

**Assessing Reduction of Nonpoint
Source Phosphorous Runoff
From Land Application of Biosolids
Treated
With Water Treatment Residuals**

Project # FY 07-200

Project Leaders

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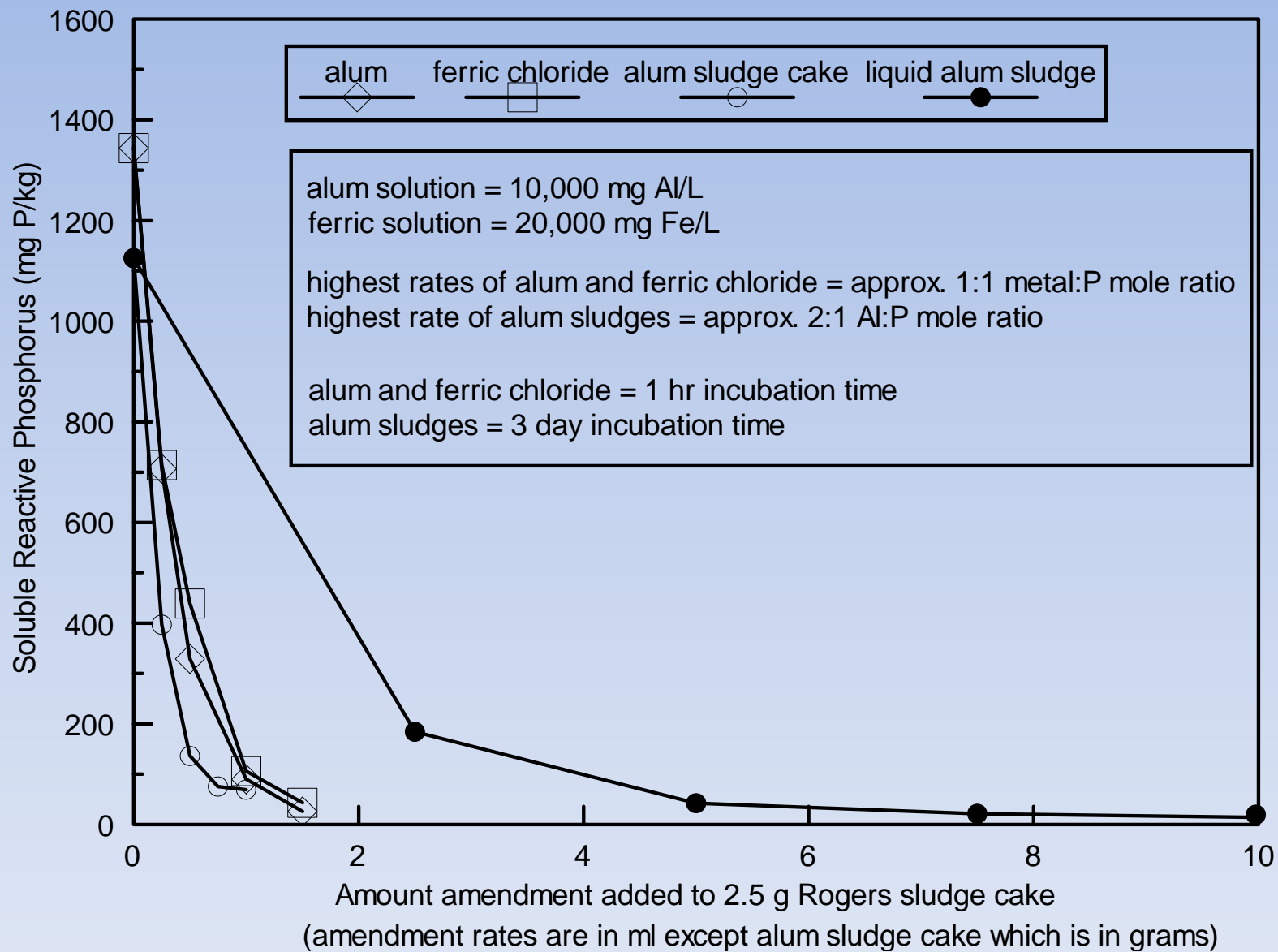
USDA/ARS - Poultry Center of
Excellence for Poultry Science

Background

- Non-point source Phosphorus
 - Problematic as considered the limiting element in eutrophication
 - 80-90% of phosphorus in runoff water from land fertilized with animal manures or biosolids is dissolved reactive phosphorus
 - Reactive phosphorus is readily available for uptake by algae and other nuisance growth

Background

- Protective rates for nutrient applications in nutrient surplus areas
 - Forced area WWTPs to landfill instead of land application
- Phosphorus Index development for biosolids
 - Alum sludge from water treatment facilities evaluated for effects on P solubility
 - Alum sludge currently being landfilled



Background

- Laboratory tests indicated that both liquid and dewatered alum sludge can reduce soluble P in biosolids
- Preliminary small scale studies indicated a reduction of soluble P in runoff of approximately 50%

Research Goals/Objectives

- The purpose of this project is to demonstrate the efficacy, cost-effectiveness, practicality and sustainability of treating biosolids (sewage sludge) with water treatment residuals (alum sludge) for land application and reduction of NPS phosphorus in runoff.

Research Goals/Objectives

- Determine optimum dosage rates for both liquid and dewatered alum sludge
- Determine the limits of soluble P reduction
- Determine the effects on forage production
- Evaluate potential savings to infrastructure

Methods

- Small plot rainfall - runoff simulations
 - Samples taken prior to fertilization (background)
 - Biosolid – alum sludge mixtures applied
 - Rainfall simulation (2" per hour storm)
 - Samples taken and analyzed
 - Process repeated on same plots after
 - 1 week
 - 3 weeks
 - 9 weeks

Methods

- Watershed level demonstrations
 - Three watersheds constructed
 - Hydrologically isolated
 - Flumes and automatic samplers installed
 - Background sampling performed
 - Biosolids alone applied to one watershed
 - Biosolids and “optimum” rate of alum sludge applied to one watershed
 - No application of any substance to third

Methods

- Watershed Level Demonstrations
 - In the event of runoff generating rainfall events
 - Runoff volumes measured
 - Samples taken for analysis
 - Forage growth periodically evaluated

Work Plan and Progress

- Develop QAPP and receive approval
 - November 2007 – January 2008
 - Final approval by EPA February, 2008

Work Plan and Progress

- Conduct rainfall simulation studies
 - April 2008 – August 2008
 - Delayed by unseasonably rainy spring and summer
 - Started simulations first week of August
 - Work in progress
- Sample soils and runoff from simulations
 - In progress











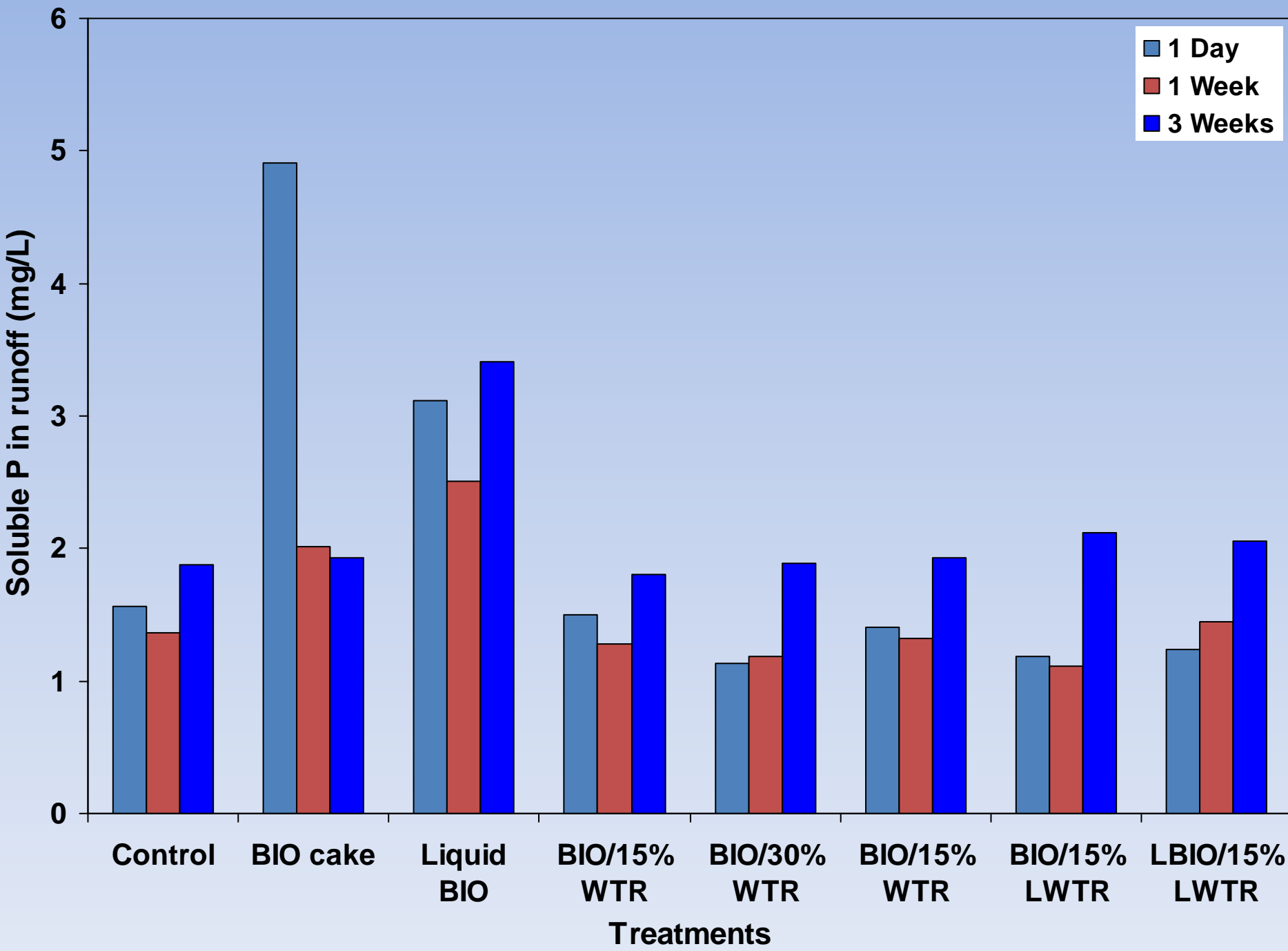


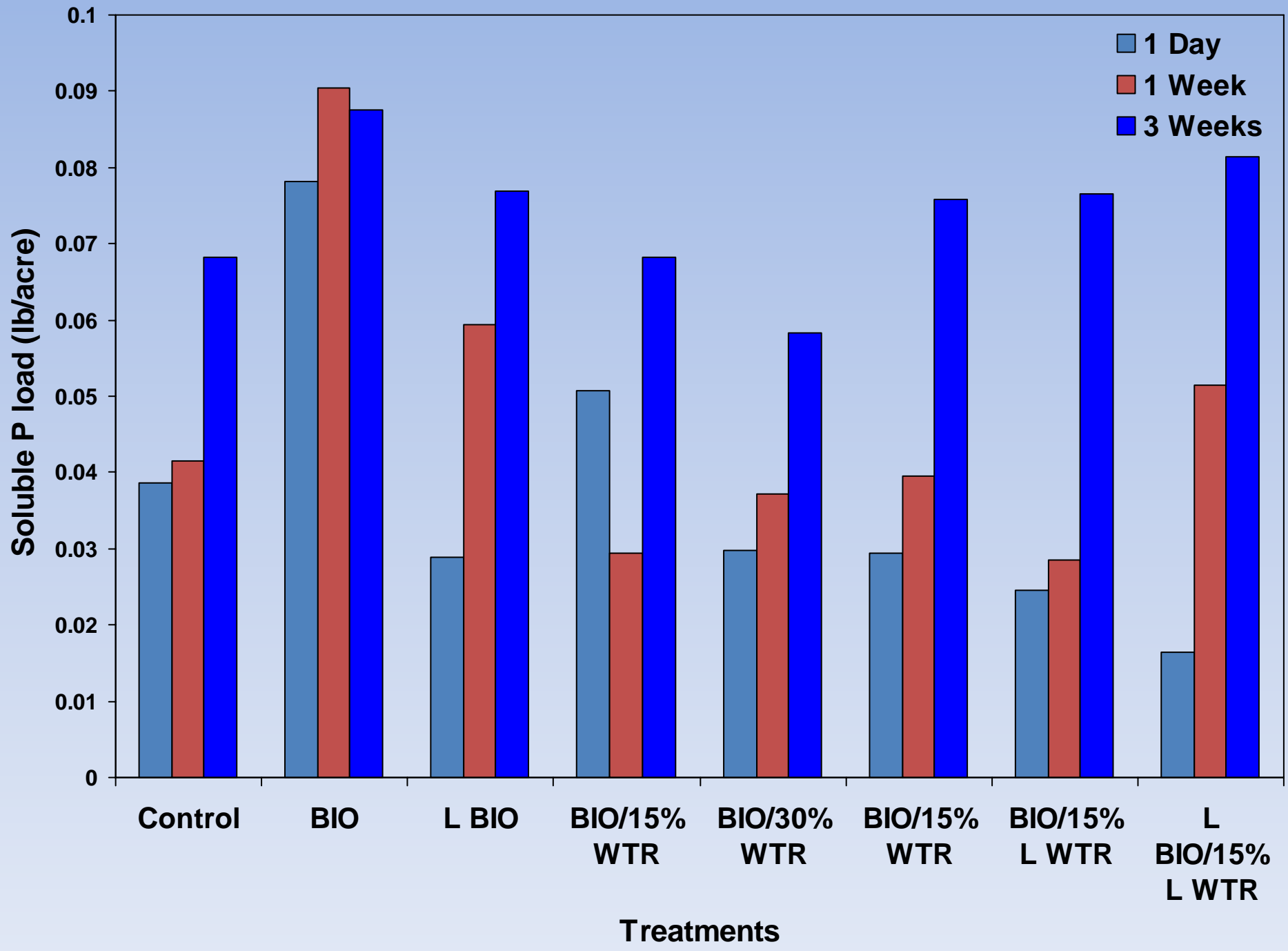


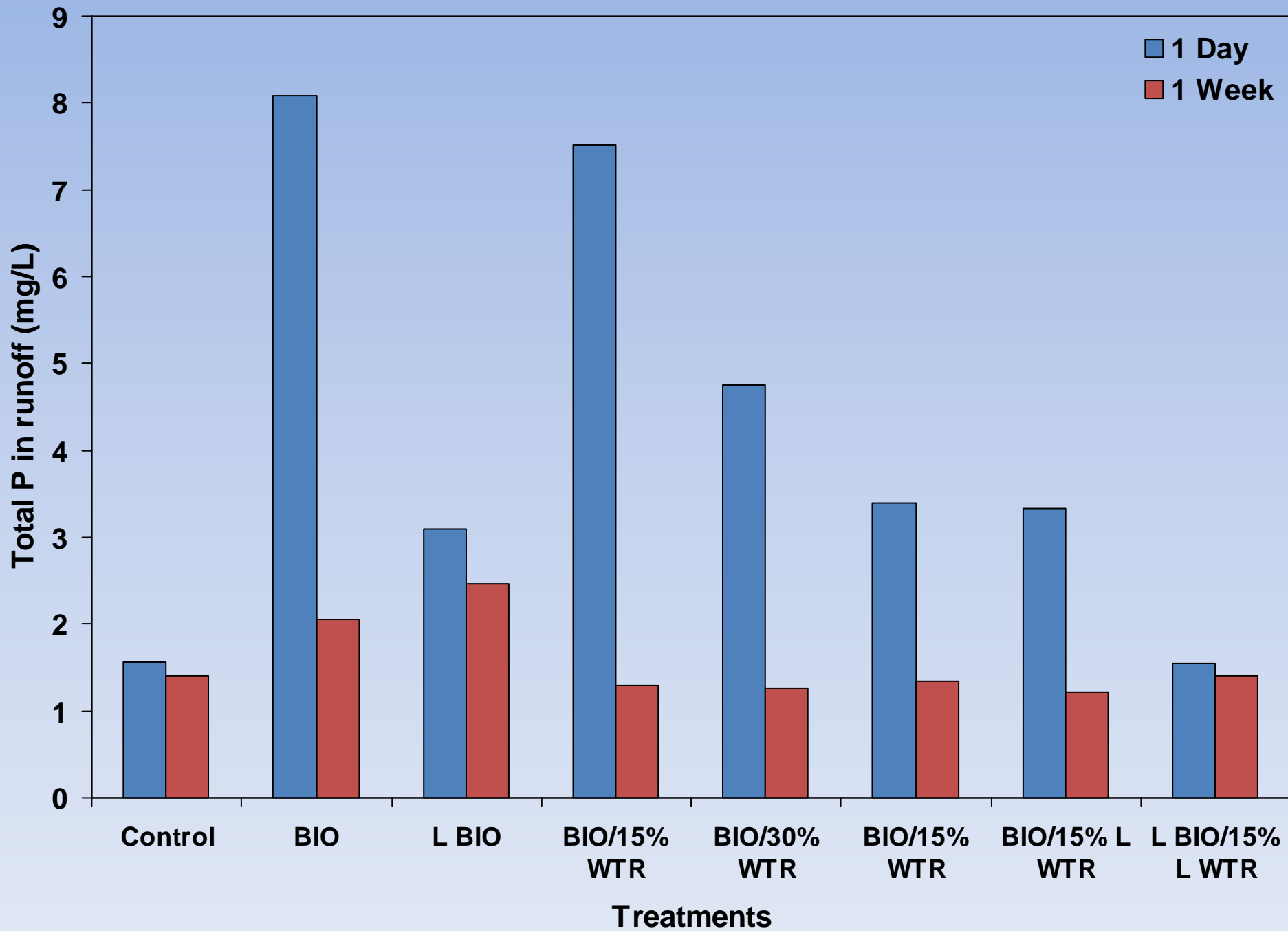
P, Al, Fe content of treatments (mg kg⁻¹)

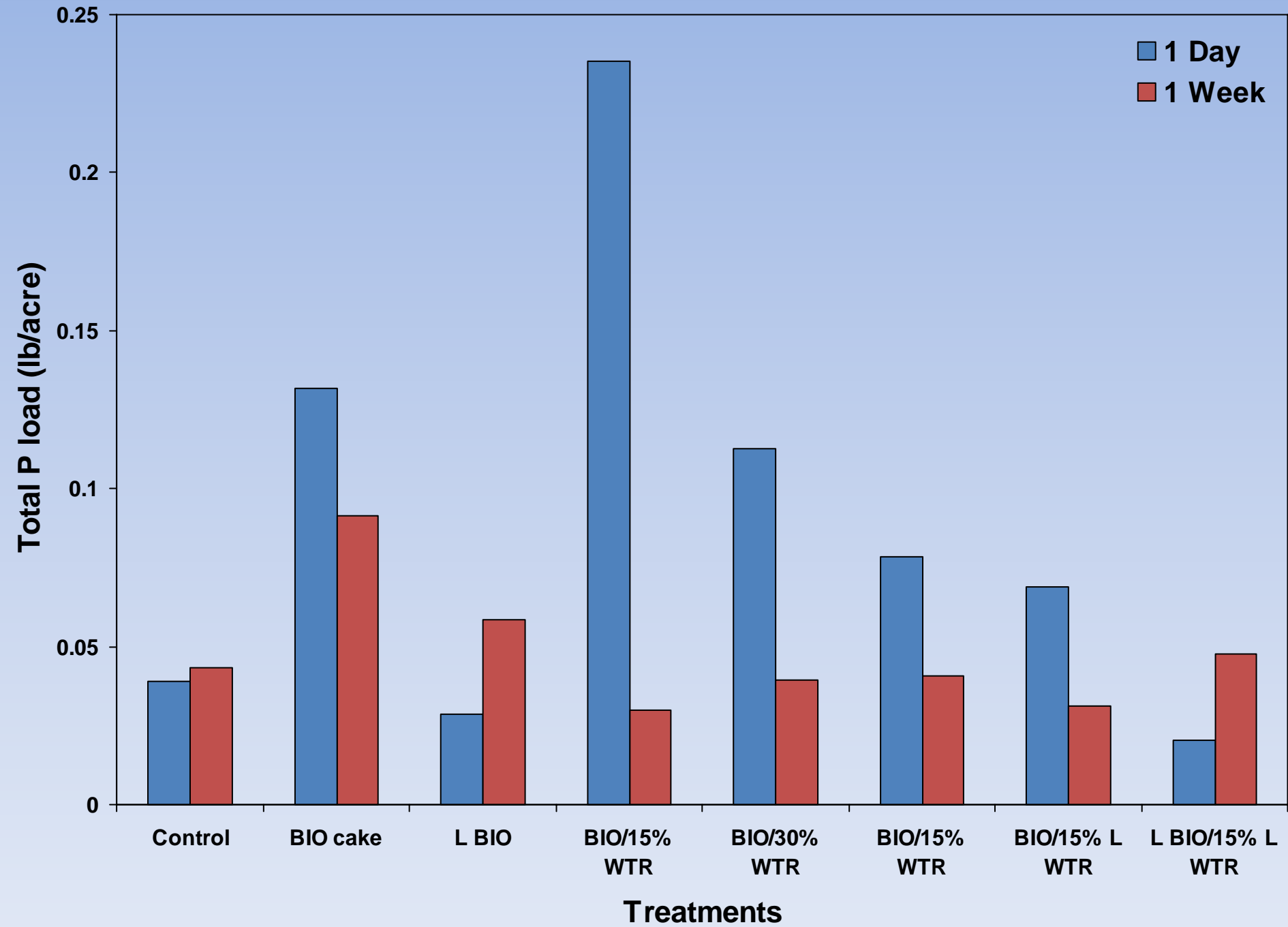
Treatment	Soluble P	Total P	Total Al	Total Fe
Biosolid Cake	1983	ADL	16298	ADL
Liquid Biosolid	4616	21258	8945	9437
Biosolid Cake + 15% Al-WTR (premixed ~3 weeks before app.)	155	19755	ADL	ADL
Biosolid Cake + 30% Al-WTR (premixed ~3 weeks before app.)	128	13917	ADL	ADL
Biosolid Cake + 15% Al-WTR (premixed 1 day before app.)	76	20675	ADL	ADL
Biosolid Cake + 15% Liquid Al-WTR	84	22030	46424	ADL
Liquid Biosolid + 15% Liquid Al-WTR	96	24438	44113	13698

ADL = Above detection limits









Work Plan and Progress

- Construct watersheds for field scale studies
 - February 2008 – May 2008
 - Delayed by unseasonably rainy spring and early summer months
 - Earthwork completed in early June
 - Samplers and flumes acquired and installed in July
 - Soil samples for background taken
 - Runoff sampling for background in progress























Work Plan and Progress

- Determination of optimum application rate in progress from small scale simulations
- Will apply biosolids and biosolid-alum sludge mix by the end of November
- Currently scheduled to present preliminary results (as available) to SWAWWA in October and AWRA in November
- Reporting requirements satisfied to date

Work Plan and Progress

- To Do List
 - Finish up small scale simulations and associated sampling & analysis
 - Determine optimum sludge mixture
 - Continue watershed/field scale studies including sampling and analysis
 - Cost analyses
 - Technology transfer
 - Reporting as required
 - Final report due in May 2010

Challenges

- Mother Nature
 - Unseasonably wet weather put us around a month or two behind schedule (temporarily)
 - Should be able to compensate
- No other critical issues to date
- This project is going smoothly thanks to:

Kudos & Thanks

- Sue Filat-Alami
- Jeff Hall
- Philip Moore
- Phillip's crew and lab
- Mo Shafii @ADEQ
- Duyen Tran @ OMI
- Beaver Water

QUESTIONS

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