

## **Pesticide leaching via subsurface drains in different hydrologic situations**

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esticides and their degradates in tile drainage waters were studied in two small, predominantly agricultural, tile-drained subcatchments in the Bohemian-Moravian Highlands, Czech Republic. The goal was to evaluate their occurrence and the dynamics of their concentrations in drainage waters in different hydrologic situations using discharge and concentration monitoring together with  $^{18}\text{O}$  and  $^2\text{H}$  isotope analysis for Mean Residence Time (MRT) estimation and hydrograph separations during rainfall - runoff (R-R) events.

The drainage and stream discharges were measured continuously at the closing outlets of three drainage groups and one small stream. During periods of prevailing base and interflow, samples were collected manually in two-week intervals for isotope analysis and during the spraying period (March to October) also for pesticide analysis. During R-R events, samples were taken by automatic samplers in intervals varying from 20 min (summer) to 1 hour (winter). To enable isotopic analysis, precipitation was sampled both manually at two-week intervals and also using an automatic rainfall sampler which collected samples of precipitation during the R-R events at 20-min. intervals.

The isotopic analysis showed, that MRT of drainage base flow and interflow varies from 2,2 to 3,3 years, while MRT of base flow and interflow in surface stream is several months.

During R-R events, the proportion of event water varied from 0 to 60 % in both drainage and surface runoff.

The occurrence of pesticides and their degradates in drainage waters is strongly dependent on the hydrologic situation. While degradates were permanently present in drainage waters in high but varying concentrations according to instantaneous runoff composition, parent matters were detected almost exclusively during R-R events.

In periods with prevailing base flow and interflow (grab samples), especially ESA forms of chloracetanilide degradates occurred in high concentrations in all samples. Average sum of degradates varied between 1 730 – 5 760 ng/l.

During R-R events, pesticide concentration varied according to runoff composition and time between spraying and event. Event with no proportion of event water in drainage runoff were typical by increase in degradates concentrations (up to 20 000ng/l) and none or low occurrence of parent matters. Events with significant event water proportion in drainage runoff were characterised by decrease in degradates concentrations and (when event happened soon after spraying) by presence of parental pesticides in drainage runoff. Instantaneous concentrations of parent matters can be extremely high in that cases, up to 23 000 ng/l in drainage waters and up to 40 000 ng/l in small stream.

Above results suggest that drainage systems could act as significant source of pesticide leaching. When parent compounds leaches via tile drainage systems, there are some border conditions that must exist together such as the occurrence of R-R event soon after the pests application and the presence of event water (or water with short residence time in the catchment) in the drainage runoff.