Controlling Floating Aquatic Vegetation to Reduce Labile Phosphorus Pools in Drainage Canal Sediments

UID 93748

Anne E. Sexton (aes9922@ufl.edu), Jehangir H. Bhadha, Timothy A. Lang, and Samira H. Daroub
Everglades Research and Education Center, Belle Glade, FL and Soil and Water Science Department, Gainesville, FL

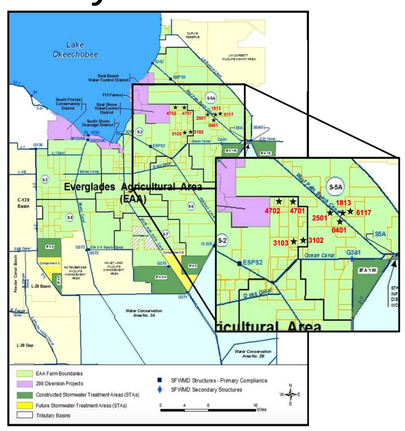
Introduction

We hypothesize that floating aquatic vegetation (FAV) has a significant impact on the ability of agricultural canal sediment to retain and release phosphorus (P) in the Everglades Agricultural Area (EAA) in South Florida.

Expected results of FAV removal:

- Increase in recalcitrant Ca-Mg and Fe-Al bound P
- Decrease in labile P discharged from farm canals
- Increased light penetration into the water column, possibly allowing for the co-precipitation of P with calcium and magnesium (Ca-Mg) into less labile minerals
- Increased dissolved oxygen increases redox potential and P sorption with iron and aluminum (Fe-Al) minerals

Study Site



Far left: Experimental farm locations within the EAA, depicted with stars and Farm ID; top right: clean canal; bottom right: water lettuce infestation.

Farm Descriptions

Table 1: Table identifying farm pairs (1, 2, 3, and 4), treatment (T) and control (C) assignment, farm size (acres), and percent land cover by crop type (SC= Sugarcane) for 2012, 2013, and 2014.

Farm ID	Size (acres)	Crop type (%)	Farm ID	Size (acres)	Crop type (%)
3102 (T)	1387	2012: 50% SC; 50% fallow 2013: 100% SC 2014: 70-89% SC; 11-30% leafy vegetables	6117 (T)	781	2012: 90% SC; 10% corn 2013: 80% SC; 20% corn 2014: 100% SC
3103 (C)	609	2012: 75% SC; 25% beans 2013: 75% SC; 25% corn 2014: 50% SC; 25% corn; 25% rice	1813 (C)	594	2012: 100% corn 2013: 79% SC; 21% corn 2014: 100% SC
0401 (T)	908	2012: 84% SC; 16% corn 2013: 100% SC 2014: 77% SC; 23% corn	4701 (T)	630	2012: 50% SC; 50% fallow 2013: 100% SC 2014: 50% SC; 50% rice
2501 (C)	824	2012: 70% SC; 30% fallow 2013: 88% SC; 12% corn/fallow 2014: 88% SC; 12% corn	4702 (C)	640	2012: 50% SC; 50% rice 2013: 100% SC 2014: 100% SC

Methods

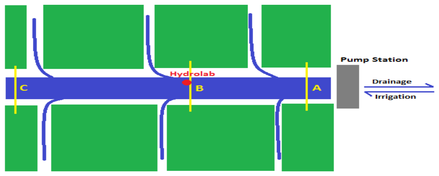
Research is being conducted on eight farms in the EAA, with four treatment-control pairs from 2011-2016. Treatment farms use spot-spraying of herbicide to prevent infestation of FAV, while control farms practice under normal canal management. Normal management can include reducing spray events to lower costs but allowing infestation.

Objective:

- Determine impact of controlling FAV on sediment properties, including P-fractions and water quality

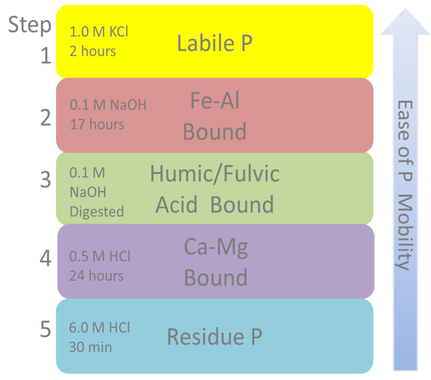
Sediment Sampling

Each farm has three transects, A, B, and C (figure below). Core samples are collected from each transect twice per year (figure right) and sectioned for analysis. Dataloggers collect water quality data at daily, 15-minute intervals year round at transect B.

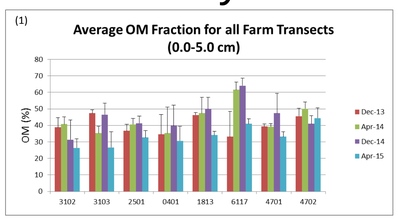


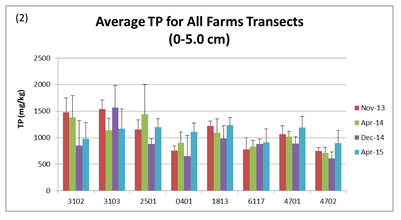
Sequential P-Fractionation

- Phosphorus with varying rates of bioavailability are present in sediments (Reddy et al., 1998);
- Fractionation measures the concentration of labile and recalcitrant P forms in sediment;
- Chemically treated farms are expected to show differing P fractions from control farms over time.

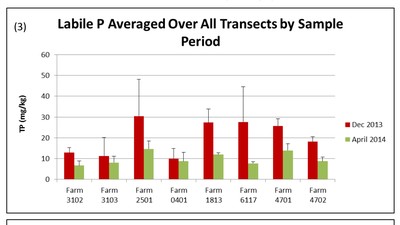


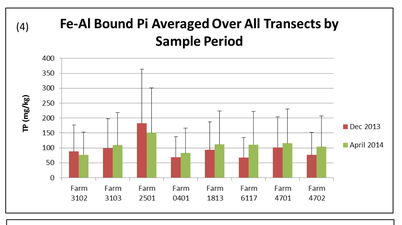
Preliminary Results

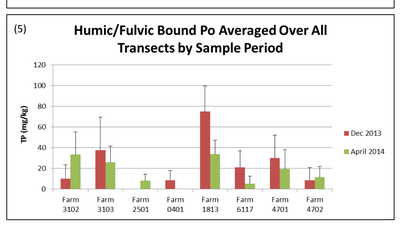


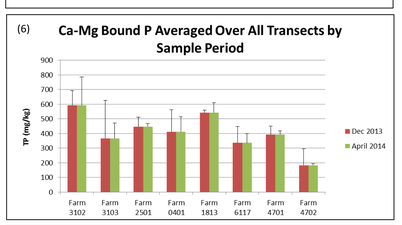


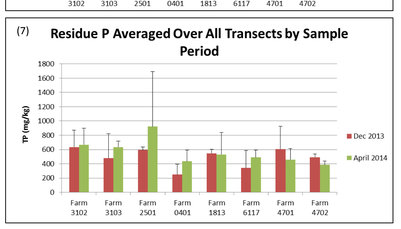
(1) Percent Organic Matter (OM) content averaged for each farm over 2013-2015 sampling periods ranging from 25-65%; (2) Total phosphorus (TP) averaged over all transects for each farm over 2013-2015 sampling periods.







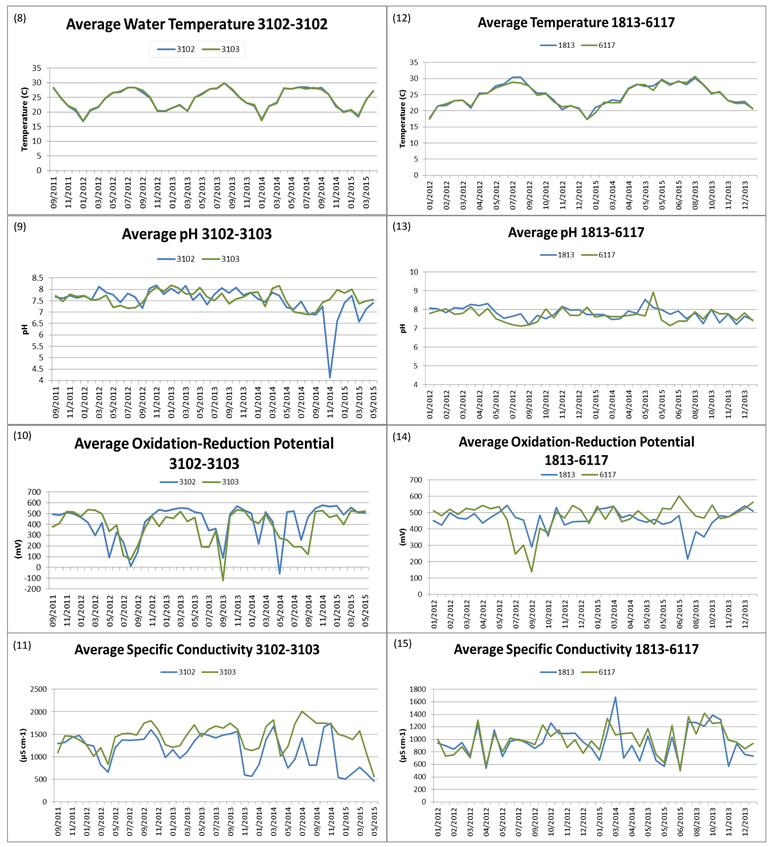




(3-7) are separated by type of bound P averaged over all transects of each farm for 2013 and 2014. KCl is the most labile form of P while residue P is the most recalcitrant. Note scale difference between the different graphs.

Preliminary Water Quality Results

Preliminary water quality data is derived from dataloggers stationed year-round in each canal. Water temperature, pH, oxidation-reduction potential, and specific conductivity data are collected at 15-minute intervals and are averaged by month.



Discussion

Floating aquatic vegetation removal is expected to produce denser, more recalcitrant inorganic P forms that will reduce P transport out of farm canals. Suppression of FAV can potentially serve as an additional management practice in reducing P loads. No significant changes have been detected yet. Sediment fractionation results will be assessed with x-ray diffraction analysis results of dominant sediment minerals.

Future Work

In the future, discharge waters from drainage canals will be collected and suspended sediments settled out. The discharge sediments will undergo p-fractionation analysis to assess nature of P carried out during pumping. Fe-Al content of the canal sediment will be analyzed, as well as equilibrium phosphorus content (EPC), to assess the canal sediment's capacity to retain phosphorus.

Acknowledgements

This project is funded by the Everglades Agricultural Area- Environmental Protection District, and is overseen by the South Florida Water Management District to continue the Everglades Agricultural Area phosphorus reduction in accordance with the Everglades Forever Act (1994).

References: Reddy, K. R., Wang, Y., DeBusk, W. F., Fisher, M. M., & Newman, S. (1998). Forms of Soil Phosphorus in Selected Hydrologic Units of the Florida Everglades. *Soil Science Society of America Journal, 62*, 1134-1147.