Seed Research, Vol. 35(1): 124-128, 2007

Short Communication

Effect of Pre-treatments on Seed Germination and Seedling Vigour of Four Different Species of *Albizzia*

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Seed coat imposed dormancy is a usual feature in most of the tropical tree seeds particularly the legumes. Although these seeds can remain viable but dormant for a long period after fall from mother plant and undergo a process of natural softening of their seed coat through burial [1, 2], microbial attack [3], an understanding of breaking seed dormancy is vital for any agroforestry and tree planting project [4]. This is particularly true when one considers the supply of high quality seeds and therefore, in recent years, more emphasis is given to assessment of seed quality in some lesser known multipurpose tree species [5, 6, 7]. Seed germination and vigour are the most important parameters in determining seed quality and are the sum total of those properties of seed which determine the potential level of performance and activity of non-dormant seed during germination and seedling emergence [8].

Various effective treatments such as nicking, hot water soaking, physical or acid scarification and mechanical scarification have all been used to enhance seed germination and seedling vigour of many legume species of tropical and subtropical origin. The role of the seed coat in regulating imbibitions is also well known in legumes, and differences in seed coat permeability resulting from maturation factors, mechanical damage during harvest, or scarification treatments may all impinge negatively on germination by causing imbibition injury [9, 10]. The present paper seeks to understand the effect of different pre-treatments on the per cent seed germination, germination energy and seedling vigour of four species of *Albizzia*.

Seeds of four different species of *Albizzia* viz., *Albizzia chinensis, A. lebbek, A. procera* and *A. stipulata* were collected from Forest Research Institute, Dehra Dun in 2003 for nursery trial. Prior to this, the seed quality was assessed for each species. Eight hundred seeds of uniform size were sorted out for working sample from each species to reduce non-treatment variation, as seed vigour in most species is often correlated with seed size [11, 12]. These seeds were divided into 8 sub-samples meant for 8 treatments, thus taking 100 seeds for each treatment. Each sub-sample meant for a treatment was further divided into 5 replicates of 20 seeds each.

The seeds were treated with hot water for a varying period of 1, 5 and 10 minutes, soaked in concentrated sulphuric acid for 10, 20 and 30 minutes and nicked (a small portion of the seed coat, about 1mm was removed at the distal end using a secateur). A control set of experiment without any treatment was also kept to compare the variations. All the treated seeds (including the control) were soaked in distilled water for 24 hr before placing in plastic Petri dishes (size 10.5 x 1.5 cm) filled with a thin layer of very finely sieved soil, watered and kept in the seed germinator at an alternating simulated temperature of 30° and 7°C (12 hr at each temperature) maintaining a 12 h photoperiod. As the seedlings emerged, they were counted and measured for their height at regular intervals following standard rule [13]. The

Received January 2006 Revised November 2006 Accepted December 2006

germination speed was calculated as $\Sigma n_1/dn_1+n_2/dn_2+n_3/dn_3$ ..... n_x/dn_x where n_1 and n_x are the number of seeds on first (dn_1) and final day (dn_x). The germination energy was calculated as the percentage of seed germination obtained at maximum daily germination speed. Seedling vigour was calculated as seedling height x germination per cent. The seedlings were classified into low vigour (seedling height below experimental mean height) and high vigour (seedling height above experimental mean height). The final readings were noted on 30th day. The data were subjected to analysis of variance (ANOVA) using SPSS (version 6.1) computer program (SPSS Inc. Chicago, IL. 60606-6307, USA).

Germination percentage

The germination percentage of seeds varied between species and treatments. Among the treatments, nicking provided highest germination percentage and this was true for all the four species (Table 1). Hot water also provided better germination percentages as compared to acid treatments and control. The seeds treated in hot water for 10 min gave higher per cent germination than those treated either for 5 or 1 minute. Soaking of seeds in acid for 30 min gave better germination than the seeds soaked in acid either for 20 or 10 minutes. It appears that the seeds in hot water provided enhanced germination by producing stimulatory effect on the germination process and causing the lens tissue to rupture creating a passage through which water entered into the seeds. Sulphuric acid helped in softening the seed coat causing inflow of water, thereby provided better condition for seed germination in the hard seeds. In natural situation, the buried hard coated seeds remained un-germinated in soil until the seed coat get properly weathered by the available soil temperature, moisture and other *in situ* microclimatic factors. The natural weathering cause the hourglass cells in the seed coat below the strophiolar plug region (lens) to break resulting in germination and emergence of seedlings.

Seeds pre-treated with some chemicals have been found to have influenced emergence index in groundnut [14]. Although the hard seed coat is seen as a hindrance to uniform and rapid germination, it however, performs the critical functions of regulating water uptake, providing a barrier to fungal invasion, and reducing leakage from the embryo during imbibitions [15] and provide advantage to withstand unfavourable conditions [16]. Decline in number of non-germinated seeds with increased soaking time in hot water as well as acid indicated that longer exposure of the seeds to these pre-treatments favoured better germination in all the species.

Table 1. Seed germination (G) percentages after 1-month and germination energy (GE) after 12 days of pre-treatments in four different species of *Albizzia*

Treatments	*A. chinensis*		*A. lebbek*		*A. procera*		*A. stipulata*	
	G	GE	G	GE	G	GE	G	GE
Control	58	45	63	45	65	50	50	45
Nicking	92	85	100	95	100	92	95	87
Hot water 1 min	60	45	70	50	74	60	59	45
Hot water 5 min	65	58	74	72	80	75	61	57
Hot water 10 min	75	65	82	76	85	80	70	63
Acid 10 min	55	45	70	50	71	60	50	40
Acid 20 min	73	60	87	80	80	75	65	60
Acid 30 min	80	70	95	92	99	90	76	70

Germination per cent was in the order of *A. procera* *A. lebbek* > *A. chinemis* > *A. stipulata.*

Germination energy

Almost all the treatments except the seeds treated in acid for 10 min and control conditions provided high germination energies for all the species. Among the pre-treatments, nicking provided highest germination energy, followed by hot water (10 min) and acid scarification (30 min) in all the species studied. The germination energy decreased with decreasing soaking time in hot water. Similar was the case with the acid treatment (Table 1). These trends were more or less uniform in all the species. However, the germination energy was higher in case of *A. procera* followed by *A. lebbek* while least in A *stipulata* irrespective of the treatments.

Seedling vigour

There was differential response by the species in giving rise to vigour seedlings. In general, more percentage of low vigorous seedlings was found under nicking than any other treatments (Table 2). Most of seedlings were of low vigor category under nicking although there were higher germination per cent and higher germination energies in all the species. The possible reason for this could have been due to physical restriction of the embryonic parts by the remaining seed coat due to nicking and the unrestricted inflow of water into the cell closed to the nicked part causing shearing and tearing of hydrated cells from the dry ones, as argued by some workers [10, 17]. The seeds soaked in hot water for 10 min resulted in more seedlings in the high vigour category than soaked in for 5 and 1 minutes in *A. stipulata* while the seeds soaked in hot water for 5 min provided more seedlings of high vigour category than 1 or 10 minutes in case *of A. chinensis.* On the other hand, the seeds soaked in hot water for 1 min provided more seedlings of high vigour category than the low vigour category in *A. lebbek* and *A. procera.*

In natural situation, raising of good quality seedling will be delayed as weathering of hard seed coat in soil takes very long time [18, 19] and thus, emphasizing the need for pre-treatments. In the present study, the treatment effect on seed germination and vigour was significant ($P < 0.05$) in all species. The F-values on germination and germination energy of *A. lebbek* and *A. stipulata* were quite high compared to the corresponding values of other two species (Table 3). Although nicking produced high germination per cent and energy in most of the species studied, the resultant seedlings were of low vigour category, therefore, this pre-treatment may not be suitable in producing

Table 2. Proportion of seeds that gave rise to low vigour (LV) and high vigour (HV) seedlings and become non-germinated (NG) in four different species of *Albizzia*

Treatments	*A. chinensis*			*A. lebbek*			*A. procera*			*A. stipulata*		
	NG	LV	HV	NG	LV	HV	NG	LV	HV	NG	LV	HV
Control	42	40	18	37	43	20	35	38	27	50	35	15
Nicking	8	52	40	0	58	42	0	65	35	5	56	39
Hot water 1 min	40	34	26	30	26	44	36	22	42	41	31	28
Hot water 5 min	35	20	45	36	30	34	20	37	43	39	24	37
Hot water 10 min	25	40	35	18	38	44	15	30	55	30	22	48
Acid 10 min	45	25	30	30	23	47	39	13	48	50	18	32
Acid 20 min	27	30	43	13	52	35	20	28	52	35	31	34
Acid 30 min	20	30	50	5	67	28	1	36	43	24	16	60

Table 3. Analysis of variance due to treatments on seed germination (G), germination energy (GE), seedling vigour categories (LV & HV) in four different species of *Albizzia*

Species	F-value			
	G	GE	LV	HV
A. chinensis	29.62*	34.24*	36.538*	31.08*
A. lebbek	101.43**	550.198**	168.184**	32.657*
A. procera	47.68**	83.88**	82.5**	34.286*
A. stipulata	129.7**	413.47**	71.243**	41.9*

*,**Significant at P<0.05 and P<0.01 respectively.

better seedling quality in nursery. A higher proportion of high vigour seedlings of *A. chinensis* and *A. stipulata* were obtained when their seeds were pre-treated in acid for 30 minutes. Similarly, more per cent of high vigour seedlings of *A. lebbek* and *A. procera* was obtained when the seeds of former were pre-treated with acid for 10 min and with hot water for 10 min in the latter. Therefore, to obtain higher proportion of seedlings of high vigour category or better seedling quality, the seeds of all the four species studied here except *A. procera* could be pre-treated with acid. Hot water 10 min pre-treatment provided high germination per cent, high energy as well as high vigour seedlings in case of *A. procera* depicting hot water as the best pretreatment for this species.

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