

# Mississippi Corn Promotion Board 2020 Progress Report



**Title:** The effects of cover crops on corn production, soil health, weed suppression, and forage production in East-Central Mississippi

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## Project Summary

Cool-season cover crops have been identified as important components of diversified crop rotations. Benefits of cover crops include soil erosion protection, reduction of nutrient losses, greater C sequestration, increased weed suppression, forage production, and wildlife habitat enhancement. Most research has been extensively focused on the context of cover crops supplying N to the following corn crop. While N additions are important, that is only one part of the equation for healthy soil and does not fully equate all benefits cover crops can add in corn production systems. Row crop producers in the Midwest have successfully integrated the use of cover crops as a routine management practice, thus reaping the benefits of increased organic matter, soil stabilization, water retention, and increased plant diversity. Cover crops can not only improve corn crop health but cover crops can also provide a significant reduction in weed pressures and the potential for livestock integration through forage production. Research from the Midwest has shown that corn planted following a winter cover crop drastically reduces weed pressure, especially when using cover crops like cereal rye which have allelopathic traits. Cover crops have also shown the ability for row crop producers to increase revenue through grazing. Selecting the optimal cover crop can drastically reduce weed pressure, provide an alternative revenue stream through livestock integration, and improve overall crop health, resulting in a cost savings on herbicide and fertilizer inputs.

This study will examine the optimal cover crop system for corn producers with a strong emphasis on benefits versus costs to ensure that ultimately a return on investment is identified. Field studies will be conducted at the Coastal Plain Branch Experiment Station over a three-year period to examine initial soil characteristics and assess changes over time in soil health, weed pressure, forage production, and corn yield with a continuous corn production system. While crop rotation is of the greatest importance, examining a continuous corn system and finding cover crop solutions that work in that system will translate to normal rotational programs in Mississippi.

## Project Results/Outcomes

In 2020, field trials were established to determine the effects of cover crops in a continuous corn production system. The field trial consists of two plot areas of the same soil type: 1) grazed and 2) un-grazed. This was the 2nd growing season for the grazed area, and the 1st growing season in the un-grazed area. Within each area, a randomized complete block design with three replications was implemented. Each area has 12 cover crop treatments combined with two tillage treatments (conventional – CT; no-till – NT). Plots measure 25' x 30' and corn grain is harvested from the center six rows. Corn (Mission 1548 DGV2P) was planted in both plot areas on Apr 2, 2020 on 30-inch row spacing. The stand received 70 lb K<sub>2</sub>O using 0-0-60, followed by N applications of 50 lb ac<sup>-1</sup> (46-0-0), 100 lb ac<sup>-1</sup> (N-sol 28-0-0), and 50 lb ac<sup>-1</sup> (33-0-0-12S) for a total of 200 lb N ac<sup>-1</sup>. Herbicides used in this trial included s-metolachlor + atrazine (Invictis S-Moc + ATZ; 26.1% s-metolachlor and 33.0% atrazine) at 1.3 qt ac<sup>-1</sup> and mesotrione (Undercover) at 3 oz ac<sup>-1</sup> applied at planting. Mean plant population across the entire trial was 29,400. Weed control ratings were taken at 21, 42, 63, and 84 DAP. Soil data (bulk density, compaction, C/N analysis, and nutrient availability) was collected in May and Nov (grazed and un-grazed plots). Corn harvest was conducted on Sep 14. Mean grain yield was 137 bu/ac. Cover crop planting was conducted on Sep 30 for the un-grazed and grazed study areas. Tillage treatments were applied on the same dates. Soil data collection was conducted shortly after planting. As part of the grazed portion of the trial, temporary fence was constructed around the field trial to allow for grazing. In the spring of 2020, grazing was accomplished using commercial four bred heifers (mean 1223 lb hd<sup>-1</sup>) stocked at approximately 5,000 lb ac<sup>-1</sup>. Two grazing events took place in the spring of 2020; Feb 17-25 and Mar 17-23 for a total of 14 d grazing. Forage mass, nutritive value, botanical separations, and selectivity were measured before and after each grazing event. Soil data will be collected following the termination of the cover crop in the spring of 2021. Upon termination, tillage treatments will



## Project Results

be re-applied, and corn will be planted at the same target plant populations as 2020. Comparisons will be made between the grazed and un-grazed plot areas, which will include corn grain yield, cover crop forage dynamics (yield and nutritive value), soil health (bulk density, compaction, soil moisture, nutrient availability, and organic matter), weed control ratings, and economic productivity. As of date, no grazing events have taken place for the 2020-2021 grazing season due to a lack of forage availability. However, the first event is expected to take place in the coming weeks. As part of the project, Mr. Ken Waddell was hired as a Graduate Assistant in the fall of 2019. He has completed his 1st year of classes and data collection for this project. Already in his second semester of coursework, Mr. Waddell has already formed a graduate committee, held his first committee meeting, determined his course projections, and has begun writing his thesis proposal.



Figure 1. Corn field trial (grazed experimental area) in Newton, MS comparing the impacts of grazing cover crops on corn grain yield, soil health, weed suppression, and economic profitability.



Figure 2. Corn harvest (un-grazed experimental area) in Newton, MS comparing the impacts of grazing cover crops on corn grain yield, soil health, weed suppression, and economic profitability.

## Project Impacts/Benefits

Thorough investigation of integrated crop-livestock systems for grain and livestock production will impact several stake-holder groups throughout Mississippi and the Southeast. Firstly, corn producers will benefit from the information collected in this project. The immediate impacts of cover crops and the implementation of livestock with and without tillage on crop performance and grain yield will have implications for dryland producers. Secondly, cattlemen and women of Mississippi will greatly benefit from the validation of novel approaches to increasing animal weight gain and improving grazing land efficiency and sustainability through cover crops. By partnering with row-crop producers, new avenues for livestock marketing will be developed which can help reduce risk and offer new sources of revenue for both crop and livestock producers. Our research will quantify the impact of grazing cover crops on soil productivity and subsequent grain production. Also, natural resource professionals will gain from the information generated from this study. Such information will provide land managers with the data necessary to make informed decisions for the successful inclusion of cover crops into row crop production, conservation plantings, or grazing systems. Information gained from this study will also help in training Extension personnel from across the state in advising producers on best management practices and how to effectively transition into integrated crop livestock systems. Finally, the general public will benefit from these findings. This research can ultimately impact ecosystem services that lead to cleaner drinking water and improved soil conditions for future food production systems that can enhance economic prosperity in rural communities.

## Project Deliverables

Waddell, K.R., J.B. Rushing, B.S. Bass, and J.C. Lyles. 2021. The effects of cover crops in an integrated livestock/continuous corn cropping system in east-central Mississippi. American Forage and Grassland Council Annual Conference. Savannah, GA. 3-6, Jan.



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Bass, B.S., J.B. Rushing, K.R. Waddell, and J.C. Lyles. 2021. The effects of grazing cover crops on animal performance, forage mass, and nutritive value in east-central Mississippi. American Forage and Grassland Council Annual Conference. Savannah, GA. 3-6, Jan.

Rushing, J.B., J.C. Lyles, B.S. Bass, and K.R. Waddell. 2021. Integrated crop-livestock systems in the southeastern USA. American Forage and Grassland Council Annual Conference. Savannah, GA. 3-6, Jan.



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