A Holistic Solution to Using Soil Moisture Data for Scheduling Irrigation

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Objective: Integrate Irrigator Pro into the Dynamic Variable Rate Irrigation (VRI) System.

The overall goal of the project is to develop and demonstrate that dynamic variable rate irrigation (VRI) is a viable and implementable solution for peanuts. Over the past four years we have demonstrated that by using a VRI system linked to an automated soil moisture sensing system, we can consistently achieve irrigation water use efficiency gains (IWUE) of up to 40%. This means that we can produce 40% more crop with every drop of irrigation water than other irrigation scheduling methods.

For the first two years of this study, we scheduled irrigation using only soil moisture data while our cooperating grower scheduled irrigation using the traditional version of Irrigator Pro. The traditional version of Irrigator Pro uses manually entered soil temperature and precipitation to make irrigation decisions. In both years, our IWUE was 40% greater than the grower's but our yields were even or less than his. His yields were high because Irrigator Pro is a sophisticated model that takes into account the crop's physiology and makes irrigation scheduling decisions based on several variables – not just soil moisture. During the third year of the study, we used the new generation Irrigator Pro to decide when to irrigate and the soil moisture sensor data to decide how much water to apply. The result was 40% better IWUE and 5% better yields than the grower. The new generation Irrigator Pro uses soil moisture, soil temperature, and precipitation data to make irrigation scheduling decisions. In 2018, we collaborated with a different grower – one who used a strict calendar method to schedule irrigation. Our Irrigator Pro driven dynamic VRI system ***resulted in 47% higher IWUE and 11% higher yields***. We believe that after four years of on-farm evaluations, we ***can unequivocally state that dynamic VRI results in significantly higher IWUE and higher yields***.

However, the truth is that soil moisture sensor-driven dynamic VRI is expensive and difficult to implement because it requires a minimum of one and likely two or three sensors for each irrigation management zone (IMZ) for it to perform to its maximum potential. That is how we achieved the results described above. An alternative way may be to use evapotranspiration (ET) –based soil water balance models to schedule irrigation. Our experience with the SmartIrrigation Cotton App and Dr. Diane Rowland's PeanutFARM model show that these models can perform as well as sensor-based irrigation scheduling. To use a model-based dynamic VRI approach, we would still delineate the field into IMZs and apply the model individually to each IMZ. The model outputs would be used to write the VRI prescription map. Demonstrating that ET model-based dynamic VRI is a viable approach for peanut production that results in IWUE and yield gains similar to those we achieved with sensor-driven dynamic VRI can lead to rapid adoption of this method by peanut growers as it will not require investing in and installing and removing sensors.

Figure 1. The field used for our dynamic VRI study in 2018. The approach of pairs of parallel conventional and VRI strips will be used again in 2019. The gages indicate the location of UGA SSA sensor nodes.