COTTON IRRIGATION SCHEDULING: A COMPARISON OF IRRIGATION SCHEDULING STRATEGIES

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Introduction

- Cotton is one of the most difficult crops to irrigate because it requires to just the right amount of water stress at the right time to maximize yield. However, excessive stress or excessive water will reduce lint yield.
- There are many irrigation scheduling tools available to producers, each with its own levels of time and monetary investment.

Objectives

- The main objective of this multi-year study was to evaluate various commercially available irrigation scheduling strategies to aid cotton growers in determining the best irrigation scheduling strategy for their operation.
- The sub-objectives of this study were:
  - To monitor soil moisture and determine optimal irrigation timings for each method.
  - To log the total amount and distribution of rainfall and irrigation during the season for each irrigation scheduling method, and to determine the effect of the irrigation scheduling method on final crop yield and irrigation water use efficiency (IWUE).

Materials and Methods

Experimental design: Randomized block design implemented under a lateral irrigation system equipped with a variable rate irrigation controller at UGA's Striping Irrigation Research Park near Camilla, GA. Nine treatments replicated three times were evaluated in 2020, 2021, and 2022.

Treatments: Soil water tension thresholds of 20 (wet), 45 (optimum), and 75 (dry) kPa, USDA-ARS IrrigatorPro, Crop Metrics CropX, Valmont's Valley Irrigation Scheduling, SmartIrrigation Cotton Irrigation Scheduling app, UGA's Checkbook method. A limited water treatment replaced the IrrigatorPro during the 2022 growing season. A rainfed check was utilized each year to evaluate irrigation water use efficiency.

Data Collection and Implementation: Three watermark soil water tension (SWT) sensors integrated into a probe at depths of 6, 10, and 14 inches were installed into two of the three replications or each treatment each year. Data was logged and monitored hourly and used for monitoring purposes only in all plots except for the 20, 45, and 75kPa treatments which used the data through a weighted average approach to estimate rooting depth and determine when the irrigation trigger point was reached.

Figure 1: from left to right:

- CropX sensor system,
- Valley Scheduling system,
- SWT probe and data logger

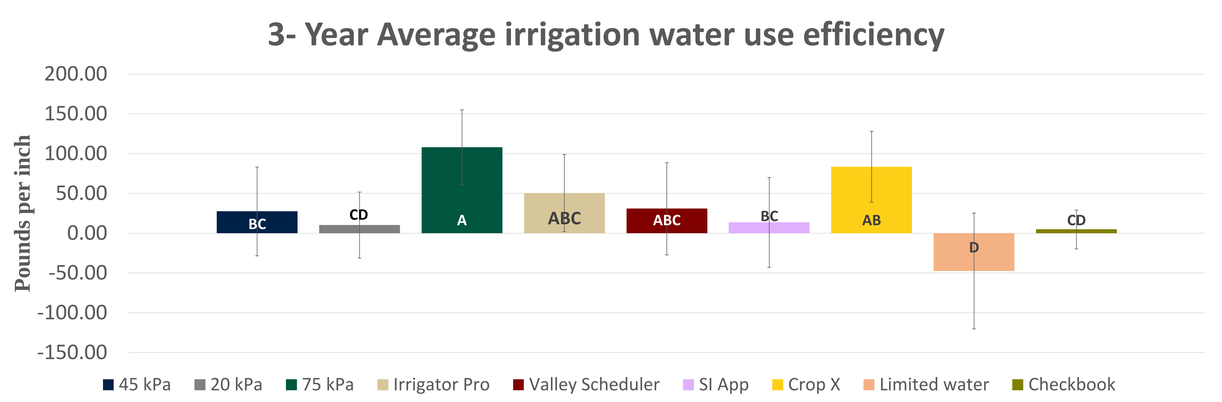
Analysis: Analysis of variance(ANOVA) and Tukey comparisons were conducted using JMP Pro 16.0 (SAS, Cary NC).

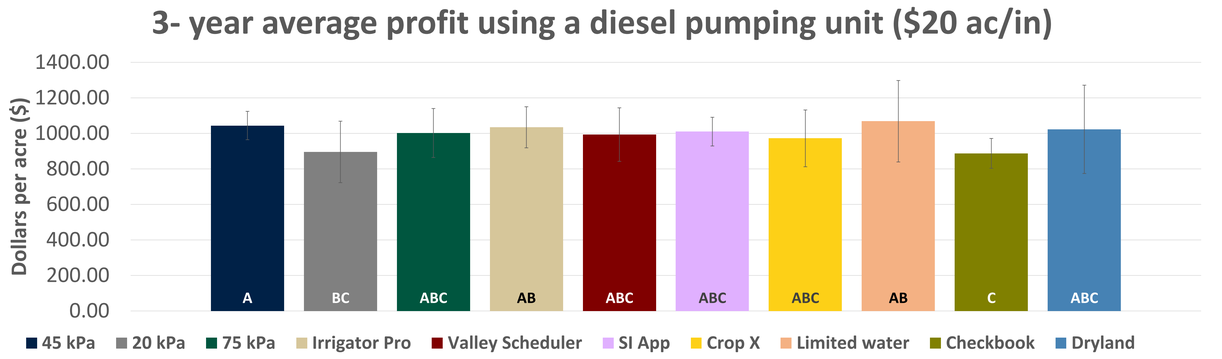
Profitability: Was calculated using estimates from the UGA enterprise budgets to estimate the price of 1-acre inch of water. These estimates show a price of $7 per ac/in when using an electric drive and $20 ac/in when using a diesel pumping unit.

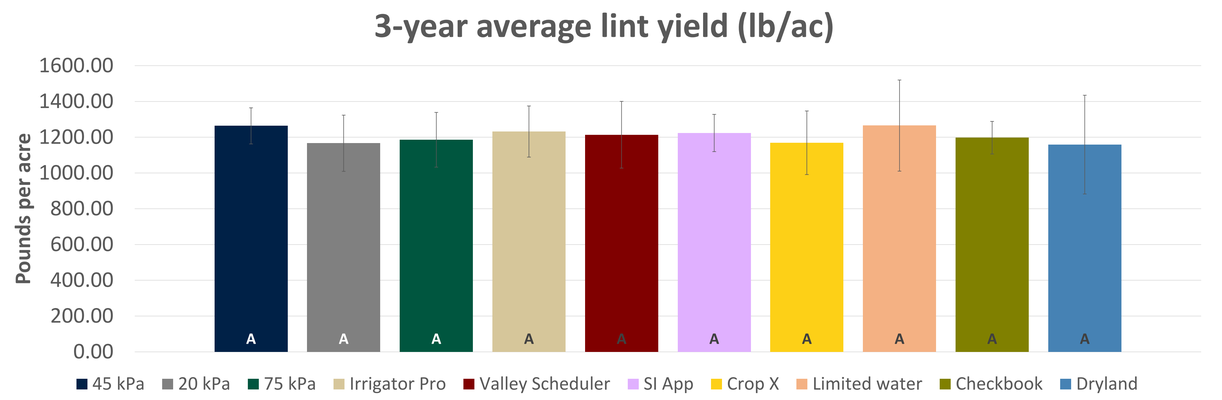
Irrigation water use efficiency (IWUE): Was calculated by using the total irrigation amount and normalized yield by using the dryland as a base yield to calculate the total lint yield increase per inch of irrigation applied.

$$\frac{Yield - Mean\ Dryland\ Yield}{Total\ Irrigation} = IWUE$$

Results







Conclusions

- There was no statistical difference in lint yield between any of the treatments across the three years.
- Profitability was maximized when using the 45 kPa trigger point when using a diesel pumping unit however these differences were unsubstantial when using an electrical pumping system.
- Irrigation water use efficiency can result in a negative number or less lint yield per inch of water when compared to dryland. This occurs when over-irrigation is applied which decreases overall profitability.

References

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