Glyphosate sorption to soils of Argentina. Estimation of affinity coeficient by pedotransfer function

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Argentine agricultural production is fundamentally based on a technological package that combines direct seeding and glyphosate with transgenic crops (soybean, maize and cotton). Therefore, glyphosate is the most employed herbicide in the country, where 180 to 200 million liters are applied every year. Glyphosate is strongly sorbed to soil by binding to clay minerals, layer silicates, metal oxides, non-crystalline materials or organic matter. Sorption of glyphosate is a reversible process that regulates the half-life and mobility of the herbicide and it is therefore related to the risk of contaminating courses of surface and groundwater. However, this behavior may vary depending on the characteristics of the soil on which it is applied. In addition, pH is a determining factor since it modifies the net charge in the molecule and, with it, the force of the electrostatic interaction between the glyphosate and the components of the soil. For a reliable risk assessment of groundwater contamination from pesticides precise predictions of sorption coefficients are needed.

The aim of this work is to study the affinity of glyphosate to different soils of Argentina and create a model to estimate the glyphosate Freundlich sorption coefficient (Kf) from easily measurable soil properties. Adsorption of glyphosate was investigated on 12 different agricultural soils of Argentina using batch equilibration technique and fit to Freundlich sorption model. The correlation coefficients and the effects of soil characteristic factors on glyphosate adsorption parameter were analyzed through principal component and multiple lineal regression analysis.

Results indicate that pH and clay contents were found to be the most significant soil factors which affect the glyphosate adsorption process.

The Freundlich (Kf) pedotransfer function obtained by stepwise regression analysis was Kf = 735.2*Clay – 104.2*pH + 0.7*Polsen – 3.8*Alin. A 97.9% of the variation of glyphosate sorption coefficient could be attributed to the variation of the soil clay contents, pH, Polsen and Alin.