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Industrial Wastewater Irrigation Affects Soil Quality in Urban Vegetable Production of Burkina Faso

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Abstract

Utilisation of industrial wastewater in urban and peri-urban gardens poses risks of contamination of humans, animals, soils and plants. Irrigation with sodic alkaline wastewater is common worldwide and may lower soil productivity especially under semi-arid, hot climatic conditions. Our study reviews literature addressing agricultural use of wastewater with > 100 mg l^{-1} sodium (Na) under semi-arid climates. Findings were compared to those of a case study from urban gardens in Ouagadougou, Burkina Faso. Our aims were to (i) examine to what extent Na in water can induce soil sodicity; (ii) evaluate the effect of industrial wastewater on top- and subsoil sodification in Ouagadougou, and (iii) compare the results of our case study with those reported in the literature.

Soil samples from 45 randomly selected fields were analysed for pH, electrical conductivity (EC) and exchangeable cations. Farmer interviews were used to record information on irrigation and cultivation, including management practices used over the last decade. Wastewater originating from industrial tanneries and beverage producers had pH values from 8.5 to 9.8. Effluents had Na concentrations of 300 to 1200 mg l^{-1}. Wastewater irrigation induced a reduction in soil quality by increasing soil pH by up to 2 units, increasing EC by 14 % to 500 % and increasing Na up to 28 times compared with the initial value. Both, continuous and short term irrigation with sodic wastewater led to Na accumulation in the soil. Our study further indicated that dissolved Na percolated both vertically and horizontally, thereby contaminating the subsoil and the surrounding non-irrigated area.

Keywords: Industrial wastewater, irrigation, sodic soil, urban agriculture

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