# ADAPTIVE AND PREDICTIVE DECISION SUPPORT SYSTEM FOR IRRIGATION SCHEDULING: AN APPROACH FOR THE INTEGRATION OF THE HUMAN IN THE CONTROL LOOP

***Gregory Conde**, Sandra M. Guzmán*

Agricultural and Biological Engineering Department, UF/IFAS Indian River Research and Education Center, Fort Pierce, FL. USA

In this presentation, our team will introduce the development of an adaptative and predictive irrigation management decision support system (DSS) using seepage irrigation as a case study. The DSS is a feedback plus feedforward algorithm that uses modeling, estimation, prediction, and control strategies. The major feature of this DSS is the consideration of human intervention in the control loop. The DSS integrates field data, including soil moisture, rain, temperature, and irrigation, in addition to weather forecasting. It provides irrigation managers with precise and practical instructions based on the manager's decision of when and how much to irrigate. The DSS will adapt in real-time to provide irrigation volume recommendations that ensure optimal soil moisture levels are maintained. Our approach includes the incorporation of a simplified control-oriented model (COM) to characterize the soil moisture dynamics, a data processing stage that makes the measured data compatible with the COM, a parameter estimation stage that guarantees an optimal adjustment of the COM parameters, a control stage that uses the parametrized COM, measured information from the crop, and weather forecasts to obtain optimal irrigation volume recommendation. To evaluate our DSS, we conducted a test in a commercial sweetcorn field in South Florida, where seepage irrigation is used. Our findings demonstrate that i) the proposed model and estimation stage offer an accurate description of the soil moisture dynamics, reaching R-squared values greater than 0.84 during all the evaluations, ii) the algorithm can consistently regulate soil moisture, ensuring it remains at the desired levels reducing the risks associated with leaching and runoff, and iii) water savings can increase by 30 % if both in-field sensors and the DSS are implemented. Therefore, our DSS has the potential to serve as a standardized platform for providing optimal and practical irrigation recommendations to irrigation managers.

PRESENTER BIO: Dr. Gregory Conde is an Associate Postdoc at the University of Florida's Smart Irrigation and Hydrology Laboratory. An expert in control systems, he specializes in optimizing agricultural practices through applied math and artificial intelligence. Dr. Conde holds a joint Ph.D. in Automatic Control and Engineering and has been recognized for his contributions to improving water management in irrigation systems.

His postdoctoral research is funded by the Conservation Innovation Grants program at USDA's Natural Resources Conservation Service entitled: *"Enhancing the irrigation management in vegetable farms in southeast US by developing root zone soil moisture maps in both high spatial and high temporal resolutions".*