



Transport of glyphosate and AMPA in the soil profile: field experiment

Eliana Gonzalo Mayoral (1), José Luis Costa (2), Roberto Rizzalli (3), Eduardo De Gerónimo (2), Juan Pablo Monzón (4), Fernando Andrade (2), and Fernando Garcia (5)

(1) FONCyT, (2) INTA, Agronomy, Balcarce, Buenos Aires, Argentina, (3) FCA- UNMdP, (4) CONICET, (5) IPNI

The main herbicide used in Argentina and worldwide is glyphosate (N-(phosphonomethyl) glycine), an organophosphate herbicide, non-selective, with a broad spectrum of action. Its main degradation metabolite is AMPA (aminomethylphosphonic acid). Several studies affirm that both molecules have been detected in groundwater, despite presenting great affinity for soil.

The objective of this work is to evaluate the vertical transport of glyphosate and AMPA in a field experiment, located at the EEA INTA Balcarce (37° 52' 49.64" S, 58° 17' 41.27" W). The soil under study is a typical Argiudoll, Mar del Plata Series. Horizon A is loam (48, 27 and 24% of sand, silt and clay, respectively), B is sandy clay loam (41, 19 and 40% of sand, silt and clay, respectively), and C is sandy clay loam (56, 20 and 24% of sand, silt and clay, respectively). The design of the experiment is a DBCA with three blocks of plots of 10x40 m and two treatments: intensified management (IS) and control management (MT). The first aims to increase the use of inputs and resources, and minimize the use of pesticides, and the second is similar to the management of producers in the area. The blocks are duplicated to simulate the rotation phases. Each phase has an automatic drainage water extraction system, consisting of a tensiometer, a vacuum pump and two ceramic capsules per treatment, located 1.2 m deep. These are connected to collection bottles, from which the soil solution is extracted for analysis in UPLC MS/MS (Waters[®]). Leachate samples were taken in the period June-2016 to April-2017, and soil sampling was conducted in July 2017 at 0-2; 2-5; 5-10; 10-15; 15-20 cm depth.

Both molecules were detected in the leachate samples, in concentrations ranging from <0.1 $\mu\text{g L}^{-1}$ to 5.93 $\mu\text{g L}^{-1}$ of glyphosate and from <0.15 $\mu\text{g L}^{-1}$ to 1.85 $\mu\text{g L}^{-1}$ of AMPA, coinciding with the highest concentration in the MT treatment, 10/04/17. In soil samples, the treatments presented statistically significant differences for glyphosate only in the first 2 cm, associated with the time of the last application. After 10 cm, the concentration of the herbicide was less than 20 $\mu\text{g Kg}^{-1}$. On the other hand, AMPA presented higher concentrations than glyphosate and it was only differentiated between treatments in one of the cultivation phases.

The results obtained so far indicate that both molecules are present in the first centimeters of the soil, and are transported through the profile, at least up to 1.2 m deep. Such results are preliminary and constitute a first step in the study of the process of vertical transport of these molecules at field scale.