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Seed Pre-Sowing Treatment Methods to Improve Germination of *Dacryodes edulis* (G. Don) H.J. Lam, A Multipurpose Forest Tree Species

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ABSTRACT
Experiment was conducted to determine the optimal method for overcoming seed coat dormancy of *Dacryodes edulis* (G.DON) H.J. Lam (African pear). Fruits were germinated using four (4) forms of pre-sowing treatments- depulping of fruit leaving the seed coat (T1), depulped fruit without seed coat (T2), whole fruit without depulping (T3) and decayed fruits (T4) using top soil and river sand as sowing media. One hundred and sixty (160) seeds were used for this study. Cumulative germination counts were made for 6 weeks. T1 and T2 effectively gave 100% germination. However; the rate of germination was faster in river sand. Also, 18% germination was observed for both T3 and T4. The effect of pre-sowing treatment was significantly different ($p < 0.05$). There was no significant difference in the effect of the sowing media or the interaction between pre-sowing treatment and sowing media on the germination percentage. Depulping of fruits with the removal of the seed coat and sowing in riversand are the most appropriate methods for propagation of *Dacryodes edulis* through seeds.

Keywords: sexual propagation, underutilized tree species, non timber forest product

INTRODUCTION

Forest is one of the most diverse natural resources of the world based on its components. According to Evans (1992) about one-third of the earth's surface is forested land. Like other natural resources, forests are unevenly distributed and vary greatly in their potential usefulness from country to country. For instance, Nigeria is home to 1417 known species of fauna and at least 4715 species of vascular plants according to figures from the World Conservation Monitoring Centre. According to Okafor, (1991) conservation of ecosystems and genetic resources of target species in areas where edible plants are found is particularly important in the tropics where the forests are being subjected to destruction or excessive exploitation.

Dacryodes edulis (G.Don) H. J. Lam formerly called *Pachylobus edulis* belongs to the family *Burseraceae*. It is locally known as 'Elemi' (Yoruba) and Ube (Igbo). The common names are: white man's pear (Burkill, 1985), African pear or Butter tree. The oil fruit of *Dacryodes edulis* is a rich source of amino acids and triglycerides. The oil content of the fresh pulp varies between 33 and 65% depending on the variety and the state of maturity (Omoti and Okiy 1987). The fruits resemble those of *Dacryodes buettneri* but they are bigger (Louppe *et al*, 2008). It has the potential to improve nutrition, boost food security, foster rural development and support sustainable landrace. Taxonomic and phenological studies of *D. edulis* based on gross morphology have led to delimitation of intra- specific taxa. The generic name is derived from the Greek word 'dakruon' (a tear) in reference to the resin droplets on the bark surface of its members while the specific name 'edulis' means edible.

Dacryodes edulis is a medium-sized, evergreen tree attaining a height of 18-40 m in the forest but not exceeding 12 m in plantations. It is generally branched from low down, with a deep, dense crown. The bole is rather short, slightly fluted, 50-170 cm in diameter and more or less sinuous. The scented, pale grey, rough bark exudes a whitish resin. Fruits are ellipsoidal drupes rather variable in size, 4-12 x 3-6 cm, resembling olives; exocarp thin, pink, becoming dark blue to violet at maturity; pulp firm and thin. It is a shade-loving species of non-flooded forests in the humid tropical zone. Where there is a well-marked season, it is found only in gallery forest and on swampy ground. *D. edulis* can be cultivated widely, since it adapts well to differences in day length, temperature, rainfall, soils and altitude. It is planted in southern Nigeria, Cameroon and Democratic Republic of Congo for its nutritious fruit, which has high oil content. The species is native to Angola, Benin, Cameroon, Central African Republic, Congo, Cote d'Ivoire, Democratic Republic of Congo, Equatorial Guinea, Gabon, Ghana, Liberia, Nigeria, Sierra Leone, Togo, Uganda while it is exotic in Malaysia (Burkill, 1994; Keay, 1989). The objective of

this study is to investigate the effect of pre-sowing treatment methods on mature seeds of *Dacryodes edulis* with a view to improving germination in the species.

Plate 1: Trees and fruits of *Dacryodes edulis*

Materials and methods

Fresh fruits were collected from the mother tree at National Centre for Genetic Resources and Biotechnology (NACGRAB), Moor Plantation, Ibadan, Oyo State, Nigeria. One hundred and sixty (160) fruits were used for this study. These fruits were divided into four groups of 40 fruits each. They were germinated using four (4) forms of pre-sowing treatments namely- removing of the pulp (mesocarp) alone using surgical blade (T1), removal of the pulp andseed coat (T2), whole fruit without removing the pulp (T3) and decayed fruits (T4). These were sown in two (2) sowing media- top soil and river sand. Cumulative germination counts were recorded for 6 weeks. The data collected was subjected to analysis of variance (ANOVA). Significant differences in means were separated using Least Significant Difference (LSD).

RESULTS AND DISCUSSION

Effect of pre-sowing treatment on the germination of *D. edulis* seed

The effect of pre-sowing treatment was significantly different ($p < 0.05$) (Table 1). There was no significant difference in the germination either in the sowing media or in the interaction between pre-sowing treatment and sowing media. Using Least significant difference, a follow up test was carried out on pre-sowing treatments used, this showed that fruits without depulping (T3) and decayed fruits (T4) were not significantly different from each other with mean values of 13.3% and 8.3% respectively. Depulped fruit leaving the seed coat (T1) with the mean value of 55.4% was significantly different from decayed fruit, fruits sown without pulping and depulped fruit without seed coat. Depulped fruit without seed coat with the mean value 81.7% was significantly different from decayed fruit, those sown without depulping and depulped fruits with seed coat (Table 2).

Table 1: Analysis of variance for the effect pre-sowing treatments on the germination of *D. edulis* seed

SV	**DF**	**SS=**df x ms	Ms	F	P-level
Pre-sowing treatment (P)	3	44,247.39	14749.13	19.37	0.00*
Medium (M)	1	117.19	117.19	0.15	0.69 ns
P X M	3	343.23	114.41	0.15	0.93 ns
Error	40	30462.50	761.56		
Total	47				

* significant at 5% probability level

NS- not significant at 5% probability level.

Table 2: Mean values for the effect of pre-sowing treatment on germination of *D. edulis*

Pre-sowing treatments	Mean Germination %
Whole fruit without depulping (T3)	8.3a
Decayed fruits (T4)	13.3a
Depulped fruit leaving the seed coat (T1)	55.4b
Depulped fruit without seed coat (T2)	81.7c

*Means with the same letters are not significantly different

Effect of pre-sowing treatments on germination of *D. edulis* across the assessment period

Figure 1 shows that, at the end of six weeks, depulped fruit without seed coat (T2) and depulped fruit leaving the seed coat (T1) gave 100% germination on both sowing media while decayed fruits (T4) and whole fruit without depulping (T3) gave 18% on the two sowing media. It was also observed that germination was fastest in depulped fruit without seed coat, at the end of first week 20% germination was recorded, 60% germination by the 2nd week and 100% by the 3rd week. Although depulped fruit with seed coat also gave 100% but at a slower rate, 0% in the 1st week, < 10% in the 2nd week, < 60% in the 3rd week , < 100% in the 4th and 5th week and finally 100% in the 6th week. Also from the graph it can be inferred that the germination rate for decayed fruit and fruits without depulping is very slow for the period of six weeks.

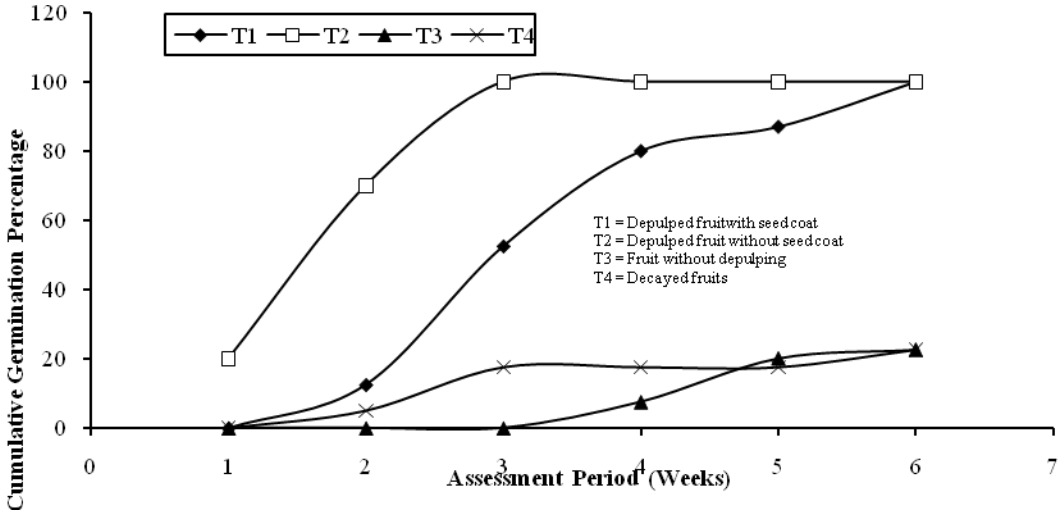

Figure 1: Cummulative germination percentage of *Dacryodes edulis* seeds under different pre-sowing treatments

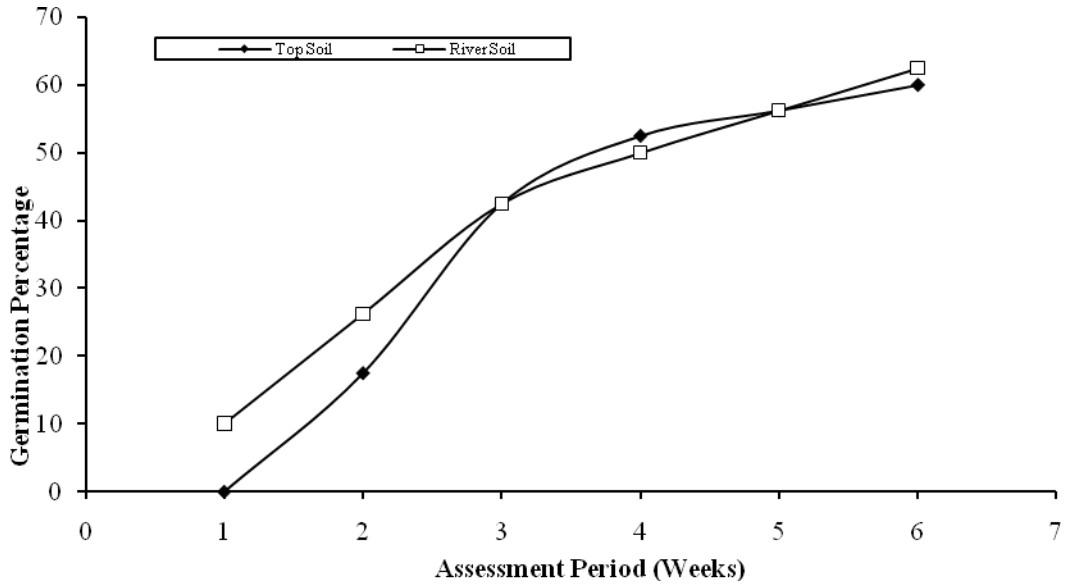

Figure 2: Germination percentage of *Dacryodes edulis* seeds under different sowing media

Effect of sowing media on germination of *D. edulis* seeds across the assessment period.

Although there was no significant difference on the effect of sowing media on the germination of *D. edulis* seeds as both sowing media gave the same result at the end of the assessment period but the effect on rate of germination differs. Germination in river sand started in the 1st week of sowing, with 10%, and over 20% in the 2nd week, there was zero germination in the 1st week and less than 20% germination in the 2nd week for seeds sown in top soil. Both media intercepted in the 3rd and 5th week (Figure 2). This is in agreement with the observations of Akinyele (2007) who recorded no significant difference in the germination of seeds of *Buchholzia coriacea* sown in both topsoil and riversand.

Depulped fruits of *D. edulis* without seed coat sown in river sand gave the highest cumulative percentage at the earliest time. This was due to the fact that the seed coat had been removed. This is contrary to what was observed in *Vitellaria paradoxa* (shea butter), where highest germination was recorded in uncracked seeds with 55%, followed by seed with seed coat cracked at microphyla end 35.6% while seeds whose coats were totally removed had 15% (Aderounmu, 2010). The seed sown without depulping and the ones whose mesocarp was allowed to decay before sowing gave very poor result with less than 20% germination. This is because the cotyledons of seeds without depulping were infected, by the time it was in the sowing media for weeks, they turned brown from pink colour. The germination of *D. edulis* is epigeal therefore in the depulped fruits without seed coat, the embryo fed immediately on the food stored in the cotyledon, absorbed water and latent heat then sprouted within one week by bringing up its seeds. The sowing media- river sand and top soil- gave the same result at the end of the experiment, but at different germination rates. This can be inferred from the compaction nature of top soil and fewer pore spaces due to the presence of humus and clay particles. The germination rate of river sand was faster because of adequate pores spaces in the soil particles. This makes it easier for the tender roots of the seedlings to penetrate without much restriction.

CONCLUSION

The viability of a seed is the capacity of the seed to survive and to continue to develop. This is a crucial quality for germination. Majority of rainforest species are known to have seeds, which lose viability within a few days under the conditions of high temperature and high humidity (Roberts, 1988). Temperature, water, gases and sunlight have been identified as the most essential factors, which affect germination of seeds. However, there are other factors, which are internal to the seed that could inhibit germination even when the environmental conditions are optimal. These inhibitors which include impermeable seed coat and soluble chemical in the seed can be removed in various ways. Such pre-sowing treatments include soaking of seeds in cold water before sowing, using hot water treatment short exposure to a high temperature, chemicals, partial removal of seed coat, scarification and stratification (Toodd-Bockarie and Duryea, 1993; Maghembe, 1994; Bongkik, 1996; Moussa *et al*, 1998 and Verheij, 2004). The best pre-sowing treatment for raising *Dacryodes edulis* seedling as shown

in this investigation is depulping the fruits, removal of the seed coat and using river sand as the sowing medium. In a situation where river sand is not available, top soil can be used as a substitute. Fruits should not be sown without depulping nor be allowed to decay before sowing.

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