Improving irrigation and fertilization Best Management Practices (BMP) for corn, carrot, peanut rotation in north Florida

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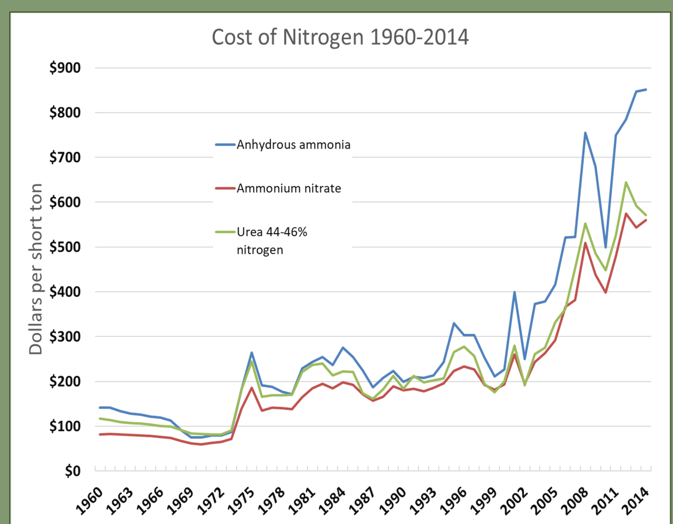
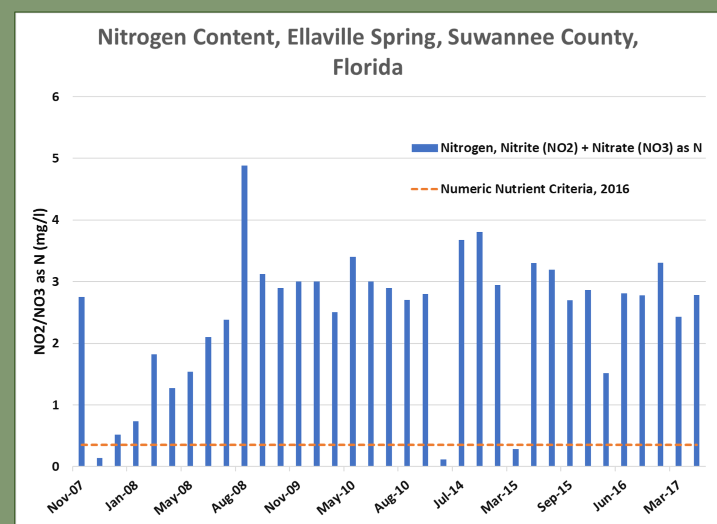
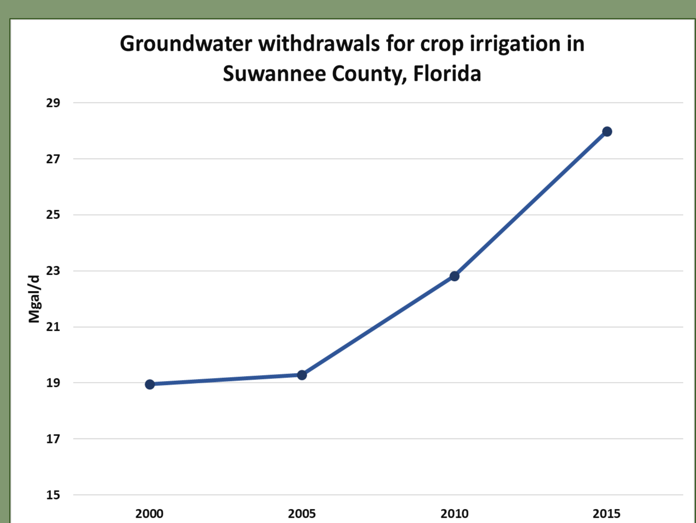
Motivation and Objectives



Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, Agricultural Prices.



Source: Florida Department of Environment Protection. STORET Public Access https://www.floridadep.gov



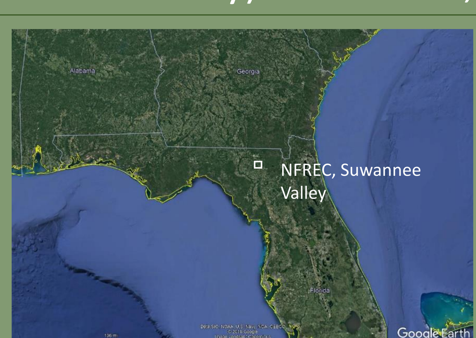
Source: USGS, Water Use Data for Florida. https://www.Waterdata.usgs.gov

- **Continue to develop sensor based irrigation BMP's that reduce water use and maintain expected yields.**
- **Improve Nitrogen Use Efficiency through improved fertility and irrigation BMP's.**

Materials and Methods

Study area site characterization

- Study area is located at the North Florida Research and Education Center (Suwannee Valley) in Live Oak, Florida (30.31353N, -82.90122W).

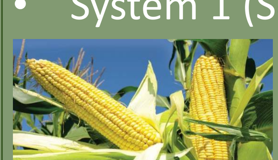


- Soil
  - 96% Sand
  - 2% Clay
  - Bulk Density
    - 0-15cm ≈ 1.28 g cm^{-3}
    - 16-30cm ≈ 1.33 g cm^{-3}
    - 31-60cm ≈ 1.33 g cm^{-3}
    - 61-90cm ≈ 1.32 g cm^{-3}

- Approximately 3 hectares under variable rate, linear irrigation system.

Cropping systems

- System 1 (South field):

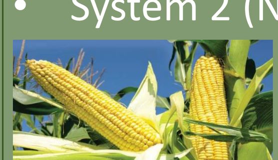

2018

2018-2019

2019


2019-2020

- System 2 (North field):


2018

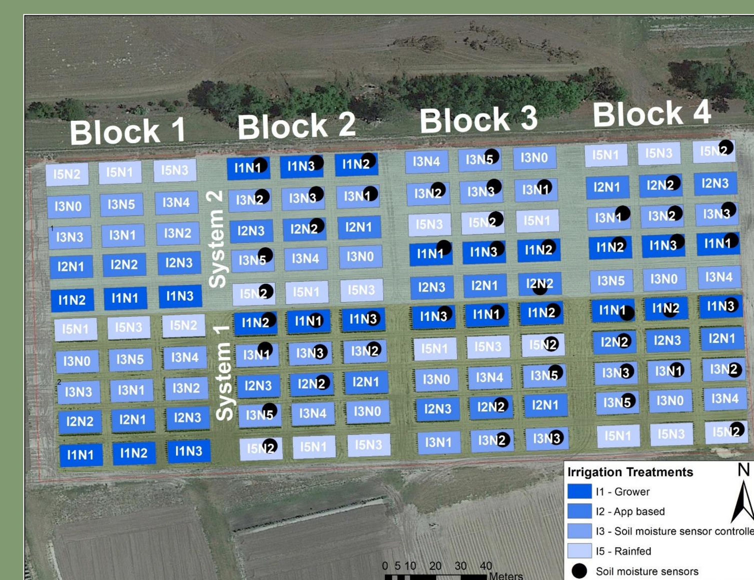

2018-2019

2019


2019-2020

Experimental design

- Split-plot in a randomized complete block design.
  - Four replicates (Blocks)
    - Four Irrigation treatment in the main plot.
    - Three Fertilization treatments in the sub-plots for I1, I2, and I5 and six fertilization treatments in I3 (SMS based).



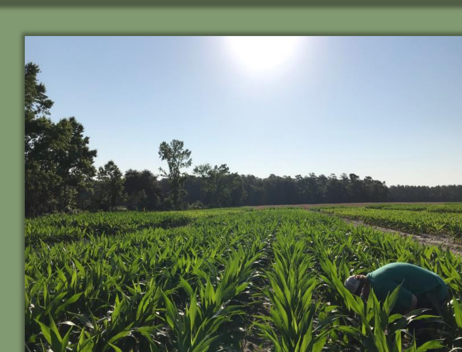
Main plot (Irrigation)	Sub-plot (Nitrogen rate)					
	N0	N1	N2	N3	N4	N5
I1 – Grower Practices		112 kg/ha	224 kg/ha	336 kg/ha		
I2 – App controlled		112 kg/ha	224 kg/ha	336 kg/ha		
I3 – Soil moisture sensor controlled	0 kg/ha	112 kg/ha	224 kg/ha	336 kg/ha	448 kg/ha	560 kg/ha
I5 - Rainfed		112 kg/ha	224 kg/ha	336 kg/ha		

Data collection


Samples collected at four depths, within the row, throughout the growing season.


Samples are air dried for two days.


Then packaged and sent to Analytical Research Laboratory (ARL) for NO_3-N and NH_4-N analysis.

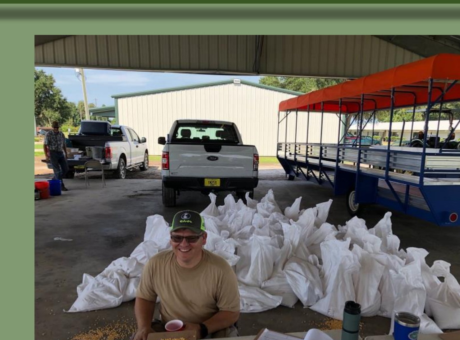

All plants in a 1 meter section of row, cut at ground level at various growth stages.


Plants are separated into leaves, stems and ears then chipped and ground.

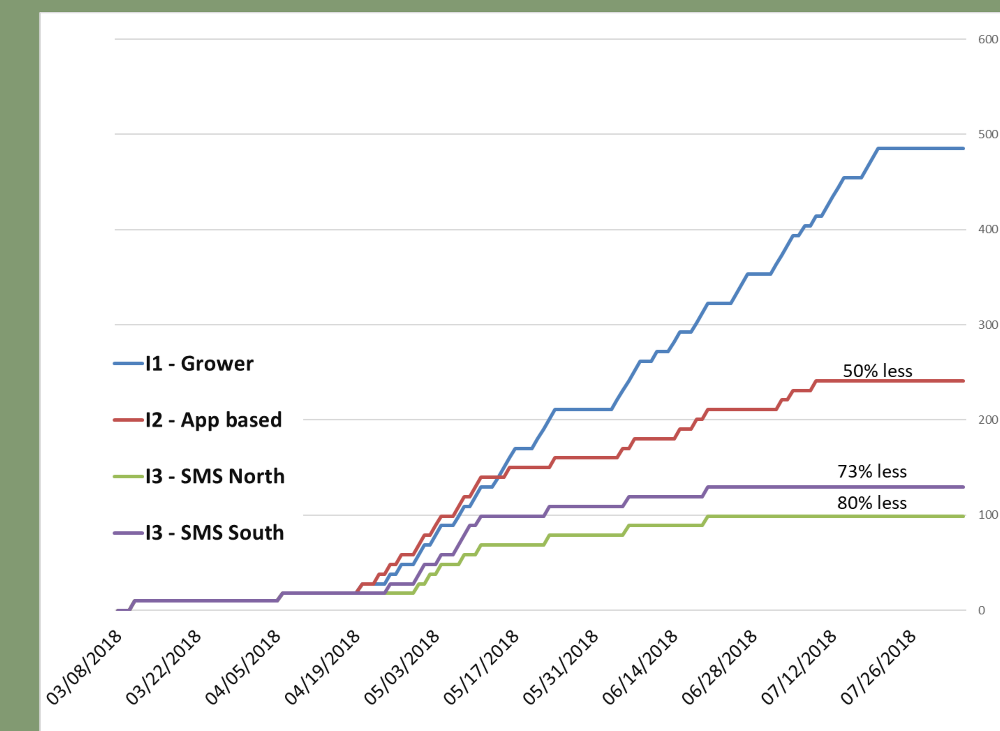

Samples are packaged and sent to the Forage lab for NO3-N and NH4-N analysis

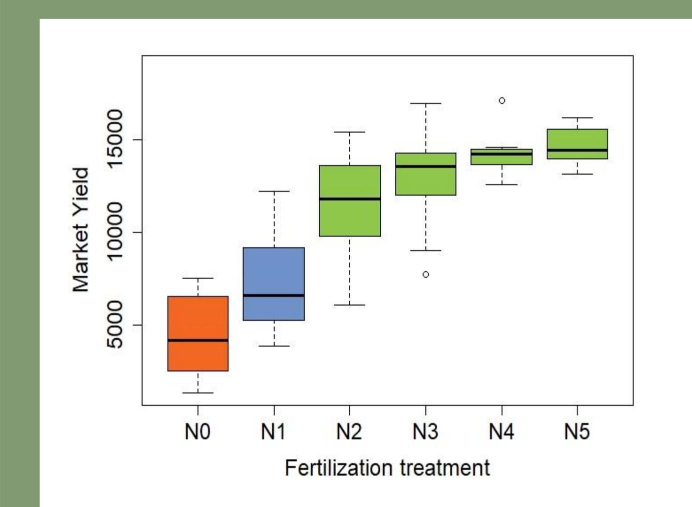

Two rows are hand harvested from each plot.


Ears are counted, shucked, weighed, shelled and weighed again.

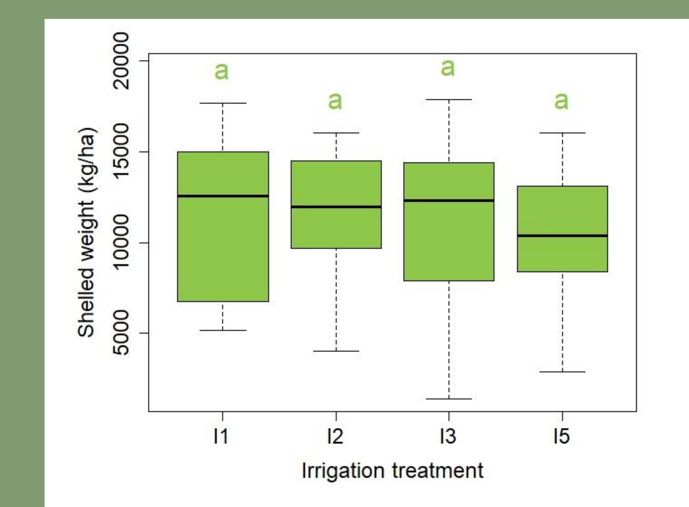

Moisture readings and 100 kernel weight from each plot are recorded.

Results

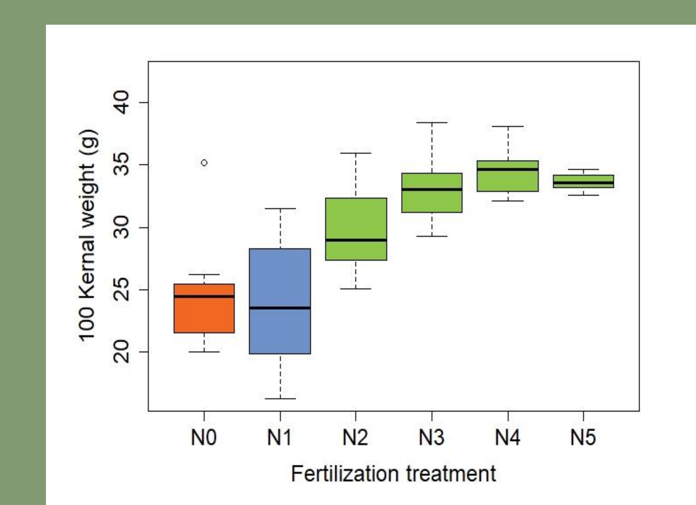




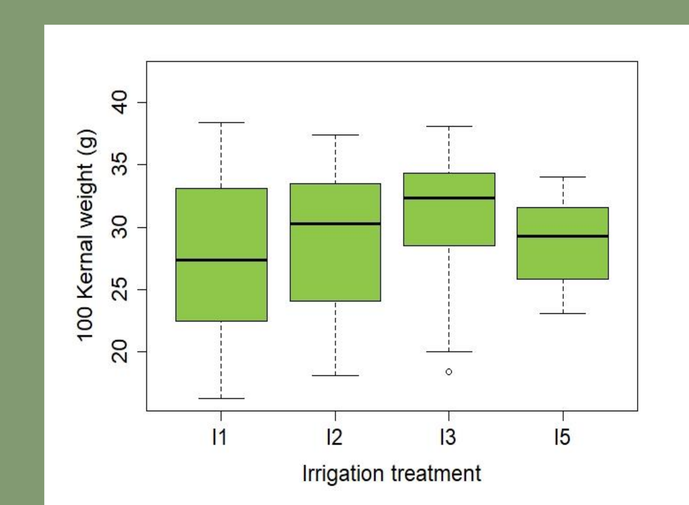
Comparison of yields by fertilization treatment.



Comparison of yields by irrigation treatment.



Comparison of grain size by fertilization treatment.



Comparison of grain size by irrigation treatment.

Preliminary conclusions

- Water savings over calendar-based, grower practices of 70% to 80% were observed by using soil moisture sensors to prompt irrigation at a maximum allowable depletion of 50% available water.
- Water savings of 50% were observed in the application based irrigation treatment over the calendar-based grower practices.
- Currently tests of significance are being run to analyze differences in total yield or grain size among the irrigation treatments, including rainfed. The 59 rain events in 2018 totaling 526 mm in conjunction with the preliminary results in the above figures suggest we may not find a statistically significant difference in irrigation treatments.

Acknowledgements

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USDA United States Department of Agriculture National Institute of Food and Agriculture