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EFFECT OF SEED SIZE AND STORAGE ON THE GERMINATION OF *Artocarpus Altilis* (PARKINSON: FORSBERG)

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ABSTRACT

A study was designed to assess the effect of seed size and storage on the germination of Artocarpus altilis seeds. Six fallen pods were collected under the mother tree and seed length (cm) and diameter (cm) measured while germination treatments were fresh intact seeds (FIS), separated into six pod origin, A, B, C, E, F, and G pods (control), testa removed seeds (TRS), 1day storage (1DS), 7days storage (7DS), and 14 days storage (14DS) in a completely randomized experimental design. The results showed that there is a significant difference ($p<0.05$) in seed length and diameter among the pods studied. There was however no significant difference ($p>0.05$) in dormancy period, number of days to complete germination, germination capacity (%), germination speed and uniformity of germination. Testa removal however improved germination of Artocarpus altilis seeds. Furthermore storage negatively affected the germination of the seeds while immediate sowing after processing of fresh seeds improved germination. Arthocarpus altilis seeds are therefore recalcitrant and will require the establishment of field genebanks to preserve and conserve the species germplasm. Moreover to propagate the plant from seed care must be taken to select large seeds so as to improve the quality of seedlings produced.

Keyword: Germination, seed, germplasm, conservation, preservation

INTRODUCTION

Artocarpus altilis is valued in Nigeria for the fruit similar to what obtains in other parts of the tropics where the species thrive. It is reported to be indigenous to south-east Asia, New Guinea and south Pacific (Ndukwu, 2011) where it has been cultivated for generations (Roberts-Nkrumah, 2012). *Artocarpus altilis* supports food and nutrition security in its native area, has been domesticated and also has medicinal values.

Individual stands of the tree are usually found around homesteads in south-eastern Nigeria where the seed is eaten after boiling. Although the popularity of the species in Nigeria is nothing compared to its value in its native region, *Artocarpus altilis* supports rural livelihoods and food security in the country. It is a common feature of rural fruits markets that provides supplementary income and alternative livelihood opportunities.

Like many indigenous fruit trees *Artocarpus altilis* is not widely cultivated and promoted for food and nutrition security in Nigeria. Improved cultivation of the species holds the promise of increasing on-farm biodiversity, the choice of fruit trees available to farmers and improved rural livelihoods.

Artocarpus altilis is cultivated vegetatively in its native area (Roberts-Nkrumah, 2012) but this has not been the practice in Nigeria and may be responsible for the long period before fruiting of the trees as this is the case with plants of seed origin. To promote the species in the country the vegetative propagation practice needs to be adopted to reduce fruiting age. However the need to assess the storability and germination behaviour of the seeds is important to germplasm preservation and conservation as well as to nursery propagation of the seeds in the country. A study was therefore designed to study the

germination of the seed and the effect of storage on the seed germination parameters.

MATERIALS AND METHODS

The study was conducted at the nursery of the Swamp Forest Research Station of the Forestry Research Institute of Nigeria, at Onne, Rivers state. The area is located on Lat. 4^0 42^I 10.32N and Long. 7^0 10^I 32.46E, with 2400 mm mean annual rainfall, relative humidity 78% in February (dry season) and 89% in July (rainy season), mean annual temperature 27^0C in February and 25^0C in July, soils are ultisols derived of coastal sediments, highly acidic (pH 4.4), with low fertility, and classified as siliceous, isohyperthermic, typic paleudult, usually deep, chemically poor, well drained with good physical properties (Okonkwo *et al.* 2019).

Freshly fallen pods were collected from mother tree and processed immediately after collection. Twenty (20) sample seed were then randomly collected from each of six pods for the measurement of seed dimension. Seed dimensions length (mm) and diameter (mm) were then measured with the aid of a veneer caliper and then converted to centimetres. A total of 160 seeds were used for the germination study in a completely randomized experimental design. Seeds were separated into the following five (5) treatments: fresh intact seeds, (FIS) (separated into six pod origin, A, B, C, E, F, and G), testa removed seeds (TRS), 1day storage (1DS), 7days storage (7DS), and 14 days storage (14DS). Seeds propagation was done in non-transparent plastic containers kept at room temperature (28^oC – 30^oC) in the dark. Seeds were checked for germination every two days. Furthermore *Artocarpus altilis* seed required between a few hours to 24 hours air drying before sowing otherwise seeds grew mouldy and decayed in the germination box. Thus seeds were taken out regularly and washed with water and returned immediately into the germination box. Germination parameters assessed were (1) duration of dormancy: this is the number of days before seed germination, (2) duration of germination (days to complete germination), (3) total germination: this is percent of total germinated seeds per treatment, (4) germination speed: the number of days to reach 50% germination capacity, and (5) uniformity of germination. Data collected were number of days before first and last germination in each treatment and germination count i.e. number of germinated seeds per treatment. Data analysis was done using descriptive statistics, and ANOVA was conducted after normality test and transformation of non-normal data by taking the logarithm.

RESULT

Seed size variability

Mean seed length per pod was pods A 3.4cm, B 3.2 cm, C 3.1cm, E 2.4cm, F 2.5cm, and G 2.2cm while mean seed diameter was pods A 2.5cm, B 2.4cm, C 2.3cm, E 2.4cm, F 2.5cm, and G 2.2cm respectively (fig. 1). There was a significant difference ($p<0.05$) in seed length and diameter among the six (6) pods of *Artocarpus altilis* studied. Seeds from pod B, E, F, and G were more uniform in length with standard deviations from the mean seed length per pod of 0.2cm while seeds from pods A and C were more variable in seed length with 0.3cm and 0.4cm standard deviations from the mean seed length. Seeds from pods C, F, and G were more uniform in seed diameter with a standard deviation of 0.2cm from the mean seed diameter, while seeds from pods A, B, and E were more variable with standard deviation from mean seed diameter of 0.3cm and 0.4cm respectively.

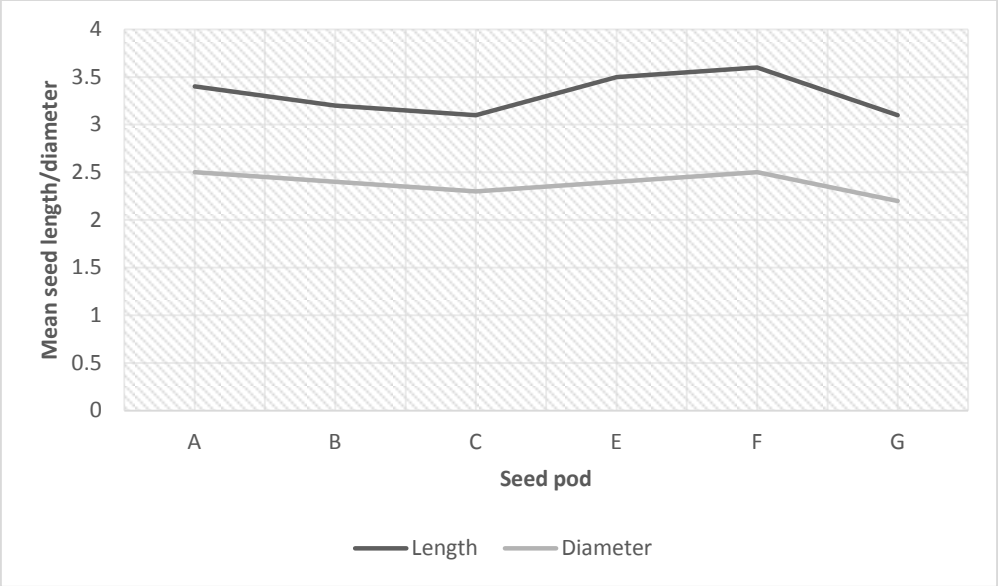

Figure 1: Variation of mean seed length and diameter of *Artocarpus altilis* seed from six pods

Dormancy period

There was no significant difference ($p>0.05$) in the number of days before germination i.e. dormancy period among all 5 seed treatments. Figure 2 however show that TRS had the lowest dormancy period of 2 days before onset of germination: FIS from pods A, B, and C, and 7DS recorded the longest dormancy period of 9 and 8 days respectively while 14DS did not germinate during the period of the study.

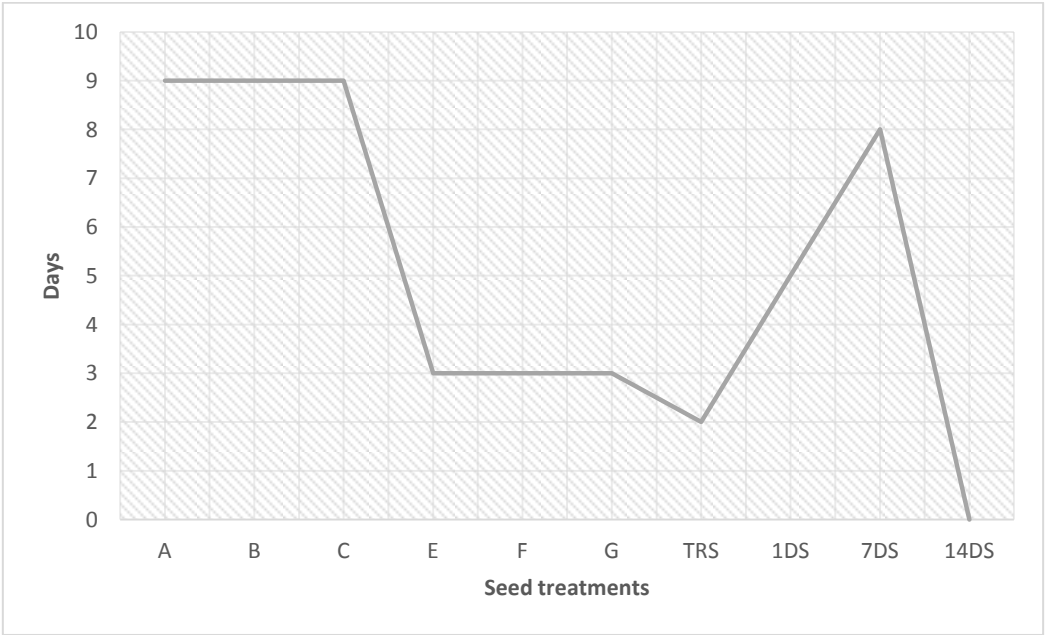

Fig. 2: Effect of seed treatment on duration of dormancy of *Artocarpus altilis* seed.

Days to complete germination

There was no significant difference ($p>0.05$) in the number of days to complete seed batch germination among all 5 seed treatments. However it can be seen from figure 3 that TRS completed germination within the shortest number of days of 5 days, while FIS seeds from three pods A, B, and C, completed germination in 12 days and pods E, F, and G, 17 days, 1DS seeds 13 days, and 7DS seeds completed germinated in 19 days.

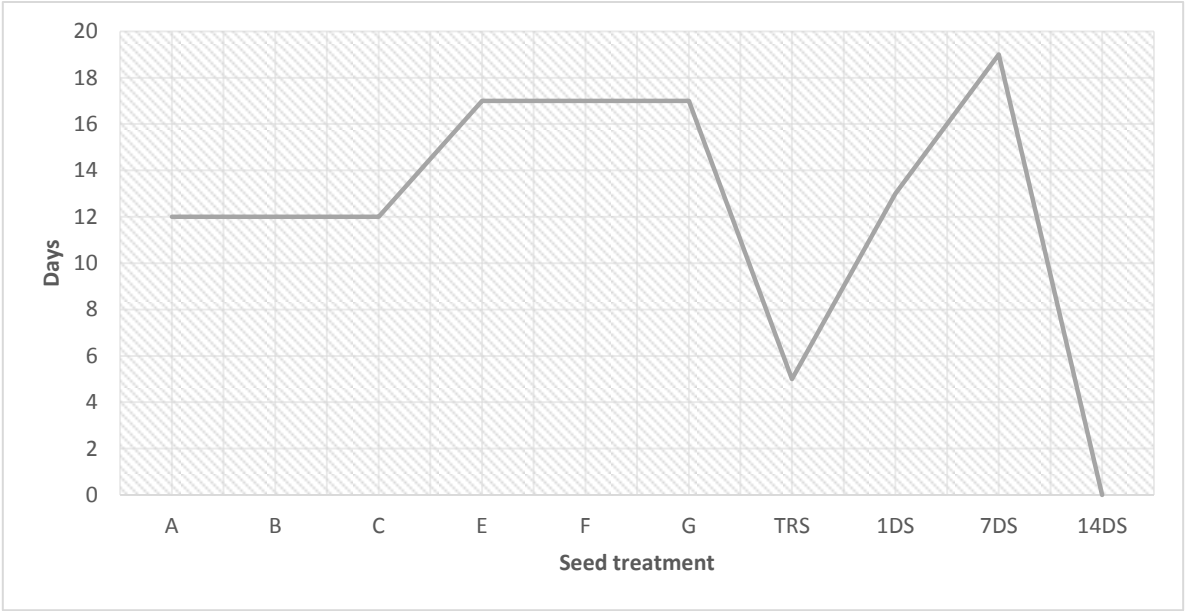

Figure 3 Effect of seed treatment on the number of days to complete germination of *Artocarpus altilis* seed

Total Germination (%)

There was no significant difference ($p>0.05$) in the total number of seeds that germinated (%) among all 5 seed treatments. However the treatments that recorded the highest number of total germinated seed was FIS from pods A, C, G, and TRS, 1DS, 7DS 100%, while FIS from pods B, E, F and 14DS recorded 95%, 90%, 95% and 0% total germinated seeds (fig. 4).

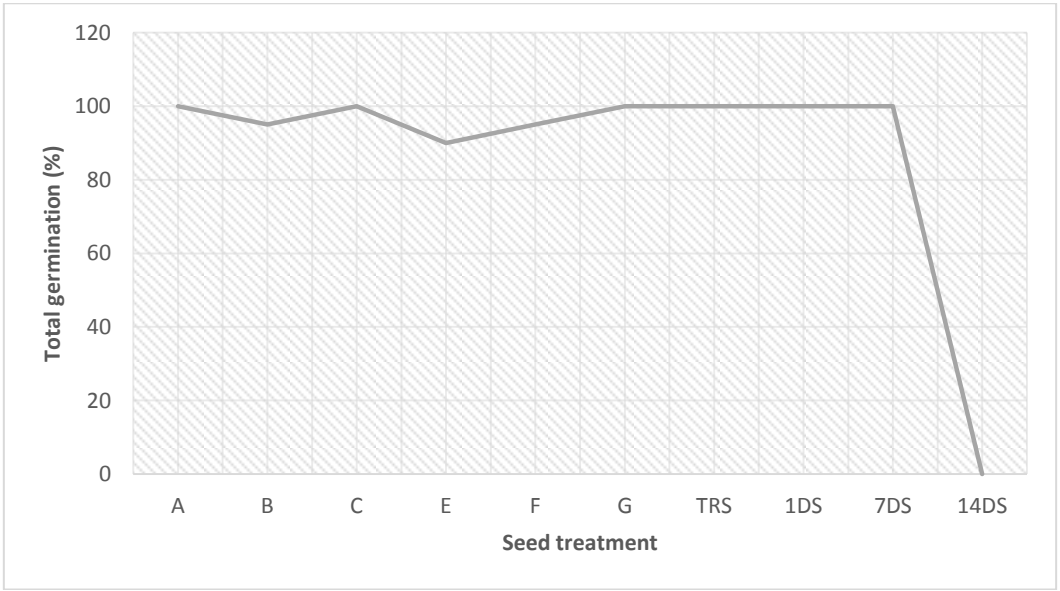

Figure 4: Effect of seed treatment on the number of germinated seeds of *Artocarpus altilis*.

Germination speed

Germination speed, the number of days to reach 50% germination capacity per treatment is shown in figure 5 to be in the order pod A 6 days, pod B 7 days, pod C 5 days pod E 6 days, pod F 5 days, pod G 4 days, TRS 2days, 1DS 5days, 7DS 7 days, and 14DS 0 days respectively. Germination speed was highest in TRS and lowest in pod B, and 7DS.

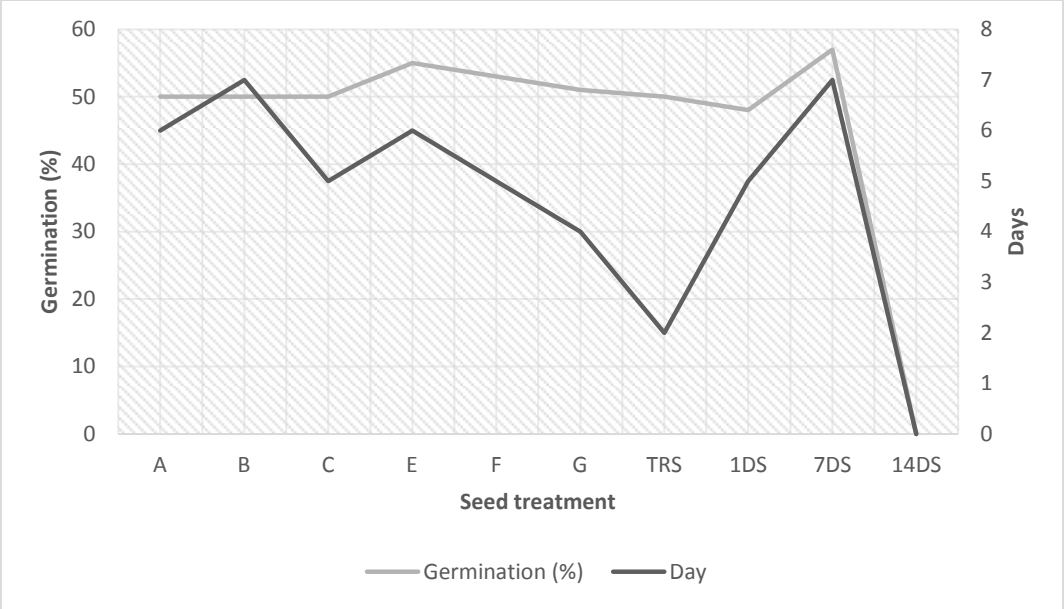

Figure 5: Effect of seed treatment on germination speed of *Artocarpus altilis* seed

Germination uniformity

Standard deviation from the mean germination days per treatment figure 6 show was TRS 2, pods E, F, and G 5, pods A, B, C, and 1DS 6, while 7DS was 10. Germination was therefore most uniform in TRS and least uniform in 7DS seed treatment, the rest of the treatments fall in between the two. There was a more uniform germination in TRS than in all other seed treatments.

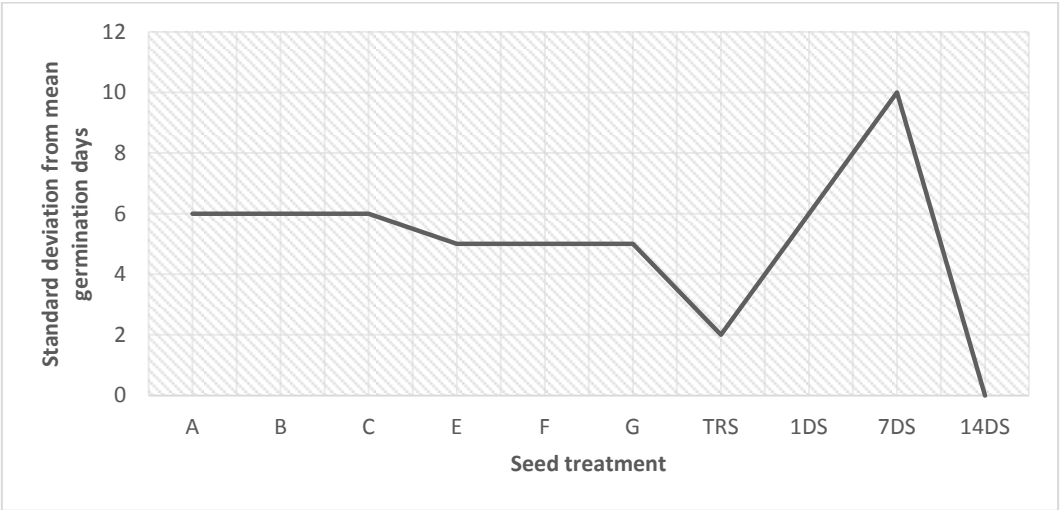

Figure 6: Effect of seed treatment on uniformity of germination in *Artocarpus altilis* seed

DISCUSSION

The significance of the variability in seed size of *Artocarpus altilis* seeds studied is in agreement with (Parrota, 1994) who confirmed variability in seed and fruit character of the species. Seed size is usually an indicator of seed quality and important to germplasm selection and propagation as it generally affects the vigor and performance of the resultant plant (Ambika *et al.* 2014). In plant improvement seed selection is one of the steps taken to ensure that plants produced are elite genotypes (Cookson *et al.* 2001: Adebisi *et al.* 2011): larger seeds usually represent quality and promising genotypes while smaller seeds means weak and poor genotypes. Seed size is also an important factor for consideration when dealing with species of commercial value like *Artocarpus altilis* where large seed or fruit size is desirable (Kumar and Seth. 2004). Therefore to propagate *Artocarpus altilis* from seed in the nursery there

will be the need to sort the seed to ensure the selection of large sized seeds to ensure quality seedlings and planting materials are produced. Furthermore the variability in seed size per pod provides opportunity for clonal selection and propagation of large seeded cultivar to improve the species (Hartmann *et al.* 2014).

Testa removed seeds (TRS) performed better than all other seed treatments in all the germination parameters assessed. This is in agreement with Okonkwo *et al.* (2014) who reported that testa removal improved germination in *Garcinia kola* seeds. Intact seeds (FIS) also performed well (Orwa *et al.* 2009) although not as much as TRS. Therefore in a situation of mass propagation of *Artocarpus altilis* seed fresh intact seeds can as well be used although this will increase the seed dormancy period a little.

Germination performance of *Artocarpus altilis* seeds diminished with increasing storage time. Nuga *et al.* (2011) also reported that storage reduced the germination performance of *Treculia africana* seeds. Seeds that quickly lose viability in storage like *Artocarpus altilis* are normally called recalcitrant seeds. These seeds make difficult germplasm preservation and conservation and require expensive techniques of storage. Although *Artocarpus altilis* is usually propagated vegetatively the recalcitrant nature of the seed raises concerns about future availability of germplasm for propagation of the species against the backdrop of increasing rate of deforestation and biodiversity loss in the tropics.

CONCLUSION

There is the need to sort *Artocarpus altilis* seeds before sowing to select large sized seeds capable of producing vigorous seedlings due to the variability in seed size. However the variability provides also opportunity for clonal selection to improve the cultivated varieties of the species. Artocarpus *altilis* seeds are recalcitrant like many tropical fruit tree seeds. Germplasm preservation and conservation of the species and other indigenous fruit tree seeds therefore will require modern and expensive methods. In the face of growing deforestation concern in the country it is important to consider urgent solutions to the preservation and conservation of germplasm of the species. However field genebanks provide immediate solutions although this should only be considered after proper assessments of the risks from deforestation. There is the need to promote the propagation of the species in the country to improve rural livelihoods. To this end the present propagation of the species from seed must be discarded for the vegetative method that has been successful in the species native areas.

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