Validating Erosion Models using Cesium-137-Derived Spatial Data

Soil erosion is a worldwide problem causing severe land degradation and surface water quality deterioration. To effectively control soil erosion, distributed soil erosion models such as the Water Erosion Prediction Project (WEPP) have been developed to predict spatial and temporal patterns of soil erosion. However, all of the spatially distributed erosion models have not yet been rigorously tested in the absence of spatial erosion data. The lack of spatial soil erosion data has restricted the validation and application of spatially distributed erosion models.

In a recently published article in the *Soil Science Society of America Journal*, spatial distribution patterns of soil erosion by water on a 200-m-long slope were estimated using the cesium-137 tracking technique. The author also thoroughly validated the WEPP model with the derived spatial data to diagnose the potential weakness in the configuration and functionality of the WEPP model with respect to the prediction of downslope erosion patterns.

The spatial erosion patterns predicted by WEPP using 1-m default rill spacing (rill density) were vastly different from those estimated by the $^{137}$Cs technique. Soil erosion rates predicted by WEPP were overly sensitive to slope length increases. However, the two patterns were well matched if different rill spacings along the slope were used to run the WEPP model.

The study demonstrates that rill spacing is a key input parameter for correctly simulating soil redistribution patterns with WEPP. Knowledge of rill density distribution along a hillslope is critical to satisfactorily predicting rates of hillslope soil erosion and sediment deposition. The accurate prediction of spatial soil erosion patterns would afford a great opportunity for efficiently implementing precision soil conservation measures and effectively controlling soil erosion.


AVAIL Copolymer Solubilizes Phosphate from Metal Hydroxides

Four million metric tons of phosphate fertilizer are applied annually to U.S. agricultural soils, but less than 40% is taken up by most crops. AVAIL copolymer is a fertilizer additive developed to enhance plant availability of applied phosphate, but its mode of action is still unclear and its effectiveness in the field is variable.

In a recently published article in the *Soil Science Society of America Journal*, researchers report on experiments evaluating the mechanisms of AVAIL in solubilizing phosphate reacted with poorly crystalline iron and aluminum hydroxides, important phosphate sorbents in soils.

They found that dissolved phosphate increased by up to 34% of added phosphate with increasing levels of co-added AVAIL and phosphate. The mechanism implied by their data was competition between the anionic polymer and orthophosphate anions for adsorption sites on the hydroxides.

The observation that AVAIL enhances dissolved phosphate better at higher phosphate inputs suggests that AVAIL would be more effective when used in banded fertilizer applications that concentrate phosphate in a smaller soil volume. The study also indicated that the effect of AVAIL would be improved when application rates depend on a soil’s phosphate sorption capacity and degree of phosphate saturation.


Dissolved phosphate concentrations as affected by levels of AVAIL and phosphate simultaneously reacted with ferrihydrite (left axis) and poorly crystalline Al-hydroxide (right axis on graph), in relation to a conceptualization of corresponding zones (rings) of decreasing soil phosphate and polymer concentrations with increasing distance from banded fertilizer granules (blue dots). Experimental phosphate inputs were 30, 50, or 80% (P30, P50, P80) of the maximum sorption capacity for each sorbent.