MISSISSIPPI SOYBEAN PROMOTION BOARD
PROJECT NO. 11-2017 (YEAR 2)
2017 ANNUAL REPORT

Project Title: Practical Application of Sensor-based Irrigation Scheduling Method in Soybean

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OBJECTIVES

1. Develop practical application method of soil moisture sensors for irrigation scheduling on soybean
2. Compare the sensor-based irrigation scheduling method with Arkansas Irrigation Scheduler.

PROGRESS

Objective 1.

A randomized block design was implemented with 2 irrigation treatments, ISSCADA (Irrigation Scheduling and Supervisory Control and Data Acquisition System), and VRI (Variable Rate Irrigation) with 2 replications in a 20-acre soybean field (Fig. 1). Irrigations are scheduled using ISSCADA in the ISSCADA treatment while using the VRI method in the VRI treatment.

Both the ISSCADA and VRI treatments used soil moisture sensors to measure soil water content to support an irrigation decision. 10 soil moisture sensing locations were selected in the field. In 6 locations, GS-1 soil water content sensors were installed underground at depths of 6, 12, and 24 in., respectively at each location to detect the soil water content in the rooting zone. In another 4 locations, 16 TDR-315 soil water content sensors were installed with at depths of 6, 12, 18, and 24 in.

ISSCADA was installed on the pivot to scan the soybean canopy for canopy temperature. Soil moisture data were collected and wirelessly reported in each hour. Sensor-measured soil moisture data were processed using a weighted-average method to reflect soil water status in the root zone and used in irrigation scheduling coupled with soil electrical conductivity and canopy temperature.

Objective 2.

Irrigation events in the VRI treatment were scheduled based on measured soil water content (SWC). Soil water contents in the various depths were calculated and used for irrigation scheduling in the VRI treatment. Percent plant available water (PPAW) is calculated using equation 1 to trigger irrigation events.

$$PPAW = \frac{(Sensor\text{–}measured\ SWC) - (SWC\ at\ wilt\ point)}{(Field\ Capacity - SWC\ at\ wilt\ point)} \quad (Equation\ 1)$$

Irrigation will be triggered when PPAW dropped approximately to 50%.
Irrigations were conducted using a center pivot irrigation equipment. Over the season, five irrigation events were scheduled with total depth of 3.1inch water applied in the ISSCADA treatment and the VRI treatment at the 100% irrigation rate.

Crops were harvested on Sept. 8, 2017. Soybean yield samples were collected and yield data of the whole field were collected using a yield monitor in the harvester. Hand-harvested soybean crop samples were prepared for the yield. All data will be analyzed for effect of irrigation treatments on yield.

The Arkansas Irrigation Scheduler (AIS) was installed in computers. A Bio-Science Aid was hired through MSU and assigned to process the data for AIS. Data including weather data and plant growth information were entered in the AIS for comparison of AIS-based irrigation scheduling and soil moisture sensor-based irrigation scheduling.

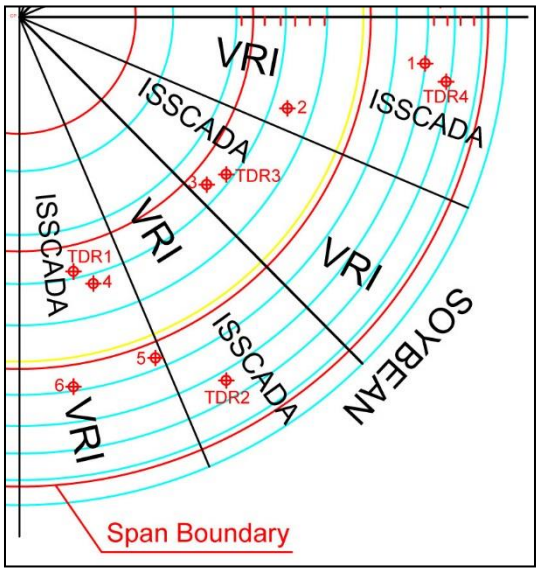

Figure 1. Experimental setup for sensor-based irrigation scheduling.

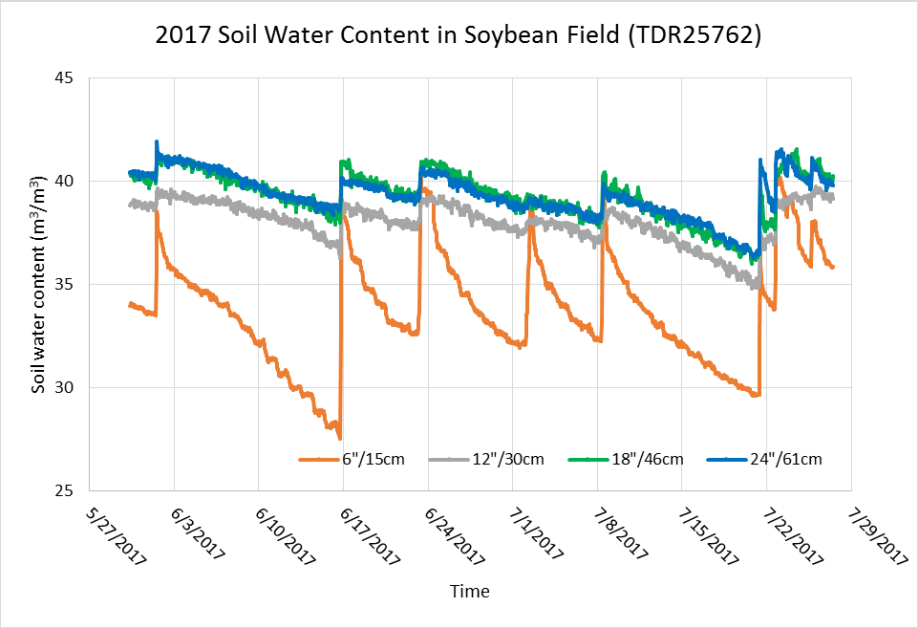

Fig. 2. Soil water content measurements across 2017 season in soybean field.