Assessing the Relationships Between Soil Test Phosphorus and Soil Phosphorus Release with Spring Snowmelt to inform Agronomic P Management

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Introduction

- Soil test phosphorus (STP) is widely used to estimate soil P availability and the risk of P loss to waterways.
- In cold regions such as the Canadian Prairies, snowmelt-induced offsite transport is the major pathway of soil P loss
- The relationships between STP levels and P release under these unique snowmelt conditions are still not well understood.
- This study investigates how STP influence phosphorus release during simulated snowmelt flooding to improve P loss risk assessment for cold-climate agricultural soils.

Objectives

- This study was conducted to quantify phosphorus release from soils with Olsen P levels ranging from below 60 ppm to over 180 ppm under simulated snowmelt conditions

- To determine the nature of the relationship between soil test P concentrations and phosphorus release to snowmelt water, whether it follows a linear, exponential, or threshold pattern across the tested concentration range

Materials and Methods

Collecting Intact soil columns → Add MAP to create a range of soil P levels → Mimic Freeze-thaw cycle → Flooding → Incubation for 14 days inside the cooler → Measure soil P and Flood water DRP

- Collected from four different agricultural lands

- MAP was added in powdered form, dissolved in D.H_2O and added up to the volume of soil's respective field capacity

- The columns kept 6 days for freezing and transferred to the cooler and kept 4.5 days for thawing

- Collected a small soil sample (1-3g) from each column
- Flooded the columns

- Fixed redox probes
- Kept in the cooler for incubation

- Extracted flood water using a syringe
- Measured pH, DRP in the flood water
- Measured STP in collected air dried soils

Results and Discussion

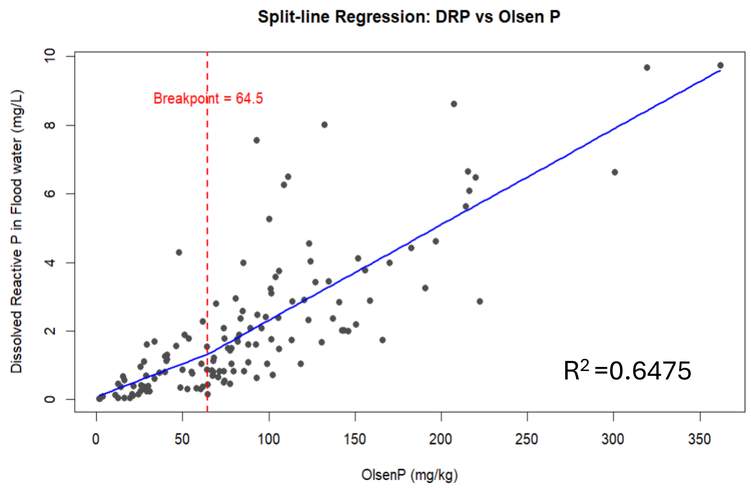
➢ Site information and soil properties of the selected soils

	Glenlea	LaFloche	Carman	Libaue
Fertilizer management	Conventional	Conventional	Conventional	Organic
Tillage	yes	yes	Yes	No till
Bulk density (g/cm3)	0.91	1.07	1.11	1.17
pH	8.2	8.3	8.5	8.5
EC (dS/m)	0.94	2.04	0.59	1.19
CEC (meq/100g)	54.4	32.9	25.5	45.6
OM%	5	3.5	7.6	5
Olsen P (ppm)	56	23	25	3.4
Texture	Clay	Sandy loam	Sandy loam	Clay loam

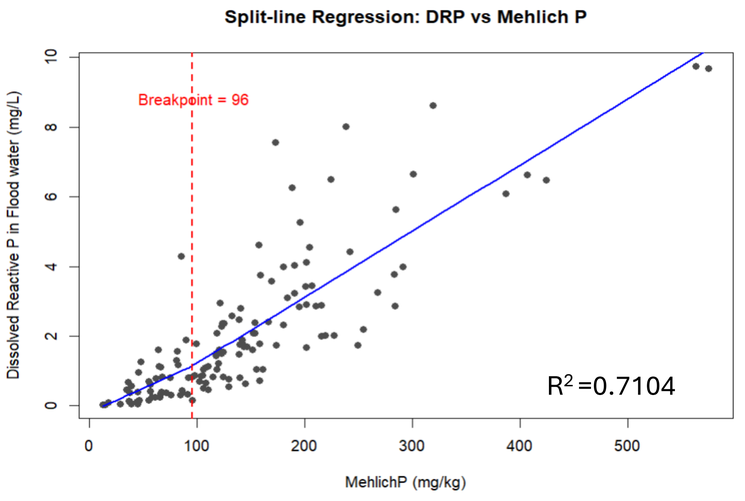
- Soil pH ranged in between 7.1 to 7.8 after 14 days

- Soil Eh reduced and stabilized in between +200 to -300 after 14 days

➢ Relationships between soil test P (Olsen P and Mehlich P) and floodwater DRP



- Olsen P tested range 0-365 mg kg^{-1}
- DRP ranged 0-10 mg L^{-1}
- Change point (CP) observed at 64.5 mg kg^{-1}
- Slope before CP is 0.019
  Slope after CP is 0.028



- Mehlich-III P tested range 0-575 mg kg^{-1}
- DRP ranged 0-10 mg L^{-1}
- Change point (CP) observed at 96.03 mg kg^{-1}
- Slope before CP is 0.014
  Slope after CP is 0.019

Conclusions

➢ The findings highlight the practical importance of maintaining soil P below critical thresholds to reduce P loss, support more informed nutrient management decisions and help producers balance crop fertility needs with water-quality protection.

Cont. Analysis

➢ Analysis will be further continued exploring more indices such as water extractable P, Oxalate extractable P, Degree of P saturation and P sorption capacity

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Acknowledgement
This project is funded by NSERC