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Perspectives for studying glyphosate and AMPA impact on soil ecosystem engineering in farming soils from Argentina.

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Ecosystem engineers are organisms that modulate the availability of resources to other species by causing physical state changes in biotic or abiotic materials. In the agricultural soils of the Pampa region of Argentina, earthworms are undoubtedly the key soil ecosystem engineers. Indeed, earthworms are involved in building and maintenance of porosity through bioturbation and burrowing; comminution, selection and or activation of microflora activities and in soil formation, by bioturbation, cast deposition and particle selection. Attending to the importance of such processes to preserve the soil capacity to sustain crop productivity, the promotion of suitable habitats for earthworm communities, has become a main goal for sustainable agriculture. However, in Argentine Pampas, the impact of the huge amount of pesticides currently spread on farming soils, on the earthworm biology and ecology, is scarcely considered when agricultural managements practices are selected. In fact, more than 250 million liters of glyphosate-based herbicides are spread by year in the farming soils of Argentina. Glyphosate has a relative short half-life, but one of the major breakdown products, the aminomethylphosphonic acid (AMPA), is persistent in soils. We tested its toxicity1 on the earthworm Eisenia andrei, and we found no mortality but growth and reproductive disorders. However, E. andrei is seldom found in agricultural lands. Indeed, for the last 8 years, we have sampled an important variety of agricultural soils, representing the most important farming systems used in Argentina, and we never found Eisenia spp. but 13 earthworm species: 8 exotic from Lumbricidae and 5 natives from Acanthodrilidae, Glossoscolecidae and Ocnerodrilidae families. However, the ecotoxicological effect of glyphosate has been detailed studied only in three of the mentioned exotic species, and only in four studies2,3,4,5. Such a few studies and a few species indicates a real lack of accurate knowledge about the ecotoxicological effect of glyphosate on the most distributed earthworm species in our country. Moreover, the effect of AMPA on these species is unknown. In this context, we acknowledge the urgent need for performing a deep research on the ecotoxicological effects of glyphosate-based herbicides and their metabolites on native and exotic but abundant earthworm species inhabiting farming soils in Argentina. Moreover, in addition to the classical ecotoxicological test, we are interested in studying the impact of glyphosate-based herbicides on soil ecosystem engineering, by means of a mesocosm approach assessing the production of biogenic structures by earthworms (casts and galleries) at different dosses of herbicides and considering different soils and crops.

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