Using organic amendments to prevent pesticide leaching in soils

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Motivation

More than 2.4 million active pesticide ingredients are applied worldwide annually to control the occurrence of weeds, insects, and other unwanted organisms [1]. The European Union Directive 2020/2184 sets a limit of 0.1 µg/L for pesticides in the water intended for human consumption. Despite the regulations, one or more pesticides in concentrations above 0.1 µg/L are detected in 30 % of all EU water monitoring sites, posing hazard to humans and ecosystems [2]. Alternative methods for pesticide removal from drinking water are imperative to protect human health [1].

Organic amendment (OA) application is an agricultural practice that increases soil nutrient and organic matter content. Additionally, organic residue application modifies the sorption behavior of pesticides. This effect has potential to enhance future pesticide transformation and reduce their transport through the soil profile [3]. Thus, OA application for direct pesticide remediation in the soil is a promising approach to preventing water pollution.

This research aims to develop a fundamental understanding of factors responsible for the fate of pesticides in soil, as well as interactions between pesticides and organic amendments. Obtained knowledge will be used to propose soil management and organic amendment application guidelines for pesticide leaching prevention.

The main benefits would be:

- Obtaining nature-based solution for pesticide removal in soil.
- Preventing surface and groundwater pollution.

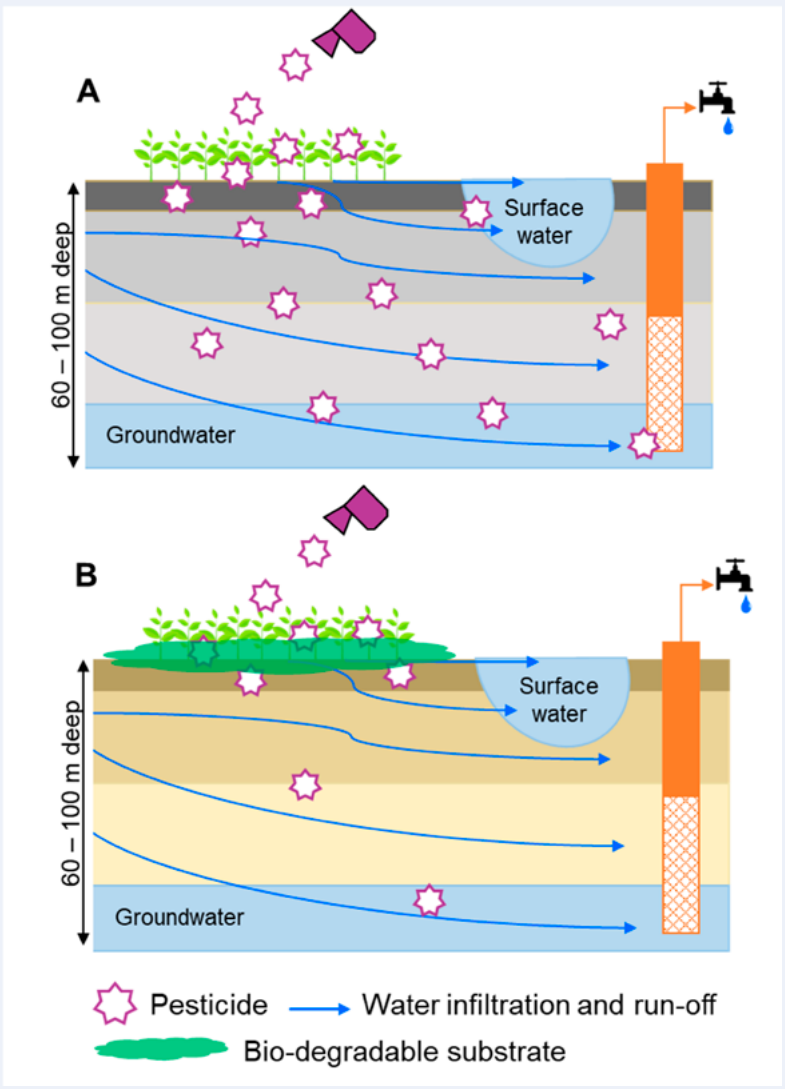

Figure 1. Pesticide distribution in the soil/water environment: A – common scenario; B – after organic amendment application.

Technological challenges

- Accounting for the complexity and abundance of the physical, chemical, and biological interactions in the soil-water matrix [3].
- Accounting for the variable nature of the organic amendments, and pesticide intrinsic properties [2].
- Establishing the influence of soil management practices on pesticide environmental fate [3].
- Combining the obtained knowledge to propose soil management and OA application guidelines. OAs should first adsorb and then desorb the pesticide at the optimal rate for its degradation in soil.

Research goals

1. Determine the mechanisms and kinetics of selected pesticide sorption in different soils.
2. Establish the mechanisms and kinetics of pesticide degradation in different soils.
3. Elucidate the influence of organic amendments with different organic matter content and composition on the sorption and degradation of pesticides.
4. Determine the mobility potential of pesticides in soils with and without organic amendment addition under different flow and pesticide aging conditions.

References

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