Aminomethylphosphonic acid (AMPA) retention in different soil profile horizons

Eliana Gonzalo Mayoral¹, Virginia Aparicio¹,²,³, José Luis Costa³, and Eduardo De Gerónimo¹,²,³

¹CONICET
²INTA, Agronomy, Balcarce, Argentina (aparicio.virginia@inta.gob.ar)
³Facultad de Ciencias Agrarias. Universidad Nacional de Mar del Plata

Aminomethylphosphonic acid (AMPA) is a metabolite of microbial degradation of the widely used herbicide glyphosate and other phosphonate compounds, such as detergents. In the soil, AMPA has a strong adsorption than the glyphosate. No studies have been reported on adsorption of AMPA in the soil profile. There are only a few studies of retention in superficial horizons of the soil. In this sense, the objective of this study is to determine the adsorption coefficients of AMPA in the three main horizons of a typical Argiudoll.

The adsorption isotherms were performed by shaking 1 g of soil in 10 ml of CaCl₂ (0.01M) at different concentrations of AMPA (0, 2, 5, 10, 20, 50, 100 ppm). Six replications were performed for each main horizon (A-B-C). The samples were incubated and agitated at 25 °C for 24 hours to reach equilibrium. Then it was centrifuged at 3000 rpm for 10 minutes. The concentration of AMPA was quantified in UPLC MS/MS (Waters®). The experimental data was adjusted following the Freundlich model. At the same time, physical-chemical determinations of each horizon were made in order to characterize the soil.

The percentage of AMPA adsorption was greater than 91, 85 and 74% of the concentration applied, for all concentration, in horizons A, B and C, respectively. These percentages decreased for each horizon from lower to higher concentration. If the adsorption between horizons is compared for each applied concentration, horizon B is the one that presents the highest percentages of adsorption of AMPA, followed by A, and then C. Only in the highest concentration used (100 ppm), horizon A registers the highest percentage of adsorption with respect to the other horizons. In this sense, the Kf values obtained were 295, 329 and 152 for the horizons B, A and C, respectively, with significant differences for the latter.

When looking for correlations between Kf values and the soil properties, it was found that the cation exchange capacity, K content and percentage of clays are the properties that correlate most strongly with the Kf value. On the other hand, the percentage of sand and the pH showed a strong negative correlation with Kf.

The results obtained indicate that, in soils (or horizons) with a high clay content, the AMPA is strongly retained, decreasing the probability of being transported to the underground water.