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# Mimicking pestcide percolation dynamics in ditches bed by successive column infltration experiment

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Soil layers underlying ditch beds acquire specific characteristics due to ii) hydrological and erosion/deposition processes occurring within the ditch and ii) management practices (burning, dredging, mowing, . . . ). For example, organic matter contents of the ditch beds can be larger than those in neighboring fields, since ditches act as buffer zones. Besides, in Mediterranean catchments, farmed ditches are known to be zones of groundwater recharge and thereby may contribute to groundwater pollution. The role of farmed ditches in groundwater contamination needs therefore to be clarified.
The purpose of this study was to determine the dynamic of pesticide percolation in infiltrating farmed ditches bed during a sequence of flood events. A complementary aim was to determine to which extent pesticide percolation from the ditches is correlated to surface flow water contamination.
A succession of 9 flood simulations were performed on an undisturbed soil column sampled in the a ditch of the Roujan catchment (Hérault, France), which belongs to the long term Mediterranean hydrological observatory OMERE (Voltz and Albergel, 2002). The soil column was 15 cm long with a 15 cm inner-diameter. For the first 5 flood simulations, injected water was doped with 14C-diuron, an herbicide used in vineyards; uncontaminated water was injected for the last 4 simulations. Free drainage was imposed at the bottom of the column. Diuron concentration was kept constant during a simulated infiltration experiment, but it was progressively decreased from 1000 to 0 $\mu$g/L along the succession of the 9 events to mimic the observed seasonal variation of mean diuron concentration in surface flow at the study site (Louchart et al., 2001). Additionally, the first flood simulation was performed with tritium water to assess references on conservative transport within the soil column. For each simulation, the inflow and outflow hydrogram and chemogram were monitored. Extractable (water and solvent) and non-extractable (NER) diuron residues in the soil column were determined at the end of the simulation.
The results show two main points. First, a very significant part of the infiltrated pesticide and its metabolites leached or could have leached, with a dynamic that is not directly linked with surface water concentrations. Indeed, from the third flood, diuron leaching concentrations were higher than injected diuron concentration. Moreover, the chemogram of diuron leaching was very similar for the 2 last flood simulations (with clear water) with diuron concentrations remaining quite high (from 8 to 2 $\mu$g/L). Second, water flow and diuron transport mechanisms involve two ways: a fast way attributed to macroporal flow and a slow one that corresponds to microporal flow. The macroporal compartment varied during and along flood simulations inducing different proportion of water and diuron fast flowing.
Finally the possibility that farmed ditches contribute to groundwater contamination is high. Contamination mechanisms seem to be complex with a fast way leading to direct contamination of underlying soil layer with actual flooding water and a delayed way leading with past flooding water and involving the remobilization of pollutants stocked within the soil.