Ryan Ruggiero
University of Vermont (UVM)
James M. Jeffords Hall, 63 Carrigan Drive, Burlington VT, 05405
631-609-5006
ryan.ruggiero@uvm.edu

12/04/2021

Dear MDPI's *Agriculture* Editorial/Review Board,

We are submitting this manuscript for the "Optimizing Nutrient Management in Cold Climate Agroecosystems" special issue in MDPI's *Agriculture*. This manuscript has not been published, nor is it being considered for publication, elsewhere. This research quantified phosphorus (P) export from archetypal dairy agroecosystems in the Northeastern U.S. Tile drainage (TD) was a significant P export pathway, despite the use of best management practices (i.e. manure injection, light tillage, cover cropping) to reduce P losses. Most of the P export occurred during the non-growing season, however drought played an important role in seasonal export. Peak P concentrations coincided with events post manure injection in the fall, and in the spring with events post cover crop termination and post planting. In addition to reporting annual P export estimates, we performed a robust analysis of the factors controlling P transport.

Preferential flow pathways (PFP) have been identified as a major factor in P export from fields with TD. We explored PFP by combining two hydrograph separation techniques, electrical conductivity end member mixing and hydrograph recession analysis. These two methods were then combined into a four-component model that estimates matrix-PFP mixing. This four-component model was proposed by a study published earlier this year, and our results build on theirs.

The rate of TD installation is likely to increase as rainfall patterns leading up to and during the growing season are altered by climate change. Climate change is also expected to increase rainfall intensity and periods of drought, furthering the need to understand the role of PFP activity on P transport. TD hydrographs rapidly responded to rainfall pulses throughout the year, so we wanted to look at the effect of rainfall pulse intensity on P loading in TD. We performed a unique, intra-event rainfall pulse analysis using temporal rainfall data from a tipping bucket rain gauge. Results showed event P loading in TD was higher because of higher intensity rainfall pulses.

Thank you for the consideration!

Sincerely,

Ryan Ruggiero
M.S. Graduate Student, Department of Plant and Soil Science
UVM