Effects on macronutrient contents in soil-plant irrigated with different quality waters and wastewaters

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ABSTRACT

The goals of this research were focused on investigating the effects of irrigation with untreated wastewater, ozone-enhanced primary treated wastewaters (O_3EPTW), tap water and tap water + fertilizer on the macronutrient content in soil and plant tissues. The effect on plant development was evaluated by growing *Lactuca sativa* in soils irrigated with these different quality waters and wastewaters, and by determining the macronutrients content in water, soil and plants. In this study, the soils irrigated with O_3EPTW showed increased organic matter concentrations, which is advantageous for crop cultivation. The electric conductivity for the O_3EPTW irrigated soils remained below those of the tap water + fertilizer and untreated wastewater. The soil irrigated with tap water + fertilizer showed a marked decrease in pH, and its long-term use could lead to soil acidification. Macronutrient levels in plant tissues (N, K and Mg contents) were similar for all irrigation waters, except for tap water which always remained lower than the others. It was concluded that the use of O_3EPTW may become a good irrigation alternative that can be employed without the health risks associated with the use of untreated wastewaters, also reducing the adverse effects on soil's salinity or acidification.

Key words | macronutrients, ozone-enhanced primary treated wastewaters (O_3EPTW), wastewater reuse

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INTRODUCTION

Sometimes wastewater is the only available alternative for agricultural irrigation, but its use represents a potential health hazard due to its elevated content of pathogenic microorganisms, including Helminth eggs. Pathogenic microorganism concentrations can be lowered by the use of an advanced primary treatment (APT), which provides an effluent beneficial to agriculture because of its nutrients content (Orta de Velásquez *et al.* 2008). The nutrients contained in reclaimed wastewater can contribute to crop growth, but periodic monitoring of nutrient levels is needed to avoid an imbalance in nutrient supply for the irrigated plants (Pedrero *et al.* 2010). Previous research has shown that the use of wastewater for crop irrigation may increase soil salinity, organic matter content, levels of exchangeable cations, phosphorus, and other microelements available for plant growth; as well as diminishing the soil's pH (Kiziloglu *et al.* 2008; Adrover *et al.* 2012). Kiziloglu *et al.* (2008) also reported on the changes in chemical soil characteristics (N, P, K, Ca, Mg and Na contents) evaluated after irrigation with untreated, preliminary and primary treated wastewater. They concluded that the soils irrigated with wastewater showed an increase on the yield of the plants and in their macro and microelement content. Hence, wastewater has a high nutritive value that can improve plant growth, reduce fertilizer application and increase crop productivities of poor fertility soils. However, while untreated wastewaters can be used on agricultural land for a short period of time, primary-treated wastewaters can be used in sustainable agriculture over a long term (Kiziloglu *et al.* 2008).

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