



Modelling the dissipation and leaching of two herbicides in decomposing mulch of crop residues

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Conservation agricultural practices are increasingly adopted because of ecosystem services such as conservation of soil and water resources. These farming systems are characterized mainly by the presence of mulch made of residues of harvested or cover crops on soil surface. The mulch can intercept and retain applied pesticides depending on pesticide molecule and rainfall timing. The pesticide wash-off from mulch is considered a key process in pesticide fate and can have effects on degradation and transport processes. This work highlights a modelling approach to study the pesticide wash-off from mulch residues and their further transport in soil under two rainfall regimes. Transformation and leaching of two herbicides, s-metolachlor and glyphosate, was studied and simulated by Pastis-mulch model. A pesticide module describing pesticide degradation in mulch and soil was coupled to a transport model including a mulch module. The model was tested to simulate the pesticide dissipation, wash-off from mulch and further leaching in soil. Pesticide degradation parameters in mulch were estimated from incubation experiments with ¹⁴C-labelled molecules in small cylinders. The model was then tested using the data obtained through a soil column experiment (reconstructed soil cores :15 cm diameter x 35 cm depth), a mulch of Zea mais + Doliquos lablab and with two treatments varied by water regimes: i) frequent rain (temperate, twice a week) with week intensity (6 mm/hr); and ii) occasional rain (tropical, twice a month) with stronger intensity (20 mm/hr). Columns were incubated at 20 °C for 84 days to monitor soil water, C, N and pesticide dynamics. Model successfully simulated the experimental data of pesticide dissipation in mulch residues. Results showed that the rain regime affected more S-metolachlor than glyphosate behavior. The simulated results indicated also that the dynamics in mulch of the two molecules differed according to the rain treatment. Glyphosate showed a greater leaching from mulch than S-metolachlor because of its lower adsorption coefficients to organic mulch. Moreover, simulated results showed a much faster degradation of glyphosate but greater non-extractable residue formation for S-metolachlor.

Keywords: Mulch; Pesticides; Transport; Degradation; Modeling; Pastis-mulch

References

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