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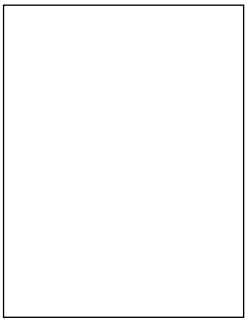

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Dynamics of Soil Moisture and Salt Content after Infiltration of Melting Saline Ice Water in Saline-Sodic Soil Columns

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ABSTRACT

Laboratory experiments were conducted in soil columns to investigate the redistribution of soil moisture, salt content and sodium adsorption ratio (SAR) in saline-sodic soil under the infiltration of saline ice melt-water. Soils were treated by saline water with three irrigation volumes (1600, 2400 and 3200 ml) in combination with four salinity levels. These four salinity levels included salt free (0 g L^{-1}), low salinity level (1.4 g L^{-1}), moderate salinity level (2.7 g L^{-1}), and high salinity level (4.1 g L^{-1}). The prepared saline water was frozen into ice, and then the ice was put on the surface of soil columns to infiltrate for 96 hours. Results showed that infiltration rate and soil moisture content of saline ice meltwater were greater than that of salt-free ice meltwater, and was increased with the increase of ice salinity. Infiltration of saline ice meltwater increased soil moisture content of the surface layer in all treatments. But this trend was reversed in the deeper soil layers. Both salt contents and SAR values at the top soil layers were decreased in all saline ice treatments, and were lower than those in salt-free ice treatment. The highest desalting rate and lowest SAR were observed in high salinity treatments under three irrigation volumes in 0-15 cm soil layer, especially under irrigation volume of 2400 ml. These results indicate that irrigation saline ice meltwater is beneficial to saline-sodic soil reclamation and the best improvement effect would be achieved irrigating high concentration of salt ice meltwater under optimal irrigation volume.

Key Words: desalting, infiltration, reclamation, saline ice meltwater

INTRODUCTION

Soil salinization and alkalinization have detrimental effect on crop yields and agricultural production, especially in the arid and semi-arid areas (Cayuela *et al*., 2001; Yuan *et al*., 2007; Li and Keren, 2009; Yazdanpanah *et al*., 2013). In order to overcome water scarcity, many countries have adopted the use of marginal water and in particular, for irrigation (Oron *et al*., 2002). Songnen Plain covers an area of about 17.0×10^6 ha in the central part of northeastern China. The climate is classified as the transition of sub-humid and semi-arid. The salt-affected soil area has reached 3.4×10^6 ha, amount to 19.4% of the whole plain (Song *et al*., 2003; Lin and Tang, 2005; Chi *et al*., 2011).This plain has become one of the three largest sodic-saline areas in the world (Zhang *et al*., 2007). Different from coastal saline soil with chlorine salt as the dominant component, the saline-sodic soil of Songnen Plain is primarily montmorillonite clay and sodium bicarbonate with pH larger than 9.5 and high levels of exchangeable sodium (Liu *et al*., 2009; Zhang *et al*., 2013). Due to the scarcity of fresh water, long-term irrigation with poor water quality results in the secondary salinization,

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