

Impact of treated sewage effluent on soil fertility, salinization, and heavy metal content

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ABSTRACT: A long-term experiment (2013 to 2017) of treated sewage effluent (TSE) levels via fertigation in a humid tropical region was installed in Jaboticabal, state of São Paulo, Southeast of Brazil, to evaluate the impact of TSE on soil fertility and the potential for salinization and heavy metal contamination of an Oxisol. The area was cultivated with *Urochloa brizantha* under the application of four TSE levels at the irrigation depth (0, 11, 60, and 100% TSE) during the four years of the experiment. The TSE chemical composition was monitored throughout the experimental period. The heavy metal levels and soil fertility were evaluated in the 0–0.10 and 0.10–0.20 m layers at the end of the four years of the experiment. Fertigation using TSE did not increase the concentration of potentially toxic elements (As, Cd, Cu, Hg, Mo, Ni, Pb, Se, and Zn) in the soil due to their low concentration in the effluent. A higher Na concentration was also observed at high TSE levels (60 and 100%). However, the sodium adsorption rate in the TSE was low, generating no potential for soil salinization and sodification. Fertigation with TSE levels increased soil fertility, increasing by more than 30% the P content and base saturation in the soil compared to control. According to the chemical attributes evaluated in the soil and effluent, this long-term study showed that TSE application via fertigation in humid tropical regions on clayey soils cultivated with forage grasses is recommended.

Key words: water reuse, environmental contamination, soil chemical analysis, potentially toxic elements, wastewater.

INTRODUCTION

The increasing demand for food and water and the environmental pollution as a result of constant population growth are important global challenges facing humanity nowadays. Water consumption has increased in recent years at twice the rate of population growth and will continue to grow at a similar rate in the near future (Lavrnić et al. 2017). The agricultural sector is the most affected by water scarcity, as it accounts for 70% of global freshwater withdrawals for irrigation and over 90% of consumption (Norton-Brandão et al. 2013). On the other hand, the concentration of the human population in urban areas has significantly increased the production of sewage wastewater, which causes detrimental environmental impacts if appropriate actions are not taken.

In this context, wastewater can be an important component of an integrated water management policy (Van Lier and Huibers 2010; Andrews et al. 2016). Treated domestic wastewater is a widely available sustainable hydric source that can be used to meet the growing demand for agricultural irrigation (Santos et al. 2017). Thus, in recent years, wastewater recycling has gained importance as part of agricultural water sources in many countries facing water scarcity (Coelho et al. 2020).

The application of treated sewage effluent (TSE) in agricultural areas may be a viable alternative for nutrient recycling, reducing the water footprint in agriculture and increasing soil fertility. Therefore, it is necessary to examine the quality of the effluent to be used for this purpose. The application of TSE in agriculture provides essential nutrients to crops, especially

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