Journal of Forestry Research and Management. Vol. 18(2).104-111; 2021, ISSN 0189-8418

www.jfrm.org.ng

INFLUENCE OF GRANULATED GRANITE STONE MIXTURE ON GROWTH OF *Treculia africana.* Decne SEEDLINGS

[1]Akintola, O. O., [1]Ekaun, A. A., [1]Ibode, A. T., [1]Okeleke, S. O and [1]Ayeni, O. D

[1]Federal College of Forestry, P.M.B. 5054, Jericho Hill, Ibadan, Oyo State, Nigeria
[2]Forestry Research Institute of Nigeria, Jericho Hill, Ibadan, Oyo State, Nigeria
Correspondence:Stardus001@gmail.com.

ABSTRACT

Soils are quickly impoverished when forest or other plant cover is gone due to human activities thus, the influence of granulated granite rock mixture as soil remineralisation agent on the growth of *Treculia africana* seedlings was investigated using different potting media.A nursery experiment involving five treatments: T1 (2kg of top soil), T2 (0.5 tons/ha of granulated granite rockper 2kg of top soil), T3 (1.0 tons/ha of granulated granite rockper 2kg of top soil), T4 (1.5 tons/ha of granulated granite rockper 2kg of top soil), T5 (2.0 tons/ha of granulated granite rockper 2kg of top soil) were replicated six times. The experiment was laid out in Completely Randomized Design (CRD). Data were collected on number of leaves, seedling heights and collar diameter for 12 weeks. Data collected were subjected to Analysis of Variance (ANOVA)andmeans were separated using Duncan multiple range test.Results showed that seedlings from T5had the highest mean number of leaves of 8.8 followed by T4 with mean value of 7.8 leaves while those from T2had least mean value of 5.2 leaves. Seedlings grown in T5recorded the highest mean seedling heights of 31.27cm followed by T4 (30.40cm) while T1 had least mean value of 26.11cm. For stem diameter, seedlings from T5 had highest mean value of 6.80mm while T1 had the lowest mean value of 4.90 mm. There was significant difference among the treatments at p= 0.05 indicating the influence of the granulated granite rock. Thus, granulated granite rocks (dust) can be used as soil remineralisation for optimum growth and production of *T.africana* seedlings in the nursery.

Keywords: *Treculia africana*, topsoil, granite rock, soil remineralisation, optimum growth

Introduction

The myth of fertility of tropical soils is giving way before abundant evidence to the contrary. Many areas of the tropics have soils which are in a more or less advanced stage of natural laterization, which occurs when the soil is leached of silica, leaving residual minerals such as iron, aluminum, manganese and nickel. These widespread laterite-prone soils are usually covered by rainforests or savannas. Most available organic matter is quickly reused by the living plants on such soils instead of forming a layer of humus (Greene and Cox, 1939). Thus, the soils are quickly impoverished when forest or other plant cover is gone due to human activities. This has also led to loss of soil nutrient and productivity, land degradation among others (Pimentel *et al*., 1995).

Remineralisation of soil increases the fertility by returning minerals that has been lost as a result of erosion, leaching, surface runoff, over farming into the soil. Soils organic and sustainable farmers have long relied on rock dust, as an all-natural way to improve roots systems, increase yields, and promote general plant health in a wide variety of crops and conditions (Smart *et al.*, 2020). Rock dust which mainly consists of finely crushed rock that has been processed either by natural or mechanical means can

be used as additives to the leached and depleted mineral soils (Wolfe *et al*., 2005). The granite rocks contain the highest mineral content that of great benefit to soils and plants. Its dust according to Wood *et al*., (2001) can increase the soil moisture, water holding capacity, improves the soil structure and drainage; and soil's cation exchange potential. Thus, its ability to sustain soil biota environment makes it more appropriate than chemical fertilizers.

A suitable sowing media is important for the production of quality plants seedlings. As it affects the development of plant directly and later affect the maintenance of the extensive functional rooting system. A good sowing medium provides required support to the plant, permit gaseous exchange between the roots and atmosphere outside the root substrate, serves as reservoir for nutrients and water and allow oxygen diffusion to the roots (Baiyeri, 2003). It was reported by Makinde*et al*., (2007) that the soil depth available for rooting is a major physical soil factor in silviculture. Soil utilization can be limitedby the shallowness of the soil which can restrict the supply of moisture, air and availability of nutrients to forest stands. Thus, depths at which seeds are sown into the soil affect the germination of these seeds, and subsequent seedling growth (Adenawoola and Adejoro, 2005). Some seeds germinate well on the soil surface while others require a little or more depth into the soil.

Treculia Africana (African bread fruit; wild jack fruit, or African boxwood) as commonly known, belongs to the family of moraceae. Other members of this family include *Ficus exasperata, Milicia excelsa, Artocarpus spp* and so on. There are three species in the genus of *Treculia.* They are *Treculia africana* (Decne), *Treculia obvoidea* and *Treculia aruminatra* (Sahin *et al*., 2005). Most of the tree species, in this family are good economic trees and forest fruit tree which are used for construction workssuch as furniture and cabinet making, *Treculiaafricana*seeds can be roasted, cooked mashed and eaten as snacks food or as flour in bread making, cakes, alsoused in soup thickening and for food formulation (Ariahu *et al*., 1999; Fasasi*et al*., 2003; Osuji and Owei, 2010). It has also been reported by various authors that, the seeds are highly nutritious and are cheap sources of vitamins, proteins, carbohydrates and fats (Giami *et al*., 2002; Adindu and Williams, 2003). The seed of *T. Africana* when fresh contains Carbohydrates, Crude protein, moisture, crude fibre, ash and ether extract fat contents of 38.26, 17.67, 3.82, 15.85, 3.97 and 15.85 %, respectively (Onyekwelu and Fayose 2007),

Proximate and mineral composition of *T. Africana* seed hull showed that it is a good source of iron (Akubor*et al.*, 2000) which is essential in haemoglobin formation in animals and human beings. In Nigeria, Ghana and Cameroon, the sale of *T. africana* seeds is a major means of livelihood most especially among rural dwellers. Due to the fact that it contributes a reasonable amount to the economy, this tree has been widely exploited and is highly endangered (Onyekwelu and Fayose, 2007). Thus, there is need to intensify their cultivation sincepropagation from seed is inexpensive and usually effective, and is therefore a viable method for their ex-situ conservation (Abirami *et al.*, 2010).Therefore, this research aimed at investigating theinfluence of granulated granite rock mixture as soil remineralisation agent on the growth of *T. africana* seedlings for managing its maximum production for afforestation and plantation establishment.

Materials and Methods

The experiment was carried out at the screen house of Federal College of Forestry,

Ibadan. The College is located at Jericho area of Ibadan North West Local Government area of Oyo State, The area is on latitude 7°26'N and 7°28'N; longitude 3°54'E and 3°57'Eof the Greenwich meridian. Its annual rainfall is about 1400 - 1500mm while the average temperature is 31.8°C. The average relative humidity is 65% (FRIN, 2014).

Ten composite topsoil samples were collected at the depth of 0.15cm from within the premises of Federal College of Forestry, Ibadan. The granulated granite rocks (dusts) were collected from the commercial quarries along Ibadan-Lagos express way, Oyo state. The rock dusts (residual minerals fines) were collected underneath the rock crushers where the finest dust tends to accumulate. After collections, the rock dusts and soil samples were taken to laboratory for determination of its physical and chemical composition.Particle size distribution test was carried out using hydrometer (method of Brown (2003)). Soil pH wasobtainedusing soil distilled water (1:2.5), while the organic carbon contents of the soils were determined using Walkley and Black (1934) method and then multiplied by 1.724 to calculate soil organic matter content. Total nitrogen (TN) was determined using the method given by Stanford and smith(1978) and Kjeldahl nitrogen (Kjeltechanalyzer) (Jackson1958) while available phosphorous were estimated bymethod of Olsen *et al*. (1983) and stannous chloridemethod given by Sparling *et al.* (1985) followed by hotplate digestion in HNO_3:$HClO_3$(3:1) at 180ºC for 6 h.The exchangeable cation was extracted using 1M ammonium acetate solution; Ca and Mg were analyzed from the extract by EDTA titration method while K and Na were done by flame photometer. Analysis of Zn, Cu, Fe and Mn were analysed using atomic absorption spectrophotometer (AAS, MEDTECH).

*Treculiaafricana*fruitswere collected from a mother tree within the premises of Federal College of Forestry, Ibadan. The fruits were allowed to ferment for two weeks before the extraction of seeds. The seeds were sown into constructed germination bed at the nursery for 4 weeks, after which they were transplanted into polythene pots. Five treatments consisting of five replicates:T1 (2kg of top soil), T2 (0.5 tons/ha of granulated granite rockper 2kg of top soil), T3 (1.0 tons/ha of granulated granite rockper 2kg of top soil), T4 (1.5 tons/ha of granulated granite rockper 2kg of top soil), T5 (2.0 tons/ha of granulated granite rockper 2kg of top soil) were replicated six times making a total of 30 polythene pots. Prior to transplanting, granite dusts were mixed together with the top soil and left for some days. Watering was done twice a day (early in the morning and evening). Regular weeding was also carried out when necessary. The experiment was laid out in Completely Randomized Design (CRD). Data were collected on number of leaves, seedling heights and collar diameter weekly for 12 weeks of the experiment. Data collected were subjected to Analysis of Variance (ANOVA)andmeans were separated using Duncan multiple range test.

Results and Discussion

The physical and chemical properties of the granulate granite rock and top soils used in this study were presented in Table 1. The pH of the granulated granite rock is 5.75 and is acidic in nature while that of topsoil is 6.68 and alkalinicin nature. Texturally, the topsoil is loamy(medium texture) while the granulated granite rock has phaneritic texture (course grained). Generally, the essential minerals found in granite rock are quartz, K-feldspar, plagioclase of albite-oligoclase composition while common

accessory minerals such asbiotite, zircon, apatite, sphene , with or without monazite, allanite, hornblende, magnetite are found in the granite. The exchangeable cations in the granulated granite rocks were Na (1.11), K(0.48), Mg (0.36) and Ca (4.21) in Cmol/kg. This is higher than of topsoil soil used in the study (Table 1).The granulated granite rock has high amount of Fe (185.09 mg/kg)) than the topsoil (99. 22 mg/kg) and this is attributed to the mineral composition in the rocks. The soil organic matter, total nitrogen and available phosphorous were 11.20%, 0.28% and 3.31%, respectively. This is higher when compared to the organic matter content (5.51%), total nitrogen (0.19%) and available phosphorous (2.45%) in the topsoil (Table 1). The result of the granulated granite used in this study. The result is in line with the similar study carried out by Smart *et al.* (2021)

Table 1.Physical and Chemical Properties of Topsoil and Granulated Granite rocks used

Parameters	Topsoil	Granulated Granite rock
Sand	50.00	-
Silt	43.50	-
Clay	6.50	-
Textural class	Loam soil	Phaneretic
pH	6.68	5.75
Soil organic matter (%)	5.11	11.20
Total nitrogen (%)	0.19	0.28
Available phosphorus (%)	2.45	3.31
Na (Cmol/kg)	1.11	0.51
K (Cmol/kg)	0.48	0.23
Ca (Cmol/kg)	4.21	3.51
Mg (Cmol/kg)	0.36	0.28
Fe (mg/kg)	99.22	185.09
Cu (mg/kg)	3.11	2.31
Mn (mg/kg)	86.22	10.21
Zn (mg/kg)	5.43	1.25

Table 2: Mean Values of *Treculia africana* seedlings heights

Treatment	WAT 2	WAT 4	WAT6	WAT 8	WAT 10	WAT12
T1	10.41c	13.45b	15.53c	18.61bc	21.72c	25.82c
T2	13.02b	15.15ab	17.30b	19.50b	22.86bc	26.11c
T3	14.69a	16.46a	18.88ab	20.0ab	23.24b	29.31b
T4	14.15ab	16.15a	18.30ab	20.55ab	24.75ab	30.40ab
T5	14.73a	16.92a	19.52a	21.69a	25.46a	31.27a

LSD	0.43	0.21	0.13	0.10	0.17	0.15
%CV	12.7	11.3	10.7	16.2	10.2	10.8

WAT: weeks after transplanting

Note: Means with the same letter are not significantly different from each at p= 0.05.

Influence of Granulated granite rock mixture on Treculiaafricanaseedling heights

The result presented in Table 2 showed the influence of granulated granite rock mixture on heights of *Treculia africana* seedlings after transplanting. From week 2 after transplanting, it was observed that T5 (2.0 tons/ha of granulated granite rockper 2kg of top soil) recorded the highest mean values while T1 has the lowest values. At week 12, the result showed that seedlings raised with 2.0 tons/ha of granulated granite rock per 2kg of topsoil (T5) had the highest height with mean value of 31.27cm, followed bythose raised with 1.5 tons/ha of granulated granite rock per 2kg of topsoil (T4) with mean value of 30.40cm while seedlings raised with 2kg of topsoil (T1) with mean value of 26.11cm. Means were significantly difference among the treatments at p=0.05. The highest value of height grown in T5 can be attributed to the high content of nutrients in the treatment when compared to others.This result disagrees with Sodimu, *et al.*(2020), who observed least significant height growth of *J. curcas* in the iron stone soil. The mean values of seedling heights in this study are higher than the value obtained by Ibe *et al.* (2014) and Salami *et al.* (2018),

Table 3: Mean Number of leaves of *Treculiaafricana* seedlings

Treatment	WAT 2	WAT 4	WAT6	WAT 8	WAT 10	WAT12
T1	3.0b	4.0ab	4.0b	5.0b	5.0b	7bc
T2	2.0c	3.0bc	4.2b	4.5bc	4.8bc	5.2c
T3	2.0c	3.8b	4.0b	5.0b	6.0ab	7.4bc
T4	4.0a	4.0ab	6.0a	7.2a	7.2a	7.8b
T5	3.8a	5.0a	6.0a	7.0a	7.0a	8.8a
LSD	0.2	0.2	0.2	0.2	0.2	0.5
%CV	6.2	4.6	3.8	3.2	3.1	6.3

WAT: weeks after transplanting

Note: Means with the same letter are not significantly different from each at p= 0.05.

Influence of Granulated granite rock mixture on number of leaves of Treculia africana seedlings

The Table 3showedthat there was significant difference among the treatments at at p=0.05 indicating the influence of granulated granite rocks on the number of leaves of *Treculia africana* seedlings. At week 12 after transplanting, the result showed that seedlings raised on soil with 2.0 tons/ha of granulated granite rocks (T5) produced the highest number of leaves with a mean value of 8.8 leaves. Seedlings raised on soil with 1.5 tons of granulated granite rocks (T4) performed second best with mean value of 7.8 leaves while seedlings raised on topsoil with 0.5tons of granulated granite rocks (T2) performed least with mean value of 5.2 leaves. The mean number of leaves was lower than those obtained by Salami *et al.*, (2018 using organic and inorganic fertilizers while it was higher than the values obtained by Ibe *et al.* (2014).

Table 4: Mean Values of *Treculia africana* seedlings collar diameter

Treatments	WAT 2	WAT 4	WAT6	WAT 8	WAT 10	WAT12
T1	2.3b	3.1b	3.5ab	3.8b	4.5ab	4.9b
T2	3.3ab	3.5ab	3.6ab	3.8b	4.6ab	5.1ab
T3	3.4ab	3.6ab	4.1a	4.3ab	4.8ab	5.1ab
T4	3.5ab	3.7ab	4.3a	4.6ab	4.8ab	5.6ab
T5	3.8a	4.1a	4.7a	5.2a	5.3a	6.4a
LSD	0.04	0.08	0.08	0.15	0.05	0.06
%CV	10.0	10.8	10.7	12.9	10.0	9.0

WAT: weeks after transplanting

Note: Means with the same letter are not significantly different from each at p= 0.05.

Influence of Granulated granite rock mixture on collar diameter ofTreculiaafricana seedlings

The result presented in Table 4 showed that there was significant difference among the treatments at p= 0.05. The effect of iron granulated stone on early growth of *Treculia africana* seedlings. At week 12, the result showed that seedlings raised in soil with 2.0 tons/ha of granulated granite rock(T5)performed bestin collar diameter with mean value of 6.2mm followed by those raised in soil with 1.5 tons of granulated granite rock (T4) with mean value of 5.6mm while seedlings raised in 2kg of topsoil granulated granite rock (T1) had least mean value of 4.9mm.

Generally the influence of granulated granite rock observed on the growth performance of *T. africana* seedlings agreed with the findings Smart *et al* (2020) where he observed effect of rock dust on cocoa.

However, in this study there was significant among the treatments used and this may be attributed to richness of the nutrients in the granite rocks as well as plant species and soil type among others.

Conclusion

The influence of granulated granite rock mixture as soil remineralisation agents were investigated on *Treculiaafricana* seedlings in the nursery. The growth parameters studied showed significant performance with granulated granite rock mixture than control (topsoil) throughout the study. Thus, granulated granite rocks (dust) can be used as soil remineralisation for optimum growth and production of *T. africana* seedlings in the nursery.

References

Abirami, K., Rema, J., Mathew, P. A., Srinivasan, V. and Hamza, S. (2010). Effect of different propagation media on seed germination, seedling growth and vigour of nutmeg (*Myristicafragrans*Houtt). *Journal of Medicinal Plants Research* 4(19): 2054-2058.

Adenawoola, A. R. and Adejoro, S. A. (2005): Residual effects of Poultry manure and NPK fertilizer residues on soil nutrients and performance of Jute (*Corchorusolitorius* L.). *Nigerian Journal of Soil Science* 15:133-135.

Adindu, M.N. and Williams J.O. (2003): Effect of storage on dehydrated African Breadfruit seeds (*Treculia Africana* Decne). *Plant Foods for Human Nutrition* 58: 1-8.

Akubor, P. I., Isolukwu, P. C., Ugbabe, O. and Onimawo, I.A. (2000). Proximate composition and functional properties of African breadfruit kernel and wheat flour blends. *Food Research International* 33: 707-712

Ariahu, C.C., Ukpabi, U. and Mbajunwa, O.K. (1999). Production of African bread-fruit (*Treculiaafricana*) and soybean (*Glycine max)* seed based food formulations, 1: Effects of germination and fermentation on nutritional and organoleptic quality. *Plant Foods for Human Nutrition* 54(3): 193-206

Baiyeri KP (2003): Evaluation of nursery media for seedling emergence and early seedling growth of two tropical tree species. Moor J. Agric. Res. 4(1): 60 – 65.

Brown, R.B. (2003): Soil Texture. Fact Sheet SL-29., University of Florida, Institute of Food and Agricultural Sciences.128pp

Fasasi, O.S., Eleyinmi, A.F., Fasasi, A.R. and Karim O.R. (2003). Chemical properties of raw and processed breadfruit (*Treculiaafricana)* seed flour. *African Crop Science Conference Proceedings* 6: 547-551.

FRIN (2014). Forestry Research Institute of Nigeria, Metrological Report.

Giami, S.Y., Adindu, M.N., Akusu, M.O. and Emelike J.N.T. (2000): Compositional, functional and storage properties of flours from raw and heat processed African Breadfruit (*Treculia Africana* Decne) seeds. *Plant Foods for Human Nutrition* 55: 357-368.

Greene, H., and Cox, H. F. (1939): Some Soils of the Anglo-Egyptian Sudan, *Soil Research, 6,* 325-38.

Ibe, A. E., Onuoha, G. N., Madukwe, D. K., Adeyemi, A. A. and Nwakasi, C. E (2014). Assessment of early growth performance of *Treculiaafricana*under different growth media. *Journal of Tropical Forestry and Research. 30(2) 57-61*

Jackson, M. L. (1958): Soil chemical analysis. Prentice Hall, EnglewoodCliffs

Makinde, E. A., Ayoola,O. T. and Akande, M. O. (2007). Effects of organic-mineral

fertilizer application on the growth and yield of "egusi" melon (*Citrullus vulgaris L.*). *Australian Journal of Basic and applied sciences*, 1(1): 15 - 19.

Olsen, S., Watanabe, F. S. and Bowman, R. A. (1983): Evaluation of fertilizer phosphate residues by plant uptake and extractable phosphorus.*Soil Science Society of American Journal.* 47:952–958

Onyekwelu, J.C. and Fayose, O.J. (2007). Effect of storage methods on the germination and proximate composition of *Treculiaafricanaseeds.Conference on International Agricultural Research for Development. University of Kassel-Witzenhausen and University of Göttingen,* October 9-11, 2007.

Osuji, J. O. and Owei, S.D. Jr. (2010). Mitotic index studies on*Treculia Africana* Decne. In Nigeria. *Australian Journal of Agricultural Engineering* 1(1): 25-28.

Pimentel, D., Harvey, C., Resosudarmo, P., Sinclair, K., Kurz, D., McNair, M., Crist, S., Shpritz, L., Fitton, L., and Saffouri, R(1995). Environmental and economic costs of soil erosion and conservation benefits. *Science-AAAS-Weekly Paper Edition*, 267(5201), pp.1117—1122

Sahin U, Ors S, Ercisli S, Anapali O, Esitken A (2005): Effect of pumice amendment on physical soil properties and strawberry plant growth. J. Central Europ. Agric. 6(3):361–366.

Salami K. D, Jibo A.U and Lawal A. A (2018). Effects of organic and inorganic fertilizer on early growth performance of *Treculiaafricana.* linn (african bread fruit). *DutseJournal of Agriculture and Food Security (DUJARFS)* 5 (2): 28-36

Smart, M. O., Akintola, O. O., Adesida, O. A. and Adeoye, A. S. (2020): Effects of Rock Dusts on the Early Growth of Cocoa (*Theobroma Cacao*) L. Common wealth forestryassociationconferenceproceedings. 134-138pp

Sodimu, A. I., Lapkat, G. L., Oladele, N. O., Osunsina, O. Suleiman R. and Awobona' T. A. (2020).Evaluation of Growth Performance of Physic Nut Different Soils in the Northern Guinea Savanna Agrological Zone of Nigeria. Asian Soil Research Journal 3(2): 12-17.

Sparling, G.P., Whale,K.W.andRamsay, A. J. (1985). Quantifying thecontribution from the soil microbial biomass to theextractable P levels of fresh and air dried soils. *Australian Journal of Soil Resources*, 23:613–621. Doi: 10.1071/SR9850613

Stanford, G. and Smith, S. J. (1978): Oxidative release of potentiallymineralizable soil nitrogen by acid permanganate extraction.*Soil Science* 126:210–218

Walkley, A. and Black, I.A (1934). An Examination of the Digestrates. Method for Determining Soil Organic Matter and Propose Modification of the Chronic Acid Titration Method. *Soil Science.* 37: 29-38.

Wolfe, A. David, Oand Shazzie, S. (2005).Naked Chocolate: The Astonishing Truth about the World Greatest food. *North Atlantic Books. p. 98.* ISBN 978-1-55643-731-1. Retrieved 15 December 2011.

Wood, G. A. Rand Lass, R. A. (2001). Cocoa. *Tropical agriculture series (4th Ed.). John Wiley and Sons.* ISBN 978-0-632-06398-7 Pp. 195-209