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Best Pre-Germination Techniques on *Spondias mombin* Linn. Seeds for Plantation Establishment

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Abstract: Hog plum (*Spondias mombin* L.) seeds exhibit physical innate dormancy due to its hard seed coat. In order to determine the best method of germinating the seed of this important fruit tree, its seeds were subjected to seven pre-germination treatments which include; soaking of seeds in 60% concentrated tetraoxosulphate (VI) acid (H_2SO_4) for 5 and 10 minutes, soaking in cold water, hot water and scarification using sandpaper. Seed germination was monitored for 8 weeks (56 days). Seeds scarified with sandpaper at the micropyle had the highest germination percentage of 70%, while those seeds that were not treated at all had 45% germination. The result showed significant difference (P= 0.05) among the treatments used. It therefore revealed that, the best pre-germination treatment for *S. mombin* seeds is sandpaper scarification at both distal end and at the micropyle.

Key words: Seed · Dormancy · *Spondias mombin* · Germination · Treatments · Scarification

INTRODUCTION

Spondias mombin is one of the chief agroforestry trees of the tropics. The tree is a native and common on moist lowland forests from Southern Mexico to Peru and Brazil and in many of the West Indies. It grows to a limited extent in India and Indonesia; is rare in Malaya, but widely cultivated and naturalized in tropical Africa. Its genus is *Spondias* while the family is Anacardiaceae. In Nigeria, Yoruba calls its fruits *"Iyeye"* [1] and trees *"Akika"*; "Oheeghe" (the fruit) in Edo; Nsukakara in Efik; *"Isada"* in Hausa [1]; *"ngwu or ngulungwu in Igbo* [2, 3]. The local names vary widely. *S. mombin* is a tree that grows to 20 metres high and its trunk up to 60-75cm in diameter. The best known species identified are yellow mombin *(Spondias mombin)* or hog plum and red mombin or Spanish plum (*Spondias purpurea*). It grows in the rainforest and in the coastal area. The fruit is like the temperate plum, 3.7 centimeters long, ovoid, one-seeded, yellow-skinned when ripe. The fruit of *S. mombin* is commonly sold in most local markets especially during its fruiting season. Young leaves are cooked as greens and excessive indulgence in the fruit can cause dysentery [3]. As a result of the presence of ascorbic acid in *S. mombin* leaves, the plant can be used in herbal medicine for the treatment of common cold and other diseases like prostate cancer [4, 5]. *S. mombin* is also used for various herbal remedies for numerous conditions and virtually every part of the tree is used for curing various ailments from its thick corky barks to its fruits, roots and even flowers [6]. It is also used as anti-helmintic [7], anti-malarial [8] and used as reduced glutathione synthesis [9]. The plant has been traditionally noted for its medicinal and food values. It was reported that the plant has a wide range of antibacterial and antifungal properties [10, 11]. Kramer [12] recommended its use for pregnant woman but

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only after five months of pregnancy. Ayoka [13] has confirmed that the fruits of Spondias have been traditionally noted for its medicinal and food values. Hence, the awareness of the potentials of this tree species has increased the demand for its seedlings [6, 7].

Since seed is fundamental in silviculture for both artificial and natural regeneration, hence, to provide high quality trees, one has to sow high quality seeds [14]. The propagation of trees is majorly from seeds and it is very vital to have a successful plantation raised from suitable and quality seeds [15]. Propagation through seeds is a very cheap method of agroforestry tree plantation establishment. These seeds must germinate first to seedlings. Even though, germination of seeds requires absorption of water by the seeds because, seeds of trees species have thick "seed coat" that inhibit water absorption and thus delay germination [16]. One of major constraints in working with seeds is the dormancy even when all other necessary conditions are constant. Some attributes which affect germination of seeds and growth of seedlings are also encountered in many of the tree species. These include hard seed coats, type of seeds and size in addition to the problem of seed dormancy and longevity [17]. These can be terminated by stratification, temperature manipulations, leaching in water and sun-drying [18-22.] *S. mombin* as one of the socio-economic trees which serves in many purposes are being exploited for food, timber, wood products and other services like shelter or shade and boundary, barriers or support. These make the tree endangered and if not regenerated, there will be loss in genetic resources embedded in it and ultimately going into extinction.

MATERIALS AND METHODS

The study was carried out in the forest nursery of the Federal University of Agriculture, Abeokuta. The University is located along Alabata road, North-East of Abeokuta within latitude $7^{0}12^{1}$ N and $7^{0}58^{1}$ N and longitude $3^{0}20^{1}$ E and $3^{0}37^{1}$ E, respectively. Seeds of *S. mombin* were obtained from Center for Environmental Resources Management, Research and Development (CENRAD), Jericho, Ibadan, Nigeria. Other vital materials include: acid of 60% concentrated H_2SO_4 solution, water, river sand, top soil and cow dung, watering can, germination polythene bags (28cm x 24cm), sand paper and field book for recording data. The potting mixture was prepared by sieving the river sand, top soil and cow dung with 2mm sieve and mixed in ratio 1:2:1.

Table 1: Dormant seeds of Hog plum (*Spondias mombin* L.) were subject to the following pre-germination treatments.

Treatments	Description of the treatments
A	Seeds scarified with sand paper at distal end
B	Seeds scarified with sand paper at the micropyle
C	Seeds soaked in cold water for 24 hours
D	Seeds soaked in hot water for 5 minutes
E	Seeds soaked in 60% concentrated H_2SO_4 for 5 minutes
F	Seeds soaked in 60% concentrated H_2SO_4 for 10 minutes
G	No treatment (Control)

The mixture was then put into 28 germination polythene bags of 28cm by 24cm dimensions. Each of the polythene bags were sown with treated seeds and arranged in a Randomized Complete Design (RCD) as labeled in seven treatments as; A, B, C, D, E, F, G and replicated into four (4) I, II, III, IV replicates. Therefore, the various pre-germination treatments used for breaking the seed dormancy of the hog plum (*S. mombin*) include; A-seeds scarified with sand paper at distal end, B-seeds scarified with sand paper at the micropyle, C-seeds soaked in cold water for 24 hours, D-seeds soaked in hot water for 5 minutes, E-seeds soaked in 60% concentrated H_2SO_4 for 5 minutes, F-seeds soaked in 60% concentrated H_2SO_4 for 10 minutes and G-no treatment (Table 1). Forty (40) seeds were treated under each of the above treatments in order to break the seed dormancy. A total number of 280 seeds were sown, that is, 10 seeds were sown in each polythene bag and watering was done on regular basis to avoid drying off of the seeds.

RESULTS

It was revealed from the result that various pre-germination treatments had significant (P=0.05) effect on the *S. mombin* seeds (Table 2). Among the various treatments used, treatment B gave the best germination with 70% germination percentage and treatment D had the lowest germination percentage of 20% (Fig. 1). Both treatments showed that scarification of seeds with sand paper at the micropyle gives the best pre-germination treatment on *S. mombin* and seeds soak in hot water for too long (5 minutes) results in severe damage of the seed embryo.

Model:

$$Y_{ijk} = \mu + R_i + T_j + E_{ijk}$$

where:

Y_{ijk} – Individual observation for jth treatment and ith replicate,

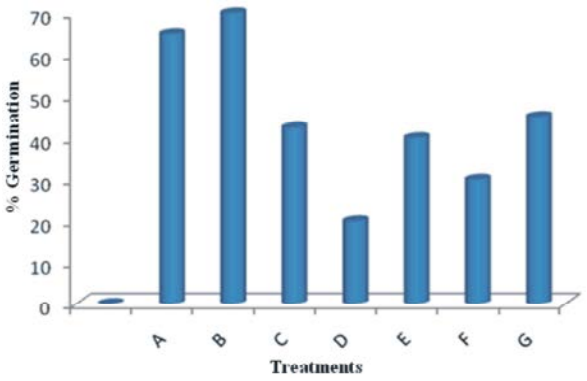

Fig. 1: Germination percentage of the Spondias mombin seeds on various treatments used

Table 2: Analysis of variance (ANOVA) for the pre-germination treatment of *Spondiasmombin* Linn. seeds.

SV	DF	SS	MS	F-Values
Replicate	3	2.11	0.70	0.68
Treatment	6	76.22	12.70	12.26
Error	18	18.64		
Total	27	96.97		

SV= Source of Variation, DF=Degree of Freedom, SS= Sum of Square, MS= Mean Square, F-Values (F- Calculated)

μ = General mean
R_i = Effect of the jth Replicates
T_j = Effect of the jth Treatments
E_{ijk} = Experimental Error

In RCBD, there is no restriction on the number of replicates and treatments that can be used. So, grouping the experimental units into replicates yield more precise results.

Hypothesis

Treatment:

Ho = The effect of the seven treatments are not significantly different.

H_A = The effects of the seven treatments are significantly different.

Replicate:

Ho = No significant different in the replicates

H_A = Significant different in the replicates

Treatments

F-calculated = 12.26**,** F-Tabulated at 0.05 level of significant = 3.16.

With respect to the treatments, the F-calculated (12.26) is greater than F-tabulated (3.16) at 0.05% level of significance. Therefore, Ho is rejected. It is concluded that there is significant differences in the effects of the seven treatments on the germination rates of the seed by accepting H_A.

Replicates

F-calculated = 0.68, F-tabulated at 0.05 level of significance = 2.66

With respect to the replicates, the F-calculated (0.68) is less than F-tabulated (2.66) at 0.05% level of significance. Meaning that, Ho is accepted and H_A is rejected. Therefore, there is no significant difference in the effects of the seven treatments on the germination rates of the seeds in each replicate.

DISCUSSION

The seeds of *Spondias mombin* germinate whenever the plumule emerges from above the soil (hypogenous germination) as confirmed by Roshetko [25]. Therefore, *Spondias mombin* seeds express hypogeal germination type. There was difference in the germination rate of the seeds in each treatment because pre-germination treatments speed up the germination of seeds as mentioned by Agboola [23]. Germination of seeds started on the 10th day of sowing due to the fact that it has overcome dormancy according to the opinion of Roshetko [25]. The seeds scarification with sand paper at the micropyle (treatment B) and at the distal end (treatment A) respectively germinated first. This suggests that the seed embryo sprouts from the micropyle and distal end sides of the seeds. Therefore, treatment B gave the best seed germination (70%) and followed by treatment A with (65%) seed germination.

CONCLUSION

Germination of seeds is vital to all sowers, whether Silviculturists, Botanists, Agriculturists. It is therefore, essential to determine the best, cheap and safest seeds pre-germination treatments to quicken their germination rate and growth. It is obvious from this study that the *Spondias mombin* seeds scarified with sand paper at the micropyle gave the best and highest germination percentage (70%), while seeds boiled in hot water for five (5) minutes gave least germination percentage (20%). The seeds not treated at all gave (45%) response despite hard seed coat dormancy which is the problem of germination in *Spondias mombin* seeds. Treatments E and F with

60% concentrated H_2SO_4 for six (6) and ten (10) minutes which gave (40% and 30%) respectively. It has been discovered that sand paper scarification is cheap, less expensive and can be handled by all farmers compared with acid which requires skill. Therefore, seeds of *S. mombin* are best germinated if scarified with sand paper at both the micropyle and distal end.

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