Sensor-Based Irrigation Management in Blueberry Production System in Missouri

Asbin B K[1*], Jasmine Neupane[1]
Division of Plant Science and Technology,
University of Missouri, Columbia

Introduction

- Precision irrigation management is crucial for sustainable agriculture as it optimizes water use efficiency, improve crop productivity and quality, and conserve resources.
- Advanced Internet-of-Things (IoT) soil moisture sensors enable site specific precision irrigation management based on crop water requirement using real time information from sensors.
- Insufficient rainfall, spatial variability in water requirement and detrimental effect of both over and underirrigation due to shallow root system necessities the site-specific irrigation management in blueberries.

Objectives

- The objectives of this study is to compare the sensor based and conventional irrigation scheduling method and identify the effectiveness of sensor-based irrigation in blueberry production

Materials and Method

- **Study location: U**-pick blueberry farm Columbia, Missouri.
- **Soil sampling:** Soil samples were collected from two different depths(15 and 30 cm) of study area for analysis of soil pH, texture, organic matter and other nutrient conditions of the soil.
- **Sample preparation:** For two different soil depth, soil samples were composited and mixed thoroughly and sent to the laboratory for further analysis

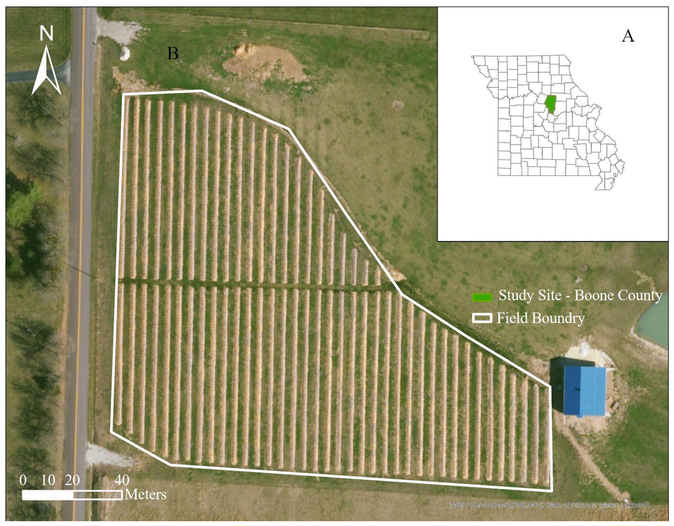


Fig 1: Boone County within the Missouri state and (A), Research field (B)

Fig 2: Experimental areas with data loggers

- **Experimental Design:** Split plot with two treatments for irrigation method - sensor based and conventional, and varieties - Duke and Legacy, each treatments replicated twice and randomly assigned.

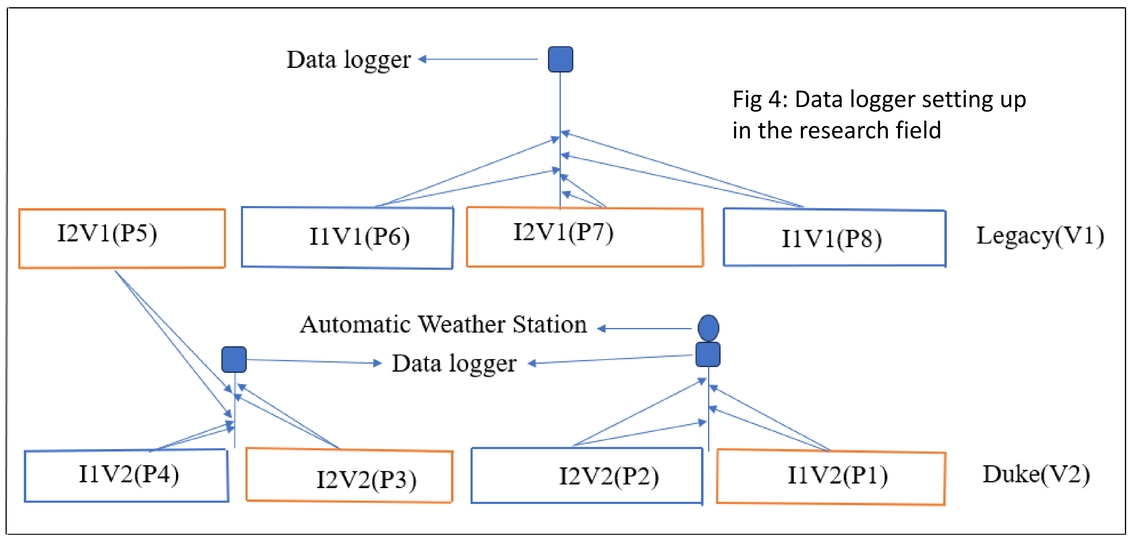


Fig 4: Data logger setting up in the research field

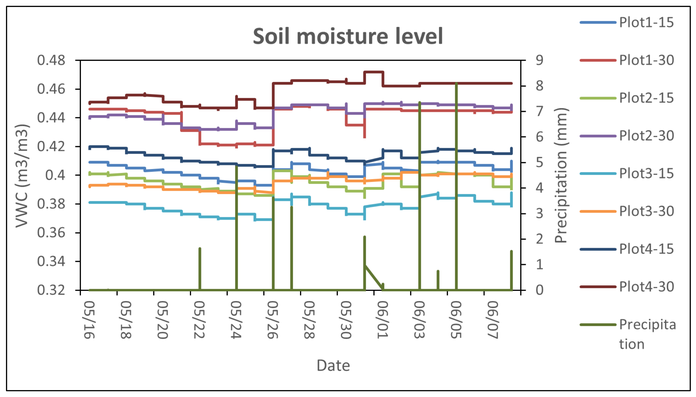
Note: I1=Sensor-Based, I2=Conventional, V1= Legacy, V2= Duke, P1 to P8= Plots

Fig 3: Experimental design

- Each plot consists of 4 plants with 2 sensors placed at 15 cm and 30 cm depth in between the middle two plants.
- Sensor based irrigation application based on soil moisture sensor readings in treatment plots.
- Collection of drone imagery and evapotranspiration calculations to make valid conclusions regarding sensor-based irrigation.

Preliminary Results

- The study area has the silty clay loam soil with organic matter content of 4 to 4.9 % and 3.2 to 3.4 % organic matter in 15 and 30 cm depths respectively.
- Higher amount of soil moisture are being recorded in lower depth(30 cm) as compared to upper depth(15 cm) depths in all the plots(Fig. 4).
- NDVI calculated before the application treatment showed the variation in vegetation health indicating potential spatial variability in soil moisture(Fig. 5).



Note: Depth of the soil moisture sensor is in cm

Fig 4: Soil moisture reading in different plots

Fig 5: NDVI calculations of the field before irrigation treatment

Ongoing Activities and Future Work

- Two harvests from the Duke(V2) and one harvest from Legacy(V1) is already done and berries samples are sent to laboratory for quality analysis.
- A total of 3 pickings will be done for each varieties and samples will be sent to the laboratory for quality analysis.
- Irrigation treatments will be applied continuously based on soil moisture sensor readings.
- Drone based data are being collected before each harvest and two days after each irrigation treatments.
- The data from automatic weather station are being recorded and for crop-coefficient and evapotranspiration calculation.

Fig 6: Data logger setting up

Fig 7: Drip line channel diversion

Fig 8: Sample collections

Fig 9: Ripe blueberry samples

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