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ASSESSMENT OF VARIOUS PRE-SOWING TREATMENTS ON GERMINATION OF TEAK (*TECTONA GRANDIS* LINN. F) SEEDS IN BANGLADESH

M.N.I. Khan*, S.R. Biswas and A.K.F. Hoque
Forestry and Wood Technology Discipline, Khulna University, Khulna 9208, Bangladesh

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Abstract: Delayed and non-uniform germination of seed due to hard and thick pericarp of the fruit, is the main hindrance in producing teak (*Tectona grandis*) seedlings. This study was intended to develop a seed treatment technique to enhance germination of teak seeds, which is efficient, cheap and uses locally available materials. A total of 16 treatments under five broad categories, viz., hot water (90-100^{o} C), cold water (room temperature, 20-25^{o} C), cow dung diluted in water (dung: water, 3:10), soil pits and fungal attack were tested. Alternate soaking in cold water and sun drying at 24 hours interval continued up to seven days showed best germination success (61.11%). Thus, for practical use in Bangladesh these two pre-sowing treatments are recommended for germination of teak seeds.

Key words: *Tectona grandis*; Germination; Sowing; Seed; Nursery technique

Introduction

Teak (*Tectona grandis* Linn. f) is known as the best timber in the world. The durability, highly favorable strength to weight ratio and resistance against decay have made it suitable for versatile uses (Tewari, 1992). In Bangladesh it grows best in the eastern hilly areas. It is also growing successfully in other parts of the country. Teak is propagated by seed. Vegetative propagation, though possible, has little practical significance (Dharmalingm, and Masilamani, 1997).

Teak seeds are microbiotic (Tewari, 1992), positively photoblastic (Yadav, 1992) and orthodox (Prasad and Kandya, 1992). Delayed and non-uniform germination of teak seeds, both in natural state and nurseries, are common. Thick and hard pericarp of teak fruits (seeds in practice) is generally considered responsible for delay and irregularities in germination. The germination rate varies not only with provenance (dry or moist) and age of the seed but also with the position of seed in the seed bed (Tewary, 1992).

* Corresponding author. Tel.: 880-41-720171-3 Ext. 228; Fax: 880-41-731244; E-mail: forest@ku.khulnanet.net
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Breaking the dormancy of the seed and lower germination success concern teak growers. Several authors (Ngulube, 1986; Tewari, 1992; Chacko *et al*., 1997; Unikrishan and Rajeeve, 1990; Dadwal, 1988; Vijaya *et al*., 1996) have studied the pre-sowing treatment of teak seeds. Their treatments included soaking of the fruits in cold/hot water, cowdung solution, growth promoting substances (e.g., gibberellic acid), scarifying the fruits in concentrated sulfuric acid, removal of pericarp and mesocarp either mechanically or by burying fruits in ant pits, and weathering of pericarp by fungi.

In recent decades, tree planting has become a social movement in Bangladesh. To support such public attitude, nurseries producing seedlings are mushrooming up in different parts of the country providing employment and income to a handsome population. Teak is an important element of these nurseries. In Bangladesh, pit and water soaking methods are generally followed for pre-germination treatments of teak seeds.

Thus objective of this study was to suggest a pre-sowing treatment, which is technically and economically feasible and uses locally available materials.

Materials and Methods

During January 1999, fruits were collected from about 50 years old trees from a seed orchard at Kaptai Hill District. Fruits were cleaned by removing persistent calyx and other debris, sun dried and graded using a 8 mm sieve. Fruits passing through the sieve were rejected. Selected seeds were subjected to various pre-sowing treatments (Table 1) and germination tests were carried out during May-July, 1999.

Four treated seeds, with their stalk downward, were sown in each polybag ($10'' \times 6''$) filled with a mixture of soil and cowdung. After sowing seeds, polybags were placed in the sun, mulched with paddy straw and watered twice daily. Germination was recorded on every 5^{th} day up to 60 days. In this experiment, each of the treatments had 36 fruits equally distributed in three replications in a completely randomized design.

Results and Discussion

Considering local availability, acid scarification technique was not included in this study, though Vijaya *et al.* (1996) found very high germination success (92%) with Gibberellic acid treatment. In most cases, germination commenced within 15 days after sowing and was completed within 40 days. Mean cumulative germination % (mean of three replications) at five days interval for all the treatments is presented in Fig. 1 (A, B, C, D).

ANOVA showed significant difference among the treatments at 5% level of significance (Table 2). Duncan's Multiple Range Test (DMRT) showed that the treatments II(d) and III(a) differ significantly at 5% level of significance over control and other treatments (Fig.-1).

Table 1. Treatments of *Tectona grandis* seed.

Treatment code	Pre-sowing Treatments	Total time length
I(a)	Immersion in hot water (90-100°C) for 10 minutes followed by 12 hours sun drying and soaking in cold water (at room temperature, 25-30°C) for another 12 hours.	24 hours
I(b)	Immersion in hot water (90-100°C) for 20 minutes followed by 12 hours sun drying and soaking in cold water (room temperature) for another 12 hours.	24 hours
I(c)	Immersion in hot water (90-100°C) for 30 minutes followed by 12 hours sun drying and soaking in cold water (room temperature) for another 12 hours.	24.5 hours
I(d)	Immersion in hot water (90-100°C) for 60 minutes followed by 12 hours sun drying and soaking in cold water (room temperature) for another 12 hours.	25 hours
II(a)	Soaking in cold water(at room temperature) for 48 hours	48 hours
II(b)	Soaking in cold water (room temperature) for 72 hours	72 hours
II(c)	Alternate soaking in cold water (room temperature) and sun drying for 12 hours intervals.	7 days
II(d)	Alternate soaking in cold water (room temperature) and sun drying for 24 hours intervals	7 days
III(a)	Soaking in cowdung: water solution (3:10 ratio) for 24 hours followed by storage in the wet gunny bag for three days	4 days
III(b)	Soaking in cowdung: water solution (3:10 ratio) for 48 hours followed by storage in the wet gunny bag for three days	5 days
III(c)	Alternate soaking in cowdung: water solution (3:10 ratio) drying and for 12 hours intervals.	7 days
III(d)	Alternate soaking in cowdung: water solution (3:10 ratio) drying and for 24 hours intervals.	7 days
IV(a)	Seed kept in the pit (25 sq. cm with 50 cm depth) for five days	5 days
IV(b)	Seed kept in the pit (25 sq. cm with 50 cm depth) for seven days	7 days
IV(c)	Seed kept in the pit (25 sq. cm with 50 cm depth) for 10 days	10 days
V(a)	Seeds treated in fungal chamber (made with moist bread) for five days followed by 12 hours drying and soaking in cold water (room temperature) for another 12 hours.	6 days
V(b)	Seeds treated in fungal chamber (made with moist bread) for seven days followed by 12 hours drying and soaking in cold water for another 12 hours.	8 days
V(c)	Seeds treated in fungal chamber (made with moist bread) for 10 days followed by 12 hours drying and soaking in cold water for another 12 hours.	11 days
O	Control (without any pre-sowing treatment).	

Table 2. Analysis of variance.

Source of variation	Sum of Squires	Degrees of Freedom	Mean S.S.	Observed F	Tabulated F	
					5%	1%
Treatment	23715.94	21	1129.33	7.40*	1.65	2.06
Replication	32.04	2	16.02	0.11		
Error	6407.13	42	152.55			
Total	30155.11	65				

* Significant

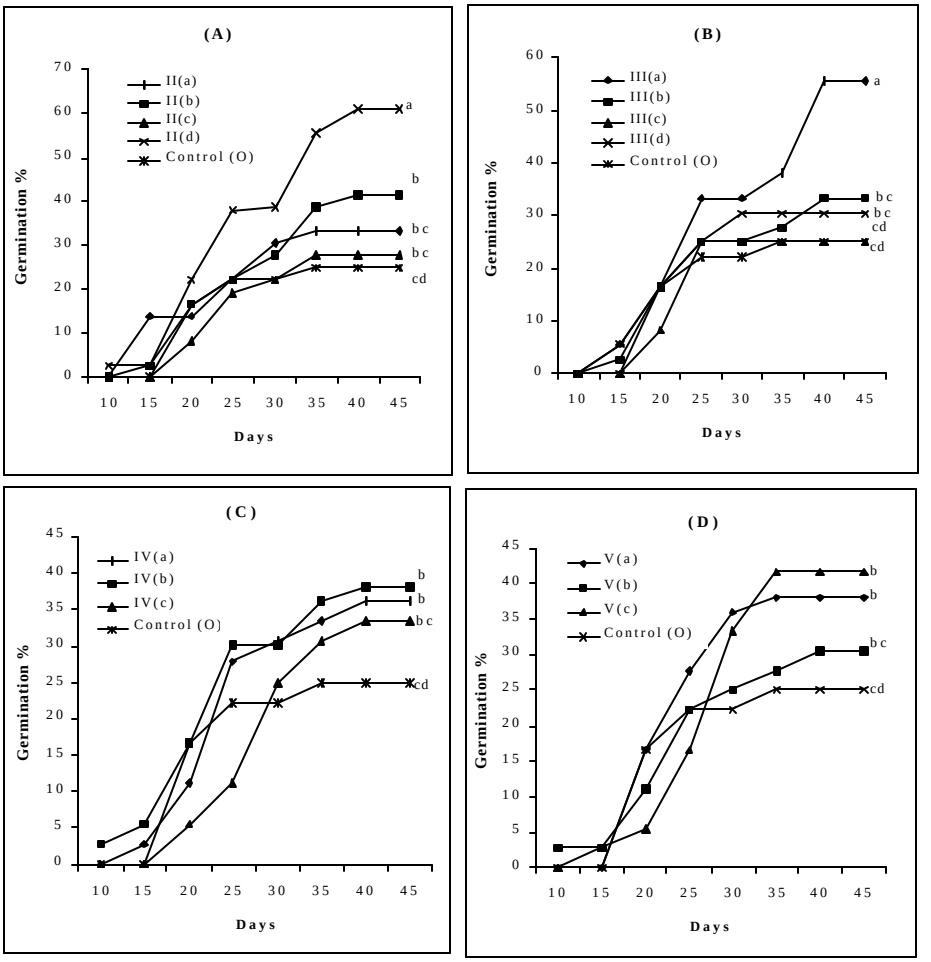

Fig. 1: Mean cumulative germination % in relation to time and treatments. (A) Soaking in water at room temperature; (B) Soaking in cowdung: water solution (3:10 ratio); (C) Pit treatment and (D) Fungal attack treatment. Bars show 95% confidence limit and a, b, c and d signify the significant differences (p=0.05) on array as measured by DMR test.

In this experiment, for treatment II (d) germination success was 61.11% (Fig. 2) and for similar treatment Chacko *et al.* (1997) obtained 16.6% germination success and Ngulube (1986) found 32.6% germination success. In case of treatment III(a), germination success was 55.55% (Fig. 2) whereas, by similar treatment, Chacko *et al.* (1997) found 35.7% germination success.

For seeds exposed to fungal attack, 30.55 to 41.66% germination success was observed. It is reported that fungi play an important role in the decomposition of the pericarp of teak seeds (Dadwal, 1988). High temperature was found to be detrimental to teak seed.

All seeds soaked in hot water (90-100^{o}C) for 10-60 minutes failed to germinate. Chackko *et al.*,(1997) also had similar experience with seeds boiled or steamed for an hour.

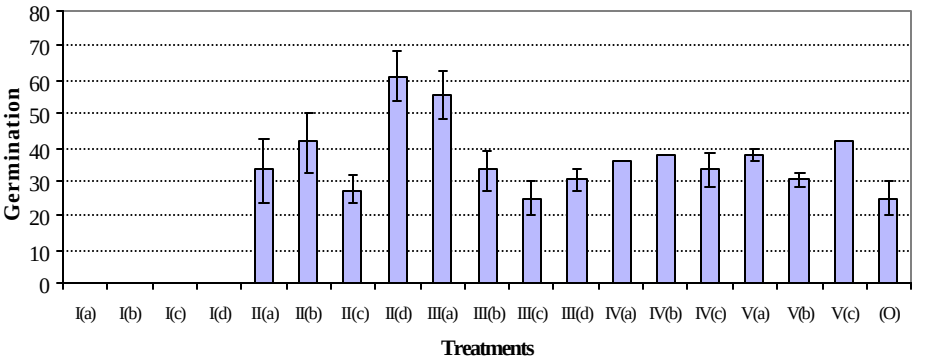

Fig. 2. Germination performance of all the treatments. Bars show standard error at 95% confidence. No error bar with columns indicates zero standard error, i.e. equal rate of germination in all replications.

Conclusion

Delay and non-uniformity in seed germination, due to hard seed coat, concern all teak growers. Several pre-sowing treatments have been developed to overcome this problem. In this study, germination generally commenced within 15 days after sowing and germination was complete within 40 days. Alternate soaking in cold water and drying in the sun at 24 hours interval, up to seven days showed the best germination success (61.11%). Next promising performance was obtained by soaking seeds in cowdung solution for 24 hours and then storing in damp gunny bag for three days. Thus, for practical use in Bangladesh these two pre-sowing treatments are recommended for promising germination of teak, as these are technically and economically feasible and can be done with locally available materials.

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