Scaling down rainfall simulators to evaluate the fertilizer-related transport of phosphorus in surface runoff

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Freshwater contamination is an important environmental concern worldwide. Numerous initiatives are under evaluation to minimize water quality degradation, including changes in soil tillage, conservation practices and fertilizer technologies. The adoption of environmentally friendly fertilizer formulations aims to mitigate losses of phosphorus (P) in runoff. The effect of new fertilizer technologies (e.g., coating treatments) on runoff is usually evaluated using field or indoor soil trays under simulated rainfall. However, the number of treatments which can be evaluated with these large-scale trials is limited, because it is costly, labour intensive and time consuming given the apparatus and analyses involved. We built two rainfall simulators to compare their performances on P runoff evaluation: a regular-sized simulator (3 x 3 x 2.5 m) for use with soil trays of 1 m length, following internationally accepted standards, and a smaller version (1 x 0.6 x 1 m) for laboratory-scale assessments using soil trays of 0.5 m length. Grass was grown in the soil trays to create a vegetative coverage prior to application of several P fertilizers. The artificial rainfall delivered on the 5%-inclined trays generated the runoff, which was collected at regular intervals. We found very good correlation in terms of P losses in the runoff between both simulators, regardless of the fertilizer type, solubility or coating. Thus, it is suggested that a smaller version of the conventional rainfall simulators can be used as a rapid, more flexible, easier and efficient way to evaluate the effect of fertilizer formulation on runoff losses.