Mitigation options for phosphorus and sediment (MOPS): Overview and results of the first two years

John Quinton (1), Martyn Silgram (2), Clare Deasy (1), Carly Stevens (1), Bob Jackson (2), Alison Bailey (3) and Louise Heathwaite (1)

(1) Lancaster Environment Centre, Lancaster University, Lancaster, LA1 4YQ, UK
(2) ADAS Wolverhampton, Wolverhampton WV6 8TQ, UK
(3) Department of Agriculture, University of Reading, Reading RG6 6AR, UK

Losses of phosphorus (P) from agriculture are of particular concern, as agricultural systems traditionally have high inputs of P applied in fertilisers and manures to enhance productivity. Although there has been extensive research into effective treatments for reducing soil erosion from arable land, less is known about the effectiveness of mitigation options for reducing P losses. To address this research gap, the Defra funded MOPS (Mitigation Options for Phosphorus and Sediment) project (PE0206) investigates a range of treatments with potential for mitigating P losses from combinable crops on arable land. Field monitoring is being carried out over three field seasons on fifty-two unbounded hillslope-length plots at three field sites in the UK (Herefordshire, Staffordshire, Leicestershire) with contrasting soil types (silty clay loam, sandy loam, clay). At each site, trial mitigation options have been selected which are appropriate for each soil type. The treatments investigated include tramline disruption, crop residues, minimum tillage, contour cultivation, and the use of in-field vegetative barriers. Results from the first two field seasons show that P losses at all three sites are principally particulate (>76 %), hence control of erosion is important in mitigating losses of P from arable land. Tramlines are the main route of P and sediment transfer from arable fields, with losses of runoff, sediment and P from plots containing tramlines at least an order of magnitude higher than losses from plots without tramlines. Treatments which reduce runoff and erosion within tramlines have been found to be effective in reducing sediment and P losses. Disruption of tramlines using a ducksfoot tine consistently reduced runoff, sediment and P losses to levels comparable to non-tramline areas at two of the sites. Chopping and spreading straw, instead of baling and removing it also significantly reduced runoff, sediment and P losses from arable land, typically by 30-60 %. Both minimum tillage and cultivation on the contour reduced P losses compared to conventional tillage and up-and-down slope cultivation, and the use of vegetative barriers across the slope also appears to be effective as this reduces the slope length and promotes contour cultivation. Each treatment is assessed to determine the economic viability of the mitigation options selected. Results from the first year of the project showed little difference in yields between treatments, but differences in operating margins mean that minimum tillage and contour cultivation may be the most cost-effective mitigation options. The results from the final year of the project are expected to provide further support for the effectiveness of different treatments, and will also allow determination of the economic viability of different mitigation options in reducing sediment and P losses from arable land at field, farm and regional scales.