Controlling phosphorus in animal waste management systems with mine drainage residuals

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ABSTRACT

•Innovative cost-effective practices for substantially decreasing phosphorus in manure management systems are needed, as these systems are a significant source of non-point pollution to the Chesapeake Bay. This project will field-demonstrate the ability and cost-effectiveness of using mine drainage residuals (MDRs) to decrease soluble (water extractable) P in manure management systems. Soluble P can be decreased through additions of Fe, Al, and Ca solids from MDRs to the manure before field application.

•Successful implementation of this project will augment efforts to reduce the non-point phosphorous loadings received in the Chesapeake Bay and enhance efforts to remediate abandoned mine drainage in Bay tributaries.

METHODS

•Three MDRs were initially evaluated. "Farmington" MDR was produced passively from an acid coal mine discharge; "Wilson" MDR was produced passively from an alkaline coal mine discharge; and "Brandy" MDR was produced by a lime process from an acid coal mine discharge.

•The initial field-demonstration efforts for this project included the assessment of soluble P and addition of MDRs to a dairy farm manure recycling system in Clinton County, PA. The second demonstration included land application of MDR treated manure and was conducted in Clearfield County, PA.

MDRs from a mine drainage treatment system during recovery (left) and after processing (right).

250,000-gallon manure storage tank with tractor pump (left) and manure being sprayed on fields in spring 2009 (right).

PRELIMINARY RESULTS

•Results from the initial assessment of MDR addition at the Clinton County dairy farm indicated that the low concentrations of soluble P in the recycling system required amounts of MDR that would reduce the cost-effectiveness of phosphorus control using MDR .

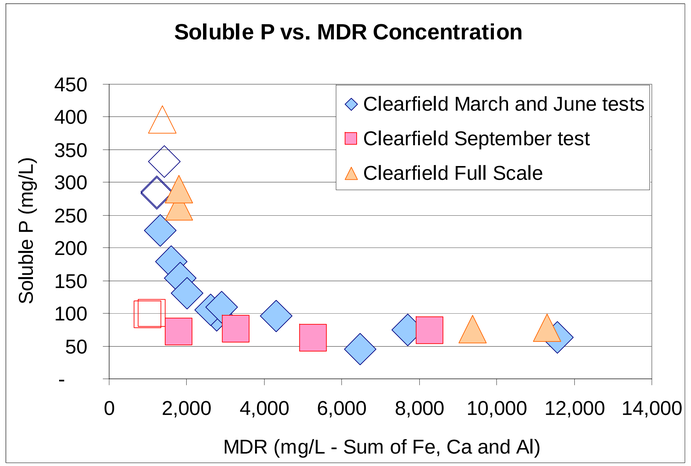
•Results from the MDR addition at the Clearfield County dairy farm, where the manure had substantially higher levels of soluble P, yielded consistent and cost-effective reduction in soluble P.

Major nutrient concentrations for project manures

Site	Solids	N^{tot}	K^{tot}	P^{tot}	P^{WE}*
	%	mg/L			
Clinton Average	***2.2***	***2,125***	***2,006***	***184***	***52***
Clearfield Average	***5.7***	***2,762***	***1,653***	***354***	***239***

** Water extractable P, per Kleinman et al. (2007)*

Effect of MDR additions on soluble P concentrations



Note: Hollow markers indicate control samples without MDR.

NEXT STEPS

•Results from initial field-demonstrations will be transferred and applied to full-time demonstrations at a number of to-be-selected dairy farms throughout the West Branch Susquehanna River watershed.

•Project tours and outreach activities will target conservation districts, NRCS, DEP, and local farmers.

ACKNOWLEDGEMENTS