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Research Paper

EFFECT OF POTTING MEDIA AND ORGANIC MANURE DOSAGE ON THE GERMINATION AND EARLY GROWTH OF *Treculia africana* (DECNE)

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Abstract

Despite the wide economic and social uses of heavily exploited *Treculia africana*, little is known about the effect of planting media and varying organic manure application dosages on this species which is presently endangered. Limited agronomic information and the long gestation period of 10 years (or above) have limited the widespread utilization and cultivation of *T. Africana*. This research assessed the germination rate of *T. africana* using different potting media with application of different dosages of organic manure. ranging from 0 to 10g per poly pot. The study site was the Forestry Nursery, Federal University of Agriculture, Makurdi, Nigeria. Three potting media: top soil, river sand and a combination of top soil and river sand were used. Also three organic manure sources, viz: cow dung, poultry droppings and a combination of cow dung and poultry droppings were applied to the germinated seedlings at dosages ranging from 0 to 10g per poly pot. The growth of the germinated seedlings were measured with respect to seedling height (cm), number of leaves and seedlings stem girth (cm). The data collected was analyzed using one-way analysis of variance on Gensat 12th edition software. Results showed that top soil mixed with river sand was most suitable for the germination of *Treculia africana* seeds. For early height growth, it was observed that for seedling height, topsoil mixed with river sand and 2g dosage of poultry dropping as manure gave the mean height of 7.00cm making this combination the best for raising seedlings of *T. africana.* For number of leaves, it was observed that the combination of topsoil and river sand at 2g of poultry droppings as manure gave the highest mean number of 4.00 leaves. Lastly for seedling stem diameter it was observed that the seedling stem diameter was widest with the combination of river sand and topsoil at 2g of poultry droppings with a mean diameter of 0.3cm. Therefore, this research recommends that for efficient and successful seed germination and growth of *T. africana* seedlings the combination of top soil and river sand should be adopted to which 2g of poultry

droppings should be applied per seedling for raising vigorous and healthy seedlings *T. africana* in the nursery for plantation establishment.

Key words: Potting media, manure dosage, germination, growth.

INTRODUCTION

Background of study

Treculia africana Decne is a large multipurpose tree species commonly known as African breadfruit. It belongs to the family *Moraceae* and grows in the forest zone, particularly the coastal swamp zone [1]. It is widely grown in southern Nigerian where it is known by various tribal names viz:'*afon*' (Yoruba), "*barafuta"* (Hausa) "*Ize*" (Bini), "*eyo*" (Igala), "*ediang*" (Efik) and "*ukw*a (Igbo).

The seed is a popular traditional food item, commonly roasted, cooked, mashed and consumed either directly as main dish, snack food or as flour for use in soup thickening, cakes, and bread and for food formulations [2]. It is reported that *T.africana* seeds are highly nutritious and constitute a cheap source of vitamins, minerals, proteins, carbohydrate and fats. Fresh *T.africana* seeds have carbohydrate, crude protein, moisture, crude fibre, ash and ether extract [3].

The proper handling of seed through the processes of ripening or maturation, collecting, processing, storage (if needed), dormancy, stratification and germination is required for success in producing a new seedling. Two main factors that affect seed quality are seed harvest time and seed extraction method [4] Seed biologists consider germination as the physiological events occurring in imbibed seeds, which are completed by the emergence of the embryo, usually a radicle (embryonic root) first, however, to agronomists, the emergence of seedlings from soil is sometimes called germination [5]**.** There are three conditions necessary for germination; these include moisture, temperature, and atmospheric oxygen. Seeds absorb water from the soil by a process of imbibition which leads to the swelling and breaking of the seed coat. Following imbibition process, hydrolytic enzymes (hydrolase) are activated which break down the stored food substance into metabolically useful chemicals. Atmospheric oxygen is obtained by the seeds from the soil pore spaces, which is often used in aerobic respiration to supply energy until it grows out leaves (beginning of photosynthesis).

Studies on seed germination of *T. africana* have been few. It was noted that, sowing depths affect the germination of *T. africana*, seeds sown on the upper surface of the soil gave higher germination than seeds sown in the deeper depths which may indicate that environmental factors such as alternating temperatures, light, nitrates and water regimes effect its seed germination.

Manure from different animals has different qualities and requires different application rates when used as fertilizer. For example, horses, cattle, pigs, sheep, chickens, turkeys, rabbits, and guano from seabirds and bats all have different properties [6]. For instance, sheep manure is high in nitrogen and potash, while pig manure is relatively low in both. Horses mainly eat grass and a few weeds so horse manure can contain grass and weed seeds, as horses do not digest seeds the way that cattle do. Chicken litter, coming from a bird, is very concentrated in nitrogen and phosphate and is prized for both properties.

Chicken manure is the faeces of chickens used as an organic fertilizer, especially for soil low in nitrogen [6]. Of all animal manures, it has the highest amount of nitrogen, phosphorus, and potassium. Chicken manure is sometimes pelletized for use as a fertilizer, and this product may have additional phosphorus, potassium or nitrogen

added. The major components of poultry litter include the bedding material, feather, manure and the spilt feed [7].

Although the challenge of forest resources depletion is global, the Nigerian case is even more worrisome [8]. Nigeria has the world's highest deforestation rate of primary forests[9]. This justified studies on cultural methods of conserving and preserving plant species like *Treculia africana* that are of significant economic value in their naturally endangered ecological areas. The objectives of this study were to: (a) assess the germination of *Treculia africana* seeds in different potting media (top soil, river sand and a mixture of top soil and river sand), (b) To assess the effect of type of potting media on early growth of *Treculia Africana* and (c) examine the effect of various levels of cow dung and poultry droppings application on the early growth of *Treculia africana* seedlings

MATERIALS AND METHODS

Study area

The study area was carried out at the Forestry Nursery, University of Agriculture Makurdi located adjacent the University Water Works, South Core, Makurdi Benue State Nigeria. Makurdi, the capital of Benue state covers an area of 804 square kilometres.and it lies between Latitude 07^{o} 45'N to 07^{o} 50'N, Longitude 08^{o} 45'E to 08^{o} 50'E, 98m above sea level. Makurdi has the Guinea Savannah vegetation and it witnesses an annual annual rainfall of between 100 to 150cm which extends for between six to eight months. Temperature ranges between 20-33^{o}C

Materials

Used water sachets served as poly pots used to plants the seeds. Top soil and river sand were collected using shovel. Head pan, wheelbarrow. Watering cans used were obtained from the University of Agriculture Makurdi Forestry Nuesery. An electronic scale was used to measure the dosages of cow dung and poultry droppings which were used as manure before applying the organic manure to the germinated seedlings.

A 30cm ruler was used to measure seedling height while a veneer caliper was used to measure the seedling stem diameter in cm

The top soil used was collected by digging organic matter-rich not below 10cm depth into the ground outside the Forestry Nursery, the river sand was collected from the River Benue; the cow dung was collected from the cattle unit of the University of Agriculture Animal Farmwhile the poultry droppings were collected from Ochepson Farm, along University of Agricuture Makurdi Road, Makurdi., Benue State.

Experimental design

The experimental design used was 3×3×10 factorial design. (using three planting media, three organic manure types and 10 levels of organic manure application. Each treatment was replicated five times).

Seed collection

The seeds of *Treculia africana* were collected from a mother tree located in Nnobi town, Idemili South Local Government Area of Anambra State, Nigeria. The depulped seeds were washed to remove the slime and air dried under room temperature for 24 hours

Viability Test

The viability of the seeds was determined by floating method. The seeds were floated in water in a container. The seeds that settled at the bottom of the container were considered viable while those that floated on the surface were considered non-viable. The viable seeds were used for the experiments.

Nursery practices

The soils after collection were transported into the nursery using a wheel barrow. The soils were then sieved with a sieve to remove stones and other materials before potting. The experimental set up required a total of 495 poly pots. These poly pots were filled in the nursery they were arranged according to treatments as follows: 50 poly pots contained top soil and poultry droppings (treatment 1), 50 poly pots contained top soil and cow dung(treatment 2), 50 poly pots contained top soil with a mixture of both organic manure in a 1:1 ratio(treatment 3), 50 poly pots contained river sand and poultry droppings(treatment 4), 50 contained river sand and cow dung(treatment 5), 50 poly pots contained river sand with a mixture of both organic manure in a 1:1 ratio(treatment 6), 50 poly pots contained a mixture of top soil and river sand in a 1:1 ratio and poultry droppings(treatment 7), 50 poly pots contained a mixture of top soil and river sand in a 1:1 ratio and cow dung(treatment 8) and 50 poly pots contained a mixture of top soil and river sand in a 1:1 ratio and a mixture of both organic manure in a 1:1 ratio (treatment 9).

Each treatment had levels of organic manure concentration ranging from 1 to 10 and each level had 5 replicates, bringing it to a total of 450 poly pots in 9 treatments. Each treatment had 5 controls bringing the number of control to 45 thereby totalling the whole experiment to 495 poly germination pots. The organic manure was applied in different levels of concentration ranging from 1 to 10g

The pots already containing the soil were then watered before the seeds of *T.africana* were planted. The seeds were planted at a 3cm depth into the soil. The planted seeds were watered every morning.

Organic manures were then added after germination (post emergence). For treatment 1 which was top soil and poultry droppings, poultry manure was applied on a scale of 1 to 10g levels of concentration. The manure was weighed using an electronic weighing scale. The same method was used to apply organic manure to the other 8 treatments excluding their various controls.

Data collection

Primary data was collected. Germination data was collected daily from the 14th day when germination commenced till the 4th week when organic manure was applied then early growth data was collected at 2weeks interval. The measurements were taken at random. Measurements were taken before and after organic manure application. The parameters assessed include:

- Seedling height in centimeters (cm) using a 30cm ruler
- Number of leaves
- Seedling's girth in centimeters (cm), using a caliper

Data analysis

Data were collected on germination and early growth. Germination percentage, seedling height (cm), stem girth (cm) and number of leaves, their means were determined. Data was analysed using two-way analysis of variance (ANOVA) on Gensat 12th edition.

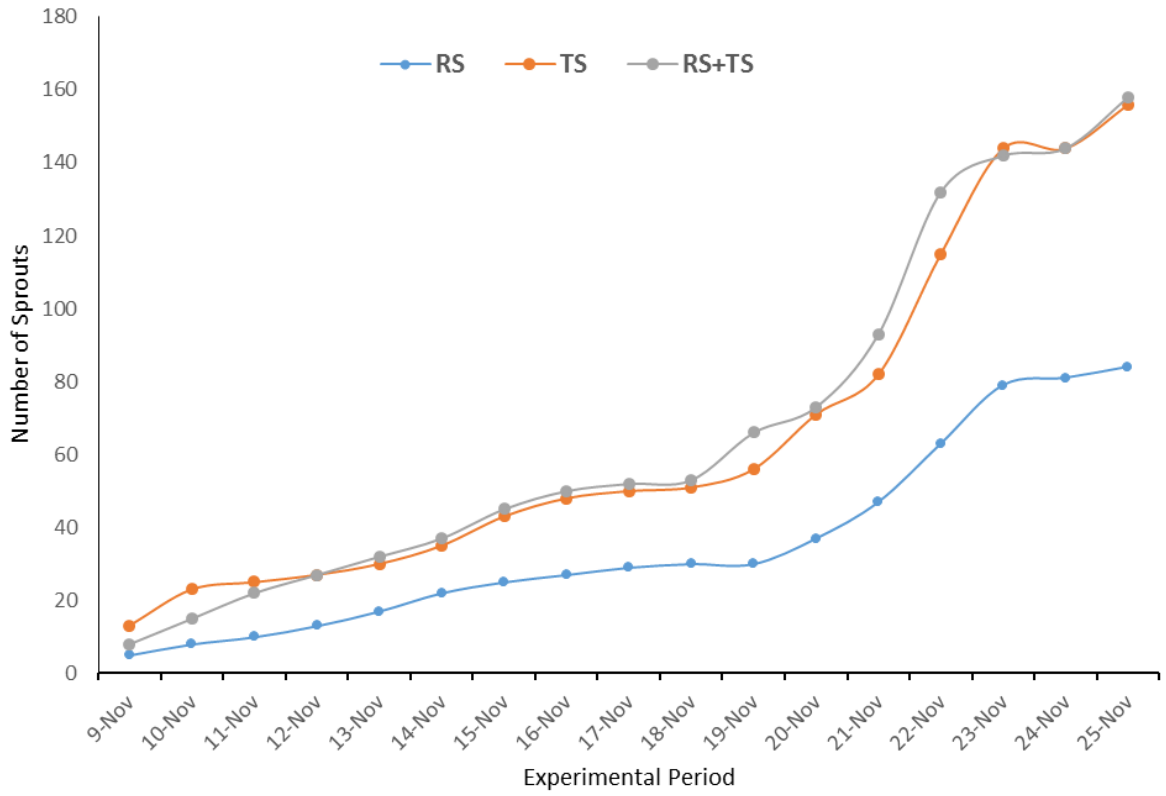
RESULTS

Germination of *Treculia Africana* seeds

From figure 1, I observed that for river sand, germination rate was low from the first four days with a number of 15 seedling sprouts, it increased from the fifth day to the eleventh day with 30 seedling sprouts and was at its highest from twelfth to

seventeenth day with a number of seedling sprout increasing to 84. For top soil, I observed that for the first five days, a total number of 35 seeds sprouted, from the sixth to tenth day, germination increased by a number of 51 seedling sprouts, and from the eleventh to the seventeenth day, and germination showed tremendous increase by 71 seedling sprouts bringing the total number of seedling sprouts to 157. For the soil combination of top soil and river sand, I observed that for the first five days, a number of 35 seeds sprouted, the number increased to 56 from the seventh to tenth day and from the eleventh to seventeenth day, 91 seeds sprouted bringing the total number of seedling sprout to 165.

Germination was best recorded on seeds planted on the soil combination of top soil and river sand where all the 165 seeds planted germinated successfully, followed by seeds planted on top soil where 157 out of 165 seeds planted germinated, and lastly the seeds planted on river sand, where 84 seeds out of the 165 seeds planted, germinated. Germination started on the 14th day after planting and was recorded for 17 days. Out of 495 seeds planted, 406 germinated.



Key: RS= River Sand **TS-=**Top Soil **CD=** Cow Dung **PD=**Poultry Droppings

Figure 1: Germination Curves of *Treculia africana* seeds using three Potting Media for 17 Days (November, 2017)

Source: Field Survey

Effects of Organic Manure Application on the Number Leaves *T. Africana*

From Table 2, the interaction of the fertilizer and the number of leaves produced, it was observed that at an interaction of RS X CD at dosage 1g, 2g, 4g, 6g, 7g and 10g showed the same number of leaves with the control. Whereas grams 3, 5, 8 and 9 only differ slightly form the number of leaves as compared to the control. Furthermore, that for RS X CD X PD interaction, grams 1, 2, 6, 7 and 10 show equal numbers of leaves with the control while 3, 4, 5, 8 and 9 only differs slightly in the number of leaves from the control. In the interaction of RS X TS X CD, the researcher observed that grams 1, 3, 6 and 10 showed no difference from the number of leaves on the control while all others only differ slightly from the control. At the interaction of RS X TS X CD X PD the researcher observed that 1g, 4g and 10 g do not differ from the control number of leaves whereas all others differs but with not more than ± 0.5cm. during the interaction of RS X TS X PD the researcher observed that at 2g the number of leaves in 0.5cm greater than the control at 4.00cm whereas all others showed number of leaves equal or less than the control number of leaves. At the interaction of TS X CD, TS X CD X PD and TS X PD the number of leaves from the control and differ with ± 0.5cm from all grams of manure applied. The lowest being at 5g and the highest being at 7g of the each of the applied fertilizer.

The mean number of leaves of the *Treculia africana* seedlings for river sand, river sand and top soil and topsoil soil were 2.50±0.34cm, 3.16±0.40cm and 2.83±0.16cm. The mean number of leaves of *Treculia africana* seedlings for cow dung, cow dung mixed poultry dropping and poultry dropping were 2.66±0.21cm, 2.83±0.21cm and 3.16±0.47cm respectively. The number of leaves of *Treculia africana* planted under river sand and top soil was significantly different (higher) than the ones grown in river sand and top soil. The number of leaves of *Treculia africana* seedlings fertilized with poultry droppings was significantly different (greater) than the height of seedlings for cow dung, cow dung and poultry dropping. The number of leaves of seedlings for control did not exhibit any significant different in height. River sand and top soil interaction with poultry droppings gave the highest mean height of 4.00 on the second dosage.

Effects of Organic Manure on the Diameter of Stem of *T. Africana*

It was observed that after applying the following combinations of soil and manures. RS X CD at grams 2, 5, 7 and 8 showed the same size of diameter with the control, whereas others differ from the control by ±0.1 cm in RS X CD X PD the diameter at 3g appears to be the highest with a diameter of 0.22cm while grams 6 and 8 differs with a -0.1 cm from the control of 0.20cm. In the interaction of RS X PD the diameter difference from the control is observed in grams 1to 4 only while others show no difference at all. The interaction of RS+TS X RS shows the widest diameter of control measuring 0.24cm and even wider of 0.26cm at 7g. the interaction RS+TS X CD+PD 1g is observed to show the widest diameter of 0.25cm with a control of 0.20 cm. Others differ from the control but not with more than ±0.01 cm. the interaction of RS+TS X PD show two widest diameters of 0.25cm each at 1g and 6g respectively but the widest diameter is at 2g with a diameter of 0.31cm. TS X CD and TS XPD both show similarity in all quantities of fertilizers. Both show that the difference from the highest from the control likewise the difference from the lowest to the control is not more than ± 0.02cm. The researcher also observed that the interaction of TS X CD+PD shows a wide range at 3g from control 0.20cm to 0.27cm as compared to others.

The mean stem diameter of the *Treculia africana* seedlings for river sand, river sand and top soil with topsoil soil were 0.20±0.00cm, 0.24±0.02cm and 0.25±0.00cm. The mean stem diameter of *Treculia africana* seedlings for cow dung, cow dung mixed poultry dug and poultry droppings were 0.22±0.00cm, 0.23±0.01cm and 0.24±0.02respectively. The stem diameter of *Treculia africana* planted under top soil was significantly different (higher) than the ones grown in river sand, river sand and top soil. The stem diameter of *Treculia africana* seedlings fertilized with poultry droppings was significantly different (greater) than the height of seedlings for cow dung, cow dung and poultry dropping. The stem diameter of seedlings for control did not exhibit any significant different in height. Top soil interaction with cow dropping and poultry dropping gave the highest mean height of 0.27cm on the third dosage

DISCUSSION

The planting medim involving the mixture of top soil with river sand to which two grammes (2g) of poultry droppings were applied gave the highest percentage germination compared to the control and other potting media used in the study. Mixing of river sand with nutrient-rich top soil and nutrient-rich poultry droppings had a synergistic effect in supporting germination and improving soil conditions for seedling growth. Manuring can improve soil physical, chemical and biological properties leading to beneficial effects on *T. africana* seedling production This research is in agreement with the work of Sahni *et al* who observed that the organic matter in poultry droppings could have increased the water-holding capacity of the medium making the seeds in the medium to germinate faster [10]. Poultry manure is the faeces of chickens used as an organic fertilizer, especially for soils low in nitrogen. Of all animal manures, it has the highest amount of nitrogen, phosphorus, and potassium [5]. In their work however, Ibe *et al* reported that the use of topsoil supported by watering twice daily gave the highest seed germination and growth in *T. africana* seeds, while the potting medium with sand had the least growth rate of *T. africana* seedlings [11].

CONCLUSION

Three soil types (top soil, river sand and a combination of top soil and river sand) and three types of organic manure (poultry droppings, cow dung and a combination of poultry droppings and cow dung) was used for this experiment. It was necessary to evaluate the difference that would exist between these treatments in assessing germination and early growth. Germination counts were taken for 17 days after which the organic manure was applied in dosages from 0-10g and early growth was assessed using the following parameters; seedling height, number of leaves and stem diameter.

From the results of the research, it was observed that the combination of topsoil and river sand showed highest rate of germination, followed by topsoil and lastly river sand had the lowest rate of germination. This observation was noted based on the fact that topsoil showed high water retention capacity compared to river sand which shows low water retention capacity.. The combination of topsoil and river sand best fulfilled the conditions of moisture and aeration required for germination. Germination was poor on river sand because from the research, it was observed that river sand could not retain much water in its soil and given moisture as a condition for germination, river sand did not provide a good environment for successful germination.

For seedling height, it was observed that the combination of topsoil and river sand and 2g dosage of poultry dropping as manure gave the mean height of 7.00cm making this

combination the best for raising seedlings of *T. africana.* For number of leaves, it was observed that the combination of topsoil and river sand at 2g of poultry droppings as manure gave the highest mean number of 4.00 leaves. Lastly for the seedling stem diameter as the last parameter for growth it was observed that the seedling stem diameter was widest at the combination of river sand and topsoil at 2g of poultry droppings with a mean diameter of 0.3cm.

From the above results it is concluded that the combination of topsoil and river sand appeared to be the best medium for efficient germination of seeds, also the interaction of poultry droppings at 2g with the combination of topsoil and river sand gave the best favorable environment for early growth of seedlings of *T. africana*. Therefore, poultry dropping is the best manure for early growth of seedlings of *T. africana* and should be applied at the quantity of 2g per stand.

RECOMMENDATIONS

After a careful analysis of the result, the following pragmatic recommendations were made:

1. For efficient and successful germination of *T. africana* seeds a combination of top soil and river sand should be adopted for establishing *T. Africana* plantation.
2. For vigorous and healthy seedlings of *T. africana* the combination of Topsoil and river sand interacting with 2g of poultry droppings should be adopted
3. Further research should be carried out as to ascertain a more suitable environment and conditions to reduce the long gestation period of *T. africana*, a highly nutritional, ecological and economic plant.

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APPENDICES

Variations in Height of seedlings by Type of Potting Media and dosage of organic manure applied

Quantity of organic manure (g)	Seedling Height by Type of Potting Media			CV	P-Value
	RS	RS + TS	TS		
0(Control)	4.91±0.53^{a}	5.70±0.44^{ab}	6.25±0.15^{a}	19.61	0.03
1	5.13±0.71	5.76±0.31	6.21±0.43	22.30	0.35^{ns}
2	3.76±0.45^{b}	5.81±0.40^{a}	5.41±0.43^{a}	26.89	0.01
3	3.90±0.71^{b}	5.53±0.44^{a}	5.65±0.29^{a}	28.65	0.05
4	4.50±0.51	5.45±0.43	5.08±0.15	20.07	0.27^{ns}
5	4.45±0.91	4.40±0.47	4.55±0.17	31.08	0.98^{ns}
6	3.08±0.37^{b}	5.01±0.43^{a}	5.36±0.48^{a}	32.04	0.01
7	4.38±0.72	5.23±0.47	5.36±0.25	25.56	0.37^{ns}
8	3.40±0.61	4.71±0.44	4.58±0.26	29.09	0.12^{ns}
9	2.88±0.87^{b}	4.81±0.45^{a}	4.36±0.25^{a}	39.66	0.04
10	2.78±0.49^{b}	4.93±0.4^{4}	4.31±0.30^{a}	33.63	0.01

Means on the same row with different superscript are statistically significant p<0.05); ns=not significant

Effect of different dosages of organic manure and potting mixtures on the number of leaves on growing seedlings

Quantity of organic matter (g)	No. of Leaves by Potting Media			CV	P-Value
	RS	RS + TS	TS		
0(Control)	2.50±0.22	3.00±0.25	2.66±0.33	24.58	0.44^{ns}
1	2.33±0.21	2.66±0.33	2.83±0.16	23.27	0.37^{ns}
2	2.50±0.34	3.16±0.40	2.50±0.22	30.36	0.28^{ns}
3	2.33±0.21	2.33±0.21	2.50±0.22	21.00	0.82^{ns}
4	2.50±0.22^{ab}	2.83±0.30^{a}	2.00±0.00^{b}	25.19	0.05
5	2.16±0.16	2.00±0.25	2.66±0.42	33.01	0.29^{ns}
6	2.16±0.16^{b}	2.66±0.33^{ab}	3.00±0.25^{a}	26.72	0.03
7	2.16±0.16	2.83±0.30	2.33±0.21	25.19	0.14^{ns}
8	2.00±0.30	2.66±0.33	2.33±0.33	32.87	0.34^{ns}
9	2.16±0.30	2.16±0.16	2.50±0.22	25.22	0.53^{ns}
10	2.33±0.21	2.83±0.30	2.66±0.21	23.27	0.37^{ns}

Means on the same row with different superscript are statistically significant p<0.05); ns=not significant

Effect of type of potting mixtures as well as quantity of organic manure on Seedling Stem Diameter

Quantity of organic manure (g)	Stem Diameter by Potting Media			CV	P-Value
	RS	RS + TS	TS		
0(Control)	0.20±0.00	0.23±0.01	0.22±0.02	18.80	0.40^{ns}
1	0.19±0.00	0.22±0.00	0.21±0.01	12.02	0.06^{ns}
2	0.20±0.00	0.24±0.02	0.22±0.00	16.55	0.22^{ns}
3	0.19±0.00	0.20±0.00	0.21±0.00	9.24	0.06^{ns}
4	0.19±0.00	0.20±0.00	0.19±0.00	5.30	0.08^{ns}
5	0.20±0.00	0.20±0.00	0.19±0.00	5.45	0.40^{ns}
6	0.19±0.01^{b}	0.24±0.01^{a}	0.20±0.00^{b}	12.02	0.02
7	0.16±0.02^{b}	0.23±0.01^{a}	0.21±0.01^{a}	22.44	0.01
8	0.19±0.00	0.22±0.01	0.21±0.00	10.07	0.06
9	0.21±0.01	0.21±0.00	0.22±0.01	12.65	0.97^{ns}
10	0.18±0.01^{b}	0.24±0.01^{a}	0.25±0.01^{a}	18.23	0.01

Means on the same row with different superscript are statistically significant p<0.05); ns=not significant

Variations in height of seedlings by Type of potting mixture, and quantity of Organic Manure applied

Quantity of organic manure (g)	Height variation by Type of Organic Manure CD	CD+PD	PD	CV	P-Value
0(Control)	5.60±0.49	5.80±0.38	5.46±0.54	9.24	0.88^{ns}
1	5.51±0.42	5.61±0.37	5.98±0.75	5.30	0.89^{ns}
2	5.01±0.23	4.98±0.60	5.00±0.77	5.45	0.99^{ns}
3	5.45±0.42	4.20±0.53	5.43±0.71	12.02	0.23^{ns}
4	4.98±0.42	5.10±0.26	4.95±0.56	22.44	0.96^{ns}
5	4.80±0.59^{ab}	5.13±0.46^{a}	3.46±0.62^{b}	25.19	0.03
6	4.80±0.59	4.36±0.49	4.30±0.73	32.87	0.82^{ns}
7	5.41±0.39^{a}	5.66±0.36^{a}	3.90±0.51^{b}	25.22	0.02
8	4.70±0.33^{a}	4.76±0.40^{a}	3.23±0.53^{b}	19.61	0.04
9	4.78±0.63^{a}	4.36±0.43^{ab}	2.91±0.68^{b}	22.30	0.05
10	4.20±0.38	4.53±0.52	3.30±0.66	26.89	0.27^{ns}

Means on the same row with different superscript are statistically significant p<0.05); ns=not significant

Variation in the number of leaves on seedlings based on type potting mixture as influenced by the quantity of organic manure

Quantity of organic manure (g)	No of leaves per type and quantity of Organic Manure (cm)Type of Organic Manure CD	CD+PD	PD	CV	P-Value
0(Control)	2.50±0.22	2.83±0.30	2.83±0.30	19.61	0.44^{ns}
1	2.66±0.21	2.50±0.34	2.66±0.21	22.30	0.37^{ns}
2	2.66±0.22	2.33±0.21	3.16±0.47	26.89	0.28^{ns}
3	2.33±0.21	2.33±0.21	2.50±0.22	28.65	0.82^{ns}
4	2.66±0.33^{a}	2.50±0.22^{ab}	2.16±0.16^{b}	5.45	0.03
5	2.33±0.33	2.16±0.16	2.33±0.42	12.02	0.29^{ns}
6	2.66±0.21	2.50±0.34	2.66±0.33	22.44	0.11^{ns}
7	2.50±0.22	2.33±0.21	2.50±0.34	22.44	0.14^{ns}
8	2.16±0.40	2.66±0.33	2.16±0.16	25.19	0.34^{ns}
9	2.16±0.30	2.33±0.21	2.33±0.21	32.87	0.53^{ns}
10	2.50±0.22	2.66±0.21	2.66±0.33	22.30	0.37^{ns}

Means on the same row with different superscript are statistically significant p<0.05); ns=not significant

Variation in Stem Diameter of Seedlings raised on different potting mixtures under varying dosages of organic manure

Quantity of organic manure (g)	Stem Diameter of seedlings raised on different potting mixtures (cm)			CV	P-Value
	CD	CD+PD	PD		
0(Control)	0.21±0.01	0.22±0.02	0.21±0.01	25.56	0.94^{ns}
1	0.20±0.00	0.23±0.01	0.20±0.00	29.09	0.09^{ns}
2	0.20±0.00	0.21±0.00	0.24±0.02	39.66	0.13^{ns}
3	0.20±0.00	0.20±0.00	0.20±0.00	33.63	0.95^{ns}
4	0.20±0.00	0.20±0.00	0.19±0.01	22.30	0.49^{ns}
5	0.19±0.00	0.20±0.00	0.20±0.01	26.89	0.16^{ns}
6	0.21±0.01	0.20±0.01	0.21±0.01	28.65	0.72^{ns}
7	0.21±0.01	0.21±0.00	0.17±0.02	5.30	0.26^{ns}
8	0.21±0.00	0.20±0.01	0.21±0.01	5.45	0.41^{ns}
9	0.21±0.01	0.21±0.00	0.22±0.01	12.02	0.78^{ns}
10	0.23±0.01	0.24±0.01	0.22±0.02	22.44	0.65^{ns}

Means on the same row with different superscript are statistically significant $p<0.05$); ns=not significant

Table 2: Effect of Organic Manure Application on Number of Leaves of *Treculia africana* Seedlings

Potting media	Organic Manure Dosage (g)										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Soil	**Number of Leaves of *Treculia africana* Seedlings**										
RS	2.33±0.21	2.50±0.22	2.50±0.34	2.33±0.21	2.50±0.22	2.16±0.16	2.16±0.16	2.16±0.16	2.00±0.25	2.16±0.16	2.33±0.21
RS+TS	2.58±0.25	2.66±0.33	3.16±0.40	2.33±0.21	2.83±0.30	2.00±0.25	2.66±0.33	2.83±0.30	2.66±0.33	2.16±0.16	2.83±0.30
TS	2.40±0.33	2.83±0.16	2.50±0.22	2.50±0.22	2.00±0.00	2.66±0.42	3.00±0.25	2.33±0.21	2.33±0.33	2.33±0.33	2.66±0.21
LSD	*1.02*	*0.92*	*0.49*	*0.81*	*0.27*	*1.11*	*0.45*	*0.43*	*0.47*	*0.40*	*0.92*
Manure											
CD	2.50±0.22	2.66±0.21	2.66±0.21	2.33±0.21	2.66±0.33	2.33±0.33	2.66±0.21	2.50±0.22	2.16±0.40	2.16±0.30	2.50±0.22
CD+PD	2.21±0.30	2.50±0.34	2.83±0.21	2.33±0.21	2.50±0.22	2.16±0.16	2.50±0.34	2.33±0.21	2.66±0.33	2.33±0.21	2.66±0.21
PD	2.83±0.30	2.66±0.21	3.16±0.47	2.50±0.22	2.16±0.16	2.33±0.42	2.66±0.33	2.50±0.34	2.16±0.16	2.33±0.21	2.66±0.33
LSD	*1.02*	*0.92*	*0.49*	*0.81*	*0.27*	*1.11*	*0.45*	*0.43*	*0.47*	*0.40*	*0.92*
Interaction											
RS X CD	2.50	2.50	2.50	2.00	2.50	2.00	2.50	2.50	1.50	2.00	2.50
RS X CD+PD	2.50	2.00	2.00	2.50	2.50	2.50	2.00	2.00	2.50	2.50	2.00
RS X PD	2.50	2.50	3.00	2.50	2.50	2.00	2.00	2.00	2.00	2.00	2.50
RS+TS X CD	2.50	2.50	3.00	2.50	3.50	2.00	2.50	3.00	3.00	2.00	2.50
RS+TS X CD+PD	3.00	3.00	2.50	2.00	3.00	2.00	2.50	2.00	2.50	2.00	3.00
RS+TS X PD	3.50	2.50	4.00	2.50	2.00	2.00	3.00	3.50	2.50	2.50	3.00
TS X CD	2.50	3.00	2.50	2.50	2.00	3.00	3.00	2.00	2.00	2.50	2.50
TS X CD+PD	3.00	2.50	2.50	2.50	2.00	2.00	3.00	3.00	3.00	2.50	3.00
TS X PD	2.50	3.00	2.50	2.50	2.00	3.00	3.00	2.00	2.00	2.50	2.50
LSD	*1.76*	*1.60*	*1.92*	*1.41*	*1.06*	*1.92*	*1.76*	*0.75*	*1.84*	*1.60*	*1.60*

Means on the same column (for each section) with differences > the LSD are statistically significant (p<0.05)
Keys: RS- River Sand **TS-** Top Soil **CD-** Cow Dung **PD-** Poultry Droppings
Source: Field Survey

Table 3: Effect of Organic Manure Application on Stem Diameter of *Treculia africana* Seedlings

Potting Media	Organic Manure Application Dosage (g)										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Soil	**Stem Diameter (cm)**										
RS	0.19±0.00	0.20±0.00	0.20±0.00	0.19±0.00	0.19±0.00	0.20±0.00	0.19±0.00	0.16±0.02	0.19±0.00	0.21±0.01	0.18±0.01
RS+TS	0.21±0.01	0.23±0.00	0.24±0.02	0.20±0.00	0.20±0.00	0.20±0.00	0.24±0.01	0.23±0.01	0.22±0.01	0.21±0.00	0.24±0.00
TS	0.20±0.02	0.22±0.01	0.22±0.00	0.21±0.00	0.20±0.00	0.19±0.00	0.20±0.0	0.21±0.00	0.21±0.00	0.22±0.00	0.25±0.00
LSD	*0.05*	*0.02*	*0.03*	*0.01*	*0.01*	*0.008*	*0.02*	*0.02*	*0.02*	*0.03*	*0.03*
Manure											
CD	0.19±0.01	0.22±0.00	0.20±0.00	0.20±0.00	0.20±0.00	0.19±0.01	0.21±0.01	0.21±0.01	0.21±0.00	0.21±0.00	0.23±0.01
CD+PD	0.20±0.02	0.23±0.01	0.21±0.00	0.20±0.00	0.20±0.00	0.20±0.00	0.20±0.00	0.21±0.00	0.20±0.00	0.21±0.00	0.24±0.01
PD	0.21±0.01	0.20±0.00	0.24±0.02	0.20±0.01	0.19±0.01	0.20±0.00	0.21±0.01	0.17±0.02	0.21±0.01	0.22±0.01	0.22±0.02
LSD	*0.05*	*0.02*	*0.03*	*0.01*	*0.01*	*0.008*	*0.02*	*0.02*	*0.02*	*0.03*	*0.03*
Interactions											
RS X CD	0.19	0.20	0.19	0.18	0.20	0.19	0.20	0.19	0.19	0.19	0.20
RS X CD+PD	0.20	0.20	0.22	0.20	0.20	0.20	0.19	0.20	0.19	0.21	0.21
RS X PD	0.20	0.19	0.21	0.18	0.18	0.20	0.20	0.10	0.20	0.25	0.15
RS+TS X CD	0.24	0.21	0.20	0.21	0.20	0.20	0.24	0.26	0.23	0.23	0.23
RS+TSX CD+PD	0.20	0.25	0.22	0.18	0.21	0.20	0.22	0.21	0.20	0.21	0.26
RS+TS X PD	0.22	0.25	0.31	0.21	0.20	0.22	0.25	0.23	0.24	0.20	0.25
TS X CD	0.20	0.20	0.22	0.22	0.21	0.19	0.20	0.20	0.21	0.21	0.26
TSX CD+PD	0.21	0.24	0.21	0.27	0.20	0.21	0.20	0.22	0.21	0.23	0.25
TS X PD	0.20	0.20	0.22	0.22	0.21	0.19	0.20	0.20	0.21	0.21	0.26
LSD	*0.09*	*0.04*	*0.05*	*0.03*	*0.01*	*0.014*	*0.04*	*0.05*	*0.03*	*0.06*	*0.06*

Means on the same column (for each section) with differences > the LSD are statistically significant ($p<0.05$)

Key: RS=River Sand TS=Top Soil CD=Cow Dung PD= Poultry Droppings

Source: Field Surve