The Effects of Cover Crops In an Integrated Livestock/Continuous Corn Cropping System in East-Central Mississippi

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Introduction

Due to a growing awareness of agroecosystem resiliency, integrated crop-livestock systems are being implemented across the agricultural landscape in order to increase soil health, preserve natural resources, and increase economic sustainability. Integration of crops and livestock have major potential to benefit the soil and water conservation and increase profitability with minimal economic risks. Within the state of Mississippi, the acreage of corn (*Zea Mays*) continues to increase and the need to be profitable on that land continues to intensify during the non-row crop time. This study will be conducted in order to find optimal cover crop combinations on different tillage treatments along with grazing events in the fall through spring on corn plots in Newton, MS.

Relevant Research

- Cover crops can
  - Increase yield potential or
  - Reduce N fertilizer required by a succeeding crop (depends on cover crop and crop rotation system) (Reeves et al., 1995)
- Integration of forage and grazing with cropping system can benefit both production and environmental goals (Franzluebbers, 2007)
- Soil bulk density may be increased when livestock graze on crop residues or cover crops (Lenssen et al., 2013)
- Accumulation of surface soil organic C can buffer against potential compaction resulting from cattle traffic (Franzluebbers, 2001)

References

Franzluebbers, A.J. 2007. Integrated Crop-Livestock Systems in the Southeastern USA. American Society of Agronomy 99:361-372(2007)

Franzluebbers, A.J., J.A. Stuedemann, and S.R. Wilkinson. 2001. Bermudagrass management in the Southern Piedmont USA: I. soil and surface residue carbon and sulfur. Soil Sci. Soc. Am. J. 65: 834-841

Lenssen, A.W., U.M. Sainju, and P.G. Hatfield. 2013. Integrating sheep grazing into wheat-fallow systems: Crop yield and soil properties. Field Crops Res. 146:75-85

Reeves, D.W., D.D. Tyler, and W.L. Hargrove. 1995. Winter cover crops. p. 27-30. In G.W. Langdale and W.C. Moldenhauer (ed.) Crop residue management to reduce erosion and improve soil quality: Southeast. Donserv. Res. Rep. 39. USDA-ARS, Washington, D.C.

Figure 1. Aerial photo of grazed plots at the Coastal Plain Branch Experiment Station, Newton, MS

Figure 2. Aerial photo of ungrazed plots at the Coastal Plain Branch Experiment Station, Newton, MS

Objectives

1. Determination of the optimal cover crop combination that produces the greatest return on investment for livestock/continuous corn producers
2. Evaluation of the change in soil physical properties, weed pressures, and forage production throughout the duration of the study.

Materials and Methods

- The study is being conducted at the Coastal Plain Branch Experiment Station in Newton, MS
- The study will be conducted from Spring of 2019 through Fall of 2021
- Two experimental areas included in the study – Grazed and Ungrazed trials
- Two tillage treatments will be replicated 3 times perpendicular to corn and cover crop plant
  - Conventional till
  - No-till

Figure 3. Photo of no-till and conventional tillage treatments at the Coastal Plain Branch Experiment Station, Newton, MS

Figure 4. Photo of planting of cover crops in the fall of 2019 at the Coastal Plain Branch Experiment Station, Newton, MS

- Cover crop treatments were established in a randomized strip-plot design with three replications
  - 12 cover crop * tillage replications
  - No-till drilled with specific seeding rates

Species	Cultivar	Seeding Rate (lb./acre)
Common Oat (O)	Coker	90
Cereal Rye (CR)	Elbon	90
Crimson Clover (CC)	Dixie	15
Radish (R)	Daikon	5
O+CC		80+10
CR+CC		80+10
CC+R		10+5
O+R		80+5
CR+R		80+5
O+CC+R		70+10+5
CR+CC+R		70+10+5
Control		0

Table 1. Cover Crop species, cultivars, and seeding rates to be established in grazed and ungrazed experiments at the Coastal Plain Branch Experiment Station, Newton, MS.

- Nitrogen applied at 50 lb. N/acre
  - Following establishment
- Termination of cover crop approximately 20 days before planting of corn in spring of 2020

Materials and Methods

- Biannually soil sampling and analysis will take place on both grazed and ungrazed trial
  - Samples will be taken beginning and end of each cropping sequence (following harvest and after planting)
  - Soil Bulk Density at a depth of 0-6 inches
  - Two samples per plot
- Soil carbon, total nitrogen, and macronutrients will be recorded during soil sampling
- Soil compaction will be measured using a soil penetrometer
  - Collected biannually
  - Depths 10cm, 20cm, 30cm
  - Two readings per plot

Figure 5. Photo of soil penetrometer and soil moisture meter in use at the Coastal Plain Branch Experiment Station, Newton, MS.

Figure 6. Photo of weaned beef steers (*Bos Taurus)* that will graze the grazed portion of the study at the Coastal Plain Branch Experiment Station, Newton, MS.

- Soil moisture every two weeks
- Cover crops are grazed by bred heifers (*Bos Taurus*) using a cafeteria style design during fall through spring
- Begin grazing at 10–12-inch height cover crop and end grazing at 4–6-inch height.
- Stocking rate = 2,700 lbs. per acre (4 bred heifers)
- Forage quality analysis will be collected
- Weed ratings and species identification will be conducted during corn growing season

Results

- No differences in soil compaction between grazed and un-grazed areas across all sampling depths (P=0.0718).
- Mean OM was significantly greater for the grazed area (1.11%) compared to the un-grazed area (0.87%) across all sampling dates (P<0.0001).
- The un-grazed area had significantly greater FM (4866.9 lb./acre) compared to the grazed area (1141.9 lb./acre)(P<0.0001).
- No significant difference in CP across all sampling dates (P<0.4015).
  - CP ranged between 11.5% to 14.9% across both experimental areas.