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Effects of wastewater irrigation on soil physico-chemical properties and vegetables quality: A review

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Summary: This study analyses the use of raw urban wastewater for irrigation and its effects on soil characteristics and vegetable crops. There is rampant use of urban waste water by small scale urban vegetable farmers in Zimbabwe, leading to health concerns for consumers of urban vegetables and decrease in soil functioning. The significance of this study was to appraise the use of urban waste water to answer the research question: What is the impact of waste water on selected soil physico-chemical properties and heavy metals in vegetables irrigated with waste water? A systematic review of 3100 articles from PubMed, Scopus, and Google Scholar (2010–2024) was performed within PRISMA guidelines. After excluding irrelevant studies, 49 from Nigeria, India, Pakistan, China, Saudi Arabia, and DRC were selected for analysis. These countries were found to have a long history of wastewater irrigation. This literature review identified an overview of existing literature on urban waste water irrigation and its effects on soil properties and vegetable crops. The results showed ($P < 0.05$) soil properties changed significantly: electrical conductivity (0.2–0.4 to 1.5–2.0 dS/m), organic matter (2–3% to 4–6%), cation exchange capacity (10–15 to 20–25 cmol(+) c/kg), and soil pH (7.0–7.5 to 8.0–8.5). The level of nutrients (N, P, K) shifted alongside the source of wastewater. Soil also accumulated heavy metals (Pb, Cd, Cr, Mn, Cu) while the crops accumulated unsafe levels of Pb (2.5 mg/kg), Cd (1.2 mg/kg), and Cr (3.1 mg/kg) which results highlighted the concern for health and environmental hazards. Treatment of the wastewater, monitoring and regulation are needed for safe agricultural practice.

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