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An example of treated waste water use for soil irrigation in the SAFIR project.

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The safe use of treated domestic wastewater for irrigation needs to address the risks for humans (workers, exposed via contact with irrigation water, soil, crops and food, consumers, exposed via ingestion of fresh and processed food), for animals (via ingestion of crops on soil), for the crops and agricultural productivity (via salinity and trace element uptake), for soil (via accumulation or release of pollutants) as well as for surface, groundwaters and the associated ecosystems (via runoff and infiltration, Kass et al., 2005, Bouwer, 2000). In this context, the European FP6 SAFIR project (Safe and High Quality Food Production using Low Quality Waters and Improved Irrigation Systems and Management) investigates the geochemical quality of the root zone soil, knowing it is the main transit and storage compartment for pollutants. The type of reaction (sorption, co-precipitation…) and the reactive mineral phases also determine the availability of trace elements for the plant and determine the passage towards crops and products. Reactions of the infiltrating water with the soil solid phase are important for the solute cycling, temporary fixation and remobilisation of trace pollutants. Therefore the soil water quality was directly or indirectly assessed. Direct measurements of soil water were made through porous cups.

The experiments were carried out during the growing season of 2006, 2007 and 2008 in a vegetable commercial farm, located at 10 km north of Belgrade. The soil is silty clayey, and developed on alluvial deposits. It was classified as humogley according to USDA Soil Classification. The climate of the field side is a continental type with hot and dry summers and cold and rainy winters. As in the rest of Serbia, farm suffers from water deficits during the main growing season.
The initial soil quality was assessed through a sampling campaign before the onset of first year irrigation; the soil quality was then monitored throughout three years. Soil sampling focused on the fully irrigated plots because the potential impact of irrigation water quality on soil and plant quality are expected higher for fully irrigated soils compared to other irrigation strategies. Samples were taken within the soil volume of potential influence around each of the drip emitters. Potato (Solanum tuberosum) variety Liseta was used for investigation. The seeds tubers were planted in the similar period in all three seasons (middle of Spring) at the depth of 10 cm. Two irrigation methods were used in all three seasons: drip and furrow systems. Water for irrigation was supplied from a channel which is located 100m away from the experimental field. For all experiments, three sampling campaigns were foreseen for each of the three irrigation seasons: at pre-planting, at the end of irrigation, and at harvest.

After three campaigns, the results show a variability of the elements concentrations in water and soil between the three years. The soil appears significantly depleted in CaO (a mean of -40 %), MgO (-20%), Na (-30%), and Sr (-10%) and Pb (-12%). On the contrary, concentrations of Mn, Ni, V and Li slightly increase (+15 to 20%) whereas SiO2, Al2O3, Fe2O3, Cu and Cr do not significantly increase (a mean of + 10%). Knowing that potatoes do need between 40 to 50 kg per ha of CaO and 15 to 30 kg per ha of MgO (Soltner, 1999), potato absorption of Ca and Mg may be the main sink for both elements. A statistical analysis (ACP) shows precisely a Ca-Mg-Sr pole which explains more than 90 % of the second component; the first component being explained by Al2O3, SiO2, Fe2O3 and TiO2 at the same percentage.

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