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(9453 - 1492) Nutrients enrichment in soils irrigated with treated wastewater

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The use of treated wastewater in irrigation is considered an interesting alternative to avoid disposal into water bodies. Water reuse becomes more critical in arid areas where water scarcity obliges to do an efficient use of it. Nevertheless, irrigation with water containing high levels of salts and nutrient contents involves environmental risks that should be contemplated. We conducted this research with treated wastewater coming from the sludge treatment plant of Ingeniero Jacobacci (Río Negro-Argentina, 41°19'19.51"S – 69°30'36.88"), placed in an arid zone with 150 mm of mean annual precipitation . The experiment consisted in a split plot design, comparing the effect of irrigation with well water-WW and treated wastewater-TW, on the soil of a natural vegetation and an alfalfa crop. We took soil samples every 20 cm up to 80 cm depth, at the beginning of the experiment and 9 months after start of irrigation, when crops were fully developed. Apart from other parameters not reported here, we analyzed ammonia- NH_4^+ and nitrate- NO_3^- (Bremner) and available phosphorus-P (Olsen) in all soil samples. We also evaluated dry matter production. We performed an ANOVA with the two types of water as the main factor of interest. Differences of soil nutrients concentration between sample dates were analyzed. In both types of vegetation, soils irrigated with WW showed a reduction of NO_3^- (on average for all depths: -4.2±2) and on P (-4.6±3), and showed similar values of NH_4^+(0.6±0.6) , in agreement with the high demand of the growing vegetation. In plots with TW, differential nutrient contents were in all cases positive (NH_4^+ 10.1± 4.4; NO_3^- 8.8±5.2; P 15.7±3.7), and significantly higher than plots with WW ($p<0.05$), showing an increasing nutrient load with this treatment. Maximum absolute values were found in TW treatment: 12 -NH_4^+, 30 -NO_3^- and 34 –P mg/kg. Dry matter production was similar in both treatments in alfalfa (circa 23000 kgMS/ha), and it was higher in TW than in WW (17000 vs 6600 kgMS/ha) in natural vegetation. Although the maximum values observed do not represent environmental risks yet, a clear trend to a soil nutrient load in treatments with TW irrigation was made evident. These experiments will provide the information needed to develop a precise crop and water management that seek to transform this nutrient load into dry matter production. Anyway, these data show that a rigorous monitoring of environmental impacts is also needed.

Keywords: treated wastewater, irrigation, environmental impacts, mineral nitrogen, phosphorus

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