

Germination Behavior and Initial Growth Performance of Seven *Leucaena leucocephala* Varieties in Chittagong University Sites

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Abstract: Seeds of seven *Leucaena leucocephala* varieties were treated equally and sown in the nursery of the Institute of Forestry and Environmental Sciences, Chittagong University and transplanted in University sites to study their comparative germination behavior and growth attributes in the field. The result revealed that all of those exotic varieties have the potential to grow fast. Among them variety 23.2 (T₄) shows the highest germination rate whereas variety 48.2 (T₅) and 48.2 (T₆) shows the lowest. Highest growth rate was also recorded with 23.2 (T₄). Maximum biomass was found with the variety 1.1(432 gm).

Key words: Ipil-Ipil, *Leucaena leucocephala*, Growth, Nursery, Chittagong

INTRODUCTION

Regarding the Forest Area Statistics of Bangladesh there is shortage of reliable information since it is described through different figures in different sources. The Forestry Sector Master Plan accounted it as 17.8% of the total land area of Bangladesh^[1] whereas the Bangladesh Bureau of Statistics[2 noted 14%, World Bank^[3] reported 11%, Ahmed^[4] found it as 9% in a recent report. Roy^[5] reported that the total forest area is 17.5% of the total land surface but only 7.7% land surface is under tree cover. But this figure was reported as 5% by Ahmed^[4], 6% by World Bank^[3] and Chowdhury^[6], 5.8% by Forest Department (FD)^[7]. It is one of the most densely populated countries of the world having 123.1 million peoples in 14.4 million ha area (834 persons per km²)^[8]. Here 77 percent people live in the rural areas. Overall per capita land availability is about 0.12 ha^[9]. The per capita consumption of fuelwood (0.1 m³) in Bangladesh is one of the lowest in the world and there is a big shortfall of supply compared to demand, the balance of fuel wood requirement being met using farm-by products^[10,11,12]. Each year this supply and Demand gap is widening. It was estimated that there will be a net deficit of about 3.47 million m³ of fuel wood by the year 2013 if the tree resources are not managed properly on a sustainable yield basis^[1]. The present forest system of Bangladesh is unable to meet the present demand of forest products for its people due to overexploitation of resources, destruction of forests by different agents, shortage of quality seed supply and planting stocks, increased cost

of raising plantation and shortage of sufficient research and technical know how. The northern part of the country is going to turn into desert due to shortage of water level. Beside these, Plantation of Bangladesh is generally done by traditional method by seeds and seedlings. For this program, seeds are generally collected from existing plantations and natural stands. As a result, problems like non-uniformity of timber, slow growth, average low quality and quantity. Pests and diseases often damage these seeds. To get rid of such worse situation Bangladesh Forest Department introduced *Leucaena leucocephala* in August 1977 from the Philippines^[13]. *Leucaena* probably offers the widest assortment of uses compared to all tropical legumes. Through its many varieties, *Leucaena* can produce nutritious forage, firewood, timber, and rich organic fertilizer. The wood, leaves, twigs have a medicinal value as well as tannin^[14]. It's diverse uses in regenerating tropical hill slopes and providing windbreaks, firebreaks, shade and ornamentation. *Leucaena* is relatively resistant to the pests and diseases. More over in mixed cropping it is reported that Bananas may do better in the shade of *Leucaena*^[15]. Wood specific gravity of *Leucaena leucocephala* is about 0.50-0.70^[16]. *Leucaena* wood has the potential to become a major source for pulp and paper, round wood and construction materials^[17]. In some cases, the wood of *Leucaena leucocephala* is used for light furniture, handles of agricultural tools^[18]. The cylindrical type of bole is also used for Posts, poles, rafts^[14]. Plants are used in some countries for shade for black pepper, coffee, cocoa, quinine, and vanilla and for hedges^[15]. Fuel

wood calorific value of this species is about 4200-4600^[16]. This species is browsed by cattle, goats^[16]. In Bangladesh it was reported that the leaves, twigs and fruits are excellent fodder for domestic animals^[18,19,14,20]. The powdered form of seeds is used as poultry feed^[19]. Young pods and seeds are cooked and eaten with rice^[21]. In recent, British-American Tobacco Company Ltd. utilizes the wood chips of Ipil-Ipil for the substitute of Tobacco. So it is more economic as well as to conserve human health. Due to its multipurpose utility and wide range of ecological amplitudes (especially suitable to Bangladesh Environment) the species is recommended for roadside as well as khetland other than forest land^[20]. The species has potentiality in newly formed islands and coastal areas of the country where immediate plantations are essential for stability of soils and protect the country from unexpected flood and other natural calamities. However in most of the plantation forestry in Bangladesh could not yield that much products due to the lack of good planting materials, and use of uncertified seeds for large scale plantation. Narrow genetic base is a major reason of poor production of different plantation species. This paper is an endeavor to select some new varieties of *Leucaena* in the plantation based on their initial growth performance.

MATERIALS AND METHODS

The study was conducted in the nursery of Institute of Forestry and Environmental Sciences, University of Chittagong (IFESCU) campus, Chittagong, Bangladesh. The area is situated in the south-eastern part of Bangladesh that lies approximately at the intersection of 91°50' east latitude to 22°30' north longitude^[22]. The nursery site enjoys a tropical monsoon climate characterized by hot, humid summer and cool, dry winter. The average monthly mean temperature varied 29.75° C maximum and between 21.14 °C minimum^[23]. Relative humidity was generally the lowest (64%) in February and highest (95%) in June-July-August and September. The soil used in the nursery was moderately coarse to fine textured. It has a grey to olive grey color; sandy loams sub soil with moderate coarse and medium angular blocky structure. The seeds of the experiment were obtained from the New Forest project, U.S.A. The varieties are Variety 1.1 (T₁), Variety 6.5 (T₂), Variety 9.5 (T₃), Variety 23.2 (T₄), Variety 46.5 (T₅), Variety 48.2 (T₆) and Variety 50.4 (T₇). Polybags of 6" X 4" size in the nursery were arranged following a Randomized Complete Block Design with four blocks and four replicates, each replicates contained 25 polybags. Before sowing *Leucaena* seeds were soaked in cold water for 12 hours. In each bag two seeds were sown at the end of March. Hence a total of 1400 seeds (200 for

each) were sown at equal depth and 10 cm apart from each other. Germination percent, germination energy % and germination period were calculated following Zabala^[24]. When germination completed only 168 healthy seedlings (one in each polybag) were kept and others were removed carefully so that the seedlings do not get injured. Watering was carried regularly by fine shower which could not disturb the seedlings physically. Removal of weeds, grasses etc. were done as far as possible. Proper care and maintenance were given for one year. NPK (4:2:3) Nitrogen @ 80 kg/ha, Phosphorus @ 40 kg/ ha and Potassium @ 60 kg/ ha were applied once on two months aged seedlings. When the seedlings reached three months they were transplanted to field maintaining 1m x 1m spacing following Completely Randomized Block Design with four blocks and four replications (6 plants in each replication) and allowed to grow for another 7 months. All the seedlings in the field were measured and weeded monthly for the seven months in plantation site. After seven months survival percentage and height of each plant were recorded and they were harvested to measure different growth parameters (like fresh weight, dry weight of root, shoot, leaf and finally total biomass). The data were analyzed statistically. Duncan Multiple Range Tests (DMRT) was used to compare mean values of all the treatments following Zaman *et al*^[25].

RESULTS AND DISCUSSIONS

Germination percentage among the seven varieties differed significantly. The highest (39%) Germination rate was recorded with T₄, followed by T₃ (35%), T₇ (33%), T₂ (29%), T₅ (19%), T₆ (19%) and T₁ (18%) (Table1). Longer Germination period (23 days) was recorded for T₄ and the shorter (14 days) was found for T₆ (Table 1). Though shortest germination period were recorded the germination percentage was very poor with T₆. Maximum Germinative energy 39% in 30 days were recorded with T₄ (39% in 30 days), followed by T₃ (35% in 30 days), T₇ (33% in 30 days), T₂ (29% in 30 days), T₅ (19% in 20 days), T₆ (19% in 20 days) and T₁ (18% in 30 days) (Table 1). Hence, variation of Germination energy among the varieties is well recognized.

The highest (100%) survival percentage was found with T₄ and T₆, whereas the lowest was found with T₇ (92%) (Table 2). Maximum (432 gm) biomass productivity was recorded in T₁, followed by variety T₆ (362 gm), T₄ (273 gm), T₂ (268 gm), T₇ (240 gm), T₅ (224 gm) and T₃ (160 gm) (Table 2). Difference among the initial height growth (Seventh months after transplanting) of *Leucaena* varieties were found significant (Table 1). Best height was recorded with the T₄ (260 cm), followed by T₆ (220 cm),

Table 1: Germination (%), germination energy (%), germination period and height of *Leucaena leucocephala* varieties

Treatment	Species Variety	Germination (%)	Germination energy (%) Days			Times required to reach the highest germination (Days)			Height Growth (7 months of Transplanting) (cm)
			10 D	20 D	30 D	Starts	Ends	Germination Period	
T ₁	1.1	18c*	10	17	18	3	23	20	185e*
T ₂	6.5	29b	23	25	29	4	23	19	218bc
T ₃	9.5	35ab	26	30	35	4	23	19	194d
T ₄	23.2	39a	22	31	39	2	25	23	260a
T ₅	46.5	19c	16	19	19	5	20	15	180f
T ₆	48.2	19c	18	19	19	6	20	14	220b
T ₇	50.4	33ab	22	25	33	5	22	17	216c

* Means followed by the same letter (s) are not significantly different at p<0.05, Duncan's Multiple Range Test (DMRT).

Table 2: Survival % and biomass productivity of the different varieties of *L. leucocephala*.

Species	Survival (%)	Root (Fresh wt) (gm)	Shoot (Fresh wt) (gm)	Leaf (Fresh wt) (gm)	Root (Dry wt) (gm)	Shoot (Dry wt) (gm)	Leaf (Dry wt) (gm)	Total biomass (gm)
1.1(T ₁)	97	165	355	209	109	198	125	432
6.5(T ₂)	94	144	223	129	78	130	60	268
9.5(T ₃)	97	82	185	77	34	93	33	160
23.2(T ₄)	100	119	305	143	67	148	58	273
46.5(T ₅)	97	90	254	83	50	140	34	224
48.2(T ₆)	100	179	405	170	80	202	80	362
50.4(T ₇)	92	95	315	90	47	150	43	240

T₂ (218 cm), T₃ (194 cm), T₁ (185 cm) and T₅ (180 cm) (Table 1, Figure 1).

The germination percentage found through the cold water treatment is far below than that of hot water or acid treatment recorded by Jabbar^[26] and Alam *et al*^[27]. Seed treatment of *Leucaena* may result rapid and uniform germination was reported by Daguma *et al*^[28] and National Research Council^[29]. At the same time 80% Germination percent were reported by Mahmud *et al*^[30] with the same seeds when treated by hot water for 3 minutes followed by cold water for 12 hours. They also reported 18 days germination period and 27% germinative energy in 30 days with the same species. Mahmud *et al*^[30] reported 100% survival of *Leucaena* in another experiment for the seeds of same sources. Similar trend of height growth (336 cm in 7 months of transplanting) was observed in separate experiment by Mahmud *et al*^[30].

Conclusion: Like all the natural forest areas of Bangladesh, Chittagong university campus hill is also subjected to several disturbances like deforestation, soil erosion, and unplanned management. In the hilly areas of Chittagong University every year remarkable areas are

being taken under tree plantation programs. Still there exist huge lands where local peoples have been practicing destructive agriculture like root crop production on the steep slopes. These accelerate soil erosion and loss of soil fertility and finally the lands are getting barren. For successful plantation program in such areas Nitrogen fixing multipurpose tree species should be given preference. Researches have shown that declines in soil fertility due to land degradation can be checked and soil sustainability can be maintained by planting Nitrogen fixing tree species. In denuded hills like Chittagong University area where immediate green cover is required to combat different environmental problems fast growing multipurpose trees like *Leucaena* could be the best option among several other species. Initial growth performance of any species is very much important as it leads to the better growth performance in the field. This finally results in the best yield. Hence, Initial growth performance could be a good indicator for the selection of best variety in the plantation program. The present study revealed that the variety 23.2 (T₄) would be the recommended *Leucaena* variety for the large scale plantation.

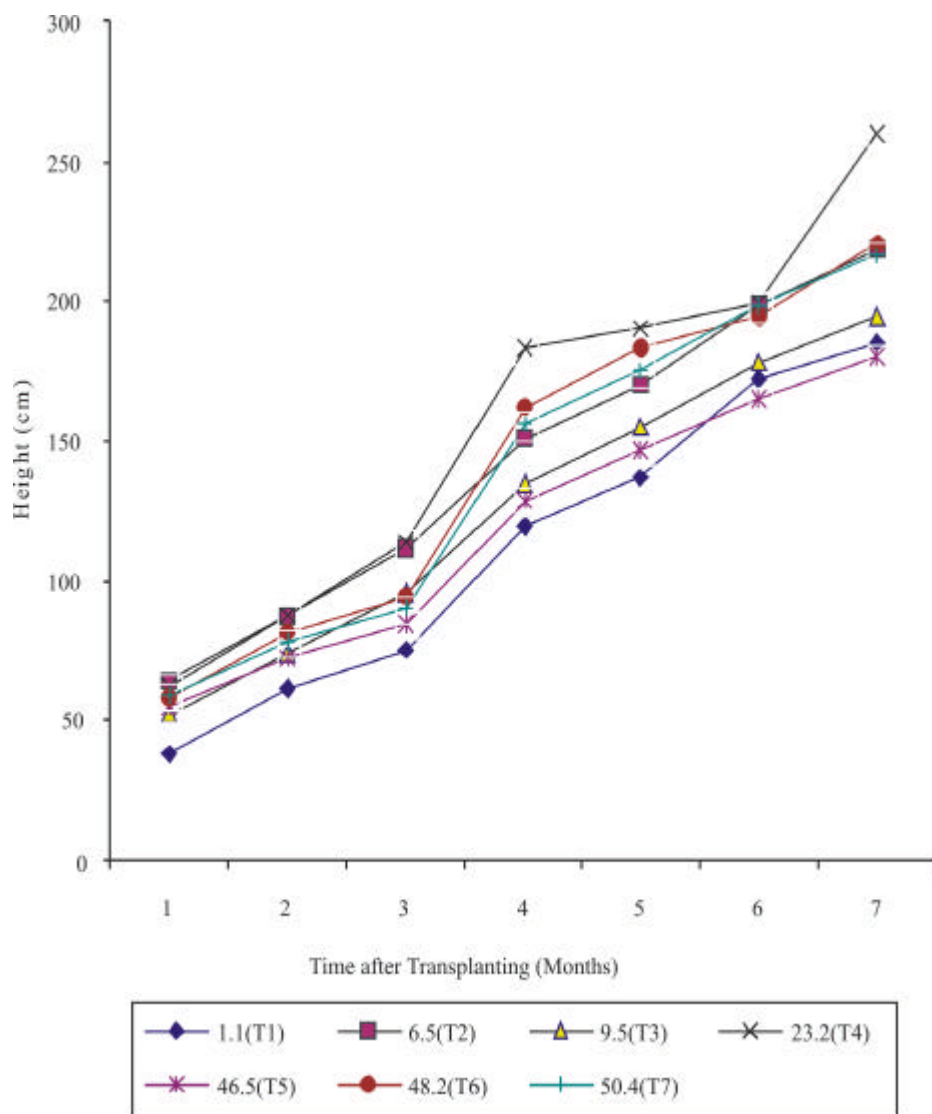


Fig. 1: Height growth of different Leucaena varieties

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