Journal of Applied Sciences Research, 5(10): 1515-1519, 2009

Effect of Presowing Treatments on Seed Germination and Percentage Starch Content Levels in *Tamarindus indica, prosopis africana, parkia biglobossa* and *Albizia lebbeck*

[1]AJIBOYE,A.A., [2]M.O. ATAYESE AND [3]D.A. AGBOOLA

[1]Department of Biological Sciences, Osun State University P.M.B. 4494
Osogbo, Osun State, Nigeria.
[2]Department of Plant Physiology and Crop Production, University of Agriculture,
P.M.B. 2240, Abeokuta, Ogun State, Nigeria
[3]Department of Biological Sciences University of Agriculture,
P.M.B. 2240, Abeokuta, Ogun State, Nigeria

Abstract: Investigations on Pre-germination treatment and determination of percentage starch content levels of four savanna its delepeforest tree species in Nigeria, *Tamarindus indica* (L), *Parkia biglobossa* (Jacq.) R. Br. Don, *Albizia lebbeck* (Benth) and *Prosopis africana* (Guill & Perr) were conducted. Percentage germination of acid alcohol treatments was 100% in *Albizia*, and 80-90% under 10-15mins time of scarification. The percentage germination of the Plier treatments was 70% in *Tamarindus* seeds. About 100% germination was obtained for *Tamarindus* seeds while 60% and 20% was observed for *Albizia* and *Prosopis* respectively. The 5 weeks cold storage treatments at 4°C gave 80% germination in *Albizia* and 70% in *Tamarindus*. Untreated seeds served as control. The starch content level in fresh seeds was 27.2% in *Parkia*, 26.6% in *Prosopis*, 26.4% in *Albizia* and 26.0% in *Tamarindus*. Data were subjected in to Analysis of Variance (ANOVA) using Least significant difference test (LSD[t]).

Key words: Seed germination, savanna, forest, acid/alcohol, plier and emery cloth abrasion.

INTRODUCTION

The savanna in Nigeria covers more than half of the country's land expanse [2]. This is divided into three major zones including the Guinea savanna, Sudan and Sahel savanna, from the south to the northern part of the country. The zoning is based basically on the areas that are covered by grasses [10,11]. The savanna tree, species of economic importance in Nigeria include *Terminalis glaucescence, Acacia albida, Cassia lebbeck, Afzelia Africana, Terminalis superba, Dialum guineensis, Haraugana madagascariensis*. Their roles in the savanna cannot be underrated. The complex is a balanced ecological situation which assures that most of the Nitrogen required by grass species are fixed naturally by leguminous plants [3]. Wild species of the savanna plants, especially tree legumes, have been a significant source of edible fruits, vegetables, medicinal plants, charcoal, gum, resin and timber for carnivals and constuction, provision of shade for man and livestock [2].

The tree legumes are very drought resistant and are well adapted to the heat and poor soils of dry regions. These trees thrive in light sandy or rocky soil. They can grow and develop to about 20-40m tall. Most of the tree seeds can retain viability for a long period of time. The wood of these trees are for construction and as poles for fencing. They serve as good shade in yards and parks. Some of their seeds are used to prepare special delicacies (*Prosopis africana, Parkia biglobossa* and *Tamarindus indica*) for the people living in the savanna. Most of their tree parts have medicinal values for treating ailments.

These valuable tree legumes are not cultivated due to handedness of their seed coats. They face regular savannah bush burning and deforestation with little regard for reforestation. It is therefore observed that their seeds suffer from dormancy problems. The research goes a further step ahead in knowing and determining the percentage starch content level present in the fresh mature seeds of the tree legumes before germination. Because it is believed that what is present in the seeds will affect the performance of the germination. Therefore, the study aimed at providing the presowing conditions for improvement in seed germinability of these valuable tree legumes, in order to promote seedling establishment for afforestation and forest regeneration.

MATERIALS AND METHODS

Seed Procurement and Seed Processing: The fruits of *Tamarindus indica, Parkia biglobossa, Prosopis africana* and *Albizia lebbeck* were collected under the

Corresponding Author: AJIBOYE, A.A., Department of Biological Sciences, Osun State University P.M.B. 4494 Osogbo, Osun State, Nigeria
Email-abidupsy @yahoo.com

tree stands within the campus of University of Ilorin, Nigeria (8.32°N and 4.34°E). This is an area in the Guinea savanna zone of Nigeria. The fruits were split open manually and the seeds were extracted. The processed seeds were sun dried for 6 hours. The seeds were stored in desicators.

Viability tests: An instrument called HACH viability test meter was used to carry out viability tests on the seeds. The meter was used in the Plant physiology laboratory of International Institute of Tropical Agriculture (IITA) Ibadan. This machine was calibrated with pure water and water drops was wiped off completely on the electrode of the meter with sterile tissue paper. The seeds at each case were put in extraction cup while the electrode of the meter was dipped in the extraction cup containing the seeds. The viability readings were observed and recorded for each tree seed species.

Per-seed Treatments: Seeds were divided into lots, 100 seeds from each lot were immersed in acidlcohol (3:7%). Some quantities of sulphuric acid was added dropwise in absolute alcohol solution in ratio 3:7%. The mixture was allowed to cool down for an hour. Clean seeds were poured for periods ranging from 10-15mins and stirred at intervals. The acids was decanted and seeds were immediately washed in several changes of distilled water. The set up was air dried for 5mins and put in 9cm Petri dishes containing 2 sterile filter paper soaked with distilled water. The Petri dishes were kept under laboratory conditions at (29 ± 1°C) and germination was recorded daily. Emergence of radicles at 1cm was taken as visible signs of successful germination.

Plier and Emry Cloth Abrasion Treatments: Seed coats were cracked by using 6 inches size of a plier. The seeds which were dipped at the distal and tip of the mycropylar ends were prepared for germination in the 9cm Petri dishes. Some seed coats were also rubbed against emery cloths which have coarse surface. The seeds were surface sterilized with 5% mercuric chloride and prepared for germination.

Cold Storage Treatments: Some fresh seeds lots were put in the 9cm glass Petri dishes and placed in the refrigerator along with a thermometer for 1-5 weeks. The refrigerator was set in 4°C. Untreated seeds served as control.

Determination of Percentage Starch Content Level in the Seeds: About 0.05g sample of seeds was weighed at each case into centrifuge tubes and wet with 0.1ml of 95% ethanol, 2.0ml distilled water was added and mixed thoroughly. After which, 10.0ml hot 95% ethanol and vortex was equally added. The whole process was centrifuged with bench centrifuge for 10mins. The supernatant was decanted into volumetric flask and made up to mark, 0.5m of 5% phenol was added and mixed with 2.5ml conc. H_2SO_4 and vortex. This was allowed to cooled and absorbance was read at 490nm. A standard curve was made using 0.100µg/ml glucose flowing the use of 0.1-1.0ml extract that was diluted to 1ml with distilled water. The residue was then hydrolysed with perchloric acid into monosaccharides. The sugars were quantified colorimetrically using phenol and sulphuric acid. Sugars extracted from the seeds gave a brown colour when treated with phenol and sulphuric acid. Sugars with the solvent are directly analyzed to determine the sugar content. Sugars obtained after hydrolysis of the residue was converted to starch by multiplying by 0.9.

RESULTS AND DISCUSSION

The highest percentage viability testing was observed in the seeds of *Prosopis africana* with 100%. Followed by *Albizia, Parkia* and *Tamarindus* with 90-80% percentage viability (Fig. 1).

Fig. 2 and 3 showed the percentage germination of the seeds when subjected into acid/alcohol treatments. It was observed that the highest percentage germination was observed in the seeds of *Albizia lebbeck* after 10mins of duration treatments. Followed by the seeds of *Parkia* that showed about 50-60% germination percentage. Fig. 2. *Albizia* responded positively with acid/alcohol treatments under 15mins time duration by showing up to 80-90% germination. The seeds of *Parkia* showed about 40% germination. While the seeds of *Prosopis* and *Tamarindus* were not favoured by the treatments Fig. 3. The effect of plier and emery cloth abrasion treatments on seed germination of those tree species was maximum with the seeds of *Tamarindus* showing up to 60-70% germination under plier scarification treatments. Whereas , *Albizia* showed 20% germination *Parkia* and *Prosopis* plus control showed 0% germination Fig. 4.

Maximally, the seed pretreatments of emery cloth abrasion supported the growth and germination of *Tamarindus* seeds (100%) while the seeds of *Albizia* favoured under the treatments by showing 60% germination. The *Prosopis* seeds showed only 20% percentage germination while control and *Parkia* seeds did not support the pre-germination treatments. This is evident in showing 0% percentage germination Fig. 5.

The starch content level in each seed was determined. It was showed that about 27.2% of starch level content was obtained for *Parkia* seeds. Followed by 26.6% starch content level obtained for *Prosopis* seeds. About 26.4% was obtained for *Albizia* seeds. However 26% of starch content level was obtained for *Tamarindus* being the lowest of all Fig. 6.

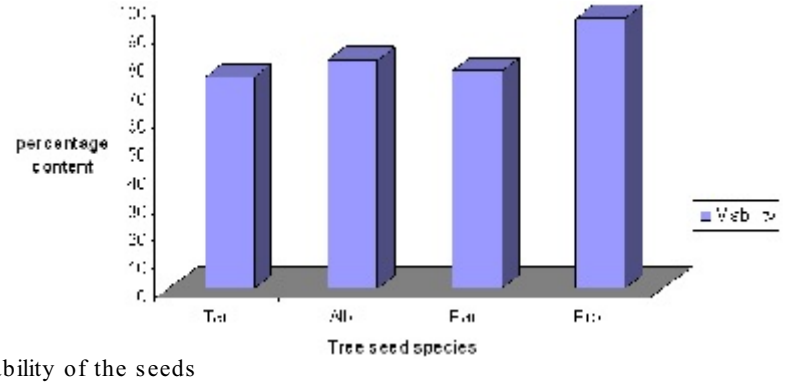

Fig. 1: Percentage Viability of the seeds

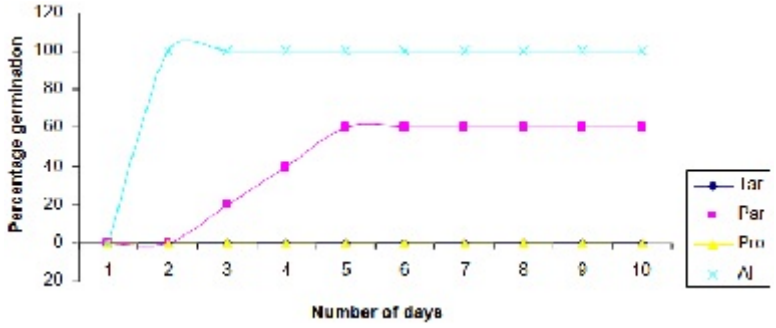

Fig. 2: Effect of Acid/Alcohol scarification on seed germination of tree species for 10mins

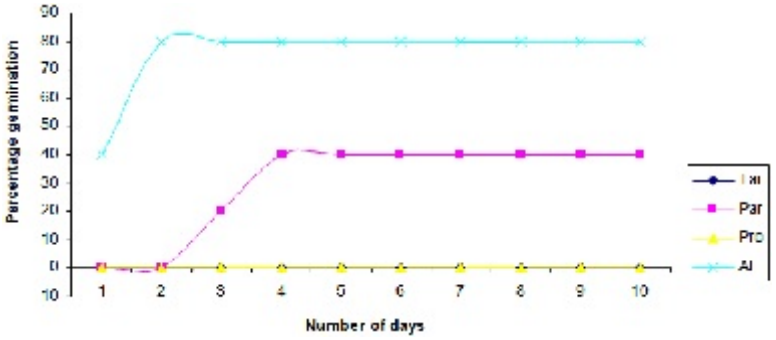

Fig. 3: Effect of Acid/Alcohol scarification on seed germination of tree species for 15mins

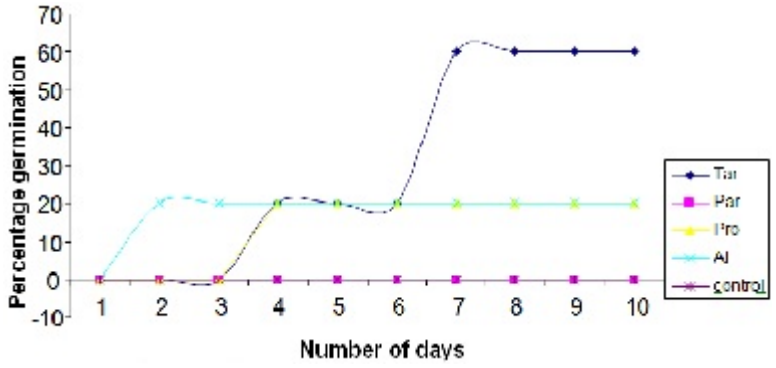

Fig. 4: Effect of Plier treatment on seed germination of tree species

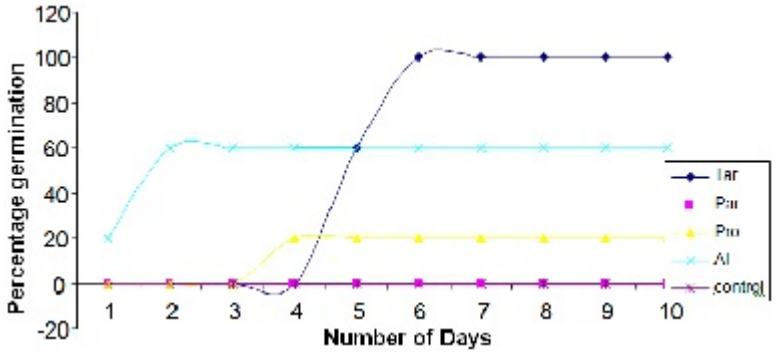

Fig. 5: Effect of Emry cloth treatment on seed germination of tree species

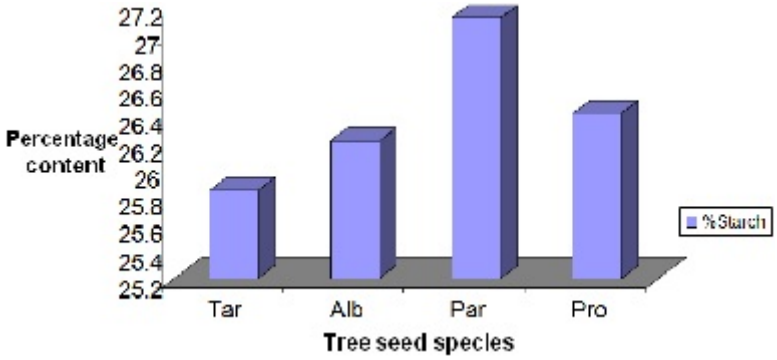

Fig. 6: Determination of Starch content of the seeds

Discussion: The seeds of the four tree species have been observed to exhibit physical dormancy due to hardedness of their seed coats. Apparently, seeds with this form of dormancy possess hard or thick testa, pericarps or other structures that impose high mechanical resistance on non-dormant embryo, or block water uptake of influx of oxygen into the internal parts of the seeds. An attempt to eradicate this problems may lead to the usage of some seed pre-treatments that can render the seed costs that is hard permeable to water and other constituents that can promote or induce germination in the viable seeds.

The pre-germination treatments employed are designed to soften, puncture, wear away or split the seed coat in order to access the embryo for germination. The use of plier and emery cloth abrasion could be termed the "mechanical" method of pre-germination treatments. This method has also been proved by Agboola D.A. [1] The use of acid/alcohol treatments could be termed the chemical method of scarification to raise germination in savanna tree seeds. This method was found to improve germination in both tropical and savanna tree seeds. Sulphuric acid treatments has been found to be effective for several tropical species such as *Acacia albida, Cassia siemea, Terminalia Sivorensis, Terminalia grandifolia* etc. [13,7,12,1].

Cold storage system of seed pre-treatment are also found to be effective in seed germination of these seeds especially in the seeds of *Tamarindus* and *Albizia*. That of *Parkia* and *Prosopis* seeds were found not to be effective with the treatments. As a result of the fact that the seeds were found to be spoilt after about 1-2 weeks of cold storage. This implies that the cooling effect that the storage had on the seed coats may help to rupture or soften it which had helped to pave way for water and oxygen into the embryo of the seeds thereby mobilizing the food reserves in the embryo that had led to the germination of the seeds. There have been various instances where low or high temperature treatments have been used to terminate dormancy. Low or high temperature may cause changes in the structure of the seed coats thereby causing permeability of seeds to water and gases which enhance germination [5]. This work compare closely with those of [6,4,1,2,9] have increasingly pointed out that the barrier effect of the seed coat could be due to the physical or chemical characteristics of the seed coats as well as the permeability changes to water, gases or solutes [8]. In the savanna zones, fire is a powerful natural factor in the removal of seed coat dormancy. The annual bush burning which is of common occurrence for hunting and bush clearing in the savannah was found to reduce seed coat impermeability.

There is evidence of reduction in reserves of starch content level of the seeds in savanna. The growth of the embryonic axis requires active respiration and involves the synthesis of new cell wall maternal and protoplasm. The starch and other food reserves are used in the process of germination. The controlling mechanism in the germination of seeds of *Tamarindus, Parkia, Prosopis* and *Albizia* seems to be the mechanical strength of the seed coat.

ACKNOWLEDGEMENT

We acknowledged the technical support of Mrs. M. D. Ajiboye and Mr. Basil of IITA.

REFERENCES

1. Agboola, D.A., 1995: Studies on dormancy and germination of seeds of *Prosopis africana*. Nigerian Journal of Botany, 8: 45-56.
2. Agboola, D.A., A.O. Ebofin, A.M. Aduradola and A. A. Ajiboye, 2006: Effect of presowing treatments on seed germination of two savanna tree legumes. Journal of Tropical Forestry. J., 20: 1-II.
3. Ajiboye, A.A., A.O. Ebofin, M. S. Atayese, M.O. Adedire and D.A. Agboola, 2006. Effect of presowing treatments and ectomycorrhiza on seed germination and seedling growth of two multipurpose savanna tree legumes, Dialium guineensis and Prosopis Africana. BEST Journal, 3(4): 23-28.
4. Esan, K., 1965. Seed coat. In: Plant Anatomy 2nd ed. John Willey and Sons. Inc. New York, 617-623.
5. Fasidi, I.O., Isamani, M. Kadiri and D.A. Agboola 2000. Dormancy types and water uptake in seed of *Parkia biglobossa* (Jacq.) R. Br. Don. Journal of Natural and Applied Sciences, 1(1): 14-20.
6. Hyde, E.O.C., 1954. The function of the helium in a papilonaceae in reaction to ripening of the seed and permeability of the testa. Annals of Botany, 18: 241-256.
7. Kariski, E.M., 1987. Effect of presowing treatment on seed germination of four important tree species in Kenya. Proceeding of International symposium on forest seed problems in Africa. Harare, Zimbabwe August 23rs – September 2nd Umea, Sweden.
8. Khan, A. A., 1980. The physiology and biochemistry of seed germination. North Holland Co. New York, 29-32.
9. Kozlowski, T.T., 1971. Growth and development of trees. Academic Press Ltd. London, 1: 71-81.
10. Nielson, M.S., 1965. Flowering plants of West Africa. University of London Press Ltd., 39-49.
11. Olorode, O., 2002. Vegetation fauna. In: Atlas of Nigeria (Africa Atlas) Bieflot Printers, Belgium., 66-67.
12. Snezko, R.A. and D.P. Gwaze, 1987. Effect of seed treatment on germination of *Acacia albida* Del. Proceedings of International symposium on forest seed problems in Africa. Harare, Zimbabwe August 23-September 2, 1987, Umea, Sweden.
13. William, R.L., 1993. Seed pretreatment to overcome dormancy: In seed pretreatment technical note No. C-10, Darida Forest Seed Centre, Denmark.