Phosphorus Loss to Water from Animal Manures and Manure-Amended Soil

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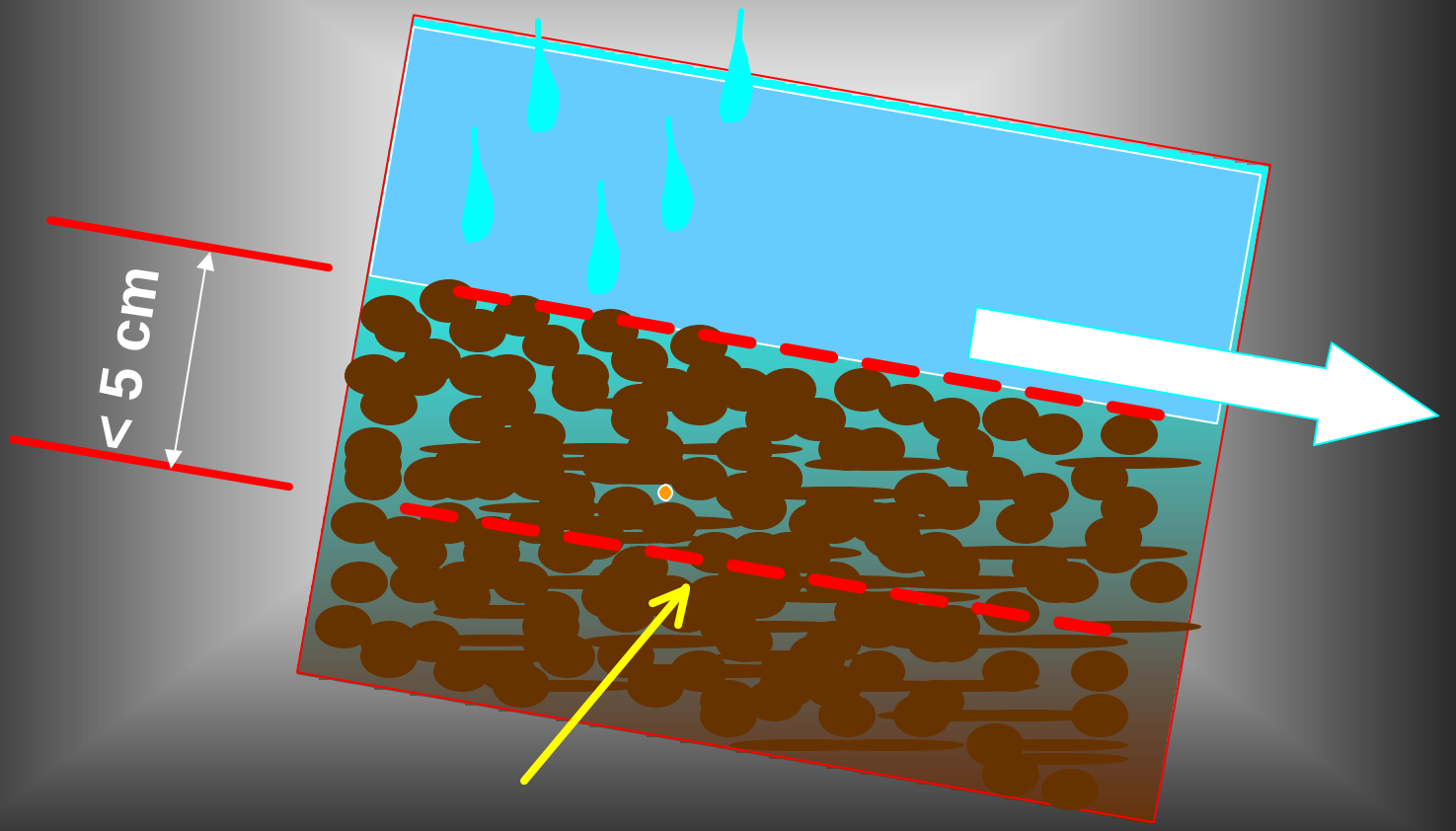
The problem we're trying to avoid

Our research focused on the potential for phosphorus from manures and manured soils to dissolve in water

P dissolves into saturated soil solution prior to runoff



Incubation 1

Plano silt loam surface soil

Low P soil = 12 ppm

High P soil = 30 ppm

Total Manure P application: 162 lb $P_2 0_5$ per acre

Dairy manure
0.6 % P
25 wet T
per acre

Poultry litter
1.7 % P
3 wet T
per acre

Dairy manure contained more than twice as much water-extractable P as poultry litter

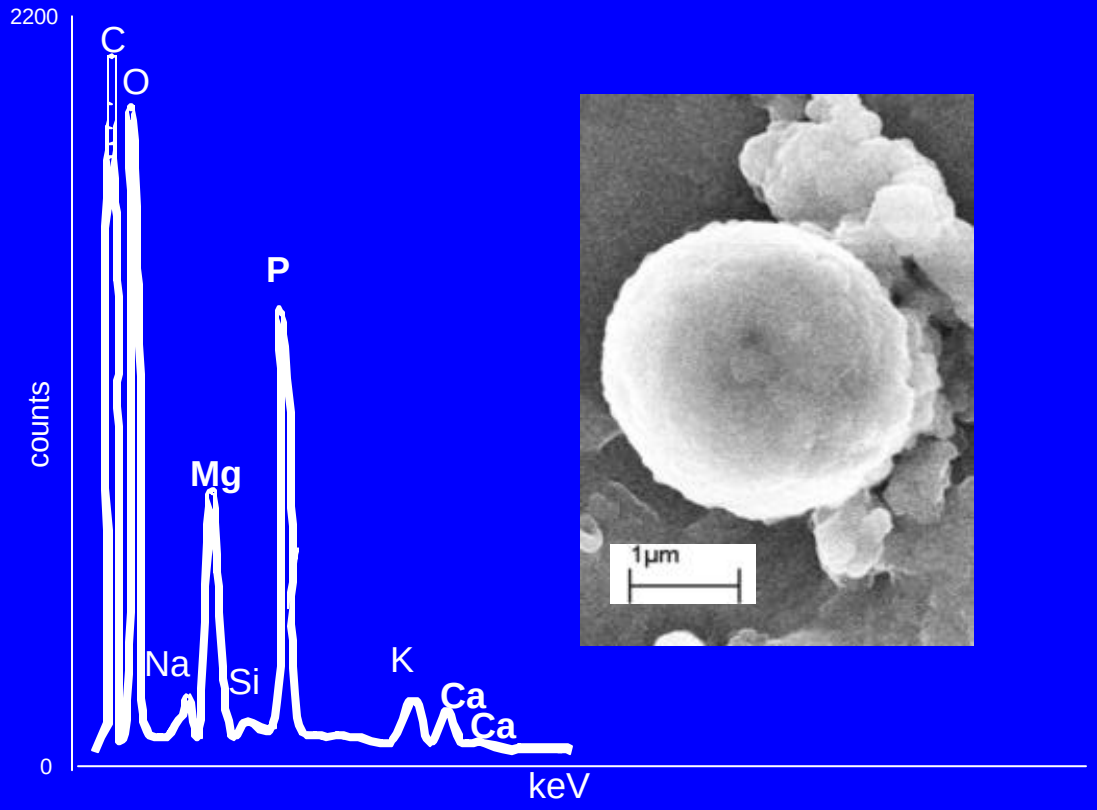
	Percent of total P that was extracted in water as reactive P	
Extraction procedure	Poultry	Dairy
1:100, 1 hour	12%	28%
1:1000, 18 hours	22%	61%

Highlights from 1st Incubation

- Highest concentrations of water extractable P from both manures in 1st 2 weeks only
- No difference between two STP soils and PL
- DM-High STP soil released twice the concentration of water extr. P compared to DM-Low STP soil
- Two manures behaving very differently when applied to same soils at same total P rate

Poultry litter particle on 5-µm filter

21 of 25 particles examined in the 5-35 µm size class were primarily Ca-Mg-P



Incubation 2

Soils: Plano silty clay loam surface soil

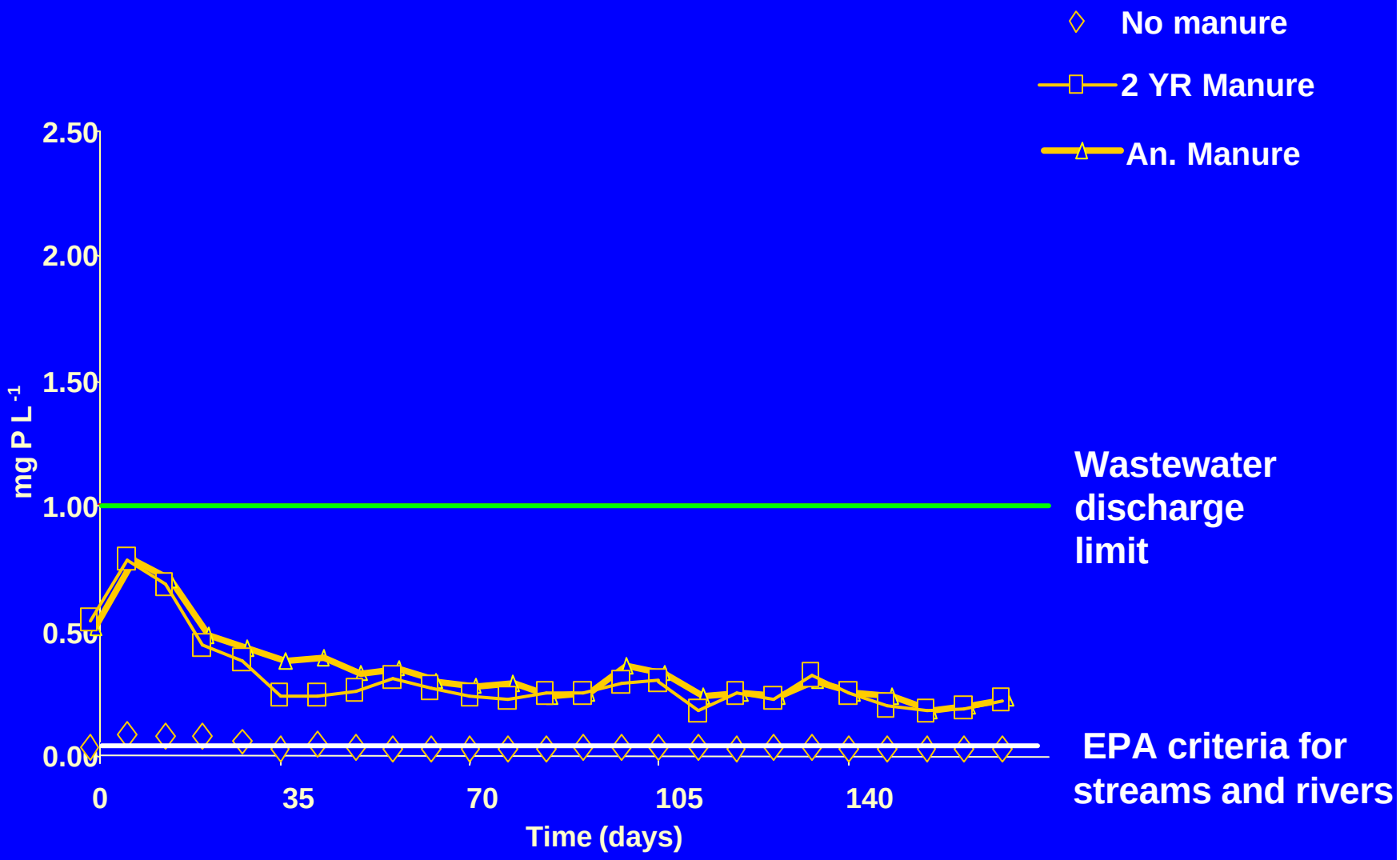
- NoM: No previous manure, 32 ppm
- 2yrM: 40 tons/acre/yr dairy manure 1994 and 1997, 76 ppm
- AnM: 40 tons/acre/yr dairy manure 1994 - 1999, 85 ppm

Amendments

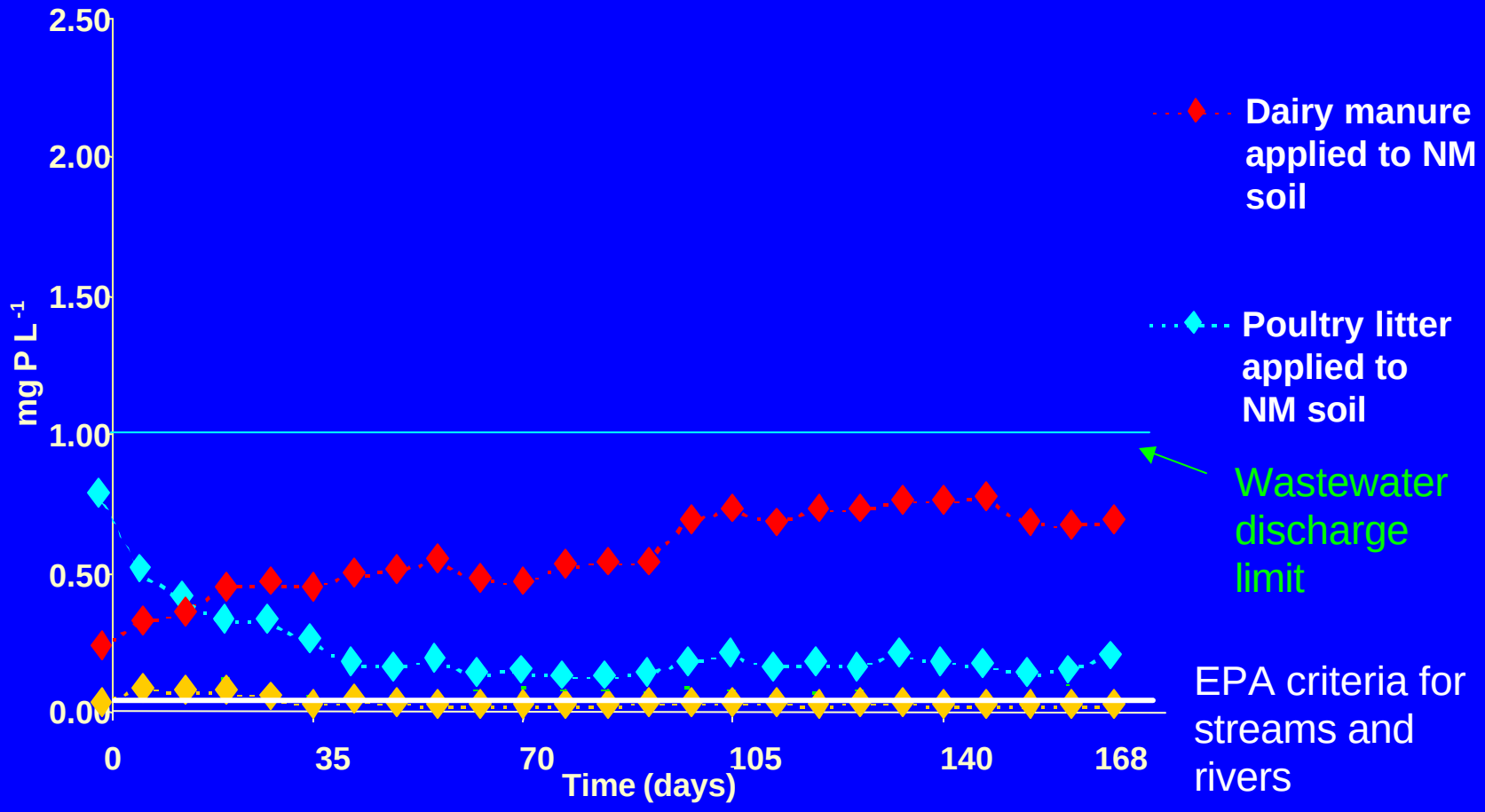
- DM: Dairy manure – 110 lb P_2O_5/acre
- PL: Poultry litter – 110 lb P_2O_5/acre
- CaP: Calcium phosphate mineral P – 55 lb P_2O_5/acre

Twelve treatments, four replications per treatment.

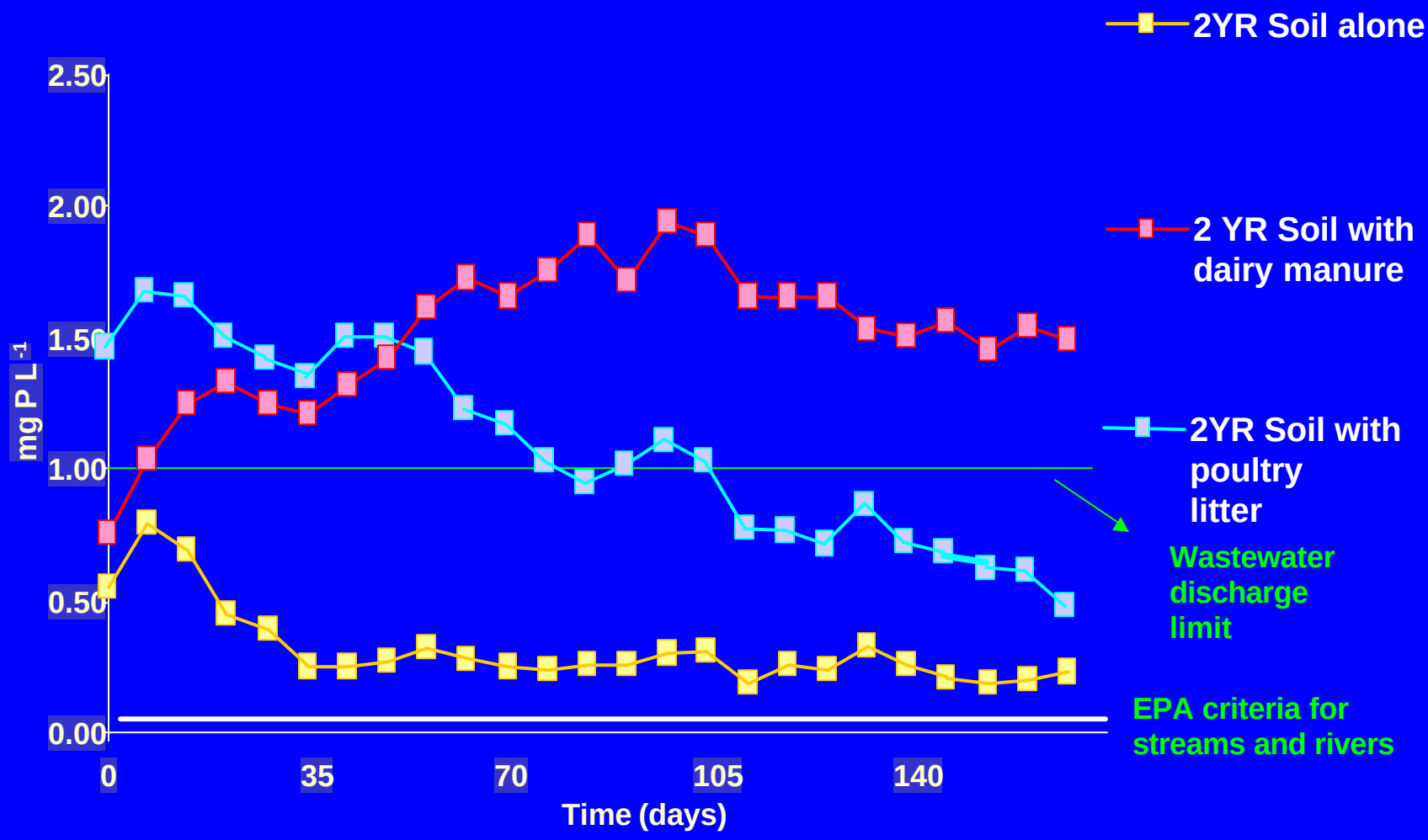
Water P concentrations from incubated unamended soils



Water-P concentrations with 25 tons per acre dairy manure or 2.5 tons per acre broiler litter



Water P concentrations from previously manured silty clay loam soil with new manure applications



Overall Summary

- Poultry litter contained sparingly soluble mineral phosphates; acts like slow release fertilizer; DM does not.
- Water soluble P remains elevated in dairy manure amended soils, especially when re-amended with manure.
- Manure P and soil test P may not have an additive effect on soluble P loss to surface waters
- Consider manure amendment history rather than STP in evaluating risk of P loss to surface water

Potential management implications for poultry litter

Applications to cropland:

Incorporate to reduce losses to water of easily suspended particles.

Interventions to reduce P solubility:

Adjust poultry diet, litter conditions to encourage formation of Ca-Mg-phosphates.

Potential management implications for dairy manure

Applications to cropland:

Consider dairy manure P to be mostly soluble at time of application.

Promote infiltration as the solution to reducing P in runoff from dairy manure amended soils.