Mississippi Corn Promotion Board
2016 Progress Report

Project title: Irrigation and Soil Management Strategies that Improve Irrigation Application Efficiency, Soil Quality, Water Quality, and Corn Yield

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Project Summary (Issue/Response)

The United States Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS) made an unprecedented push for the adoption of cover crops nationally and in the Mid-South specifically. Under NRCS's own admission, however, their assertion of cover crop benefits on Mid-South production systems (improved soil quality, reduced erosion, reduced fertility inputs, increased water holding capacity, irrigation reductions, improved profitability, etc.) is not supported by replicated research data. Rather, cover crop benefits are supported by testimonials from select Mid-West producers. However, the Row-crop Irrigation Science and Extension Research (RISER) Program's small-plot and on-farm validation data for soybean indicates potential for cover crops and no-tillage to improve irrigation application efficiency, soil quality, and on-farm profitability while, concurrently, reducing erosion and off-site N and P transport. Moreover, RISER data indicate potential for sensor-based irrigation scheduling in corn to be optimized by growth stage to improve yield and water-use efficiency.

Project Results/Outcomes

The objective of this project is two fold. First, we are developing a cover crop production system for corn that maintains profitability, increases irrigation water use efficiency, and improves soil/water quality. Second, we are attempting to optimize irrigation water use efficiency for corn by defining sensor based irrigation thresholds by growth stage.

For objective 1, cover crops including cereal rye, tillage radish, "tropic sun" sunn hemp, Austrian pea, and crimson clover were planted 10/20/2016. Baseline soil quality samples were collected at planting. The first corn crop will be established spring 2017.

For objective 2, a split-plot experimental design was used to determine optimum sensor based thresholds as a function of crop growth stage. The main plot was growth stage (Vn to R1, R2 to R3, R4 to R6), and the subplot was irrigation threshold (-40 cbar or -130 cbar). Season long thresholds (-50, -75, -100, and -125 cbar) were included for a positive control, and a non-irrigated treatment was included for a negative control.

Project Results

Preliminary data indicate potential for sensor based irrigation scheduling to improve corn grain yield and irrigation water use efficiency. Foremost, our data indicate that over-irrigating can have an adverse effect on corn grain yield. For example, corn grain yield was not different than that of the non-irrigated when the soil moisture content was maintained at –40 cbar during the early reproductive growth stages, that is, R1 through R3. This is the first replicated data we have collected that indicates unnecessary irrigations during vegetative and/or early reproductive stages can have an adverse effect on corn grain yield. The majority of delta corn producers are, unfortunately, unnecessarily irrigating during these growth stages. Moreover, our data indicate that corn grain yield and irrigation water use efficiency were optimized when an irrigation threshold of -100 cbar was maintained throughout the growing season, which is consistent with our on-farm demonstration results.

Treatment	Yield (bu/acre)
Non-irrigated	128.7 c
-130 cbar all season	142.9 cb
-100 cbar all season	152.0 ab
-70 cbar all season	147.9 ab
-40 cbar all season	150.4 ab
Vn to R1 -130 cbar	148.6 ab
Vn to R1 -40 cbar	148.6 ab
R1 to R3 -130 cbar	151.8 ab
R1 to R3 -40 cbar	142.2 bc
R3 to R6 -130 cbar	153.1 ab
R3 to R6 -40 cbar	166.2 a

Treatments followed by the same letter are not statistically different at P = 0.05.

Project Impacts/Benefits

This project has identified an irrigation strategy that should be avoided due to a reduction in corn grain yield, that is, over irrigation during early reproductive growth stages. Secondly, results from this project are helping to identify an irrigation threshold that maximizes corn grain yield and irrigation water use efficiency. Coupling these two benefits should improve on-farm profitability and extend the use of our most precious natural resource, the Mississippi Alluvial aquifer.

Project Deliverables

Five scientific talks (146 attending), 2 field days (145 attending), 30 grower meetings (1,986 attending), and 22 technical presentations (938 attending) were conducted across the state from October 2014 through December 2016. Four popular press articles and 5 blog posts were also published within that same timeframe.