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# Tracing Phosphorus Transport Using Multiple Tracers

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**Abstract**

Phosphorus (P) is one of the most significant and problematic diffuse pollutants. Eutrophication resulting from P transport into surface waters has been estimated to cost between £75 - 114 million per year in the United Kingdom, but due to its effectiveness as a fertilizer its introduction into the environment cannot be prevented. The primary transport mechanisms of P from arable land is via soil erosion. It is possible with tracing methods such as rare earth oxides (REOs) or $Cs^{137}$ to locate sediment sources during soil erosion and infer from this the location of P sources; however as P exists in different phases (dissolved, colloidal and particulate) it is not possible to trace all phases with a single tracer. We report on ongoing experimentation combining REOs and fluorescent microspheres (FMS) to trace P transported with bulk sediment and with colloids.

Experimentation is primarily taking place using rainfall simulation on soil boxes, with replication of the experiment at the field scale. Concentrated solutions of P are applied to an area of the plot, which is subsequently tagged with a REO and one color of FMS. Transported sediment is analysed for concentrations of the applied REO and total particulate P concentrations. Run-off is analysed for concentrations of microspheres and total dissolved P. Similar transport times for the tracers and the relevant P phases will indicate if the tracers are effective in mimicking P transport. This will be confirmed by variation of the slope angle having similar effects on transport times of both the tracers and P phases. An effective method of tracing sources and transport routes of different P phases will aid in developing mitigation strategies to minimize P loss from agricultural land.