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Interaction of Salinity and Industrial Effluents on the Growth of *Dalbergia sissoo* (Shisham) Seedlings

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ABSTRACT

Dalbergia sissoo seedlings were grown in the nursery and then transplanted in plastic pots. Single salinity as well as both salinity and industrial effluents were applied to the seedlings. Data revealed that height, fresh shoot weight, oven dry shoot weight and leaf area were affected significantly with the application of salinity and industrial effluents. Double stress of salinity and industrial effluents was more serious (e.g. 35 cm at EC 2 dSm^{-1}) as compared to single stress of salts (57.75 cm) in the case of height.

Key Words: Salinity; Industrial effluents; Growth; *Dalbergia sissoo*

INTRODUCTION

Shisham (*Dalbergia sissoo*) is reputed as one of the finest cabinet, furniture and veneer timbers of the world. A large area of Pakistan is under cultivation of the species. However, shortage of water is an obstacle in increasing the land under *Dalbergia sissoo* cultivation. Increased urbanization and industrialization now generate a lot of municipal wastewater. Although the sewage effluents are considered to be a source of organic matter and plant nutrients and also contains considerable amounts of soluble salts and varying amounts of potentially harmful substances including heavy metals like Iron, Manganese, Copper, Zinc, Lead, Nickel, but their concentrations are variable in time and space (Ghafoor *et al*., 1994). The main objective of present studies was to determine the suitability of industrial wastewater and saline water to *Dalbergia sissoo* seedlings.

MATERIALS AND METHODS

The research work was carried out in the net house of Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad, during the month of May 2001.

Seedlings of *Dalbergia sissoo* were raised in nursery and transplanted in plastic pots containing washed gravel after one month. The experiment was laid out in completely randomized block design with four replications.

There were three treatments with two factors (Table I), (T1) control (EC 2 dSm^{-1}) (a) 50% nutrient solution (b) industrial effluents with 50% nutrient solution; (T2) EC 10 dSm^{-1} (a) with salts only (b) Industrial effluents + salts; (T3) EC 20 dSm^{-1} (a) only salts (b) salts and industrial effluents. The experiment was conducted for 45 days. At the end of experimental period, height, fresh and oven dry weights of shoot and leaf area were recorded. Data collected were subjected to analysis of variance and DMR test was applied to compare the treatment means (Steel & Torrie, 1984).

Table I. Detailed description of various treatments applied in the experiment

Treatments		Description	
	EC (dSm^{-1})	Factor-1	Factor-2
T1	2	Hoagland's nutrients solutions	Hoagland's nutrients solutions+ Industrial effluents (EC 3 dSm^{-1})
T2	10	Salts + Hoagland's nutrients solutions	Salts (EC7 dSm^{-1}) + Industrial effluents (EC 3 dSm^{-1}) + Hoagland's nutrients solutions
T3	20	Salts + Hoagland's nutrients solutions.	Salts (EC 17 dSm^{-1}) + Industrial effluents (EC 3 dSm^{-1}) + Hoagland's solutions

RESULTS AND DISCUSSION

The data on plant height of *Dalbergia sissoo* was affected by combined interaction of salinity industrial effluents (Table II). Results show that the height at EC 2 dSm^{-1} with treatment having only salts gave significant difference in height as compared to EC 10 and EC 20 dSm^{-1}. Height at EC 20 $dSm^{-1}$was almost half (34.5 cm) than that at EC 2 dSm^{-1} (57.75 cm). Similar trend in decrease of height was in treatment having combination of industrial effluents and salts (Table II). It is evident from the data that less height in excessive salt combination is due to their toxic effect on the growth of the seedlings. The combined effect of salts and industrial effluents significantly reduced the height because of the presence of metal ions like Fe, Cu, Mn and Zn as identified in effluents in other various studies (Hussain *et al.*, 1999; Kamini & Shrabani, 1999). The results of present study are in confirmatory with the earlier studies conducted by Khalil *et al*. (1967), Hussain and Gul (1991) and Poss *et al*. (2000).

Data regarding the fresh weight of *Dalbergia sissoo* (Table II) showed that it is affected by the combination of

Table II. Interaction of salinity and industrial effluents on the growth of *Dalbergia sissoo*

Treatments * EC dSm^{-1}	Height (cm)		Fresh Shoot Weight (g)		Dry Shoot Weight (g)		Leaf Area (mm^2)	
	Without *IE	With IE	Without IE	With IE	Without IE	With IE	Without IE	With IE
2	57.75a	35d	8.19d	4.14f	2.6j	1.27d	130h	67.2d
10	39.75c	26.5c	3.42fg	2.3gh	1.9k	0.83e	99h	54d
20	34.50d	20.1d	2.7g	1.30h	0.98i	0.35f	51h	30.2d

Different letters in a column show significant effect at 5% level of probability; * IE = Industrial effluent; * EC=electrical conductivity

salt and industrial wastewater salts. Double stress of salinity and industrial effluents having toxic metals, free harmful salts and plants pathogens was more harmful for compared with single stress of salts and reduced the growth. These results are in line with earlier studies by Sindhu and Reeta (1999), Pence *et al.* (2000) and Nakazawa (2000).

Dry weight of shoot of the plant species were affected significantly under various treatments (Table II). Maximum shoot weight was observed (2.6 g) under EC 2 dSm^{-1}. It showed more weight at low EC level, which is more than EC 20 dSm^{-1} (0.98 g). Single stress of salinity and dual stress of salinity and industrial effluents reduced the dry weight of plants. Salinity alone affected dry weight of the species under study. Reduction in weight due to high salinity (EC 20 dsm^{-1}) took place i.e. 0.98 g .It was because of much ions which were harmful for the growth of the seedlings The results are similar to Minhas *et al.* (1997), Poss *et al.* (2000). The dry weight of shoot is also affected by mixing salinity with industrial effluents significantly, more as compared to single salinity as shown in Table II, which is almost three times less than the value of EC 2 dSm^{-1} (*Dalbergia sissoo*). Plants stunted and could attain less weight at EC 20 dsm^{-1}. Similar results had reported earlier (Minhas *et al.*, 1997; Kamini & Shrabani, 1999; Stevens *et al.*, 1999; Poss *et al.*, 2000). It shows that higher salinity levels had more significant effect on reduction of shoot weights due to salt toxicity when both salts and industrial effluents are applied. This combination affected more than single salts stress because of double pressure on seedlings, which disturbed the physiology and ultimately reduced the growth.

Data relating to the leaf area of *Dalbergia sissoo* seedlings was affected. Results show that the species was affected significantly under various treatments

Maximum leaf area was obtained in *Dalbergia sissoo seedlings* (130 mm^2 and 67.2 mm^2) in without IE and with effluents at EC 2 dsm^{-1}, respectively. Salinity alone as well as in combination with industrial effluents reduced the leaf area of the species. It was further noted that the combination of the industrial effluents and salinity reduced the leaf area of the plants more than that of single salt condition (Table II) having harmful heavy metals, and microorganisms, which caused the reduction of the growth. These results are in confirmatory with the results of Sindhu *et al.* (1999), Singh and Singh (2000) and Snowdon *et al.* (2000).

CONCLUSION

Salty water and industrial effluents is not suitable for the growth of *Dalbergia sissoo* seedlings but It is better useful for overall trees as compared to crops, vegetables, fruit trees because these are consumable by living things. Industrial effluents have harmful elements like Fe, Cu, Mn and Zn ions as identified in the experiment.

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