Indian Journal of Ecology (2023) 50(3): 799-801
DOI: https://doi.org/10.55362/IJE/2023/3972

Manuscript Number: 3972
NAAS Rating: 5.79

Survival, Growth and Biomass of *Bambusa tulda* Seedlings as affected by Different Level of Saline Irrigation Water

Twinkal S. Patel, J.G. Pathak, M.B. Tandel, S.M. Patel, M.R. Parmar, D.H. Prajapati and J.R. Chavda

Department of Silviculture and Agroforestry, College of Forestry
Navsari Agricultural University, Navsari-396 450, India
E-mail: twinkalpatel11803@gmail.com

Abstract: The objective of this study was to evaluate the influence of saline irrigation water on the production of bamboo seedlings (*Bambusa tulda*) in nursery condition. The present investigation was carried out at Bamboo Resource Centre, College of Forestry, NAU, Navsari, Gujarat during March, 2021 to June- 2022. The experiment was carried out in nursery conditions with completely randomized design comprising five treatments and four repetitions. Seedling were irrigated with five different levels of saline irrigation water *i.e.*, S_1: 0.5 dSm^{-1}, S_2: 2.0 dSm^{-1}, S_3: 4.0 dSm^{-1}, S_4: 6.0 dSm^{-1} and S_5: 8.0 dSm^{-1} at interval of 2 days up to 120 days after imposing the treatments (DAT). Among different levels of saline irrigated water, a significant reduction in survival, growth, and biomass of *B. tulda* seedlings was observed at 8 dSm^{-1} and slight reduction 4 dSm^{-1} level in nursery condition. However, S_1: 0.5 $dSm^{-1}$and S_2: 2.0 dSm^{-1} showed less impact on seedling survival, growth and biomass parameters. Study showed that the critical limit of saline irrigation water for *B. tulda* species is 8 dSm^{-1}, however, a 4 dSm^{-1} irrigated water not drastically reducing the survival, growth and biomass parameters of *B. tulda* under nursery condition.

Keywords: *Bambusa tulda*, Salinity, Irrigation water, Survival, Growth, Biomass and Nursery condition

Bamboo is one of the fastest growing, versatile plants of immense utility and large economic benefits. Now a days bamboo is also known as green gold. Day by day demand of bamboo is increasing due to which farmers are showing interest in bamboo farming. Among different bamboo species in India, *Bambusa tulda* is now a days gaining popularity among farmers due to its versatile uses and culm characters. It is a widely used bamboo for commercial purposes in Bangladesh and India. Paper pulping industry makes substantial use of *B. tulda* as a raw material. It can be used to make wrapping, writing, scaffolding, incense stick, kite industry and printing paper. In agroforestry, *B. tulda* is often planted as a wind-break around farms and fields. Around 6.727 million ha area in India, which is around 2.1 per cent of geographical area of the country is salt-affected of which 2.956 million ha is saline having high TDS (Arora et al. 2016, Arora and Sharma 2017). Most of Bamboo species have moderate salt tolerance. Bamboo leaves are acidic in nature which reduces the salinity of the soil. Bamboos are potential species for reclamation of saline soils and water (Pulavarty and Bijaya 2018). Bamboo species which can establish and survive in high TDS water can be useful in bamboo farming in areas of high TDS water. National Bamboo Mission, in consultation with industry and states has identified 10 crucial species to be encouraged to be planted by farmers and others to make the country self-sufficient in the supply of raw material to our industry. Among these 10 species, *B. tulda* had been selected for the present study.

MATERIAL AND METHODS

The present investigation was carried out at Bamboo Resource Centre, College of Forestry, NAU, Navsari, Gujarat during the March-2021 to June-2022. The climate of experimental area is typically tropical, characterized by fairly hot summer, moderate cold winter and humid warm monsoon. In general, monsoon commences during the second week of June and ends by the second fortnight of September. Most of the precipitation is received from South West monsoon, concentrated during the months of June, July and August. The minimum and maximum temperature during the course of experiment varied from 20.3°C to 33.6°C, whereas the minimum and maximum Relative Humidity (RH) was varied from 49.93 to 88 per cent.

The experiment was carried out in nursery conditions with completely randomized design. One year old seedlings of *B. tulda* were transplanted in to polybags size 18 cm x 18 cm having a mixture of soil and vermicompost in a ratio of 3:1. Total weight of plastic bags along with media was 12 kg. The sea water was collected from nearest seacoast *i.e.*, Dandi sea coast, which is having EC 38 dSm^{-1} and was diluted with normal water as per the treatments and stored. Initially seedlings were irrigated with normal water till survival and

after 15 days, seedling were irrigated with five different levels of saline irrigation water *i.e.*, S_1: 0.5 dSm^{-1}, S_2: 2.0 dSm^{-1}, S_3: 4.0 dSm^{-1}, S_4: 6.0 dSm^{-1} and S_5: 8.0 dSm^{-1} at an interval of 2 days up to 120 DAT. The observations on survival, growth and biomass of seedling were recorded at 120 DAT.

RESULTS AND DISCUSSION

The data on survival, growth and biomass of *B. tulda* seedlings as affected by various levels of saline irrigation water are furnished in Table 1.

Survival of seedling was decrease with increase in salinity level of irrigation water. The maximum survival percentage of *B. tulda* seedlings 120 DAT was found in S_1: 0.5 dSm^{-1} (89.00 %) which was followed by S_2: 2.0 dSm^{-1} (84.67 %) and S_3: 4.0 dSm^{-1} (76.67 %). The lowest survival percentage was recorded in S_5: 8.0 dSm^{-1} (39.67 %).

Seedling height was negatively affected by saline water, showing a reduction in height as increase in the salinity level of irrigation water. At 120 DAT, maximum seedling height was found in S_1: 0.5 dSm^{-1} (76.69 cm) which was at par with S_2: 2.0 dSm^{-1} (71.85 cm). In S_3: 4.0 dSm^{-1} (69.55 cm) marginal reduction in seedling height was observed. The lowest seedling height was recorded in S_5: 8.0 dSm^{-1} (47.21 cm). Reduction in seedling height could be due to high concentration of soluble salts which increase the osmotic pressure and decrease the osmotic potential of soil solution which means that the soil water is held with extra energy produced by the presence of salts in *Leucaena leucocephala, Acacia nilotica* and *Casuarina equisitifolia* (Ali et al 1987). Number of leaves per seedling was registered maximum in S_1: 0.5 dSm^{-1} (96.46) which was on same bar with S_2: 2.0 dSm^{-1} (92.78) and S_3: 4.0 dSm^{-1} (89.78) whereas lowest number of leaves per seedling (50.50) was noted in S_5: 8.0 dSm^{-1}.

Maximum number of shoots was reported in S_1: 0.5 dSm^{-1} (4.73) which was at statistically at par with S_2: 2.0 dSm^{-1} (4.53). At 120 DAT diameter of shoot registered maximum in S_1: 0.5 dSm^{-1} (5.47 mm) which was followed by S_2: 2.0 dS m^{-1} (4.16 mm) and S_3: 4.0 dSm^{-1} (4.07 mm), whereas, it was found lowest in S_5: 8.0 dSm^{-1} (3.04 mm).

As the salinity level of irrigation increase the fresh and dry biomass of shoot and root affect adversely. Fresh biomass of shoot and root were recorded maximum in S_1: 0.5 dSm^{-1} (53.11 and 37.44 g, respectively) which was at statistically at par with S_2: 2.0 dSm^{-1} (5.23 and 33.52 g, respectively). In salinity level of S_3: 4.0 dSm^{-1} (44.45 and 15.23 g, respectively) marginal reduction in biomass was observed as compare to control and it was found lowest in S_5: 8.0 dSm^{-1} (14.95 and 5.82 g, respectively). Dry biomass of shoot and root are also found maximum in S_1: 0.5 dSm^{-1} (17.69 and 20.48 g, respectively) which was on same bar with S_2: 2.0 dSm^{-1} (16.96 and 19.60 g, respectively). In saline irrigation water of S_3: 4.0 dSm^{-1} (26.46 and 15.66 g, respectively) slight reduction in biomass was noted as compare to control and it was found lowest in S_5: 8.0 dSm^{-1} (8.09 and 4.60 g, respectively) (Table 1).

The assessment of biomass clearly indicates that a significant increase in fresh and dry biomass was observed in seedlings treated with S_1: 0.5 dSm^{-1} as compared to different salinity levels. It was found that salinity stress caused significant decrease in total fresh and dry biomass at S_4: 6.0 dSm^{-1} and 8.0 dSm^{-1} as compared to seedlings treated with 0.5 dSm^{-1}.

The significant loss observed in higher salinity level could be due to the cause of wilting and leaf shedding. Similar decrease in shoot biomass production and the number of leaves was recorded in bamboo by Pulavarty and Sarangi (2018). These reductions in production are explained by the influence of salt stress, which can also alter the partitioning of photo-assimilates between the different parts of the plants

Similar decreases in number of leaves per plant, plant height, biomass and survival were reported by Samarakkody

Table 1. Survival, growth and biomass of *Bambusatulda* at 120 days after imposing treatment (DAT)

Treatments	Survival (%)	Height (cm)	Number of leaves	Number of shoot	Diameter of shoot (mm)	Fresh biomass of Shoot (g)	Dry biomass of shoot (g)	Fresh biomass of root (g)	Dry biomass of root (g)
S_1 - EC_{iw} = 0.5 dS m^{-1}	89.00	76.69	96.46	4.73	5.47	53.11	17.69	37.44	20.48
S_2 - EC_{iw} = 2.0 dS m^{-1}	84.67	71.85	92.78	4.53	4.16	50.23	16.96	36.52	19.60
S_3 - EC_{iw} = 4.0 dS m^{-1}	76.67	69.55	89.78	4.33	4.07	44.45	15.23	26.46	15.66
S_4 - EC_{iw} = 6.0 dS m^{-1}	52.67	63.82	58.63	3.13	3.28	34.13	11.89	16.23	9.40
S_5 - EC_{iw} = 8.0 dS m^{-1}	39.67	47.21	50.50	1.47	3.04	14.95	5.82	8.09	4.60
Mean	68.53	65.82	77.63	3.64	4.00	39.38	13.52	24.28	13.95
S.Em. ±	1.01	2.05	2.40	0.07	0.12	1.03	0.35	0.78	0.35
CD (0.05)	3.03	6.16	7.19	0.20	0.35	3.09	1.04	1.95	1.04

and Palihakkara (2005) in *Melia azedarach, Swietenia mahogany, Artocarpus heterophyllus* and *Acacia mangium*. The threshold tolerance limit of salinity *i.e*., 4 $mScm^{-1}$, 0.13 $mScm^{-1}$, 8 $mScm^{-1}$ and 12 $mScm^{-1}$ were observed by them respectively for *Melia azedarach, Artocarpus heterophyllus, Swietenia mahogany* and *Acacia mangium* seedlings. The most likely factor causing these differences in salt tolerance may also be the rate of salt transport to the shoots adversely affecting the leaf expansion reducing the photosynthetic efficiency of the plant, further reducing the dry matter production. Therefore, the present study showed that survival percentage, seedling height, collar diameter, number of leaves per seedling, number of shoots per seedling, fresh and dry biomass of shoot and root were significantly influenced by different salinity levels of irrigation water. Interestingly, lower salinity levels such as S_1: 0.5 dSm^{-1}, S_2: 2.0 $dSm^{-1}$and S_3: 4.0 dSm^{-1} showed less negative influence on these survival, growth and biomass parameters and the values of S_2: 2.0 dSm^{-1} and S_3: 4.0 dSm^{-1} for growth parameters recorded to be non-significant when compared with control *i.e.* S_1: 0.5 dSm^{-1}.

CONCLUSION

The higher level of salinity significantly reduced the survival percentage, seedling height, collar diameter, number of shoots per seedling, number of leaves per seedling, fresh and dry biomass of shoot and root in *B. tulda.* Among different level of saline irrigated water, significant reduction in survival, growth and biomass of *B. tulda* was registered at S_4: 6.0 dSm^{-1} and S_5: 8.0 dSm^{-1} while marginal reduction at S_3: 4.0 dSm^{-1}. However, S_1: 0.5 $dSm^{-1}$and S_2: 2.0 dSm^{-1} showed less impact on *B. tulda* seedling's survival, growth and biomass parameters. From the present study, it is inferred that *B. tulda* can be successfully grown with slight reduction in survival, growth and biomass up to the salinity level of 4 dSm^{-1}. It is also noticed that the critical limit of saline irrigation water under nursery condition for *B. tulda* is 4 dSm^{-1} which shows less negative impact on survival, growth and biomass as compared to higher salinity levels.

Received 21 January, 2023; Accepted 15 May, 2023

REFERENCES

Ali S, Chaudary MA and Aslam F 1987. Growth of *Leucaena* at different salinity levels. Barani Agri. College, Rawalpindi, Pakistan. *Leucaena Res. Rep*. **8**: 53.

Arora S and Sharma V 2017. Reclamation and management of salt-affected soils for safeguarding agricultural productivity. *Journal of Agricultural Safety and Health* **1**: 1-10.

Arora S, Singh YP, Vanza M and Sahni D 2016. Bioremediation of saline and sodic soils through halophilic bacteria to enhance agricultural production. *Journal of Soil Water Conservation* **15**: 302-305.

Pulavarty A and Sarangi BK 2018. Screening bamboo species for salt tolerance using growth parameters, physiological response and osmolytes accumulation as effective indicators. *Chemistry and Ecology*: 1-13, doi: https://doi.org/ 10.1080/027 57540. 20 18.1427227.

Samarakkody WD and Palihakkara IR 2005. Effect of different levels of salinity on growth performances of some selected tree species. *Tenth Annual Forestry & Environmental Symposium.* Department of Crop Science, Faculty of Agriculture, University of Ruhauna. Sri Lanka.