Phosphorus Dynamics in Buffer Strip Soils

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A buffer strip is a generic name for a vegetated piece of land, typically 2-15 m wide, which is managed separately from the rest of the agricultural area. It is usually sited within fields or next to water courses with the purpose of reducing agriculturally derived pollutant transfer to surface waters. The most important pollutant affecting freshwater eutrophication is phosphorus (P).
Most research into P loss from agricultural soils has focused on inorganic P, as organic P was not considered to be readily available to plants and microorganisms. However, in recent years it has been shown that some organic P compounds are, or can readily become, bioavailable, and thus may pose a pollution risk. This is particularly important because organic P can have a greater contribution than inorganic P to total P in leachate from grassland (Preedy et al., 2001). Buffer strips have been shown to be effective at retaining P, but many studies have focused on inorganic P retention or total P retention, with organic P dynamics being inferred by difference. Therefore it is unknown whether there is a net retention or release of organic P from buffer strips.
Presented here are preliminary results of the quantification and characterisation of the P in the runoff from a hydrologically isolated and replicated grassland plot scale experiment, on a drained clay soil. The experiment has been designed in such a way as to allow comparison of the runoff from 40x10 m plots, either with or without 6x10 m buffer strips, and the monitoring of separate surface and subsurface hydrological pathways. Many studies investigating retention of P within buffer strips only account for surface runoff, but losses in subsurface drainage can be significant (Haygarth et al., 1998) and may by-pass buffer strips completely, especially where drainage has been installed.
Previous work has determined the organic P species present in manures and the soil, but we are developing methods to characterise the organic P species in runoff and drainage water from grassland, which is still in its infancy. This will be used to establish whether organic P loss from grassland is in the form of labile phosphomonesters and phosphodiesters, or the more recalcitrant inositol phosphates, and allow the effect of the buffer strip to be determined. Furthermore the effect of applying cattle slurry will be investigated, as application to lysimeters has been shown to significantly increase organic P concentrations in leachate (Preedy et al., 2001). This will also present an opportunity to characterise both the P inputs to the plots via slurry and the P outputs from the plots in surface and subsurface flows, and hence investigate the mobility of the organic P species relative to each other and inorganic P forms.

Haygarth P.M., Hepworth L., Jarvis S.C. (1998) Forms of phosphorus transfer in hydrological pathways from soil under grazed grassland. European Journal of Soil Science 49:65-72.
Preedy N., McTiernan K., Matthews R., Heathwaite L., Haygarth P. (2001) Rapid incidental phosphorus transfers from grassland. Journal of Environmental Quality 30:2105-2112.