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Germination Response of *Acacia senegal* (Linn) Seeds to Various Presowing Treatments in the Nursery

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Absrtact: A study on effect of various pretreatment techniques on germination of *Acacia senegal* was conducted in the Teaching and Research Farm of Faculty of Agriculture, Delta State University, Asaba Campus. These seeds were subjected to pretreatments in water at 60 and 28°C; dilute sulphuric acid (H_2S04) and storage in refrigerator at 0°C. Under warm water experiments the following treatments were considered: 5 and 15 min soaking, 20 min and control (No soaking). With regards to cold water experiment, the following treatments were also considered 12, 24, 48 and 72 h soaking in water. While, under dilute H_2S04, the seeds were soaked for 5, 15, 20 min and control (no soaking). Lastly, seeds were stored in refrigerator for 48, 120 and 192 h and control (no soaking). The results indicated that dilute H2S04 pretreatment of the seeds for 20 min gave a significantly higher percent germination of 90 than other treatment ($p<0.05$), while highest germination of 60% was recorded for seeds soaked in cold water for 48 h. Seeds stored in refrigerator had no significant effect on germination as it gave highest germination of 40% after storing for 192 h. However, no germination was recorded for seeds pretreated with warm water. It is recommended that local farmers should adopt these techniques for a better germination of the species.

Key words: Seed germination, seedling emergence, soaking, water, species, soaking

INTRODUCTION

The role of rainforests in meeting the food need of man cannot be overstressed. Most of today's cultivated crops originated from the rainforests. Quite a lot still awaits discovery and improvement. According to Ola-Adams (1997) tropical forests ecosystem consist of many wild relatives of modern food crops and domesticated animals. The wide range of edible products obtained from wild fruit trees include nuts and seeds used as food supplements, condiments, thickening agents and flavour, leafy vegetables, fresh fruits, fresh seeds, edible oil, species, fruit drinks, non-alcoholic beverages and alcoholic drinks, (Leakey and Newton, 1994). The edible forest products constitute important and cheap sources of vitamins, minerals, proteins carbohydrates and fats and their contribution to diet of local people is great. The dietary contribution of trees to improved nutritional status of mankind is further enhanced by the timing of their availability which often falls at strategic periods of general food storage, particularly in Nigeria (Oni and Gbadamosi, 1998).

Among the forest trees that produce edible fruits when the conventional staple foods are scarce is *Acacia senegal*. It belongs to the family Mimosoidae. It is a legume, a deciduous shrub or shrub tree. This species is a multi-purpose African tree highly valued for centuries for gum Arabic production. It plays a secondary role in agricultural systems restoring soil fertility and providing fuel, fodder and it is also browsed by animals. It is an orthodox seed with hard seed coat making it difficult to germinate. For this reason, farmers have problem in its cultivation, they also lack awareness on the conditions, necessary for its germination.

Furthermore, a lot of research work has been carried out in the northern part of the country on this species, but none has been done in this agro ecological zone. In view of the economic importance of this species it is therefore, reasonable that factors affecting its germination and growth be critically studied. The study examines the response of *A. senegal* seeds to various nursery techniques.

MATERIALS AND METHODS

Experiment 1: Effect of dilute sulphuric acid on seed germination of *Acacia senegal*.

Seeds of *Acacia senegal* were placed in 60% dilute solution of H_2S0_4 for 5, 10, 15 and 20 min and 0 (control)

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treated with acid. The acid treated seeds were thoroughly washed with distilled water. The seeds were sown in perforated custards pot of 24.5 cm by 13 cm in dimension (10 seeds per pot). A total number of 10 seeds were sown per pot. Each of the treatments was replicated 4 times using completely randomized design. The growth media was top soil collected from the Department of Forestry Wildlife, Nursery site.

Experiment 2: Effect of cold water treatment on seed germination of *Acacia senegal*.

Seeds of *Acacia senegal* were soaked in cold water at a temperature of 28°C. The temperature was determined with the aid of a thermometer. The seeds were soaked separately for 12, 24, 48 and 72 h and control treatment (no soaking). There were five treatments in all of 10 seeds each. The water utilized for soaking was changed every 24 h. Later, seeds were sown in perforated custard pot of 24.5 cm by 13cm dimension. The design adopted was completely randomized design with three replicates.

Experiments 3: Effect of warm water treatment on germination of *A. senegal*.

Procedure: Seeds of *Acacia senegal* were soaked into the constant temperature water bath at 60°C. The treated seeds were removed according to soaking time required. In this case, the treatments (soaking time) were 5 and 15 min. The seeds were later sown in perforated custard pots of dimension 24.5cm by 13cm filled with top soil. The experiment was carried out using a complete randomized design with three replicates.

Experiment 4: Effect of storage in refrigerator on seed germination of *Acacia senegal.*

Procedure: Rough sand paper was used to effect scarification by rubbing the seed on the surface of the sand paper. This was done at the micropiyle and distal end of the seeds. The seeds were later stored in a refrigerator at temperature of 0°C; temperature was determined with the aid of a thermometer. They were stored for various h according to treatment. The treatments were: 0 h (control); 48 h; 120 h and the 4th treatments, 192 h. The seeds were later planted in a perforated custard pot of dimension 24.5cm by 13cm filled with top soil. This experiment was also carried out using a completely randomized design with three replicates.

RESULTS

Effect of dilute acid concentration on seed germination: Dilute sulphuric acid treatment greatly enhanced germination in *Acacia senegal*. Highest germination was recorded in seeds soaked for 20 min with 60% within the first three days of sowing (Table 1). Seeds treated with sulphuric acid for 15 min gave 30% germination within the first three days sowing. A percentage of 90% was recorded for seeds treated with the acid for 20 min while a 70% germination was recorded for seeds soaked for 15 min in dilute H_2S0_4 as against 30% for the control in the interval of 15 days. Significant differences ($p>0.05$) occurred among the treatments. Number of days to germination of this species is shown in Table 1.

Table 1: Mean% germination and days of emergence of *A. Senegal* seedlings as influenced by different soaking time dilute H_2S0_4

Treatment	% Germination	Days of emergence
5 m	0c	0
10 m	10bc	3
15 m	70b	3
20	90	3
Control	30c	3

Table 2: Mean% germination and days of emergence of *A. Senegal* seedlings as influenced by different soaking time in cold water (20°C)

Treatment	% Germination	Days of emergence
5 m	40b	21
10 m	50ab	21
15 m	60a	21
20	10c	21
Control	30c	21

Effect of cold water treatment on germination of *Acacia senegal*: Seeds soaked in cold water for 12, 24, 48, 72 h and the control gave 40, 50, 60, 10 and 30% germination respectively after a period of 21 days (Table 2). Highest germination of percentage of 60 was recorded for seed soaked in cold water for 48 h at 2WAS. There was significant difference ($p>0.05$) among the treatments. It took 21 days for the seeds to emerge (Table 2).

Experiment 3: Effect of soaking seeds in warm water (60°C) on the germination of *A. senegal*.

Water at 60°C did not enhance rate and percentage germinated of *A. senegal*. Only the control did. The control treatment gave 60% germination at 4 WAS. However, 10% germination was recorded for seeds pretreated in warm water for 5 min within the same period. Seeds soaked in water at 60°C for 15 and 20 min failed to germinate. Significant differences existed among the treatment (Table 3).

Experiment 4: Storage in refrigerator did not considerably promote germination of *A. Senegal* (Table 4). A 10% germination was recorded at 5 DAS for seeds stored for 192 h. At 2 WAS 40% germination was recorded for seeds stored in the refrigerator for 192 and 120 h. The results in Table 4 also indicated that 48, 120 and 192 h and the control treatment gave 20, 40, 40 and 60% germination

Table 3: Mean% germination and days of emergence of *A. Senegal* seedlings as influenced by different soaking time in cold water (60°C)

Treatment	% Germination	Days of emergence
5m	10c	28
10m	0c	0
15m	0c	0
20	0c	0
Control	50a	28

Table 4: Mean% germination and days of emergence of *A. Senegal* seedlings as influenced by storage in refrigeration

Treatment	% Germination	Days of emergence
48 h	20b	14
120 h	40a	14
192 h	40a	14
Control	30a	15
LSD	6.68	

Means with the same letters are not significantly different

respectively at 4 WAS. There was significant difference among the treatments at ($p<0.05$). It took a minimum of 121 days before the seeds emerged (Table 4).

DISCUSSION

From this study, it is quite obvious that pretreatment of seeds in warm water did not induce germination. This could be due to the destruction of certain enzymatic constituents present in the seed. Kaul and Manohar (2000) reported that most seeds will develop impermeability as they mature on trees, which indirectly supports the above observation. FAO (1998) also reported that majority of rainforest species are known to have seeds which lose their viability within a short period under condition of high temperature. Gill (1996) attributed the major cause of loss of viability to the scarcity of oxygen, since water at high temperature has less gaseous content. However, Gill *et al.* (1996) reported 40% germination of seeds of *Delonix regia* when immersed in warm water for 3 min.

Seeds of *A. senegal* treated with acid for 15 min gave 90% germination. This value was significantly higher that the control treatment. Fishwick (2000) obtained similar results for *Acacia nilotica* and *Acacia albida*. Cavanagh (1997), opined that pretreatment with sulphuric acid is frequently more attractive for African Acacia. Generally, acid treatment stimulates prompt and uniform germination. The low germination recorded in the control and 5 min treatments of *A. senegal* with dilute acid may be as a result of the inability of the acid to wear off the seed coat within the time of exposure to the acid.

As regards scarified seeds stored in refrigerator, low germination percentage was recorded. This is however, in contrast to the observation of Tran and Cavanagh (1999) who observed that the highest and most uniform germination occurred in *Pinues patula affer* seeds were stored for a few weeks and at about 4°C. Smith (1996) also, reported that four weeks cold storage of seeds improved germination from 65 to almost 90% in Swaziland. The low percentage germination recorded in this study could be due to the scarification of the seeds before cold storage. Dulta (1984) reported that pre-soaking seeds in water increases percentage germination in many plant species. The mechanism by which seed hydration treatment improves seed germination is probably due to increase in hydrophytic enzyme activity. However, seeds of *A. senegal* soaked for 72 h did not give good result of germination. This may be due to the fact that the appropriate time was exceeded. That is, the seed were now experiencing a water-logged situation.

CONCLUSION

This study showed that pretreating *A. senegal* seeds in dilute sulpheric acid for 20 min gave 90% germination. Highest germination of 60% was recorded when the seeds were soaked in cold water for 48 h. Furthermore, seeds of *A. Senegal* should not be pretreated in warm water as low germination was recorded in this study for seeds soaked in warm water. Finally, storage of *A. Senegal* seeds in refrigerator at 0°C did not enhance germination.

The information on seed germination of this species considered in this study will go a long way to promote Agro forestry and combat desertification and will be useful in selection and breeding programme if adopted by researchers and farmers.

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