Incorporating Volumetric Water Content (Capacitance) Sensors into the Irrigator Pro-Based Irrigation Scheduling Tool

Principal Investigator: Dr. George Vellidis[1] (229.402.1278, yiorgos@uga.edu)

Project Participants: Dr. Chris Butts[2], Mr. Ioannis Gallios[1]
[1]University of Georgia, [2]USDA-ARS National Peanut Research Laboratory

Layman's Summary:

Irrigator Pro is an irrigation scheduling tool developed by USDA ARS that has been proven to result in improved efficiency and profitability. Over the last five years UGA, NPRL, and the FRSWCD have pooled resources and worked together to develop a smartphone application for the new generation Irrigator Pro that we will hereafter refer to as the ***App***. The Irrigator Pro App uses soil moisture and soil temperature to make irrigation scheduling decisions. Up until 2018, the App required the user to physically visit the field to download the data from soil moisture sensors. Last year we improved the App so that soil moisture and temperature data automatically populate the model. The App now imports data directly from two automated soil moisture sensing systems that report soil moisture in terms of soil matric potential – the Trellis system and the UGA SSA system. The user selects one of the two systems and thereafter, soil moisture and temperature data flow directly to the Irrigator Pro cloud server where the model runs. Decisions are then sent to the App on the user's smartphone where they are displayed as notifications. In addition to integrating the soil moisture sensor systems, we also integrated automated rain gages so precipitation is now also automatically recorded although it is not used by the model. These developments ***eliminate the need to visit the field*** several times a week to collect data. The overall goal of this project is to promote adoption of Irrigator Pro-based irrigation scheduling tools by Georgia's peanut growers by making Irrigator Pro more automated and easier to use.

Objectives

The most current version of Irrigator Pro developed by Co-PI Butts uses soil matric potential measured with soil moisture sensors at 8, 16, and 24 inches to estimate the plant available soil water in the soil profile. This limits the model's use to sensors that can measure soil matric potential. These types of sensors are marketed by a limited number of vendors.

The **specific objective** of this proposal is to modify Irrigator Pro to accept data directly from volumetric water content (VWC) sensors that are also referred to as capacitance sensors. These are the most common sensor-type on the market and some have excellent telemetry systems that ensure reliable delivery of data to the cloud server. This will make Irrigator Pro a much more flexible irrigation scheduling tool and allow growers who have already invested VWC to seamlessly use the model.

Work Completed During FY2022-2023

During 2022, we used a replicated plot study at UGA's Stripling Irrigation Research Park (SIRP) and the USDA ARS Hooks-Hanner Environmental Research Center (HERC) to compare irrigation scheduling with VWC version of Irrigator Pro (IPVWC) to existing versions of the model and other scheduling tools. The VWC version of Irrigator Pro was developed using data collected from field experiments during the 2021 growing season.

In 2022, IPVWC was compared to the soil temperature and soil matric potential version of Irrigator Pro, an evapotranspiration (ET) -based peanut irrigation scheduling tool that is under development, and to matric potential (UGA SSA) soil moisture sensor (SMS) -based scheduling. IPVWC was run in spreadsheet form as it has not yet been programmed into the Irrigator Pro web and app portals. Rainfed (no irrigation except to promote germination and activate herbicides) plots were also included in the study. Results from SIRP and HHERC are shown in Figures 1 and 2, respectively. IPVWC performed at least as well as other irrigation scheduling treatments. Rain totals at SIRP (525 mm, 20.7 in) were higher than at HHERC (406 mm, 16 in) leading to good yields from the rainfed treatment at SIRP.

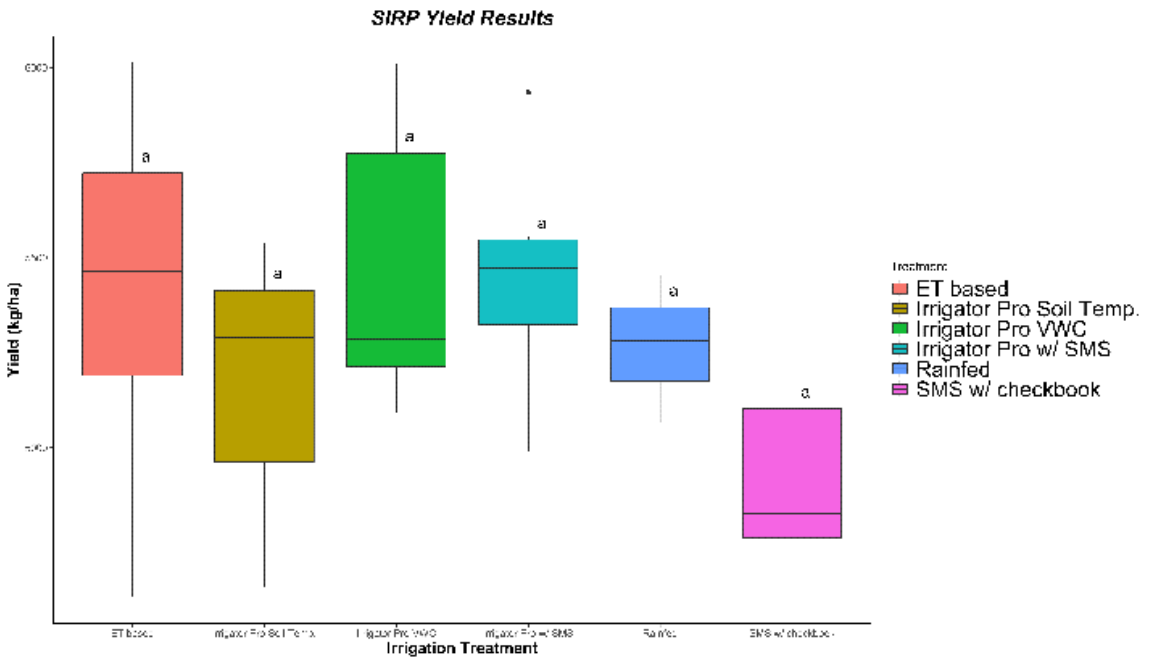

Figure 1. Yield of the 2022 irrigation scheduling study at SIRP (There were no statistically significant differences between treatments.

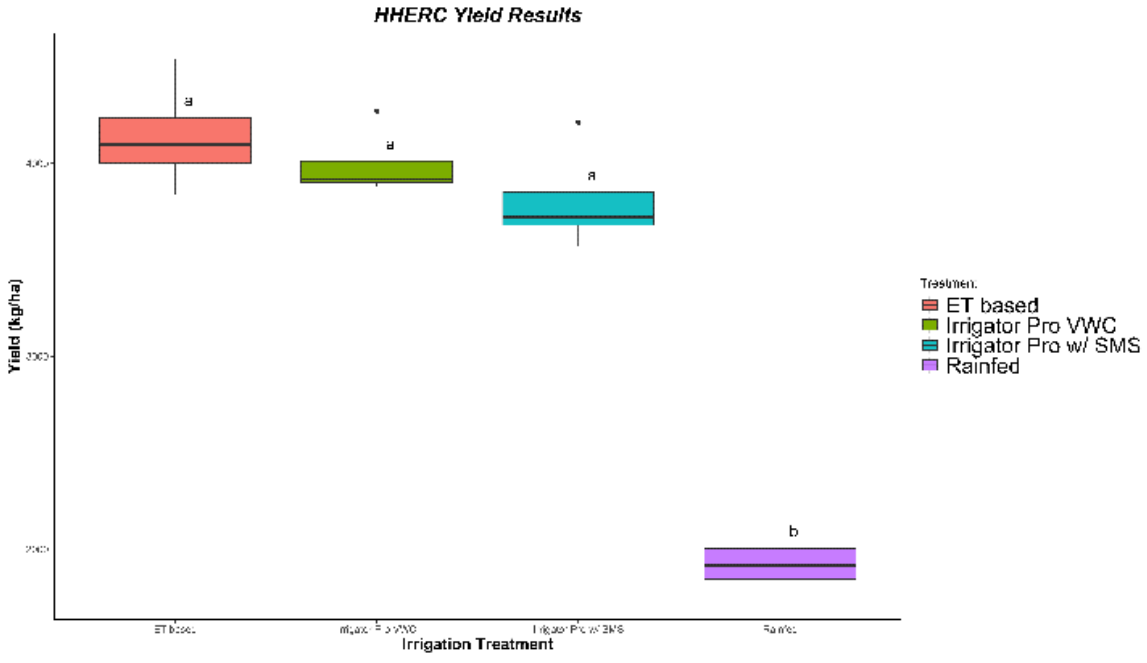

Figure 2. Yield of the 2022 irrigation scheduling study at HHERC. There were no statistically significant differences between treatments except for rainfed.