

Predicting phosphorus runoff from phosphate fertilizers using fast laboratory assays

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Losses of phosphorus (P) from fertilized fields may result in water quality degradation. Rainfall simulator techniques are used to evaluate the losses of nutrient in runoff, but these are time consuming, labour intensive and costly given the apparatus and analyses involved. We hypothesized that laboratory-based methods could be useful tools for the evaluation of the P runoff risks from contrasting phosphate fertilizers. In order to develop a rapid, inexpensive, and efficient screening process for the evaluation of new and environmentally friendly fertilizer technologies, we compared laboratory-scale methods to assess fertilizer formulations for nutrient release characteristics and nutrient diffusion in soil, and compared the results with those obtained from a greenhouse rainfall simulator-based trial, using soil trays. The release characteristics of P fertilizers varying in solubility were obtained in batch experiments based on electrical conductivity (EC) measurements. A Petri dish method with a fertilizer granule added in the centre was used to assess the P diffusion through a recently developed rapid visualization technique. A rainfall simulator was used to assess the surface runoff losses of P. Grass was grown in the soil trays to create a vegetative coverage prior to application of different types of P fertilizers. The artificial rainfall delivered on the 5%-inclined trays generated the runoff, which was collected at regular intervals. The faster and inexpensive EC and diffusion visualization methodologies were good predictors of the risks of P losses in runoff and seem to be a useful tool for research on fertilizer-related losses of P from fertilized soils.