



## Effect of Pre-Sowing Treatment on Seed Germination and Seedlings Growth Characteristics of *Albizia procera*

Sunil Kumar Tiwari<sup>1\*</sup> and S. S. Dhuria<sup>1</sup>

<sup>1</sup>Department of Forestry, Wildlife and Environmental Sciences School of Natural Resources, Guru Ghasidas Vishwavidhyalaya, Bilaspur, Chhattisgarh 495009, India.

### Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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### ABSTRACT

The objective of this study was to identify the most suitable pre-treatment method that will increase germination and enhance seedling growth of *Albizia procera*. The fresh seeds of *A. procera* were collected from five provenances viz., Bilaspur, Bastar, Korba, Raigarh and Sarguja of Chhattisgarh, India to study the germination and growth characteristics of *A. procera* after pre-sowing treatment. The experiment was carried out at Forestry Nursery (Department of Forestry, Guru Ghasidas Vishwavidhyalaya, Bilaspur, Chhattisgarh, India). Three pre-treatment methods were employed i.e., soaking in coldwater for 24 hrs at room temperature, in hot water (50°C), and Hormonal treatment IAA (25%). These all pre-treatments were undertaken separately and compared with control i.e. after each pre-treatment. The result show significant differences ( $P \leq 0.05$ ) in germination percentage and seedling growth by pre-sowing treatments as compared to control across all the five provenances. The overall results confirm the stimulation in the aforementioned germination and growth characteristics of *A. procera* by hormonal treatment (IAA 25%) for raising elite nursery stock,

\*Corresponding author: E-mail: [sunilt167@gmail.com](mailto:sunilt167@gmail.com);

and for successful plantation. Also, it was recorded that across all the provenances Bilaspur and Bastar provenance show better results for both germination and growth attributes than other provenances.

**Keywords:** *Albizia procera*; provenance; germination percentage; seedling growth; pre-sowing treatments.

## 1. INTRODUCTION

*Albizia procera* commonly called (white siris) is one of the important species belongs to family Fabaceae. It is a large, fast-growing medium to large sized deciduous tree. It is distributed throughout moist and dry deciduous forests of India. In Chhattisgarh, it is found on alluvial grounds along streams and moist swampy places. This species provides wood for a variety of purposes, nutritious fodder for livestock. It is extensively planted in farm lands, agricultural boundary, wasteland and roadside avenues, it is an important reforestation and agro forestry species. Due to its multipurpose use and nitrogen fixing ability it is considered as one of the priority species in plantation programs. To ensure successful plantation of *Albizia* species, it is important to provide better planting stock.

Since *Albizia procera* suffers from seedling establishment problems throughout the state. A kind attention is required by the forest tree breeders to overcome this problem in *Albizia procera*. There are many other forest tree species where they suffer from the same problem, but their germination and growth was stimulated by giving them certain type of pre-sowing treatments. The results of pre-sowing treatments were found efficient in *Acacia auriculiformis* [1], *Albizia procera* [2,4,6], *Melia azedarach* [5], *Dalbergia sissoo* [7], *Albizia lebbek* [8]. Different pre-sowing treatment have been used by different Researchers to enhance seed germination of different species including *Faidherbia albida* [9,10], *Acacia spp.* [11], *Grewia oppositifolia* [12], *Terminalia chebula* [13], *Tetrapleura tetrapetra* [14] and *Adonsania digitata* [15]. Keeping in view the results of these researchers, the present study was designed to identify the most suitable pre-sowing treatment which will stimulate seed germination and enhance seedling growth of *A. procera*.

## 2. MATERIALS AND METHODS

The fresh seeds were collected from five provenances viz., Bilaspur, Bastar, Korba, Raigarh and Sarguja. From each provenance

Pods/seeds were collected from five phenotypically superior trees located about 1000 m apart from each other in order to avoid narrowing down of the genetic base due to relatedness or inbreeding. Seeds from all the trees of a provenance were mixed and a composite seed lot was made for each provenance.

An extensive survey was carried out for the selection of superior/plus trees for the collection of pod/seeds. The selection of plus tree was made on visual observations. The individuals trees with defective bole, bi-forked, diseased, dead branches, or attacked by any pathogen and pests were rejected in the initial stage of selection. The main characteristics considered for the plus tree selection were, tree should be middle aged, having cylindrical bole, with well-developed crown, straightness, non-forking, non-twisting bole, free from buttresses and flutes and minimum form characteristics. The preferred best phenotypically trees were dominating in height and girth compared to its surrounding trees of the same species and age.

The germination tests were examined in the Forestry Nursery (Department of Forestry, Guru Ghasidas Vishwavidyala, Bilaspur, Chhattisgarh, India), Location: 21°47' to 23°08'N and 81°14' to 83°15'E. In nursery, the experiment was laid out in randomized block design (RBD) using 25 bags each in four replications for each provenance.

Three pre-treatment methods were employed, namely soaking in coldwater for 24 hrs at room temperature, in hotwater(50°) and Hormonal treatment IAA (25%). These all pre-treatments were undertaken separately and compared with control i.e. after each pre-treatment, the seeds were sown in polythene bags of 30 x 45 cm size filled with soil, sand and farm yard manure in 3:2:2 ratios. Seeds were considered germinated when sprouted plumules just emerged from the soil surface. The bags were regularly watered and weeded in the nursery. Observations were recorded every day. Germination percentage (ISTA1999), Germination energy index, Germination value (Czabator 1962), Germination

Speed (Chiapuso et al., 1997) were calculated by given formula. The experiment was conducted in the first week of May-2015.

The observations on morphological growth parameters were recorded viz., plant height, a number of leaves and dry weights of root, stem, branch and leaf were made on ten randomly selected seedlings.

These all pre-treatments were undertaken separately and compared with control i.e. after each pre-treatment, the seeds were subjected to germination in the nursery, and the following parameters were recorded. Seedling height, Number of leaves, Data was subjected to Analysis of Variance (ANOVA).

### 3. RESULTS AND DISCUSSION

Various pre-treatments were employed to record their effects on seed germination and seedling growth response in the seeds collected from various provenances of *A. procera*. After each treatment seeds of each provenance were tested for their germination and the data has been depicted in Table (1). On an average germination was (71.6, 71.44, 75.82, 80.02) respectively, when seeds were pre-treated with coldwater, hot water and hormonal treatment for 24 hours, irrespective of provenances. In almost all the provenances, seeds pre-treated with hormones stimulated the germination significantly ( $P \leq 0.05$ ), in contrast to cold and hot water pre-sowing treatments. Seeds pre-treated with hormone IAA had highest germination percentage across all the provenances. In case of hormonal treatment maximum (90.5%) germination was recorded in Bilaspur provenance followed by Bastar (84.3%) while the minimum (67.2%) was observed in Korba provenance (Table 1).

The effect of various pre-treatment on germination value and germination energy index (Table1). The highest enhancement in germination energy index (46.8) and germination value (54.4) recorded for Bastar provenance after hormonal treatment and these values were lowest (21.2 and 30.5) for Korba provenance when exposed to coldwater treatment. The speed of germination across all the provenances was enhanced significantly ( $P \leq 0.05$ ) when the seeds were exposed to hot water and hormonal treatment; the cold water treatment had no effect in germination speed over control. It observed that pre-seed treatment with hormones at

different concentration can stimulate the germination behaviour of *A. procera* (Table 1).

The influence of different pre-seed treatments was also observed for different seedling growth attributes of *A. procera* among different provenances (Table 2). Across all the pre-seed treatments the hormonal treatment proved effective in enhancing different seedling growth attributes significantly ( $P \leq 0.05$ ) for each provenance, It was observed that the coldwater treatment did not significantly changed the shoot length, root length, number of leaves and leaf area, than the control of each provenances. While hot water treatment and hormonal treatment enhanced these growth parameters significantly and successively for each provenance. Moreover it was also recorded that the seedling growth parameters differ significantly ( $P \leq 0.05$ ) across all the provenances, with the most elite provenance was Bilaspur and Bastar respectively.

The pre-sowing treatments influence the germination percentage of *A. procera* seeds. The seed dormancy affect the use of dormant species in nurseries for the production of seedlings, it is known that seed dormancy vary from species to species, so the type of pre-treatments should be given in accordance with the forest tree species [16,17]. Several authors [17,18,19,20,21,22,23, 24,25,26] have discussed different methods of pre-sowing treatments for seed germination in order to break dormancy and enhance the rate of germination and speed up the germination process. The findings of the present study shows that seed germination of *A. procera* under different pre-treatment methods significantly increased ( $P > 0.05$ ) over the control. Among the three pre-treatments, seeds pre-treated with cold-water had optimum germination than those pretreated with hot-water and hormonal treatment. Similar studies have been done on *Albizia falcataria* [27] where seed dormancy and germination of these species were experimented and found that hot water treatments at 40°, 60°, 70°, 80°C significantly increased germination in both species. IAA and riboflavin was found to enhance germination of *A. procera* and *A. lebbeck* in another studies [28]. In *Albizia lebbeck* the highest germination was found when the seeds were pretreated with hot water [8]. The pre-treatment methods that affecting germination also influenced seedling growth the highest root and shoot length (27.8 cm and 11.6 cm) were recorded with seeds treated with hormone and followed by hot water, coldwater.

**Table 1. Effect of various treatments on Germination Percentage (GP%), Germination Value (GV), Germination Energy Index (GEI) and Germination Speed(GS) of various provenances of *Albizia procera***

Provenance	Control				Cold water				Hot water (50 <sup>0</sup> C)				Hormonal			
	GP	GV	GEI	GS	GP	GV	GEI	GS	GP	GV	GEI	GS	GP	GV	GEI	GS
Bilaspur	84.0	46.2	44.9	15.2	80.2	40.6	34.6	12.2	86.2	46.6	42.6	16.2	90.5	49.8	44.5	16
Baster	78.5	49.6	38.3	12.3	76.2	44.6	38.2	13.3	80.5	50.4	46.2	14.5	84.3	54.4	46.8	15.2
Korba	60.0	18.8	29.8	7.1	62.3	21.2	30.5	8.8	65.4	26.9	32.5	12.7	67.2	29.5	34.6	12.5
Raigarh	64.0	26.4	34.7	10.2	66.5	29.4	36.5	10.5	72.4	33.2	40.5	13.6	79.6	35.2	42.5	12.9
Sarguja	71.5	34.3	33.8	10.7	72	37.6	32.7	9.4	74.6	38.9	36.4	14	78.5	40.6	39.9	13.7
Mean	71.6	35.0	36.3	11.1	71.44	34.68	34.5	10.84	75.82	39.2	39.64	14.2	80.02	41.9	41.66	14.06
SD(±)	9.92	12.99	5.68	2.97	7.21	9.38	3.04	1.89	7.93	9.59	5.34	1.30	8.59	10.23	4.69	1.50
Significance	P-Value= 0.027(Across Provenances) * Statistically significant= P ≤ 0.05 P-Value=0.0311(Across Different Treatments)															

**Table- 2. Effect of various treatments on growth parameters, Shoot Length (SL), Root Length (RL), Number of Leaves (NL), Leaf area (LA ) of various provenances of *Albizia procera***

Provenance	Control				Cold water				Hot water (50 <sup>0</sup> c)				Hormonal			
	SL (cm)	RL (cm)	NL	LA (cm)	SL (cm)	RL (cm)	NL	LA (cm)	SL (cm)	RL (cm)	NL	LA (cm)	SL (cm)	RL (cm)	NL	LA (cm)
Bilaspur	22.7	08.3	8	12.2	21.4	8.3	8	13.5	25.6	10.5	10	14.7	27.8	11.6	12	14.0
Baster	21.3	11.4	8	10.0	22.7	9.2	8	11.4	23.2	10.0	10	11.6	25.0	10.5	10	12.5
Korba	15.7	07.0	4	06.8	16.2	8.5	6	08.7	18.4	09.5	6	08.9	20.5	09.0	8	09.5
Raigarh	17.8	08.8	6	08.4	17.2	7.9	8	08.7	21.5	10.9	8	10.3	23.6	10.0	8	10.6
Sarguja	17.0	08.0	6	07.9	16.4	8.0	8	08.9	22.6	11.5	8	09.5	23.8	10.7	8	10.0
Mean	18.9	8.7	6.4	9.06	18.78	8.38	7.6	10.24	22.26	10.48	8.4	11	24.14	10.36	9.2	11.32
Sd (±)	2.97	1.65	1.67	2.10	3.04	0.52	0.89	2.15	2.63	0.78	1.67	2.30	2.64	0.96	1.79	1.88
Significance	P-Value= 0.0398(Across Provenances) * Statistically significant= P ≤ 0.05 P-Value=0.0466(Across Different Treatments)															

### 3. CONCLUSION

The present studies revealed that there were a difference in seed germination and seedling growth among the different seed source, so in order to produce large number of quality seedlings it is necessary for pre-sowing treatments because it plays a vital role to enhance the seed germination and seedling growth. According to our studies, the best treatments for *A. procera* is hormonal treatment and hot water treatments.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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