Utilizing Mine Drainage Residuals to Control Phosphorous from Land-Applied Animal Manure

A Webinar Presentation by Trout Unlimited and Iron Oxide Recovery
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This webinar describes progress to date of a Trout Unlimited project that is assessing the feasibility of using mine drainage residuals (MDR) as a best management practice (BMP) to lessen the environmental mobility of phosphorus in land-applied manure. Land-applied animal manure from dairy and swine farms is a significant source of phosphorus to the Chesapeake Bay because many farms do not have a sufficient area to land-apply manure, which then results in an excess of nutrients to the streams and eventually the Bay. Although no-till practices have proven to be effective for lessening the runoff of solids and nitrogen from fields, no-till manure applications can actually result in higher losses of phosphorus, specifically water extractable phosphorus (WEP), during runoff events than is observed under conventional tillage practices.

Mine drainage residual (MDR) is the solid precipitate that is formed as a result of mine drainage treatment.

No economically viable BMP currently exists that allows small farms to substantially decrease WEP in the dairy manure before it is land-applied. Incorporating MDR into animal manure prior to land application does not require equipment purchases or long-term investments that will be problematic for small and mid-sized dairy and swine farmers. This BMP provides a means to continue land application of manure while decreasing the risk of phosphorus pollution to receiving streams and ultimately the Chesapeake Bay.

The use of MDR to adjust the WEP of land-applied manure could be a valuable stop-gap BMP for controlling phosphorus pollution in the Bay watershed.

MDRs have chemical characteristics that make them particularly reactive with oxyanions such as phosphate. This current project involved the collection and characterization of 21 MDRs collected from a variety of mine water and treatment environments in Pennsylvania (USA). The chemical composition of the MDRs was assessed relative EPA's Part 503 Biosolids Rule hazardous metal limits. Nine of the MDRs were found to have elevated

concentrations of nickel or arsenic. The chemical characterization of MDRs prior to their use in agricultural applications is necessary.

The effect of MDR additions on the WEP content of dairy manures was evaluated with laboratory experiments and field trials. The effectiveness of MDR for WEP reduction was a function of purity and particle size. Highly impure MDRs, which had low iron and aluminum were ineffective. Particle size was important. Coarse particle preparations of MDRs were less effective at reducing WEP than fine particle preparations. Reducing the particle size of an MDR increased its reactivity.

One trial tested MDR addition at a large concentrated animal feeding operation, a second tested at a 100-cow freestall operation, and a third tested at an 80-cow operation at which 400,000 gallons of stored manure was treated prior to land application. All three trials decreased WEP similar to laboratory testing. The results confirmed that solids produced in mine drainage treatment can have value for decreasing phosphorus pollution associated with animal manure management.

A finely-milled MDR was tested in field trials at three dairy farms.

This project is being continued with the following objectives:

- Standardize MDR testing with Pennsylvania State University Agricultural Analytical Services Lab
- Conduct simulated precipitation events using MDR-amended manure with the USDA Agricultural Research Service
- Conduct dose-effect test and field trial(s) with swine manure
- Conduct additional field trials to evaluate the economics and develop cost-effective methods
- Conduct crop yield measurement studies associated with field trials
- Develop into BMP for inclusion in the PA Technical Guide practice standards listing for NRCS

For more information or to find out how you can become involved in this project, please contact:

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