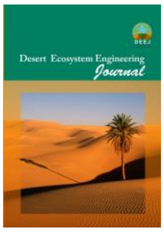
University of Kashan

Desert Ecosystem Engineering Journal

Journal homepage: http://deej.kashanu.ac.ir



Interaction of Soil Salinity with Biomass of Seidlitzia rosmarinus and Nitraria schoberi in the Desert Regions of Ardestan, Qom, and Kashan

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Received: 22/04/2025 Accepted: 28/06/2025

Extended abstract

Introduction: Soil salinity is a major factor that limits plant growth and biomass production, particularly in arid and semi-arid regions. To effectively restore land and combat desertification in these challenging environments, it's crucial to understand how native halophyte species — plants adapted to salty conditions — respond to different levels of soil salinity. This study focused on evaluating the impact of soil salinity on the biomass production of two specific salt-tolerant plant species: Seidlitzia rosmarinus and Nitraria schoberi. We conducted our research across various sites within the central deserts of Iran, including Ardestan Plain, Fakhreh (Kashan), Gonbad Namaki (Qom), Hosseinabad, and Kashan Forest Park. To gather our data, we used a transect-plot method for vegetation sampling. For soil analysis, samples were collected at two depths: 0–20 cm and 20–40 cm, allowing us to assess vertical variations in soil properties. We measured several key physical and chemical characteristics of the soil, including electrical conductivity (EC), pH, sodium adsorption ratio (SAR), and total neutralizing value (T.N.V.). Finally, to determine biomass, we measured both aboveground components (leaves, stems, branches) and belowground biomass (roots), which involved complete root excavation and weighing after oven-drying.

Materials and Methods: Data analysis was performed using SPSS and Excel software. Before proceeding with statistical tests, the normality of data distribution was confirmed. To examine differences among treatments (species and sites), we used one-way analysis of variance (ANOVA). This was followed by Duncan's multiple range test at a 5% significance level ($\alpha=0.05$) to pinpoint specific differences. Additionally, Pearson's correlation coefficient was calculated to assess the relationships between various biomass traits and key soil salinity indicators, specifically electrical conductivity (EC) and sodium adsorption ratio (SAR).

Results: We found significant differences ($p<0.01$ and $p<0.05$) in the measured traits across the five study sites. Soil properties like EC, pH, and T.N.V. varied significantly by location, indicating that local environmental factors play a big role. Interestingly, only plant available water (PAW) showed a significant variation with soil depth ($p<0.05$), meaning that site conditions have a stronger impact on soil quality than differences between the two depths we sampled. When looking at biomass, we saw that site conditions significantly influenced canopy cover, canopy diameter, and total biomass production ($p<0.01$). Plus, the interaction between the site and plant species significantly affected biomass accumulation. In highly saline environments (where EC was over 50 dS/m and SAR over 100), Nitraria schoberi performed better than Seidlitzia rosmarinus, producing higher root and shoot biomass. For example, in Qom, Nitraria schoberi had a root biomass of 4056 g and a leaf biomass of 20,250 g, while

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DOI: 10.22052/deej.2025.256740.1103

Seidlitzia rosmarinus had much lower biomass in the same conditions. Conversely, in less saline environments (EC less than 40 dS/m) like Hosseinabad, Seidlitzia rosmarinus produced nearly six times more biomass than Nitraria schoberi. This shows that Seidlitzia rosmarinus is more sensitive to extreme salinity and prefers moderately saline conditions.

Our correlation analysis confirmed a positive relationship between Nitraria schoberi's biomass production and increasing soil salinity. In contrast, Seidlitzia rosmarinus's biomass was negatively affected by high EC and SAR levels.

Discussion and Conclusion: The findings of this study underscore the significant role native halophyte species can play in restoring saline and degraded soils. Specifically, Nitraria schoberi demonstrated a remarkable ability to maintain biomass production under highly saline conditions, highlighting its potential for use in severely degraded environments. Conversely, Seidlitzia rosmarinus performed better in moderately saline environments, suggesting its suitability for areas with less extreme soil conditions. Cultivating these halophyte species offers a cost-effective and sustainable approach to land reclamation. Their presence not only contributes to soil stabilization by increasing organic matter and preventing wind erosion, but also enhances the soil's physical and chemical quality through processes such as ion uptake and organic carbon input. This biological method provides a viable alternative to expensive engineering techniques for combating desertification. Our study suggests that species selection for restoration projects should be based on detailed assessments of specific soil salinity conditions. Furthermore, adopting an intercropping system that combines multiple halophyte species with varying salinity tolerances could significantly increase the resilience and sustainability of restored ecosystems. Integrating these biological solutions with strategic water resource management, such as using treated wastewater or saline water for irrigation, can further enhance restoration success. For future research, we recommend focusing on a deeper understanding of the interactions between halophyte species and soil microbial communities, as these play a crucial role in nutrient cycling and plant health under saline conditions. Additionally, investigating the carbon sequestration potential of these species could offer new insights into their contribution to climate change mitigation strategies.

Keywords: Soil salinity, Sodium adsorption ratio (SAR), Halophytic plants, Land reclamation, Arid ecosystems.