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EFFECT OF SEED LOCATIONS ON THE GERMINATION AND EARLY GROWTH OF *Treculia africana* Var. Decne Seedlings (AFRICAN BREAD FRUITS)

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ABSTRACT

Location of seeds source may be far from intended planting sites while some species do not produce seed every year, hence there is a need for appropriate seeds source. A nursery experiment to evaluate the effect of seed location in Cross River was carried out. Seeds of Treculia africana were collected from Yala, Obubra and Akamkpa and examined for variation in germination performance and early growth seedlings. A total of 540 seeds (3 replications of 180 seeds) per location were sown. The growth parameters such as stem height, number of leaves, number of branches and Leaf area were assessed. Data was analysed using descriptive statistics. Seed sourced from Akamkpa gave the highest germination percentage (86%) followed by seed from Obubra (77%), while the lowest germination percentage (75%) was recorded for seeds from Yala LGA. Commencement of germination was earliest (10 days after sowing) in Akamkpa seed location, which was closely followed by seed form Obubra and Yala that commenced germination 13 days after sowing. Akamkpa recorded the highest number of leaves (262.9) followed by Yala (228.5). The lowest number of leaves was recorded from Obubra (224.9). Seedlings from Akamkpa seed location produced the tallest plant height (98.7cm) while seedling from Yala seed location had the shorted plant height (77.5cm). Obubra had the highest number of branches (32) while the lowest number of branches was observed from Yala (15). The highest mean Leaf Area of (241cm^2) was observed from Akamkpa seeds location. The least Leaf Area (163.5cm^2) was obtained from seed sourced from Yala. Seeds location from Akamkpa LGA tends to perform better in terms of germination and with batter growth attributes. The study showed that the choice of an appropriate seed location was an important process in plantation establishment and development of the plant species.

Keywords: Seed location, Germination, Early Growth, Seedlings, *Treculia africana*.

INTRODUCTION

Treculia africana (African breadfruit) is a large evergreen tropical food species belonging to Moraceae family. It grows in the forest zone particularly the coastal swamp zone (Agbogidi and Onomeregbor, 2008) and it enjoys a wide distribution in West Africa, central Africa and Madagascar (Okafor, 2009). The species grows best in equatorial lowland between 600-1550m above sea level (Nwajiaku *et al*., 2003). It is widely grown in southern Nigeria for its seeds. The Ibo people call the tree "Ukwa". The species is a large tree which grows up to 30m high. It grows between October and February (Salami, 2002). *Treculia africana* is a traditional important edible fruit tree in Nigeria; its importance is due to potential use of seeds leaves, timber, roots and bark (Okafor, 1999). It is increasingly becoming commercially important in Southern Nigeria, Baiyeri and Mba (2006), describe it as an important natural resource, which contribute significantly to the dietary intake of the poor. Many rural dwellers in Nigeria and Cameron are engage in the collection processing and sale of *T.*

a*fricana* seeds as a means of livelihood. The seed can be boiled, pounded and eaten with soup and stew or cooked into porridge. The seed can also be roasted and eaten in the same way as peanuts. The seed kennel is used in preparing pudding, as a thickener in traditional soups and in the manufacture of food products such as flour for bread, beverages, and weaning food for children. The seeds of T. *africana* are highly nutritious containing most of the essential nutrients needed for the maintenance of good health. Nutritionally it contains 17.3% crude protein and 10.21% crude fat (Okafor and Okolo, 1974, Okafor and Caldecott 1990). Proximate analysis shows that the seeds of *Treculia africana* contain protein, fat iron, ash, calcium, phosphorous, carbon, hydrogen, magnesium iron, sulphur, crude fibre, carbohydrate and other minerals including zinc, lead, copper and tannin (Nwanna *et al.,* 2008). The seed have an excellent polyvalent dietetic value, whose biological value exceeds even that of soybeans (WAC 2004). Idowu *et al.,* (2013) reported that *Treculia africana had* been over exploited and unable to naturally regenerate, therefore becoming endangered and gradually going into extinction.

A seed source refers to the naturally occurring place (.mother tree) of Seed for planting. seed source should represent the best available genetic materials for planting as exhibited by the parental materials (Mbora *et al*., 2009) seeds source testing of natural species is necessary to screen the available variation for high productivity and future breeding work. Selection of the best seed location of desired species for a given site or zone is necessary to achieve maximum productivity in plantation forestry (Takuathing *et al.,* 2012). The process of fruit collection, seed extraction and cleaning are crucial in seed matters as they can negatively alter the quality and quantity of seeds obtainable from collected fruit as well as the viability. Relevant information concerning species whose seeds are to be collected include where they occur naturally and a good phenotypic status, when it start to bear fruits, the frequency and quantity of fruits, fruit dispersal method, duration of matured fruits on tree before falling and harvesting method. All these need to be known in order to make the collector prepare for and plan well, and be at the site of fruit / seeds collection on time, as well as being able to collect maximum quantity of fruits or seeds at a time. For this reason, it is advisable that, the collector should collect seeds that are matured and just ready to split and keep them where they can be dried under his supervision and later split / threshed for seed extraction. The visual signs of approaching maturity vary between species and may need careful observation. Changes in colour, moisture content and abscission zone development of fruit or cone are common indicators (Evans and Tumbull, 2004) when selecting trees from where to get seeds. It is better to avoid narrow genetic base as this would cause inbreeding and low productivity in the long run. To minimize deterioration, total quality control must be applied to all phases of seed collection, handling, processing, and storage to produce high quality seeds (Turnbull, 1996). The objective of this study was to investigate the appropriate seed location in the germination and early growth of *T. africana* that would make the seeds available and adequate for planting as well as for eating over a long period of time.

MATERIALS AND METHODS

The research (germination) was conducted at the nursery site of the Department of Forestry and Wildlife Management, Cross River University of Technology, Obubra Campus. The study site lies between latitude 4^0, 28^i and 5^0, 6^i North of the Equator and longitude 5^O, 7^i, and 9^O, 28^i East of the Greenwich meridian. The Location has an annual maximum and minimum temperature of about 21^Oc – 30^Oc and annual rainfall of about 2000 – 2500mm. **Source:** Nigeria Metrological services (NIMET, 1996).

Collection and Extraction of Seed

Matured fruits of *T. africana* were collected from three agro-ecological zones of Cross River State, namely Yala, Obubra and Akamkpa. The fruits

were kept under a banana shade for 14days for softening, extraction and washing of seed. Five hundred and forty seeds (540) of *T. africana* were used for the experiment. The seeds were subjected to viability test by soaking in cold water. Seed that still float after 24 hours were discarded and those that sank to the bottom of the container were collected for sowing (Schmidt 2000)9 followed by air drying for two days.

Experimental Design and Sample Size

The experiment was laid in Completely Randomized Design (CRD) in three replications with seed sources as treatment and the only source of variation. Five hundred and forty (540 seeds), one hundred and eighty (180) per location were sown. Each treatment location was replicated three times with (60 seeds in one replication). Observation for seed germination was done daily, starting from the first day of sowing for 30 days. Seeds were directly sown in germination trays measuring 40cm x 30cm x 15cm filled with topsoil kept moist by watering daily. No organic/inorganic manure or mycorrhizal inoculation was applied. Seedlings (50 N0) of equal height from each location were selected and transplanted into polybag sizes 25 x 15 x 10cm, filled with topsoil collected from the forest floor, arranged on germination beds for observation of germination responses for fourteen weeks (14 weeks) Watering was done manually, twice daily (morning and evening) with the use of watering can.

Data Collection

Observed parameters included seedling height, number of leaves, number of branches and Leaf Area (LA). The seedlings height was measured with a metre rule at the distance from the soil level to the terminal bud. The number of leaves and branches were assessed by counting. The Leaf Area (LA) was determined by tracing the leaves on a sheet of graph paper and the total leaf area per-seedling obtained by counting the number of 1cm squares. Data obtained was subjected to descriptive statistics using SPSS (version 23)

RESULTS

Growth Performance

The results showed that germination of *T. africana* from different locations was higher in terms of growth percentage. The highest germination percentage was obtained from seeds sourced in Akamkpa LGA (86%), followed by seeds from Obubra (77%), and (75%) for Yala (Table 1). The differences in germination percentage can be attributed to effect of seed location, as influenced by environmental or climatic factors. There was no significant different ($P< 0.05$) in the time of Commencement of germination of *Treculia af ricana* from different locations (Table 1). Seeds from Akamkpa had the earliest or fastest germination time of 10 days after sowing, which was followed by seeds from Obubra and Yala that started germinating 13days after sowing. Germination periods for the different seeds location ranged from 17-20 days (Table 1).The result showed that germination periods for seeds from Akamkpa was significant ($P< 0.05$) lower than seeds from other locations (Table 1).

Table 1: Growth performance of *Treculia africana* seedlings

Agro-ecological Zone	No of seeds sown	No of Seeds Germinated	Germination %	Days after sowing	Germination periods
Yala	180	135	75	13	17
Obubra	180	140	77	13	17
Akamkpa	180	155	86	10	20

Number of leaves per seedlings

Location influenced the number of leaves count from the various seeds sources. The mean leaf count revealed that Akamkpa seed sourced recorded the highest number of leaves (262.9), closely followed by Yala (228.5). The lowest number of leaves was recorded for seed sourced from Obubra (224.9) Figure 1.

Number of branches per seedlings

The highest number of branches was obtained from Obubra seed sourced (32), followed by Akamkpa (22).The least number of branches (15) was obtained for seeds from Yala LGA (Figure 2).

Seedlings height (cm)

The mean plant height from the various locations revealed that Akamkpa LGA recorded the highest plant height (98.7cm), closely followed by seeds from Obubra LGA (87.6cm).The least plant height was observed from Yala LGA (77.5cm) Figure 3.

Leaf Area per seedlings (cm^2)

Leaf Area was significantly different ($P < 0.05$) for all assessed seeds locations. Akamkpa had the highest Leaf Area ($241cm^2$), followed by Obubra ($225cm^2$) while Yala obtained the lowest Leaf Area ($163.5cm^2$) respectively Figure 4.

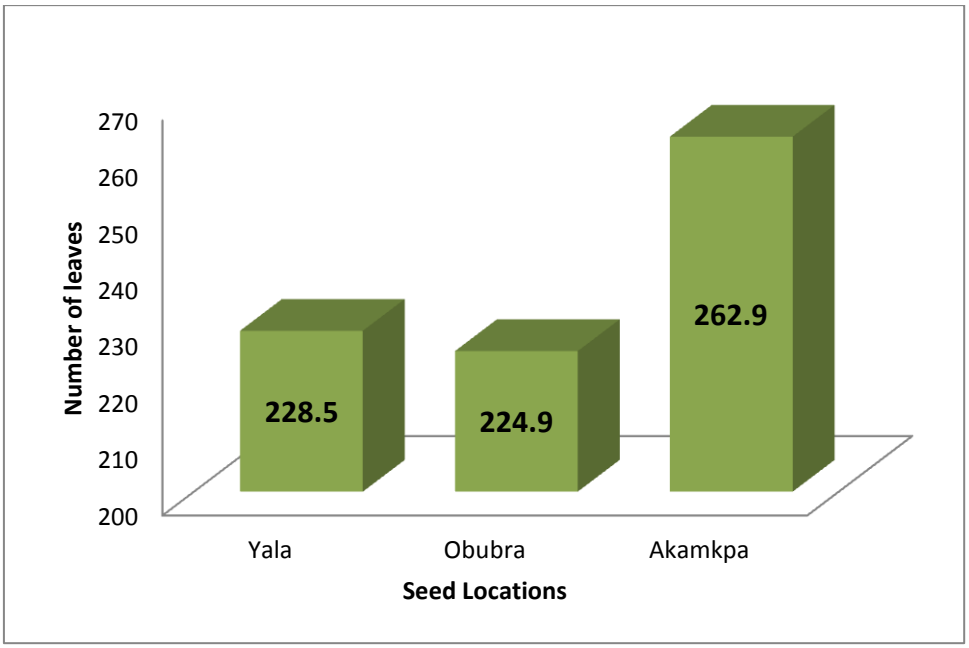

Figure 1: Effect of seeds location on the number of leaves per plant

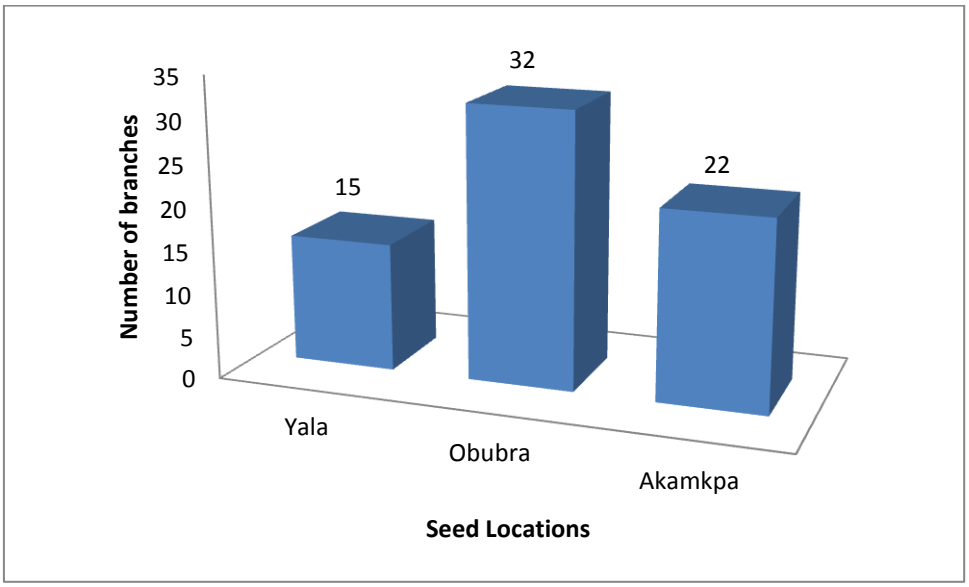

Figure 2: Effect of seeds locations on the number of branches per plant

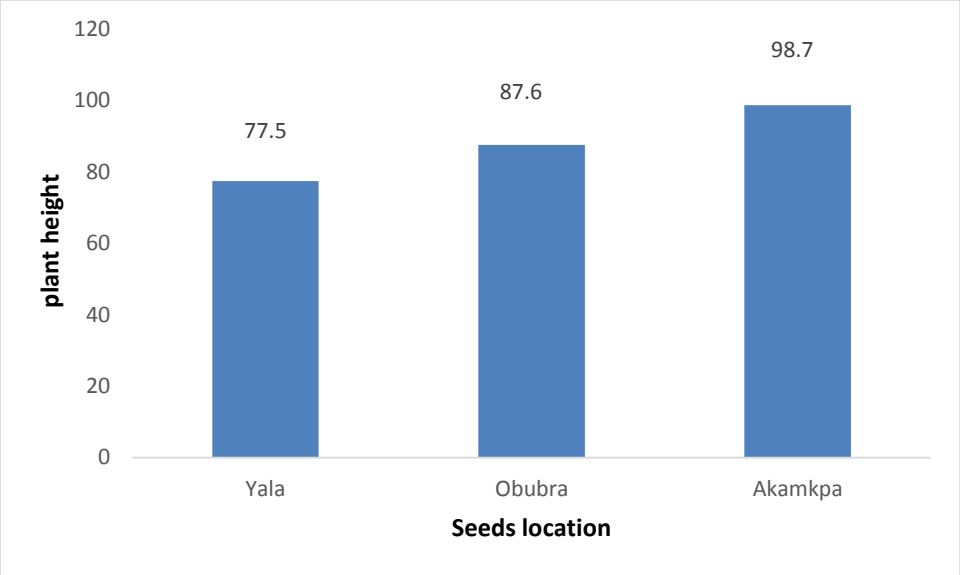

Figure 3: Effect of seeds locations on stem height

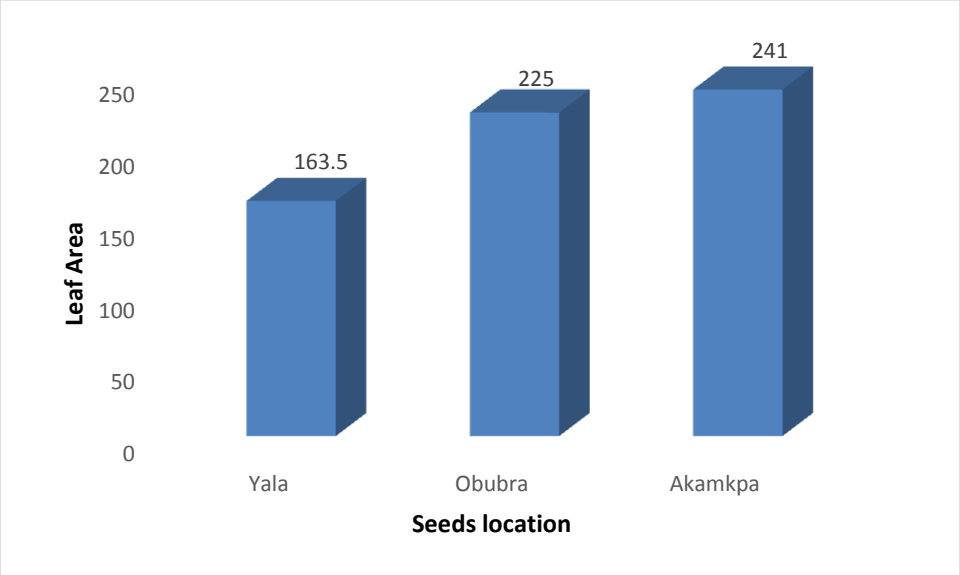

Figure 4: Effect of seeds locations on Leaf Area

Plate 1: *Treculia africana* fruits

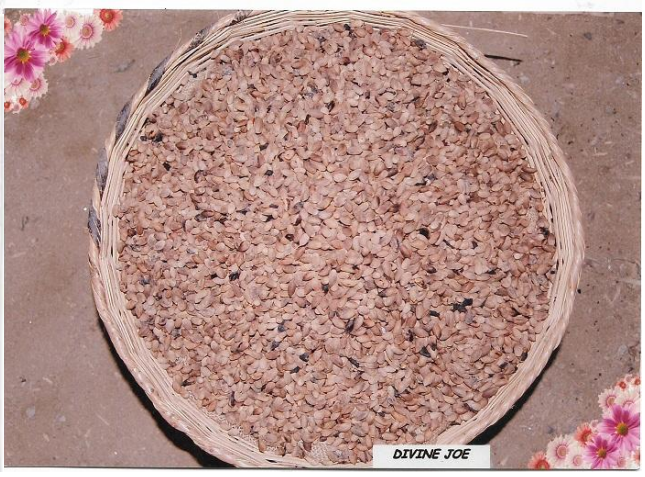

Plate 2: *Treculia africana* seeds

DISCUSSION

The periods of Commencement of seeds germination and germination percentage depended on the location of seed Source as influenced by environmental or climatic factor. Loha *et al*., (2006) started that seed germination capacity is due to provenance effect. Similarly, Gush and Singh (2011) also revealed the influence of seed locations on germination performance in most plant species. Seed vary in their degree of germinability between and within populations as well as between and within individuals (Benoviez *et al.*, 2000, 2001; Gera *et al.*, 2002, Mkonda *et al.*, 2003) some of these variations can be of genetic origin, but much of it is known to be phenotypic (caused by the local environment under which the seed matured). Apart from seed location, which is due to agro-ecological variables of seed origin, other factors cannot be undermined. Fenner (1991); Anderson and Milberg (1998); Bhatt *et al.*, (2000) and Gutterman (2000) reported that germinability of seeds can be markedly influenced by materials factors, such as position of the seed in the fruit / tree and the age of the mother tree during seed maturation as well as environmental factors. Differences in germination values of the different seed sources are in conformity with those reported for Fir and (Spruce) (Singh and Singh, 1981), *Acacia spp* (Mathur *et al.*, 1984) and *Albiza facataria* (Bahuguna *et al.*, 1989). These differences in germination performance due to different location of seeds could be attributed to longitudinal locations. Loha *et al*., (2006) reported that speed of germination, as determined by the germination energy has significant positive correlation with the longitude of the seed source.

Hazara and Tripathi (1986) reported that biomass production is a function of the photosynthetically active radiation on the leaves. As optimal mass levels increase, biomass production would substantially increase. Due to higher leaf area, Akamkpa and Obubra seed location may have higher potentials for photosynthetic carbon fixation. This was reflected in the larger Leaf Area of seedlings from these seed locations in comparism with those from other seed location. Differences in the seedling leaf area therefore, can be attributed to the differences observed in the growth parameters. These findings are in line with those reported for *Acacia spp* (Mathur *et al.*, 1984). Observation shows that, there was a common trend in all the seedling parameters attributes for all the seed locations. This observation, however, is at variance with the finding of Aslan (1975) and Isik (1986) for *Pinusbrutia*, Manga and Sen (1995), Negi and Todaria (1997) for *Terminalia spp.* and *Sapindus mukorossi*, who reported that high elevation (altitude) provenances produce large and better quality seedlings than low-elevation populations.

CONCLUSION

From the result of this study, seed germination and growth of *T. africana* seedlings varied considerably among *T. africana* seed locations. The differences in seed germination were attributed to the effect of seed location. *T. africana* growth parameters were also different for all studied seed location. Seeds sourced from Akamkpa LGA tend to perform better in terms of germination percentage. This research is useful when sourcing for seeds as this will avoid the introduction of seeds from poor geminating and growing seed sources (locations) for plantation establishment.

Recommendations

Based on this study, it is therefore recommended that:

1. Selecting and analysing additional seeds location in future research could be appropriate in order to achieve higher germination and further improved growth rate for seeded *Treculia africana.*
2. *Treculia africana* seeds should be source from Akamkpa LGA for better germination of the recalcitrant seeds to produce seedlings with better growth attributes.
3. Plantation of African breadfruits should be established to save the species from going extinct.

4. Further research is necessary to determine whether African breadfruits seedlings which grow in the nursery will survive and grow well when planted in the field.

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