# Development of a BMP for sustainable water quality in the South Dade Everglades agricultural region

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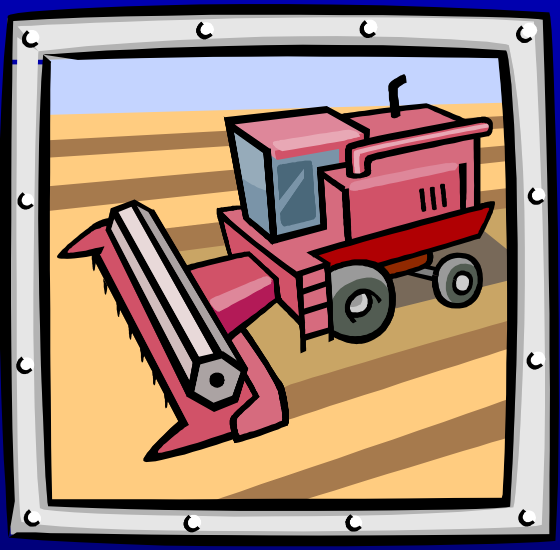

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# Outline:

1. Introduction
2. Objectives
3. Field Monitoring
4. Results
5. Conclusions

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# 1. Introduction

- This collaborative (USDA-ARS-Tifton/UF-TREC) research/demonstration project is designed to evaluate the extent to which residues of fertilizers and pesticides used to produce sweet corn affect groundwater and how the use of summer cover crops can reduce and minimize potential leaching and preserve the aquifer.
- Results from studies of this type will contribute to enhanced water quality and promote agricultural sustainability in the region.

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# 2. Objectives

- Evaluate the effectiveness of a rapidly growing summer cover crop (sunn hemp) in minimizing potential leaching of agrochemical residues (atrazine and nutrients)
- Assess the extent and rate at which pesticides attach to the soil and degrade
- Determine the rate and direction of groundwater flow in the upper Biscayne Aquifer and how contaminants are dispersed as they move with the groundwater.
- Calibrate, test and compare mathematical models for predicting agri-chemical movement in the soil and groundwater in the region

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# 3. Field monitoring

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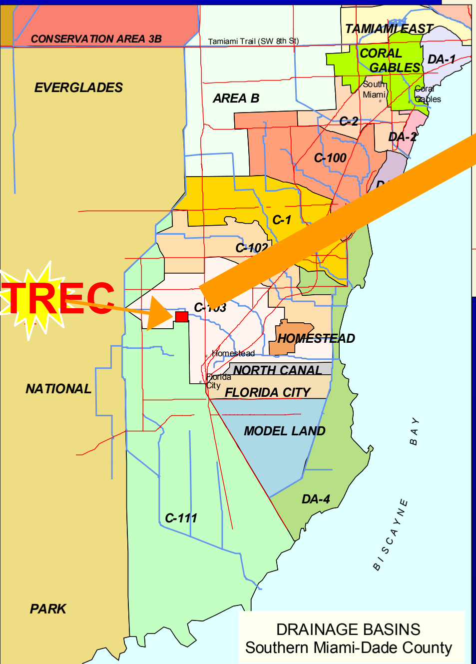
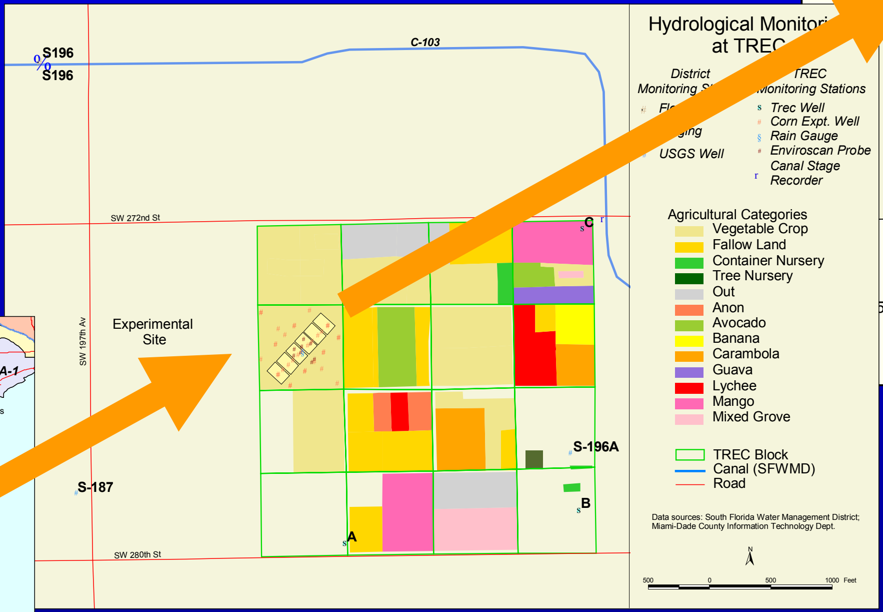
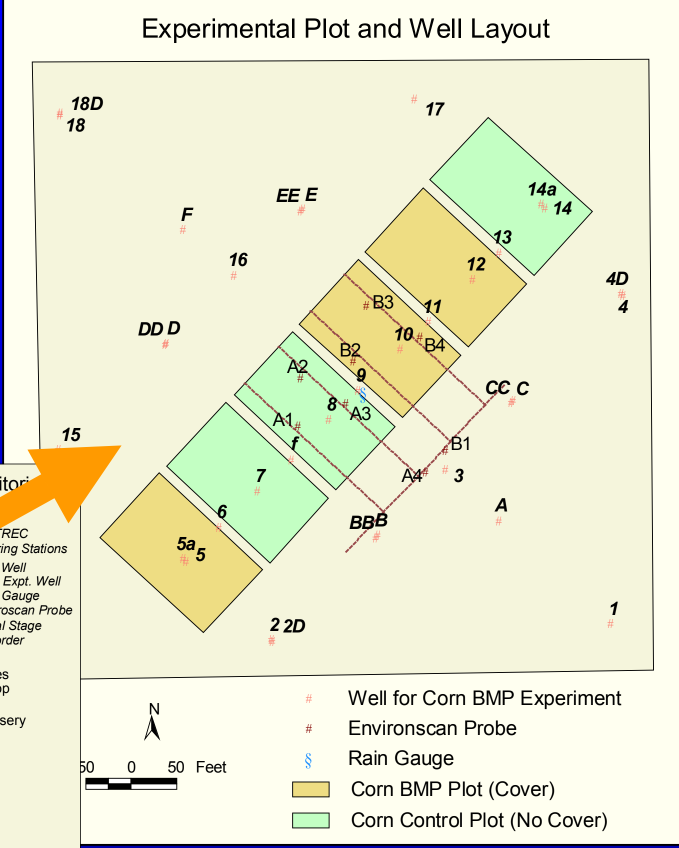
# - Location:

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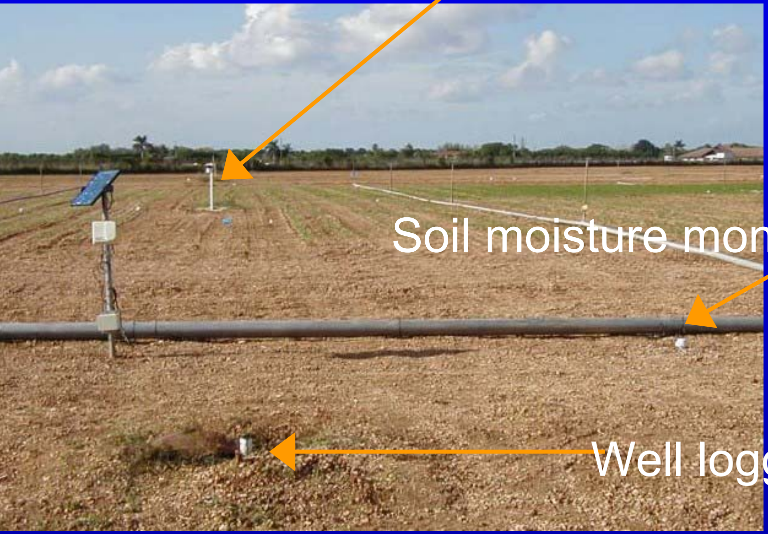
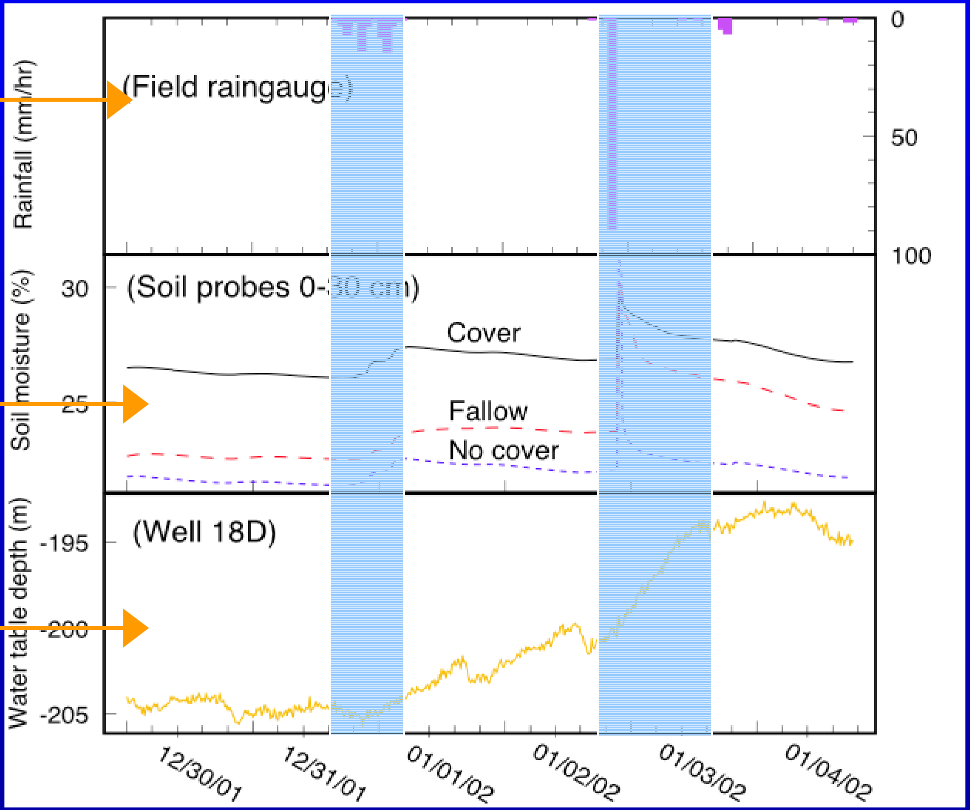
# - Equipment and Data:




- Bi-weekly water quality samples in wells and C-103 canal
- Event based sampling (rainfall >1")
- Continuous logging of hydrological inputs (groundwater and canal levels, rainfall, weather UF-FAWN, soil moisture)

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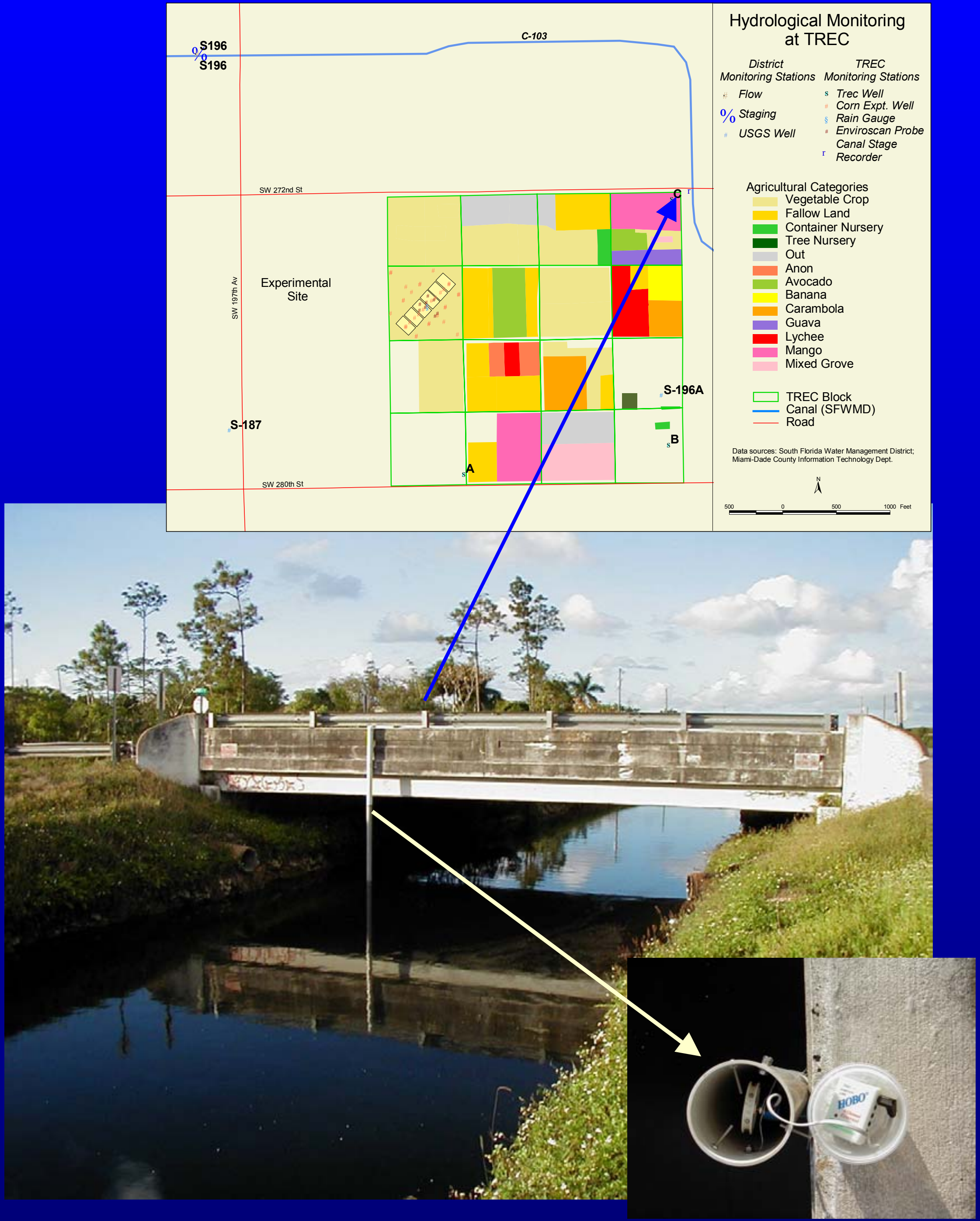
•The groundwater flow in this area is driven not only by precipitation, but also by the remote management of the C-103 canal levels.

•Independent records of canal levels are obtained by an inexpensive stage recorder, newly designed at UF, installed in the C-103 canal to the north of TREC. This information is essential for interpretation of the hydrology of the area.

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# - Sulfur hexafluoride (SF6) tracer study at UF-TREC study site:

- Injection made on evening of April 15th in well 9 located in center of plots
- Intensive sampling and analysis of GW in 21 wells surrounding injection point - to May 9 > 400 samples.

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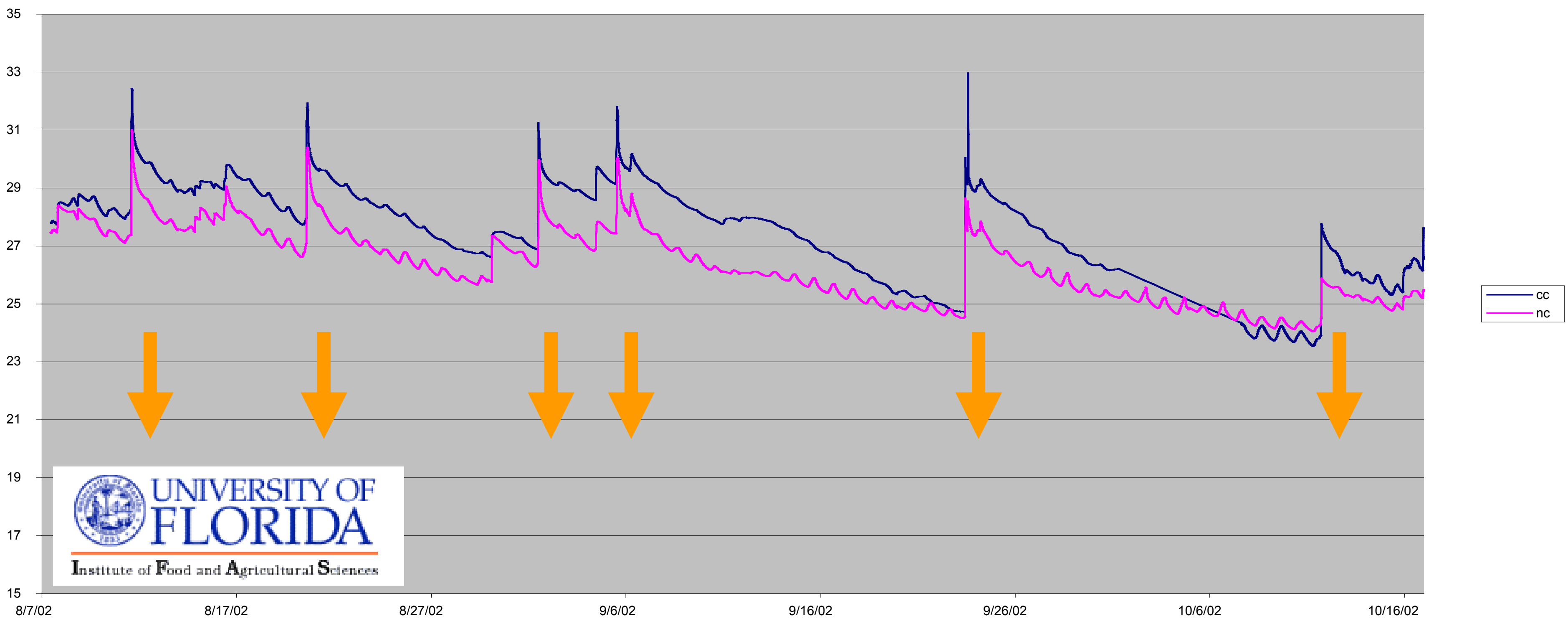
# 4. Results

# - Field monitoring

- A clear soil moisture trend difference was observed. The cover crop plot soil retained more water after each rain event. They coincided with spikes in the graphs. Soil water content was also higher in the cover crop plot soil during periods between events.



- The net effect of this trend (shown below) is lower leaching rates on the cover crop plots.

- Nutrient and pesticide residue measurements on samples collected from monitoring wells under each treatment support this conclusion (consistent lower concentrations under cover crop plots). So, local groundwater is positively affected by the BMP.

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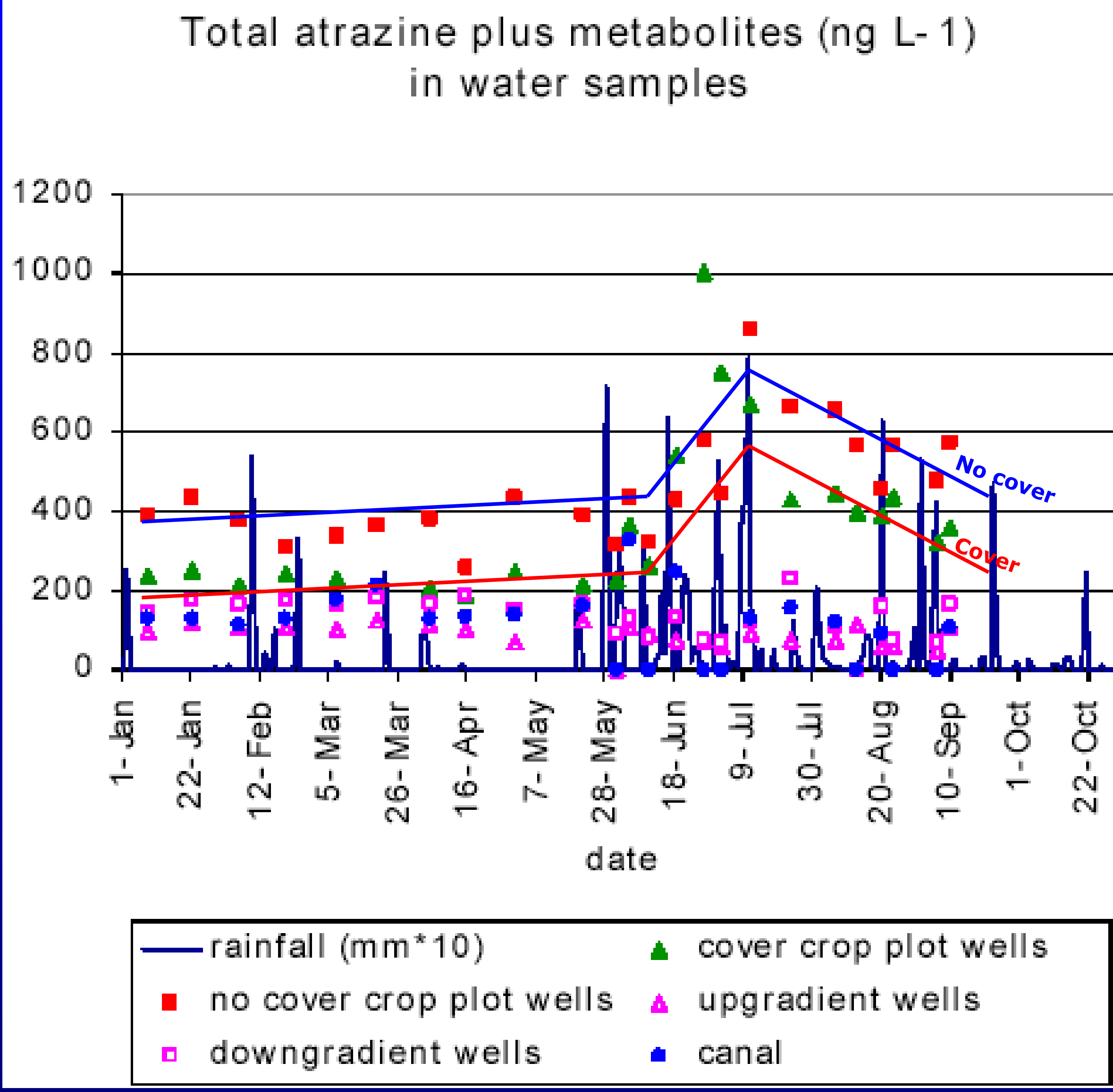
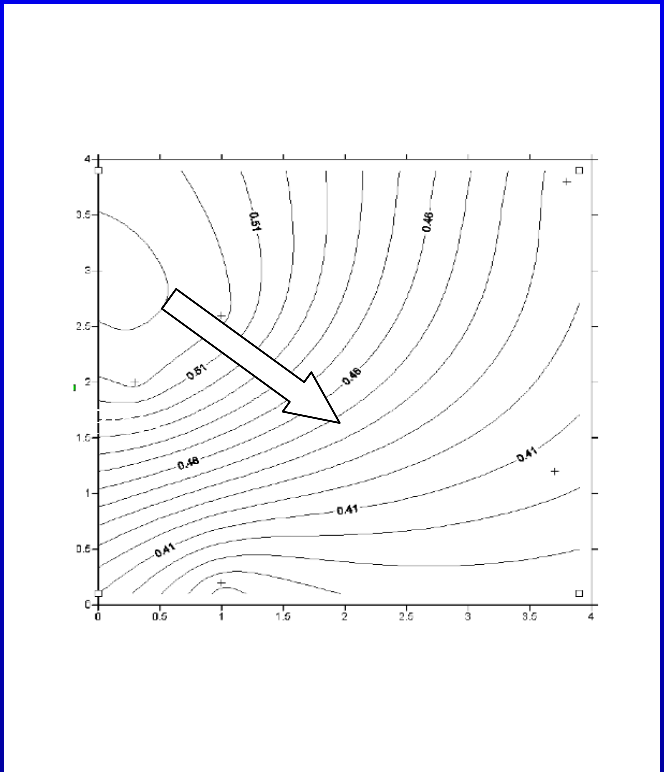
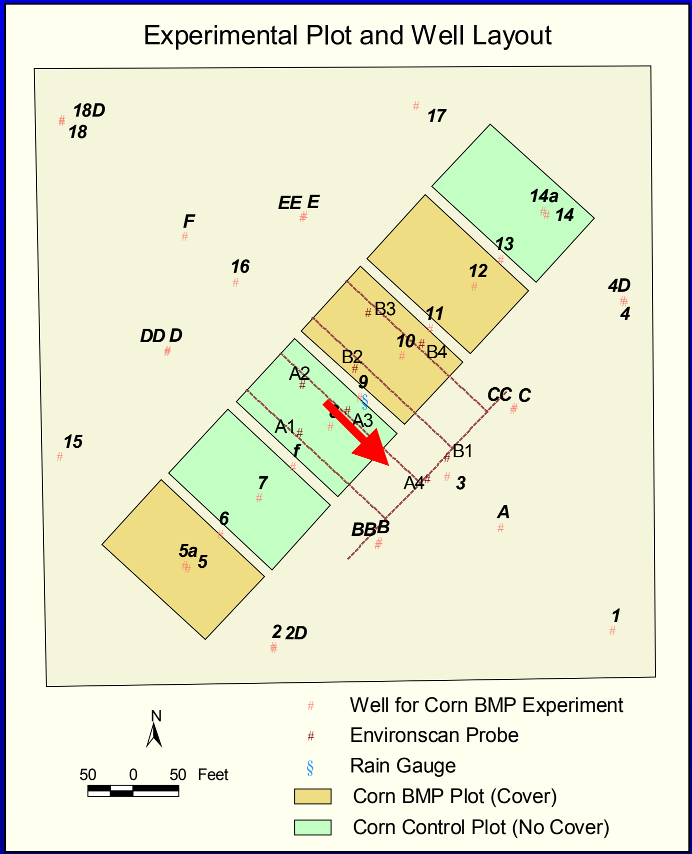
- A likely explanation of the higher water content in the cover crop plot soils was an increase in soil organic carbon content.



# - Tracer test results

## Groundwater elevation contours at UF-TREC on 04/09/2002




Wells 3 and 9 are 130′ apart

- GW gradient inferred from from sensor network
- Direction of gradient S-SE
  - consistent with flow direction determined by $SF_6$ tracer injection

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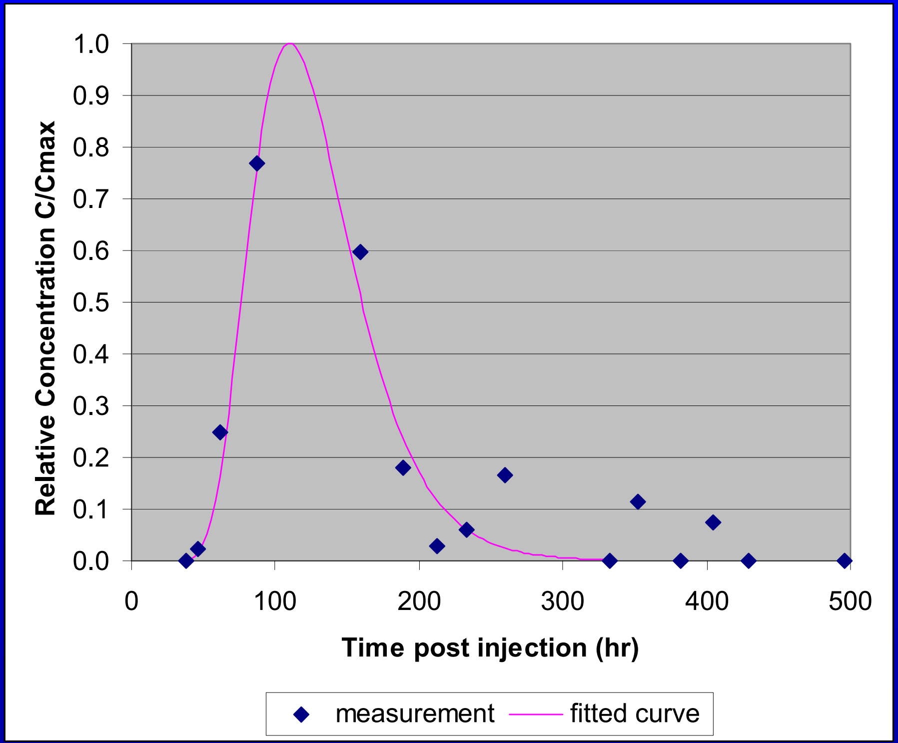
# Preliminary analysis of the tracer test data:

- Model: 2-dimensional Dispersion Model
- Fitting with the least square method to the first 8 data points
- Interpretation of tailing
  - minor pahtways (most likely)
  - matrix diffusion




**Results for main path way:**

mean water velocity $v_0$ : 7.1 m/d

longitudinal dispersivity $\alpha$ : 2.0 m

## Estimation of hydraulic conductivity K

With: porosity p = 0.51 (estimated from values in Guardiario 1996)

average ground water gradient i = 0.316 m per 1000 m

$K = v_0 * p / i = 11.477$ m/s

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# - Model testing

- Water quality models (GLEAMS, WAVE) to assess the Best Management Practice were calibrated using a complete hydrologic and water quality dataset collected from an experimental field site at UF-TREC. We used a combination of experimental soil measures and state-of-the-art inverse modeling procedure based on a global optimizing algorithm (Global Multi-Level Coordinate Search).

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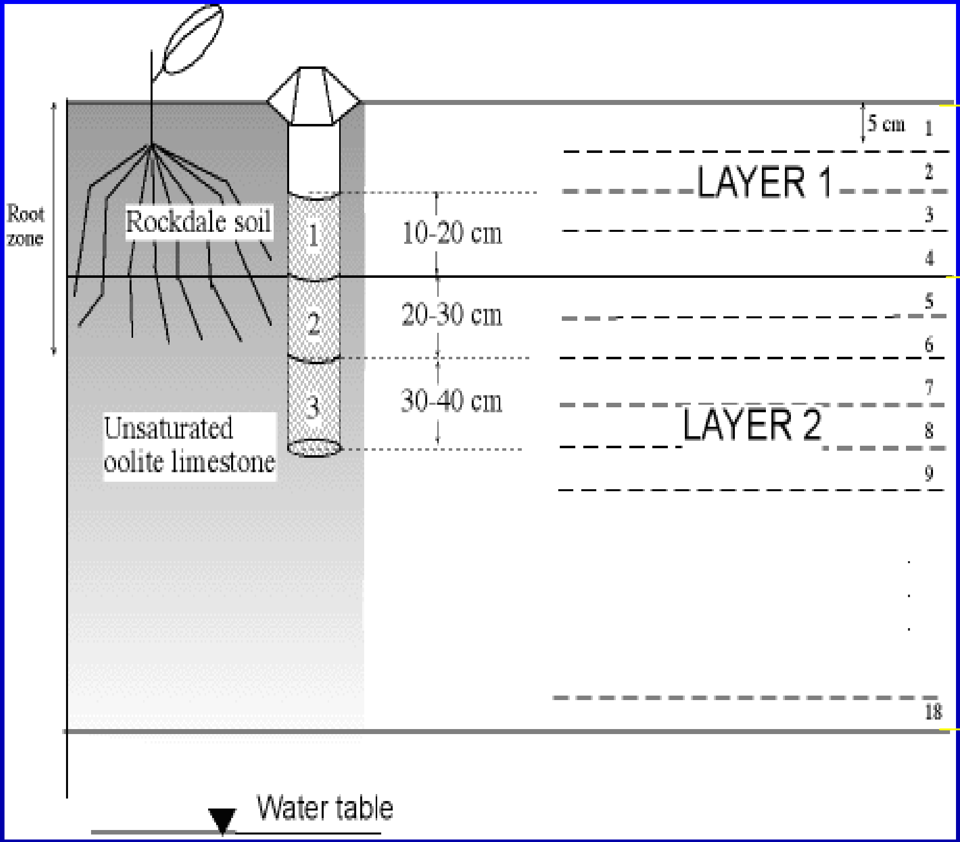


Soil moisture was monitored independently at three different depths in plots with summer cover crop and no cover crop

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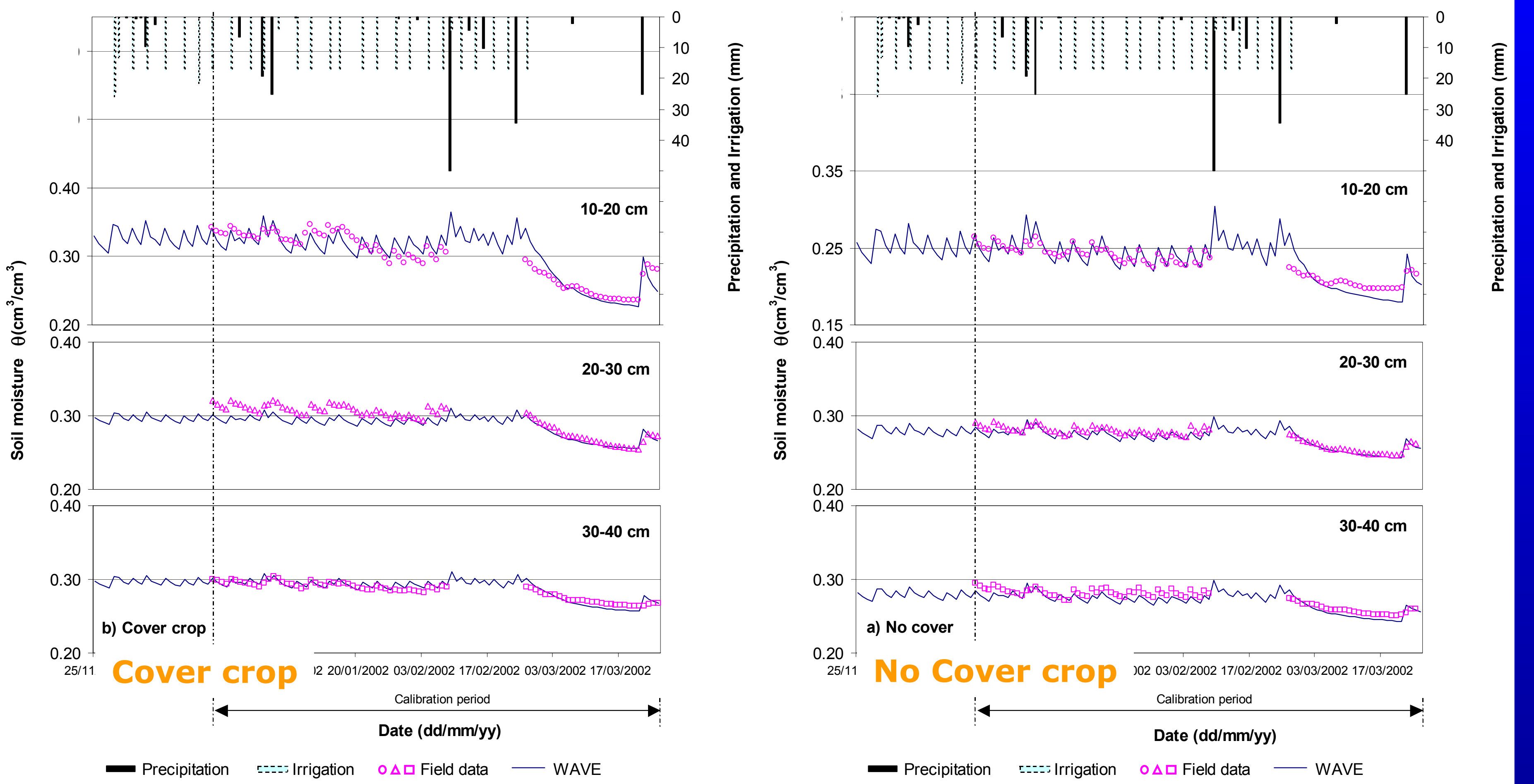


Confidence in the model was achieved when good soil moisture predictions were obtained for both types of fields.

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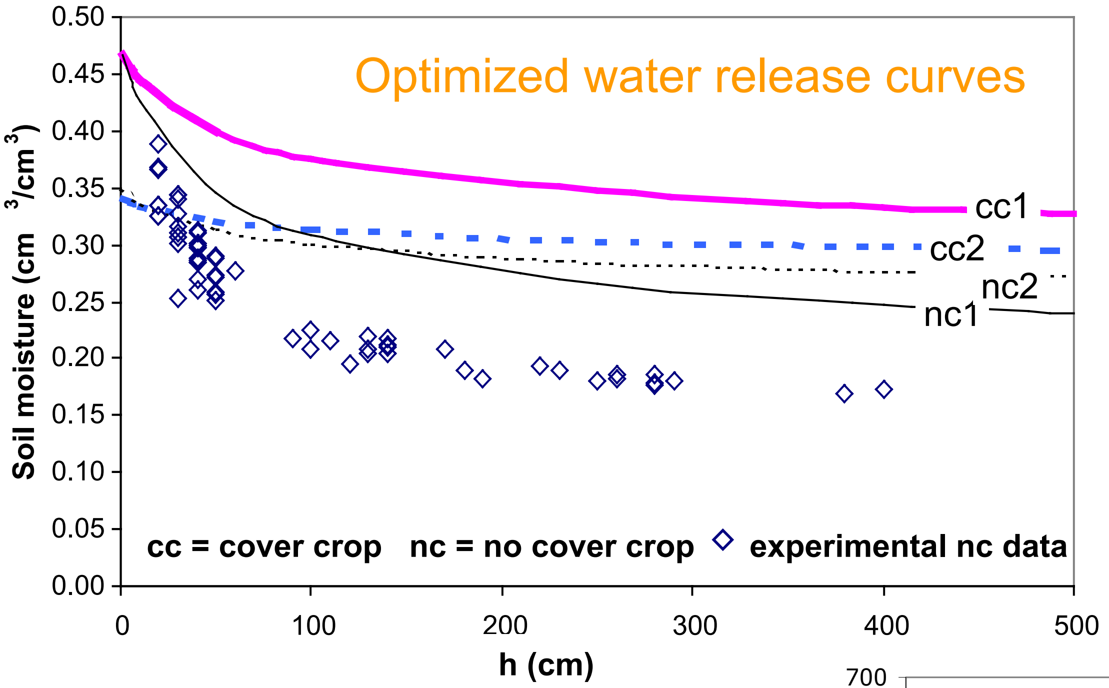
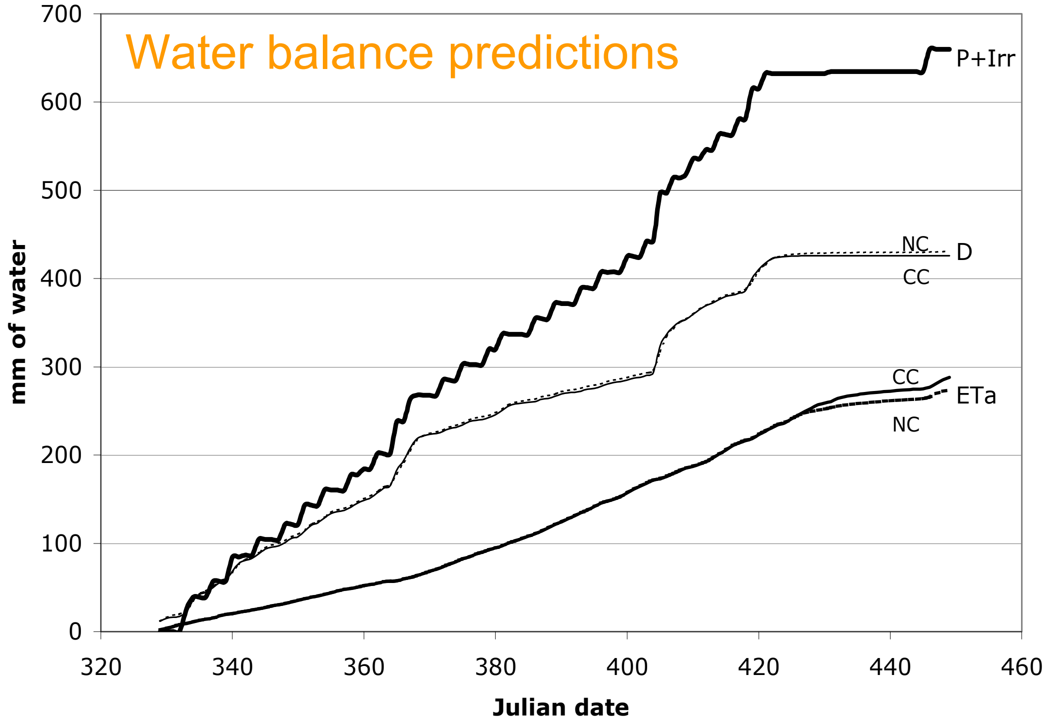



Preliminary modeling results suggest that the summer crop is effective on improving the soil's hydrological and microbiological properties by the addition of organic matter after several years' rotation

This reduces soil drainage and could limit associated atrazine leaching.



# 5. Conclusions

- A collaborative (USDA-ARS-Tifton/UF-TREC) research/demonstration project was designed to evaluate the extent to which residues of fertilizers and pesticides used to produce sweet corn affect groundwater and how the use of summer cover crops can reduce and minimize potential leaching and preserve the aquifer.

- A clear soil moisture trend difference was observed. The cover crop plot soil retained more water after each rain event. The net effect of this trend (shown below) would be lower leaching rates on the cover crop plots.

- Concentrations of nutrient and pesticide residues on water samples collected from monitoring wells under cover crop and no cover crop plots showed consistently higher values in the no cover crop wells.

- Two water quality models (GLEAMS and WAVE) are being tested to predict potential changes in deep soil drainage caused by the BMP. Initial results showed that the BMP was effective in delaying and reducing deep drainage rates in the soil, thus increasing the oportunity for chemical degradation.

- Results from studies of this type will contribute to enhanced water quality and promote agricultural sustainability in the region.

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