EFFECTS OF DIFFERENT POTTING MEDIA ON THE GERMINATION AND EARLY GROWTH OF *Newbouldia laevis.* (P.Beauv.) Seem.

ABSTRACT

The research was conducted at the screen house of the Department of Forestry and Wildlife, Faculty of Agriculture, Nnamdi Azikiwe University, Awka, Anambra state, Nigeria. The study was carried out from January to May 2021 to access the effect of different potting media on germination and early growth of *Newbodia laevis*.

Treatments were laid out in a Complete Randomize Design (CRD) with four replications. The germination parameters measured were days to germination, germination period and germination percentage while the growth variables measured includes plant height, collar diameter and number of leaves. The potting media used were T1 (topsoil and cow dung), T2 (topsoil and goat dung), T3 (topsoil and poultry dropping), T4(topsoil and sawdust), T5 control (topsoil only)

Data collected were subjected to R software, using the following packages: plyr, car, gvlma, one-way tests, user friendly science, ggplot. Results obtained indicated that T1 had the highest germination percentage (85%) followed by T2 and T3 with germination percentages of 82% and 80% respectively. T4 had the poorest germination percentage (60%). The results also showed that the treatment had direct effect on the seedling early growth; the highest mean collar girth was observed in T1 with 1.85cm while the least was observed in T4 with 0.72 m. The highest mean height was observed in T2 with 22.15 cm while the least was observed in T4 with 7.23 cm. Also, the highest mean number of leaves was observed in T2 with 21leaves while the least was observed in T4 with 7 leaves. Based on the findings of these experiments it is recommended that for maximum growth and optimum germination of *Newbodia laevis,* T1 and T2 should be used, sawdust had poor germination and growth performance and thereby is not recommended for the early growth of *Newbodia laevis* seedlings.

KEY WORDS: *Newbouldia laevis* , germination, early growth, potting media, seedlings.

INTRODUCTION

Newbouldia laevis is a medium sized angiosperm in the Bignoniaceae family. It is native to tropical Africa. It is popularly known as the tree of life or fertility tree in Nigeria. Most significantly, it is known as a symbol of unity, family symbol of authority and a shrine for ancestral worship Ehiagbonare and Onyebi (2009). The plant species is known in English as tree of life or fertility tree. In Nigeria it is known in Yoruba as okoko,Hausa - aduruku, Tiv - Kontor, Benin - Ikhimi, Igbo-Ogirisi, Efik - obot, Urhoho - ogiriki (Gill, 1992). The plant species plays a role in phytomedicine, and the barks, leave and root are the parts mostly used. The isolated chemical constituents of the plant as reported by Gill (1992) are alkaloids, tannins and saponins. It is reported to be effective in the treatments of elephantiasis, syphilis, epilepsy, insomnia, convulsions, rheumatic swelling, piles, dysentery, constipation, and psychosis (Usman and Osuji, 2007; Odugbemi, 2008).

The tree grows to a height of about 10m - 20m high , 60- 90cm in girth. Bark greyish to pale brown, fairly smooth, slash cream, fibrous. Branchlet short and twisted, with short knobby twigs often with clustered leaves at their ends. Leaves are up to 50cm long and usually with 3- 5 pairs of leaflets. The common stalk being prominently swollen at the point of attachment of each pair, leaflets 15- 20cm long by 5- 10cm broad, elliptic to broadly elliptic, sometimes slightly oblanceolate, acuminate, cuneate rather leathery, dark green, glabrous, usually with coarse teeth but the margin sometimes entire with 5- 8 pairs of prominent lateral nerves, looped well away from the margin, leaflet stalk very short, stout. The flowers (Dec- Feb) are purplish- pink with darker stripes, trumpet shaped, up to 6cm long, closely crowded in almost spike-like panicles at the ends of short side stouts, calyx about 2.5cm long, splitting down one side. The fruits (plate 2) usually mature and ripe between (Jan- Feb) having 22- 30cm long, pendulous, surface dotted with

purplish glands which are attractive to ants, packed with winged seeds (Plate 1), flat, about 3.5cm long including the wing at each end.

The young leaves of the plants are crushed in little amount of water and the extract is used to treat eye flammation and redness. Kargbo (1982) reported that, it can be administered to stop vaginal bleeding in threatened abortion and that the leaves and roots are also used in the treatment of round worm infection, elephantiasis, dysentery, malaria, stomachic, migraines, convulsions and the bark is chewed, swallowed to relieve headache. The wood is pale brown, durable, evenly textured and hard and it tends to remain alive for a long time even after cutting it. This makes it viable for usage as boundary tree, woodworks, yam stakes, house posts, bridges and firewood.

Also, *Newbouldia laevis* has different symbols and meanings to different countries for example; some villages in Gabon and Ivory Coast plant the tree near the tombs to act as a protective talisman. The Ibibio and Efik people of Nigeria regard the tree as a symbol of their deities thus they tend to plant in their sacred places. The Igbo part of Nigeria refers to the *Newbouldia laevis* (ogilisi) tree as a sacred tree that has some spiritual powers hence, they usually plant it in front of a native doctor, chief's house, or sacred places (Ersan et al., 2008). It is highly used in every traditional rite and as a sacred tree as it is commonly found in sacred places such as shrine and other traditional sacred places.

Newbouldia laevis is a very useful multipurpose tree which provide numerous services which includes wood, fuelwood, poles, medicinal and produce the oxygen we breathe, and serve as raw materials for many industrial products (Ajibesin, 2011). This plant species of great cultural importance and diverse phytomedicinal uses should not be left in the wild. As such this specie needs to be domesticated by using an appropriate media that would ensure both the germination and its early growth.

Potting media is a combination of organic and inorganic material mixed in an appropriate or desired proportion depending on the demand of the research. It serves as a medium in which the species would grow and support the root of the species as it grows with the supply of the content nutrient. The nutrient content of a potting media is dependent on the research as each media can be modified or limited. The potting media needs to supply plant with a means of support, good drainage, adequate air circulation and storage of water and nutrient.

According to Anozie et.al., (2020) good potting media management is essential to the production of quality tree seedlings, since vigorous growths needed to face the seasonal hazards encounter on the field. Plant requires favorable potting media for its growth.

To achieve its function, growing media used should have light-weight, good porosity, well-drained but with good water holding capacity, contained required nutrients, slightly acidic with good cation-exchange-capacity, able to maintain a constant volume when wet or dry, free of insects, diseases, and weed seeds, low in silt, clay and ash content, easily stored for long periods of time without changes in physical and chemical properties, and easily handled and blended.

The development of a healthy, good root system needs a media with these good physical properties. Any nutrient or chemical deficiencies in soil can be compensated or supplemented using good potting media.

Germination is usually the growth of a plant contained within a seed Anozie and Oboho (2020), it leads to the formation of a young seedling, it is also the process of reactivation of metabolic machinery of the seed resulting in the emergence of radicle and plumule (Baskin, 2014).

Early growth of a plant begins after germination. The early stage of a plant is also known as seedling stage, and it is one of the most critical phases during a plant's life history. Seedling survival not only exerts an important influence on the size, persistence, and genetic variability of plant populations, but also on the availability of required nutrients at the early stage of growth. (Kitajima and Fenner, 2000; Grime, 2001). People do not have interest on the germination of this species as they believe that trees are natural gift of nature as it grows naturally on its own without planting. This believes poses a threat on the existence of this species.

The tree is characterized with poor or slow rate of seedling growth, and it is susceptible to insect attack. Several researchers have carried out research about the medicinal content of the leaves and bark as well as the sap. However, there is little or no information on the effect of different potting media on the germination and early seedling growth of this species in Nigeria. Therefore, there is the need to carry out this study that will effectively determine the best potting media that can positively increase germination percentage and enhance early seedling growth of this species.

Hence, this research was carried out to investigate the effect of different potting media on the germination and early growth of *Newbouldia laevis.*

PLATE 1. Seeds of *Newbouldia laevis*

PLATE 2. Fruits of *Newbouldia laevis*

MATERIALS AND METHOD

Experimental Site/ Study Area

This study was carried out at the screen house of the Department of Forestry and Wildlife, Faculty of Agriculture, Nnamdi Azikiwe University, Awka. The University is located in the

southeastern Nigeria and lies between latitude of 6.2485°N and longitude of 7.1154°E, with mean elevation of 136 meters above the sea level. It is within the tropical rainforest region with average annual temperature of 26.3°C and the rainfall pattern fanging between 1828mm-2002mm Ezenwaji *et al.,* (2013).

Experimental Design

Completely Randomized Design (CRD) was used for this study. There were five treatments used with four replicate each.

Seed Procurement and preparation

The seeds used in carrying out this study were procured from Nnamdi Azikiwe University, Awka premises. Matured ripe fruits of *Newbouldia laevis* were gathered from phenotypically superior mother tree within Nnamdi Azikiwe University Awka. Afterwards, the fruit were opened for seeds extraction. The extracted seeds were air dried at room temperature for 6 hours and then wrapped in a paper to avoid drying up and losing viability as a result of prolong exposure to the immediate environment and the seeds were planted immediately into the already prepared growing media .

Organic Manure Procurement and preparation

The poultry dropping, cow dung and goat dung that was used for this experiment were gotten from the animal farm at the Department of Animal Science, Nnamdi Azikiwe University. While the sawdust was gotten from sawmill located around Eke Awka Market.

The poultry dropping, saw dust, cow dung, and goat dung were mineralized for two weeks. This was done by mixing them respectively with topsoil in the ratio 2:1, one media: two topsoils, after which the mixture was made moist but not water logged and covered with black nylon. This was done to enable microorganisms act on the media and in the process liberate the nutrients in the form that can be absorbed by the roots of the plants, increase aeration and light reflection. The mineralized media was then sieved and filled into ten 5x3 inches poly pots ready for germination.

Potting Media (Treatments) Used

T1= Topsoil and Cow dung.

T2= Topsoil and goat dung.

T3= Topsoil and poultry dropping.

T4= Topsoil and saw dust

T5= Topsoil only (control).

Routine Maintenance of Experimental Plot

Daily watering of the germination poly pot (day and night) was done using watering can. Weeding was also carried out appropriately when necessary.

Data Collection

Data was collected based on germination and growth response assessment as highlighted below;

i. **Germination response**: the effect of different potting media on the germination was assessed by counting the number of seeds that germinated daily. The germinated seeds was counted and recorded from the date of first emergence until there was no more germination.

ii. **Growth response**: For growth assessment, the first three seedlings to germinate in each treatment per replicate were marked and used for growth assessment of the germinated seedlings.

The effect of different potting media on growth of *Newbouldia laevis* seedlings was evaluated by measuring some growth valuable at five weeks after germination. The growth parameters measured in weekly bases includes.

i. plant height (using measuring tape or ruler)

ii. ii. Collar girth (collar girth at soil level was measured using veneer caliper

iii. iii. Number of leaves (was determined by counting the number of leaves)

Data Analysis.

Data were expressed as mean ± standard deviation (SD) and then analyzed with R (R Core Team, 2014), using the following packages: plyr, car, gvlma, onewaytests, userfriendlyscience, ggplot2. Prior to the comparison of means, the global test for linear model validation was used to test for linear model assumptions. Since the data did not satisfy the linear model assumptions of normality and homogeneity of variance, they were subjected to the Welch ANOVA followed by Games-Howell post hoc test. Statistical significance was determined at less than 5% probability level.

Expected Result

The study is expected to provide the result that will review the best growth media for best germination and early growth performance of *Newbouldia laevis* in respect to plant height, stem diameter, and leaf production using different potting media.

Soil physio-chemical analysis

The topsoil used in this research was obtained from the Department of Forestry and wildlife nursery, located at the Faculty of Agriculture, Nnamdi Azikiwe University Awka and was subjected to soil analysis, the analysis which was aimed at accessing the availability of important soil chemical nutrients that are required for plant growth.

RESULTS AND DISCUSSION

RESULTS

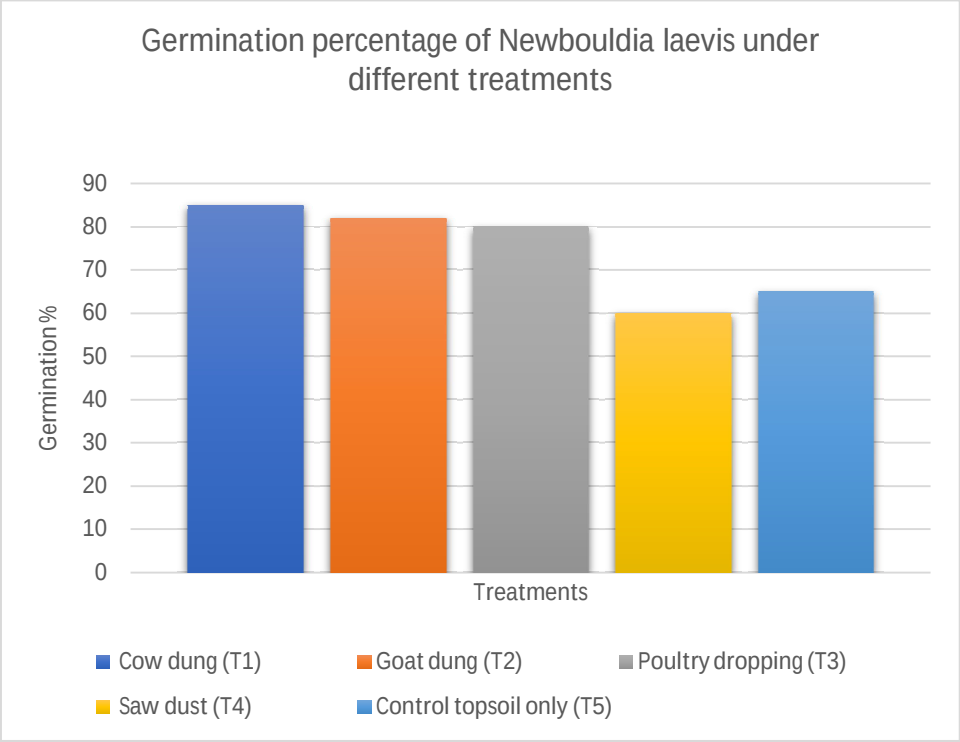
GERMINATION

The type of germination exhibited by *Newbodia laevis* seeds was epigeal germination. The new seedlings emerged with the hypocotyle. There was no significant difference between the days to emergence as the whole treatment started germinating the same day which was five days after planting. The germination period in ***Newbodia*** *laevis* was relatively short as all the treatment completed their germination between 6-9 days (table 1). Treatment T1 has the highest germination percentage (85%) followed by T2 (82%),T3(80%),T5(65%),T4(60%) (Table1 and Figure 1**).**

Table 1: Germination parameters of *Newbodia laevis* in relation to treatment.

Treatment	Days to Germination	Germination Period (days)	Germination Percentage (%)
Cow dung (T1)	5	5	85
Goat dung (T2)	5	6	82
Poultry dropping (T3)	5	5	80
Saw dust (T4)	5	9	60
Control topsoil only (T5)	5	8	65

Fig.1: Germination percentage of *Newbouldia laevis* under different treatments



Analysis of growth variables

Data were expressed as mean ± standard deviation (SD) and then analyzed with R (R Core Team, 2014), using the following packages; plyr, car, gvlma, onewaytests, userfriendlyscience, ggplot2. Prior to the comparison of means, the global test for linear model validation was used to test for linear model assumptions. Since the data did not satisfy the linear model assumptions of normality and homogeneity of variance, they were subjected to the Welch anova followed by Games-Howell post hoc test. Statistical significance was determined at less than 5% probability level.Values are mean ± standard error (SD) of replicate samples. Column that have means with the same letter are not significantly different from each other

Plant height under different growth media

Table:2 shows the result of the descriptive statistics of plant height (cm) of *Newbouldia laevis* under different treatments. The result shows the mean diameter as 20.739583±6.309791, 22.154167±7.316653,15.958333±4.189088,7.227778±1.339421and 14.666667±5.072371 for treatment T1, T2, T3, T4 and T5 respectively.

Table 2: Descriptive statistics for plant height under different growth media.

Seedling growth Variables	Treatment	N	Mean	Std. Err	Std. de
Plant Height (cm)	Cow dung (T1)	144	20.739583	6.309791	0.5258159
	Goat dung (T2)	144	22.154167	7.316653	0.6097211
	Poultry droppings(T3)	144	15.958333	4.189088	0.3490907
	Sawdust (T4)	144	7.227778	1.339421	0.1116184
	Control (topsoil) T5	144	14.666667	5.072371	0.4226976

Collar girth under different growth media

Table.3 shows the result of the descriptive statistics of collar girth (cm) of *Newbouldia laevis* under different treatments. The result shows the mean collar girth as 1.8486111±0.7576174, 1.8180556±0.7761887 , 1.3583333±0.6588292,0.7159722±0.3638687, and 1.3833333±0.6317918 for treatment T1, T2, T3, T4 and T5 respectively.

Table 3: Descriptive statistics for collar girth under different growth media

Seedling growth Variables	Treatment	N	Mean	Std. Err	Std. de
Collar girth	Cow dung (T1)	144	1.8486111 12	0.7576174	0.06313478

(cm)	Goat dung (T2)	144	1.8180556	0.7761887	0.06468239
	Poultry droppings (T3)	144	1.3583333	0.6588292	0.05490244
	Sawdust (T4)	144	0.7159722	0.3638687	0.03032239
	Control (topsoil T5)	144	1.3833333	0.6317918	0.05264931

Number of leaves under different growth media

Table.4 shows the result of the descriptive statistics of number of leaves of *Newbouldia laevis* under different treatments. The result shows the mean diameter as 18.43056±9.549761, 20.63194±10.573583,13.98611±6.230969,6.75000±2.827191, and 15.94444±7.914559 for treatment T1, T2, T3, T4 and T5 respectively.

Table 4: Descriptive statistics for number of leaves under different growth media

Seedling growth Variables	Treatment	N	Mean	Std. Err	Std. de
Number of leaves	Cow dung (T1)	144	18.43056	9.549761	0.7958134
	Goat dung(T2)	144	20.63194	10.573583	0.8811319
	Poultry droppings(T3)	144	13.98611	6.230969	0.519247
	Sawdust (T4)	144	6.75000	2.827191	0.2355992
	Control (Topsoil T5)	144	15.94444	7.914559	0.6595466

Analysis of variance

From the analysis of variance in table 4.5 below, it shows that there is significant difference between the height and treatments since the probability (0.001) is less than the alpha value. This analysis also shows that the collar girth and number of leaves has a probability value of (0.01) which is less than the alpha value of (0.05). this shows that the collar girth and number of leaves are significant respectively.

Table 5: The result of ANOVA for the *Newbouldia laevis*

Growth variables	Source of Variation	Sum of Squares	Df	Mean Square	F	Sig.
Height (cm)	Between Groups	20009.86	4	5002.46	180.7	.0001
	Within Groups	19793.82	715	27.68		

	Total	39803.68	719			
Collar	Between Groups	121.37	4	30.34	70.82	.001
girth (cm)	Within Groups	306.32	715	0.043		
	Total	427.67	719			
Leaf count	Between Groups	16323.77	4	4080.94	65.3	.001
	Within Groups	44681.33	715	62.49		
	Total	61005.1	719			

Height of *Newbouldia laevis* under different organic manure

Table.6 shows the results of mean separations for seedling height under different growth media. The seedlings which were raised under T2 (Top soil + goatdung) produced the highest height with mean of 22.15±7.32, followed by T1 (Top soil + cowdung) with mean of 20.74±6.31, (Top soil + poultry droppings) with mean of 15.96±4.19 and T5(Top soil only) with mean of 14.67±5.07. Seedlings raised under T4 (Top soil and sawdust) produced the least height with mean of 7.23±1.34. The result further revealed that there was significant difference observed between seedlings raised under different treatments.

Table.6 Seedling height of *Newbouldia laevis* under different organic manure

Treatment	N	Mean ± SE (cm)alpha=0.05
T1=Topsoil+Cow dung	144	20.74 ± 6.31b
T2=Topsoil+Goat dung	144	22.15 ± 7.32a
T3=Topsoil+Poultry droppings	144	15.96 ± 4.19c
T4= Topsoil +Sawdust	144	7.23 ± 1.3de
T5 =Control(top soil only)	144	14.67 ± 5.07cd

collar girth(cm) of *Newbouldia laevis* under different organic manure

Table .7 shows the results of mean separations for seedling collar girth under different growth media. The seedlings which were raised under T1 (Topsoil + cow dung) produced the highest collar girth with mean of 1.85±0.76, followed by T2 (Top soil + goat dung) with mean of 1.82±0.78, (Top soil only) with mean of 1.38±0.63and T3(Top soil + poultry droppings) with mean of 1.36±0.66. Seedlings raised under T4 (Topsoil and sawdust) produced the least collar girth with mean of 0.72±0.36. The result further revealed that there was significant difference observed in the collar girth of seedlings raised under different treatments.

Table .7: Seedling collar girth(cm) of *Newbouldia laevis* under different organic manure

Treatment	N	Mean± SE (cm) alpha=0.05
T1=Topsoil+Cow dung	144	1.85 ± 0.76a
T2=Topsoil+Goat dung	144	1.82 ± 0.78ab
T3=Topsoil+Poultry droppings	144	1.36 ± 0.66bc
T4= Topsoil +Sawdust	144	0.72 ± 0.36abcd
T5 =Control(top soil only)	144	1.38 ± 0.63bd

Number of leaves of *Newbouldia laevis* under different organic manure

Table.8 shows the results of mean separations for number of seedling leaves under different growth media. The seedlings which were raised under T2 (Topsoil + goat dung) produced the highest number of leaves with mean of 21±10.57, followed by T1 (Topsoil + cow dung) with mean of 1.18±9.55, (Topsoil only) with mean of 16±7.91and T3 (Topsoil + poultry droppings) with mean of 14±6.23. Seedlings raised under T4 (Topsoil and sawdust) produced the least number of leaves with mean of 7±2.82. The result further revealed that there was significant difference observed in the number of seedling leaves raised under different treatments.

Table.8: Seedling number of leaves of *Newbouldia laevis* under different organic manure

Treatment	N	Mean ± SE alpha=0.05
T1=Topsoil+Cow dung	144	18 ± 9.55b
T2=Topsoil+Goat dung	144	21 ± 10.57a
T3=Topsoil+Poultry droppings	144	14 ± 6.23cd
T4= Topsoil +Sawdust	144	7 ± 2.83abc
T5 =Control(top soil only)	144	16 ± 7.91b **c**

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Effect of Different Treatments on Girth Measurement

The highest mean girth was observed with the cow treatment (1.85 m) while the least was observed with the sawdust treatment (0.72 m). The difference in the mean girth between the different treatments was statistically significant ($P < 0.001$). Figure 2 shows that the difference in the mean girth for the cow treatment and that of the goat treatment were not statistically significant. Both were, however, significantly higher than that of poultry, sawdust, and control. The mean girth for the sawdust treatment was observed to be significantly lower than those of the poultry treatment and the control.

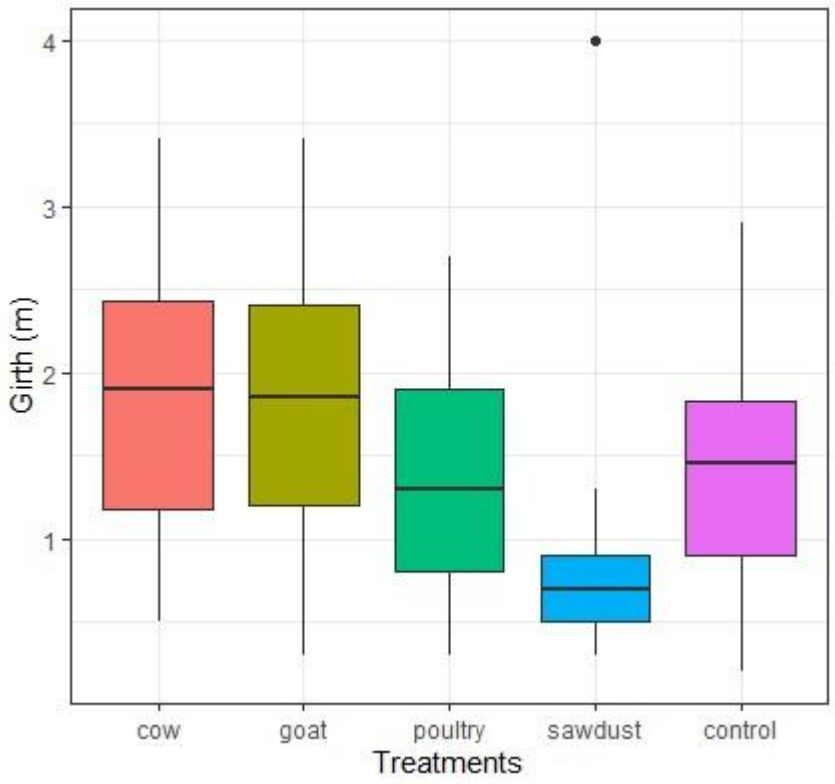

Figure 2. Effect of the different treatments on girth measurement

Effect of Different Treatments on Height

The highest mean height was observed with the goat treatment (22.15 m) while the least was observed with the sawdust treatment (7.23 m). The difference in the mean height between the different treatments was statistically significant ($P < 0.001$). The difference in the mean height for the cow treatment and that of the goat treatment were not statistically significant. Both were, however, significantly higher than those of poultry, sawdust, and control. The mean height for the sawdust treatment was observed to be significantly lower than those of the poultry treatment and the control (Figure 3).

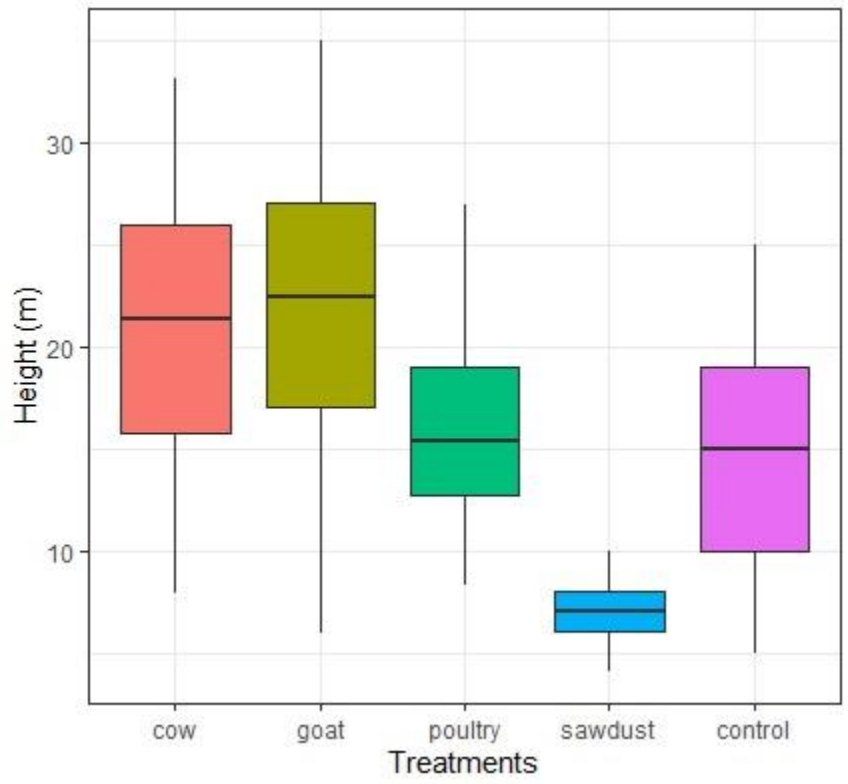

Figure 3. Effect of the different treatments on height

Effect of Different Treatments on the Number of Leaves

The highest mean number of leaves was observed with the goat treatment (21) while the least was observed with the sawdust treatment (7). The difference in the mean number of leaves between the different treatments was statistically significant ($P < 0.001$). The mean number of leaves for the goat treatment was significantly higher than those of poultry, sawdust and control, but not that of the cow treatment. The mean number of leaves for the sawdust treatment was observed to be significantly lower than those of the other treatment and the control (Figure 4).

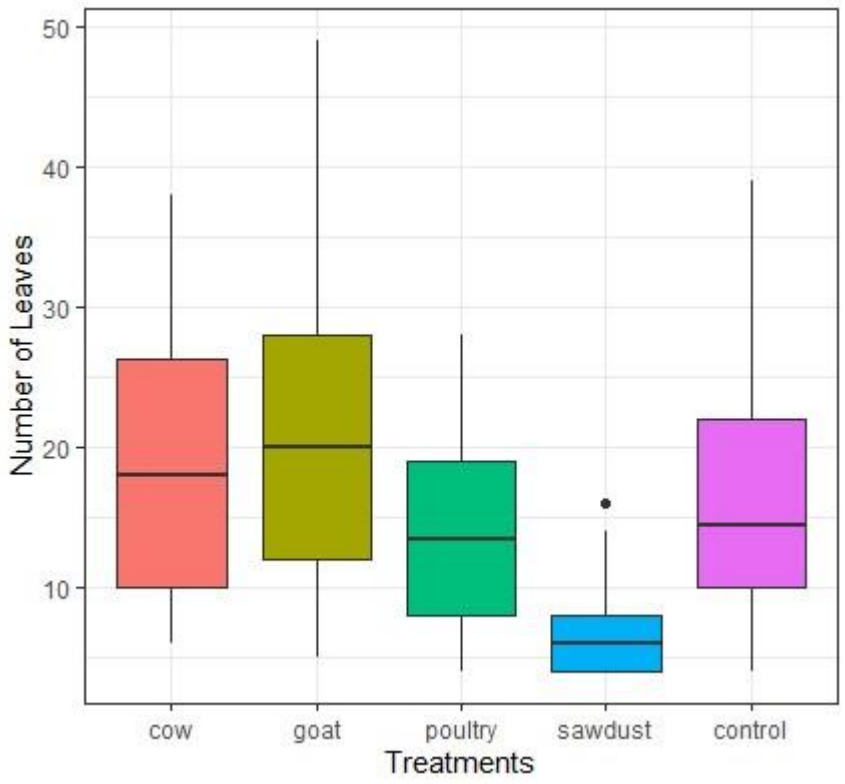

Figure 4. Effect of the different treatments on the number of leaves.

SOIL ANALYSIS

The results of the topsoil analysis (Table 10) shows that the soil used contained the following components which includes soil Ph=5.8,sand=73.2, silt =20,clay=6.4,O.C=1.31, D.M=2.27 ,TEA 1.2, Al3+=0.86, H+=0.3, T.N=0.11, Ca++=3.2, mg++=2.1,K+=0.22,Na+=0.14,CEC=6.77, B5(%)=82.2,P(mgkg+2)=6.25.

Table 10: Result of soil physiochemical analysis

Parameters	Minimum	Maximum	Mean		Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error
PH H2O	5.79	5.91	5.8420	.02083	.04658	.605	.913
SAND	72.70	73.60	73.2000	.18708	.41833	-.512	.913
SILT	20	20	20.00	.000	.000	.	.
CLAY	6.10	6.70	6.4000	.10000	.22361	.000	.913
O.C	1.29	1.34	1.3180	.00860	.01924	-.590	.913
D.M	2.25	2.29	2.2700	.00707	.01581	.000	.913
TEA	1.00	1.40	1.2000	.07071	.15811	.000	.913
AL3+	.70	1.00	.8600	.05099	.11402	-.405	.913
H+	.28	.32	.3000	.00707	.01581	.000	.913
T.N	.11	.11	.1128	.00058	.00130	-.541	.913
Ca++	3.10	3.30	3.2000	.03162	.07071	.000	.913
Mg++	1.90	2.10	2.0000	.03162	.07071	.000	.913
K+	.21	.24	.2220	.00583	.01304	.541	.913
Na+	.12	.16	.1400	.00707	.01581	.000	.913
CEC	6.75	6.79	6.7700	.00707	.01581	.000	.913
B5 (%)	82.10	82.30	82.2000	.03162	.07071	.000	.913
P(mgkg+2)	6.23	6.27	6.2500	.00707	.01581	.000	.913

DISCUSSION.

Appropriate potting media greatly influences germination and early growth rate of *Newbodia laevis.* Infertility in tropical soils is among the main cause of declines in plants productivity (Dania *et al*., 2014). The potting media (organic amendment) used in this research significantly improves germination and seedling growth of *Newbodia laevis* .

Newbodia laevis seeds used in this research generally performed very well irrespective of the treatment. This increase in germination percentage support the work of Ehiagbonare and Onyebi (2009) who also recorded increase in germination percentage of *Newbouldia laevis* planted in different media.

However, T1 had the highest germination percentage of 85%. This supports the finding of Vijayalakshmi *et al* (2017) who obtained highest germination of *Pterocarpus santalinus* when grown with cow dung. This increase according to Naskar *et al*, (2003) might be because, the addition of cow dung increases the mineral status of soil, enhances the resistance of seed against pest and disease; stimulate germination and other beneficial activities such as sulpho-oxidation and phosphorus solubilization .Composted cow manure makes an excellent growing medium for plants and also contains beneficial bacteria, which convert nutrients into easily accessible forms so they can be slowly released without burning tender plant roots. (Gardening Know How 2021). The least germination percentage was observed in T5 (control) with 60%,the result of the soil analysis reviewed that the top soil used contains some important chemical nutrient required for plant growth and this was in line with findings of Egwunatum et.al (2020) that good top soil is considered ideal for planting because it retains nutrients well and also retains water while still allowing excess water to drain away even though it does not contains enough manure for better seedling growth. However, germination period was generally short within 5-9 days in all the treatment and this trend was also reported by Ehiagbonare and Onyebi (2009) who also recorded short germination period of *Newbouldia laevis* planted in different media.

The highest mean height was observed in goat dung (T2), this might be due to the fact that goat dung supply organic matter in the soil and have a definite benefit in improving soil nutrient as reported by Duarsa et al., (1996) who revealed that goat dung improved water holding capacity,

soil fertility, microbial activities and in-creased crop dry matter. This also concur with the report of Murwira *et al*., (1995), who stated that goat manure can help increase pH, organic matter content and cation exchange capacity, and improve soil physical characteristics like water holding capacity that results to increase in plant height growth.

Cow dung also did well as it was observed to perform better than poultry, sawdust, and control as regards to media effect on the seedling height of *Newbodia laevis,* this according to Miller (1999), is because cow dung media is a good treatment for plant cultivation which contains moisture 79. 05%, phosphorous 0.096% and potassium 0.520%.

The least height growth was observed in sawdust. This low seedling height growth according to Miller and Jones (1995) is due to the fact that, sawdust and similar material further depleted the soil nitrogen supply by the production of a compound injurious to the soil nitrifying bacteria and the possibility that such a compound was poisonous to plant roots. This supports the finding of Ashiona *et al*., (2017), who obtained lowest height growth of *Eucalyptus saligna* in Sawdust treatment stating that seedlings in Sawdust treatment had severe stunted growth, symptoms associated with deficiency of essential nutrients in the growth media. This was also in accordance with the findings of Garner, (2014), who stated that the slow rate of decomposition of sawdust and temporary depression of nitrogen has been the principal objection to it use in the field.

The highest mean collar diameter was obtained in T1 (cow dung). Cow dung has long been recognized as perhaps the desirable animal manures because of its high nutrient and organic matter content. This finding corresponds to that of Agbo-Adediran *et al*., (2020), who obtained best result in stem girth of *Entandrophragma angolense* using cow dung. Offiong *et al*, (2010) and Mukhtar (2016) also recorded high performance of stem diameter in cow dung manure application with *Adansonia digitata* and *Tetrapleura tetraptera* seedlings. But this disagrees with the findings of Yahaya *et al*., (2016), whose cow dung treatment on Vegetative growth of *Moringa oleifera* obtained a low stem girth diameter result.

Addition of cow dung increases the organic carbon content of degraded soil which may lead to the increasing activity of beneficial soil microorganisms as well as the fertility status of soil by

increasing the availability of nutrients for plants growth, (Akande *et al*., 2006; Mehedi *et al*., 2011; Gudugi, 2013). Cow dung is good for plant growth, it contains moisture 79.05%, potassium 0.520% and phosphorus 0.096% (Miller, 1999).

However, there was no significant difference between the effect of treatment with cow dung and goat dung. It was observed that goat dung also did well on the collar diameter more than poultry, sawdust, and control media. This might be to the fact that goat manure has desirable characteristics to increase soil fertility, and this was in accordance with the work of Malavolta *et al*. (2002), that goat manure has a better structure (more solid and much less aqueous) generating better aeration and faster fermentation which makes it ideal for plant growth.

The least collar diameter was observed in T4 (sawdust). This supports the finding of Midgley (1990) who opined that if decomposed sawdust decreases plant growth, the decrease could be attributed to the wide carbon: nitrogen ratio in the soil. Newton and Daniloff (1997) also stated that the depression of growth and yield following the addition of low nitrogen materials to the soil may be largely overcome by applying 75Ibs of nitrate of soda per ton of sawdust used.

The highest mean of leaf count was obtained in T2 (goat dung). "Goat manure contains high content of nitrogen as compared to cows, sheep, and poultry manure. This nitrogen further enhances the growth of plants and crops by nitrogen fixation; hence it increases the yield of crops at least by 20%," said Wangare (2018). Goat manure treatments increased soil N, P, K, Ca, Mg and pH and leaf N, P, K, Ca and Mg growth and yield parameters as number of leaves is significantly increased by goat manure treatments (Awodun, *et al*., 2007). This was followed by T1 (cow dung), this result is in line with the findings of Alas (2000) who discovered that goat dung kept the soil loose, porous, increased moisture content, microbial activities and provided proper aeration and as a result plant nutrient became available for growth and development of leaves which ultimately increased number of leaves. However, this oppose the findings of Haouvang, *et al*. (2017), who found out that cow dung and poultry dung was more effective to number of leaves of *moringa oliefera* than goat dung.

The least average leaf count was obtained in T4 (sawdust). This may be due to insufficient nitrogen content in the saw dust as reported by Miller and Jones (1995). Turk (1943) found out in

greenhouse tests that nitrogen added in sufficient quantity to give the sawdust the equivalent of about 2% by weight of nitrogen would overcome the detrimental effect of the sawdust in soils low in available nitrogen. Sawdust is also a largely sterile material that does not harbor microorganisms due to its low nutrient content (Okalebo *et al*., 2002).

CONCLUSION

The study revealed that growth media has effect on both the germination and early growth of *Newbodia laevis.* The treatment T1 (topsoil and cow dung) has the highest germination percentage of (85%) followed by T2 (82%) however, there was no significant difference in the days to germination for all treatments as their germinations started the same day (the 5th day after sowing of seed). T1 and T3 media recorded the most minimum number of germination period (5 days) followed by T2 (6 days) and T5 (8 days), while T4 had the longest germination period of 9 days.

The T1 (topsoil and cow dung) had the best in germination percentage and collar girth, followed by T2 (topsoil and goat dung) which had the highest seedling height growth and number of leaves. However, the least result was observed in T4 (topsoil and sawdust) both in germination percentage, seedling height, collar diameter and number of leaves.

Therefore, it can be concluded that for maximum germination and optimum growth rate, treatment T1 (topsoil and cow dung) is the best for raising the seedlings of *Newbodia laevis.*

RECOMMENDATION

Based on the results obtained, it is therefore recommended that

i. for maximum germination and optimum early growth of *Newbodia laevis* cow dung media is recommended.
ii. where cow dung is not available, goat dung should be used,
iii. sawdust had the lowest germination percentage and poor growth performance; hence it is not recommended for the optimum germination and early growth of *Newbodia laevis* seedlings.
iv. where only germination of *Newbodia laevis* seedlings are required, any of the treatments (T1,T2,T3,T5) should be used as they all have germination percentage of 65% and above.

This study is an asset to domestication and regeneration of *Newbodia laevis* seedlings and can easily be adopted by resource poor farmers and tree growers.

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