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Transportation process of plant protection products due to runoff and erosion during rainstorm events - an artificial irrigation study

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Introduction:
Environmental fate modelling and monitoring of active substances from plant protection products and their metabolites contribute considerably to surface water protection. In this context, surface runoff and erosion processes are seen as substantial entry pathways. The active substance Chloridazone and its non-relevant metabolites were used as substitutes for compounds with different adsorption coefficients and half-lives. To protect water biology various approaches are available to determine annual or semi long-term load, but not short-term and event- based methods.

Objectives:
We conducted field and laboratory irrigation experiments at small scale to quantify the relocation of Chloridazone and their metabolites Desphenyl-Chloridazone and Methyl-Desphenyl-Chloridazone from a silty and a sandy soil distinguished between solved in runoff and bound on soil particles. Regarding its adsorption coefficient Chloridazone is expected to adsorb slightly to suspended solids and sediment. In this study, however, concentration of Chloridazone in sediment is higher than in solution despite the runoff dominated mass flux.

Results:
Concerning the cation exchange capacity of clay minerals and the high sorption behavior of organic matter, for sandy soil with low clay content the concentration of bound Chloridazone was lower than in solved phase compared to a silty soil with identical organic matter but higher clay content. The relocation coefficient ranges between 0.5 % and 8 %. In this study the ratio between bound and dissolved Chloridazone in sediment loaded runoff is 0.04 for silty soil and 0.002 for sandy soil.

Conclusion:
We found a shift in the particle size distribution of the sediment towards finer grains compared to the starting substrate, suggesting an accumulation of the active ingredient in the sediment. As clay minerals are more likely to be relocated by erosion and to cover larger distances than coarser fine soil particles the loss of active substances by runoff and erosion depends, indeed, highly on soil condition and pesticide properties.