

Field-aged phosphate impacts on glyphosate and phosphorus sorption patterns in two Prairie soils

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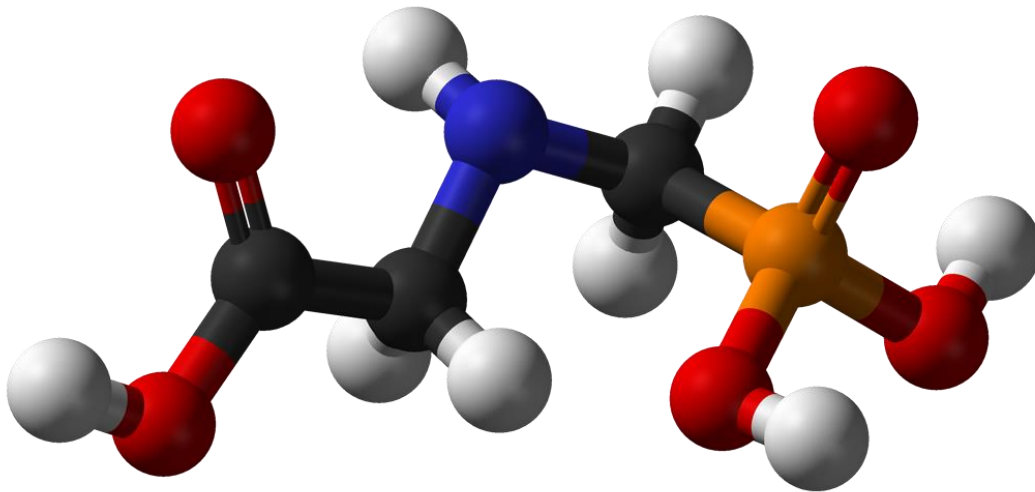


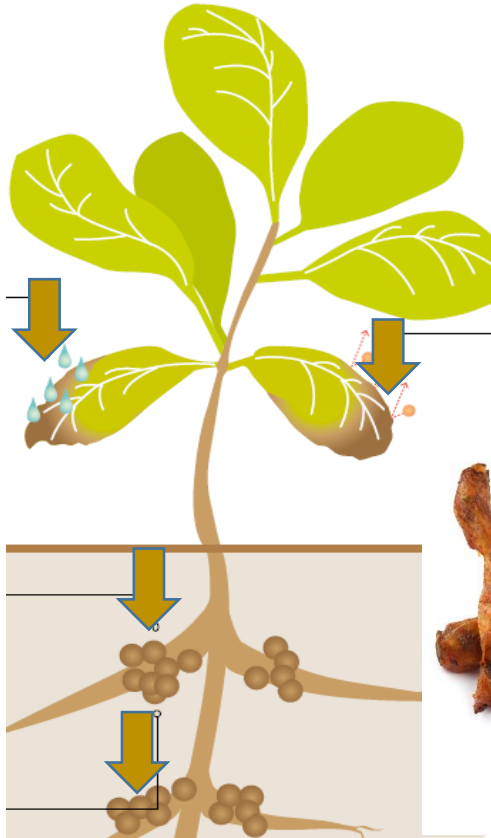
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Glyphosate is the world's best-selling chemical herbicide.





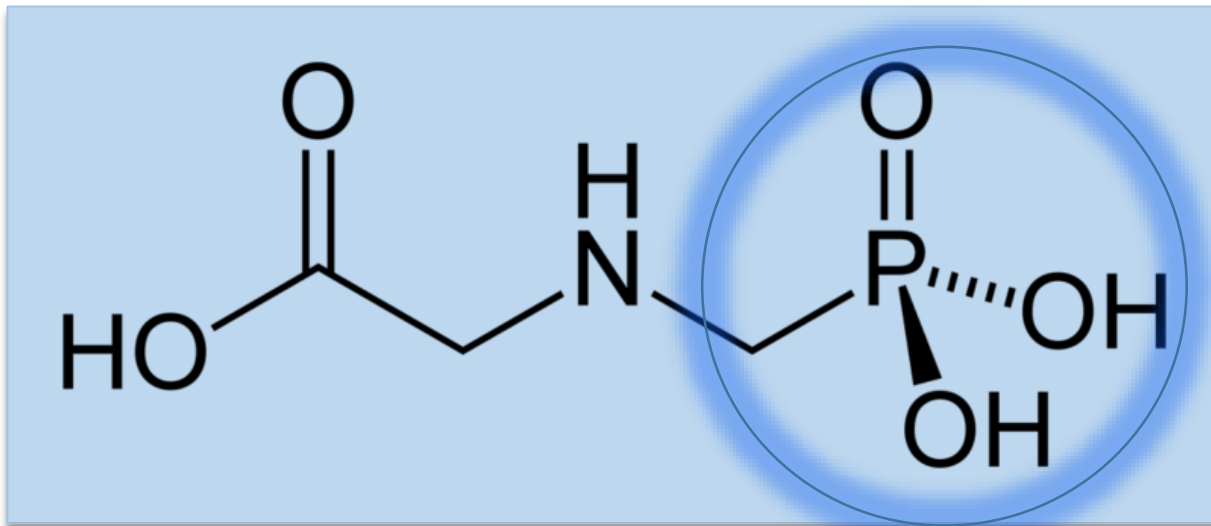
Potential concerns about glyphosate use:



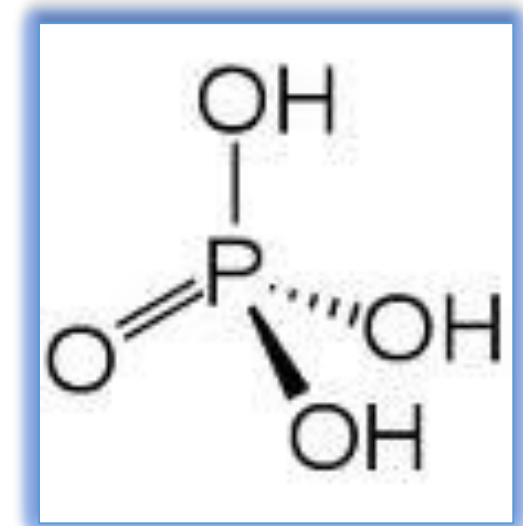
- Surface waters
- Human health
- Plant diseases
- Nutrients interaction

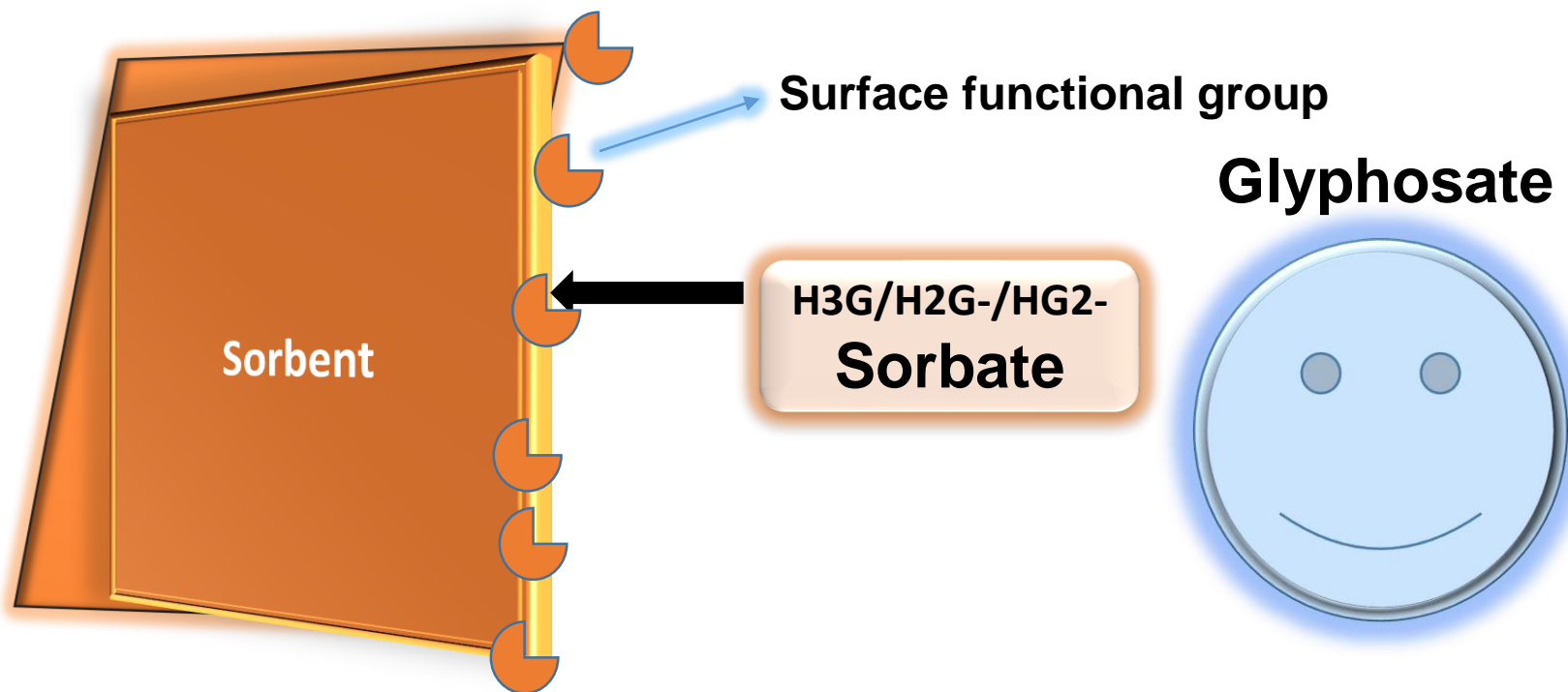


Glyphosate structure



Phosphate structure





General concept of sorption mechanism

Ligand Exchange
Inner sphere complexes
Metal-Glyphosate-Complex

- ❑ **Phosphorus (P), an essential nutrient for crop nutrition**
- ❑ **Plants typically recover less than 20% of the applied phosphorus**
- ❑ **The release of P from soil to water can accelerate freshwater eutrophication**



To examine the impact of field-aged phosphate on glyphosate and phosphorus sorption patterns in two prairie soils.



□ Fields sites were near Carman ($49^{\circ} 29.7' \text{ N}$, $98^{\circ} 2.4' \text{ W}$), and Forrest, ($50^{\circ} 1.2' \text{ N}$, $99^{\circ} 53.3' \text{ W}$) Manitoba.



**Treatment
Structure in the
field (RCBD)**

0 kg P/ha

20 kg P/ha

40 Kg P/ha

80 Kg P/ha

Introduction

Objective

Material and Methods

Results

Conclusion

Properties	Carman	Forrest
Texture	Sandy - clay - loam	Clay - loam
OC (%)	2.81 ± 0.04	3.2 ± .07
pH (soil/solution 1:2)	4.7 ± 0.02	7.3 ± 0.02
Fe₂O₃ (mg/kg)	200 ± 8.85	12.52 ± .22
Al₂O₃ (mg/kg)	6.41 ± .64	1.07 ± .47
Ca (mg/kg)	2252 ± 35	4791 ± 158
Olsen-P (mg/kg)	43 ± 7.34	23 ± 2.88

Introduction

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Research Field



Soil + Solution



Incubation



Samples into LSC



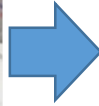
Adding scintillation cocktail



Centrifuge



Soil + Solution



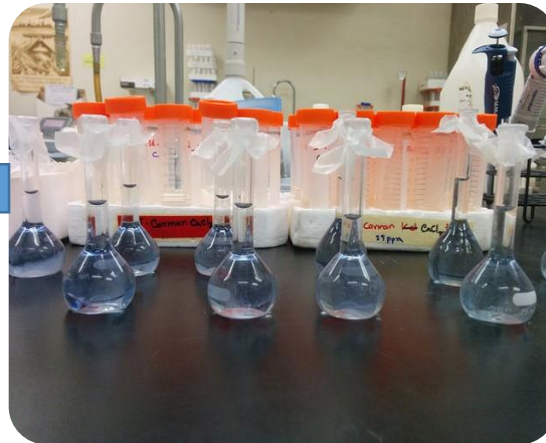
End to end shaker



Centrifuge



Spectrophotometer

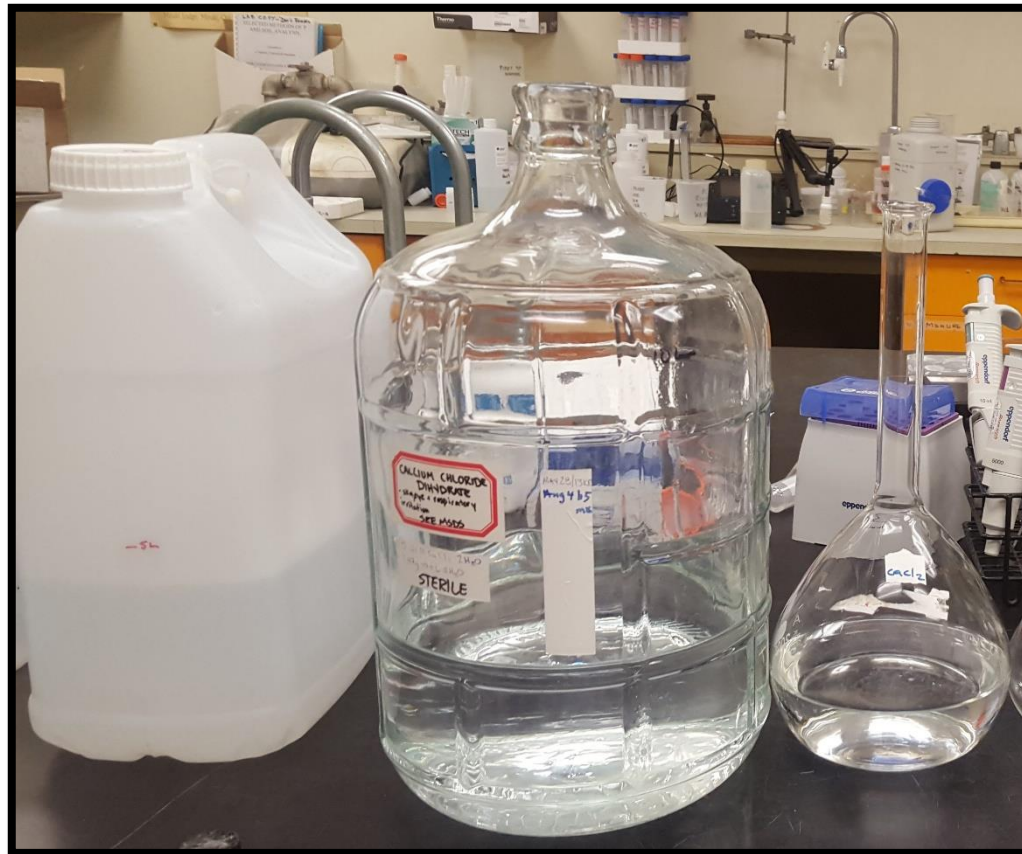


Color development

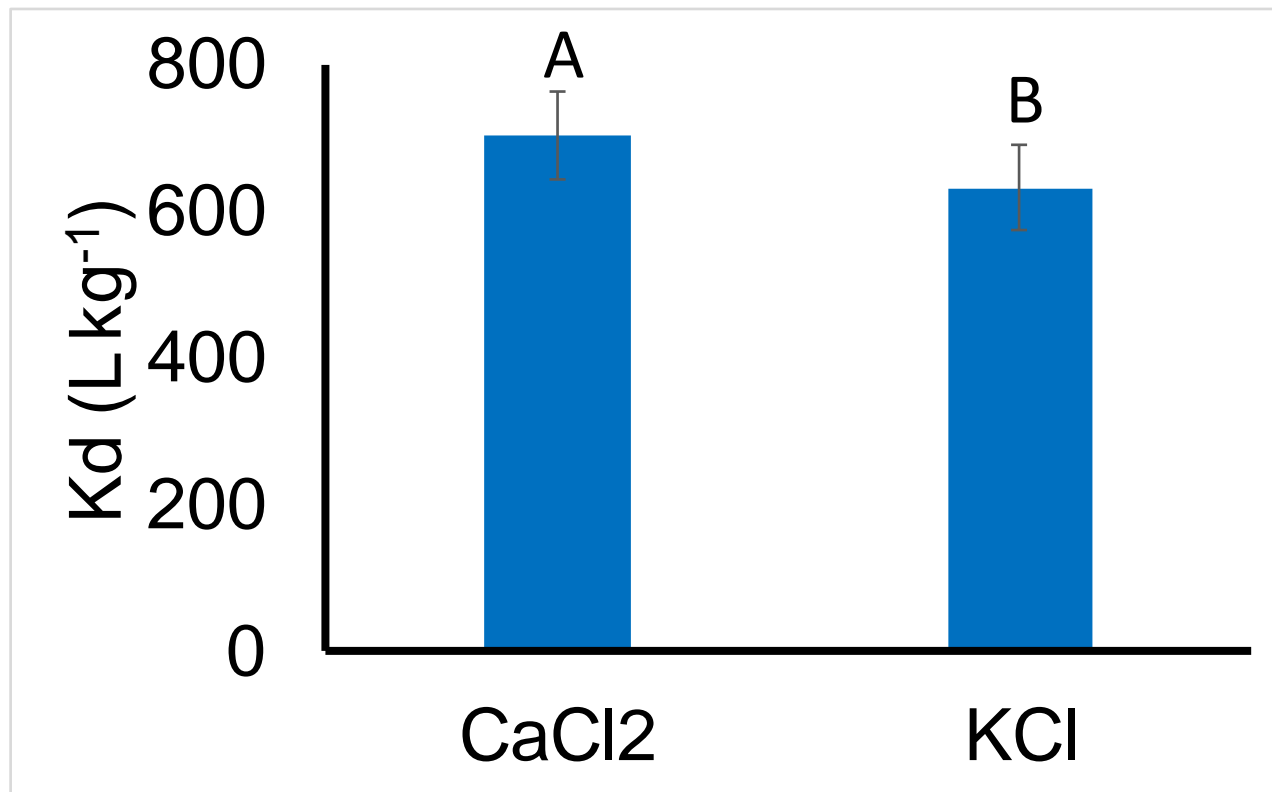


Extraction

Two solutions (0.01M CaCl_2 and 0.01M KCl) were used as background liquid

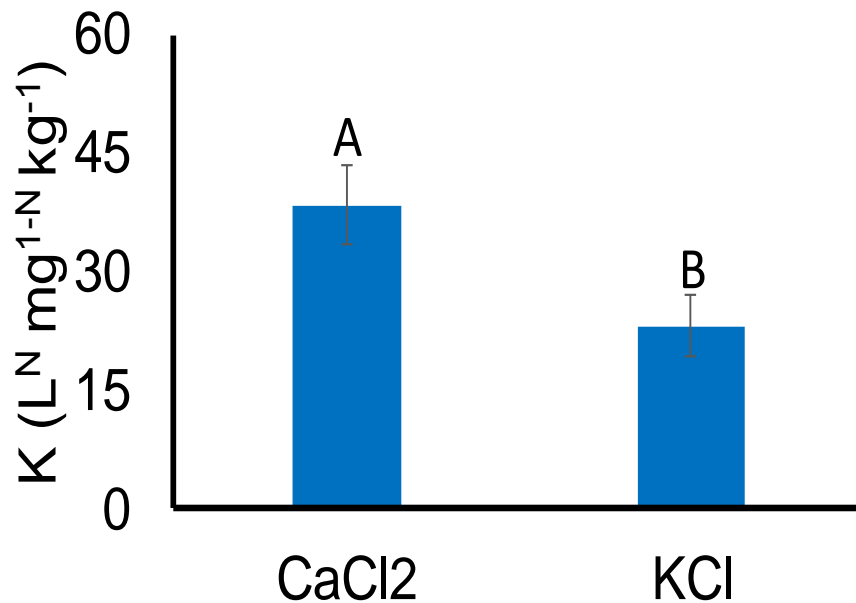


Background liquid effect on glyphosate sorption

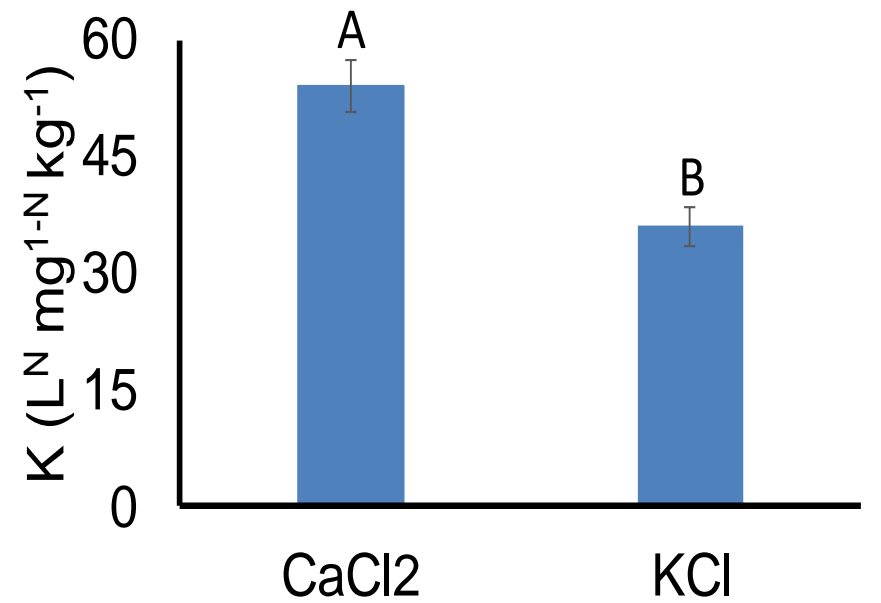


Carman Soil

Background liquid effect on phosphorus sorption

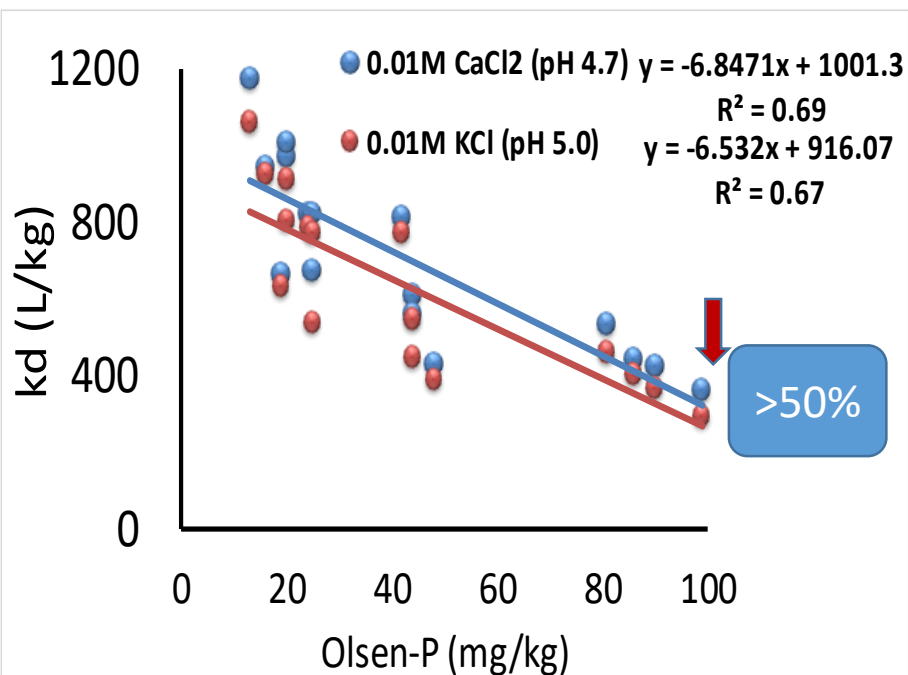


Carman Soil

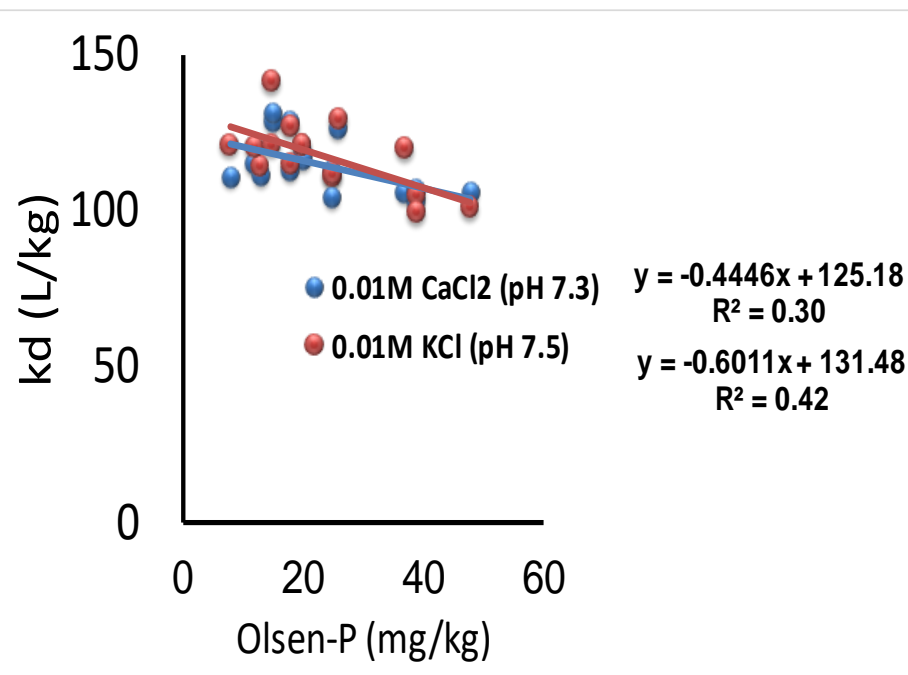


Forrest Soil

Aged-P effect on glyphosate sorption



Carman Soil

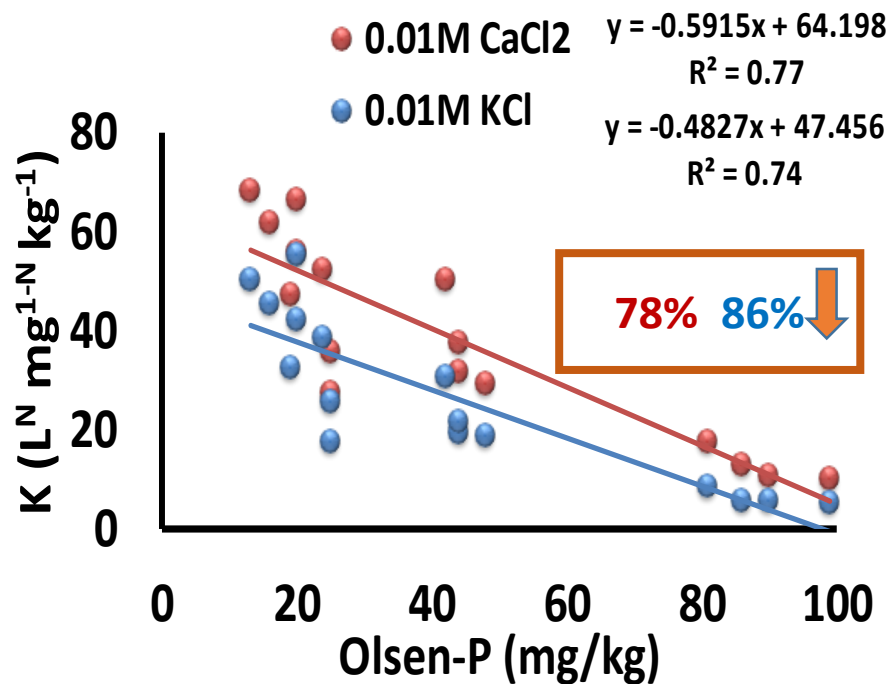


Forrest Soil

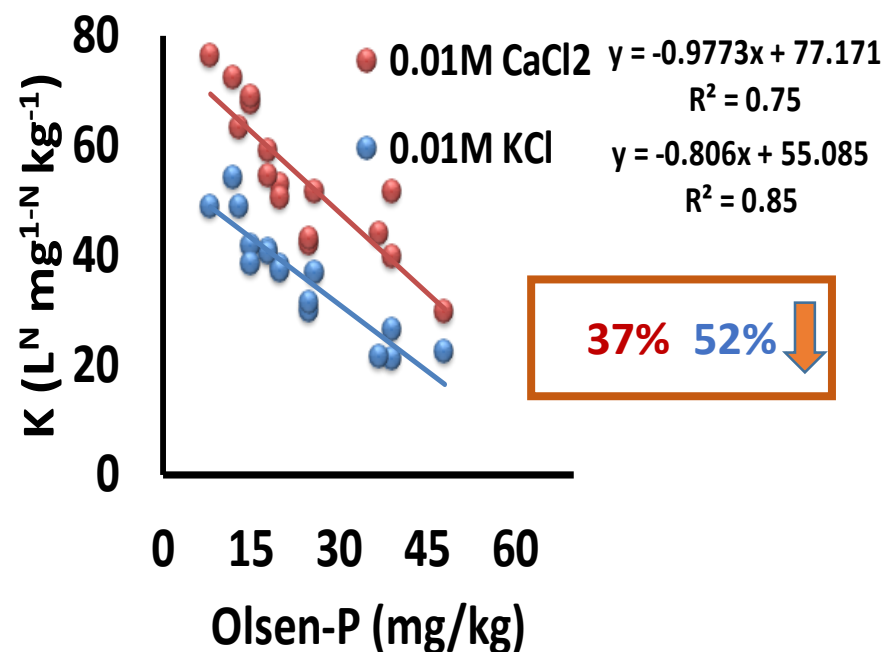
Low pH, high iron and aluminum oxides



Aged-P effect on Phosphorus sorption

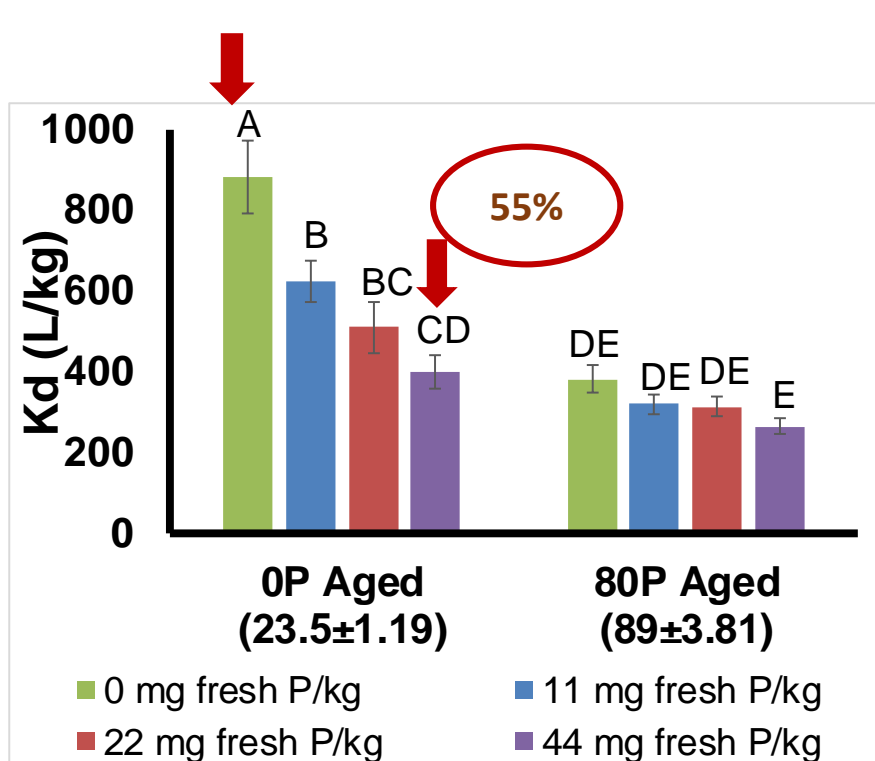


Carman Soil

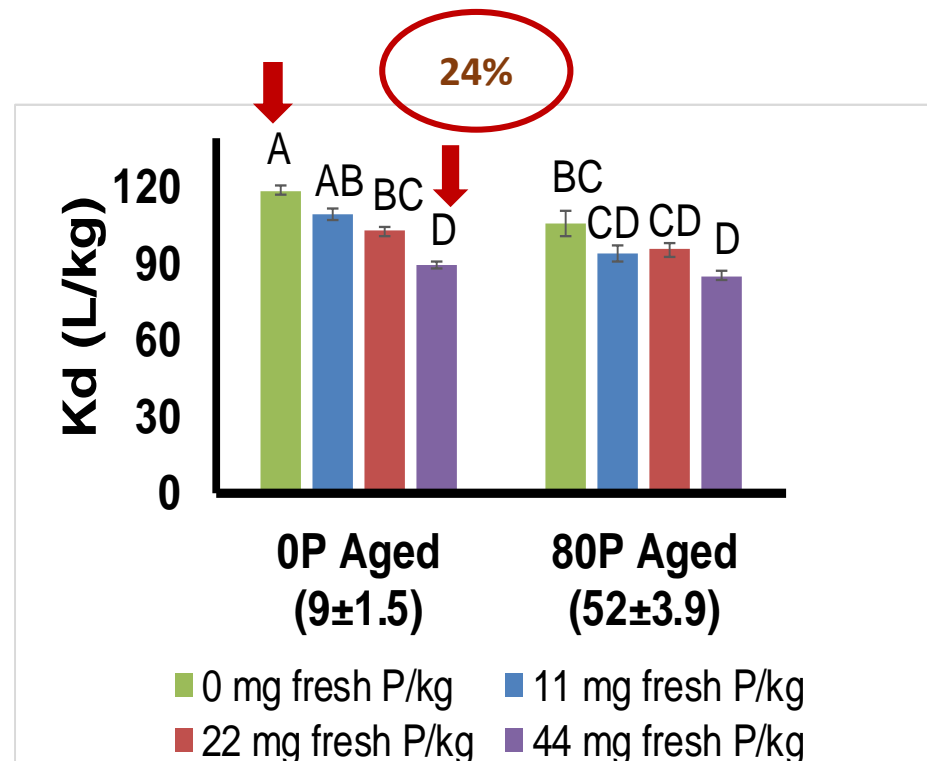


Forrest Soil

Fresh-P effect on glyphosate sorption



Carman Soil



Forrest Soil

Roundup Ultra 2 effect on Phosphorus sorption (mg/kg)

Phosphorus Level	Carman		Forrest	
	Roundup Ultra 2 level (mg/L)			
	0	100	0	100
0P plots	244 ± 20	228 ± 6	459 ± 21	427 ± 22
80P plots	229 ± 25	228 ± 12	450 ± 21	410 ± 30

- Glyphosate and phosphorus sorption was higher with background liquid CaCl_2 .**
- Long term application or co-application of fresh of phosphate fertilizer reduced the retention capacity of glyphosate and phosphorus.**

- ❑ Phosphorus sorption was not significantly impacted when Roundup Ultra 2 was added to batch slurries in the laboratory.**
- ❑ Differences in glyphosate and phosphorus K values between the soils resulted from differences in soil pH, calcium content, iron and aluminum oxide concentrations in soil.**

Acknowledgements

- I would like to thank Dr. Don Flaten, Dr. Cynthia Grant, Dr. Francis Zvomuya.
- I would like to acknowledge the University of Manitoba Graduate Fellowship Award, the Manitoba Graduate Scholarship Award, and NSERC. And Md. Mofizul Islam, Mulikat Bammeke , Rob Ellis, Summer students for their help.

A landscape photograph featuring a wide, flat field in the foreground, a line of trees in the middle ground, and a vast, dramatic sky filled with heavy, layered clouds. The text "THANK YOU!" is overlaid in the center of the image in a bold, blue, sans-serif font.

THANK YOU!

