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EFFECT OF STORAGE METHODS ON THE GERMINATION AND EARLY GROWTH PERFORMANCE OF AFRICAN BREAD FRUITS (*Treculia africana*)

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ABSTRACT

Inadequate drying and storage devices, large volumes of high quality seeds are lost for planting as well as for eating, and so there is a need in getting appropriate storage methods. The study is set to evaluate effect of storage methods on germination and early growth performances of African breadfruits were investigated. A total of 360 seeds in three replications of 60 seeds were subjected to six storage media clay pot, open basket, jute bag, wooden boxes, Jerrican and control (fresh seed) the storage aspect was monitored for 4 weeks. The seedlings produced were thereafter transplanted into the nursery bed with poly bags in a Complete Randomized Design (CRD). The seedlings were assessed for plant height, number of leaves, number of branches and leaf area. Data was analyzed using descriptive statistics. Germination percentage across the storage methods revealed that seeds without storage (control) recorded the highest germination percentage of (96%) closely followed by wooden box (93%) while Jute bags (78%). The least percentage germination (63%) was recorded for Seed stored in open basket. Plant height recorded the highest mean value (98.5cm) from seed without storage; the control closely followed by seed stored in Wooden Box (95.6cm) open basket recorded the least value (33.4cm). There was significant increase in the number of leaves (P> 0.05).The control recorded the highest number of leaves (40.3) followed by wooden box (35.4) while seeds planted in open basket obtained the least leaves count (10.5). The mean number of branches was higher for T. africana seed without storage (Control) which recorded (30) branches, while the least numbers of branches was obtained from seed stored in clay pot 9 branches. Leave area was significantly higher (P>0.05) (65.5cm^2) from the control, wooden box closely followed (54.6cm^2) with the Jerrican device recording the least leave area (25.3cm^2). It is therefore recommended that fresh seeds of T. africana be sown fresh. Where long term storage is needed, wooden boxes should be used, but the local farmers may employ the use of jute bag to store T. africana seed meant for planting.

.Keywords: Storage Methods, Germination, Growth Performance, Wooden box, African breadfruits

INTRODUCTION

The global challenges of food insecurity, rural poverty and climate change effect are alarming. It is estimated that about 842 million in the world are experiencing acute hunger or food insecurity (FAO, 2013). The undernourishment of people is more worrisome in developing countries especially in sub-Sahara Africa (FAO, 2013; Abu, 2012). In Nigeria, for example, 65% of the house hold had difficulties meeting their food requirements mainly because of low income, abject poverty and high prices of nutritious food crops (Chukwuone and Okeke, 2012; Okeke *et al*, 2008). Some nutritious crops which are rich in protein are neglected in cultivation thereby culminating to their low output (Chukwuone and Okeke, 2012) and protein deficiencies diets of people (Idrisa, *et al*, 2010). Addressing the challenges, identification and promotion of widespread planting and consumption of those crops is expedient because some of the crops species have great potential for integrated contribution to solving the multiple challenges. This is because some of the crops species have great potentials for integrated contribution to solving the multiple challenges. One of such crops species is bread fruit (*Treculia africana*) in support and in consideration of the enormous

potentials of these crops Nzekwe and Amujiri (2013). Declared 'of all the food' crops of economics and nutritional importance needed to be conserved African. Breadfruit, *Treculia Africana* quickly comes into mind.

Treculia Africana Decene (African breadfruit) is a large evergreen tropical food tree species belonging to the Moraceae family: Three varieties (Africana invesa mollis) have been distinguished Okafor, (1981;Keay. 1989). Their taxonomic differences are mainly based on fruit head size, harness of branches and leaves. Var africana produces fewer but larger fruit heads and superior seed weight than Var, inversa, while Var inversa produce twice as many branches as Var *africana*. (Okafor, 1981: WAC, 2005). The seeds are widely consumed, thus playing important role in food security, especially among rural dwellers in West Africa. It enhances economic employment and provides rural employment. Many rural dwellers in Nigeria and Cameroon are engaged in collection, processing and sale of *T. africana* 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 the same way as pea nuts.

Seed storage is important for several reasons. Seed ripening and collection often does not correspond with the time for seedlings production and tree planting. The location of seed source may be far from intended planting sites while some species do not produce seeds every year. Stored seeds are important bark-up for plant species that are threatened with extinction. The main purpose of seed storage is to secure the supply of good quality and quantity seed for planting program whenever needed. If sowing time follows immediately after seed harvesting and processing, seed can go directly to the nursery but this is rarely the case. Every year large volumes of high quality seed are lost due to inadequate drying and storage. If seed are not properly dried, they stand the risk of losing viability due to high moisture content; which is one of the factors that determine whether or not seed can be stored safely (Siddique and Wright 2003) Also the length of time seed will remain viable varies greatly by species and storage conditions. This study is set forth to investigate the effect of storage method on the germination of *Treculia africana* seeds.

METERAIAL AND METHODS

The study was carried out at the Department of Forestry and Wildlife Nursery Cross River University of Technology (CRUTECH) Obubra Campus Nigeria. Study site lies between Latitude 4°, 28^{i} and 5°, 6^{i} North of the equator and Longitude 5°, 7^{i} and 9°, 28^{i} East of the Greenwich meridian. The location has an annual rainfall of about 2000 – 2500mm with maximum and minimum temperature of about 21° - 30°C. (Source: Nigeria Metrological Services. NIMET, 1996).

Collection and extraction of seeds

Matured fruits of *T. africana* were collected from local farmers at Obubra LGA in Cross River State. The fruits were kept under a mixed plantation of *Gmelina arborea* and *Tectona grandis* (Teak) for 14 days for fermentation, easy extraction and washing of seeds. 360 seeds were used for the experiment. The seeds were subjected to viability test by soaking in clean and cold water. The non-viable seeds were discarded and those that sank to the bottom of the containers were collected for sowing. (Schmidt, 2000) follow by air drying for 3 days.

Experimental Design and Sample Size

The experiment was laid in Completely Randomized Design (CRD) in three replications with six storage methods as treatments and the only source of variation. A total of (360) seeds (60 seeds per treatment were stored in different Storage media for 4 weeks. Thereafter, the seed were separated from each medium and transplanted into polybags of 25 x 15 x 10cm, filled with top soil collected from forest floor (Oboho, 2014). The seedlings were arranged on germination bed for observation of germination response from each treatment. Each storage medium was replicated three times with 20 seeds sown in each replicate. Watering was done manually, twice daily (morning and evening) with the use of watering can.

Data Collection

Observed parameters included seedling height, number of branches, numbers of leaves and leaf area. Seedling height was measured with meter rule at the distance of the soil level to the terminal bud. The number of branches and leaves were assessed by counting. Leaf Area (LA) was determined by tracing the leaves on a graph sheet and 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

Germination of *Treculia africana* seeds from different storage media was significantly different (Table 1) (P> 0.05).The highest seeds germination percentage (96%) was obtained from seeds without storage (control) followed by seeds stored in wooden boxes (93%),while the lowest germination (63%) was obtained from seeds stored in open baskets

Table 1: Growth performance of *Treculia africana* seedlings

Storage methods	No of seeds sown	No of seeds germinated	Germination percentage	Mean germination	p- values
Open basket	60	38	63	24.87 ± 11.81^{c}	.024
Jute bag	60	47	78	45.76 ± 33.21^{ab}	.070
Clay pot	60	42	70	23.16 ± 11.34^{c}	.027
Wooden box	60	56	93	52.66 ± 31.15^{ab}	.043
Jerrican	60	45	75	24.67 ± 11.96^{bc}	.026
Control	60	58	96	58.66 ± 30.50^{a}	.031

Mean with the same superscript under the same column are not significant at ($p<0.05$).

Plant Height

Seedlings from fresh seeds (control) recorded the highest plant height (98.5cm) followed by seedlings from the wooden box (95.6cm), and then jute bag (92.5cm). The lowest plant height was recorded from seeds stored in open baskets (33.4cm) (Figure 1).

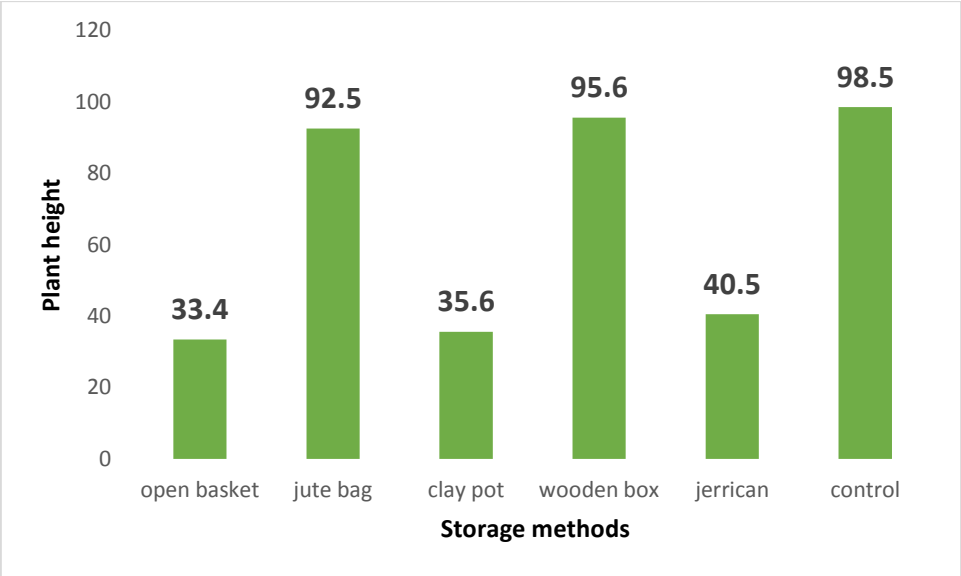

Figure 1*:* Effect of seed storage method on plant height of *Treculia africana* (cm)

Numbers of Leave

Storage methods influenced the number of leave per seedlings. Seeds that were sown fresh without storage (control) recorded the highest (40.3) number of leaves. The lowest numbers of leaves were observed from seeds stored in open baskets (10.5). (Figure 2)

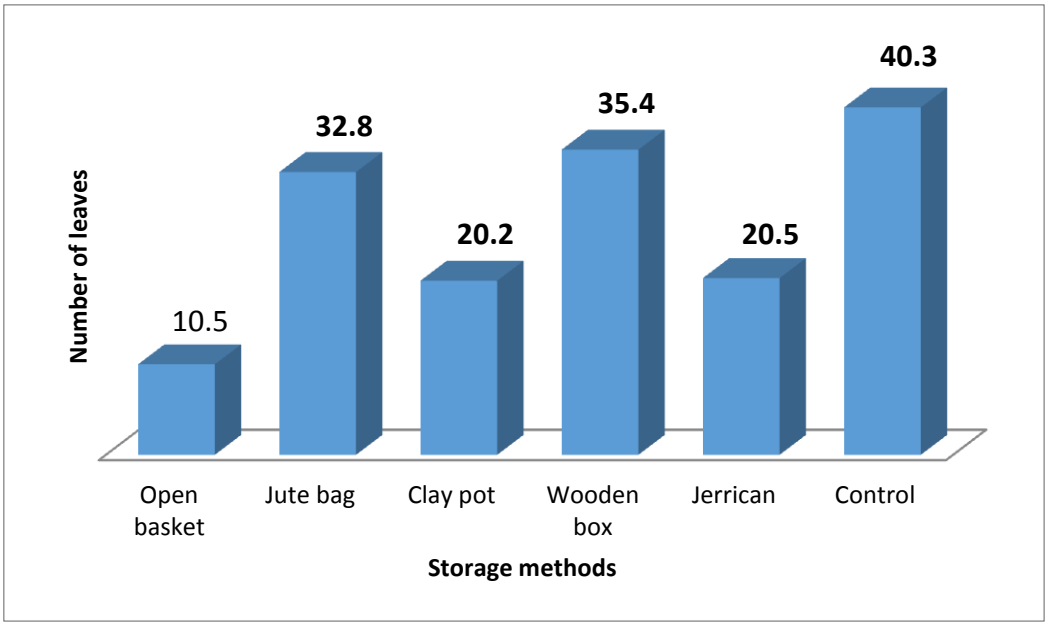

Figure 2: Effect of seed storage methods on leaf count of *Treculia africana*

Number of Branches

The highest numbers of branches were obtained from seeds that were not stored (control) (30), wooden box (25), and open baskets (20). The lowest numbers of branches were recorded from seeds stored in clay pot (9) (Figure 3).

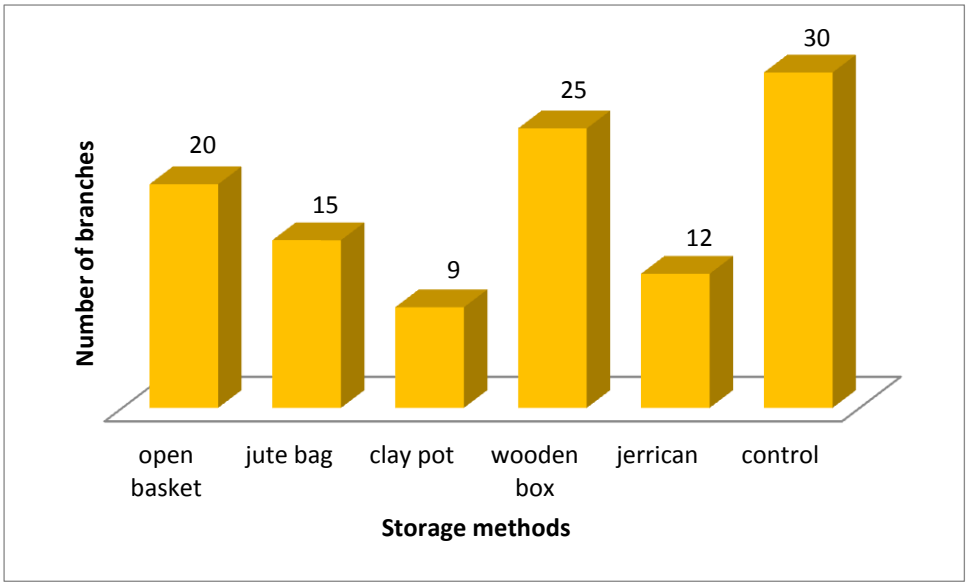

Figure 3: Effect of seed storage methods on the branches of *Treculia africana*.

Leaf Area

The Mean Leaf Area of (65.4cm^2) was observed from seed that were not stored (control) closely followed by wooden boxes (54.6cm^2), jute bag (42.7cm^2). The lowest Leaf Area was obtained from seeds stored in Jerrican (25.6cm^2) respectively, (Figure 4).

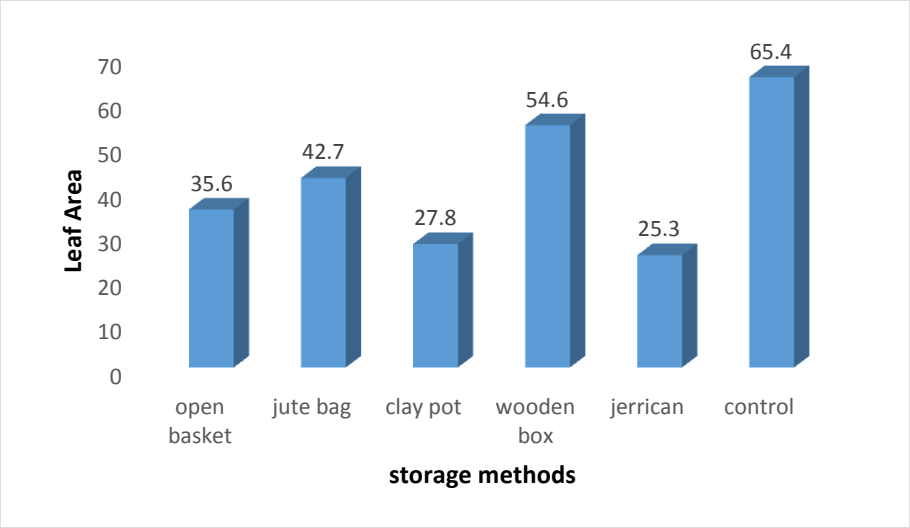

Figure 4: Effect of seeds storage methods on Leaf Area (cm^2) of *Treculia africana*.

Plate 1: *Treculia africana* fruit

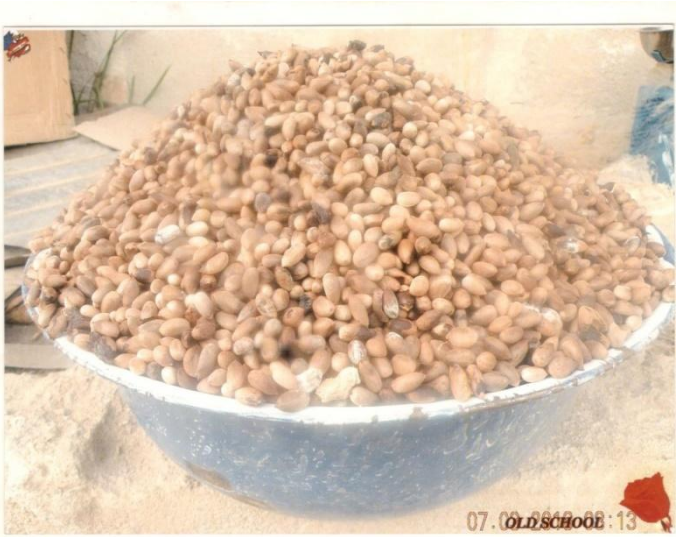

Plate 2: *Treculia africana* seeds

DISCUSSION

Better germination result was obtained from seeds stored in wooden box treatment for up to 4 weeks and similarly good results were obtained for as the control. Seeds without storage (control) produced higher values than seeds stored in jute bag and clay pot. Germination of seeds stored in open baskets, clay pots and Jerricans for 4 weeks were lower than that of jute bags and wooden boxes. The higher germination performance of seeds from wooden box medium may be attributed to the temperature regime of the medium since it had been identified that temperature had contributory effects on the length of shoot and the rate of germination which are good indicator when evaluating the level of seedlings vigor (Yamauch, 1993). Therefore, the observed discrepancies in the performance of seedlings could be attributed to the temperature effects in the various storage media. In addition, the media enhanced good establishment and development and this might be attributed to attainment of good seedling vigor. It has been observed that for better establishment and good vegetative growth of plants, good seedling vigor is a major requirement (Yamauch, 1993).

The time of commencement of seed germination depended on the storage methods. The wooden box however maintained relatively constant germination values throughout the investigation period. The 4 weeks of storage had a higher germination values irrespective of methods and there was great difference between the germination value of seeds from the wooden box, and those of clay pot, Jerrican, open basket and jute bag. Onyekwelum and Fayose (2007) and Nugal *et al* (2011) similarly found out that germination started earlier in freshly sown seed. The constantly high germination exhibited by seed in wooden box means that the method was able to

prevent seed from direct effects of the surrounding environment and agents of seed deterioration. Offiong *et al* (2000) were of the view that the environmental and inherent properties of seed play an important role in their ability to germinate. They suggested that factors like methods of seed storage, storage temperature and relative humility could cause decrease in germination of seed. The open basket and clay pot method in this study recorded the worst germination which also point to the fact that storage method has great effect on longitivity of seed. Since the seed of *Treculia africana* do not have hard seed coats they are exposed to the challenges of environment, thus affecting their embryos and subsequently leading to loss of germinating power. Such a situation leads to excessive and rapid physiological and biochemical changes in the seed resulting in the early use of food reserve in the cotyledons that culminate in reduction in germination power. This study is corroborated with findings by Nwoboshi (1982) who reported that seeds which do not possess hard impervious seed coat lose their viability rapidly as they are subjected to temperature and humidity fluctuation. That the wooden box method consistently maintained the highest germination implies that, the method was able to protect the seeds against temperature and humidity fluctuations hence, Cobina *et al* (1990) held the view that seeds without hard seed coats such as *Glricidia sepum* and *Treculia africana* required specialized storage conditions if their viability are to be maintained.

It was observed that *Treculia africana* responded differently to different storage media treatments. The control experiment recorded the highest growth, followed by wooden box, then the jute bag. This is in line with the findings of, Baiyeri and Mba (2006), who stated that most of the seedling growth parameters of *Treculia africana (African bread fruit)* varied significantly to different growth media. This also conforms to the findings of Baiyeri (2005) who reported that nursery growth influenced the quality of seedlings produced for establishment of a plantation or an orchard. However, in this present study the impressive performance of the seed in terms of germination could be attributed to the quality of seeds used and storage media. This point is explained in the study of Cernac, *et al*. (2006) who stated that the germination rate and seedlings emergence of plants are independent of the soil nutrient status, rather it depends completely on the cotyledons that are attached to the seedlings which are rich in stored nutrient reserves till the seedlings become autotrophic or develop their root system and leaves for photosynthesis.

CONCLUSION

From the result of this study, *Treculia africana* seeds should not be stored before planting. If *Treculia africana* seeds should be stored, it should be in wooden boxes or jute bags media. Pricking out the sprouted seeds from the storage media to the nursery gave them a better standing which facilitated their germination.

Recommendations

1. For effective establishment of *Treculia africana* in the field, planting of *T. africana* seeds should be planted directly into the soil in the nursery after extraction in order to obtain a higher germination
2. Storage of seeds in the wooden box is recommended for better germination of the recalcitrant seed as against other media.
3. Encouragement of more local farmers who previously had little or no knowledge about the storage growth and development of the plant to embark on its cultivation.

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