Journal of Applied and Natural Science
10 (3): 860 - 863 (2018)
ISSN : 0974-9411 (Print), 2231-5209 (Online)
journals.ansfoundation.org

Effect of pre-sowing treatments and growing media on seed germination and seedling growth of *Albizia lebbeck* (L.) Benth

Naresh Kumar*
ICAR-Central Agroforestry Research Institute, Jhansi (U.P.), India
A. K. Handa
ICAR-Central Agroforestry Research Institute, Jhansi (U.P.), India
Inder Dev
ICAR-Central Agroforestry Research Institute, Jhansi (U.P.), India
Asha Ram
ICAR-Central Agroforestry Research Institute, Jhansi (U.P.), India
A. R. Uthappa
ICAR-Central Agroforestry Research Institute, Jhansi (U.P.), India
A. Shukla
ICAR-Central Agroforestry Research Institute, Jhansi (U.P.), India
Lal Chand
ICAR-Central Agroforestry Research Institute, Jhansi (U.P.), India

*Corresponding author. E-mail: nareshbhardwaj50@gmail.com

Article Info
DOI:10.31018/jans.v10i3.1750
Received: May 24, 2018
Revised: June 21, 2018
Accepted: July 10, 2018

How to Cite
Kumar, N. *et al.* (2018). Effect of pre-sowing treatments and growing media on seed germination and seedling growth of *Albizia lebbeck* (L.) Benth. *Journal of Applied and Natural Science*, 10(3): 860 - 863

Abstract
The seeds of *Albizia lebbeck* have been observed to exhibit physical dormancy due to presence of hard seed-coat. To overcome this problem, the seeds were subjected to seven pre-sowing treatments viz., T_1-immersion of seeds in cold water for 12 h; T_2-immersion of seeds in cold water for 24 h; T_3-immersion of seeds in hot water (100 °C) and subsequent cooling at room temperature for 12 h; T_4-immersion of seeds in hot water (100 °C) and subsequent cooling at room temperature for 24 h; T_5-immersion of seeds in cold water for 12 h followed by immersion in hot water (100 °C) and allowed to cool for 1 h; T_6-immersion of seeds in cold water for 24 h followed by immersion in hot water (100 °C) and allowed to cool for 1 h. Untreated seeds served as control (T_0). Treatment T3 gave highest germination (96%) which was comparable with T_5 (95 %), T_4 (94 %) and T_6 (93%). Nine growing media *viz.*, T_1: soil, T_2: soil+sand (2:1), T_3: soil+perlite (2:1), T_4: soil+Farm Yard Manure (FYM) (2:1), T_5: soil+vermicompost (2:1), T_6: soil+sand+FYM (1:1:1), T_7: soil+sand+vermicompost (1:1:1), T_8: soil+perlite+FYM (1:1:1) and T_9: soil+perlite+ vermicompost (1:1:1) were, also, studied for their effect on seedling growth of *A. lebbeck*. Among these media, maximum values of shoot length (23.82 cm), root length (21.14 cm), collar diameter (3.59 mm) and seedling quality index (0.350) were observed in T_7.

Keywords: Germination, Pre-sowing treatments, Seed dormancy, Seedling quality index

INTRODUCTION

Albizia lebbeck (L.) Benth. commonly known by its Hindi name 'siris' belongs to family Fabaceae and it is indigenously found in India, Australia, Bangladesh, Indonesia, Malaysia, Myanmar, Nepal, Pakistan and Thailand (Orwa *et al.,* 2009). It is a multipurpose, medium-sized, deciduous tree species and is characterized by its rapid growth, ability to fix nitrogen and improve soil structure (Faisal *et al.,* 2012). *A. lebbeck* is grown for shelter belts, and as a shading tree in coffee and tea plantations (Orwa *et al.,* 2009). Due to its coppicing ability, site adaptability and nitrogen fixing property, it is one of the most suitable tree species for reforestation of degraded sites, fuelwood plantations and agroforestry systems. The seeds of *A. lebbeck* have been observed to exhibit physical dormancy due to presence of hard seed-coat and thereby resulted poor seed germination (Azad *et al*., 2006). Raising the seedlings from such seeds becomes a problem due to delayed and poor germination. Several studies showed poor seed germination in *Albizia* species when seed sowing was done without any pre-treatment (Alamgir and Hossain, 2005; Ajiboye *et al*., 2009; Azad *et al*., 2010; Merou *et al*., 2011; Azad *et al*., 2012; Nongrum and Kharlukhi, 2013). Therefore, pre-sowing treatments are required for improving the seed germination and also to shorten the ger-

mination periods. Some of the methods to overcome physical dormancy of seeds are acid scarification, mechanical scarification and immersion in water (Baskin and Baskin, 2004). Acid scarification and mechanical scarification are costlier and laborious methods as compared to hot or cold water treatments.

A plant needs a well-developed root and shoot system to survive in the harsh environment and thus, quality seedlings production is a prerequisite for any plantation programme. The development of healthy seedlings not only depends on the genetic properties or improved germination of the seed but also on physico-chemical properties of growing media. The quality of seedlings is very much influenced by growing media (Agbo and Omaliko, 2006). A good growing media is characterized by light weight, friability, easy blend ability, good water holding capacity, good drainage, porosity, low bulk density and free from fungal spores etc. (Chakrabarti *et al*., 1998). It provides sufficient anchorage or support to the plant, serves as a good supplier of nutrients and water, and permits gaseous exchange between roots and the surrounding atmosphere (Abad *et al*., 2002). The important constituents of growing media are soil, sand, perlite, cocopeat, vermicompost and FYM etc. These should be mixed in proper proportion to raise the quality seedlings. Many researchers have reported the beneficial effects of growing media containing vermicompost on seedling growth, as it contains humic acid (Muscsolo *et al*., 1999) and plant growth regulators which are responsible for increase in plant growth (Atiyeh *et al*., 2002). Vermicompost is characterized with high porosity, aeration, drainage, water holding capacity, and microbial activity. Keeping in view the importance of pre-sowing treatments for enhancing the seed germination and growing media for quality seedling production, the present study was conducted to develop economically cheaper and user friendly pre-sowing seed treatments and suitable growing media for quality seedling production of *A. lebbeck*.

MATERIALS AND METHODS

The study was carried out at ICAR-Central Agroforestry Research Institute, Jhansi to find out the best pre-sowing treatment and suitable growing media for enhancing seed germination and quality seedlings production of *A. lebbeck.* The healthy and matured seeds of *A. lebbeck* were subjected to seven pre-sowing treatments laid out in Completely Randomized Design (CRD) with four replications. The pre-sowing treatments applied were: T_1- immersion of seeds in cold water for 12 h; T_2- immersion of seeds in cold water for 24 h; T_3- immersion of seeds in hot water (100 °C) and subsequent cooling at room temperature for 12 h; T_4- immersion of seeds in hot water (100 °C) and subsequent cooling at room temperature for 24 h; T_5- immersion of seeds in cold water for 12 h followed by immersion in hot water (100 °C) and allowed to cool for 1 h; T_6- immersion of seeds in cold water for 24 h followed by immersion in hot water (100 ° C) and allowed to cool for 1 h. Untreated seeds served as control (T_0). In each treatment, 25 seeds were given pre-sowing treatment and kept in plastic petri dishes. These petri dishes were kept in incubator at 29±2 °C. Observation on germination was recorded on daily basis for a period of fifteen days from the day of sowing and cumulative germination percent was calculated for each treatment. Daily germination percentage was summed up to obtain cumulative germination.

To find out the best growing media, nine treatments *viz*., T_1: soil, T_2: soil+sand (2:1), T_3: soil+ perlite (2:1), T_4: soil+Farm Yard Manure (FYM) (2:1), T_5: soil+vermicompost (2:1), T_6: soil+ sand+ FYM (1:1:1), T_7: soil+ sand+ vermicompost (1:1:1), T_8: soil+perlite+FYM (1:1:1) and T_9: soil+ perlite+ vermicompost (1:1:1) were tested for their effect on seedling growth. The nine treatments were laid out in CRD. Pre-treated seeds (immersed in hot water followed by subsequent cooling at room temperature for 12 h) were sown in root trainers (volume: 300 cc) containing different growing media. This study was conducted under net-house, fitted with the nylon net. At the age of four months, five seedlings from each treatment were randomly selected and uprooted very carefully. The seedlings were measured for shoot length (cm), root length (cm), collar diameter (mm) and oven dry weight (g) of shoot and root. Seedlings were oven dried at 70 °C for 72 hours until the constant weight is obtained. Seedling quality index was calculated by using the formula given by Dickson (1960).

$$\text{Seedling Quality Index} = \frac{\text{Total dry weight of plant (g)}}{\frac{\text{Plant height (cm)}}{\text{Collar diameter (mm)}} + \frac{\text{Shoot dry weight (g)}}{\text{Root dry weight (g)}}}$$

...Eq.1

The data obtained from the experiment was subjected to statistical analysis (*P=0.05*) (Panse and Sukhatme, 1989)

RESULTS AND DISCUSSION

Effect of pre-sowing treatments on seed germination of *A. lebbeck*: The findings of the study showed that seed germination of *A. lebbeck* improved due to pre-sowing treatments over control. Immersion of seeds in hot water and subsequent cooling at room temperature for 12 h (T_3) gave the highest germination (96%) (Fig. 1) which was comparable with T_5 (95%), T_4 (94%) and T_6 (93%). The minimum germination percentage (18%) was observed in untreated (control) seeds (Fig. 1). The results of this study are in agreement with the find-

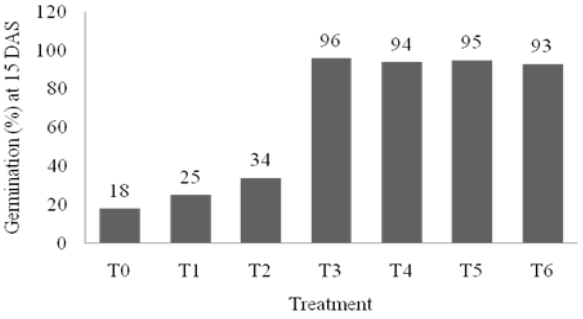

Fig. 1. *Effect of pre-sowing treatments on seed germination of A. lebbeck.*

ings of Mwase and Mvula (2011) and Azad *et al.* (2012) who reported that soaking of seed in hot water softens the hard seed-coat and hydrates the seed tissues, which facilitates good germination. Mwase and Mvula (2011) also reported more or less similar results in *Bauhinia thonningii* Schum.

Effect of different growing media on seedling growth of *A. lebbeck*: Different growing media were found to support the seedling growth of *A. lebbeck*. Among different media, the maximum shoot length (23.82 cm) was recorded in soil+sand+vermicompost (1:1:1) media mixture (T_7), however it was statistically at par withT_8: soil+perlite+FYM (1:1:1), T_6: soil+sand+FYM (1:1:1) and T_9: soil+perlite+vermicompost (1:1:1). The minimum shoot length (18.08 cm) was observed when only soil (T_1) was used as growing media. However, growing media did not affect the root length significantly (Table 1). This finding is in accordance to the observations of Shukla *et al.* (2007) who also reported that root length growth is independent of media composition. Highest collar diameter (3.59 mm) was recorded in T_7 (soil+sand+vermicompost-1:1:1), and it was observed statistically at par with T_9, T_2, T_6 and T_8 (Table 1). The significantly higher dry shoot weight (1.94 g) was also observed in T_7 over other treatments, except T_8. Similarly, maximum (1.04 g) and minimum (0.68 g) dry root weight was observed in T_7 and T_1, respectively (Table 2). These results are in close conformity with the findings of Kumar *et al.* (2011) and Samir *et al.* (2016) who reported enhanced growth in seedlings of litchi (*Litchi chinensis*) and khirni (*Manilkara hexandra*) when grown in potting media containing soil+ sand+ vermicompost mixture. The better results obtained in soil+sand+vermicompost in present study could be due to the presence of sand and nutrient rich vermicompost in the media, wherein sand provides better aeration and good drainage of water, and vermicompost contains plant growth regulating material such as humic acid (Muscsolo *et al*., 1999) and plant growth regulators (Atiyeh *et al*., 2002) which increase the plant growth.

The seedling quality index explains plant potential for survival and growth in the field and higher index values are considered better (Olivo and Buduba, 2006). Significantly highest seedling quality

Table 1. Effect of growing media on shoot length, root length and collar diameter of A. lebbeck.

Treatments	Shoot length (cm)	Root length (cm)	Collar diameter (mm)
T_1-Soil	18.08±1.93	18.34±2.07	2.88±0.45
T_2-Soil + sand (2:1)	20.22±1.86	19.08±2.44	3.51±0.66
T_3-Soil + perlite (2:1)	20.16±2.96	18.26±1.18	3.11±0.55
T_4-Soil + FYM (2:1)	21.07±2.59	18.87±2.26	3.03±0.50
T_5-Soil + vermicompost (2:1)	21.32±2.94	20.31±3.37	2.74±0.48
T_6-Soil + sand + FYM (1:1:1)	22.51±2.87	19.51±5.18	3.51±0.24
T_7-Soil + sand + vermicompost (1:1:1)	23.82±1.18	21.14±1.98	3.59±0.38
T_8-Soil + perlite + FYM (1:1:1)	22.83±3.52	21.02±4.10	3.42±0.58
T_9-Soil + perlite + vermicompost (1:1:1)	21.98±3.72	18.02±3.22	3.57±0.30
F-ratio	3.940	1.647	4.626
P value	0.001	0.125	<0.001
$LSD_{0.05}$	2.42	NS	0.42

Table 2. Effect of growing media on dry weight (shoot and root) and seedling quality index of *A. lebbeck.*

Treatments	Dry weight (g)		Seedling quality index
	Shoot	Root	
T_1-Soil	0.95±0.24	0.68±0.24	0.215±0.076
T_2-Soil + sand (2:1)	0.91±0.22	0.76±0.18	0.240±0.069
T_3-Soil + perlite (2:1)	0.98±0.21	0.69±0.26	0.210±0.067
T_4-Soil + FYM (2:1)	1.24±0.33	0.78±0.29	0.244±0.100
T_5-Soil + vermicompost (2:1)	1.53±0.32	0.94±0.10	0.264±0.053
T_6-Soil + sand + FYM (1:1:1)	1.39±0.31	0.83±0.04	0.276±0.034
T_7-Soil + sand + vermicompost (1:1:1)	1.94±0.35	1.04±0.05	0.350±0.038
T_8-Soil + perlite + FYM (1:1:1)	1.73±0.44	0.96±0.10	0.319±0.068
T_9-Soil + perlite + vermicompost (1:1:1)	1.53±0.49	0.87±0.24	0.299±0.064
F-ratio	11.815	4.580	5.125
P value	<0.001	<0.001	<0.001
$LSD_{0.05}$	0.30	0.17	0.06

index (0.350) was registered in treatment (T_7) when soil, sand and vermicompost media was used in the ratio of 1:1:1 (Table 2). This may be attributed to the fact that the equal proportion of soil, sand and vermicompost might have provided the favorable environment for seedlings growth (Bana *et al.*, 1996).

Conclusion

The present investigation showed that immersion of *A. lebbeck* seeds in hot water (100 °C) and thereafter, allowed to cool for 12 h at room temperature resulted in maximum germination. Hence, this pre-sowing treatment can be used for breaking the seed dormancy and getting the improved germination. Whereas, soil+ sand+ vermicompost (1:1:1) growing media resulted in maximum values for shoot length, root length, collar diameter, dry weight of shoot and root, and seedling quality index, hence, it may be used for production of quality seedlings of *A. lebbeck*.

REFERENCES

1. Abad, M., Noguera, P., Puchades, R., Maquieira, A. and Noguera, V. (2002). Physico-chemical and chemical properties of some coconut coir dusts for use as a peat substitute for containerised ornamental plants. *Biores. Technol*. 82: 241-245.
2. Agbo, C.V. and Omaliko, C.M. (2006). Initiation and growth of shoots of *Gongronema latifolia* Benth stem cutting in different rooting media. *African Journal Biotechnology,* 5: 425-428.
3. Ajiboye, A.A., Atayese, M.O. and Agboola, D.A. (2009). Effect of presowing treatments on seed germination and percentage starch content levels in *Tamarindus indica, Prosopis africana, Parkia biglobossa* and *Albizia lebbeck*. *Journal of Applied Science Research*, 5: 1515–1519.
4. Alamgir, M. and Hossain, M.K. (2005). Effect of presowing treatments on germination and initial seedling development of *Albizia saman* in the nursery. *Journal of Forestry Research*, 16: 200–204.
5. Atiyeh, R.M., Lee, S.S., Edwards, C.A., Arancon, N.Q. and Metzager, J. (2002). The influence of humic acid derived from earthworm processes organic waste on plant growth. *Bioresource Technology*, 84: 7-14.
6. Azad, M. S., Biswas, R. K. and Matin, M. A. (2012). Seed germination of *Albizia procera* (Roxb.) Benth. in Bangladesh: a basis for seed source variation and pre-sowing treatment effect. *Forestry Studies in China*. 14 (2): 124–1130.
7. Azad, M. S., Islam, M. W., Matin, M. A. and Bari, M. A. (2006). Effect of pre-sowing treatment on seed germination of *Albizia lebbeck* (L.) Benth. *South Asian J Agric*. 1(2): 32–34.
8. Azad, M. S., Paul, N. K. and Matin, M. A. (2010). Do pre-sowing treatments affect seed germination in *Albizia richardiana* and *Lagerstroemia speciosa*? *Front. Agric. China* 4(2): 181–184.
9. Bana, O.P.S., Singh, V. and Sah, V.K. (1996). Effect of growing media on growth and seedling quality in different tree species in U.P. hills. *Journal of Hill Research*. 9 (1): 101-108.
10. Baskin, J. M. and Baskin, C. C. (2004). A classification system for seed dormancy. *Seed Science Research*. 14: 1-16.
11. Chakrabarti, K., Azam, Z. and Siddhartha, B. (1998). Compost for container nursery. *Indian Forester*, 124 (1): 17-30.
12. Dickson A., Leaf A.L. and Hosner J.F. (1960). Quality appraisal of white spruce and white pine seedling stock in nurseries. *Forest Chron*. 36: 10-13.
13. Faisal, M., Singh, P.P. and Irchhaiya, R. (2012). Review on *Albizia lebbeck* a potential herbal drug. *International Journal of Pharmaceutics*. 3 (5): 63-68.
14. Kumar, A., Pandey, S.D., Kumar, V. and Nath, V. (2011). Evaluating potting media for production of quality planting material of Litchi (*Litchi chinensis* Sonn). *Bihar Journal of Horticulture*. 1: 48-50.
15. Merou, T., Takos, I., Konstantinidou, E., Galatsidas, S. and Varsamis, G. (2011). Effect of different pretreatment methods on germination of *Albizia julibrissin* seeds. *Seed Science and Technology*, 39: 248–252.
16. Mwase, W. F. and Mvula, T. (2011). Effect of seed size and pre-treatment methods of *Bauhinia thonningii* Schum. on germination and seedling growth. *African Journal of Biotechnology*. 10 (26):5143–5148
17. Muscsolo, A., Bovalo, F., Gionfirddo F. and Nardi, F. (1999). Earthworm humic matter produce auxin like effect on carrot (*Daucus carrota*) cell growth and nitrate metabolism. *Soil Biology and Biochemistry,* 31: 1303-1311.
18. Nongrum, A. and Kharlukhi, L. (2013). Effect of seed treatment for laboratory germination of *Albizia chinensis. Journal of Forestry Research.* 24 (4): 709 -713.
19. Olivo V.B. and Buduba C.G. (2006). Influence of six substrates in *Pinus ponderosa* grown in containers under greenhouse conditions. *Bosque*. 27(3):267–271
20. Orwa, C., Mutua, A., Kindt, R., Jamnadass, R. and Anthony, S. (2009). Agroforestry Database: A Tree Reference and Selection Guide Version 4.0. World Agroforestry Centre, Kenya.
21. Panse, V.G. and Sukhatme, P.V. (1989). Statistical Methods for Agricultural Workers. ICAR, New Delhi.
22. Samir, M., Rai, R. and Parasad, B. (2016). Effect of organic manures on seed germination and seedling growth of Khirni. *Indian Forester*, 142 (7): 666-669.
23. Shukla. G., Chakravarty, S. and Panwar, P. (2007). Effect of growing media on germination and initial seedling growth of *A. lebbeck* in Terai Zone of West Bengal. *Environment and Ecology*. 25S (3A): 949-50.