Mississippi Corn Promotion Board
2019 Progress Report

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

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Project Summary (Issue/Response)

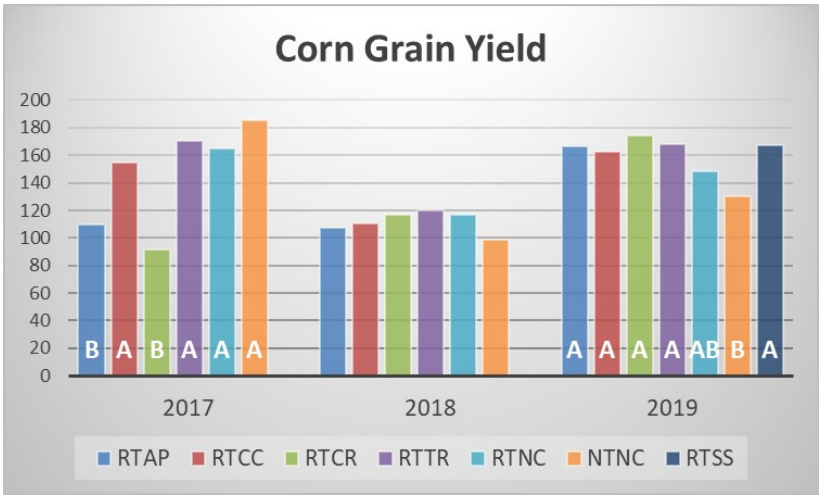
The Mississippi River Valley Alluvial Aquifer, the primary source for agricultural irrigation in Mississippi, is declining due to overdraft. Additionally, row-crop agriculture is cited as a major cause of pollution of surface water bodies. Corn in Mississippi is primarily seeded on medium- to coarse-textured soils, which are susceptible to surface sealing and erosion, thus decreasing irrigation efficiency and rainfall capture while contributing to impairment of downstream waters. Cover crops are touted as a means to improve soil quality, increase infiltration, reduce erosion, and provide enhanced nutrient cycling. This research is being conducted to evaluate the effects of cover crops (Austrian winter pea, cereal rye, crimson clover, and tillage radish) and tillage (reduced tillage with and without subsoiling and no tillage) on 1) soil quality [soil organic matter, aggregate stability, infiltration, and water holding capacity], 2) irrigation application efficiency and rainfall capture, 3) surface runoff, erosion, and off-site N and P transport under furrow irrigation and simulated rainfall, 4) nitrogen by irrigation level yield response for leguminous cover crop (Austrian winter pea), and 5) yield, water use efficiency, and profitability. The results of these studies will be used to recommend cover crop/tillage systems that optimize irrigation application efficiency, crop water use, and off-site sediment and nutrient transport while maintaining or improving yield and economic profitability.

Project Results/Outcomes

Small-plot experiments were conducted from 2017 through 2019 in Stoneville, MS on a Commerce silt loam to evaluate the study objectives. In the first year of the experiment, Austrian winter pea and cereal rye decreased corn grain yield. In 2019, no yield effect was observed for any cover crop; however, no-tillage decreased yield relative to cover crops and reduced tillage with subsoiling. Yield decreases were accompanied by stunted corn plants and delayed maturity throughout the growing season for both cereal rye in 2017 and no-tillage in 2019. In 2017 and 2019, there was no difference in irrigation efficiency/ runoff among any of the treatments. In 2018, no-tillage and crimson clover decreased irrigation runoff compared to reduced tillage. No differences in infiltration and runoff were detected in any of the three years under simulated rainfall. In 2017 and 2018, no-tillage decreased turbidity, but also increased transport of some nutrients, such as dissolved organic carbon and nitrate, under irrigation or simulated rainfall. Water quality for 2019 and soil samples are currently under analysis. Many proponents of cover crops indicate that several years are required for benefits to materialize, thus it is important to continue evaluating longer-term changes in these systems.

Project Results

Figure 1. Corn plant height and maturity in 2019; no-tillage is shown on the left and reduced tillage on the right.



Year	RTAP	RTCC	RTCR	RTTR	RTNC	NTNC	RTSS
2017	110.1	154.7	91.9	170.4	164.8	185.1	
2018	107.6	110.6	116.5	119.9	116.5	98.3	
2019	166.2	162.6	174.1	168.2	148.6	130.4	167

Figure 2. Corn grain yield for a cover crop/tillage study from 2017-2019 where treatments are reduced tillage/Austrian winter pea (RTAP), reduced tillage/crimson clover (RTCC), reduced tillage/cereal rye (RTCR), reduced tillage/tillage radish (RTTR), reduced tillage/no cover crop (RTNC), no-tillage/no cover crop (NTNC), and reduced tillage/subsoiling (RTSS).

Project Impacts/Benefits

The results from this research will allow Mississippi corn producers to make more informed decisions on whether or not to include cover crops in their production systems. Currently, little research exists on cover crop effects on soil quality, water use, erosion, nutrient transport, yield, and economic benefits in the Mid-South. Much of the NRCS's claim of cover crop benefits in the Mid-South are based on testimonials from Mid-West producers. The difference in climate and management practices between the Mid-South and Mid-West are likely to significantly influence the effectiveness of cover crops. The research proposed is necessary to either support or dispute those claims and provide Mid-South growers with the most relevant information for their operations.

Project Deliverables

Four national scientific presentations (160 attending)

Seven regional scientific presentations (250 attending)

Five regional producer/consultant presentations (200 attending)

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