Khulna University Studies 1(2): 277-282

GROWTH PERFORMANCE OF SEVEN SPECIES OF *ALBIZIA* SEEDLINGS AT NURSERY STAGE IN BANGLADESH

Md. Abdul Matin*, Md. N. Islam Khan

Forestry and Wood Technology Discipline, Khulna University, Khulna-9208, Bangladesh.

Manuscript received: October 20, 1999; Accepted: December 20, 1999

Abstract: Seedlings of *Albizia procera* (Roxb.) Benth; *A. lebbek* (L.) Benth; *A.chinensis* (Osbeck) Merril; *A. falcateria* (L) Fosberg; *A. odoratissima* Benth*; A. richardiana* King and Prain and *A. lucida* Roxb.Benth. were raised in transparent polybags (10 cm X 15 cm) to study their growth performances at nursery stage in Bangladesh condition. Performance of seedlings growth of all the seven *Albizia* species showed strong correlation with seasonal variations (wet, semi-dry and dry season). Height and diameter growth continued to rise up in wet (April - July) and semi-dry (August - November) seasons whereas in dry period (December - March) there was practically no growth at all. Leaf formation also showed the same correlation with seasonal variations. Among all the seven *Albizia* species, *A. procera, A. chinensis* and *A. falcateria* seedlings showed the best performance and are recommended as plantation species in Bangladesh.

Keywords: *Albizia* spp.; growth performances; nursery stage; seedlings

Introduction

Albizia is an important genus under the family Leguminosae. In Bangladesh, 7 species of *Albizia* were found in a short survey. The species were *Albizia procera* (Roxb.) Benth; *A. lebbek* (L.) Benth; *A.chinensis* (Osbeck) Merril; *A. falcateria* (L) Fosberg; *A. odoratissima* Benth*; A. richardiana* King and Prain and *A. lucida* Roxb.Benth. Most of the *Albizia* grow preferably in moist condition. They are found in the villages of many districts of Bangladesh. They are also planted along the roads, embankments, riverbanks and in homesteads. *Albizia* (s) are important multipurpose tree species (Alam and Mohiuddin, 1992) having faster growth rates, nitrogen fixing capacity and good cropping ability (Davidson, 1985). Their leaves and twigs are very good cattle fodder (NAS, 1980). The wood is used for furniture, agricultural instruments, vehicle bodies, poles, bridge construction and various other purposes. Moreover, in many countries of Asia and Africa, *Albizia* species are used as most common plantation species. These species are also used in other land use systems like agroforestry and tea garden. Due to these important characters of *Albizia spp.* seed morphology, germination and seedlings survivability in the nursery have been studied (Matin and Rashid, 1992). Therefore, the present study has been carried out to find the growth performance of seedlings of seven *Albizia* species at the nursery condition.

* Corresponding author. Tel: +88-(041)-721791,72171-3,Fax:880-041-731244,email:<ku@bdonline.com>

DOI: https://doi.org/10.53808/KUS.1999.1.2.277-282-Ls

Materials and Methods

Fruits and seed collections of the above mentioned *Albizia spp*, were made according to Matin and Rashid (1992). For seedling growth study, the germinating seedlings from seed tray and seed bed were transplanted into the transparent polybags (10 cm x 15 cm) at the age of two weeks whereas the seedlings raised in the polybags (10 cm x 15 cm) were separated at the same time. In all the cases, soil was mixed with cowdung in 3:1 ratio by volume and the polybags were placed in open concrete bed of the nursery. Watering was made to the polybags on regular interval other than wet season. The randomized block design was followed having four replications (10 x 4 = 40 seedlings) in each species. Each species was considered a treatment. Data were collected on the same date of each month for each species. Height growth was measured by a wooden scale keeping just above the polybag at the base of the seedlings. Diameters were measured by a slide caliper at the collar zone and the number of leaves was counted manually for each seedling individually. The duration of the experiment was 12 months. The air temperature and relative humidity were recorded from 28 to 35°C and 52 to 69% respectively during the experiment.

Results and Discussion

Height growth: Height growth of different *Albizia* species is shown in Fig. 1. Among the seven *Albizia* species, height growth of *Albizia procera, A. chinensis, A. falcateria* and *A. odoratissima* was found 1st, 2nd, 3rd and 4th positions respectively. *Albizia lebbek* and *A. richardiana* jointly took the 5th position. Analysis of variance showed significant differences in height growth among all the species at the end of 12 months other than *A. richerdiana* and *lebbek* (Table 1). Height growth of the seedlings of *A. procera A. chinensis* and *A. falcateria* was above 80 cm after 12 months whereas the other species showed near about 40 cm. Similar fast growing tendency in height growth of *A. Procera* (52.7cm), *A.falcateria* (64.2 cm) and *A. chinensis* (73.11 cm) was also reported by Nandy (1999) in an experiment after 3 months. This variation in height growth among different species may be due to different genotypes as during raising seedlings, all the environmental factors like soil medium, polybag sizes, watering, temperature, humidity etc. were equally maintained in all the species.

Table 1. ANOVA for height growth.

Source of variation	Sum of Squires	d. f.	M. S.	Calculated F-ratio	Tabulated F ratio	
					At 1%	At 5%
Species	22717.62	6	3786.27	140.44*	4.01	2.66
Blocks	27.80	3	9.27	0.34	5.09	3.16
Error	485.31	18	26.96			
Total	23230.73	27				

* Significant.

During wet season (April - July), *A. richardiana, A.lucida, A. lebbek* and *A. odoratissima* showed gradual increase in height growth whereas *A. procera A. chinensis* and *A. falcateria* showed sharp rising with significant differences among their heights in various months (Fig. 1). At the end of wet season (July) no significant differences were found between *A. richardiana* and *A. lucida, A. lebbek* and *A. odoratissima* and *A. procera* and *A. chinensis* but significant differences were found in *A. falcateria* with the rest of the species (Fig. 1). The tendency to rise up of height growths of all the species during wet season may be due to adequate rainfall in this period increase in soil moisture in the polybags of the seedlings that induced more leaf formation (Table 3) and carbohydrate assimilation. Similar investigations were also found during the growth study of some forest tree

seedlings (*Artocarpus chaplasha, Michelia champaca, Tectona grandis, Gmelina arborea and Albizia procera)* of Bangladesh (Matin and Banik, 1993). Reports are also available that there is positive correlation between the size of root system and the net photosynthesis with *Phaseolus vulgaris* (Humphries, 1963a). Formation of roots helps to absorb water to maintain a healthy water balance and replenishes water lost in transpiration (Sands, 1984).

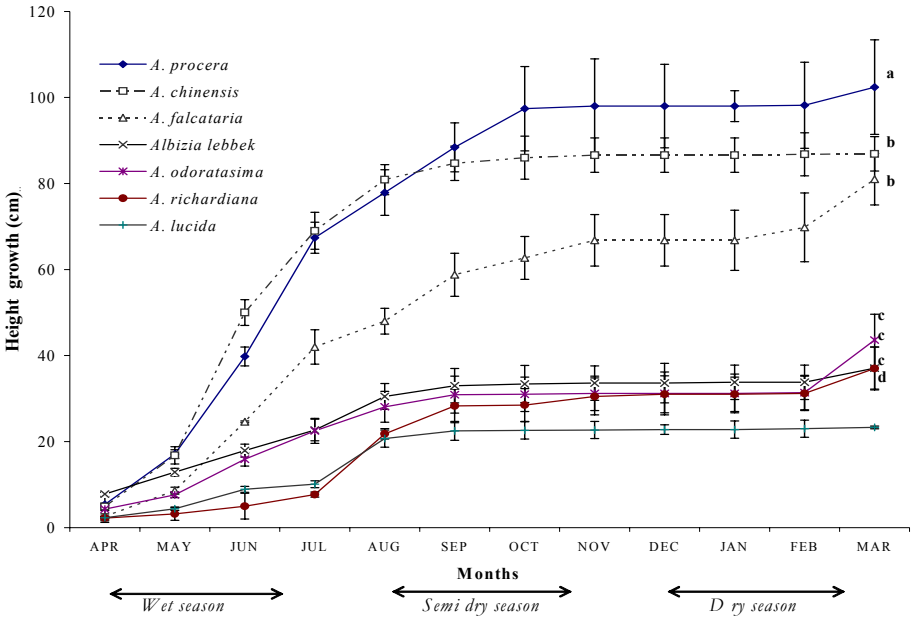

Fig. 1. Effect of age and seasons on the height-growth of 7- species of *Albizia* seedlings at nursery stage. Bars show 95% confidence limit and a, b, c and d signify the significant differences (p=0.05) on array as measured by DMR test.

In semi-dry season (August - November), only *A. procera* and *A. falcateria* maintained the trend of rising up the height growth further. The cause of this increase may be due to as same as wet season. On the other hand, in the dry season (December - March) the height growth of all the species ceased practically (Fig. 1). It may be due to development of the water stress during the dry period (Loomis, 1934 and Matin and Banik, 1993). During dry season the leaf number per plant became less than wet and semi dry season (Table 3). This reduction of photosynthetic surfaces decreased the relative amount of carbohydrates available for growth, as compared with unstressed plants (Kramer, 1969).

Diameter Growth: Diameter growth of the seven species of *Albizia* are shown in Fig. 2., where *A. chinensis, A. falcateria, A. procera, A. lebbek, A. lucida, A. odoratissima* and *A. richardiana* were found in 1st, 2nd, 3rd, 4th, 5th, 6th and 7th positions respectively. At the end of the experiment (after 12 months), analysis of variance showed no significant differences between *A. chinensis* and *A. falcataria* and among *A. lucida, A. odoratissima,* and *A. richardiana*. But differences were found in *A. procera* and *A. lebbek* with the rest of the species (Table 2). Higher diameter growth in *A.chinensis* (1.05 cm) was also mentioned by Nandy (1999) in an observation of 3 months. The cause of this variation in diameter growth may be as same as height growth.

Table 2. ANOVA for diameter growth.

Source of variation	Sum of Squires	d. f.	M. S.	Calculated F-ratio	Tabulated F ratio	
					At 1%	At 5%
Species	2.012	6	0.34	19.32*	4.01	2.66
Blocks	0.02	3	0.007	0.398	5.09	3.16
Error	0.317	18	0.0176			
Total	2.349	27				

* Significant.

In wet season (April - July), diameter growth began to rise up and continued up to semi-dry season (August - November) in all the species. In the wet and semi-dry period, soil moisture increased in the polybags and new leaves and shoots were produced to the seedlings. Formation of new leaves and roots after few weeks in *Nauclea diderrichii* cuttings increased the total carbohydrate concentrations to the cuttings (Matin, 1989) and reports are available that carbohydrate reserves and water has positive role on root growth of plants (Komissarov, 1964). But during dry season (December - March), there was practically no increase in diameter growth (Fig.-2). In this period, water stress reduces photosynthesis, decreases translocation of carbohydrates and growth regulators and disturbs nitrogen metabolism. All these add to reduced turgor in reducing growth (Kramer, 1969).

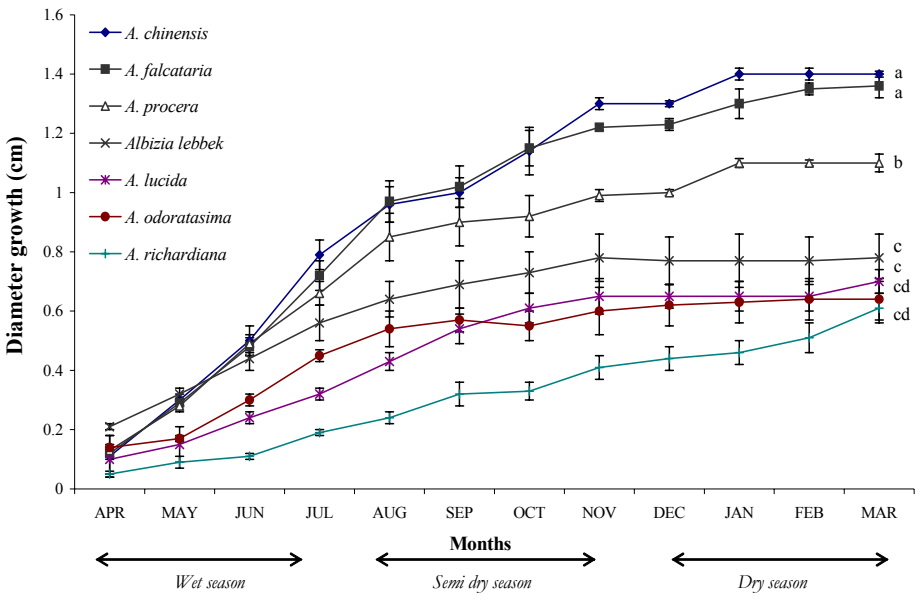

Fig. 2. Effect of age and seasons on the diameter -growth of 7- species of *Albizia* seedlings at nursery stage. Bars show 95% confidence limit and a, b, c and d signify the significant differences (p=0.05) on array as measured by DMR test.

Leaf number: Leaf formation of the above seven *Albizia* species were shown in Table 3. Average leaf number at the end of the experiment (12 months) were 101, 98, 93, 83, 82, 75, and 53 to *A. richardiana*, *A. lucida, A. chinensis*, *A. odoratissima, A. procera, A. falcateria* and *A. lebbek* respectively. Seasonal variation has positive effects on leaf production. In all of the species, leaf

number increased during wet and semi-dry periods whereas the number decreased during dry season for leaf shedding due to water stress. Among the seven species, *A. procera* and *A. chinensis* showed more leaf areas and more growth both in height and diameter. *Albizia richardiana*, *A. lucida* and *A. odoratissima* showed more leaf but less growth in height and diameter. *Albizia falcateria* showed less leaf area but more growth in height and diameter. Lastly, *A. lebbek* showed less leaf area and less growth in height and diameter. Therefore, growth in plants is not always controlled by their physiological or environmental factors rather is controlled by genetic factor.

Table 3. Monthly leaf number of seven species of *Albizia* seedlings.

Month	***Albizia lebbek***	***A. procera***	***A. chinensis***	***A. richardiana***	***A. odoratasima***	***A. falcataria***	***A. lucida***
APR	4±0.32	4±0.45	5±0.51	4±0.29	3±0.24	4±0.21	4±0.22
MAY	6±0.53	8±0.65	7±0.86	4±0.55	6±0.70	6±0.58	4±0.29
JUN	5. ±0.59	7±0.86	9±0.89	5±0.63	8±0.98	6±0.57	6±0.46
JUL	4±0.19	7±0.69	9±1.07	8±0.25	8±0.91	9±0.89	7±0.75
Sub-total	***19***	***26***	***30***	***21***	***25***	***25***	***21***
AUG	4±0.28	7±0.87	9±0.94	10±0.94	9±0.56	9±0.79	12±1.06
SEP	5±0.45	11±1.09	13±1.56	11±0.89	10±0.49	10±0.98	13±0.99
OCT	5±0.46	12±1.56	11±0.79	13±1.84	8±0.46	7±0.94	11±1.02
NOV	5±0.35	7±0.88	6±0.69	11±1.29	7±0.82	7±0.87	8±0.68
Sub-total	***19***	***37***	***39***	***45***	***34***	***33***	***44***
DEC	3±0.21	4±0.31	6±0.60	8±0.88	5±0.26	4±0.14	8±0.59
JAN	2±0.19	3±0.22	5±0.84	8±0.91	3±0.31	4±0.16	7±0.22
FEB	1±0.08	1±0.10	3±0.29	7±0.69	1±0.09	1±0.08	6±0.35
MAR	9±1.13	11±1.28	10±1.03	12±1.48	15±1.88	8±0.28	12±0.89
Sub-total	***15***	***19***	***24***	***35***	***24***	***17***	***33***
Grand total	**53**	**82**	**93**	**101**	**83**	**75**	**98**

± shows 95% confidence limit.

Conclusion

The results suggest that growth performance (height and diameter) of the above mentioned 7 *Albizia* species showed strong correlation with seasonal variations. During wet seasons (April – July) and semi-dry season (August – November) height and diameter growth of all the species continued to rise up whereas in dry period there was practically no growth at all. Among the 7 *Albizia* species, *A. procera, A. chinensis* and *A. falcateria* seedlings showed better performances (height and diameter) over the others. Leaf number also showed a good correlation with seasonal variations like height and diameter. Moreover, growth in plants is not always controlled by their physiological or environmental factors but rather by genetic factors.

References

Alam, M.K. and Mohiuddin, M., 1992. Some potential trees for Homesteads in Bangladesh. *Agroforestry Information Series,* No. 2, Bangladesh Agricultural Research Council, Dhaka, Bangladesh.

Davidson, J., 1985. Species and Sites. Field Document No. 5, UNDP/FAO Project BGD/79/017, Bangladesh.

Humphries, E.C., 1963a. Dependence of net assimilation rate on root growth of isolated leaves. *Annals of Botany (London), New Series*, 27: 175-183.

Komissarov, D.A., 1964. Biological basis for the propagation of woody plants by cuttings (Translated by Z. Shapiro and edited by M. Kohn). Israel program for scientific translations Press, Jerusalem, 106 pp.

Kozlowski, T.T.,1958. Water relation and growth of trees. *Journal of Forestry*, 56: 498-502.

Kramer, P. J., 1969. Water and it's role in plants. In: *Plant and Soil Water Relationships- A modern Synthesis*. McGraw-Hill, New York, 483 pp.

Loomis, W.E., 1934. Daily growth of maize. *American Journal of Botany*, 21: 1-6.

Matin, M. A. and Rashid, M.H., 1992. Seed morphology, germination and seedling survival of *Albizia* trees in the nursery. *Bangladesh Journal of Forest Science*, 21(1&2): 40-45.

Matin, M.A., 1989. Carbon economy during rooting of cuttings of *Nauclea diderrichii* (de, wild and th. Dur.) Merill. *M.Phil. Thesis*, Department of Forestry and Natural Resources, University of Edinburgh, U.K., 123 pp.

Matin, M.A. and Banik, R.L., 1993. Effect of polybag size on growth of some forest tree seedlings of Bangladesh. *Bangladesh Journal of Forest Science*, 22 (1&2): 37-43.

Nandy, P. 1999. Nursery techniques of eleven forest tree species of Bangladesh, Bulletin No. 1 (Nursery Technique Series), Seed Orchard Division, Bangladesh Forest Research Institute, Chittagong, pp. 1-42.

National Academy of Science (NAS), 1980. *Firewood Crops, Shrubs and Tree Species for Energy Production*. Washington, D.C, pp. 98-99

Sands, R., 1984. Transplanting stress in Radiata pine. *Australian Forest Research,* 14: 67-72.