Phosphorus Forms along a Flow Path and Application of an Area Weighted P-Index to Multi-field Watersheds

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In many settings, particulate phosphorus (PP) has been reported to be the dominant form of P in surface water runoff from agricultural systems. Past monitoring of rural streams in the Lower Fox River basin in Northeastern Wisconsin has shown mean concentrations of dissolved phosphorus representing from 40 to 75% of total P (TP) concentration. The effectiveness of improved management strategies that target PP is dependent on the form of P leaving source areas. Total dissolved phosphorus (TDP) losses may not be reduced with best management practices such as grassed water ways, filter strips, and conservation tillage. This study was conducted to better understand P forms leaving source areas and how the dissolved fraction changes along a flow path at different scales in the Apple Creek watershed, Outagamie County, Wisconsin.

Samples were collected near peak flow at 11 rural source area sites (0.25 to 2.5 km^2) and 4 integrator sites (12 to 85 km^2) during runoff events in 2004-06. A USGS continuous monitoring station also collected event samples on the main stem (117 km^2). For six runoff events in 2004-05, median TP was 0.51 mg/L from source area sites, 0.48 mg/L from integrator sites, and 0.72 mg/L from the main stem. Median TDP percentage was 39% from source areas, 40% from integrator sites, and 27% at the main stem. The median TDP percentage for the six events at each source area site, varied greatly (10% to 82%). The portion of TDP in a snowmelt and a low intensity event in 2006 were twice the median from earlier events.

Area weighted Wisconsin P-Index (SnapPlus) values for eastern red soils were compared to P concentrations from event monitoring at source area watersheds. Farm data, including crop rotation, nutrient applications, and tillage practices were collected from nutrient management plans. Preliminary comparisons show a strong ($R^2 = 0.72$) relationship between TDP concentration in surface water and area weighted soluble P-Index values. It appears that the factors affecting variability in TDP export between source areas are reasonably described by the Wisconsin P-Index.

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