The responses of soil function to reclaimed water irrigation changes with soil depth

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ABSTRACT

The effect of reclaimed water irrigation on soil microenvironment and nitrogen economy in soil profiles was studied by monitoring different plots with nitrogen fertilization rate that had been irrigated with effluents in 2014 and 2015. The tap water irrigated plot with nitrogen toprressing 270 kg/ha served as the control and provided reference “background” values. Soil temperature, organic matter (OM), pH, electrical conductivity (EC), total nitrogen (TN), and mineral nitrogen at different soil depths were analyzed by data logger and lab test, and soil microbes were analyzed by agar plate dilution method. The results indicated that soil average temperature gap value between rhizosphere and bulk soil was elevated for all three reclaimed water treatments, while microbes amount was significantly higher in rhizosphere soil compared with control. OM, TN, EC, and mineral nitrogen increased in the top 10-cm soil layers with reclaimed water irrigation, while average pH decreased in 0–60 cm soil layers compared with control. Irrigation with reclaimed water also significantly increased both the yield, biomass, partial factor productivity from applied N, and nitrogen-supplying capacity in the fields. It showed that reclaimed water irrigation could be of agricultural reuse due mainly to its OM concentrations and nutrients input, furthermore, nitrate-nitrogen content could be improved, which may eventually reduce amount of chemical fertilizer, thus, we recommend irrigation with reclaimed water in semi-arid areas, however, EC was elevated and pH was decreased in 0–60 cm soil layers, which may eventually lead to deterioration of soil and disposal of the cation ions of effluent.

Keywords: Reclaimed water; Soil microenvironment; Rhizosphere soil; Partial factor productivity from applied N; Nitrogen-supplying capacity