

BMP Research Report: Floating Aquatic Vegetation Impact on Farm Phosphorus Load



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*Long Term Planning Meeting
SFWMD, May 22, 2015*

Presentation Outline

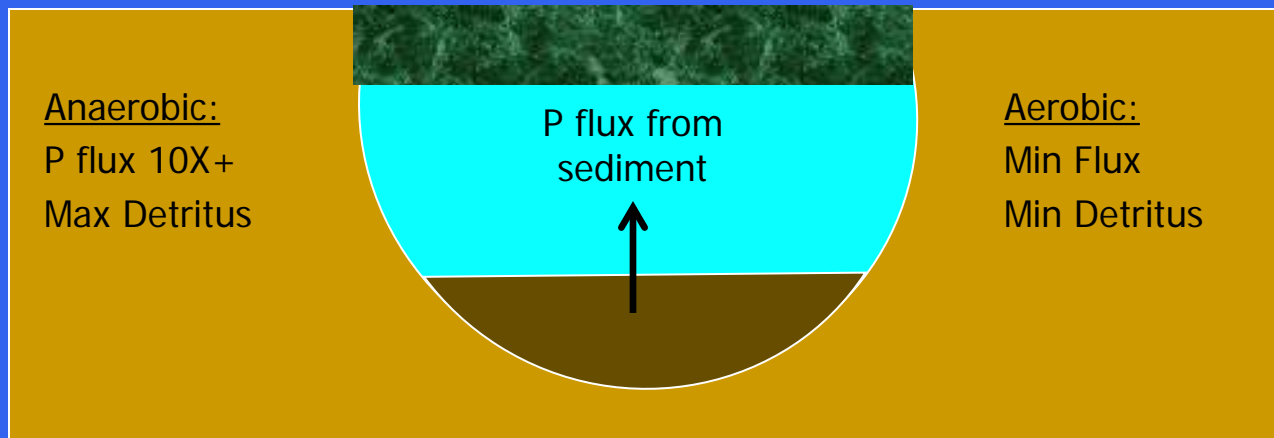
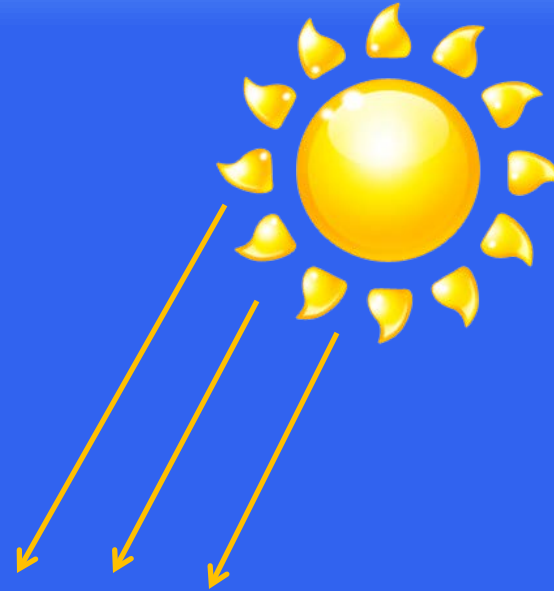
- Introduction
- Project Update: Floating Aquatic Vegetation (FAV)
Impact on Farm P Load
 - FAV Biomass
 - Farm Treatment and Control Selection
 - Farm Drainage Water
 - Farm Canal Sediments
- BMP Training Overview and Accomplishments
- Project Personnel / NELAC

Floating Aquatic Vegetation Impact on Farm Phosphorus Load



FAV Project Update

Experiment Rationale



FAV Project Update

Objectives

1. Evaluate FAV management practices in the EAA farm canals for impact on
 - a) farm drainage water phosphorus (P) load
 - b) P speciation of farm drainage water
 - c) canal sediment properties
2. Use research results to develop a BMP for managing FAV in farm canals that further lowers farm P loads.

The goal is to provide growers an additional tool in their efforts to reduce off-farm P loading in the Everglades Agricultural Area.



FAV Project Update

Methods

Paired farms study (4 pairs)

- Two pairs each in S-5A and S-6 sub basins
- 2-yr calibration and 3-yr treatment periods
- Calculate changes after initiation of practices
- Improved vs. typical FAV control practices



FAV Project Update

Farm Descriptions and Locations

S-5A Sub-basin

Farm 0401: 908 acres- cane w/corn

Farm 2501: 823 acres- cane w/corn

Farm 1813: 594 acres- cane w/corn

Farm 6117: 800 acres- cane

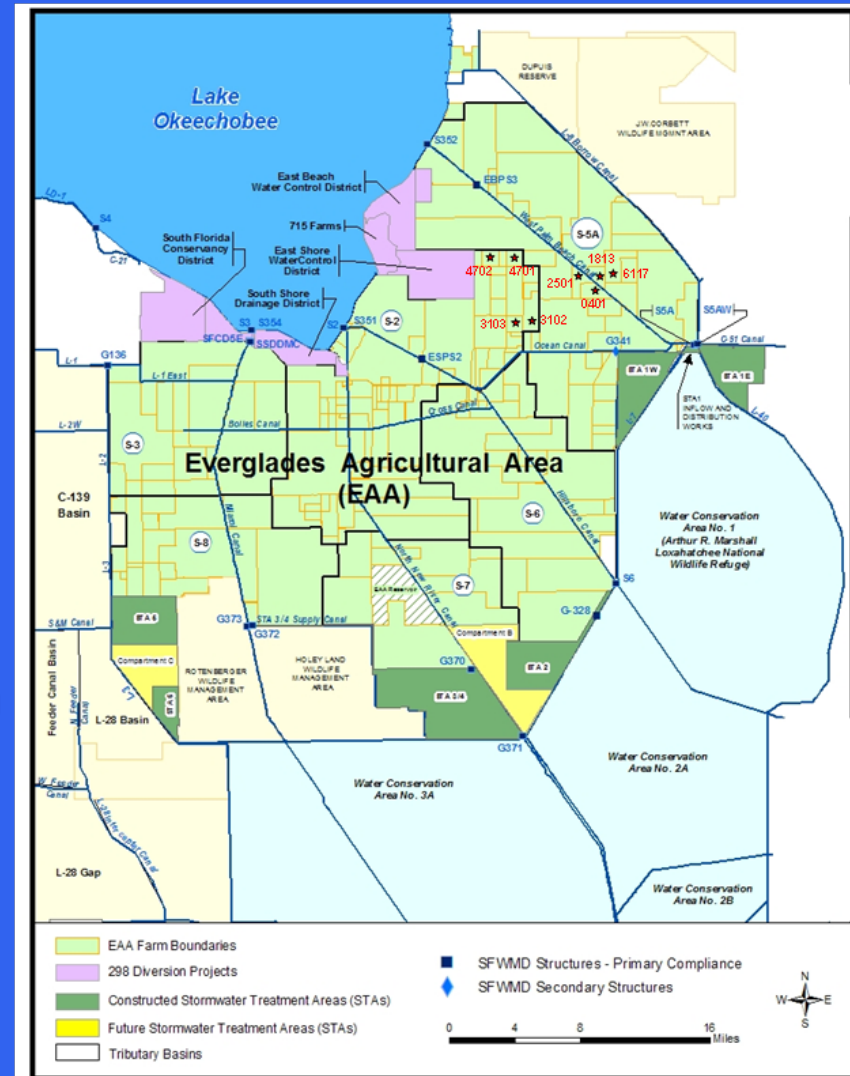
S-6 Sub-basin

Farm 3102: 1608 acres- cane w/corn

Farm 3103: 602 acres- cane+veg w/corn

Farm 4701: 630 acres- cane

Farm 4702: 640 acres- cane w/rice



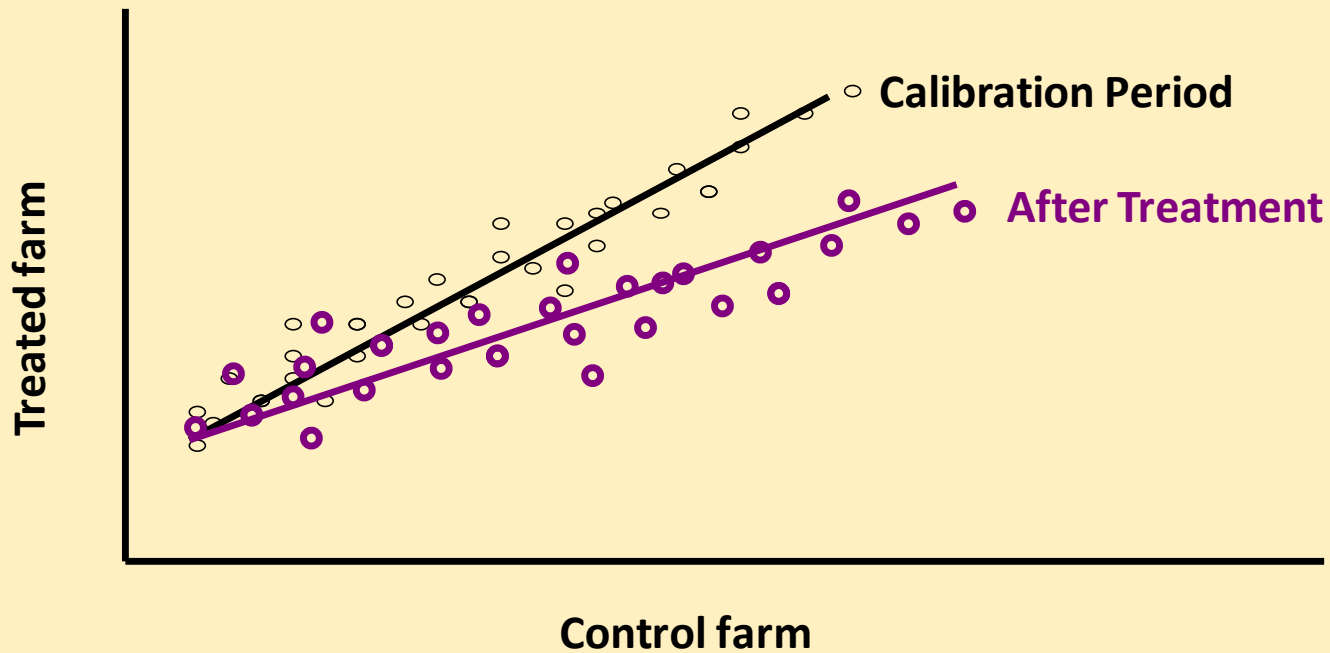
Example: Farm Pair Aerial View



FAV Project Update

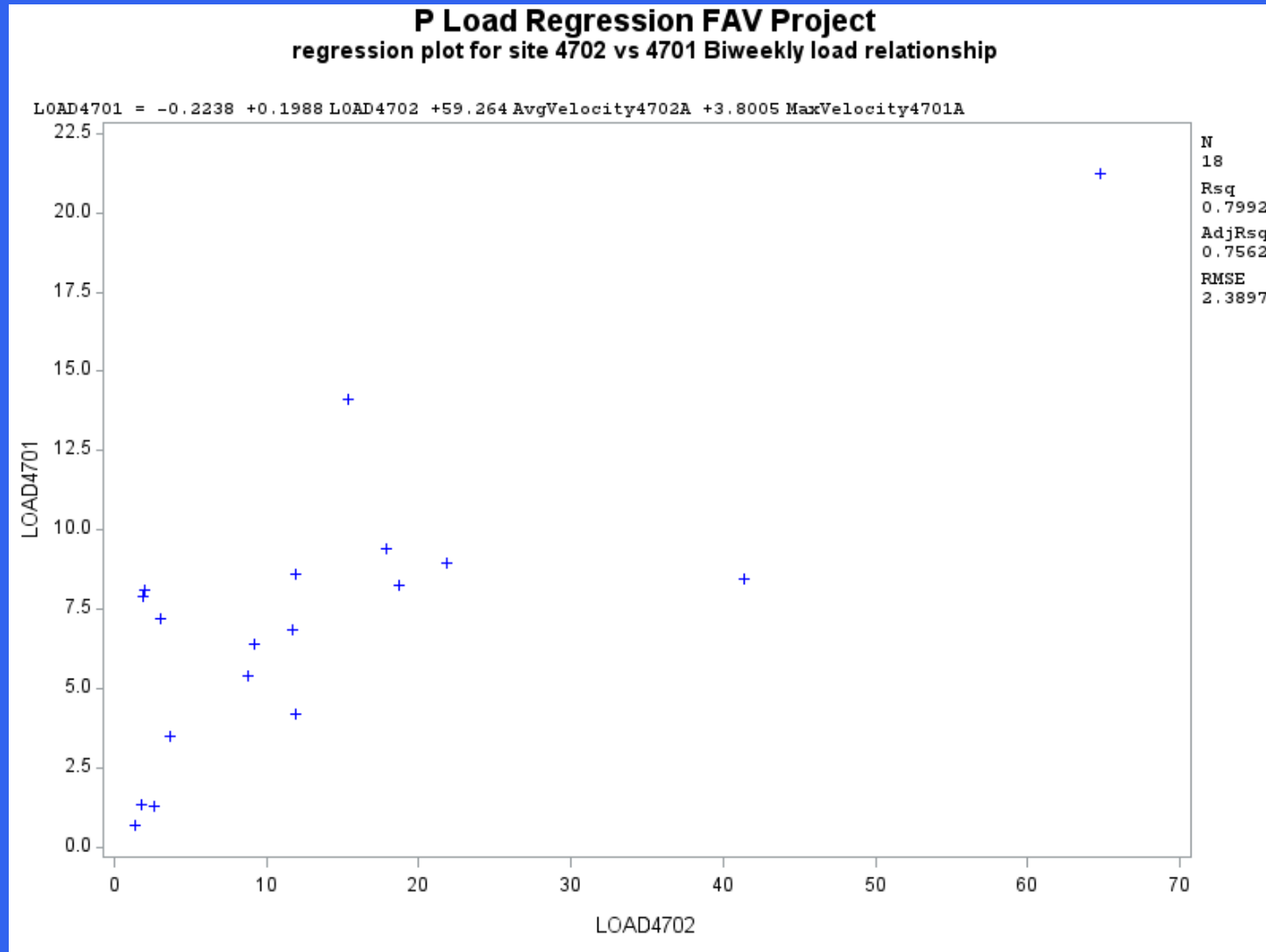
Comparative Regression Analysis For P Load

$$\text{Treated}_i = b_0 + b_1 (\text{Control}_i) + e$$



Calibration P Load Regression

Farm Pair 4701/4702 Biweekly



FAV Project Status

- Treatment Farms: 3103 0401 6117 4702
- Control Farms: 3102 2501 1813 4701
- Treatment Initiation: May 1, 2013 for 3 farm pairs
- Treatment Initiation: May 1, 2014 for farm pair 4 (4701/4702)
- Monitoring of FAV growth
- Biweekly spot spraying if needed, with approved aquatic weed herbicides

FAV Project Update

Data Collection

FAV Biomass:

Species composition, Aerial Coverage, P Content, Biomass

Drainage Water:

Flow volume, velocity

TP/TDP/SRP (PP/DOP), Ca, DOC, pH, TSS

Ambient Canal Water:

TP/TDP/SRP (PP/DOP), Ca, DOC, pH, TSS

Hydrolab *in situ*: Temp, DO, ORP, SpCond

Canal Sediments:

TP, Wet Density, Dry Density, OM (LOI), ash content

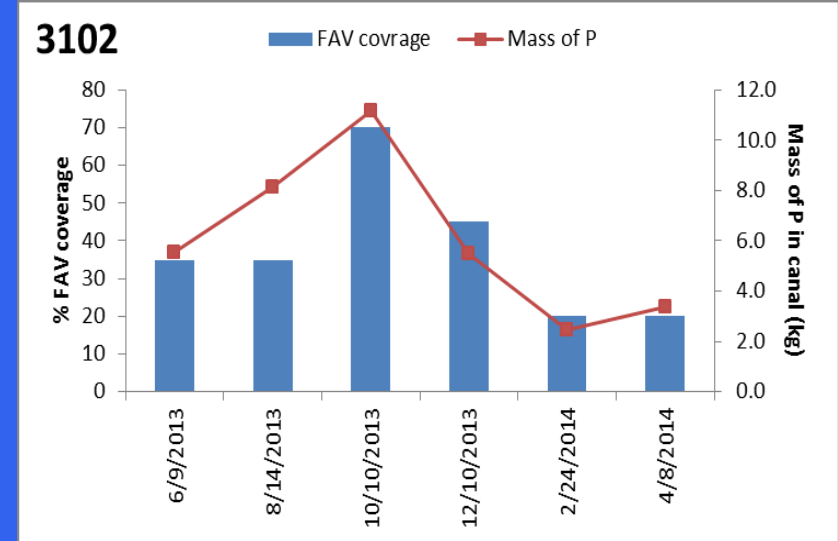
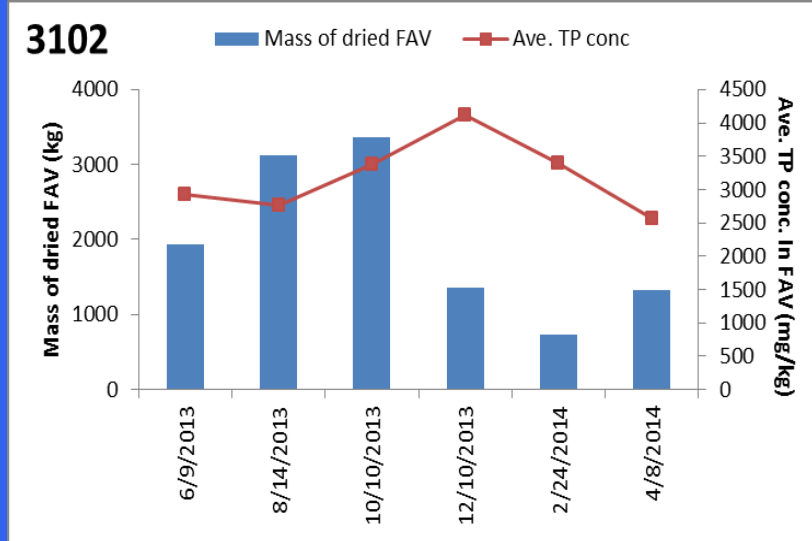
Sediment depth surveys

P fractionation

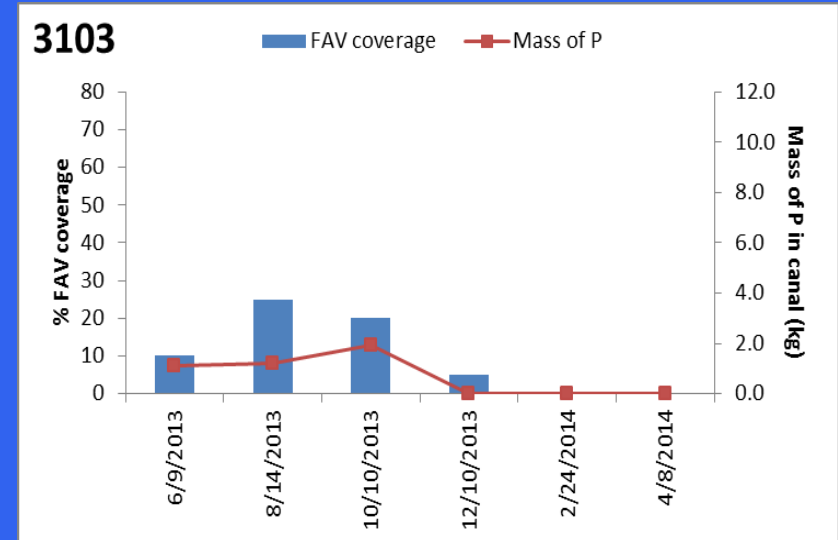
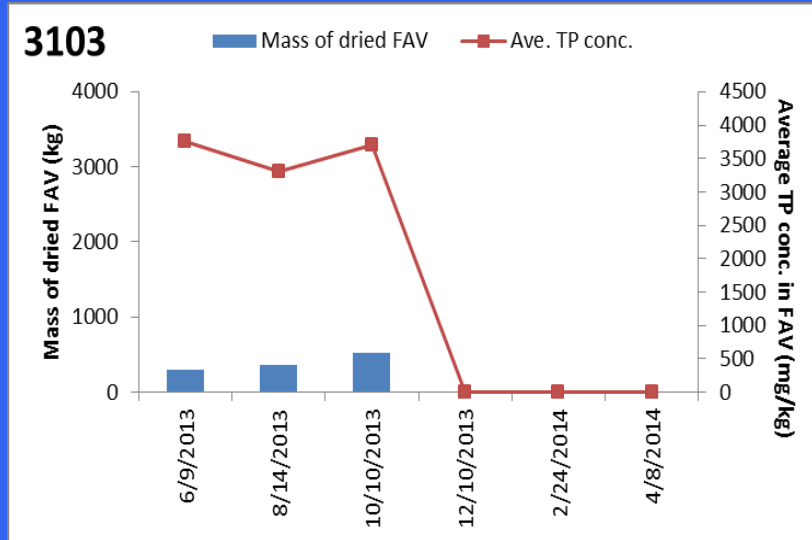
FAV Project Update

FAV Coverage and Biomass

Control

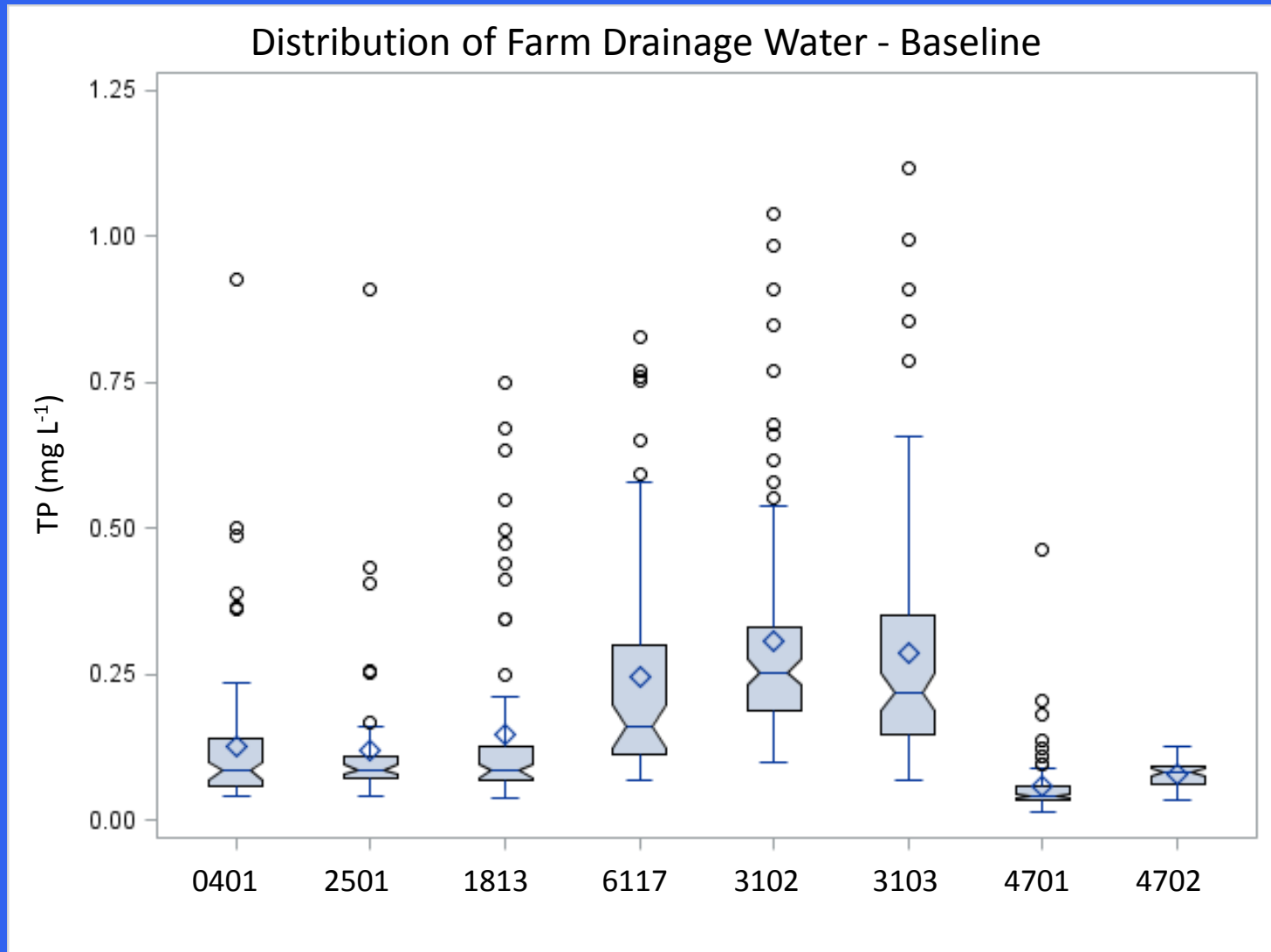


Treatment



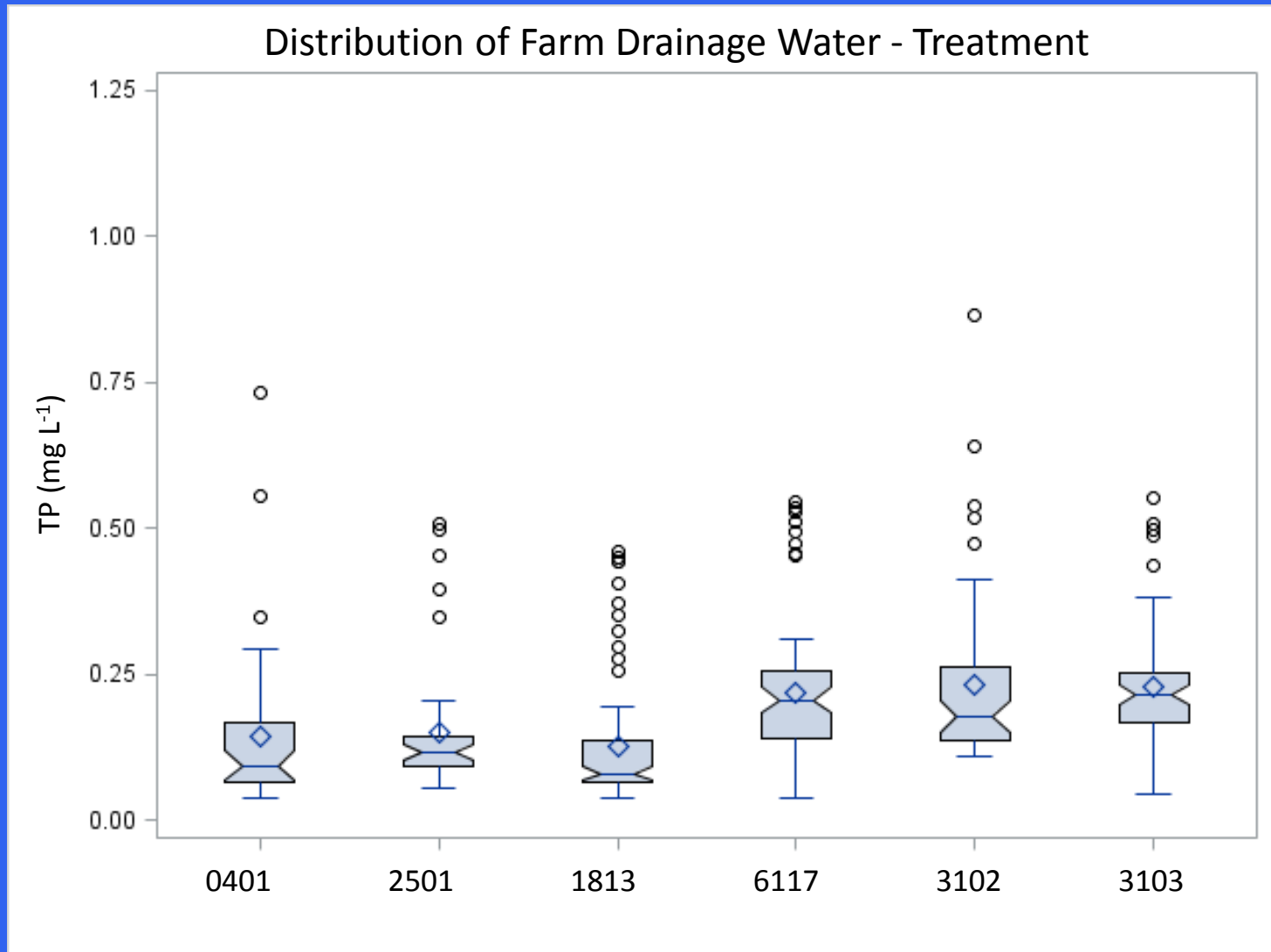
FAV Research Project

Farm Drainage Water – Calibration period



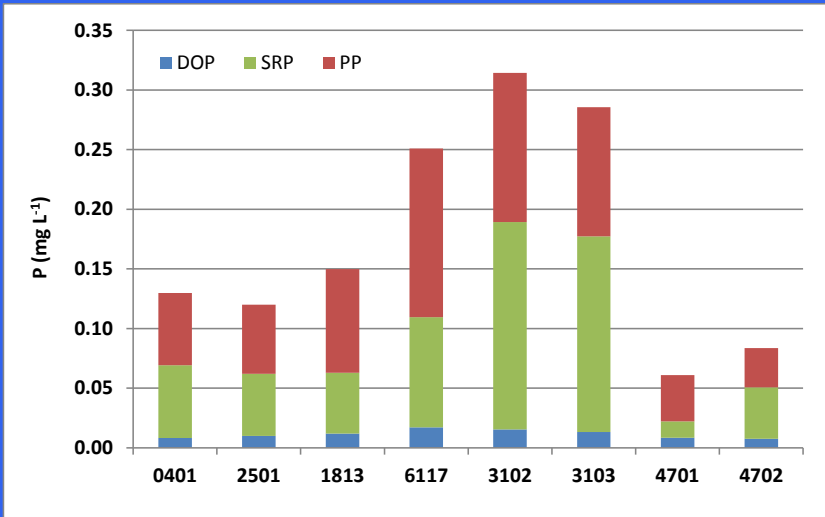
FAV Research Project

Farm Drainage Water –after 1 year of treatment

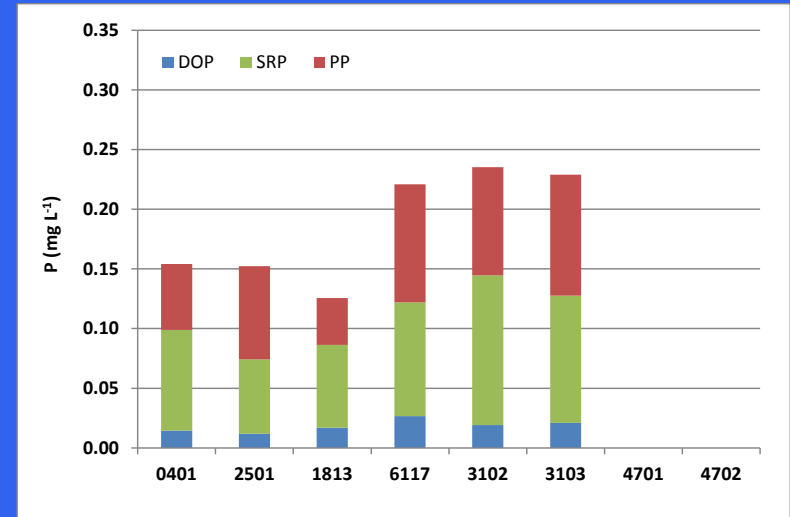


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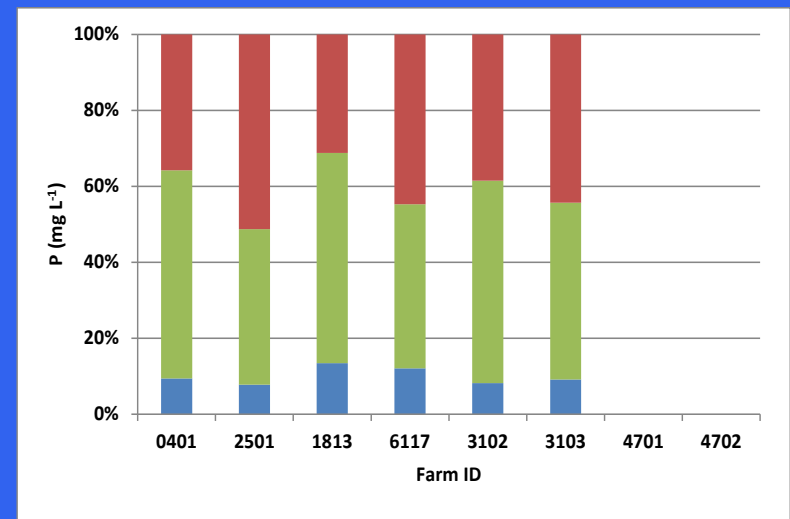
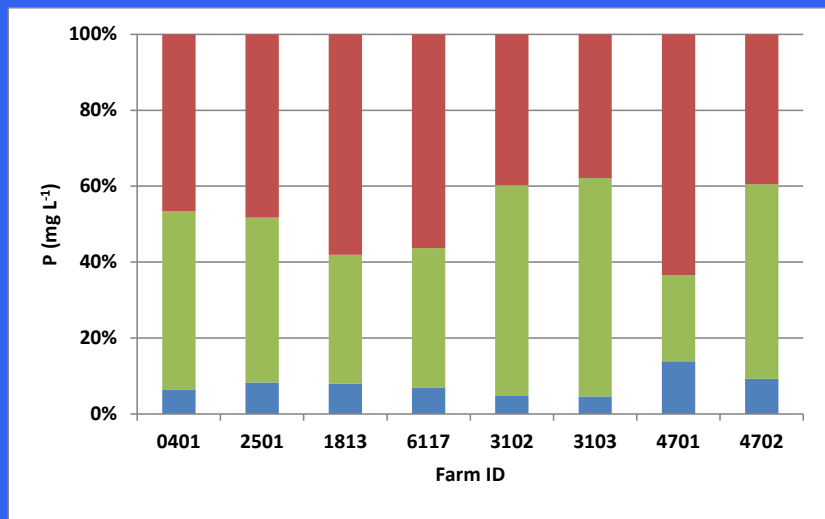
Farm Drainage Water



Calibration Period

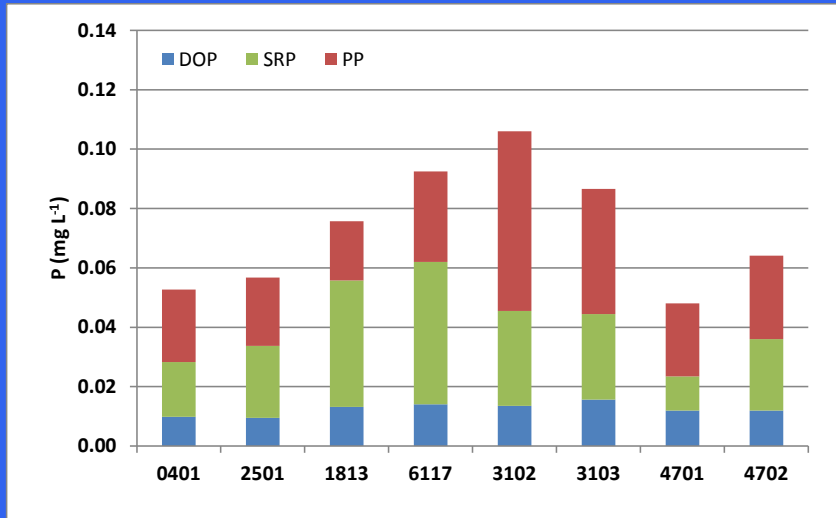


Treatment Period

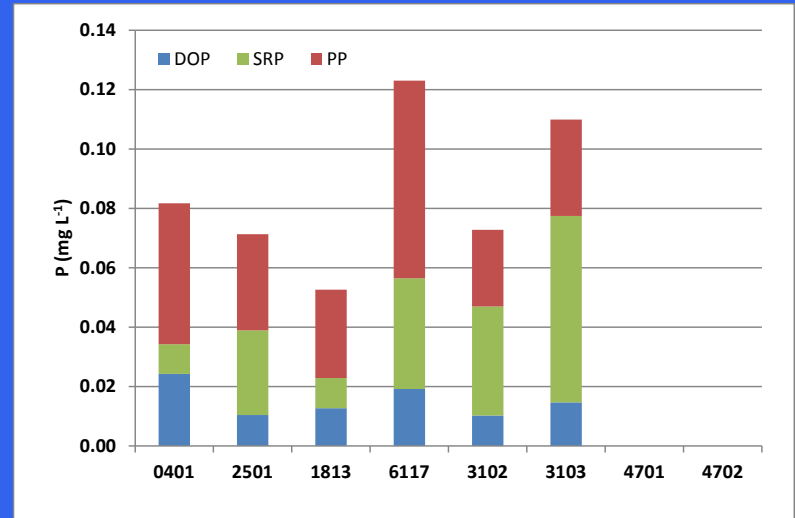


FAV Research Project

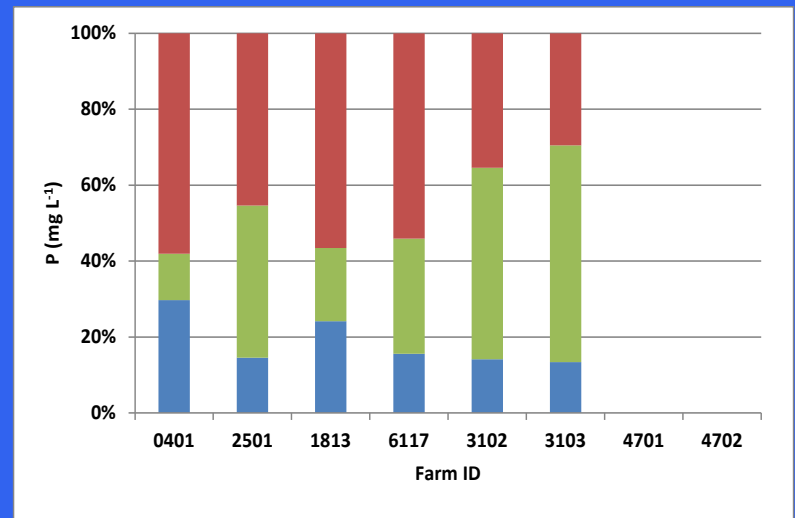
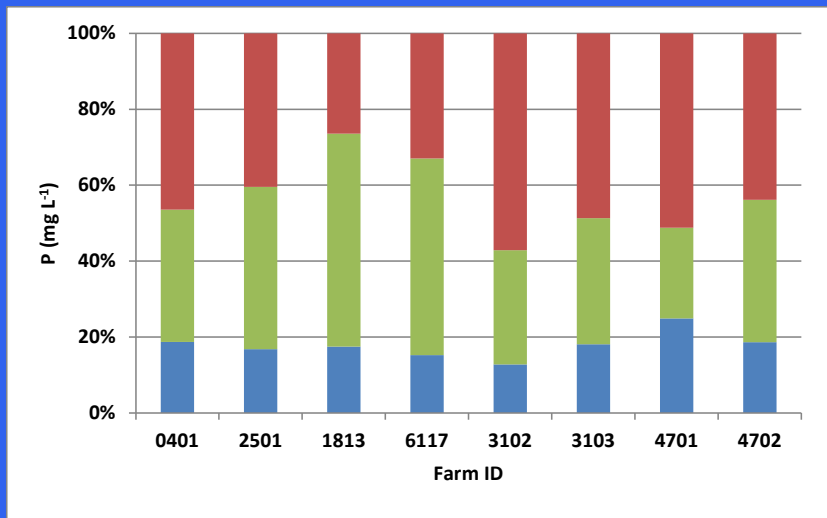
Ambient Canal Water



Calibration Period



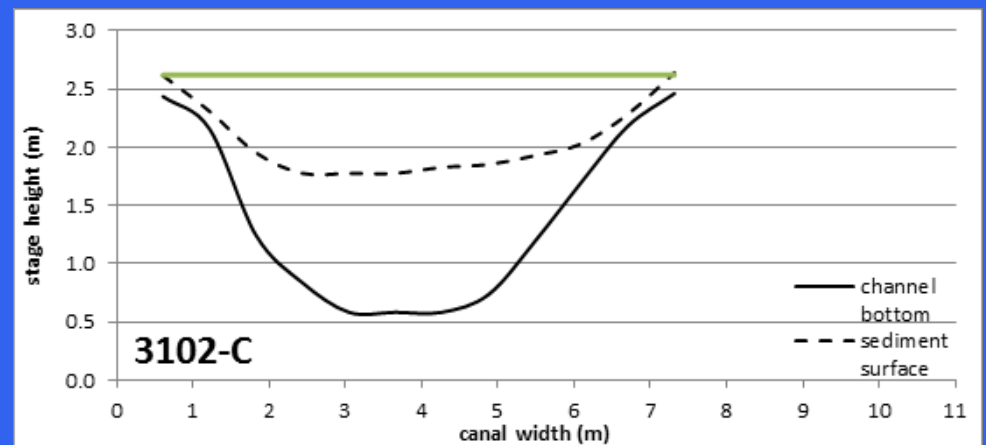
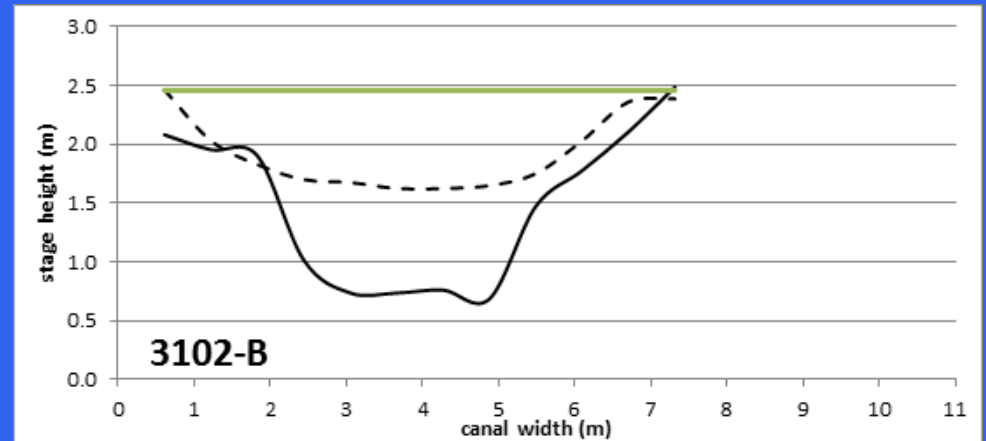
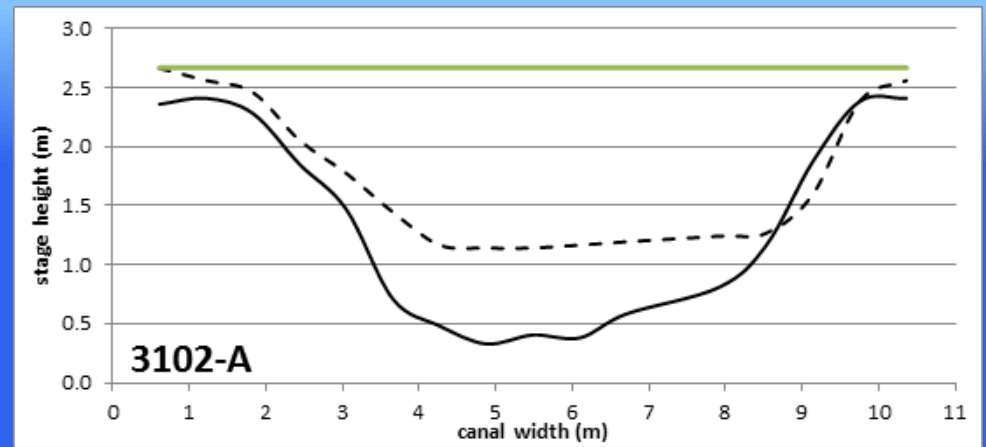
Treatment Period



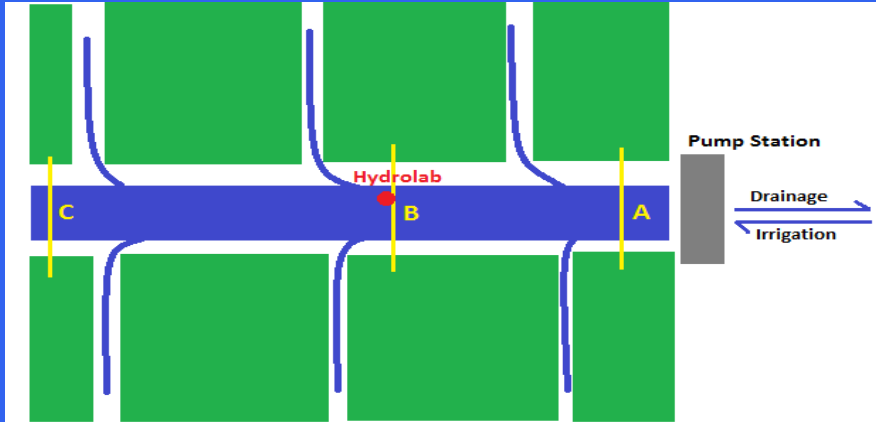
FAV Research Project

Sediment Surveys

Sediment profile of main canal of farm 3102 at three transects, A, B, and C, surveyed in April 2014. Green line corresponds to height of water.



P-Fractionation



Step

1

1 M KCl
2 h

Labile P

2

0.1 M NaOH
17 h

Fe-Al Bound

3

0.1 M NaOH
Digested

Humic/Fulvic Acid Bound

4

0.5 M HCl
24 h

Ca-Mg Bound

5

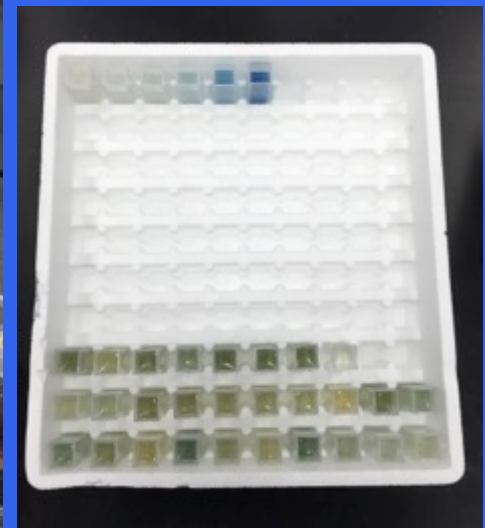
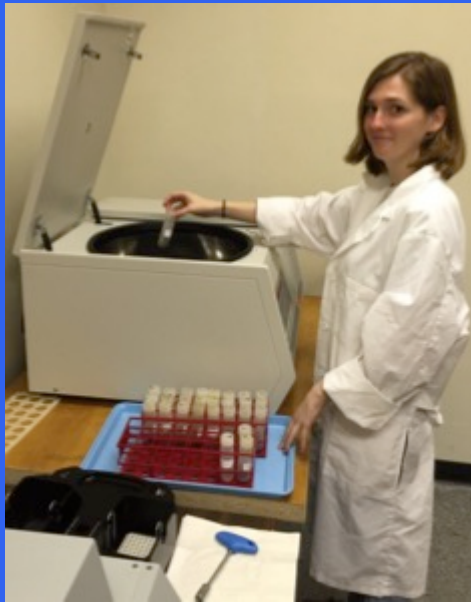
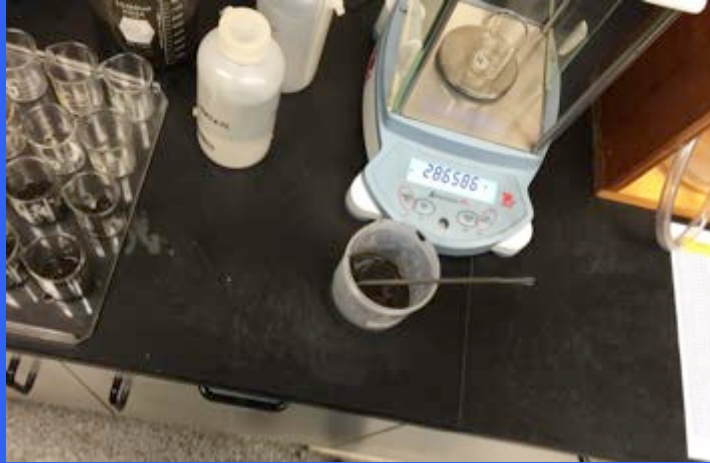
6 M HCl
30 min

Residue Recalcitrant P

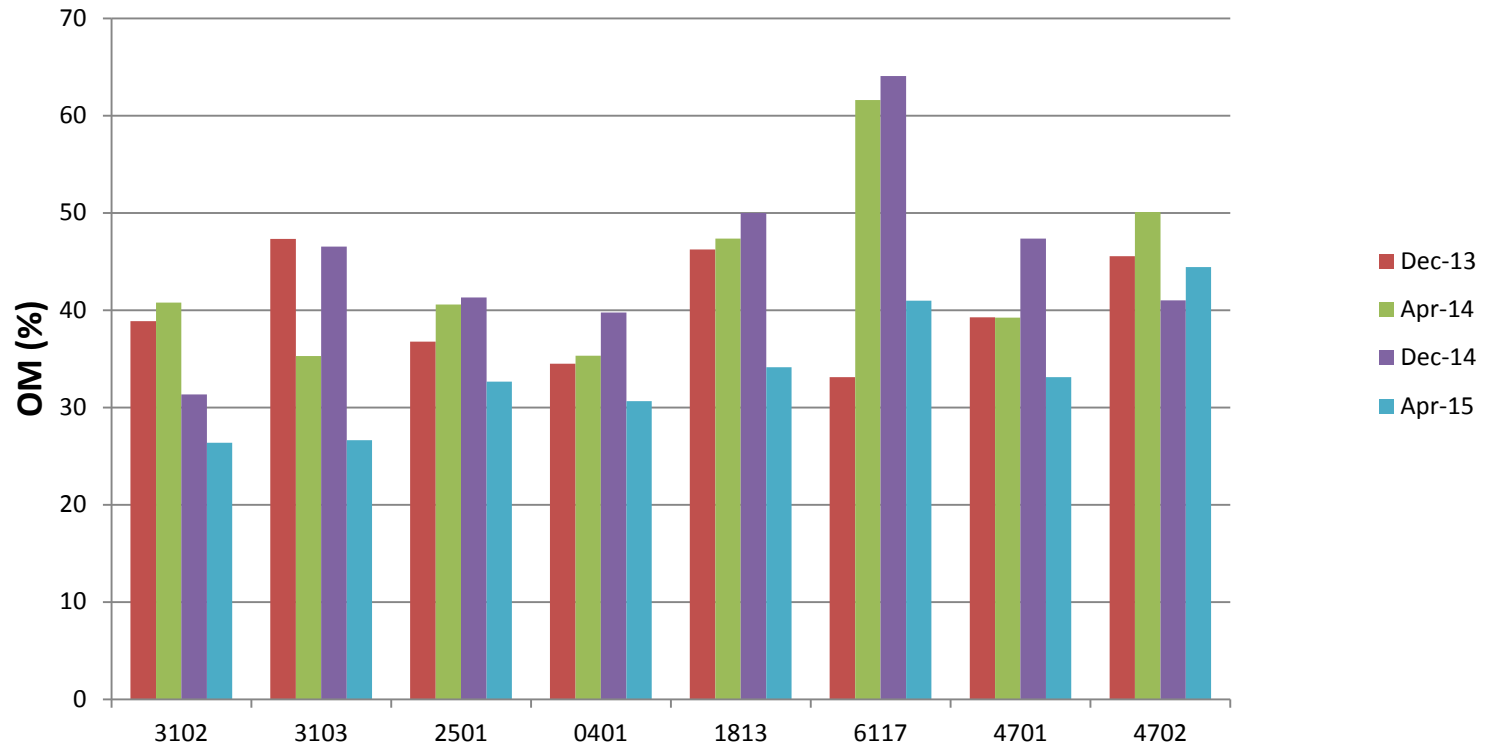
Ease of P Mobility



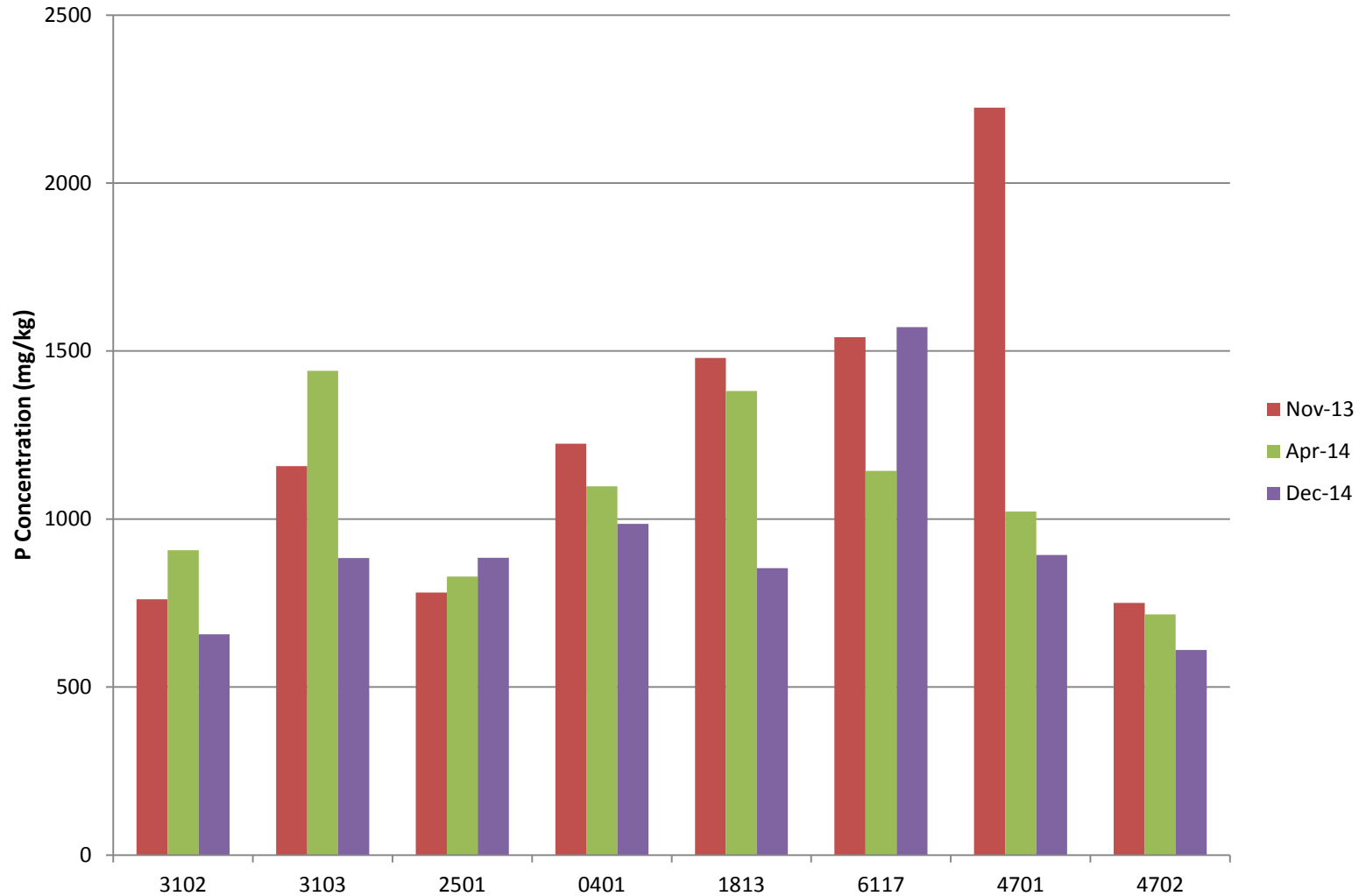
Processing Samples



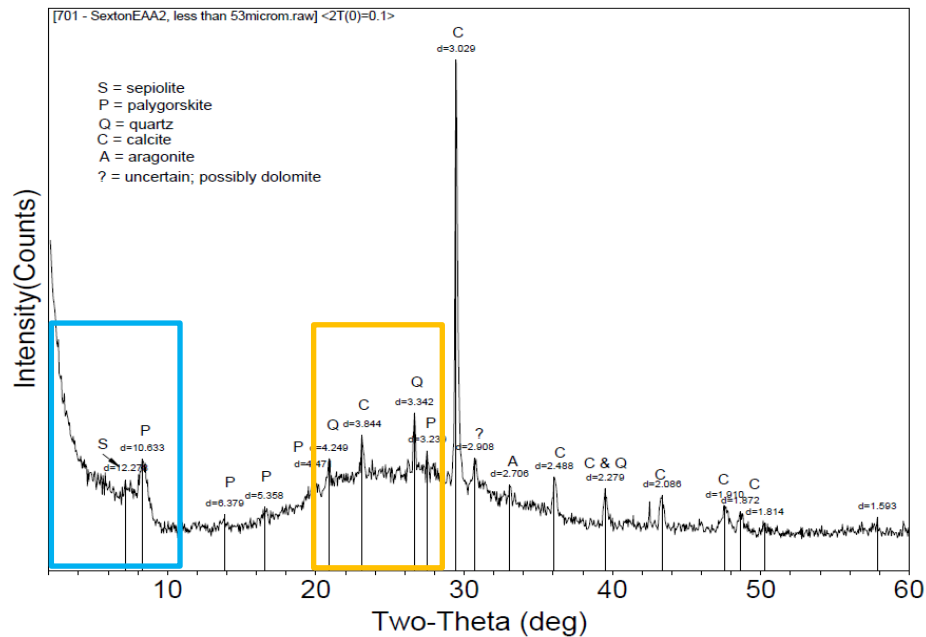
Average % OM for All Farms and Transects (2013-2015)



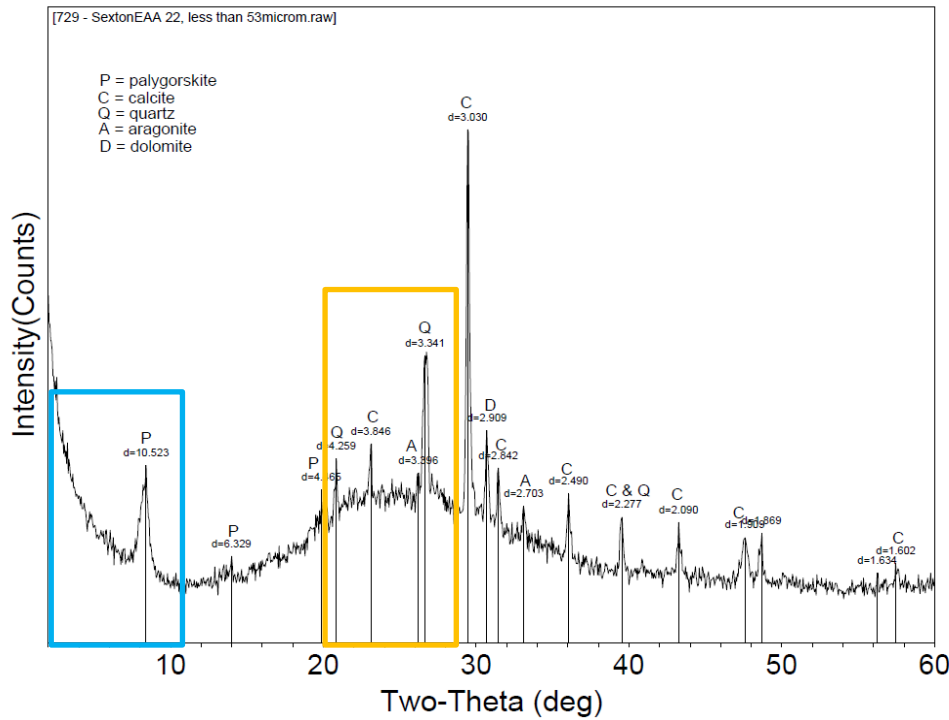
Average TP Over All Farms and Transects (2013-2014)



X-Ray Diffraction



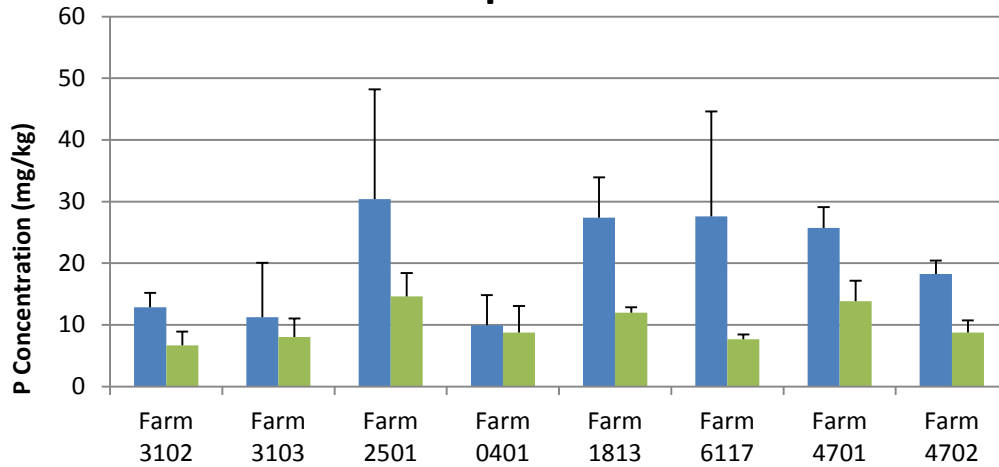
- Differing peak intensities of palygorskite, quartz, calcite, aragonite, and dolomite between samples
- Presence of sepiolite in (top) not seen in (bottom)



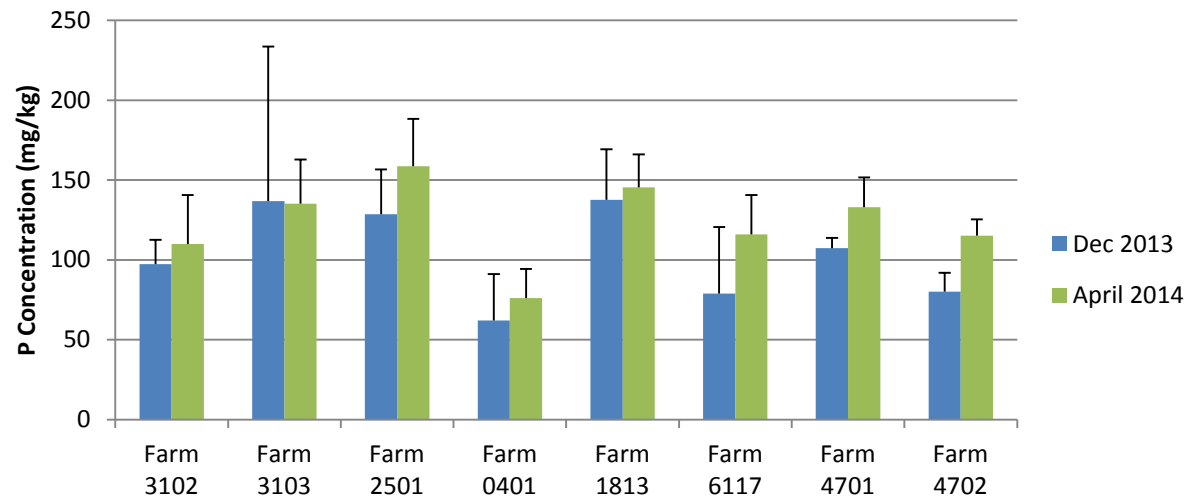
Preliminary Results

TRT: 3103, 0401, 6117, 4702

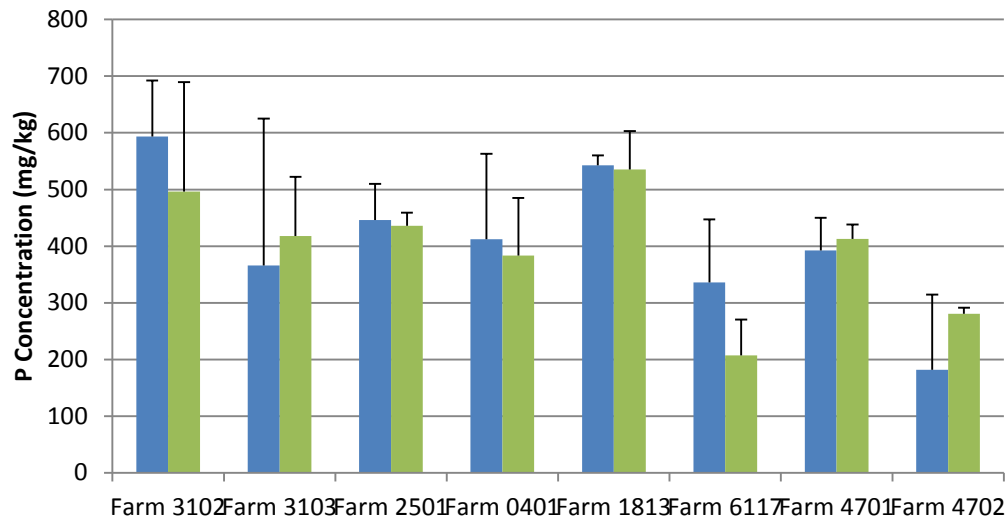
KCl-Bound P Averaged Over All Transects by Sample Period



NaOH-P Averaged Over All Transects by Sample Period

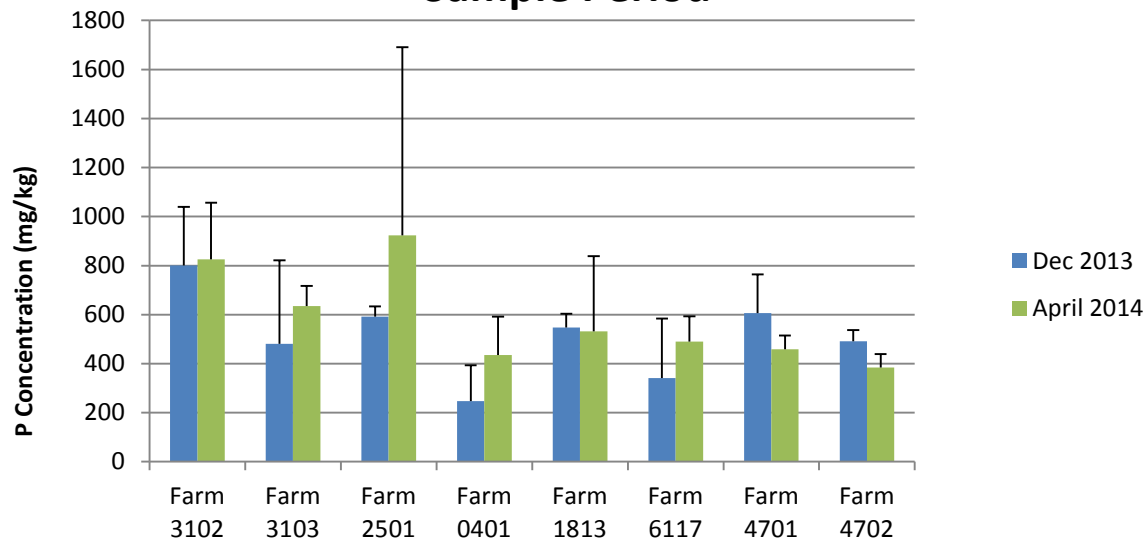


HCl-Bound P Averaged Over All Transects by Sample Period



TRT: 3103, 0401, 6117, 4702

Residue P Averaged Over All Transects by Sample Period

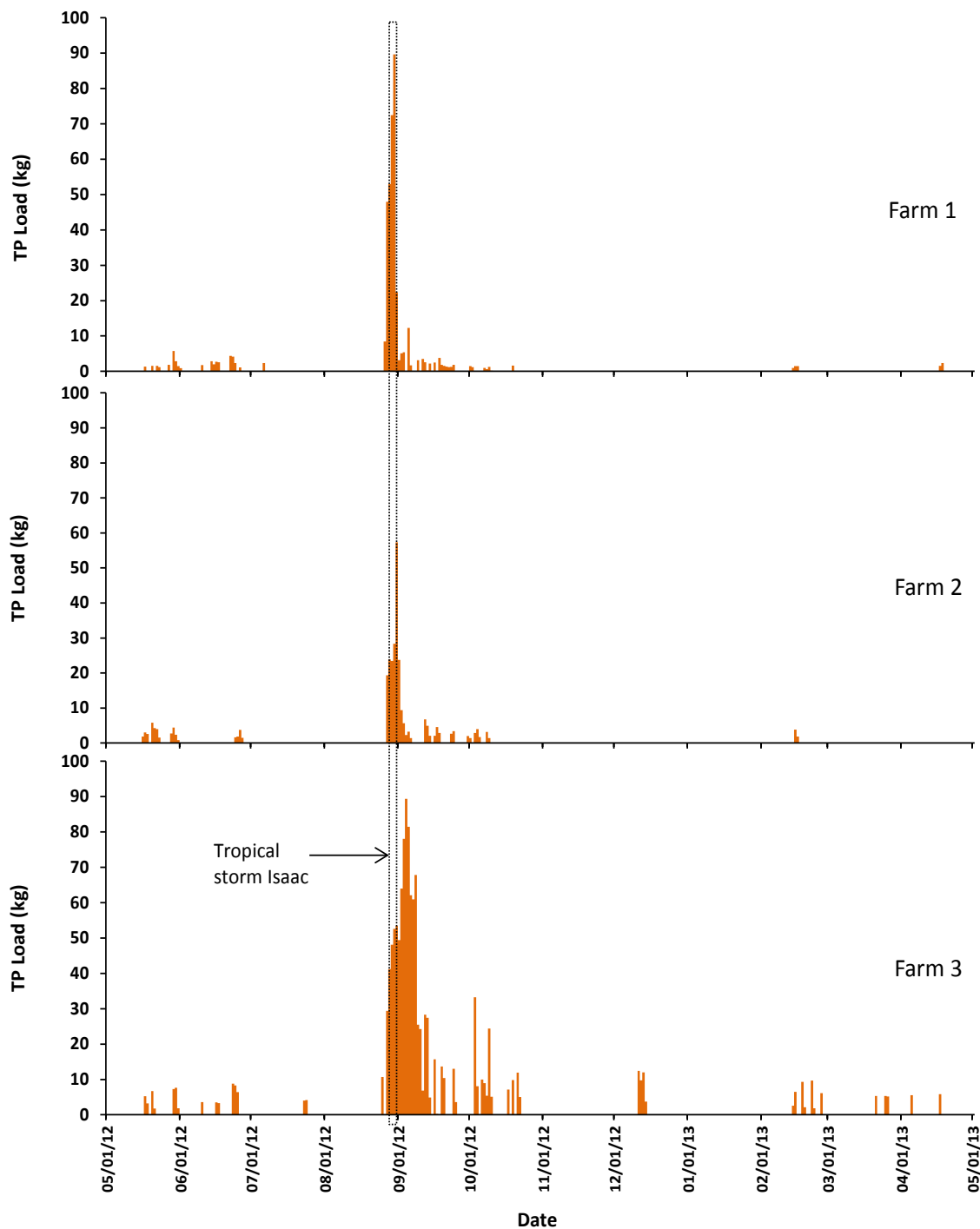


DRAINAGE WATER PARTICULATES Vs. SEDIMENTS

CHARACTERIZATION

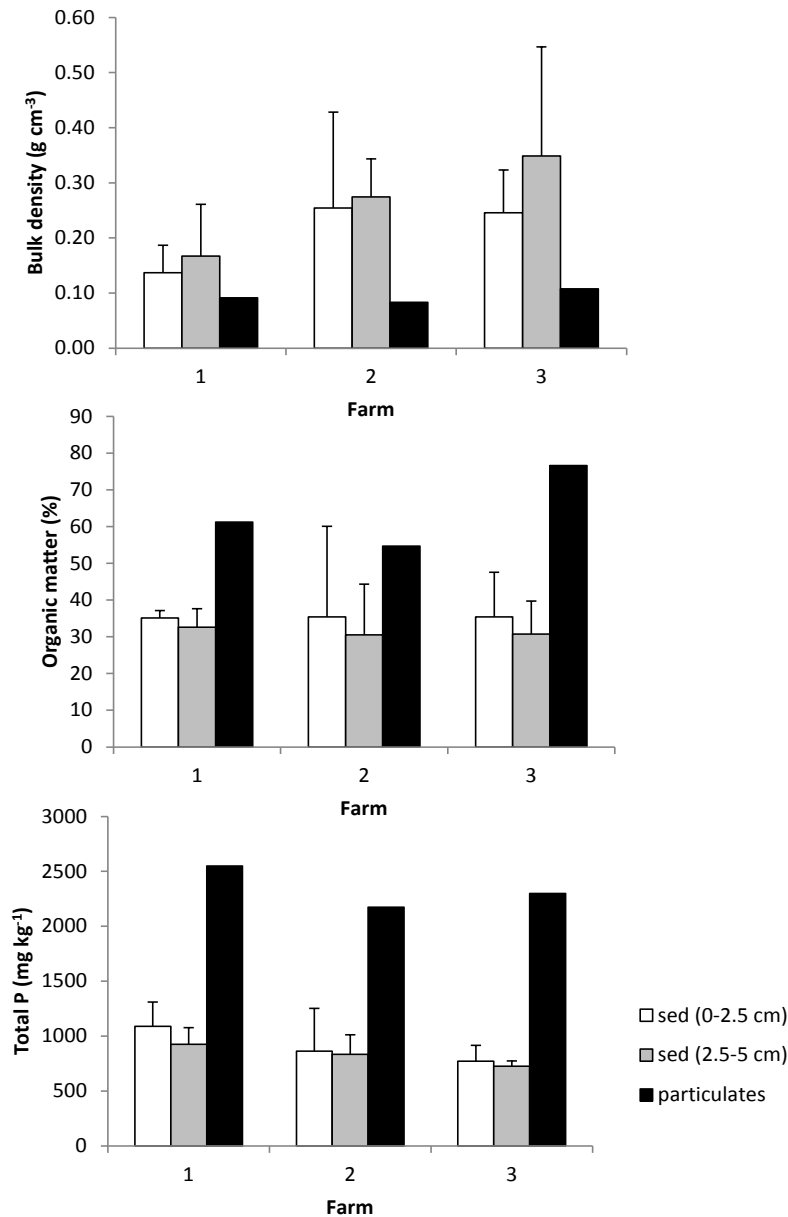
- ▶ Particulates exiting EAA farms comprise up to 70% of the P load
- ▶ > 50% of particulates comprise of organic plant matter
- ▶ Drainage water collected during pumping events; particulates isolated via settling tanks August 22-28, 2012
- ▶ P-fractionation was conducted on the particulates and farm canal sediments





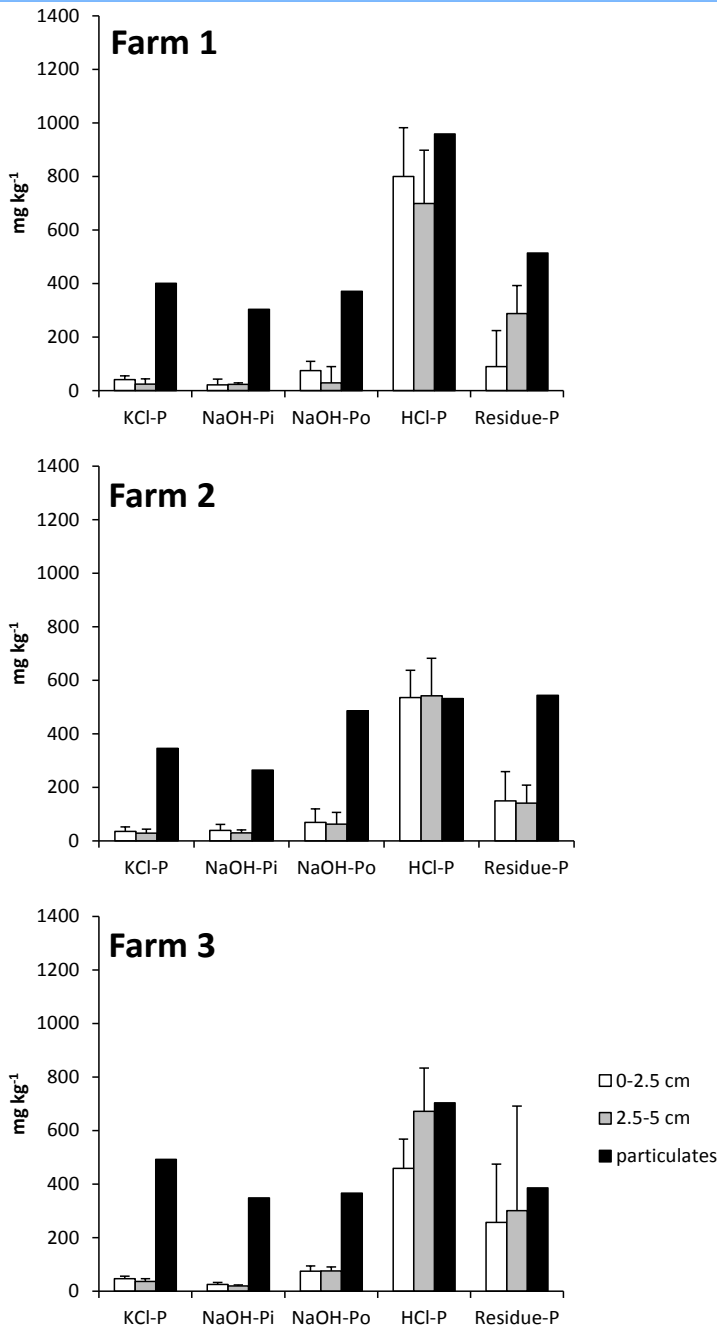
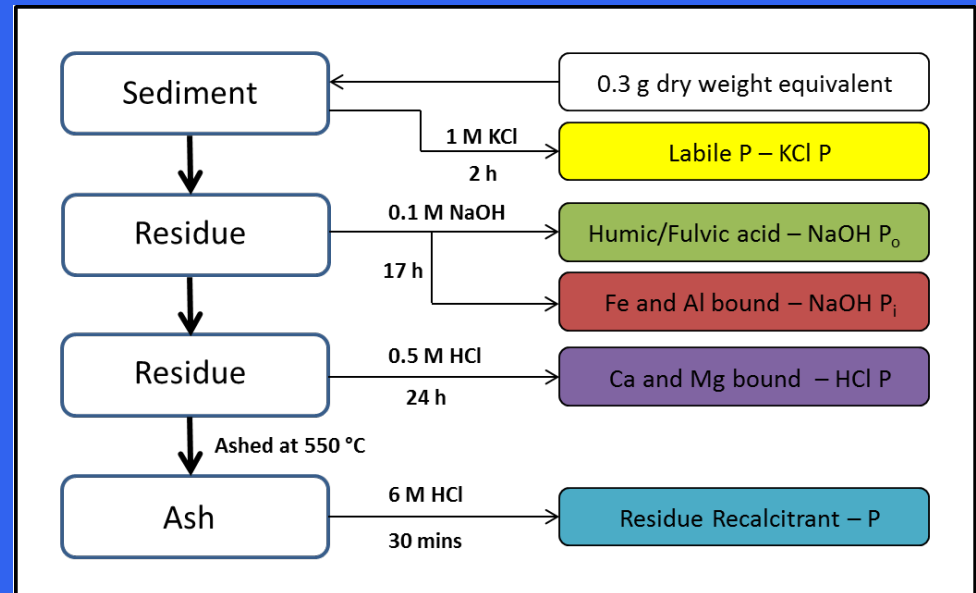
Daily total P load (kg) from all three farms associated to drainage discharge (y-axis). X-axis corresponds to time over a one year period from May 1, 2012 to April 30, 2013.

Characterization of particulates and sediments (0-2.5 cm and 2.5-5 cm) from three farms in the EAA



Phosphorus fractionation of particulates and sediments (0-2.5 and 2.5-5 cm) collected from three farm canals within the EAA

Five step P-fractionation



BMP Training

Twice Yearly Sessions

September 2014 - 108 Participants
May 2015-Spanish - 67 Participants

Spanish Language Training:

- Outstanding variety of speakers
- Open and thorough discussions
- New topic: BMP economics



BMP Training

Twice Yearly Sessions

Speaker	Presentation Title	Speaker	Presentation Title
Samira Daroub	Everglades Program Chapter 40E-63	Pepe Lopez	Rainfall Detention
Les Baucum	Wise Use of Atrazine and Ametryn	Cesar Asuaje	Wise Use of Pesticides in the EAA
Doug Pescatore	EAA Basin Phosphorus Loads	Orlando Diaz	Nutrient Controls
Bill Donovan	BMP Verification Methodology	Carmela Bedregal	BMP Program Overview
Lyn Gettys	Aquatic Weeds in Farm Canals	Ximena Pernet	BMP Verification/Documentation
Barry Glaz	Sugarcane Production and BMPs	Viviana Nadal	BMP Research Update
Tom DeBusk	STA Research	Luis Girado	Sediment and Particulate Controls
Mark Howell	Pumping/Discharge Methods	Luis Girado	BMP Economics

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Soil & Water Resources

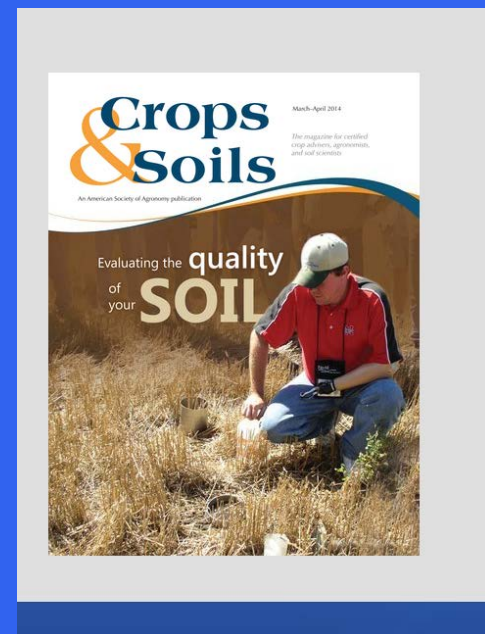
- Best Management Practices & Water Resources
- *Samira Daroub*
- Best Management Practices training presentations - April, 2014
 - *Agenda for the EAA BMP Training in Spanish, held in Thursday, April 24, 2014*
 - *Precipitation Detention, by Pepe López (Detención de Precipitación, por Pepe López)*
 - *Rational Use of Pesticides, by César Asuaje (Uso Racional de Plaguicidas en el EAA, por César Asuaje)*
 - *Sediments and Particles Control, by Luis Girado (Control de Sedimentos y Partículas, por Luis Girado)*
 - *Nutrients Control, by Orlando Díaz (Control de Nutrientes, por Orlando Díaz)*
 - *Verification and Documentation of the BMP Program, by Camela Bedregal (Verificación y Documentación del Programa BMP, por Camela Bedregal)*
 - *Economy of the BMP Program, by Luis Girado (Economía del Programa BMP por Luis Girado)*
 - *Updating Research for the BMP Program, by Viviana Nadal (Actualización de la Investigación del Programa BMP, por Viviana Nadal)*
- Best Management Practices training presentations - September 26, 2013
 - BMP Verification and Documentation*
 - EAA Basin and Farm P Loads*
 - Sugarcane, Water Tables, and BMPs*
 - Aquatic Weed Control in the EAA*
 - Wise Use of Pesticides in the EAA*
 - Nutrient Application Practices*
 - Flat Land, Low Level Farm Drainage*
 - Stormwater Treatment Area Research Update*
 - BMP Rule 40E63 and Research Update*
- Best Management Practices training presentations - April 2013
 - 40E-63 Explanation & Research Update*
 - Herbicide Resistance*
 - BMP Audits and Documentation*

EAA BMP Research Accomplishments

- 73 Publications since 1995 (journal articles, extension pubs and reports)
- 63 presentations since 2001 in national and international meetings
- National attention to the EAA and success of the BMP program

National attention to the EAA and BMP program

- Featured article in National magazine *Crops & Soils* and about success of the BMP program in the EAA
- *“The cooperative, science-based approach to the BMP program is at the core of its success, says Rick Roth. In fact, it’s made him a better farmer.”*



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edis.ifas.ufl.edu/topic_a88053750 - 8k

SL231/SS450: Best Management Practices in the Everglades ...
... Best Management Practices in the Everglades Agricultural Area: Fertilizer Spill Prevention 1. OA Diaz, SH **Daroub**, RW Rice, TA Lang, and M. Chen 2. Introduction. ...
author: O.A. Diaz, S.H. Daroub, R.W. Rice, T. A. Lang, and M. Chen
department: Soil and Water Science
edis.ifas.ufl.edu/ss450 - 16k - 2008-09-15

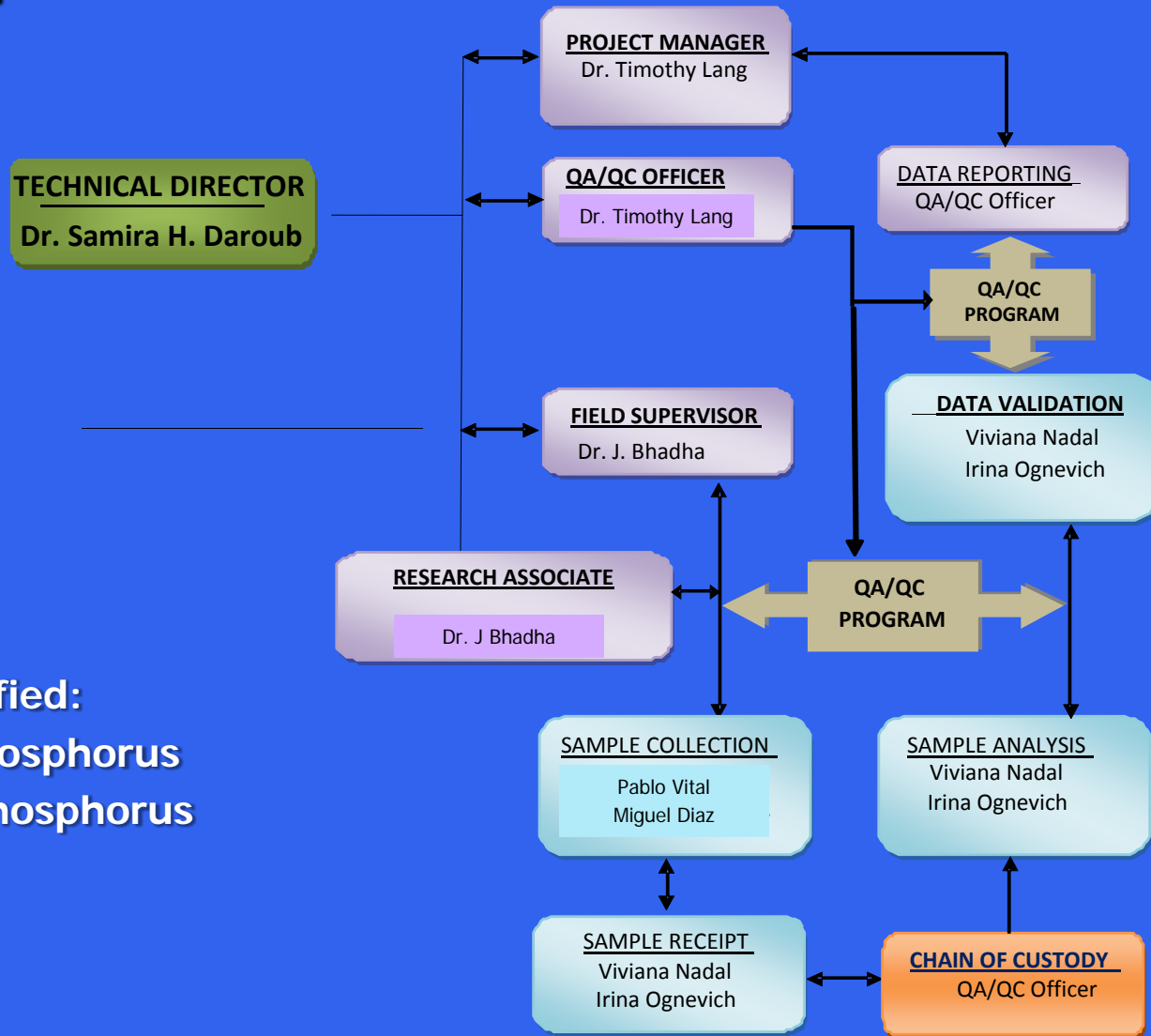
SL231-SP/SS471: Mejores Prácticas de Manejo en el Area Agrícola ...
... Everglades: Prevención de el Derramamiento de Fertilizantes 1. OA Diaz, SH **Daroub**, RW Rice, TA Lang, VM Nadal, and M. Chen 2. Introducción. ...
author: O.A. Diaz, S.H. Daroub, R.W. Rice, T.A. Lang, V.M. Nadal, and M. Chen
department: Soil and Water Science
edis.ifas.ufl.edu/ss471 - 18k - 2010-07-08

SL-232/SS451: Best Management Practices in the Everglades ...
... Best Management Practices in the Everglades Agricultural Area: Fertilizer Application Control 1. TA Lang, SH **Daroub**, OA Diaz, and M. Chen 2. Introduction. ...
author: T.A. Lang, S.H. Daroub, O.A. Diaz, and M. Chen
department: Soil and Water Science
edis.ifas.ufl.edu/ss451 - 22k - 1998-10-30

SL-225/SS445: Best Management Practices in the Everglades ...
... SH **Daroub**, OA Diaz, TA Lang and M. Chen 2. Introduction. ... 44 pp. Sievers, P., D. Pescatore, S. **Daroub**, JD Stuck, J. Vega, P. McGinnes, and S. Van Horn. 2003. ...
author: S.H. Daroub, O.A. Diaz, T.A. Lang and M. Chen
department: Soil and Water Science
edis.ifas.ufl.edu/ss445 - 25k - 2006-03-24

SL232-SP/SS470: Mejores Prácticas de Manejo en el Area Agrícola ...

NELAC



NELAC Certified:
Total Phosphorus
Ortho Phosphorus

Personnel

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Irina Ognevich, BS

Odiney Alvarez-Campos

Anne Sexton

Pablo Vital, AA

Miguel Diaz, AA

Principal Investigator

Project Manager

Lead Scientist

Head Chemist

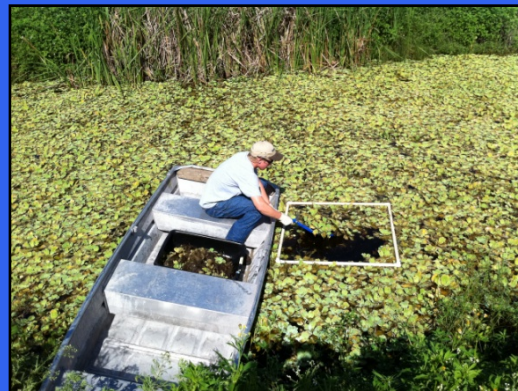
Chemist

Grad Student

Grad Student

Field Technician

Field Technician





Thank You!

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