Mississippi Corn Promotion Board
2019 Progress Report

Project Title: The effects of cover crops on corn production, soil health, weed suppression, and forage production in east-central Mississippi

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Department: Coastal Plain Experiment Station

Project Summary (Issue/Response)

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 2019, 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. Prior to 2019, the grazed plot area was in continuous soybean production, whereas the un-grazed area was in continuous wheat. 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. To begin the trial, corn (Dekalb DKC70-27 120 d VT Double Pro) was conventionally planted in the grazed area on Mar 21, 2019 on 30-inch row spacing. No corn was grown in the un-grazed area. The stand received 50 lb N/a using 15-5-10 at planting, followed by subsequent applications of 50 lb N/a on Apr 17 and May 3 using 46-0-0. Herbicides used in this trial included s-metolachlor + atrazine (Invictis S-Moc + ATZ; 26.1% s-metolachlor and 33.0% atrazine) at 1 qt/a applied at planting. A subsequent application of metolachlor (Dual Magnum) at 1 pt/a was applied on Apr 3. Plant population data was collected on May 3. Mean plant population across the entire trial was 29,400. Soil data (bulk density, compaction, C/N analysis, and nutrient availability) was collected on May 7 (grazed plots only) and Nov 8-11 (grazed and un-grazed plots). Corn harvest was conducted on Sep 4. Mean grain yield was 137 bu/ac. Due to widespread drought in late summer and fall, cover crop planting was delayed until Oct 19 and 23, for the un-grazed and grazed study areas, respectively. 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 strip grazing of each replication. Grazing will be accomplished using commercial bred heifers (± 1000 lb) stocked at approximately 10,000 lb/a in a cafeteria style design. Forage mass, nutritive value, botanical separations, and selectivity will be measured before and after each timed grazing event. Soil data will again be collected following the termination of the cover crop in the spring of 2020. Upon termination, tillage treatments will be re-applied, and corn will be planted at the same target plant populations as 2019. 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 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 already begun classes and collecting data 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.

Project Impacts/Benefits

Thorough investigation of integrated crop-livestock systems for grain and livestock production will impact several factions. Firstly, corn producers in Mississippi and throughout the Southeast will benefit from the information gathered in this project. The immediate impacts of cover crops with and without tillage on 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. 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. 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 will enhance economic prosperity in rural communities.

Graphics

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

Figure 2. Sample collection for forage yield and nutritive value analysis. Pictured from left to right: Ken Waddell (MSCPB GRA) and Bronson Strickland (MAFES SRI GRA).

Project Deliverables

Waddell, K.R., J.B. Rushing, B.S. Bass, and J.C. Lyles. 2020. The effects of cover crops in an integrated livestock/ continuous corn cropping system in east-central Mississippi. American Forage and Grassland Council Annual Conference. Columbia, SC. 5-8, Jan. Abstract/Poster.

Rushing, J.B., B. Karisch, R. Lemus, J. Maples, and J. Byrd. 2020. Coastal Plain Beef Cattle Field Day. Coastal Plain Branch Experiment Station. 26, Mar. Tour presentation.

Rushing, J.B., J. Maples, K. Mullenix, and J. Tucker. 2020. Integrated crop/livestock systems for the southeastern United States. USDA AFRI Submission. 9, Apr. MSCPB pre-data used for funding request.