Identification of herbicide transport pathways in drainage ponds

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BACKGROUND

➢ crucial need to reduce non-point source agricultural inputs to achieve the aims of the European Water Framework Directive
➢ semi-natural drainage ponds become increasingly important as removal measures for plant protection products in agricultural productive areas
➢ behaviour of pesticide loads within drainage ponds is neither well monitored nor understood yet
➢ drainage ponds can reach retention efficiencies that are comparable to larger wetland areas ➔ demand of modifications to prolong hydraulic residence times and to let natural transfer and transformation processes take effect

AIM

➢ to monitor drainage ponds in daily resolution and to gain an improved understanding of reduction of herbicide load peaks from drainage flows before reaching receiving river systems

METHODS

➢ consideration of different discharge routes of herbicide loads entering the drainage ponds
➢ focus on 2 herbicide parent compounds (PC) commonly used in rapeseed (Metazachlor) and winter crops (Pendimethalin) and 2 transformation products (TP), which differ in characteristics
➢ area of interest in Northern Germany is characterized by sandy-loamy soils and agricultural land use
➢ investigation area drains via connected ponds in the river system
➢ to capture the hydrological behaviour and daily herbicide loads in drainage pipes, a daily monitoring from 10/2016 to 01/2017 after autumn application is carried out

RESULTS

➢ Concentration and load of the active herbicide Metazachlor applied in autumn 2016 (2.4% EC, dosage rate 2.25 kg a.e. ha⁻¹) at the drainage pipe entering Ferienhof Radlandsichten; Fig. 8 shows concentrations close to pond and pond at final exit

FINDINGS

➢ pond surface water: detection of highest loads for TPs Metazachlor – QA und – ESA (Fig. 5, Fig. 6); first flush delivered high concentrations of PCs Pendimethalin and Metazachlor at pond inlet (Fig. 3, Fig. 4), even though Metazachlor application was in year 2015
➢ groundwater: GW1 (close to pond) showed low concentrations of all target compounds, because of effluent groundwater condition (Fig.2.); in GW2, only Metazachlor – TPs were detected in considerably higher concentrations (Fig.7)
➢ sediment: only concentrations of TPs Metazachlor – ESA and – QA detected, in flow direction higher (Fig.8)
➢ retention efficiency: a retention 34% in drainage pond (12 to 34 % for mobile and up to 63% for non mobile compounds) ➔ correlation of retention efficiency and kfc for PCs; mobile Metazachlor – TPs showed good retention though low kfc, but found in resolute part of sediment samples (Fig.8)