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Sustainable use of reclaimed water for irrigation of mandarin trees

Oussama mounzer, Francisco Pedrero, Francisco Perez, Rosalia Alcobendas, Jose Maria Bayona, Pedro Nortes, Emilio Nicolas, and Juan Jose Alacron

Departament of irrigation: Centro de Edafología y Biología Aplicada del Segura, CEBAS-CSIC, Murcia-Spain (omounzer@cebas.csic.es, fpedrerosalcedo@gmail.com, frapesar@cebas.csic.es, ralcobendas@cebas.csic.es, jmbayona@cebas.csic.es, emilio@cebas.csic.es, panortes@cebas.csic.es, jalarcon@cebas.csic.es)

The volume of treated wastewater is in continuous increase due to environmental concerns and the progressive implementation of the European WasteWater Directive (91/271/EEC). In Murcia-Spain there are at least 80 operating water treatment plants "WTPs" delivering more than 101.8 hm3 per year: ESAMUR (2008), which restore up to 6% of the annual renewable water resources: PHCS (1997). The free availability of this considerable volume of water against the negative impact of water shortage and the related potential disagreements in the country has renewed and enhanced the use of urban wastewater in modern agriculture (mainly drip irrigation). The ionic concentration of minerals dissolved in these reclaimed water remains high and holds both the risk of ion toxicity and/or soil salinasation unless they are continuously monitored and carefully managed to ensure a sustainable use of this water source. Two different water-quality sources have been used over three years for irrigation of adult mandarin trees in a commercial orchard located in the Region of Murcia under Mediterranean climatic conditions. The first water source "TW" with an electrical conductivity "EC" $\leq$ 1 dS.m-1 was derived from the Tajo-Segura water transfer channel. The second source "RW" was conveyed from the wastewater treatment plant of the North of Molina and had an EC $\approx$ 3 dS.m-1. These sources were used to fully cover the plant water requirements (100% ETc) in three irrigation treatments; the control water treatment "CWT" was irrigated with TW water over its whole production cycle, the reclaimed water treatment "RWT" was irrigated with RW over its whole production cycle and, the dual-water treatment "DWT" was irrigated with TW during the period of high ETc (> 4 mm.d-1) from May till September and with RW during the rest of the year. The soil water content, soil matric potential and soil solution has been monitored on biweekly bases within the soil wetted volume under the emitter. Furthermore, gravimetric soil samples were taken three times per year to evaluate the accumulation of salts at 10, 30 and 60 cm away from the emitter and at 20, 40 and 60 cm depth. Field observations are compared with simulations of water and solute transport using HYDRUS-2D and a new irrigation schedule with dual-was also simulated. Neither the soil water content nor the plant water status was affected by the irrigation treatments. The accumulation of salts within the plant-root zone was higher under RW irrigation than TW and DW irrigation and therefore the yield of the RWT was negatively affected. A fair agreement was found between the field measured and HYDRUS simulated values.