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EFFECTS OF LIMING ON GROWTH, BIOMASS PRODUCTION AND NUTRIENT CONTENT OF *ALBIZIA PROCERA* SEEDLINGS GROWN IN ACID SOIL

Shawan Mazumder, Md. Abu Naser Khan[1], Md. Faruque Hossain[1], A. H. M. Zulfiquar Ali and Md. Khalilur Rahman[*]

Department of Soil, Water and Environment, University of Dhaka, Dhaka-1000, Bangladesh

A pot experiment was carried out in the net house of the Department of Soil, Water and Environment, University of Dhaka to evaluate the growth performance of *Albizia procera* (Roxb.) Benth. Seedlings grown in acid soil under the influence of lime (CaO). Nine different treatments were applied. Height, fresh and dry weight of root, stem, leaf and nutrient contents were higher in T_7 treatment (4 ton lime/ha).

Albizia procera (Roxb.) Benth. species (locally known as Silkoroi) is popular among the rural farm holder in Bangladesh and extensively used as a potentially important agroforestry component. In Bangladesh, it grows well in Chittagong Hill Tracts, Chittagong, Cox's Bazar and Sal forests in Dhaka and Mymensingh. It survives on a variety of soils, grows best on moist alluvial soils, well-drained loams or clay soils with a pH of 5.5 - 7.5. Due to its multipurpose utility and wide range of ecological amplitudes *viz.* fast growing, high nitrogen-fixing capacity, ability to control erosion as well as to reclaim degraded soils, and has the ability to adapt in a wide range of environmental conditions. Keeping this view in mind, a pot experiment was conducted to evaluate the growth, biomass production and nodulation and nitrogen, phosphorus, potassium and iron content in the leaf of *A. procera* seedlings grown in acid soil of Mirzapur as influenced by liming in the net house of the Department of Soil, Water and Environment, University of Dhaka.

Sample was collected from the village - Hatubhanga, union- Gorai, upazila- Mirzapur, district- Tangail, Bangladesh. Some physico-chemical properties of the soil are as follows: pH 4.76 (1:2.5 W/V H_2O), sand 19.48%, silt 45.79% and clay 34.73%, textural class- silty clay loam (Piper 1944), soil colour- brown red and organic carbon 1.04% (Jackson 1958). The available and total nitrogen were 109 mg/kg and 0.12% (Marr and Cresser 1983), available phosphorus and potassium were 6.9 and 23.9 mg/kg, respectively.

Three kilogram of soil was used per plastic pot. Treatments with three replications were as follows: T_1: Control (without lime), T_2: 0.5 ton lime/ha, T_3: 1 ton lime/ha, T_4 : 1.5 ton lime/ha T_5: 2 ton lime/ha T_6: 3 ton lime/ha T_7: 4 ton lime/ha T_8: 5 ton lime/ha, and T_9: 7 ton lime/ha. Pots were arranged in a complete randomized design (CRD) in the net house of the Department of Soil, Water and Environment, University of Dhaka. *A. procera* seeds were collected from Forest Department, Govt. of Bangladesh. Three seeds were sown per pot. Seedlings were irrigated with tap water. Intercultural operations *viz*. weeding, pesticide application etc. were done as and when needed.

*Author for correspondence: <khalil93@du.ac.bd>. [2]Ministry of Forest and Environment, Government of Bangladesh.

Height was measured from the surface of the soil to the tip of the leaf of the seedlings. Seedlings were allowed to grow 120 days and harvested as root, stem and leaf. Fresh and dry weights were recorded (Table 1). The samples were air-dried in the room temperature and oven-dried at 65^0C in the laboratory. The concentration of N in leaf was determined by using a Kjeldahl steam-distillation apparatus in the presence of excess 40% NaOH (Cresser and Parsons 1979). The concentration of P in leaf was determined by the ammonium molybdate blue color method in a Cecil spectrophotometer (Murphy and Riley 1962). The concentration of K in leaf was determined by feeding the extract into a flame photometer using a suitable filter. Iron was determined by atomic absorption spectrophotometer (AAS). Soil pH was measured by corning electrode pH meter.

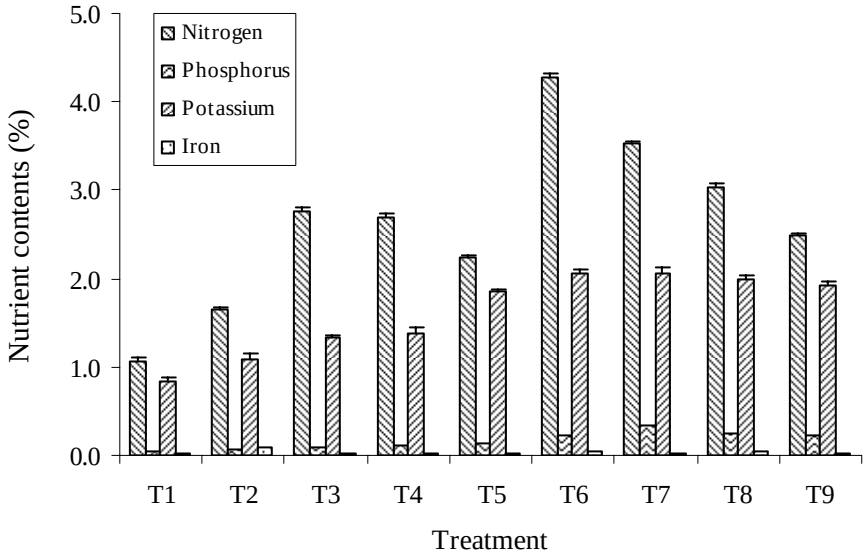

Fig.1. Effects of liming on the nutrient contents in the leaf of *A. procera* seedlings grown in acid soil.

One-way analysis of variance (ANOVA) was performed to test the effects of liming on fresh and dry matter production, root and shoot length, and number of nodules formed and concentration of N, P, K and Fe content in leaf. All statistical analyses were performed with Minitab, version 17.

The results of the height, fresh and dry weight of root, stem and leaf, number of nodules, length of root, ratio of root and shoot after harvest have been presented in Table 1. The values of height did not vary significantly but the longest height (20.9 cm) was recorded in T_7 treatment (4 ton lime/ha). Fresh weight of root and leaf varied significantly ($p = 0.5$). Stem did not show significant variation. The highest value of root (5.58 g/plant), stem (2.95 g/plant) and leaf (3.02 g/plant) were achieved in T_7 treatment. Total fresh weight of root, stem and leaf (11.55 g/plant)

Table 1. Effects of liming on height, biomass production and nodule formation of *Albizia procera* seedlings grown in an acid soil.

Treatments	Height (cm)	Fresh weight (g/plant)				Dry weight (g/plant)				No. of nodule/plant	Root length (cm)	Root/shoot ratio
		Root	Stem	Leaf	Total	Root	Stem	Leaf	Total			
T_1:Control (–lime)	18.0	1.11	1.25	1.40	3.76	0.46	0.53	0.38	1.37	10.67	11.00	0.87
T_2:0.5 ton lime/ha	18.8	3.27	1.43	1.55	6.25	1.73	0.81	0.56	3.1	16.33	12.63	2.13
T_3:1.0 ton "	19.5	4.46	2.02	2.15	8.63	2.28	1.10	0.69	4.07	16.00	13.40	2.07
T_4:1.5 ton "	19.1	2.93	1.40	1.14	5.47	1.37	0.57	0.40	2.34	18.33	16.83	3.03
T_5:2.0 ton "	19.7	3.25	1.72	1.52	6.49	1.76	0.91	0.53	3.20	22.33	16.08	1.93
T_6:3.0 ton "	20.8	3.37	1.93	2.10	7.4	1.78	0.84	0.62	3.24	26.60	19.63	2.12
T_7:4.0 ton "	20.9	5.58	2.95	3.02	11.55	3.02	1.62	1.05	5.69	27.67	18.58	1.86
T_8:5.0 ton "	19.7	3.11	2.2	2.49	7.80	1.60	0.88	0.68	3.16	16.00	18.10	1.82
T_9:7.0 ton "	18.1	3.31	1.89	2.18	7.38	1.75	0.99	0.76	3.50	11.67	18.25	1.77
LSD at 5%	NS	1.20	NS	1.03	-	2.51	NS	0.30	-	6.42	5.2	-

NS = Not significant.

was recorded also highest in T_7 treatment (4 ton lime/ha). Dry weight of root and leaf varied significantly ($p = 0.5$). The highest dry weight of root (3.02 g/plant), stem (1.62 g/plant) and leaf (1.05 g/plant) were observed in T_7 treatment. Total dry weight of root, stem and leaf (5.69 g/plant) were also observed in T_7 treatment where 4 ton lime per hectare was applied. Lugo *et al.* (1990) recorded high rate of biomass production (124 ton/ ha) for this species. The benefit of liming is in agreement with Costa *et al.* (1992). Number of nodules and length of roots per plant differed significantly ($p = 0.5$). The highest values of nodules (27.67 no./plant) and length of roots (19.63 cm/plant) were noted highest in T_7 and T_6 treatments where 4 and 3 ton lime were applied, respectively (Table 1). Uddin *et al.* (2007) observed a positive effect of P fertilization on the nodule formation. The highest value of root/ shoot ratio (3.03) was achieved in T_4 treatment where 1.5 ton lime was applied per hectare. *A. procera* was planted in saline alkaline soils of Bogi of Sundarban areas and found promising growth (Hossain 2015).

The concentration of N, P, K and Fe in leaf has been presented in Fig. 1. The highest concentration of N,P,K and Fe were observed in $T_{6\ (4.28\%),}$ $T_{7(0.35\%),}$ $T_{7(2.07\%)}$ and $T_{2\ (0.09\%)}$ treatments, respectively. The best concentration of the above elements was found in T_7 treatment (Fig. 1). A significant variation ($p = 0.5$) was observed in treatments. The concentration of N was consistently higher up to treatments T_6 and the concentration of P and K increased consistently up to treatment T_7 and then decreased. Results revealed that the liming has a significant effect on nutrient content as well as on soil pH. The pH of soils after harvesting (120 days) were 4.77, 5.18, 5.75, 6.04, 6.41, 7.58, 7.56, 8.38 and 9.26 in T_1 to T_9 treatments, respectively. When lime was applied to soil at increasing rates soil pH increased progressively (initial pH 4.76). But better growth and concentration of nutrients were observed in plants in treatment T_7 (4 ton lime/ ha) possibly due to the higher assimilation of N, P, K and Ca. Valkenburg (1997) reported that *A. procera* grows well on shallow soils with a pH of 5.5 to 7.5.

This study clearly indicated that the normal physiology of *A. procera* seedlings will be seriously affected without the use of lime in acid soils and plantation programme will be unsuccessful. Application of medium doses of lime to reduce acidity could be a possible solution for healthy *A. procera* (Silkoroi) seedlings in the high land soils.

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