EFFECTS OF HOT AND COLD WATER PRE- TREATMENTS ON EMERGENCE OF *ACACIA SENEGAL* SEEDS IN THE NURSERY.

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Abstract
An experiment was carried out to check the effect of two pre germination treatments on the emergence of seeds of acacia senegal at the Department of Forestry and Wildlife, University of Maiduguri nursery. The treatments used were immersion of the seeds in cold water (at room temperature) for 8, 12 and 24 hours and hot water at 100 ^{o}C for 5, 10 and 15 minutes . The research seeks to find the best pre germination time to be used for each of the two pre- treatments used in the experiment. Completely randomized design (CRD) of analysis of variance (ANOVA) was used in analysis of obtained data for each of the treatments. Results from this study indicate no significant difference in the number of seeds that emerged from the cold water treatment (á = 0.05), while treatment with hot water showed significant differences among the treatment times (á =0.05). Treatment of a. senegal seeds with hot water for 10 minutes gave the highest number of emerged seeds (mean, 7.50) which significantly differed with the untreated control (Mean, 4.08). This study therefore, recommends treating seeds of a. senegal for 10 minutes in hot water as the best time for hot water pre treatment. Although there exists no significant difference in the values for the cold water pre treatment, 12 hour pre treatment gave the highest mean of 6.31 and can therefore be favored above the other treatments.

Keywords: *Pre- germination treatments, emergence, acacia senegal, Completely randomized design*

INTRODUCTION

Acacia senegal is a tree commonly called gum Arabic. It is widely found in the sudano-sahelian zones of Africa latitude 11 30^{0} north and above. It is widely spread in the dry savannas of tropical Africa and extends to the red sea and eastern India. It is a spiny tree five to six meters tall with a flagrant creamy white flowers- borne in spikes 5-10cm long. *Acacia senegal* grows in areas with rainfall as low as 100- 150mm per annum (Okoro 2002 and Omer, 1989). It is a multipurpose tree which is ecologically known to increase soil fertility by its active root nodules that fix atmospheric nitrogen (Anthony and Young, 1990). It is also used in the reduction of desertification and also enhances soil moisture conservation as well as reduction of erosion. Odo and Oleghe, (1988) posited that these advantages make it necessary to use gum Arabic in afforestation programs in the Sudan and Sahel regions. Economically, gum Arabic is used extensively in pharmaceutical preparations, inks, pottery, pigments, water colors, wax polishes and liquid gum. It is also used for dressing fabrics, giving luster to silk and crepe. It is used for thickening colors and mordant in calico printing (Fakoya *et al.*, 2002, Hazell and Norton, 1986). Gum Arabic is also a source of fodder to livestock such as goat, sheep and cattle in the semi arid regions due to the palatability of its leaves. Pande *et al.*, 1981, attributed the decline in the stands of gum Arabic to the cutting down of the trees by herdsmen and over grazing by livestock. *Acacia senegal* is highly valued for its gum which are dried gum exudates from its branches and stems (FAO, 1990). In Nigeria

gum Arabic is classified into grade 1*(acacia senegal*), grade 2 (acacia seyal) and grade 3 (Combretum, and other sources). Of the different *acacia* species existing worldwide *A. senegal* and *A. seyal* are the most exploited for gum purposes.

The importance of gum Arabic has made it necessary to incorporate the specie in agro forestry practices as well as commercial farming of the crop. The propagation of this important tree is however, hindered by the dormancy exhibited by its seeds. Dormancy is defined as the inability of viable seeds to germinate under appropriate conditions. Seed dormancy can be of different types that include physical, mechanical, chemical, and morphological and embryo dormancy. Odo and Oleghe (1988) reported that environmental changes can affect seed emergence and growth. Different methods have been used by scholars in breaking seed dormancy, these methods include hot water (FAO, 2008), sulphuric acid (Odo and Oleghe,1988), cold water (Doran *et al*, 1983) e.t.c. The use of hot water is the most common method of breaking dormancy in Borno state, Nigeria (Odo and Oleghe,1988), although, Doran *et al* (1983) reported the use of cold water. This study therefore, seeks to find the best treatment time for seeds of gum Arabic for both cold and hot water so that farmers can use the identified times for any of the two treatments (cold or hot water) for plantation establishment.

MATERIALS AND METHODS

Study Site

The study was carried out at the Department of Forestry and Wildlife nursery, University of Maiduguri Borno state, Nigeria. The area lies within latitude 11° to 15°E and longitude10° and 25°N. The area is hot and dry for a greater part of the year with temperature ranging from 15°C to 20°C (minimum) and 35°C to 45^{0}C (maximum). The vegetation typically consists of mainly grasses with few drought resistant trees. The seasons are divided into dry, rainy and the harmattan seasons. The rainy season is normally from June to September with relative humidity of 49%. Rainfall ranges from 500 1000mm annually and evaporation of 203mm per year (BOSG, 2008).

SEED COLLECTION AND POT PREPARATION

The seeds were collected at the Department of Forestry and Wildlife *acacia senegal* plantation located opposite the vice chancellors office. Bug sizeable seeds without visible signs of infestation were selected out of the total seeds collected. Polythene bags were filled with top soil, and watered for a period of three days to keep the planting medium moist for subsequent planting.

Viability Test

The seeds collected for the experiment were subjected to viability test to rid them of seeds that were not viable. The test involved immersing the seeds into water in a container; the seeds that were observed to float were immediately removed as they were considered not viable. The viable seeds were then immediately dried for further tests.

Seed Sowing and Weed Control

Sowing of seeds was carried out on the 10th of November 2009 between 4 and 5pm. Two seeds were sown for each polythene pot; the

sowing depth was 1cm. There was no serious weed problem as the experiment lasted, however, the few weeds that germinated with the seeds were removed by hand pulling.

Irrigation

The supply of moisture is very essential for the emergence and performance of seeds of *acacia senegal*. Because the experiment was conducted during the dry season constant watering of the polythene pots was carried out throughout the duration of the experiment. The pots were watered twice (morning and evening) everyday.

Experimental Design and Analysis

The experimental layout was completely randomized design with equal replications at p=0.05, this was taken as such because each of the treatments (hot and cold water) was analyzed independently to get the best treatment time for each of the pre- treatments. The different methods of breaking dormancy applied were the recognized sources of variation in the experiment. Untreated seeds were taken as control. Data collected in the experiment were analyzed using the SPSS 14.0 statistical package, and significant differences are further sorted out using the Duncan multiple range test (DMRT).

Hot Water Pre- Treatment

Water was boiled at 100 ^{0}C, the source of heat was subsequently removed. The seeds were then immersed in the hot water in a 100ml beaker for periods of 5, 10 and 15 minutes respectively. Upon removal from the hot water the seeds were immediately kept in an open place so that they can be dried.

Cold Water Pre- Treatment

For cold water pre- treatment, the seeds were soaked in cold water (at room temperature) for varying number of hours. The soaking times used were, 8 hours, 12 hours and 24 hours. As in the hot water pre- treatments the seeds were kept in the open to dry before they were taken for planting.

RESULTS AND DISCUSSION

For Cold Water Pre- Treatment (at room temperature)

The results for the germination of seeds using cold water pre- treatment is contained in table 1. The results indicate that seeds treated for 12 and 24 hours started to germinate at six days after sowing, this was as reported by Doran *et al*., (1983), while the seeds treated for 8 hours began to germinate on the 7th day. Subsequently, the number of seeds that germinated varied with the different treatments used. The mean seeds germinated at 16 days after sowing for the three treatments were, 3.5385 for 8 hours, 6.3077 for 12 hours and 4.4615 for 24 hours treatment. This shows higher germination rates for 12 and 24 hours treatment which is above the 8 hours and control. Peak germination values were recorded for all the treatments at 12 days after sowing, with germination values of 10, 14, 9, and 8 for 24 hours, 12 hours, 8 hours, and control respectively. The germination rates subsequently, began to fall for all the treatments after reaching the peak values (figure 1). The result of the analysis of variance however, shows no significant difference in the germination of seeds using the three durations of exposure used in this experiment at $\alpha = 0.05$.

Table 1: Number of Seeds germinated with cold -ater per-treatment

Days After Sowing	Seeds Soaking Period (hours)			
	Control	8 hour	12 hour	24 hour
6	0	0	3	2
7	2	2	5	3
8	3	2	7	4
9	5	5	9	7
10	7	6	9	7
11	6	7	11	8
12	8	9	14	10
13	7	8	10	9
14	5	6	9	7
15	4	3	5	3
16	2	0	3	1
Mean	4.0833	3.5385	6.3077	4.4615

The result of this experiment therefore, shows no statistical difference in the number of seeds germinated from the above pre- treatments, although there exist some differences in the mean germination. Pingali and Biswanger (1984), reported increase in the germination of seeds of *acacia senegal* by soaking in water at room temperature for 12-24 hours.

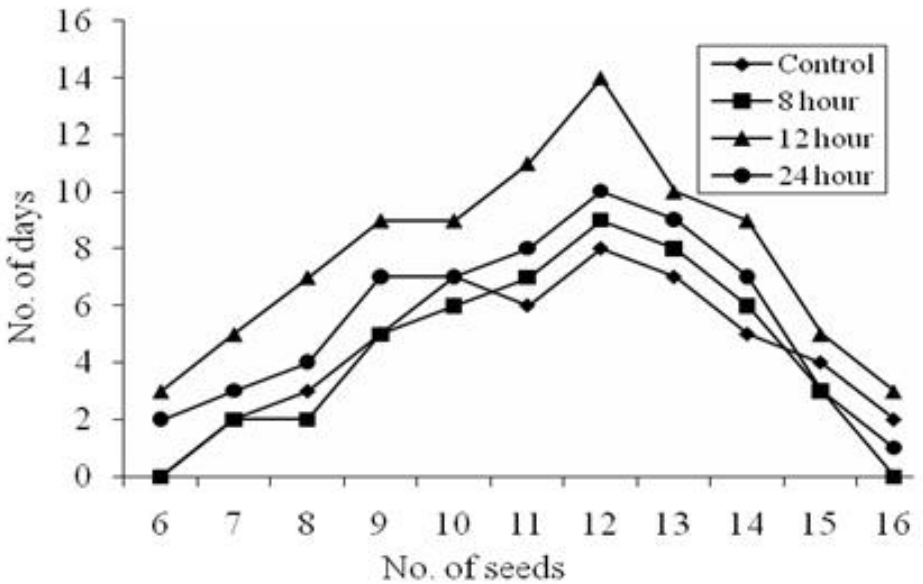

Figure 1: Germination of *A. senegal* seeds in response to cold water treatment

For Hot Water Pre- Treatment

The result for the hot water pre- treatment shows seeds from all the treatment durations showed first germination occurring at 5 days after sowing, with 10 minutes exposed seeds having the highest number of 3 seeds on the fifth day (table 2). Seeds treated for 10 minutes and the control reached peak value of 10 germinated seeds on the 12th day after sowing, while 5 minutes, and 10 minutes reached the peak value on the 11th day with 13 and 15 seeds emerging respectively, (figure 2). The mean of germinated seeds obtained for the various pre treatments were, 4.0833, 6.3571, 7.5000 and 5.4285 for control, 5 minutes, 10 minutes and 15 minutes respectively (table 2). The result of the analysis of variance indicates significant difference in the emergence of seeds pre-treated with hot water at the three different times at á=0.05.

Table 2: Number of Seeds germinated with hot water pre- treatment

Days After Sowing	Seeds Soaking Period (mins)			
	Control	**5 mins**	**10 mins**	**15 mins**
5	0	2	3	2
6	0	4	5	3
7	2	5	6	5
8	3	7	9	5
9	5	9	11	7
10	7	11	13	8
11	6	13	15	8
12	8	10	13	10
13	7	9	11	9
14	5	8	9	7
15	4	7	6	5
16	2	3	2	5
17	0	0	1	2
18	0	1	1	0
Mean	4.0833	6.3571	7.5000	5.4285

The Duncan multiple range test conducted showed significant difference between the control and 10 minutes pre treatment, while the 5 and 15 minutes pre treatment are not significantly different from each other (table 3).

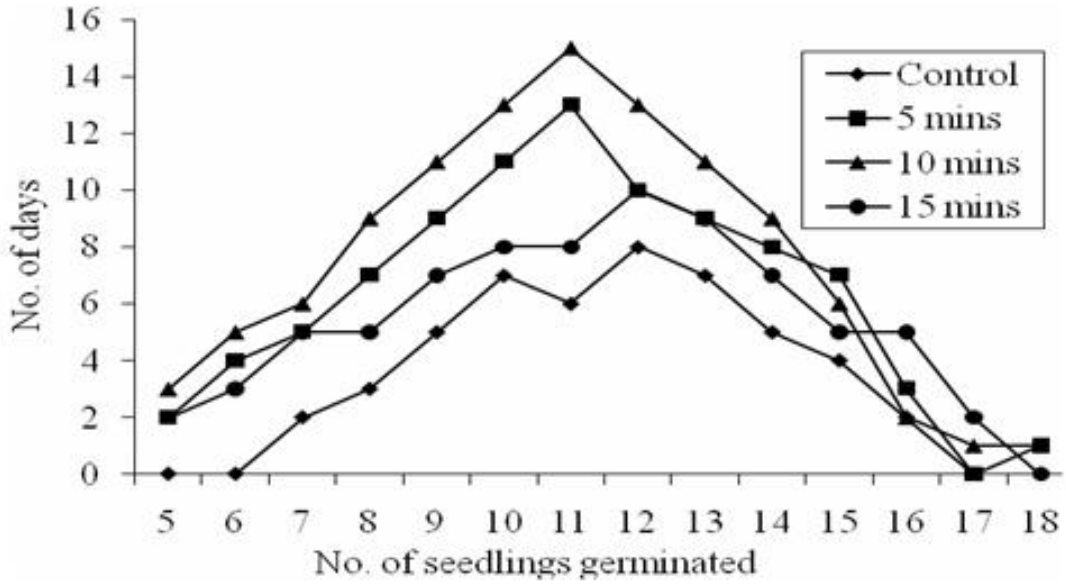

Figure 2: Germination of *A. senegal* seeds in response to hot water treatment

Table 3: Follow up test for hot water pre- treatment

Hot water treatments	Mean
Control	4.08±2.71[b]
5 minutes	6.36±3.95[ab]
10 minutes	7.50±4.74[a]
15 minutes	5.43±2.95[ab]

The result of this experiment shows 10 minutes treatment of seeds with hot water as the best pre treatment procedure as it is statistically different from the control and slightly varies with the 5 and 15 minutes. Sanyang *et.al*., (2008) also reported 10 minutes treatment of acacia Senegal seeds as giving the shortest time of germination and 50% emergence. Stanton and Young (1999) and Edwin (1992) also reported higher emergence rate of seeds of gum Arabic from treatment with hot water.

Conclusion

The results obtained in this experiment has shown that for cold water pre treatment there exist no significant difference in the germination of seeds for the exposed times, although exposure for 12 hours gave the highest mean germination of 6.3077. This time of exposure can therefore be recommended where cold water pre treatment is the desired means of breaking seed dormancy. For hot water pre treatment exposure for 10 minutes which gave the highest mean germination value of 7. 500 is the most desired pre treatment. This gives the best recommended time of exposure of *acacia senegal* seedlings for hot water treatment when that is the desired method of breaking seed dormancy.

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