

## Original Research Article

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## Effect of Storage Container, Temperature and Duration on Germination of *Leucaena leucocephala* in Western Uttar Pradesh, India

Pankaj Lavania<sup>1\*</sup>, Ashish Tiwari<sup>2</sup> and Shailaja Punetha<sup>3</sup><sup>1</sup>RaniLaxmibai Central Agricultural University Jhansi, India<sup>2</sup>Department of forestry, Kumaun University, Nanital, Uttarakhand, India<sup>3</sup>GBPNIHE, Kosi-Katarmal, Almora, Uttarakhand, India

\*Corresponding author

### ABSTRACT

*Leucaena leucocephala* (L.) commonly known as su-babul is a multipurpose nitrogen fixing, evergreen small tree of tropical and sub-tropical region, having high quality animal feed (pod), fodder, fuel wood, charcoal, pulp wood as well as contributing to soil stabilization and improvement through nitrogen fixation. Its leaves are used as fodder, mulch and green manure. A problem is that pasture seeds are actually stored for a long period prior to accessibility to farmers especially in rural communities, because of inadequate communication facilities and the lack of extension services. Legume seeds generally lose viability in prolonged storage and also having the problem like as insect attacks, its seeds get damaged during storage in ordinary conditions. Hence, the present study was carried out to study the effect of storage period, containers and temperature on seed germination in laboratory and nursery condition. The seeds were stored up to 600 days in different containers at different temperature viz. poly bag at room temperature 15-40<sup>0</sup> C (B<sub>1</sub>T<sub>1</sub>), poly bag at BOD 25<sup>0</sup> C (B<sub>1</sub>T<sub>2</sub>), polybag at refrigerator 5<sup>0</sup> C (B<sub>1</sub>T<sub>3</sub>), paper bag at room temperature 15-40<sup>0</sup> C (B<sub>2</sub>T<sub>1</sub>), paper bag at BOD 25<sup>0</sup> C (B<sub>2</sub>T<sub>2</sub>), paper bag-refrigerator 5<sup>0</sup> C (B<sub>2</sub>T<sub>3</sub>), cloth bag at room temperature 15-40<sup>0</sup> C (B<sub>3</sub>T<sub>1</sub>), cloth bag at BOD 25<sup>0</sup> C (B<sub>3</sub>T<sub>2</sub>) and cloth bag-refrigerator 5<sup>0</sup> C (B<sub>3</sub>T<sub>3</sub>). The results revealed that seeds stored for 15 days in poly bag at refrigerator 5<sup>0</sup> C (B<sub>1</sub>T<sub>3</sub>) recorded the maximum germination of in laboratory conditions which was at par with the germination observed in the seeds stored in cloth bag at refrigerator 5<sup>0</sup> C (B<sub>3</sub>T<sub>3</sub>). Similar trend of seed germination was recorded when seeds were sown in the nursery conditions. The seed germination decreased with advancement of storage period in all the storage treatments. However, after 600 days of storage period, the maximum seed germination percent (23.4±0.82) was recorded in B<sub>1</sub>T<sub>3</sub> which is at par with B<sub>3</sub>T<sub>3</sub> in Laboratory condition. Similar trend of seed germination was maximum in B<sub>1</sub>T<sub>3</sub> which is at par with B<sub>3</sub>T<sub>3</sub> in nursery condition.

### Keywords

*Leucaena leucocephala*  
Germination, Seed germination,  
Storage temperature and Container

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### Introduction

*Leucaena leucocephala* (Lam.) belongs to family Mimosoideae, is a multi-purpose,

medium-sized, almost evergreen tree with feathery foliage. It is commonly known as Subabul or kubabul and is found in tropical and subtropical countries. It is indigenous to

Mexico, and El Salvador and grow in many Oceanic states like Philippines, Indonesia, Malaysia, Hawaii, Fiji and India for various purposes such as soil conservation, to meet the growing demand of fuel, fodder and fertilizers. In India, it was tried in the last century in Andhra Pradesh, Karnataka, Tamil Nadu and Himachal Pradesh and also in Uttar Pradesh (Lohani, 1979). It can grow on a wide variety of soils and climatic conditions, from sea level to an altitude of 500 m. It can tolerate high temperature ( $> 45^{\circ}\text{C}$ ) and drought conditions, but adequate moisture is needed for its good growth. It is an N-fixing legume tree.

The species is capable of tolerating large variations in rainfall, temperature, wind, drought and topography (NAS, 1977). In poor soil areas it contributes to soil stabilization and improvement in soil through nitrogen fixation 100-200 Kg/ha (NAS-1984) and also provides high quality animal feed (pod), fodder, fuel wood, charcoal, and pulp. Its leaves are also used as fodder, mulch and green manure. This species is relished by livestock as well as wildlife and as such it is a promising forage crop for tropics and subtropics. Forage production from Cunningham variety planted in a single row along the farm road at Jhansi at a spacing of 2 m was 0.75 and 1.94 kg/tree at 3 and 4 years of age respectively (Parkash and Hocking, 1988.) It is suitable for making unbleached and bleached kraft pulp for wrapping and writing papers (Singh *et al* 1986).

To raise large scale seedlings for plantations, a huge quantity of *Leucaena leucocephala* seed is required and a full grown tree can produce 5000-6000 pods in a good fruiting season, each with usually between 15-30 seeds. Its seeds also exhibit seed dormancy due to the presence of a hard seed coat. In ordinary storage conditions, this species is under several anthropogenic pressures and their regeneration has been severely affected

as trees are lopped for fodder and also due to insect attacks, its seeds get damaged during storage in ordinary conditions.

The information on the effect of seed storage on germination of subabul is scarce. Keeping in view the importance of the *Leucaena leucocephala* the present study was carried out to see the effect of storage temperature, period and container on seed germination.

## Materials and Methods

The study area (Western Uttar Pradesh) lies between  $27^{\circ} 10' \text{ N}$  to  $26^{\circ} 04' \text{ N}$  latitude and  $78^{\circ} 02' \text{ E}$  to  $79^{\circ} 07' \text{ E}$  longitude between elevations 165 and 179.8 m above m.s.l. The seeds were collected from Agra and adjoining areas viz., Mathura and Hathras. The seeds collected from different sites were mixed together and used for study.

Before storage of seed in different containers viz., poly bag, paper bag, cloth bag at different temperatures i.e. room temperature ( $15-40^{\circ}\text{C}$ ), BOD ( $25^{\circ}\text{C}$ ) and refrigerator ( $3-5^{\circ}\text{C}$ ), the seeds were treated with Thiram 75 DS and Leaf of Neem. The details of the treatments are given as follows: Poly bag at room temperature  $15-40^{\circ}\text{C}$  ( $B_1 T_1$ ), Poly bag at BOD ( $25^{\circ}\text{C}$ ) ( $B_1 T_2$ ), Poly bag at refrigerator  $5^{\circ}\text{C}$  ( $B_1 T_3$ ), Paper bag at room temperature  $15-40^{\circ}\text{C}$  ( $B_2 T_1$ ), Paper bag at BOD  $25^{\circ}\text{C}$  ( $B_2 T_2$ ), Paper bag-refrigerator  $5^{\circ}\text{C}$  ( $B_2 T_3$ ), Cloth bag at room temperature  $15-40^{\circ}\text{C}$  ( $B_3 T_1$ ), Cloth bag at BOD  $25^{\circ}\text{C}$  ( $B_3 T_2$ ) and Cloth bag-Refrigerator  $5^{\circ}\text{C}$  ( $B_3 T_3$ ).

After 15 days of seed collection, they were tested to know the germination percent and thereafter the germination tests were conducted in lab and nursery conditions at intervals of 60 days up to 600 days.

For lab study, three replications of 50 seeds each were used. The germination was carried out in petri dishes. Germination percent was

counted when visible radicle emerged. Under Nursery conditions, three replications of 100 seeds each from different storage treatment were sown in line in nursery beds. After every 15 days seed sowing, germination (%) was counted by the following formula:

$$\text{Germination (\%)} = \frac{\text{Number of germinated seed (visible radicle of seeds)}}{\text{Total number of seeds put in petridish}} \times 100$$

Standard error was calculated by using the given formula (Chandel, 1998). Standard deviation was calculated by using the given formula (Chandel, 1998).

## Results and Discussion

### Seed germination under laboratory conditions

The data presented in Table 1, showed that maximum germination (54.8%) in laboratory conditions was recorded when seeds were stored in poly bag at refrigerator 5<sup>0</sup>C (B<sub>1</sub>T<sub>3</sub>) and sown after 15 days of collection.

Although, the seeds stored in cloth bag at refrigerator 5<sup>0</sup> C (B<sub>3</sub>T<sub>3</sub>) also registered 54.4 % germination which was at par with B<sub>1</sub>T<sub>3</sub>. The seeds were stored up to 600 days and germination tests were conducted at the interval of 60 days.

The findings of these germination tests revealed that the germination percent declined with the advancement of storage period in all the treatments.

After 300 days of storage in treatment B<sub>1</sub>T<sub>3</sub>, the germination decreased up to 23.4 % which further declined to 22.2 % (B<sub>3</sub>T<sub>3</sub>) after 600 days of storage. Although this germination was maximum in comparison to all other storage treatments.

These results were in conformity with the findings, Sharma (1980) who reported the maximum germination in fresh seeds of *Moringa oleifera* and observed that with the progressive storage period the germination percent declined considerably.

This study have also supported by observation, made in *Shorea robusta* seeds (Purohit, Sharma and Thapliyal (1982), in *Toona ciliata* (Nautiyaland Thapliyal, 1993) in *Fagussy lytica* seed (Lepper *et al.*, 1994), in *Populus ciliata* seeds (Shah *et al.* 1995), in *Azadirachta indica* seed Singh *et al.* 1997, in *Dendrocalamus brandisii* seeds (Boonarutee and Samboon 1995) and *Greviao ptiva* seeds (Nayal, 2000).

### Seed germination under nursery conditions

Almost similar trend of seed germination was recorded when seeds stored in different containers and temperatures were sown in the nursery (Table 2). The maximum germination (53.3 %) was recorded when seeds were sown after 15 days of harvesting in nursery conditions (B<sub>3</sub>T<sub>3</sub>). The seeds stored in poly bag at refrigerator 5<sup>0</sup> C (B<sub>1</sub>T<sub>3</sub>) shown almost equal (52.2 %) germination in the same treatment.

The decline in germination percent with advancement of storage period was also recorded in nursery condition, but the lesser germination was recorded in nursery as compared to laboratory conditions.

After 300 days of storage period only 53.3 % of seed germinated which further declined to 17.4 % after 600 days of storage period. The seed stored in paper bag at refrigerator 5<sup>0</sup>C (B<sub>2</sub>T<sub>3</sub>) also gave almost same germination (16.8 %) after 600 days storage period.

**Table.1** Germination percent in *Leucaena leucocephala* under different storage treatments in Laboratory

S.N.	Germination (%) in storage treatments									
	Storage Days	B <sub>1</sub> T <sub>1</sub>	B <sub>1</sub> T <sub>2</sub>	B <sub>1</sub> T <sub>3</sub>	B <sub>2</sub> T <sub>1</sub>	B <sub>2</sub> T <sub>2</sub>	B <sub>2</sub> T <sub>3</sub>	B <sub>3</sub> T <sub>1</sub>	B <sub>3</sub> T <sub>2</sub>	B <sub>3</sub> T <sub>3</sub>
1	15	48.0±0.60	53.2±1.54	54.8±1.75	45.2±0.61	50.5±1.62	48.1±0.55	43.2±0.76	47.2±0.61	<b>54.5±0.68</b>
2	60	46.6±1.00	49.6±1.35	53.1±0.71	41.7±1.07	46.8±0.53	43.2±0.98	41.4±0.74	45.2±1.17	<b>51.6±1.41</b>
3	120	42.4±0.98	45.6±6.27	47.6±0.49	35.8±0.45	45.0±0.84	38.1±1.50	34.3±0.56	40.2±1.38	<b>45.7±0.90</b>
4	180	36.6±1.00	42.1±0.89	45.8±0.25	34.5±1.25	43.4±2.46	36.7±0.55	33.4±0.57	39.3±1.03	<b>43.1±1.17</b>
5	240	33.6±0.78	39.6±1.32	44.0±0.41	33.2±1.88	40.7±0.99	35.0±0.41	30.1±1.67	36.2±0.10	<b>41.3±0.64</b>
6	300	30.7±1.70	31.9±1.10	40.9±0.35	30.6±1.17	35.2±1.25	34.1±1.00	26.1±1.38	34.0±0.91	<b>36.2±0.96</b>
7	360	25.4±0.51	26.1±0.53	29.1±1.05	27.8±1.51	27.5±1.68	25.7±1.72	24.3±1.99	26.2±1.76	<b>30.1±1.79</b>
8	420	25.0±0.76	24.5±1.24	28.6±1.27	26.5±0.75	24.3±1.53	23.3±1.19	23.1±1.69	24.8±0.99	<b>27.3±0.84</b>
9	480	24.1±1.08	23.8±0.30	26.7±0.89	24.2±0.93	23.7±1.37	22.7±2.01	22.4±2.01	23.3±1.15	<b>25.2±3.87</b>
10	540	23.2±1.77	22.1±0.46	25.1±0.38	21.2±1.16	23.2±0.81	23.1±0.57	21.2±1.12	20.2±0.88	<b>23.2±1.20</b>
11	<b>600</b>	<b>15.01±2.13</b>	<b>21.3±1.06</b>	<b>23.4±0.82</b>	<b>18.0±2.24</b>	<b>19.1±0.80</b>	<b>21.8±0.56</b>	<b>19.0±1.39</b>	<b>19.5±0.64</b>	<b>22.2±1.41</b>

**Table.2** Germination loss in *Leucaena leucocephala* under different storage treatments in Nursery

S.N.	Storage Day		Germination (%) in storage treatments								
			B <sub>1</sub> T <sub>1</sub>	B <sub>1</sub> T <sub>2</sub>	B <sub>1</sub> T <sub>3</sub>	B <sub>2</sub> T <sub>1</sub>	B <sub>2</sub> T <sub>2</sub>	B <sub>2</sub> T <sub>3</sub>	B <sub>3</sub> T <sub>1</sub>	B <sub>3</sub> T <sub>2</sub>	B <sub>3</sub> T <sub>3</sub>
1	D <sub>1</sub>	15	43.8±0.47	48.7±0.75	52.2±1.03	40.2±0.58	45.5±0.71	43.4±1.24	39.2±2.14	44.4±0.88	<b>53.1±1.01</b>
2	D <sub>4</sub>	60	40.7±0.63	44.7±1.65	47.9±1.83	38.1±0.21	42.8±0.37	39.2±0.96	37.5±1.68	40.1±0.47	<b>45.3±1.03</b>
3	D <sub>8</sub>	120	32.1±0.68	39.5±1.00	40.1±0.44	27.5±1.75	35.2±0.77	33.0±0.62	26.4±0.50	34.0±1.42	<b>36.7±0.50</b>
4	D <sub>10</sub>	180	31.0±0.88	36.1±1.12	38.1±0.69	26.0±0.22	33.5±0.55	31.9±0.64	24.7±0.70	31.2±0.95	<b>34.3±1.31</b>
5	D <sub>12</sub>	240	22.1±0.68	31.4±0.57	34.9±1.92	24.7±0.17	26.3±0.99	29.5±2.27	21.9±0.41	28.5±0.44	<b>27.4±1.04</b>
6	D <sub>14</sub>	300	21.0±1.28	27.5±1.83	27.5±0.55	22.7±0.55	23.0±0.57	26.1±0.49	21.2±0.46	24.2±1.72	<b>26.5±0.95</b>
7	D <sub>16</sub>	360	20.5±0.45	23.5±0.98	26.1±0.93	21.2±0.35	21.8±1.21	23.8±0.94	20.1±2.41	23.0±0.53	<b>24.9±0.72</b>
8	D <sub>17</sub>	420	20.2±1.15	22.01±0.25	24.3±1.01	21.0±0.95	21.2±0.44	23.4±1.10	20.1±0.57	22.3±0.70	<b>24.3±0.66</b>
9	D <sub>18</sub>	480	20.2±1.06	21.8±1.04	22.2±0.90	19.9±0.49	17.3±0.70	22.9±1.39	17.3±1.15	18.5±3.37	<b>23.0±1.57</b>
10	D <sub>19</sub>	540	19.1±0.69	18.3±1.30	20.2±0.85	19.2±0.61	15.8±1.39	22.6±0.94	15.7±1.04	17.6±1.08	<b>19.5±1.37</b>
11	<b>D<sub>20</sub></b>	<b>600</b>	<b>14.1±0.81</b>	<b>14.3±0.68</b>	<b>17.4±1.33</b>	<b>14.1±1.09</b>	<b>13.1±0.72</b>	<b>16.8±0.43</b>	<b>13.5±0.73</b>	<b>12.7±0.91</b>	<b>14.5±0.36</b>

From these results it has been observed that in all storage conditions the germination decreased with the advancement of storage period. However, the germination loss was minimum in B<sub>1</sub>T<sub>3</sub> and after 600 days 17.4 % germination was recorded. Next best storage treatment was B<sub>2</sub>T<sub>3</sub>, In which germination was recorded. Its seeds are heavily attacked by insects; we have required most appropriate container and temperature for long storage. Temperature substratum plays a very significant role during the process of seed germination. Seed of some species germinate better at constant temperature while other alternate temperature (Anon 1966, Bonner 1972, Kumar and Gopal 1974). This present study was also supported by Abdelgabar *et al.*, 2014 in *Acacia senegal*, *Acacia mellifera* and *Acacia laeta*, Joshi 2002 in *Dalbergia sissoo*, Thapiyal *et al.*, 1991 in *Bambusa tulda*, Arjuman *et al.*, 1966 in *Erythiana stricta*, Aswathanarayan *et al.*, (1996) in *Prosopis juliflora*, *Dalbergia sissoo*, and *Casuriana equisetifolia*. Sharma *et al.*, (2002) in *Albizialebbek*.

The present study may be concluded that the seeds of *Leucaena leucocephala* can be stored for longer period either in polybag or cloth bag at 5° C for long term storage to get maximum germination.

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