

Phosphorus release and retention in Irish agricultural drainage ditches: a bed sediment P fractionation and EPC₀ study

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Extensive networks of agricultural drainage ditches in Ireland exist primarily to improve field drainage and agricultural productivity. They also act as hydrologically efficient conduits that facilitate the rapid transport of diffuse phosphorus (P) output (Haygarth *et al.*, 2005). This study investigated the role of ditch bed sediments in terms of potential release and/or retention of P, in relation to seasonal changes in hydrology and storm events. Between April 2008 and March 2009, ditch water and surface bed sediment (1 cm) were sampled on a fortnightly basis at six locations in two rural sub-catchments of the Ulster Blackwater in Counties Monaghan and Armagh (Arnscheidt *et al.*, 2007). The sediment P composition was analysed using a modified Psenner fractionation scheme (Hupfer *et al.*, 1995), and the sediment equilibrium phosphorus concentration (EPC₀) was determined by batch sorption experiments. In terms of spatial comparison, sediments with the higher total P and sediment EPC₀ appeared to be associated with higher water column P concentrations, although sediment EPC₀ in relation to water column P almost always indicated non-equilibrium condition and potential for P retention. The redox-sensitive P fraction extracted by bicarbonate-dithionite was on average the largest single fraction in sediments at all locations. In terms of temporal comparison, there was not a consistent pattern of sediment total P, P composition and sediment EPC₀ reflecting changes in hydrological conditions over the 12-month period.

However, during a sequence of storm events in August 2008, there was clear evidence of sediment P depletion at some but not all sample sites. In conclusion, the bed sediments did not appear to exert marked control over water column P concentrations; rather, it is much more likely that water column P and changes in hydrological condition have considerable influence on the sediment.

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