Phosphorus concentration in overland flow from grassland field plots

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Grassland is a large proportion of farmland in many countries. In Ireland more than 80% of the 4.2 million ha of farmland is grassland. The main objective of this study was to measure the phosphorus (P) concentration in overland flow from grassland (cut and grazed) on six field plots with a range of soil test P (STP) levels and identify influencing factors. Morgan's STP between plots ranged from 3.5 to17.9 mg L^{-1} soil. Data collected from six grassland field plots over two years (Jan. 2002 to Mar. 2004) are presented. The overland flow was sampled in proportion to flow and concentrations of dissolved reactive P (DRP) in overland flow varied from the detection limit to 3 mg L^{-1}. Annual mean DRP concentrations were positively correlated with log STP. There was more than a ten-fold difference in mean annual DRP concentrations between the plots with the lowest and highest STP (0.047 vs. 0.585 mg L^{-1} P in 2002 and 0.029 vs. 0.723 mg L^{-1} P in 2003). The calculated annual dissolved DRP loads in overland flow from the plots ranged from 0.2 to 1.7 kg ha^{-1} yr^{-1}. There was a significant correlation between the three P fractions measured (86 % of total P (TP) was total dissolved P (TDP), 77% of TP was DRP and 90% of TDP was DRP). There was a wash out effect of the P fractions in overland flow in autumn (combining high flows and high P concentrations) after the summer dry period. The grazing animal can significantly increase the P concentration in overland flow, but the large variations between plots were related predominantly to soil factors rather than the presence or absence of grazing animals. The conclusion from the study are:
1) there was a marked autumn P wash out effect when P concentrations and overland flow were both high, giving high loss;
2) there was a wide variation in P concentrations in overland flow with a positive correlation between log STP and mean annual DRP concentrations for the six plots for 2002 and 2003;
3) there was a significant correlation between the three water P fractions measured;
4) the effect of the grazing animal on DRP concentrations was small relative to the effect of STP. The results show that grassland farming can contribute to high P concentrations and loads in overland flow that may impact on soil and water conservation.