



Research Article

Effect of environmental conditions on germination of *Albizia lebbek*, *Dalbergia sissoo* and *Terminalia arjuna* with special reference to Bundelkhand Region, India.

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Abstract: In the Bundelkhand plain sub region areas of Jhansi, Hamirpur and Datia districts, along the banks of rivers like the Pahuj, Betwa and Yamuna, we see *Albizia lebbek* (Siris) *Dalbergia Sissoo* (Shisham) and *Terminalia arjuna* (Arjun). There is little timber production in Bundelkhand, good teak forests are found only in Sagar and Damoh districts in small patches. Bamboo is found in small patches across the region forests and scrub lands are intensively used by to source firewood for consumption and sale. The aim of the study is to show the effect of soil and atmospheric condition on the growth of forest tree in Bundelkhand region.

Keywords: Forest trees, Seed germination, Growth etc.

Introduction

Animal and trees are the co-ordinators of nature but due to unlimited exploitation, the balance of the life animals and plants has been disturbed greatly. At present there are about a quarter of million plant species in the world. A recent study by the United Nation's Commission for Asia and the Pacific, has reported the destruction of tropical forests in South-East Asia and India as "One of the greatest tragedies of our times." Hence, only forest can save mankind from the impending disaster. The creation of forests will undoubtedly prove the best ecological antidote against the anthropogenic contamination of the environment.

Germination and growth behaviour vis-à-vis mineral status of seeding population may assume significant role in the process of recruitment to the forest during succession. This phenomenon appears to be complex and the first step of understanding is to reveal the features of the seedling of a few dominant tree species. The major conditions of life or growth necessary for germination are viz. access to water, a suitable range of temperature, oxygen pressure different concentrations of inorganic salts, inhibitors and for some seeds the exposure to light. It is suggested that the environmental factors control germination by acting on specific sites of metabolic sequences (Mayer and Shain, 1974). Culture experiments were conducted in the forest nursery, Aata, Orai Division situated at lat. 25° 59' N, Long 79° 37' E and about 125m above means sea level in Bundelkhand region, Uttar Pradesh. The study area was fully protected from all the type of biotic interferences.

Materials and Methods

All the materials and samples are collected from forest, nursery Aata, Orai. The study area was fully protected from all type of biotic interferences, climate parameters of the study site is metrological data like temp, humidity, wind, velocity and rainfall of Orai, soil sample taken from the study site was air dried, powdered and sieved through 2mm mesh size and then taken into the soil testing laboratory, Department of Agriculture, Government of U.P., Orai and research laboratory D.V. Postgraduate College, Orai.

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Seed Collection

The seed of *Albizia lebbek* (Siris) we collected in the month of February and those of *Dalbergia Sissoo* (Shisham) and *Terminalia arjuna* (Arjun) in month of March, 1998 all from the neighbouring forests. The seeds were stored in stoppered glass bottles. The trees grow in a mixed dry deciduous forest in Bundelkhand region. The forest is situated at lat. 25° 59' N long 79° 37' east and 125 m above mean sea level.

Result and Discussion

Seed Germination

Seed germination of a plant species is influenced profoundly by environmental factors (Newman, 1964). The effect of two climatic factors i.e. temperature and light and one edaphic factor i.e. pH on germination is presented in this chapter. The light effect on seed germination is significant in all the three species. The result in table show that maximum percentage of germination for *A. lebbek* and *D. Sissoo* is 79 + 4.0 and 94 + 3.1 respectively in blue light but in *T. arjuna* no germination took place in Red and Blue light.

Temperature effect on germination

The germination percentage of seeds for *A. lebbek* increases with rising temperature nearly upto 40° C. At the lower temperature of 15° C no appreciable germination was noted in both *A. lebbek* and *T. arjuna* but in *D. Sissoo* 89 percent germination was recorded. In this particular species the germination percentage in *D. Sissoo* and *T. arjuna* was recorded at room temperature (28 – 38° C), where as in *A. lebbek* at room temperature (10 – 20° C). Germination percentage was 40.1 + 9.6. The overall temp. suitable for germination in all the three species is 30 to 40° C.

Effect of pH on germination

The seed germination of all the three species is favoured by slightly acidic pH. Maximum germination percentage in *A. lebbek* and *T. arjuna* is recorded 89 and 84 percent at pH 6.4 respectively. In *D. Sissoo* maximum germination percentage is recorded 92 percent at 7.0 pH.



Table 1. Germination percentage in dark and in different light conditions

Species	Percentage		Germination	
	Dark	White Light	Red Light	Blue Light
<i>Albizgia lebbek</i>	54 + 2.5	56 + 5.6	74 + 7.5	79 + 4.0
<i>Dalbergia Sissoo</i>	74 + 4.4	64 + 8.9	93 + 2.1	94 + 3.1
<i>Terminalia Arjuna</i>	79 + 5.5	70 + 7.0	0	0

'o' indicates no germination

Table 2. Germination percentage at different temperatures

Species	Temperature (°C)				
	15	20	30	40	Room Temp.
<i>Albizgia lebbek</i>	2.0 + 1.0	48.0 + 8.6	52.1 + 5.0	75.1 + 7.6	40.1 + 9.6*
<i>Dalbergia Sissoo</i>	59.0 + 2.0	-	-	59.0 + 15.6	90.0 + 8.8**
<i>Terminalia arjuna</i>	8.5 + 1.1	-	69.0 + 6.0	64.0 + 7.0	88.0 + 4.6**

* Room Temperature 10 – 20° C; **Room Temperature 28 – 38° C; -Not recorded

Table 3. Germination percentage at different pH Values

Species		pH Values					
		2.0	5.5	6.4	7.0	7.5	8.7
<i>A. lebbek</i>	X	72 + 3.5	89 + 5.4	85 + 3.1	75 + 3.1	73 + 1.3	74 + 2.5
<i>D. Sissoo</i>	X	86 + 3.1	89 + 3.0	92 + 3.0	91 + 1.3	7.0 + 5.1	64 + 2.1
<i>T. arjuna</i>	X	82 + 8.1	84 + 11.0	74 + 4.1	69 + 8.0	64 + 4.1	65 + 3.5

x- No germination took place.

Grwth Analysis: Net Assimilation Rate (NAR)

The values of NAR for all the three species during the year 1999-2000. The maximum value of NAR is recorded in *T. arjuna* at one month age of the seedling. It is 0.048 g/cm²/month at the seedling age of one month. The minimum value of NAR recorded for *Albizgia lebbek* and *Dalbergia Sissoo* was 0.026 and 0.037 g/cm²/month respectively at the seedling age of the one month. These results suggest that NAR varies from species to species.

Table 4. Net Assimilation Rate (g/cm²/month) at different ages of seedling of *A. lebbek*, *D. Sissoo* and *T. arjuna*

Age (month)	<i>A. lebbek</i>	<i>D. Sissoo</i>	<i>T. arjuna</i>
1	0.026	0.037	0.048
2	0.013	0.001	0.044
3	0.007	0.003	0.024
4	0.0004	0.007	0.0001
5	0.007	0.011	0.0002
6	0.013	0.006	0.011
7	0.001	0.0005	0.0008
8	0.0004	0.004	0.007
9	0.003	0.002	0.001
10	0.0001	-0.004	-0.002
11	-0.005	-0.001	-0.007
12	-0.003	-0.006	-0.004

Table 5. Relative growth rate (g/g/month) of Seedlings of *A. lebbek*, *D. Sissoo* and *T. arjuna* at different stages of their growth

Age (months)	<i>A. lebbek</i>	<i>D. Sissoo</i>	<i>T. arjuna</i>
1	-2.040	-1.514	-1.238
2	0.879	0.062	1.489
3	0.411	0.120	0.929
4	0.022	0.487	0.003
5	0.337	0.536	0.019
6	0.533	0.291	0.532
7	0.049	0.027	0.040
8	0.038	0.248	0.318
9	0.203	0.148	0.082
10	0.006	-0.299	-0.119
11	-0.174	-0.115	-0.442
12	-0.644	-0.394	-1.068

Relative Growth Rate (RGR)

The maximum value of RGR throughout the experimental period for *T. arjuna* and *A. lebbek*, at the age of 6 months, were 0.532 and 0.5339/g/month respectively. But for *D. Sissoo* this value was g/month at the age of 5 month, Table shows the negative value of RGR in *D. Sissoo* and *T. arjuna* when the seedling were of 10, 11 and 12 months old, but *A. lebbek* showed negative values at the age of 11 and 12 months.

Mean Leaf Weight Rate (MLWR)

The ratio of the leaf to plant weight (MLWR) was calculated and the results are presented in table. The variation with age in (MLWR) is shown for all the three species under study. In all the species an annual peak of MLWR was attained. After this is declined gradually in all

the species. Extensive overall difference was observed between species. Throughout the experiment the average value recorded for *T. arjuna* (42.80 cm²/g/month) and *D. Sissoo* (54.52 cm²/g/month) were lower than those recorded for *A. lebbek* (i.e. 60.92 cm²/g/month)

Table 6. Mean Leaf Weight Ratio (cm²/g dry wt./month) of different seedling of *A. lebbek*, *D. Sissoo* and *T. arjuna* at different age

Age (months)	<i>A. lebbek</i>	<i>D. Sissoo</i>	<i>T. arjuna</i>
1	-79.500	-23.08	-25.13
2	77.60	45.61	34.34
3	56.73	73.44	37.98
4	53.32	68.18	50.09
5	47.06	48.23	56.41
6	41.41	31.00	46.22
7	53.43	51.26	43.14
8	69.94	59.40	43.23
9	69.58	67.97	47.24
10	77.88	71.02	51.72
11	98.07	74.54	56.85
12	86.10	63.57	46.54

Conclusion

Our study revealed that maximum percentage of germination for *A. lebbek* and *D. Sissoo* is 79 + 4.0 and 94 + 3.1 respectively in blue light. Maximum germination percentage in *A. lebbek* and *T. arjuna* is recorded 89 and 84 percent at pH 6.4 respectively. whereas in *D. Sissoo* maximum germination percentage is recorded 92 percent at 7.0 pH. The germination percentage in *D. Sissoo* and *T. arjuna* was recorded at room temperature 28-38° C, where as in *A. lebbek* at room temperature 10-20° C. Our results suggest that NAR varies from species to species.

References

- Mayer and Shain, Y. Control of Seed germination Ann. Rev. plant Physiol.1974, 25,167- 193
- Newman, E.I. Factors affecting the seed production of *Tessdalis nudicaulis* I. Germination date J.E.Col., 1964, 52, 391-404
- Sahai K. and Sahai, K. Studies on seed position and their effect on germination and seedling survival in *Dalbergia Sissoo* Roxb. Ind. Forester, 1994, 120(5), 464-465.
- Uday K. Divi and Krishna, P. J. Plant Growth Regul., 2010, 29 (4), 385-395.
- Yadav, S.S., M.S. Hooda & Bangarwa, K.S. Effect of Seed size on physiological seed quality in *Shisham* (*Dalbergia Sissoo*) Ind. Journal of Forestry, 1998, 21: (1), 13-15.

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