



DOI 10.18551/rjoas.2021-10.31

GROWTH RESPONSE OF AFRICAN BREADFRUIT, *TRECVLIA AFRICANA* (DECNE) SEEDLINGS TO VARYING RATE OF POULTRY MANURE AND AGROSORB UNDER DIFFERENT WATERING REGIME

Ojo Morenike Omoyemi

Elizabeth Ehi-Ebiewele Biodiversity Linkage Center, Forestry Research Institute of Nigeria, Ibadan, Nigeria

Asinwa Israel Olatunji

The Rainforest Research Station (RFRS) of Forestry Research Institute of Nigeria, Ore, Ondo State, Nigeria

Ayeni Olatunji David, Ogunwande Olusola Adedoyin, Williams Olufunmilola Atoke
Forestry Research Institute of Nigeria, Ibadan, Nigeria

Adelakunkehinde Moruff*

Sustainable Forest Management, Forestry Research Institute of Nigeria, Ibadan & Federal College of Wildlife Management of Forestry Research Institute of Nigeria, New Bussa, Niger State, Nigeria

*E-mail: adebayo.olaoluwa@pg.funaab.edu.ng

ABSTRACT

The study investigated the effects of poultry manure and agrosorb as a means of conserving water under different watering regime on the growth of *Treculia africana* seedlings. Four different levels of poultry manure, watering regime at two different levels (once and twice) daily and agrosorb at two different levels (0 and 3g) were applied. Sixteen treatments were used for the study and each treatment was replicated four times. Measurement of heights, stem diameter and number of leaves was carried out at weekly interval for eight weeks. The results showed that combination of poultry manure, agrosorb (3g) and watering regime (twice daily) gave the best performance in terms of stem height (11.23cm), stem diameter (1.16mm) and leaf count (22.00). There was a significant difference among the treatment in terms of leaf count, girth and stem height as the week progresses when subjected to analysis of variance (ANOVA) at 5% probability level. Therefore, combination of poultry manure, agrosorb (3g) and watering twice daily is then recommended for optimum growth of *Treculia africana* seedlings at the nursery stage.

KEY WORDS

Agrosorb, growth, poultry manure, soil water, *Treculia africana* seedlings.

The major available forest species in Nigeria shows that edible forest fruit trees i.e. Non timber forest products (NTFP) have wide spread distribution throughout the forest zones of Nigeria. An example of such species is *Treculia Africana* (Jimoh *et al.*, 2013). *Treculia Africana* is an indigenous tree species in Nigeria that also survives in other countries such as Ghana, Asia and Mexico. It belongs to the family Moraceae. However, the contributions of forest based resources especially *Treculia africana* popularly known as “Ukwa” to the livelihood of rural populace in Igbo Land South Eastern, Nigeria is enormous. This Non-Timber Forest Products (NTFPs) which are commonly found in home gardens in eastern Nigeria have formed an integral part of the people’s daily life for millennia and thus contributes to improving livelihoods (Gbedomon *et al.*, 2015). Accordingly, NTFPs generally serves as supplementary and alternative sources of food and income and are especially crucial in years of crop failure usually as a result of changing climate (Udeagha, 2015; Shackleton, 2014). On the other hand, in Nigeria there are several indigenous woody plants



with edible fruits and vegetables of high nutritive value, which are eaten by many Nigerians in which *Treculia africana* is one of them and had played an important role in sustaining the food security of the people over time. But today, these indigenous fruit producing trees serve as means of income generation to urban dwellers as well thereby contributing a reasonable amount to Nigeria economy (Kola-Oladiji *et al.*, 2006).

In Nigeria, the use of organic fertilizers such as poultry manure, cowdung and soil amendments such as agrosorb in plantation is quite a recent development (Adekiya *et al.*, 2018). Water is the principal constituents of protoplasm in photosynthesis and the vehicle of every physiochemical process by which life is maintained, and it is also essential for the maintenance of cell turgidity which is necessary for cell enlargement. Water is very important to the growth of any tree. The first step in germination of dry seed is the uptake of water and ability of a seed to imbibe water depends on the properties of the testa (Addina, 2000).

Water absorption and retention in the soil system is a significant issue in the establishment of a nursery and plantation in forestry, agricultural and horticultural industry because different soil types have varying water retention and absorption characteristics (Aluko, 2003). In sandy soil, water usually penetrate easily through the soil and out of the zone. In areas where irrigation is practiced, the water level will increase. Clay soil have low water absorption rate but have significant higher water retention capacity (Addina, 2000). Tropical soil are not generally fertile, however, recent research has provided evidence that soil fertility is decreasing in many forestland areas. It has been that a lot of nutrients were lost from agricultural soils as a result of off-take in crop yield, leaching, erosion, run-off and gaseous losses (Aluko, 2003).

The long term fertility studies on farmers in Africa savanna has revealed evidence of widespread chemical and physical soil degradation, including negative soil organic matter and nutrient balances. Soil fertility is determined by the availability of nutrients to plants for their use. The nutrients are present in the soil in solution forms and the plants absorb them as ions.

Agrosorb is defined as a hygroscopic substance which has the ability and the capability to absorb moisture and humidity from its surrounding for a better plant growth. It acts as a water retainer, when incorporated into the soil, absorbs and retains large quantity of water and nutrients. Agrosorb has the property of easily releasing the absorbed water and nutrients thereby allowing the plants to have water and nutrients available at will as a function of absorption release cycle. Its super absorbent polymers are organic cross linked copolymers specifically designed to improve the capability of soil and other growing media to retain water and plant nutrient. It has absorption tensions which allow plants roots to take up water on demand by osmotic pressure. It retains its ability to expand and contract and therefore remains effective water management tools for approximately 2-3 years depending on conditions. Agrosorb acts as a reservoir of water that is available to plants on demand, reducing plant shock and the effects of drought. Mahanwar, (2004) in his study on the effects of fertilizer application found out that agrosorb significantly reduces the leaching of fertilizers because they are stored in the soil network reducing the rate of releasing fertilizer on plant for a long time.

Soil characteristics can adversely affects the productivity of all types of plants used in forestry including crop and pastures. Therefore, a projection of new idea to provide a water additive that can be used in the forestry, horticulture and agricultural industries that reduces the quantity of water required when growing forest trees and increases forest trees, crops was the focus of this study.

Soil water absorption and retention property is a significant issue in the establishment of a nursery and plantation in the forestry, agriculture and horticultural industry. Although, water requirement of plants varies throughout the growing season, a consistent readily available water source and nutrient is essential for proper plant growth, a source of water that will be available to plants on demand, reducing plant shock and the effect of drought. Thus there is need to provide a water additive that will supply water needed by the plant which will reduce the frequency of water supply and energy wasted thereby promoting good nursery practices for optimum seedlings production.



MATERIALS AND METHODS OF RESEARCH

The experimental site was located within the Teaching and Research Farm of the Federal College of Forestry, Ibadan. The College is located in Jericho quarters in Ibadan Southwest Local Government Area and lies within Latitude 7° N and 9° N and Longitude 3° E and 58° E. The climate of the area is tropically dominated by rainfall pattern of between 1300-1500mm which is bimodal. The average temperature is about 36° C creating an annual relative humidity of about 80-85% reaching 90% during raining season (FRIN, 2009).

The materials used for the experiment include river sand, top soil, *Treculia africana* seeds, poultry manure, agrosorb, weighing balance, venier calliper, measuring ruler, sieve, hand trowel, polythene pots, labelling tags, wheel barrow, field notebook, pen, pencil and germination boxes. The *Treculia africana* seeds were procured from seed store at Forestry Research Institute of Nigeria (FRIN), Ibadan, the poultry manure was collected from a poultry house at Bora, Ibadan, the river sand was collected from nursery A of the Federal college of Forestry, Ibadan while the agrosorb was purchased at International Institute of Tropical Agriculture (IITA) Moniya Ibadan, Nigeria. Other materials such as measuring ruler, pen, pencil, field notebook were purchased from a market nearby.

Sixty four (64) polythene pots of uniform sizes were filled with top soil and transplanting of the seedlings was done three (3) weeks after sowing. The poultry manure and agrosorb were mixed with topsoil (3kg) two weeks before transplanting. Four (4) different levels of poultry manure, two (2) levels of agrosorb (0 and 3g) and two levels of watering regime (watering once and twice, 50mls) daily were applied.

The parameters assessed were:

- Plant height (cm): The measurement was taken at the tip of the plant using graduated ruler;
- Stem diameter (mm) measured with the aid of venier calliper;
- Number of leaves which was visually counted and recorded.

The experimental design employed for the research was completely randomized design (CRD). Sixteen (16) treatments were used and each treatment was replicated four (4) times.

Table 1 – Experimental layout

T ₁₃	T ₈	T ₁₁	T ₁₅	T ₇	T ₆	T ₁₆	T ₁₀
T ₁₄	T ₃	T ₅	T ₂	T ₄	T ₁₂	T ₁	T ₉
T ₈	T ₁₄	T ₇	T ₆	T ₁₂	T ₄	T ₂	T ₁₅
T ₅	T ₁₁	T ₁	T ₃	T ₁₀	T ₁₃	T ₁₆	T ₉
T ₁₂	T ₆	T ₁₄	T ₁₁	T ₇	T ₁	T ₃	T ₃
T ₁₃	T ₂	T ₄	T ₁₅	T ₁₆	T ₁₀	T ₅	T ₉
T ₃	T ₁₅	T ₆	T ₄	T ₁₃	T ₁₁	T ₁₄	T ₁₆
T ₈	T ₂	T ₁	T ₉	T ₇	T ₂	T ₅	T ₁₀

Note: T= Treatments.

The treatments used are:

- T1 = Top soil (3kg) control watered once;
- T2 = Agrosorb (3g) topsoil (3kg), watered once;
- T3 = Control watered twice;
- T4 = Agrosorb (3g) + topsoil (3kg), watered twice;
- T5 = Poultry manure (0.5kg) + top soil (3kg) watered once;
- T6 = Poultry manure (0.5kg) + top soil (3kg) + agrosorb (3g), watered once;
- T7 = Poultry manure (0.5kg) + top soil (3kg) + watered twice;
- T8 = Poultry manure (0.5kg) + top soil (3kg) + agrosorb (3g), watered twice;
- T9 = Poultry manure (1kg) + top soil (3kg) watered once;
- T10 = Poultry manure (1kg) + top soil (3kg) + agrosorb (3g), watered once;
- T11 = Poultry manure (1kg) + top soil (3kg) watered twice;
- T12 = Poultry manure (1kg) + top soil (3kg) + agrosorb (3g), watered twice;



- T13 = Poultry manure (1.5kg) + top soil (3kg) watered once;
- T14 = Poultry manure (1.5kg) + top soil (3kg) + agrosorb (3g), watered once;
- T15 = Poultry manure (1.5kg) + top soil (3kg) watered twice;
- T16 = Poultry manure (1.5kg) + top soil (3kg) + agrosorb (3g), watered twice.

The results obtained were subjected to descriptive statistical analysis using analysis of variance (ANOVA) to separate the means with the use of Statistical Package for Social Sciences (SPSS).

RESULTS AND DISCUSSION

Table 2 shows that treatment twelve (T12) has the highest mean height value of 11.23 followed by treatment sixteen (T16) with mean height value of 10.32cm while treatment one (T1) has the least mean height value of 6.47cm. This can be attributed to the buffering effect of agrosorb on the availability of fertilizer in the soil (Mahanwar, 2004).

Table 2 – Mean values of stem height (cm) of *Treculia Africana*

TREATMENTS	WEEK 2	WEEK 4	WEEK 6	WEEK 8	TOTAL	MEAN
1	5.95	6.48	6.65	6.81	25.89	6.47
2	7.70	8.80	9.73	9.48	35.11	8.80
3	6.78	7.10	7.41	7.66	28.92	7.23
4	9.00	10.00	10.65	11.21	40.86	10.22
5	6.80	7.21	7.50	7.79	29.3	7.30
6	8.40	9.13	9.59	9.95	37.07	9.27
7	6.63	6.85	7.11	7.86	28.45	7.11
8	6.73	7.04	7.41	7.60	28.77	7.19
9	7.70	8.08	8.44	8.75	32.97	8.24
10	9.10	10.23	10.76	11.10	41.19	10.29
11	6.80	7.18	7.50	7.79	29.27	7.32
12	9.05	11.15	11.95	12.78	44.92	11.23
13	8.60	9.28	9.75	10.20	37.83	9.46
14	8.60	9.35	9.75	10.20	37.92	9.48
15	8.60	9.35	9.75	10.20	37.83	9.46
16	9.10	10.25	10.78	11.15	41.28	10.32

Table 3 – Result of analysis of variance (Stem height)

SV	DF	SS	MS	Fcal	Ftab
Treatment	15	165.121	12.702	20.909*	1.90
Error	49	25.514	0.607		
Total	64	190.635			

Table 3 shows that there is significant difference at 5% (0.05) among the treatment as the week increases as f calculated is greater than f tabulated. Since Fcal (20.909) is highly significant at $p < 0.01$, this therefore agreed with the observation of (Adekiya, 2009).

Table 4 – Mean values for stem diameter of *Treculia africana*

TREATMENT	WEEK 2	WEEK 4	WEEK 6	WEEK 8	TOTAL	MEAN
1	0.77	1.06	1.26	1.36	4.44	1.11
2	0.61	0.65	0.69	0.73	2.68	0.67
3	0.72	0.74	0.50	0.54	3.12	0.75
4	0.61	0.65	0.69	0.73	2.65	0.67
5	0.61	0.65	0.69	0.73	2.68	0.67
6	0.61	0.66	0.70	0.74	2.71	0.68
7	0.59	0.63	0.67	0.70	2.59	0.65
8	0.61	0.65	0.69	0.73	2.68	0.67
9	0.72	0.76	0.80	0.84	3.12	0.78
10	0.61	0.65	0.69	0.73	2.68	0.67
11	0.71	0.75	0.79	0.83	3.08	0.77
12	0.72	0.99	1.16	1.29	4.16	1.04
13	0.58	0.65	0.69	0.73	2.65	0.66
14	0.74	0.86	1.31	1.16	3.77	0.94
15	0.63	0.67	0.71	0.75	2.76	0.69
16	0.72	0.99	1.16	1.29	4.16	1.04



Table 4 shows that treatment twelve (T12) has highest mean girth value of 1.16mm, followed by treatment one (T1) with mean value of 1.11mm while treatment seven (T7) has the least mean value of 0.65mm. This result confirms and agreed with Schonoh (1983) in his study on fertilization of eucalyptus in plantation establishment that when fertilizer is correctly applied, it increases the tree crop production.

Table 5 – Results of analysis of variance (Stem diameter)

SV	DF	SS	MS	F _{cal}	F _{tab}
Treatment	15	0.228	0.018	58.092	1.09
Error	49	0.013	0.000		
Total	64	0.241			

Table 5 shows that there is significant different at 5% (0.05) among the treatment as the week progress as f calculated is greater than f tabulated. Since F_{cal} (58.092) is highly significant at $p < 0.01$. This therefore agreed with the observation of Nwoboshi (1982).

Table 6 – Mean value for leaf count of *Treculia Africana*

TREATMENT	WEEK 2	WEEK 4	WEEK 6	WEEK 8	TOTAL	MEAN
1	8.00	12.00	16.00	20.00	56.00	14.00
2	12.00	16.00	20.00	24.00	72.00	18.00
3	12.00	16.00	20.00	24.00	72.00	18.00
4	12.00	16.00	20.00	24.00	72.00	18.00
5	12.00	16.00	20.00	24.00	72.00	18.00
6	12.00	16.00	20.00	24.00	72.00	18.00
7	12.00	16.00	20.00	24.00	72.00	18.00
8	12.00	16.00	20.00	24.00	72.00	18.00
9	12.00	16.00	20.00	24.00	72.00	18.00
10	12.00	16.00	20.00	24.00	72.00	18.00
11	12.00	16.00	20.00	24.00	72.00	18.00
12	12.00	14.00	18.00	20.00	64.00	22.00
13	16.00	14.00	18.00	20.00	64.00	16.00
14	12.00	16.00	20.00	24.00	72.00	18.00
15	16.00	18.00	22.00	26.00	82.00	21.00
16	16.00	18.00	22.00	26.00	82.00	21.00

Table 6 revealed that treatment twelve (T₁₂) has the highest mean value of 22.00 number of leaves while treatment one (T₁) which is the control has the least mean value of 14.00 number of leaves.

Table 6 – Results of analysis of variance (Leaf count)

SV	DF	SS	MS	F _{cal}	F _{tab}
Treatment	15	24.232	1.864	28.469	1.09
Error	49	2.750	0.065		
Total	64	26.982			

Table 7 revealed that there is significant difference at 5% (0.05) among the treatment as the week increases as F calculated is greater than F_{tabulated}. Since F_{cal} (28.469) is highly significant at $p < 0.01$. This therefore agreed with the observation of Adebayo and Tajudeen (1999).

CONCLUSION

The population of *T. africana* in the natural forests has declined as a result of deforestation and forest degradation activities such as timber logging operations, encroachment by farmers, expansion of human settlements, collection of non-timber forest products, etc. Regeneration of the species in the natural forests has been poor, probably due to its moderate light demanding nature, deforestation and forest degradation activities, yearly, consistent collection of the fruithead for consumption and sale, and unfavourable



climatic conditions in the forest for seed germination. Regeneration of *T. africana* under natural forest conditions takes place via seeding, where inflorescences are eaten by wild animals, also fallen seeds are usually eaten by small animals. To bridge this gap and ensure constant availability of the plants for human use, there is need to explore another means of raising the seed under a supervised environment to make available viable seedlings for forest regeneration.

The study has shown that poultry manure and agrosorb contribute to effective development of *Treculia africana* seedlings. The results shows that combination of poultry manure and agrosorb together with twice watering regime daily gave the best performance in terms of stem height stem diameter and leaf count. The best performance in height is T_{12} (11.23cm) while the leaf performance is T_1 (6.27cm) T_{12} produced the highest amount of leaf count (22.00) while T_1 have the least performance (14.00) The best performance in terms of girth is also T_{12} (1.16mm) while T_7 has the least performance (0.65).

Based on the findings of the study, the treatment containing poultry manure (1Kg/ha) agrosorb at 3g and watering twice daily improve the growth of *Treculia africana* seedlings. Therefore, T_{12} is recommended for optimum growth of *Treculia africana* in the nursery.

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