

Agriculture Best Management Practices: Technologies and Challenges

Stormwater Seminar XVIII

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Steven Safferman, Associate Professor

Jason Smith, Teaching Specialist

Younsuk Dong, Post Doc

Jessica Hauda, Graduate Student

Thiramet Sothiyapai and Corinne Zeeff, Undergraduate Students

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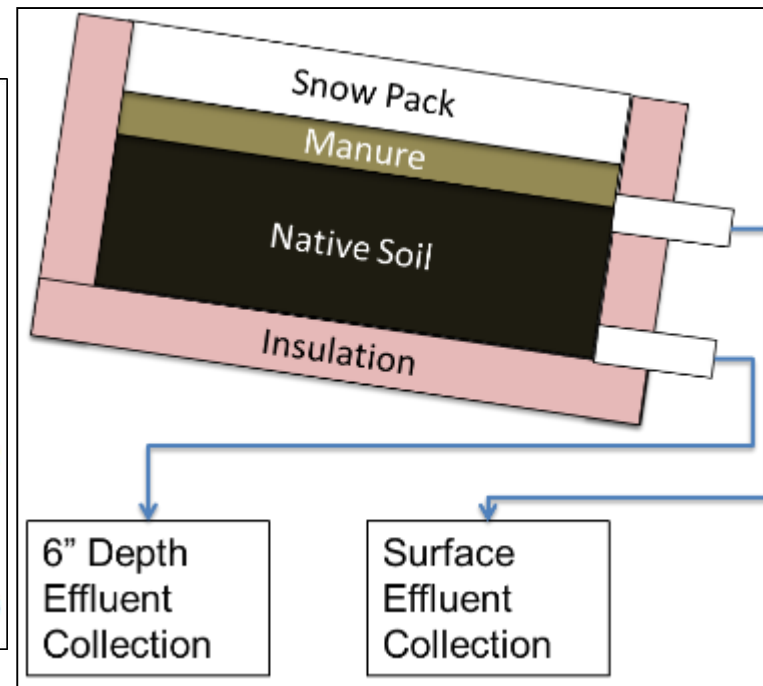
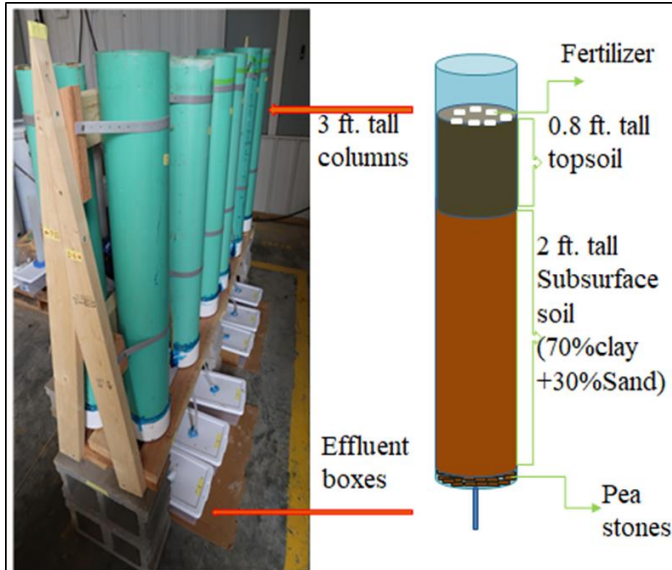
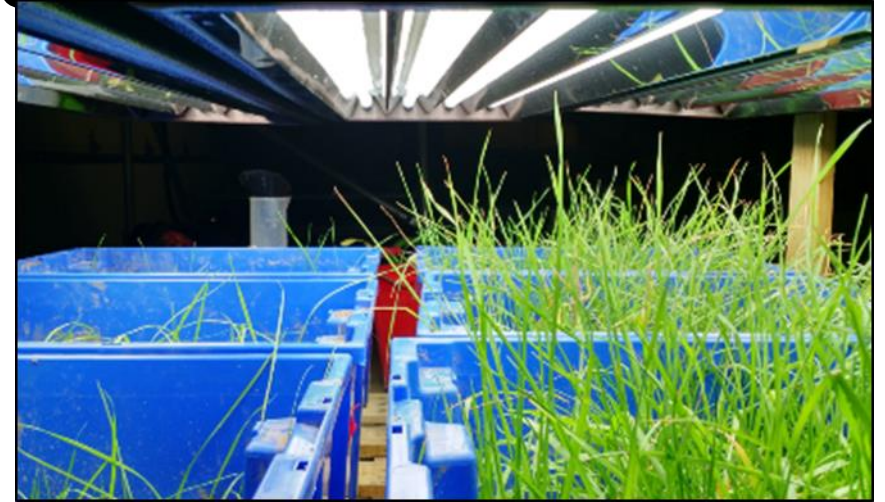
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Background

- Particulate phosphorus has been reduced in the Great Lakes but soluble levels are increasing.
- Soluble phosphorus is thought to be causing, in part, high profile eutrophication and cyanobacteria (blue green algae) issues in fresh surface waters.
- Relatively small quantities of soluble phosphorus can cause impacts due to its high bioavailability.
- Plant roots take up only 15–30% of the phosphorus applied annually in fertilizers (Syers, 2008).
- Plants use chemically sorbed phosphorus for growth, often not even coming from that season's fertilizer application (McLaughlin et al., 2011).
- Phosphorus sorption depends on several soil conditions including its mineral content, texture, legacy phosphorus levels, and moisture content.
- Changes in practices may maximize phosphorus retention in soil systems and reduce risk of leaching loss.
- Best management practices have emphasized reducing particulate phosphorus.
- Some best management practices may not reduce, and even increase, soluble phosphorus.
- New paradigm is to consider site-specific conditions to maximize soluble and particulate phosphorus retention.

Sources of Soluble Phosphorus

- Fertilizer Type
- Application Timing
- Cover Crops



Winter Manure Application: Management Practices and Environmental Impact

2016 Manure and Soil Health Working Group Report

1. Background

The practice of manure application on frozen or snowy soils remains controversial. References show that such application to frozen impermeable soils can increase the risk of manure nutrients and contaminants running off of fields during the spring thaw. Additionally, the loss of nutrients to spring thaws means a loss of soil productivity in addition to potentially impacting local water bodies

AUTHORS

Jason S. Smith, Rachele Crow, and Steven I. Safferman
Biosystems and Agricultural Engineering,
Michigan State University

AUTHOR CONTACT

Steven I. Safferman
Associate Professor
Biosystems and Agricultural Engineering
Michigan State University

Permanently 6666

Transport of Soluble Phosphorus - Macropores



Site Properties				
1	2	3	4	5
No-Till	No-Till	No-Till	Till	Till
Clay-Loam	Clay-Loam	Loam	Heavy Clay	Organic
site 1	site 2	site 3	site 4	site 5

Modeling Soluble Phosphorus Transport

HYDRUS 1D-PHREEQC is a finite element software that includes geochemical characteristics analyses to model the soil vadose zone. The software considers the movement of water and multicomponent transport.

Develop an index to qualitatively predict the fate and transport of soluble phosphorus.

- Experimental laboratory
- Edge of field monitoring
- Modeling

Soluble Phosphorus Management

- Saturated Buffer
- Sorbing and Recovery
 - Tile drainage
 - Isotherms
 - Column testing
 - Economic analyses
- Nutrient Trading



PO₄Sponge Nano-Engineered Media



FeSO₄ Modified Biochar – Natural Material



FerrIXA₃₃E Nano-Engineered Media



Blast Furnace Slag – Waste Material

Conclusions

- Select best management practices for site-specific application
- Research deficit on
 - Soluble phosphorus best management practices
 - Selection of practices that are best for watershed

Steven Safferman

SteveS@msu.edu

517-432-0812

www.egr.msu.edu/~steves/