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Germination response of *Acacia senegal* (Linn.) seeds to various presowing treatments in the nursery

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Abstract

A study on effect of various pretreatment techniques on germination of *Acacia senegal* was conducted in the Teaching and Research Farm, Faculty of Agriculture, Delta State University, Asaba Campus. The *A. senegal* seeds were subjected to pretreatments of water at 60 and 20°C, diluted (60%) sulphuric acid (H_2SO_4) and storage in refrigerator at 0°C. Under warm water (at 60°C) experiment the following treatments were considered: soaking for 5, 15 and 20 minutes and control (No soaking). With regards to cold water (at 20°C) experiment, the treatments were 12, 24, 48 and 72 hours soaking in water. H_2SO_4 treatments were soaking for 5, 15 and 20 minutes and control (no soaking). Seeds were stored in refrigerator for 48, 120 and 192 hours. The results indicated that diluted H_2SO_4 pretreatment of the seeds for 20 minutes gave a significantly ($p<0.05$) higher germination percent of 90 than the other treatments, while highest germination of 60 percent was recorded for seeds soaked in cold water for 48 hours. Seeds stored in refrigerator had no significant effect on germination as it gave highest germination of 40 percent after storing for 192 hours. 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.

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 [8], tropical forest ecosystems 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, spices, fruit drinks, non-alcoholic beverages and alcoholic drinks [7]. 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 [9].

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 multipurpose African tree highly valued for centuries for gum Arabic production. It plays a secondary role in agricultural systems restoring soil fertility and providing fuel and 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.

Materials and Methods

Experiment 1 (Effect of diluted sulphuric acid on seed germination): Seeds of *Acacia senegal* were placed in 60% solution of H_2SO_4 for 0 (control), 5, 10, 15 and 20 minutes. The acid-treated seeds were thoroughly washed with distilled water. The seeds were sown in perforated custard 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 four times using completely randomized design. The growth media was top soil collected from the Department of Forestry and Wildlife, Nursery site.

Experiment 2 (Effect of cold water treatment on seed germination): Seeds of *Acacia senegal* were soaked in cold water at a temperature of 20°C. The temperature was determined with the aid of a thermometer. The seeds were soaked separately for 0 (control, no soaking), 12, 24, 48 and 72 hours. There were five treatments in all of 10 seeds each. The water utilized for soaking was changed every 24 hours. Later, seeds were sown in perforated custard pot of 24.5 cm by 13 cm dimension. The design adopted was completely randomized design with three replicates.

Experiment 3 (Effect of warm water treatment on seed germination): Seeds of *A. senegal* were soaked into a 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, 10 and 15 minutes. The seeds were later sown in perforated custard pots of dimension 24.5 cm by 13 cm filled with top soil. The experiment was carried out using a completely randomized design with three replicates.

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

Results

Diluted sulphuric acid treatment greatly enhanced germination of *Acacia senegal* (Table 1). Highest germination percentage of 90% was recorded within the first three days of sowing for seeds treated with the acid for 20 minutes while 70% germination was recorded for seeds soaked for 15 minutes. Germination percentage was 30% for the control in the interval of 15 days. Significant differences ($p > 0.05$) occurred between the treatments.

Seeds soaked in cold water for 12, 24, 48 and 72 hours and the control gave 40, 50, 60, 10 and 30% germination respectively after a period of 21 days (Table 2). Highest germination percentage of 60% was recorded at 2 WAS (weeks after sowing) for seeds soaked in cold water for 48 hours. There were significant differences ($p>0.05$) between the treatments.

Warm water treatments did not enhance rate and percentage of germination. The control treatment gave 60% germination at 4 WAS and only 10% germination was recorded for seeds pretreated in warm water for 5 minutes within the same period. Seeds soaked in water at 60°C for 15 and 20 minutes failed to germinate. Significant differences existed between the treatments (Table 3).

Storage in refrigerator did not considerably promote germination of *A. senegal* (Table 4). A 10% germination was recorded at 5 DAS (days after sowing) for seeds stored for 192 hours. At 2 WAS 40% germination was recorded for seeds stored in the refrigerator for 192 hours and 120 hours. The results in Table 4 also indicate that 48, 120 and 192 hours storage and the control treatment gave 20, 40, 40 and 60 percent germination respectively at 4 WAS. There were significant differences between the treatments ($p<0.05$).

Table 1. Mean germination % and days of emergence of *A. senegal* seedlings as influenced by different soaking times in dilute H_2SO_4.

Treatment min.	Germination %	Days of emergence
5	0	0
10	10	3
15	70	3
20	90	3
0(Control)	30	15
LSD	17.29	

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

Treatment min.	Germination %	Days of emergence
5	40	21
10	50	21
15	60	21
20	10	21
0(Control)	30	15
LSD	10.80	

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

Treatment min.	Germination %	Days of emergence
5	10	28
10	0	0
15	0	0
20	0	0
0(Control)	50	28
LSD	9.98	

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

Treatment hours	Germination %	Days of emergence
48	20	14
120	40	14
192	40	14
0(Control)	30	15
LSD	6.68	

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 [6] reported that most seeds will develop impermeability as they mature on trees, which indirectly supports the above observation. FAO [3] 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 *et al.* [5] attributed the major cause of loss of viability to the scarcity of oxygen, since water at high temperature has less gaseous content. However, 40% germination of seeds of *Delonix regia* was found when immersed in warm water for three minutes[5].

Seeds of *A. senegal* treated with acid for 15 minutes gave 90% germination. This value was significantly higher than the control treatment. Fishwick [4] obtained similar results for *Acacia nilotica* and *Acacia albida*. Cavanagh [1] opined that pretreatment with sulphuric acid is frequently more effective for African Acacia. Generally, acid treatment stimulates prompt and uniform germination. The low germination recorded in the control and 5 minute treatments of *A. senegal* with diluted 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 [11] that highest and most uniform germination occurred in *Pinus patula* after seeds were stored for a few weeks at about 4°C. Smith [10] also reported that four weeks cold storage of seeds improved germination from 65 to almost 90 percent in Swaziland. The low germination percentage recorded in this study could be due to the scarification of the seeds before cold storage.

Dutta [2] reported that pre-soaking seeds in water increases germination percentage 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 hours did not give good result of germination. This may be due to the fact that the appropriate time was exceeded. That is, the seeds were now experiencing a water-logged situation.

Conclusions

The present study showed that pretreating *A. senegal* seeds in diluted sulphuric acid for 20 minutes gave 90 percent germination. Germination of 60% was recorded when the seeds were soaked in cold water for 48 hours. 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 the present study will go a long way to promote agroforestry and combat desertification and will be useful in selection and breeding programme if adopted by researchers and farmers.

References

[1]Cavanagh, A.K. 1997. Some aspects of the history of seed coat treatments applied to Acacias. International Group for the Study of Mimosoidae Bulletin **8**:31-36.

[2]Dulta, A.C. 1984. Fruit Germination. Botany for Degree Students. Oxford University Press, 698 p.

[3]FAO 1998. Handling Forest Trees. Forestry Development Paper No. 11. FAO, Rome.

[4]Fishwick, R.W. 2000. Neem in the Sudan zone. Unpublished manuscript, 32 pp.

[5]Gill, L.S., Jegede, J.R.O. and Ussani, S.W.N. 1996. Studies in the germination of *Acacia franesisna* (L.) (Leguminosae) weed. Journal of Tree Science **5**:92-99.

[6]Kaul, R. and Monohar, M.S. 1966. Germination studies of arid zone tree seeds. I. *Acacia senegal* Willd. Indian Forestry **92**:499–503.

[7]Leakey, R.R.B. and Newton, A.C. 1994. Domestication of tropical trees for timber and non-timber products. MAB Digest 17, UNESCO, Paris.

[8]Ola-Adams, B.A. 1997. Forest regeneration diagnosis: Review of national forest management system and results. Ghana Journal of Forestry **4**:24-34.

[9]Oni, O. and Gbadamosi, A.F. 1998. Progeny variation in seedlings of *Dacryodes edulis* G. Don. Journal of Tropical Forest Resources **14**(1):38-47.

[10]Smith, J.E.N. 1996. The Silviculture of Pinus in Papua New Guinea. Office of Forestry, Papua, New Guinea.

[11]Tran, V.N. and Cavanagh, A.K. 1999. Effects of microware energy on forest seeds. J. Microware Power **14**:21-27.