



Mississippi Corn Promotion Board 2014 Progress Report

Project Title: Corn and Soybean Crop Residue Management Impact on Soil Quality, Yield and Return

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Project Summary (Issue/Response)

Since soil quality changes occur at a slow rate, a five year (2011-2015) study is being conducted to evaluate the effects of corn and soybean crop residue management and tillage systems (in a corn-soybean rotation) on soil quality (soil physical, chemical and biological properties), grain yield, crop residue yield and nutrient content, and the economic returns associated with these crop production systems in irrigated (Stoneville) and non-irrigated (Verona) environments.

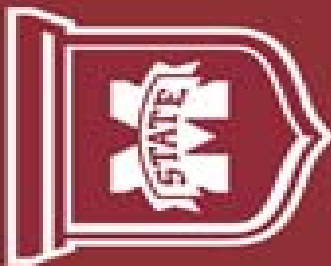
Crop residue management [burn (corn only) and no-burn] and tillage treatments [no-tillage (old beds), bed-roller, disk (2x) + in-row subsoil-bed-roll (TerraTill®, a one-pass operation implement) and subsoil-bed-roll alone] are on the same site for the duration of the study. The year 2014 was the third year data was collected. The soil's nutrient, microbial biomass, respiration, and the crop residue/biomass fertilizer nutrient content analysis have not been completed for both locations.

Except for ground cover at Verona, crop residue management (burn and no-burn) at both locations had no significant impact on all the variables measured and did not interact with tillage systems. There was a crop residue management by tillage interaction at Verona. The disk (2x) + TerraTill and bed-roller had more ground residue (old crop residue and winter vegetation) in March where corn crop residue had not been burned than where it had been burned (fall 2012). With no-tillage and TerraTill there was no difference between the burn and no-burn. No-tillage ground cover at both locations was higher than all other tillage treatments. TerraTill ground cover at both locations was higher than the disk (2x) + TerraTill. Data for both locations indicated corn seedling emergence for no-tillage was the same as the other tillage systems and there were no population, plant spatial variability, early season growth, corn crop residue yield and 100 seed weight differences. Due to above normal rainfall, good rainfall distribution and cooler temperatures during the growing season at Stoneville, no supplement irrigations were applied. At Stoneville, the disk (2x) + TerraTill and bed-roller had higher yields and net returns than no-tillage. TerraTill yields were not different from bed-roller or disk (2x) + TerraTill, but the returns were lower than bed-roller and the same as the disk (2x) + TerraTill. No-tillage and bed-roller yields and net returns at Verona were not different but were lower than the TerraTill which had the highest yield and net return. Bed integrity at both locations for the no-tillage (on old beds) system lasted two cropping seasons and had to be reshaped in the spring of 2014.

Project Results/Outcomes

Except for ground cover at Verona, 2014 (year 3 of data collection), crop residue management [burn corn stubble (only) and no burn] had no effect on corn population, early season growth, plant spatial variability, soil organic matter, soil root resistance index (penetrometer), grain yield and net returns; and had no interaction with tillage systems. At Verona, the no-burn corn crop residue had higher ground cover than the burn corn crop residue (fall 2012) treatment treatment for the bed-roller and disk (2x) + TerraTill with no differences for TerraTill and no-tillage. Ground cover in March at both locations for no-tillage was 65 and 88% for Stoneville and Verona, respectively, which was higher than all

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Project Results/Outcomes (continued)

other tillage treatments. The disk (2x) + TerraTill had the lowest ground cover. Ground cover plays an important role in dissipating the raindrop's energy on impact which results in less soil erosion. As the study progresses over time, we expect the fewer tillage trips and not burning the corn crop residue in the long term to have a positive impact on soil quality, yield and returns.

Data from both locations indicated corn seedling populations showed no emergence differences between tillage systems. Early season plant height, number of leaves per plant and plant spatial variability at both locations also indicated no differences between tillage systems. Due to below normal temperature, above normal rainfall and good rainfall distribution at Stoneville, supplemental irrigations were not applied. Above normal rainfall during the growing season also occurred at Verona. There were tillage treatment grain yield differences for both locations. The no-tillage yield of 205 bu/acre at Stoneville was equal to the TerraTill yield of 212 bu/acre, but lower than the bed-roller and disk (2x) + TerraTill yields of 220 bu/acre. TerraTill and disk (2x) + TerraTill yields of 277 and 268 bu/acre, respectively, at Verona were higher than no-tillage yield of 254 bu/acre. Bed-roller yield of 265 bu/acre was not different from disk (2x) + TerraTill, but lower than TerraTill. The disk (2x) operations did not increase yield at both locations. Kernel weight and crop residue yields for all tillage treatments at both locations were not different. The crop residue yields ranged from 4.2 to 4.9 tons/acre. Root growth resistance index (penetrometer) measurements at both locations most often indicated no-tillage and bed-roller had higher root resistance indices than TerraTill and disk (2x) + TerraTill at both the 3- and 6-inch depths.

Bed integrity at both locations for the no-tillage (on old beds) system lasted two crop production seasons, and then had to be re-bedded in 2014. The economic analysis for Verona and Stoneville indicated crop residue management had no effect on net returns above total specified costs, and there was an interaction with tillage treatments. TerraTill had the highest net return (above total specified costs) of \$518/acre at Verona, and was higher than the no-tillage, bed-roller and disk (2x) + TerraTill which showed no differences in returns. At Stoneville, the bed-roller had the highest net returns of \$262/acre, but was not different from the disk (2x) + TerraTill net returns of \$224/acre. Both had higher returns than no-tillage and TerraTill returns of \$210 and \$213/acre, respectively. The net returns were based on a corn price of \$3.70/bu with direct and fixed expense priced on values from Mississippi State University Budgets. Some items were intentionally left out of these cost calculations i.e., costs for land or land rent, taxes, insurance, general farm overhead, and expected income from government payments or insurance payments, as they vary widely between operations. Stoneville's net return analysis has not been completed.

Project Impacts/Benefits

Since soil quality improvement processes occur at a slow pace, this 5-year (2011-2013) research study when completed will provide producers the necessary information to make an informed decision regarding the economic returns associated with these crop residue management-tillage systems in irrigated and non-irrigated environments. It will provide information regarding their positive or negative impact on yield, soil quality and fertilizer nutrient use efficiency. Results from these studies will also provide needed information on the level of soil quality enhancement or degradation (soil organic matter, soil aggregate stability, bulk density, soil microbial biomass, soil respiration, etc.) from these crop residue management-tillage practices on both alluvial delta and prairie coastal plain soils in Mississippi. The outcome of this research will provide Mississippi growers the information that will enable them to understand how they can develop "Soil Quality Enhancement Activities" meeting the requirements for NRCS's Conservation Stewardship Program. The economic analysis using current and/or projected production costs and grain pricing also will allow us to measure the net return above total specified costs for these-crop residue management tillage systems in the near- and long term.

Project Deliverables

Field Presentations:

Buehring, N.W. Corn and Soybean Crop Residue Management and Tillage Impact on Soil Quality and Yield. North Mississippi Research and Extension Center Row Crops Field Day, August 7, 2014.

Poster Presentations:

Buehring, N.W., M.P. Harrison, A. Taylor, L.L. Falconer, M.W. Ebelhar, W. Kingery and S.G. Shannmugum. Tillage System Effects on Corn, Yield and Crop Residue Nutrient Yield and Ground Cover. North Mississippi Research and Extension Center, Row Crops Field Day, August 7, 2014

PowerPoint presentations:

Ebelhar, M. Wayne, Normie W. Buehring and William Kingery. 2015. Crop Residue Management and Tillage Interactions for Soybean/Corn Rotations. American Society of Agronomy, Southern Branch Meeting, February 1-4, 2015, Atlanta, GA.

MAFES Bulletins:
(Expected)



