



Adsorption and desorption of glyphosate in Mollisols and Ultisols soils of Argentina

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Glyphosate is the most used pesticide in Argentina. About 200 million liters of its commercial product are annually applied, representing nearly 60% of the total amount of the commercialized pesticides. This massive use is attributed to the widespread adoption of no-till management combined with genetically modified crops that are glyphosate resistant (e.g. soybean, maize, cotton). In this way, the use of glyphosate has created great concern regarding the potential negative impacts it may have in the environment. The adsorption-desorption process of glyphosate was studied in three Argentinean soils (two Mollisols and one Ultisol) with contrasting properties: organic carbon (1.3-3.4%), clay (14.7-78.5%), pH (5.4-6.3), P Bray (7.6-29.6 mg/kg), total Fe (0.81-8.4%), and Al³⁺ (0.11-0.69 meq/100 g). Glyphosate adsorption isotherms were modeled using the Freundlich equation to estimate the adsorption coefficient (K_f). In general, glyphosate adsorption was high and the K_f values varied from 115.6 to 1612 (R² = 0.94-0.99). The main factors controlling adsorption were clay content, total Fe, Al³⁺, P Bray and soil pH. Decreased hysteresis desorption was found in one of the Mollisols soils with the lowest contents of Al³⁺, Fe, and clay, as well as high pH and P Bray. In that soil, 12.2% of glyphosate was desorbed after three washing steps indicating a higher potential environmental risk. Results of this study contribute to the knowledge about glyphosate retention in soils and allows the identification of behavior patterns of this extensively applied herbicide in different edaphic scenarios. This is of major importance for the development of decision making tools and criteria to reduce the potential negative impacts on soil and groundwater resources.