

Determining the Effect of Mine Drainage Residuals on Phosphorus Sequestration and Rye Grass Yield¹

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Abstract: Throughout historic mining regions of the United States, waterways are impacted by metalliferous mine drainage. Efforts to treat mine water often result in large quantities of solids, also known as mine drainage residuals (MDRs). These are typically disposed by burial, landfilling, or pumping back into mine pools. We hypothesize that MDRs could be beneficially reused in agriculture applications to sorb water extractable phosphorus, potentially increasing the amount of bioavailable phosphorus for crop growth and reducing nutrient mobility. To test this hypothesis, a greenhouse study was designed to determine if MDRs from mine water treatment could be used to sorb phosphate from cow manure, reduce phosphorus leaching, and improve ryegrass yield. Before the greenhouse study, sorption experiments confirmed that phosphates in manure could sorb onto the MDRs, and bioavailability leaching experiments demonstrated that the sorbed phosphorus was available for plant growth. An additional experiment was performed to determine if MDRs would be stable under anaerobic conditions in slurry tanks or water saturated soils. For the greenhouse experiments, varying amounts of MDRs were mixed with cow manure before applying to a nutrient deficient soil, planting with rye grass, and growing in a greenhouse. The addition of the MDR to the manure, even at the highest rate, did not negatively impact rye grass yield. Both MDR and positive control treatments had similar yields but were greater than the yields from the negative control. The addition of MDRs to dairy manure was found to decrease bioavailable phosphorus by 13.1% and dissolution of MDRs under anaerobic conditions would not release significant amounts of phosphorus due to the formation of other non-soluble minerals. The results obtained from this study strongly support the potential for use of MDRs as a sustainable nutrient pollution control strategy.

Additional Key Words: Mine Drainage Residuals, Phosphorus Removal, Manure, Reduced Nutrient Runoff.

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