

Atrazine degradation dynamics in two contrasting agricultural rotations in Mollisols of southwestern chaqueño

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Due to the continuous use of agrochemicals in agriculture, appreciable quantities of herbicides and their degradation products can accumulate in the ecosystem, as a consequence of the reduction of the purification capacity of the soil. Although specific data for atrazine are not available, it is estimated that the use of the compound in the country is about 10-15 million kg or L.

Once in the environment, degradation of atrazine (ATZ) in soils occurs both by chemical and biological processes, leading to the formation of metabolites, such as hydroxytriazine (OH-ATR), desethylatrazine (DEA) and desisopropylatrazine (DIA). The objective of this work was to evaluate the degradation of ATZ over time, in two contrasting agricultural rotations belonging to a long-term trial (T1- Soy monoculture, with application in pre-sowing and T2- Corn / Sunflower-Sorghum / Soybean , with applications in pre-sowing and post-emergence of ATZ) established on a Haplustol oxic soil of sub-tropical climate, located in INTA Las Breñas (Chaco, Argentina). Soil samples were collected during the soybean and corn cycle at different time intervals: 2, 4, 6, 8, 10, 12, 14, 16, 30, 45, 60 days after each application of the herbicide. In each plot samples were taken at 0-5; 5-10; 10-20; 20-30 cm deep.

The analytical quantifications were performed by high pressure liquid chromatography coupled to tandem mass spectrometry (UHPLC / MS MS).

The results have shown:

- The ATZ distribution followed a trend similar to the stratification of organic matter with depth, with the highest concentration in the first 0-5 cm of soil in both treatments.
- After 7 days from the application, the amount of ATZ for T1 and T2 was 24% and 11% of the initial concentration, respectively.
- After 30 days, the presence of ATZ for T1 was 4.5% while for T2 and with a dose three times higher than in soybean, it was 9.69% of the initial dose.
- After 10 days of the second application of ATZ in T1, 94% of this dose had been degraded, an effect of a microbial community adapted to increase the rate of degradation after successive applications.
- During the first days of application, an increase in the concentration of DEA, DIA and OH-ATZ was observed
- OH-ATZ could be quantified in the four soil depths, unlike DEA and DIA found only in the first 10 cm, suggesting the presence of a more active microbial population on the surface due to the presence of greater carbon resources, nitrogen and phosphorus generated in direct seeding
- In both OH-ATZ treatments, I represent the highest% relative concentration of metabolites, demonstrating a quantitative dynamics similar to ATZ over time.

The dissipation of ATZ was favored by the content of differential organic matter, the high temperatures characteristic of the place and the fluctuating humidity in soil.