of germination}}{\text{Number of seed sown}} \times 100 \quad (1)
\]

Data collected on growth variables were subjected to mean and analysis of variance (ANOVA) to show the comparative performance between the treatments. Data was analysed with respect to two organic manure applications with control and two polyethylene pot sizes. Analysis of variance was performed on the data to show the comparative performance of each treatment with another. Duncan Multiple Range Test (DMRT) was applied to locate significant difference among the treatment, pot size and selected variables.

3. Result

3.1. Mean and Duncan Separation Value for Growth Variables on Basis of Treatment

The result of mean values of parameter assessed on the basis of pot size used, soil treatment given and the age performance (weeks) of *E. torelliana* is shown in Table 1. The highest mean value of plant height (29.86±9.51cm) was recorded in big pot size while the least was recorded in the small pot size (28.32±8.38cm). The same was the result in girth measurement (2.05±1.14cm and 1.69±0.86cm), leaf length, (7.25±1.32cm and 6.96±1.16cm), leave width (4.56±0.92cm and 4.47±1.21cm) and leave area (33.99±11.36m<sup>2</sup> and 32.07±12.88m<sup>2</sup>) respectively. Meanwhile, small pot recorded a higher mean value of leaf production with mean value of 10.28±2.40 while big pot size had 10.26±2.82 (Table 1).

The result of treatment application shows that *E. torelliana* seedlings treated with poultry dropping recorded the highest mean plant height of 31.26±8.78cm followed by the treatment 3 which is the combination of poultry dropping and cow dung with 30.35±9.79cm the least plant height was recorded in untreated soil (control) with mean value of 24.66±6.62cm. The result of treatment application shows that the seedlings treated with the combination of poultry dropping and cow dung recorded the highest mean girth value of 2.18 ± 1.31cm followed by treatment 2 (which is poultry dropping) with mean value of 2.02±0.99m, while control again had the least mean collar girth of 2.48±1.88cm. The result of number of leaf production shows that the seeds treated with cow dung recorded the highest mean number of leaves (10.51±2.57), followed by the treatment with poultry droppings with mean value of 10.42±2.38, while treatment 3 recorded the least number of leaves with 9.69±2.85 (Table 1).<mbox>

| Source of Variation | Plant Height (cm) | Girth (cm) | Leave Num. (cm) | Leave Length (cm) | Leave Width (cm) | Leave Area (m<sup>2</sup>) |
|---------------------|-------------------|-----------|----------------|------------------|----------------|-----------------------------|
| Pot size            |                   |           |                |                  |                |                             |
| Big                 | 29.86±9.51        | 2.05±1.14 | 10.26±2.82     | 7.25±1.32        | 4.56±0.92      | 33.99±11.36 m<sup>2</sup>   |
| Small               | 28.32±8.38        | 1.69±0.86 | 10.28±2.40     | 6.96±1.16        | 4.47±1.21      | 32.07±12.88 m<sup>2</sup>   |
| Total               | 29.09±8.99        | 1.87±1.02 | 10.27±2.62     | 7.12±1.25        | 5.1±1.07       | 33.07±12.17                 |
| Treatments          |                   |           |                |                  |                |                             |
| Cow dung            | 30.09±9.01b       | 1.95±0.88 | 10.51±2.57     | 7.35±1.02        | 4.8±1.29       | 36.24±13.19 m<sup>2</sup>   |
| Poultry Dropping    | 31.26±8.78b       | 2.02±0.99 | 10.42±2.38     | 7.04±0.91        | 4.26±0.88a     | 30.68±9.30a                 |

Table 1. Means and Duncan's Multiple Range mean separation value of parameter assessed on the basis of Pot size, treatments and weeks.
The results of analysis of variance of Plant height indicated that treatments (0.01**), and week (0.00**), significantly influenced height of *Eucalyptus torelliana*, although, the effect of pot sides (0.91**) was not significant on plant height at p<0.05. The result of 2 way interaction of Pot sizes and treatment (0.44**), pot sizes and weeks (0.76**) were not significant on the plant height but the effect of 2 way interaction of treatments and weeks was highly significant (0.00**) on the plant height. The effect of 3 way interactions of Pot sizes, treatments and weeks (0.00**) was also highly significant on plant height at p<0.05 with coefficient value of 0.17 (Table 2).

The results of analysis of variance of plant girth indicated that pot size (0.91**), and weeks (0.00**), significantly influenced the increase in plant girth, the effect of the treatment (0.31 m) does not significantly influence plant girth at p<0.05. The result of 2 way interaction of treatment and week (0.01*) was significant on the plant girth and the effect of 2 way interaction of pot size and weeks (0.62 m), was not significant on the plant girth. The effect of 3 way interactions of treatments, pot sizes and weeks (0.95**) was also not significant on plant girth at p<0.05 with coefficient value of 0.52 (Table 2).

The results of analysis of variance of leave production showed that pot size (0.91**) was not significant on leave production of *Eucalyptus torelliana*, the effect of treatment (0.01**) and weeks (0.00**), significantly influenced leave production at p<0.05. The result of 2 way interaction of treatment and pot size (0.44**) was not significant on the number of leaves production of the plant. While the effect of 2 way interactions of treatment and weeks (0.00**), was as well significant on the leave production. The effect of 2 way interaction between pot sizes and weeks (0.76**), was not significant on the leave production. The effect of 3 way interactions of treatments, pot sizes and weeks (0.00**) shows that there was the variables assessed significantly influence leave production at p<0.05 with coefficient value of 0.23 (Table 2).

### Table 2. Analysis of variance of parameter assessed (Plant height, Girth and Number of leave).

| Source of Variation | Plant Height (cm) | Girth (cm) | Leave Num. (cm) | Leave Length (cm) | Leave Width (cm) | Leave Area (m²) |
|---------------------|------------------|-----------|-----------------|-------------------|-----------------|----------------|
| Cow Dung * Poultry Dropping | 30.35±9.79b | 2.18±1.31c | 9.69±2.85a | 7.59±1.17c | 4.74±1.07b | 37.02±12.64b |
| Control | 24.66±6.62a | 1.32±1.02a | 10.38±2.57b | 6.44±1.52a | 4.21±0.88a | 28.17±10.96a |
| Total | 29.09±8.98 | 1.87±1.02 | 10.27±2.62 | 7.12±1.25 | 4.51±1.07 | 33.03±12.17 |
| Weeks | | | | | | |
| 1 | 19.80±4.69a | 1.04±0.38a | 9.55±2.15a | 6.45±1.14a | 3.89±0.94a | 25.91±9.52a |
| 3 | 25.71±5.47b | 1.59±0.59b | 11.34±2.68c | 7.04±1.22b | 4.46±1.30b | 32.35±13.48b |
| 6 | 32.93±5.63c | 2.10±0.08c | 10.68±2.76b | 7.33±1.16c | 4.73±0.84c | 35.42±10.56c |
| 9 | 37.91±7.04d | 2.75±1.20d | 9.52±2.42a | 7.60±1.88c | 4.96±0.84c | 38.44±11.20d |
| Total | 29.09±8.99 | 1.87±1.02 | 10.27±2.62 | 7.12±1.25 | 4.51±1.07 | 33.03±12.17 |

Note: mean on the same row bearing the same alphabet are not significantly different; ns=not significant.
3.3. The ANOVA Result of Parameter Assessed (Leave Length, Leave Width and Leave Area)

The results of analysis of variance of leave length indicated that pot size treatment and weeks (0.00**) significantly influenced leave length, while the effect of sapling height (0.00**) was also highly significant on the leave length at p<0.05. The effect of 2 way interactions of treatment and pot size (0.00**), treatment and week (0.00**) was as well significant on the leave length. The effect of 2 way interaction between treatment and week (0.99 *) was not significant on the leave length. The effect of 3 way interactions of treatments, pot sizes and weeks (0.00**), was not significant on leave width of the plant. The effect of 3 way interactions of Pot sizes, treatments and weeks (0.99**) was also not significant on leave width of at p< 0.05 with coefficient value of 0.17 with coefficient value of 0.29 (Table 3).

The results of analysis of variance of leave width indicated that pot sizes (0.00**), and weeks (0.00**), significantly influenced leave width of *Eucalyptus torelliana*, although, the effect of treatments (0.32ns) was not significant on leave width at p< 0.05. The result of 2 way interaction of Pot sizes and treatment (0.00**), was highly significant while that of pot sizes and weeks (0.95ns), treatments and weeks (0.86**) were not significant on leave width of the plant. The effect of 3 way interactions of Pot sizes, treatments and weeks (0.99**) was not significant on leave width at of at p< 0.05 with coefficient value of 0.24 (Table 3).

The results of analysis of variance of leave area indicated that pot sizes (0.48*) did not significantly influenced height of *Eucalyptus torelliana* while treatments and week (0.00**), significantly influenced height at p< 0.05. The result of 2 way interaction of treatments and weeks (0.99ns), pot sizes and weeks (0.91**) were not significant on leave area but the effect of 2 way interaction of treatments and pot sizes were highly significant (0.00**) on the leave area. The effect of 3 way interactions of Pot sizes, treatments and weeks (0.99**) was also not significant on leave area at p< 0.05 with coefficient value of 0.29 (Table 3).

| Source | Sum of Squares | Df | Mean Square | F   | Sig  | R² |
|--------|----------------|----|-------------|-----|------|----|
| Leave length |                  |    |             |     |      |    |
| Pot size | 9.89           | 1  | 9.89        | 8.40| 0.00**|    |
| Treatment | 89.42         | 3  | 29.81       | 25.31| 0.00**|    |
| Week    | 87.30          | 3  | 29.10       | 24.72| 0.00**|    |
| treatment * pot size | 32.31     | 3  | 10.77       | 9.15| 0.00**|    |
| treatment * week | 2.15        | 9  | 0.24        | 0.20| 0.99**|    |
| pot size * week | 0.19          | 3  | 0.06        | 0.05| 0.98**|    |
| treatment * pot size * week | 0.21       | 9  | 0.02        | 0.02| 1.00**|    |
| Error   | 527.48         | 448| 1.18        |     |      |    |
| Total   | 748.95         | 479|             |     |      | 0.29|
| Leave width |                |    |             |     |      |    |
| Pot size | 36.79          | 3  | 12.27       | 13.27| 0.00**|    |
| Treatment | 0.92          | 1  | 0.93        | 0.99| 0.32**|    |
| Week    | 76.36          | 3  | 25.45       | 27.53| 0.00**|    |
| pot * treatment | 16.16      | 3  | 5.39        | 5.83| 0.00**|    |
| pot * week | 3.15          | 9  | 0.35        | 0.38| 0.95ns|    |
| treatment * week | 0.69         | 3  | 0.23        | 0.25| 0.86**|    |
| pot * treatment * week | 1.88       | 9  | 0.21        | 0.20| 0.99**|    |
| Error   | 414.18         | 448| 0.93        |     |      |    |
| Total   | 550.13         | 479|             |     |      | 0.25|
| Leave Area |                |    |             |     |      |    |
| Treatment | 6622.46       | 3  | 2207.45     | 19.77| 0.00**|    |
| Pot size | 440.55         | 1  | 440.55      | 3.95| 0.48**|    |
| Week    | 10326.34       | 3  | 3442.11     | 30.83| 0.00**|    |
| treatment * pot size | 3113.19    | 3  | 1037.73     | 9.29| 0.00**|    |
| treatment * week | 192.59       | 9  | 21.39       | 1.92| 0.99**|    |
| pot size * week | 60.40         | 3  | 20.13       | 1.80| 0.91ns|    |
| treatment * pot size * week | 151.26      | 9  | 16.81       | 1.51| 0.99ns|    |
| Error   | 50021.37       | 448| 111.66      |     |      |    |
| Total   | 70928.15       | 479|             |     |      | 0.29|

Note: **= highly significant at 5% probability level, *=significant at p<0.05, ns=not significant
3.4. The Results of Correlation and Regression on Parameter Assessed

Result of Correlation analysis revealed that there was significant correlation between plant height and Girth (-0.17**) plant height and leave width (0.29**) and between plant height and leave area (0.72**) (Table 4). The result of the regression analysis on the effects of growth variables on tree plant height had coefficient of ($R^2 = 0.089$) (Table 5) meaning that the assessed growth variables had about 89.0% effects on plant height of *Eucalyptus torelliana* tree under intense nursery management.

Table 4. Correlations analysis of parameters assessed.

|                     | Pot size | Girth | Leave Num | Leave length | leave width | leave Area | plant height |
|---------------------|----------|-------|-----------|--------------|-------------|------------|--------------|
| **Pearson Correlation** |          |       |           |              |             |            |              |
| Sig. (2-tailed)     | 1        |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | -0.17** |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.00     |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | 0.01     |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.02     |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | -0.12** |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.00     |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | -0.04    |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.39**   |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | 0.37     |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.46     |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | -0.08    |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.05     |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | 0.09     |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.58     |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | 0.00     |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.00     |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | -0.07    |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.09    |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | 0.06     |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.04     |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |
| **Pearson Correlation** | 0.02     |       |           |              |             |            |              |
| Sig. (2-tailed)     | 0.08     |       |           |              |             |            |              |
| N                   | 480      |       |           |              |             |            |              |

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

Table 5. Table of Regression Parameters.

| Model | Unstandardized Coefficients | Standardized Coefficients | T | Sig. | R2 |
|-------|-----------------------------|---------------------------|---|------|----|
|       | B                           | Std. Error                | Beta |      |    |
| 1     | (Constant)                  | 5.89                      | 2.37 | 2.488| 0.01*|
|       | Pot                         | 0.22                      | 0.23 | 0.04 | 0.94 | 0.35**|
|       | Treatment                   | 0.48                      | 0.11 | 0.20 | 4.219| 0.00**|
|       | Week                        | -0.34                     | 0.06 | -0.40| -5.63| 0.00**|
|       | Leave Num                   | 0.13                      | 0.02 | 0.00 | 0.71 | 0.00**|
|       | Leave Length                | 0.06                      | 0.34 | 0.03 | 0.17 | 0.86**|
|       | Leave Width                 | 0.24                      | 0.60 | 0.10 | 0.39 | 0.69**|
|       | Leave Area                  | -0.02                     | 0.08 | -0.09| -0.24| 0.81**|

a. Dependent Variable: Plant Height
Note: **=correlation is significant at 1% level p<0.01, *=correlation is significant at 5% level p<0.05, ns= not significant, Dependent variable:% height increment, S. E. E mean standard Error Estimate

4. Discussion

The study considered the effect of pot sizes (big and small) and organic manure (Cow dung and poultry droppings) on the growth of *Eucalyptus torelliana* F. Muell. at seedlings growth stage at the nursery. The study was carried out with the aim to evaluate the early growth and development response of *Eucalyptus torelliana* F. Muell. raised in different pot sizes to organic fertilizer treatment at the nursery site of the Department of Forestry and Wildlife Management, Faculty of Agriculture Nasarawa State University Lafia campus.

Effect of early growth assessment of *Eucalyptus torelliana* F. Muell. treated with two different pot sizes (16 by 10cm for big size and 12 by 8cm for small size), the result in all respect showed that the best soil media for *Eucalyptus torelliana* is the big pot size. This result corroborates Geply et al. in a study carried out effect of different pot sizes and growth media on the agronomic performance of *Jatropha curcas*. He reported that when *Jatropha* in a big pot performed better in terms of height than when it was in a small pot [11]. This also agrees with the findings of Hopkins and White who reported that large polythene pot had higher level of significance on the early growth *Pakia biglobosa* compared to small polythene pot
[12]. Oni and Caspa also reported that large polythene pot had an effect on seedlings growth compared with small polythene pot in term of stem girth [13]. This could be due to the ability of large polythene pot containing large amount of soil nutrient and water molecules.

The report of growth parameter also revealed the application of organic manure significantly affect the growth rate of Eucalyptus torelliana F. Muell. this therefore shows that Plant growth is directly related to the availability of nutrient in the soil as the Eucalyptus torelliana F. Muell. plant in treated soil sample performed better than the those in the untreated soil. The application of manure had a positive effect on the growth of the assessed variable such as plant height, basal girth and number of leaves produced and other leave parameters including leave area. The result showed that the sapling of Eucalyptus torelliana F. Muell. treated with poultry droppings recorded the highest mean value of the growth in most of the accessed parameters including plant height and Plant girth. This could be attributed to the fact that nutrient availability in the soil enriches and improves plant growth. This is in accordance with the study of Egbewe [14]. It is recorded that plant cow dung treatment also improve Eucalyptus torelliana F. Muell. growth with mean values higher than the control treatment and 76.09 ± 1.9cm as the least plant height value recorded for control. This is in-line with the study of Rotowa et al. in a study they carried out to evaluate the growth response of Moringa olfera to organic and mineral fertilizer treatment where poultry manure recorded the highest yield of growth parameter assessed as followed by cow dung treatment [15].

This implies that both treatment (growth and germination media and poly pots) used for nursery propagation of Eucalyptus torelliana under the same geographical and weather conditions have significant influence on the agronomic parameters determined. Different pot sizes and growth media influenced the nursery performance of Eucalyptus torelliana F. Muell. after assessed for the period of nine weeks. This study shows that both the growth media and poly pots improved the nursery performance of Eucalyptus torelliana F. Muell., this is similar with the findings of Igboanugo, which showed that when Triplochiton scleroxylon seedlings were transferred to a more pleasant environmental conditions, there was an upsurge in their shoot growth and growth of other morphological parameters than were possible in their previous environments [16] and the study of Gepley et al. who reported better growth significant influence on the agronomic parameters determined on Jatropha curcas [11]. The result also agrees with the findings of on Eucalyptus clones which recorded significantly higher height increment and higher GBH increment where lowest height increment was recorded in the control [17].

The correlation analysis showed that there was positive significant relation between sampling height and weeks, this indicated that as week increases likewise the sampling height, basal girth, branches and possibly leave number also increase, this is growth trend is in accordance with the result of previous researches [11, 14, 15, 18, 19]. The result of correlation further showed that there was a significant variation on the growth of Eucalyptus torelliana seedlings based on the treatment given and weeks of assessment. There is also a positive significant relationship between plant height which is the major growth factor and other growth parameters including plant girth, number of leaves and leave area. While the result of regression analysis on the effect of growth variable on sample height had coefficient of determination ($R^2=0.89$) meaning that the assessed growth variable had about 89% effects on the sampling height of Araucaria heterophylla.

5. Conclusion and Recommendations

The types of organic manure and the size of polythene pot for risen successful seedlings in nursery is very essential to choose. On the basis of result obtained from this study, it is concluded that potting media (polythene pot) and organic manure significantly influenced the germination, growth and development of Eucalyptus torelliana seedlings. The overall result revealed that poultry dropping mixed with top soil filled in polythene pot size of 16 by 10cm has highest growth and development compared to that of polythene pot size 12 by 8cm and cow dung, poultry droppings + Cow dung and control (top soil). From the result of the study, it is recommended that poultry droppings treatment and large polythene pot sizes performed better than the other treatments. Therefore, it should be adopted in raising Eucalyptus torelliana in the nursery. However, further research activities on the organic manure and pot sizes on raising Eucalyptus torelliana should be done to ascertain the result of this work. This will go a long way to boost the production of Eucalyptus torelliana trees and its sustainability for wood based industries.

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