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RESEARCH ARTICLE

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Vegetation establishment in coastal salt-affected wasteland using drip-irrigation with saline water

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Abstract

Saline water has been successfully used for irrigation in arid, semiarid, and coastal regions, and drip-irrigation is widely regarded as the most promising system to deliver such water, particularly for reclaiming saline soils, because drip-irrigation saves water and leaches salts efficiently. As coastal regions continue to be urbanized rapidly, vegetation establishment in coastal salt-affected wastelands becomes increasingly urgent, but information on plants suitable for the purpose is scanty. The effects of drip-irrigation with saline water (EC 0.8–7.8 dS/m) on the leaching of salts and on the performance of 15 plants suitable for landscaping were evaluated. The field experiment comprises trees, herbs, and shrubs, and irrigation was scheduled on the basis of soil matric potential threshold set at −5 kPa in 2013, −10 kPa in 2014, −15 kPa in 2015, and −20 kPa in 2016. As a result of irrigation controlled thus, soil that was severely saline initially became mildly saline or even nonsaline in its profile up to a depth of 1 m irrespective of the salinity of irrigation water. However, the survival rates of plants differed with the salinity and SMP threshold: Survival was more than 80% in four herb species and three tree species when irrigated with saline water at 7.8 dS/m for 4 years but decreased, especially in shrubs, as the SMP threshold was lowered. The thresholds of EC_{iw} (electrical conductivity of irrigation water) and SMP were set based on the response of plants to salinity, and some plants are recommended for the ecological environment establishment. A combination of controlled irrigation with saline water and the right mix of plant species are helpful in reclamation of saline coastal areas.

KEYWORDS

amelioration, coastal salt-affected wasteland, irrigation water salinity threshold, saline irrigation water, soil matric potential threshold

1 | INTRODUCTION

Of all the water on Earth, saline water makes up approximately 97%: Only 2.55–2.75% is fresh water. This is why saline water, brackish groundwater, and treated wastewater are being explored as alternatives to fresh water, especially in arid, semiarid, and coastal regions (Rhoades et al., 1988). Saline water is now used increasingly for irrigation, and the response of many crops including cotton, sugar beet, clover, sorghum, barley, wheat, rice, and maize to such irrigation has been studied in the United States, Israel, India, China, and some countries around the Mediterranean (Murtaza, Ghafoor, & Qadir, 2006; Rajinder, 2004).

As salt from saline water enters soil, the osmotic potential decreases with increasing salinity, which lowers the total water potential and induces physiological drought; that, coupled with the harmful effects of ions, exacerbates the stress due to salinity. Therefore,

