

## Original Research Article

### Studies on Germination of *Albizia procera* (Roxb.) under Nursery Condition

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#### ABSTRACT

This study was undertaken to determine the optimum conditions for the germination of *Albizia procera* by using five different pre-sowing treatments, eight different growing mediums, and three different container types. The experiment was conducted in a complete randomized design with three replications. Germination parameters viz., germination percent, imbibition, germination period, germination value, germination energy, and energy period were influenced by different treatment combinations. Results revealed that best germination period (6.00 days), germination value (24.74) and energy period (3.00 days) were recorded in T<sub>3</sub>C<sub>1</sub>M<sub>6</sub> treatment combination i.e. [seeds soaked in cow urine for 24 hours, raised in polybags of size 23 cm×13 cm and growing medium consisting of sand + vermicompost (1:1)] whereas, least germination period (34 days), germination value (4.00) and energy period (24.00 days) was recorded in T<sub>5</sub>C<sub>2</sub>M<sub>4</sub> treatment combination i.e. (controlled treatment, raised in root trainer of size 150cc and growing medium consisting of sand + soil + FYM (1:2:1)).

#### Keywords

Pre-sowing treatments,  
Container type,  
Growing medium,  
*Albizia procera*

#### Introduction

*Albizia procera* is a fast-growing deciduous tree that generally reaches 10 to 20 m in height and 30 to 60 cm dbh and has a straight to somewhat curved stem, smoothish light brown to light greenish-gray bark, and a spreading thin crown (Little and Wadsworth, 1964, Troup, 1921). It grows best on very moist, alluvial sites of well-drained loams or clays but can tolerate shallow, dry, stony, and sandy soils (National Research Council 1979, Troup 1921, Venkataramany, 1968). It is susceptible to frost (Troup, 1921). Trees are often planted for shade or beautification

along the roadside and used for afforestation of degraded lands (Venkataramany, 1968). In the native places, sometimes planted as a shade tree in tea gardens (Parrotta 1988b; Skoupy and Vaclav 1976). Seeds are small, greenish-brown, and elliptical to round, flat, and have a hard, smooth seed coat. Seeds average 17,600 to 25,300 per kg (Francis and Rodríguez 1993, Troup 1921).

Fresh seed germinates readily without treatment (Parrotta, 1987). Clean seeds can be stored at room temperature for 10 months with minimal loss of viability (Roshetko, 1997). After storing the hard seed coat of the

species prevents the imbibition of water and exchange of gas, thus preventing initiation of the germination process.

To facilitate germination, the seed must be placed in favorable environmental conditions like adequate moisture supply, appropriate gaseous balance, and optimum light. For the sake of production of seedlings in mass and to get better germination, pre-sowing seed treatments are required.

## **Materials and Methods**

### **Details of treatments**

#### **Germination (%)**

Germination percent was calculated as the total number of seeds germinated at the end of the experiment out of total seeds sown in each treatment (as per ISTA rules).

Germination (%)

$$\text{Germination (\%)} = \frac{\text{Seeds germinated at the end of the test period}}{\text{Total number of seeds sown}} \times 100$$

#### **Imbibition (days)**

It was calculated as the number of days from sowing to commencement of germination.

#### **Germination period (days)**

Germination period was calculated as the number of days from sowing to completion of germination.

#### **Germination value**

It is an index combining speed and completeness of seed germination. Daily

germination counts were recorded and GV was calculated as per Czabator (1962).

$$GV = PV \times MDG$$

Where,

PV = Peak value

MDG = Mean daily germination

#### **Germination energy (%)**

Germination energy (GE) was calculated based on the percentage of the total number of seeds that had germinated when the germination reached its peak generally as the highest number of germination in 24 hours period (Czabator, 1962).

#### **Energy period (days)**

It was calculated as the percentage of seed in the sample that had germinated in a test upto the time when the number of seeds germinated reaches its peak, the number of days required to reach this peak was calculated as Energy period.

#### **Statistical analysis**

The entire data generated from the present investigation were put to statistical analysis under the procedure outlined by Gomez and Gomez (1984).

#### **Results and Discussion**

The interaction effect of pre-sowing treatment, container type, growing media related to germination growth (viz., germination percent, imbibition, germination period, germination value, germination energy, energy period) are presented in table no. 1 to 6.

### **Interaction effect of pre-sowing treatment, container type and growing media (T×C×M)**

From the data presented in table 1 it reveals that *Albizia procera* seedlings raised in combination of T<sub>3</sub>C<sub>1</sub>M<sub>6</sub> resulted highest germination (83.33%). However, the interaction was found statistically non-significant. Whereas, the least value of 24.00 percent was obtained for combination T<sub>5</sub>C<sub>2</sub>M<sub>4</sub>. Data of Table 2 represents that seeds raised in treatment combination T<sub>5</sub>C<sub>2</sub>M<sub>4</sub> resulted highest imbibition period of 11.00 days.

Whereas, the least imbibition period of 2.00 days was obtained for T<sub>3</sub>C<sub>1</sub>M<sub>6</sub>. Table 3 reveals that T<sub>3</sub>C<sub>1</sub>M<sub>6</sub> resulted significantly least germination period of 6.00 days. Whereas, the highest germination period of 34.00 days was obtained for T<sub>5</sub>C<sub>2</sub>M<sub>4</sub>. Table 4 reveals that germination value was highest in T<sub>1</sub>C<sub>1</sub>M<sub>8</sub> i.e., 40.67 and lowest in T<sub>5</sub>C<sub>2</sub>M<sub>4</sub> (4.00). The highest germination energy (66.60%) was recorded in T<sub>3</sub>C<sub>1</sub>M<sub>6</sub> treatment combination and lowest germination energy (16.60%) was recorded in T<sub>5</sub>C<sub>2</sub>M<sub>4</sub>.

The perusal of data in table 6 reveals that *Albizia procera* seedlings raised in treatment combination T<sub>3</sub>C<sub>1</sub>M<sub>6</sub> resulted in a significantly least energy period of (3 days). Whereas, significantly highest (23 days) energy period was obtained for T<sub>5</sub>C<sub>2</sub>M<sub>4</sub> treatment combination.

Shreesty *et al.*, (2019) also studied the effect of cow urine and plant growth-promoting rhizobacteria (PGPR) on seed germination, growth, and survival of karonda (*Carissa carandas* L.) seedlings.

Results revealed that combined effect of seed treatment with 25% cow urine and soil inoculation with 6ml/ kg pseudomonas was more superior over the other combination with highest seed germination (5.33 days), 50% germination (14.50 days), germination at 60 DAS (79.63%), coefficient of germination (6.10), speed of germination (9.15).

Farhana *et al.*, (2010) studied comparative growth performance of *Albizia procera* seedlings raised in nursery beds, polybags, and root trainers and found that seeds sown in big containers provided the highest energy period i.e., 9.

These results conform with Sharma (2013) who reported better germination and growth performance when the medium of soil + sand + compost (1:1:2) and bigger polybags of size were used for *Melia composita*.

Based on these results, it may be suggested that seeds should be treated with cow urine for 24 hours because the rapid growth of seedlings after cow urine treatment might be due to the presence of growth-promoting substances (auxins) and nutrients.

It may be recommended that seedlings should be grown in 23 × 13 cm size containers, to obtain vigorous seedlings capable of surviving in the plantation area. Among all growing mediums sand + Vermicompost (1:1) is proposed best for the growth of the seedlings.

The better growth in vermicompost is due to better soil aeration and texture thereby reducing soil compaction, water retention capacity.

**Table.1** Pre-sowing treatments (5)

T <sub>1</sub>	Soaking in normal water for 24 hours
T <sub>2</sub>	Soaking in cooling boiled water for 24 hours
T <sub>3</sub>	Soaking in cow urine for 24 hours
T <sub>4</sub>	Soaking in beejamrutha for 24 hours
T <sub>5</sub>	Control

**Table.2** Container type (3)

C <sub>1</sub>	Side perforated polythene bag (23 cm × 13 cm)
C <sub>2</sub>	Root trainer 150 cc
C <sub>3</sub>	Root trainer 275 cc

**Table.3** Potting mixture (8)

M <sub>1</sub>	Sand:soil:vermicompost (1:1:2)
M <sub>2</sub>	Sand:soil:vermicompost (1:2:1)
M <sub>3</sub>	Sand:soil:FYM (1:1:2)
M <sub>4</sub>	Sand:soil:FYM (1:2:1)
M <sub>5</sub>	Sand:FYM (1:1)
M <sub>6</sub>	Sand:vermicompost (1:1)
M <sub>7</sub>	Soil:FYM (1:1)
M <sub>8</sub>	Soil:vermicompost (1:1)

**Table.4** Effect of pre-sowing treatment, container type, growing media and their interaction effect on germination percent (%) of *Albizia procera* seedlings

	T1				T2				T3				T4				T5				C1	C2	C3	Mean				
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean								
<b>M1</b>	66.67 (8.16)	44.00 (6.62)	60.67 (7.84)	<b>57.11</b> (7.55)	66.67 (8.19)	44.00 (6.62)	61.00 (7.82)	<b>57.22</b> (7.54)	58.33 (8.19)	44.00 (6.27)	66.33 (8.16)	<b>56.22</b> (7.40)	55.00 (7.25)	26.00 (7.49)	55.33 (7.56)	44.11 (8.29)	66.67 (8.19)	66.00 (7.67)	50.00 (6.85)	<b>60.89</b> (7.80)	56.67 (8.13)	50.60 (7.02)	58.67 (7.80)	<b>55.31</b> (7.65)				
<b>M2</b>	58.33 (7.67)	33.00 (6.27)	33.00 (7.05)	<b>41.44</b> (7.00)	58.33 (7.67)	55.00 (7.40)	72.00 (8.11)	<b>61.78</b> (7.73)	66.67 (8.29)	77.33 (8.46)	61.00 (7.82)	<b>68.33</b> (8.19)	66.33 (8.02)	33.33 (6.08)	49.67 (7.05)	<b>49.78</b> (7.05)	41.67 (6.40)	33.00 (5.83)	38.67 (6.27)	<b>37.78</b> (6.19)	51.67 (7.23)	52.93 (7.20)	50.87 (7.26)	<b>51.82</b> (7.23)				
<b>M3</b>	73.33 (8.16)	66.00 (7.46)	60.67 (7.84)	<b>69.00</b> (7.30)	72.33 (8.06)	55.00 (7.40)	77.33 (8.84)	<b>69.89</b> (7.47)	75.00 (8.64)	66.33 (8.46)	44.33 (6.71)	<b>61.89</b> (7.93)	60.67 (7.84)	66.67 (8.19)	55.33 (7.49)	<b>60.89</b> (7.84)	41.67 (7.67)	33.00 (6.20)	55.33 (7.49)	<b>43.33</b> (7.12)	70.00 (8.65)	56.20 (7.47)	58.60 (7.67)	<b>56.18</b> (7.67)				
<b>M4</b>	50.00 (6.99)	55.00 (7.40)	55.33 (7.49)	<b>53.44</b> (7.29)	58.33 (7.51)	55.00 (7.40)	66.33 (8.84)	<b>59.89</b> (7.69)	58.33 (7.67)	44.00 (6.62)	60.67 (7.82)	<b>54.33</b> (7.37)	55.00 (7.72)	25.00 (5.64)	29.67 (5.94)	<b>36.56</b> (6.43)	33.33 (6.46)	24.00 (4.62)	33.00 (6.27)	<b>33.11</b> (6.45)	45.00 (6.85)	48.40 (7.15)	49.00 (7.14)	<b>47.47</b> (7.05)				
<b>M5</b>	75.00 (8.29)	66.00 (7.46)	49.67 (7.05)	<b>63.56</b> (7.60)	66.67 (8.19)	53.00 (7.28)	61.00 (7.82)	<b>60.22</b> (7.76)	50.00 (7.67)	44.00 (6.60)	49.67 (7.05)	<b>47.89</b> (7.11)	55.00 (7.40)	33.33 (5.78)	44.33 (6.71)	<b>44.22</b> (6.63)	58.33 (7.67)	55.00 (7.48)	49.67 (7.05)	<b>54.33</b> (7.40)	56.67 (7.52)	54.60 (7.24)	50.87 (7.14)	<b>54.04</b> (7.30)				
<b>M6</b>	66.67 (8.19)	33.00 (6.62)	55.33 (7.49)	<b>51.67</b> (7.43)	46.67 (7.29)	53.00 (8.24)	44.00 (6.81)	<b>47.89</b> (7.44)	83.33 (9.16)	66.00 (8.36)	66.00 (8.19)	<b>71.78</b> (8.57)	44.00 (8.22)	58.33 (6.76)	55.00 (7.40)	<b>52.44</b> (7.46)	66.67 (7.76)	55.00 (7.58)	49.67 (7.05)	<b>57.11</b> (7.46)	64.33 (7.83)	50.20 (7.80)	54.00 (7.39)	<b>61.60</b> (7.93)				
<b>M7</b>	66.67 (8.29)	33.00 (6.15)	44.00 (7.49)	<b>47.89</b> (7.31)	50.00 (7.67)	44.00 (6.62)	77.33 (8.84)	<b>57.11</b> (7.71)	50.00 (7.67)	44.00 (6.62)	66.33 (8.16)	<b>53.44</b> (7.48)	44.00 (6.67)	33.33 (5.78)	44.00 (6.62)	<b>40.44</b> (6.36)	41.67 (6.46)	44.00 (6.62)	38.33 (7.05)	<b>41.33</b> (6.71)	48.33 (7.17)	41.80 (6.53)	54.00 (7.63)	<b>48.04</b> (7.11)				
<b>M8</b>	75.00 (8.72)	55.00 (7.58)	44.33 (7.67)	<b>58.11</b> (7.99)	41.67 (6.46)	33.00 (5.89)	44.00 (6.48)	<b>39.56</b> (6.28)	66.67 (8.19)	44.00 (6.62)	60.67 (7.84)	<b>57.11</b> (7.55)	66.33 (8.46)	41.67 (7.67)	55.33 (7.49)	<b>54.44</b> (7.87)	70.33 (6.99)	33.00 (6.62)	33.00 (6.27)	<b>49.78</b> (7.29)	61.67 (8.01)	46.27 (7.03)	47.47 (7.15)	<b>51.80</b> (7.40)				
<b>Mean</b>	<b>67.71</b> (8.24)	<b>48.13</b> (6.94)	<b>50.38</b> (7.49)	<b>55.40</b> (7.56)	<b>58.96</b> (7.77)	<b>49.00</b> (7.10)	<b>62.88</b> (7.86)	<b>56.94</b> (7.58)	<b>63.54</b> (8.18)	<b>53.71</b> (7.25)	<b>59.38</b> (7.72)	<b>58.88</b> (7.72)	<b>55.79</b> (7.72)	<b>39.58</b> (6.31)	<b>48.58</b> (7.02)	<b>47.99</b> (7.15)	<b>53.17</b> (7.47)	<b>44.00</b> (6.89)	<b>43.46</b> (6.89)	<b>47.21</b> (7.08)	<b>56.79</b> (7.65)	<b>50.13</b> (7.18)	<b>52.93</b> (7.40)					
The values in parenthesis are transformed values (square root transformation)																												
	T				C				M				T × C				C × M				T × M				T × C × M			
	SEm±				1.70				2.78				3.80				4.81				6.21				10.75			
	CD <sub>0.05</sub>				4.74				7.73				10.59				N.S				17.29				N.S			

**Table.5** Effect of pre-sowing treatment, container type, growing media and their interaction on imbibition (in days) of *Albizia procera* seeds

	T1				T2				T3				T4				T5				C1	C2	C3	Mean							
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean											
<b>M1</b>	3.67	6.67	4.67	<b>5.00</b>	4.33	8.00	8.00	<b>6.78</b>	3.33	6.33	4.00	<b>4.56</b>	4.67	7.33	6.33	<b>6.11</b>	7.33	10.00	10.00	<b>9.11</b>	5.93	7.67	5.33	<b>6.31</b>							
<b>M2</b>	3.00	7.67	5.00	<b>5.22</b>	4.67	7.67	7.67	<b>6.67</b>	2.67	5.67	4.00	<b>4.11</b>	5.00	7.67	7.33	<b>6.67</b>	6.33	10.00	8.33	<b>8.22</b>	5.33	7.73	5.47	<b>6.18</b>							
<b>M3</b>	3.00	8.00	5.67	<b>5.56</b>	4.67	7.67	7.67	<b>6.67</b>	2.67	5.67	3.33	<b>3.89</b>	3.67	8.67	7.33	<b>6.56</b>	7.33	11.33	8.67	<b>9.11</b>	5.13	8.27	5.67	<b>6.36</b>							
<b>M4</b>	3.00	7.00	5.00	<b>5.00</b>	4.33	8.33	8.33	<b>7.00</b>	2.67	6.67	4.00	<b>4.44</b>	4.33	8.33	8.33	<b>7.00</b>	7.00	10.67	9.67	<b>9.11</b>	5.60	8.20	5.73	<b>6.51</b>							
<b>M5</b>	3.00	7.33	4.67	<b>5.00</b>	4.33	8.67	8.67	<b>7.22</b>	2.00	5.00	3.33	<b>3.44</b>	3.67	7.67	8.33	<b>6.56</b>	6.00	9.67	8.33	<b>8.00</b>	5.13	7.67	5.33	<b>6.04</b>							
<b>M6</b>	4.00	6.00	5.67	<b>5.22</b>	4.33	6.00	6.00	<b>5.44</b>	1.67	6.00	4.00	<b>3.89</b>	3.67	7.67	7.33	<b>6.22</b>	7.33	8.00	8.33	<b>7.89</b>	4.73	6.73	5.73	<b>5.23</b>							
<b>M7</b>	3.00	6.33	4.33	<b>4.56</b>	4.00	8.00	8.00	<b>6.67</b>	2.33	7.33	6.00	<b>5.22</b>	4.67	5.67	8.00	<b>6.11</b>	7.67	8.33	8.33	<b>8.11</b>	5.27	7.13	6.00	<b>6.13</b>							
<b>M8</b>	3.33	5.67	5.33	<b>4.78</b>	4.00	7.33	7.33	<b>6.22</b>	1.33	6.33	3.33	<b>3.67</b>	4.00	6.00	7.67	<b>5.89</b>	7.33	9.00	9.00	<b>8.44</b>	5.00	6.87	5.53	<b>5.80</b>							
<b>Mean</b>	<b>3.67</b>	<b>6.83</b>	<b>5.04</b>	<b>5.04</b>	<b>4.33</b>	<b>7.71</b>	<b>7.71</b>	<b>6.58</b>	<b>2.33</b>	<b>6.13</b>	<b>4.00</b>	<b>4.15</b>	<b>4.21</b>	<b>7.38</b>	<b>7.58</b>	<b>6.39</b>	<b>7.04</b>	<b>9.63</b>	<b>8.83</b>	<b>8.50</b>	<b>5.27</b>	<b>7.53</b>	<b>5.60</b>								
				<b>T</b>				<b>C</b>				<b>M</b>				<b>T × C</b>				<b>C × M</b>				<b>T × M</b>				<b>T × C × M</b>			
<b>SEm±</b>				<b>0.13</b>				<b>0.10</b>				<b>0.16</b>				<b>0.22</b>				<b>0.28</b>				<b>0.36</b>				<b>0.62</b>			
<b>CD<sub>0.05</sub></b>				<b>0.36</b>				<b>0.28</b>				<b>0.45</b>				<b>0.61</b>				<b>0.78</b>				<b>N.S</b>				<b>N.S</b>			

**Table.6** Effect of pre-sowing treatment, container type, growing media and their interaction on germination period (in days) of *Albizia procera* seedlings

	T1				T2				T3				T4				T5				C1	C2	C3	Mean							
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean											
<b>M1</b>	7.67	13.00	11.00	<b>10.56</b>	9.33	13.00	12.89	<b>11.78</b>	7.00	11.00	9.33	<b>9.11</b>	12.00	19.67	13.00	<b>14.89</b>	23.67	30.67	22.33	<b>25.56</b>	11.93	17.47	13.73	<b>14.38</b>							
<b>M2</b>	9.00	10.67	11.67	<b>10.44</b>	8.20	11.67	11.00	<b>10.22</b>	6.35	9.33	8.33	<b>7.89</b>	10.33	14.33	17.67	<b>14.11</b>	23.33	32.33	29.33	<b>28.33</b>	11.33	15.67	15.6	<b>14.20</b>							
<b>M3</b>	11.00	10.33	8.00	<b>9.78</b>	8.10	12.67	11.33	<b>10.67</b>	6.67	10.00	9.00	<b>8.56</b>	14.00	16.00	16.33	<b>15.44</b>	23.00	31.33	26.00	<b>26.78</b>	12.53	16.07	14.13	<b>14.24</b>							
<b>M4</b>	9.00	11.67	10.00	<b>10.22</b>	8.38	11.67	11.67	<b>10.56</b>	6.34	10.00	8.00	<b>7.89</b>	11.00	20.33	13.67	<b>15.00</b>	24.33	34.00	28.33	<b>28.78</b>	11.67	17.47	14.33	<b>14.49</b>							
<b>M5</b>	7.00	10.67	10.33	<b>9.33</b>	8.67	12.95	12.00	<b>11.56</b>	7.33	12.67	8.00	<b>9.33</b>	9.33	13.00	12.67	<b>11.67</b>	23.33	32.67	32.33	<b>29.44</b>	11.13	16.6	15.07	<b>14.27</b>							
<b>M6</b>	8.67	9.33	8.00	<b>8.67</b>	8.37	12.72	12.00	<b>11.03</b>	6.33	10.00	10.00	<b>8.89</b>	8.00	13.00	12.00	<b>11.00</b>	25.00	30.00	27.00	<b>27.33</b>	11.27	15.07	13.8	<b>13.38</b>							
<b>M7</b>	10.33	8.33	11.00	<b>9.89</b>	8.40	12.99	12.67	<b>11.44</b>	6.53	9.00	7.67	<b>7.67</b>	9.00	9.67	12.67	<b>10.44</b>	24.00	33.67	27.67	<b>28.56</b>	11.6	15.27	13.93	<b>13.60</b>							
<b>M8</b>	7.33	8.00	8.00	<b>7.78</b>	8.33	10.33	10.00	<b>9.56</b>	6.67	8.33	10.33	<b>8.33</b>	11.00	16.67	14.33	<b>14.00</b>	26.67	30.33	29.00	<b>28.67</b>	11.93	14.73	14.33	<b>13.67</b>							
<b>Mean</b>	<b>8.75</b>	<b>10.25</b>	<b>9.75</b>	<b>9.58</b>	<b>8.38</b>	<b>12.71</b>	<b>11.46</b>	<b>10.83</b>	<b>6.52</b>	<b>10.04</b>	<b>8.83</b>	<b>8.46</b>	<b>10.58</b>	<b>15.33</b>	<b>14.04</b>	<b>13.32</b>	<b>24.17</b>	<b>31.88</b>	<b>27.75</b>	<b>27.93</b>	<b>11.68</b>	<b>16.04</b>	<b>14.37</b>								
				<b>T</b>				<b>C</b>				<b>M</b>				<b>T × C</b>				<b>C × M</b>				<b>T × M</b>				<b>T × C × M</b>			
<b>SDm±</b>				<b>0.24</b>				<b>0.18</b>				<b>0.30</b>				<b>0.41</b>				<b>0.52</b>				<b>0.67</b>				<b>1.16</b>			
<b>CD<sub>0.05</sub></b>				<b>0.66</b>				<b>0.51</b>				<b>0.83</b>				<b>1.14</b>				<b>1.45</b>				<b>1.87</b>				<b>3.23</b>			

**Table.7** Effect of pre-sowing treatment, container type, growing media and their interaction on germination value of *Albizia procera* seedlings

	T1				T2				T3				T4				T5				C1	C2	C3	Mean							
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean											
<b>M1</b>	15.00	16.00	13.00	<b>14.67</b>	25.36	21.67	19.33	<b>22.12</b>	35.00	30.00	28.67	<b>31.22</b>	12.00	10.00	13.00	<b>11.67</b>	8.33	7.00	18.00	<b>11.11</b>	20.01	16.60	17.87	<b>18.16</b>							
<b>M2</b>	16.67	18.33	16.00	<b>17.00</b>	26.20	16.33	30.00	<b>24.18</b>	30.33	25.67	23.45	<b>26.48</b>	18.00	14.00	15.00	<b>15.67</b>	16.67	7.67	17.67	<b>14.00</b>	19.80	17.73	20.87	<b>19.47</b>							
<b>M3</b>	18.33	24.00	29.00	<b>23.78</b>	21.59	19.33	20.67	<b>20.53</b>	25.67	29.00	34.62	<b>29.76</b>	25.00	18.00	23.00	<b>22.00</b>	14.00	8.67	10.00	<b>10.89</b>	21.51	21.87	20.80	<b>21.39</b>							
<b>M4</b>	13.00	21.00	17.33	<b>17.11</b>	27.84	25.00	21.33	<b>24.72</b>	34.00	29.67	30.33	<b>31.33</b>	21.67	15.00	18.00	<b>18.22</b>	11.67	4.00	13.00	<b>9.56</b>	20.44	19.73	20.40	<b>20.19</b>							
<b>M5</b>	21.67	16.67	15.33	<b>17.89</b>	34.34	26.00	33.33	<b>31.22</b>	25.33	30.00	31.45	<b>28.93</b>	23.33	19.33	19.00	<b>20.56</b>	21.67	13.00	20.67	<b>18.44</b>	25.43	22.47	22.33	<b>23.41</b>							
<b>M6</b>	36.67	23.00	23.00	<b>27.56</b>	25.65	15.00	21.67	<b>20.77</b>	40.67	30.00	36.40	<b>35.69</b>	22.00	23.00	16.33	<b>20.44</b>	24.00	17.67	16.00	<b>19.22</b>	26.21	24.33	23.67	<b>24.74</b>							
<b>M7</b>	33.33	18.00	18.00	<b>23.11</b>	31.70	24.67	23.67	<b>26.68</b>	36.00	19.33	29.83	<b>28.39</b>	18.33	18.00	14.00	<b>16.78</b>	20.00	14.67	11.67	<b>15.44</b>	24.11	20.00	22.13	<b>22.08</b>							
<b>M8</b>	28.33	12.00	24.00	<b>21.44</b>	22.77	29.00	22.00	<b>24.59</b>	27.67	18.67	22.61	<b>22.98</b>	13.00	10.22	15.67	<b>12.56</b>	13.00	11.00	16.33	<b>13.44</b>	21.14	18.73	17.13	<b>19.00</b>							
<b>Mean</b>	<b>22.88</b>	<b>18.63</b>	<b>19.46</b>	<b>20.32</b>	<b>26.93</b>	<b>22.96</b>	<b>23.17</b>	<b>24.35</b>	<b>31.83</b>	<b>26.54</b>	<b>29.67</b>	<b>29.35</b>	<b>19.17</b>	<b>15.79</b>	<b>16.75</b>	<b>17.24</b>	<b>16.17</b>	<b>10.46</b>	<b>15.42</b>	<b>14.01</b>	<b>22.33</b>	<b>20.18</b>	<b>20.65</b>								
				<b>T</b>				<b>C</b>				<b>M</b>				<b>T × C</b>				<b>C × M</b>				<b>T × C</b>				<b>T × C × M</b>			
<b>SEm±</b>				<b>0.60</b>				<b>0.47</b>				<b>0.76</b>				<b>1.04</b>				<b>1.32</b>				<b>1.70</b>				<b>2.96</b>			
<b>CD<sub>0.05</sub></b>				<b>1.68</b>				<b>1.30</b>				<b>2.12</b>				<b>2.19</b>				<b>N.S</b>				<b>4.74</b>				<b>8.22</b>			

**Table.8** Effect of pre-sowing treatment, container type, growing media and their interaction on germination energy (%) of *Albizia procera* seedling

	T1				T2				T3				T4				T5				C1	C2	C3	Mean				
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean								
M1	38.87 (43.0)	55.50 (47.2)	41.67 (35.6)	<b>45.34</b> ( <b>42.0</b> )	41.67 (39.2)	33.30 (41.7)	38.87 (39.7)	<b>37.94</b> ( <b>40.2</b> )	38.87 (37.0)	55.50 (48.8)	25.00 (35.5)	<b>39.79</b> ( <b>40.5</b> )	50.00 (49.1)	44.40 (41.7)	44.43 (44.0)	<b>46.28</b> ( <b>45.2</b> )	33.33 (35.0)	33.30 (35.2)	33.30 (35.2)	<b>33.31</b> ( <b>35.1</b> )	37.33 (40.8)	44.40 (43.0)	38.87 (38.0)	<b>40.53</b> ( <b>40.6</b> )				
M2	38.87 (42.1)	44.40 (48.1)	41.67 (36.5)	<b>41.64</b> ( <b>42.5</b> )	41.67 (37.1)	55.50 (48.1)	44.40 (41.7)	<b>47.19</b> ( <b>42.3</b> )	38.87 (37.0)	44.40 (42.0)	41.17 (35.5)	<b>41.64</b> ( <b>38.2</b> )	58.33 (50.1)	44.40 (41.7)	38.87 (38.4)	<b>47.20</b> ( <b>43.7</b> )	33.33 (35.0)	33.30 (35.2)	33.30 (31.8)	<b>33.31</b> ( <b>34.0</b> )	43.33 (40.4)	44.40 (43.2)	39.86 (36.8)	<b>42.20</b> ( <b>40.2</b> )				
M3	44.43 (43.1)	33.30 (44.9)	50.00 (44.1)	<b>42.58</b> ( <b>44.1</b> )	50.00 (40.1)	44.40 (42.0)	49.97 (41.7)	<b>48.12</b> ( <b>41.3</b> )	44.43 (49.9)	33.30 (38.8)	50.00 (41.7)	<b>42.58</b> ( <b>43.5</b> )	41.67 (41.0)	55.50 (48.1)	27.73 (34.9)	<b>41.63</b> ( <b>41.4</b> )	22.17 (30.0)	33.30 (35.2)	25.00 (27.8)	<b>26.82</b> ( <b>31.0</b> )	42.33 (40.8)	39.96 (41.9)	37.75 (38.1)	<b>40.35</b> ( <b>40.3</b> )				
M4	16.60 (39.1)	55.50 (50.3)	50.00 (42.0)	<b>40.70</b> ( <b>43.8</b> )	25.00 (36.1)	33.30 (35.2)	38.87 (38.4)	<b>32.39</b> ( <b>36.6</b> )	16.00 (42.0)	55.50 (49.9)	50.00 (30.0)	<b>40.70</b> ( <b>40.7</b> )	41.67 (39.9)	44.40 (41.7)	44.43 (41.7)	<b>43.50</b> ( <b>41.1</b> )	33.30 (35.2)	16.60 (35.0)	33.33 (24.0)	<b>27.74</b> ( <b>31.4</b> )	40.00 (38.5)	44.40 (42.5)	26.62 (35.3)	<b>37.01</b> ( <b>38.7</b> )				
M5	22.17 (39.2)	33.30 (47.0)	33.33 (33.1)	<b>29.60</b> ( <b>39.8</b> )	33.33 (34.1)	44.40 (41.7)	49.97 (46.2)	<b>42.57</b> ( <b>41.0</b> )	22.17 (34.9)	33.30 (41.9)	33.33 (27.7)	<b>29.60</b> ( <b>34.7</b> )	50.00 (39.9)	33.30 (35.2)	44.43 (46.7)	<b>42.58</b> ( <b>40.6</b> )	22.17 (40.0)	33.30 (35.2)	41.67 (27.8)	<b>32.38</b> ( <b>34.3</b> )	38.33 (37.8)	35.52 (40.1)	33.18 (36.3)	<b>35.34</b> ( <b>38.1</b> )				
M6	48.43 (49.9)	66.60 (48.0)	50.00 (43.0)	<b>53.68</b> ( <b>47.0</b> )	41.67 (37.1)	55.50 (48.1)	38.87 (38.5)	<b>45.34</b> ( <b>41.2</b> )	66.60 (54.6)	44.43 (44.4)	50.00 (41.7)	<b>53.68</b> ( <b>46.2</b> )	33.33 (34.9)	55.50 (48.1)	33.30 (37.0)	<b>40.71</b> ( <b>40.1</b> )	22.17 (30.0)	44.40 (41.7)	25.00 (27.8)	<b>30.52</b> ( <b>33.2</b> )	39.00 (38.8)	57.72 (48.2)	36.64 (37.6)	<b>44.79</b> ( <b>41.5</b> )				
M7	27.73 (39.1)	33.30 (42.0)	41.67 (40.1)	<b>34.23</b> ( <b>40.7</b> )	25.00 (36.1)	44.40 (41.1)	55.53 (48.2)	<b>41.64</b> ( <b>42.0</b> )	27.73 (42.0)	33.30 (35.5)	41.67 (31.5)	<b>34.23</b> ( <b>36.4</b> )	33.33 (34.9)	33.30 (35.2)	44.43 (38.8)	<b>37.02</b> ( <b>36.3</b> )	27.73 (40.0)	33.30 (35.2)	41.67 (29.1)	<b>34.23</b> ( <b>34.8</b> )	36.67 (38.6)	35.52 (38.0)	37.63 (37.6)	<b>36.27</b> ( <b>38.0</b> )				
M8	38.87 (32.0)	44.30 (41.6)	25.00 (36.5)	<b>36.06</b> ( <b>36.8</b> )	41.67 (39.1)	55.50 (48.1)	49.97 (44.9)	<b>49.04</b> ( <b>44.4</b> )	38.87 (37.0)	44.40 (39.6)	25.00 (43.5)	<b>36.09</b> ( <b>40.1</b> )	33.33 (34.9)	44.40 (41.7)	44.43 (42.0)	<b>40.72</b> ( <b>39.6</b> )	22.17 (30.0)	33.30 (35.2)	25.00 (27.8)	<b>26.82</b> ( <b>31.0</b> )	30.00 (34.8)	44.38 (41.3)	38.86 (39.0)	<b>37.75</b> ( <b>38.4</b> )				
Mean	<b>34.00</b> ( <b>41.1</b> )	<b>45.78</b> ( <b>46.3</b> )	<b>41.67</b> ( <b>38.9</b> )	<b>40.48</b> ( <b>42.1</b> )	<b>37.50</b> ( <b>37.6</b> )	<b>45.80</b> ( <b>43.4</b> )	<b>45.79</b> ( <b>42.5</b> )	<b>42.26</b> ( <b>41.1</b> )	<b>34.00</b> ( <b>40.3</b> )	<b>45.79</b> ( <b>43.9</b> )	<b>39.58</b> ( <b>35.9</b> )	<b>43.09</b> ( <b>40.0</b> )	<b>42.71</b> ( <b>40.9</b> )	<b>44.40</b> ( <b>41.7</b> )	<b>43.03</b> ( <b>40.5</b> )	<b>43.02</b> ( <b>41.0</b> )	<b>24.95</b> ( <b>34.4</b> )	<b>34.69</b> ( <b>36.0</b> )	<b>32.29</b> ( <b>28.9</b> )	<b>30.64</b> ( <b>33.1</b> )	<b>43.29</b> ( <b>38.8</b> )	<b>35.80</b> ( <b>42.3</b> )	<b>38.75</b> ( <b>37.3</b> )					
<b>The values in parenthesis are transformed values (angular transformation)</b>																												
	T				C				M				T × C				C × M				T × M				T × C × M			
SEm±	1.56				1.21				1.98				2.71				3.43				4.42				7.66			
CD <sub>0.05</sub>	4.36				3.37				5.51				N.S				9.54				N.S				N.S			

**Table.9** Effect of pre-sowing treatment, container type, growing media and their interaction on energy period (in days) of *Albizia procera* seedlings

	T1				T2				T3				T4				T5				C1	C2	C3	Mean				
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean								
M1	5.39	7.67	8.33	<b>7.11</b>	8.33	6.33	6.00	<b>6.89</b>	4.00	6.33	5.00	<b>5.11</b>	10.00	14.33	10.00	<b>11.44</b>	20.67	23.36	21.33	<b>21.78</b>	9.47	11.73	9.4	<b>10.20</b>				
M2	6.00	9.67	6.67	<b>7.44</b>	5.00	6.00	6.00	<b>5.67</b>	3.67	6.67	5.00	<b>5.11</b>	9.69	12.67	11.00	<b>11.12</b>	22.00	22.67	23.33	<b>22.67</b>	8.20	11.13	10.2	<b>9.98</b>				
M3	8.33	8.33	9.00	<b>8.56</b>	7.00	10.33	5.33	<b>7.56</b>	3.67	7.00	4.67	<b>5.11</b>	10.00	11.00	11.33	<b>10.56</b>	21.00	23.33	22.00	<b>22.22</b>	8.67	12.13	9.53	<b>10.11</b>				
M4	10.00	8.00	8.00	<b>8.67</b>	5.33	7.67	6.33	<b>6.44</b>	3.34	13.00	12.67	<b>9.56</b>	8.33	12.67	9.67	<b>10.22</b>	20.67	23.66	21.67	<b>21.67</b>	9.47	12.8	10.87	<b>11.04</b>				
M5	9.00	9.00	10.67	<b>9.56</b>	4.67	9.67	5.67	<b>6.67</b>	3.67	6.33	13.00	<b>7.67</b>	9.67	12.67	8.00	<b>10.11</b>	21.67	20.00	21.67	<b>21.11</b>	8.73	12.2	11.13	<b>10.69</b>				
M6	5.37	5.42	8.67	<b>6.44</b>	5.00	12.67	7.00	<b>8.22</b>	3.33	7.00	5.00	<b>5.11</b>	10.67	15.33	9.00	<b>11.67</b>	21.67	22.67	21.00	<b>21.78</b>	8.27	12.27	9.4	<b>9.84</b>				
M7	8.33	10.00	7.33	<b>8.56</b>	5.67	7.33	8.67	<b>7.22</b>	4.00	6.67	4.67	<b>5.11</b>	10.33	14.67	9.33	<b>11.44</b>	22.00	20.67	21.33	<b>21.33</b>	9.27	11.33	10.2	<b>10.27</b>				
M8	8.00	10.33	8.00	<b>8.78</b>	5.33	8.00	6.67	<b>6.67</b>	4.00	7.00	5.33	<b>5.44</b>	9.70	10.67	13.33	<b>11.23</b>	21.00	22.00	22.33	<b>21.78</b>	9.2	10.73	10.6	<b>10.18</b>				
Mean	<b>7.58</b>	<b>8.50</b>	<b>8.33</b>	<b>8.14</b>	<b>5.79</b>	<b>8.5</b>	<b>6.46</b>	<b>6.92</b>	<b>3.67</b>	<b>7.50</b>	<b>6.92</b>	<b>6.03</b>	<b>9.17</b>	<b>13.50</b>	<b>10.21</b>	<b>10.96</b>	<b>18.33</b>	<b>21.13</b>	<b>18.75</b>	<b>19.40</b>	<b>8.91</b>	<b>11.79</b>	<b>10.17</b>					
	T				C				M				T × C				C × M				T × M				T × C × M			
SEm±	0.26				0.20				0.33				0.45				0.57				0.73				1.27			
CD <sub>0.05</sub>	0.72				0.56				0.96				1.25				N.S				2.04				3.53			

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