



Biogeochemical characterization of saline sodic soils and strategies for land management in the west of Jilin province (Northeast China)

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In the western Songnen Plain (Northeast China), there are about 3.73million ha of saline sodic land, one of the three major contiguous regions of saline sodic soil worldwide. Saline sodic land area in the west of Jilin Province comprises 1.43 million ha, occupying more than 28% of the province's total area, and representing the typical saline-sodic soil of China with respect to both, areal extension and importance. The presented research focusses (a) biogeochemical characterization and (b) some strategies for future land management of this exceptional ecosystem.

Meteorological factors and groundwater chemistry mainly control soil formation and development. The climate is classified semi-arid and arid, mean annual rainfall is 350t450mm, of which 70t80% is in July-September. Mean annual evaporation (1600t1800mm) exceeds 4t5 times mean annual precipitation. Seasonal drought occurs frequently in spring and autumn.

Basic soil characterization is through low nutrients, high sodicity and salinity, and poor infiltration. Nutrient concentrations in 0-30 cm soil depth layer are 4.3t5.8 gkg⁻¹ for TOC, 0.43t0.65 gkg⁻¹ for TN and 0.15t0.24 gkg⁻¹ for TP (about 4t6 times lower than that in black soil of center Jilin province). The concentrations of TOC, TN and TP decrease with soil depth. Soil layers below 70 cm show TOC, TN and TP concentration of 0.71t1.80 gkg⁻¹, 0.18t0.22 gkg⁻¹ and 0.13t0.21 gkg⁻¹, respectively. Mean total dissolved salt concentration of the topsoil (0t30cm) ranges between 0.5

t1.1% with Na_2CO_3 and NaHCO_3 as the main components. Soil pH here ranges from 8.7 to 10.7, and ESP is as high as 45% (occasionally > 70%). There is no significant difference between pH and ESP in soil profiles. Chemistry of shallow groundwater is characterized by $\text{HCO}_3\text{-Cl}^- \text{---Na}^+ \text{-Ca}^{2+}$ or $\text{HCO}_3\text{-Cl}^- \text{---Na}^+$ under mean pH of 8.59, and mean EC of 3.11 mS/cm. The groundwater level fluctuates from one season to another, as a result, salts accumulate in the soil profile.

From 1.08 million ha in 1950s, the area of saline sodic land increases with $0.6\% \text{ a}^{-1}$ under human activities such as excess cultivation, animal husbandry, grass harvest, etc. To resolve the problems of food production and environment protection, it is necessary to break key problems and to take a better way of assembly and integration of proper techniques. After more than 7 year's research and additional work, we propose the following strategies for land use and management in this region : (1) paddy rice cultivation saline sodic lands (lower elevation) with well established irrigation and drainage systems. (2) planting grass instead of crops in light saline sodic crop lands, (3) nursing grass land with fencing in mid saline sodic lands (4) seeding salt and sodium tolerant grass in highly saline sodic land, and (5) revegetating reed in saline sodic wetland.