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Variation in glyphosate and AMPA concentrations of surface water and groundwater

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The presence of pesticides in various environmental matrices indicate that the soil's ability to function as a bio-physical-chemical reactor is declining. As it operates as an interface between air and water, it causes a negative impact on these two vital resources. Currently, the pampa agriculture is simplified with a marked tendency towards spring-summer crops, where the main crops are RR soybean and corn. Herbicides are neither retained nor degraded in the soil, which results in polluted groundwater and surface waters. The objectives of this study were: a) to verify the presence of glyphosate and aminomethylphosphonic acid (AMPA) in Pergamino stream (a typical representative of the most productive agricultural region of Argentina) under different land use and to detect if in the detections there was a space-time pattern, and b) to verify the detection of these molecules in groundwater of the upper same basin under exclusively rural land use. Surface stream was sampling in six sites (five under rural land use and one under urban-industrial land use) at a rate of one sample by spring, summer and winter seasons (2010-2013, 54 total samples). Groundwater glyphosate and AMPA concentrations were determined in 24 piezometers constructed at two positions of the landscape, across the groundwater flow direction, sampled at two sampling dates (2010 and 2012, 45 total samples). In surface water, glyphosate and AMPA were detected in 54 and 69% of the samples analyzed, respectively. The median concentrations were 0.9 and 0.8 μg L-1 for glyphosate and AMPA and maximal concentrations 258 and 5865 μg L-1, respectively. The sampling site under urban-industrial land use had abnormally high concentrations of glyphosate in the spring (attributed to point pollution), a fact that not allowed to see differences in the remaining sampling times under different land uses. AMPA concentrations under urban-industrial land use were high and higher than rural land use in 3 studied seasons. Under rural land use, AMPA differences between seasons were found, being the highest concentration in spring (1.9 μg L-1). In groundwater glyphosate and AMPA concentrations were detected in 32 and 36% of the analyzed samples respectively. Medium and maximum glyphosate and AMPA concentrations were 0.7 and 1.0 μg L-1, and 2.3 and 6.0 μg L-1, respectively. In the first sampling date, glyphosate and AMPA were not detected probably associated with a dilution during a period of high groundwater recharge. On the contrary, in the second date the two molecules were detected in coincidence with a previous period with lowering water table accompanied by the first recharges. The temporal dynamics showed that herbicides are found in higher concentrations in surface water during the spring, and this is possibly associated with overlapping applications with rains that produce runoff. In groundwater, detections were associated with periods where the first small recharges are produced, which are concentrated in solutes. Loss of the environmental services retention and degradation of glyphosate of the agricultural soils was confirmed