Changes in soil chemical properties of a sodic texture-contrast soil after irrigation with saline water

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The concept of saline agriculture when crops are irrigated with saline water is gaining momentum but the environmental impact of this practice remains debatable. In this work selected soil chemical properties to a depth of 3 m were assessed following 2.5 years of application of saline irrigation to a sodic texture-contrast (Brown Sodosol) in south-eastern Tasmania. Control plots were compared to irrigation treatments of 0.8 dS/m and 16 dS/m at rates ranging from 200 to 800 mm/year. Significant impacts included electrical conductivity of soil saturated paste (ECse) and Cl^- concentration increasing between 0 – 200 cm depth in plots irrigated with 16 dS/m water. However this increase in soil ECse was still lower than the irrigation water salinity of 16 dS/m. The upper topsoil (0 – 10 cm) total organic carbon (TOC) was significantly reduced in the high salinity plots and was negatively correlated with Cl^- concentration and soil pH. In the upper 50 cm of the high salinity irrigated plots both the exchangeable Na+ and its ratio to total base cations (ESP) were significantly increased and the other exchangeable base cations (Ca2+, Mg2+, K+) were significantly decreased. The Ca:Mg ratio increased in the topsoils under high salinity irrigation regimes despite the leaching of both cations indicating relative displacement of ions based on charge/hydrated radii ratios. In clayey subsoil (below 40 cm), exchangeable Ca2+ was found to increase under saline irrigation with high saline water while Mg2+ and K+ were leached even deeper. These data support the concerns associated with application of high saline irrigation waters namely increased salinisation but they also show beneficial declines in both pH and ESP in the both alkaline and sodic subsoils. They also show the Na+ in the saline waters causes differential leaching of base cations from the rooting zone to deeper in the soil.