Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2019.23856

149 (2019) 352–362
May

Saline-alkali migration in soda saline soil based on sub-soiling technology

Jun Yuan, Weizhi Feng, Xingming Jiang, Jingli Wang*

College of Engineering and Technology, Jilin Agricultural University, Changchun, 130118, China, email: wjlwy2004@sina.com (J. Wang)

Received 22 October 2018; Accepted 15 January 2019

ABSTRACT

Objective: To study the saline-alkali migration law of soda saline-alkali soils based on sub-soiling technology, improve the soil quality of soda saline-alkali agricultural area, and provide scientific basis for the construction of high and stable yield fields of crops in soda saline-alkali soils. Based on the unsaturated soil water movement theory and the convection–dispersion theory of solute transport in porous media, a single-parameter and two-parameter model of saline-alkali transport was constructed to analyze the distribution of saline-alkali concentration in soil solution with the depth of soil layer. Soil samples were taken from four soda saline-alkali soils in different periods under sub-soiling tillage. The experimental data of soil saline-alkali content were obtained, and the law of saline-alkali migration was analyzed. When the depth was 60 cm, the content of saline-alkali in the soil before breaking the plough bottom was 0.4%, and the content of saline-alkali was 0.35% after breaking the plough bottom with sub-soiling technique. It can be seen that sub-soiling technique can promote saline-alkali infiltration and reduce the content of saline-alkali in the planting soil layer. The average water content of the sub-soiled soil was 23.4%, which was significantly higher than that of the sub-soiled soil. The soil salinity and alkali content in 100 cm depth layer decreased by 30.8%, and that in 40 cm depth layer decreased by 57%. The salinity and alkali data in different regions showed that the soil salinity and alkali content in the soil decreased by 30.8%. Saline-alkali data from different regions show that due to sub-soiling, salt-alkali in the soil moves upward, salt-alkali in the lower part of crop roots moves outward, and salt-alkali in the soil moves away from the crop root zone; between 0 and 50 cm under the soil, the content of soil salt and alkali is from small to large, forming a desalination area of saline and alkali content; sub-soiling tillage makes 0–30 cm layer soil desalinization rate reach 83.5%, the soil salt removal rate of 0–60 cm layer reached 79.9%; The effect of sub-soiling on soil salinity is less than 1.634% of the initial value.

Conclusion: sub-soiling technology can effectively reduce saline alkali content and increase crop yield in soda saline alkali soil.

Keywords: Sub-soiling technology; Saline-alkali soil; Salt and alkali transport; Law; Mathematical model; Drip irrigation infiltration

* Corresponding author.