Estimating Evapotranspiration of Sweet Corn in the Southeastern United States to Improve Irrigation Scheduling Efficacy

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Introduction

- Agriculture is responsible for 85% of the world's fresh water use
  - Timely, precise, and user-friendly irrigation scheduling is critically needed
- Smart irrigation increases the accuracy of irrigation decisions
- Understanding crop water needs is a key variable in efficient irrigation scheduling
- Faculty at UGA and UF developed a suite of irrigation scheduling smartphone applications for various crops (SmartIrrigation App Suite)
  - No application for sweet corn (*Zea mays var. rugosa)* exists at this time
- Evapotranspiration (ET)-based irrigation scheduling can serve as an alternative to soil moisture sensors
- In the FAO-56 guidelines, there is no representative crop coefficient (K_c) curve for sweet corn grown in the southeastern United States (U.S.)

Objectives

Overall objective: Develop user-friendly, ET-based irrigation scheduling tool for sweet corn grown in southeastern U.S.

- Measure *in-situ* root-zone soil moisture (RZSM) of sweet corn throughout growing season with volumetric water content (VWC) probes
- Evaluate crop phenology stages throughout the growing season
- Develop a growing degree day (GDD)-based K_c curve that estimates daily water usage (DWU) from Penman-Monteith ET (ET_o)
- Benchmark our K_c curve with Normalized Differential Vegetation Index (NDVI) and Mapping Evapotranspiration at High Resolution with Internalized Calibration (METRIC)
- Conduct on-farm evaluations with growers in Georgia, USA
- Integrate results into existing CropFit™ SmartIrrigation app Help producers achieve balance between profitability and water resource management in sweet corn production

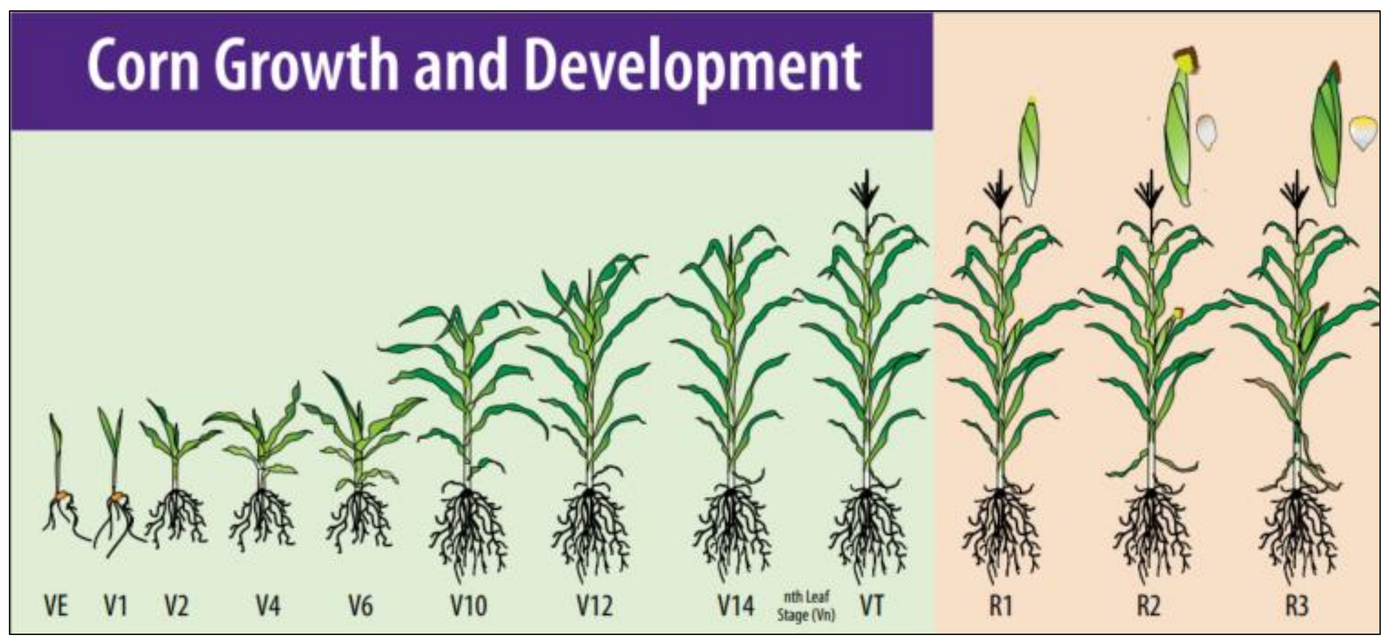

Figure 4. The vegetative and reproductive stages of sweet corn from emergence to harvest

Figure 1. Sentek™ VWC sensor installed (a), Sentek™ sensor in soil profile (d) and AgSense ™ data logger installed (b, c)

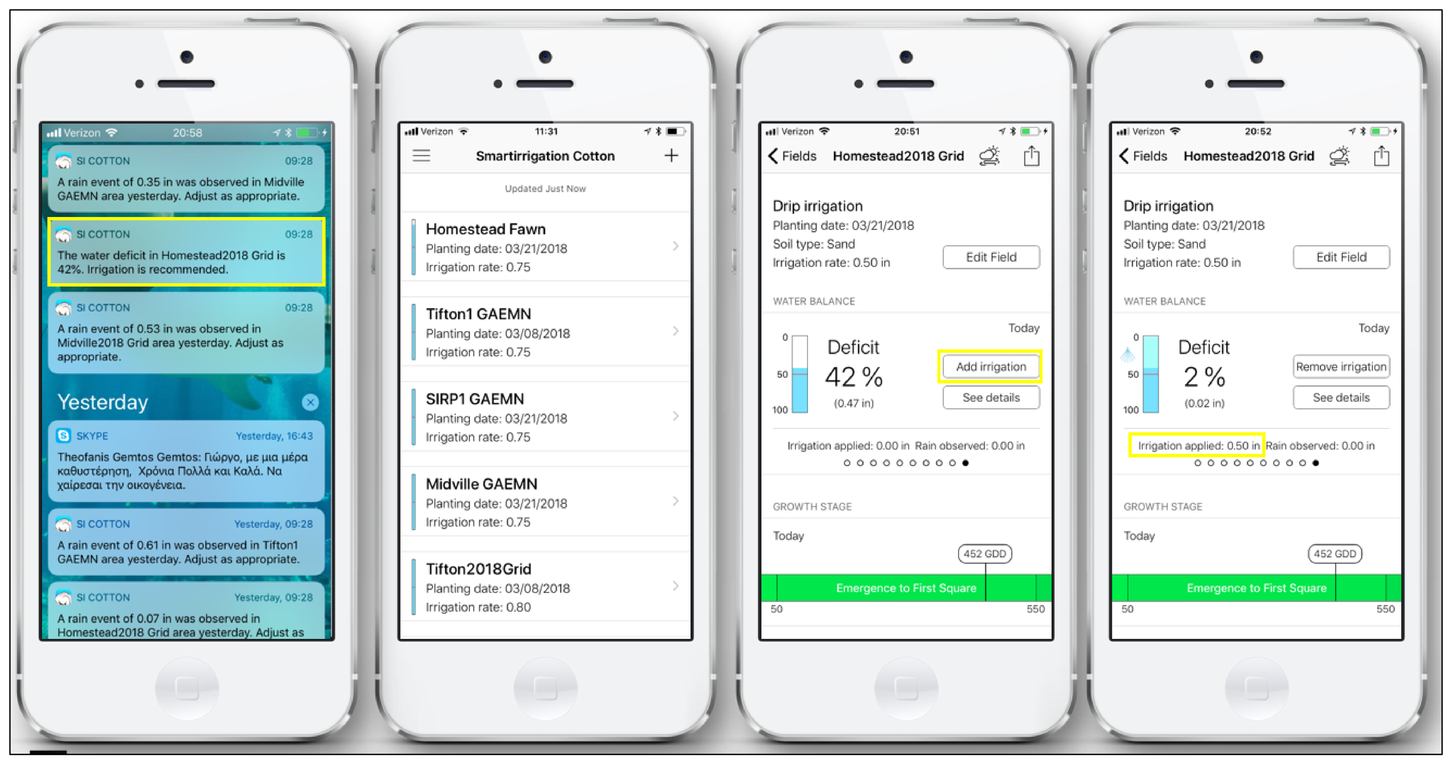

Figure 2. CropFit™ SmartIrrigation Application Interface and capabilities

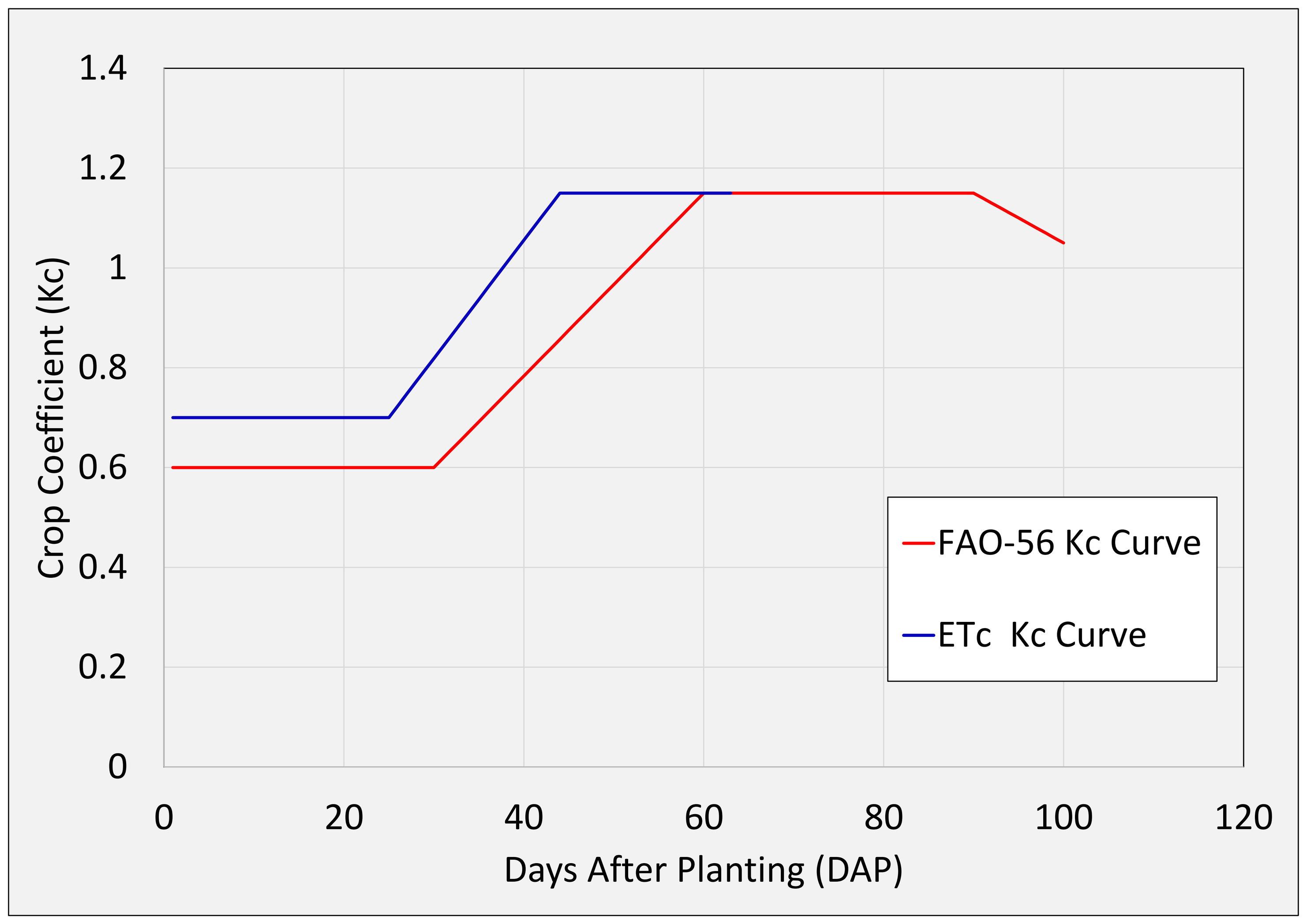

Figure 3. Crop coefficient curve derived from DWU measurements on study fields compared to generic Food and Agriculture Organization (FAO) crop coefficient curve for sweet corn grown in Idaho, USA.

Materials and Methods

- 6 Sentek™ VWC probes are installed in 3 sweet corn fields located in southwestern Georgia, USA each fall and spring season
  - 2 sensors per field: in areas of various elevations and soil types
  - 60 cm sensors measure soil moisture every 10 cm into soil
- AgSense™ data loggers are connected to each sensor
- VWC data is sent in real-time to user portal and processed
- Davis Instruments™ Vantage Pro2® weather stations are installed at each farm
  - Measuring meteorological trends
- Use FAO-56 approach to develop an ET-based model for estimating DWU
  - $DWU = Kc \times ET_o$
- Year 1 and 2 entailed using VWC sensors to estimate K_c curves for sweet corn
  - Data were extracted to reflect peak water use
  - Only days with maximum solar radiation were considered
- High spatial and climatic variability within the coastal plains attribute to difficulty in estimation of crop water needs

Expected Results and Future Work

- Benchmark our ET-based K_c curve with the methods of METRIC and NDVI
- Utilize the CropFit™ SmartIrrigation app sweet corn segment to schedule irrigation based on:
  - Irrigation system information
  - Crop-specific, growth stage needs
- Use this approach and product to educate growers on efficient irrigation practices
- Conduct in-house plot testing at Stripling Irrigation Research Park (SIRP)in Camilla, Georgia, U.S. in years 3-4.
- Experience a decrease in water and energy costs due to resulting product's insight

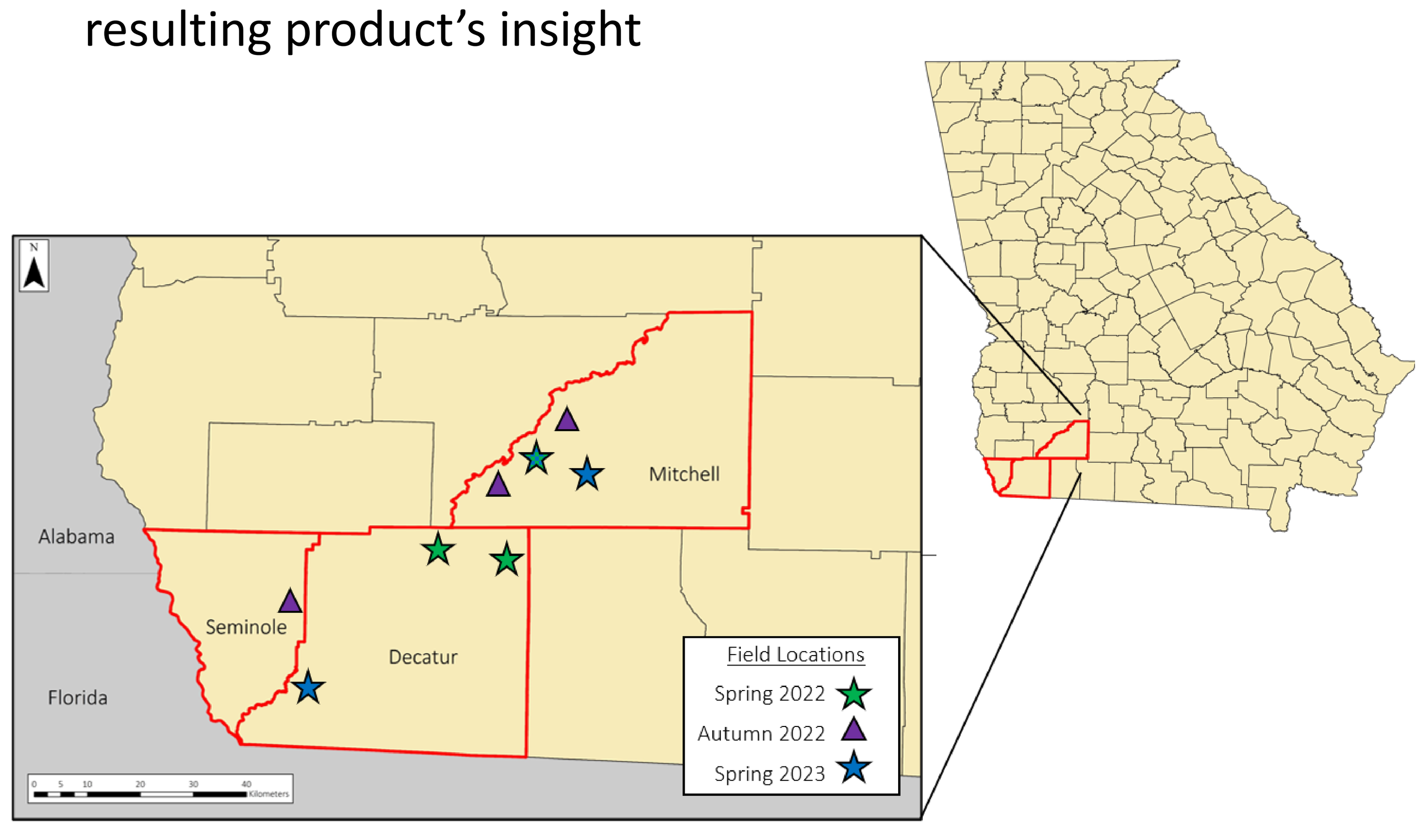

Figure 5. Location of eight study sites located in southwestern Georgia, USA

Conservation Innovation Grant

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