

PHOSPHORUS LEACHING FROM MANURE-IMPACTED SOILS AFFECTED BY FLUCTUATING WATER TABLES

Abstract

by Jaime Mejias-Bassaletti, Ph.D.

Washington State University

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Chair: Claudio Stöckle

The main objectives of this dissertation were:

1. Acquire relevant field data to determine the role of iron reduction in P transport in tile effluents.
2. Explore the relation of the soil redox potential to P release and transport in column studies under dynamic conditions.
3. Develop a P leaching indicator based on the estimate of the P sorption strength in highly P-impacted soils.

In the first study, we observed a significant positive correlation between P and Fe^{2+} concentrations in drainage water from the pasture, but not in that from the corn field.

In the latter, a significant relation was found between P Fe^{3+} concentration. Phosphorus and Fe^{2+} were positively correlated to drain flow rate in the pasture system

and the same was true for P and Fe^{3+} in the corn field. In the second study, we demonstrated that an initially oxidized system saturated with P and under dynamic flow conditions can mobilize P after reductive dissolution of ferric iron. These results revealed that a reduced system presents a sink for P due to precipitation reactions but the system turns unstable after the redox potential increases, fixing less P than the oxidized control system. These findings suggest that alternating anoxic-oxic conditions play an important role in subsurface P transport. In the third study, we demonstrated that the inverse of the equilibrium P concentration at zero sorption ($1/c_e$) is a valid estimate of the soil sorption strength, which may be used as an indicator for P leaching potential. Below a threshold level of $1/c_e=0.71$ L/mg, desorbability parameters increased significantly.