Using the Fieldprint Calculator to Evaluate Differences in Sustainability Metrics Across Various Cover Crop Treatments in Georgia

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Introduction

Cover cropping is a not a new agricultural technology; however, it has not been widely evaluated in row crop production systems in Georgia. There are documented benefits for implementing cover cropping techniques, but there are few research studies that have evaluated the impact these techniques have on on-farm sustainability. The Fieldprint Calculator, developed by Field to Market: The Alliance for Sustainable Agriculture, can be used to quantify and measure on-farm sustainability metrics. The eight sustainability metrics include energy use, greenhouse gas, land use, soil carbon, soil conservation, irrigation water use, water quality, and biodiversity.

Objective

The main objective of this multi-year research was to evaluate sustainability impacts of four cover crop treatments on row crop production in Georgia using the Field to Market Fieldprint Calculator.

Materials and Methods

- **Site Location**
  - 24 hectare field located in Terrell County, Georgia
    - 4 x 6 hectare treatments
- **Crop Rotation Timeline**
  - 2020 – Corn (*Zea mays*)
    - No cover was established before 2020 crop year
  - 2021 – Cotton (*Gossypium hirsutum*)
    - Cover crop planted 1 November, 2020
  - 2022 – Cotton
    - Cover crop planted 10 November, 2021
- **Cover Crop Treatments**
  - Cereal rye (*Secale cereal*) monoculture (control)
  - Crimson clover (*Trifolium incarnatum*) monoculture
  - Rye + hairy vetch (*Vivia villosa*)
  - 4-way mixture (rye, clover, vetch, black oat (*Avena strigose L.*))
- **Nitrogen (N) Application Rates** (Figure 1)
  - Reduced N rates of each treatment were determined by using the UGA Cover Crop Calculator and biomass samples collected

2021 - N Application Rate (Units)						
Rye (control)	Clover - Full	Clover - Reduced	Rye + Vetch - Full	Rye + Vetch - Reduced	4-way - Full	4-way - Reduced
110	110	50	110	65	110	56

2022 - N Application Rate (Units)						
Rye (control)	Clover - Full	Clover - Reduced	Rye + Vetch - Full	Rye + Vetch - Reduced	4-way - Full	4-way - Reduced
90	90	50	90	40	90	40

Figure 1. Nitrogen application rates

Field Layout

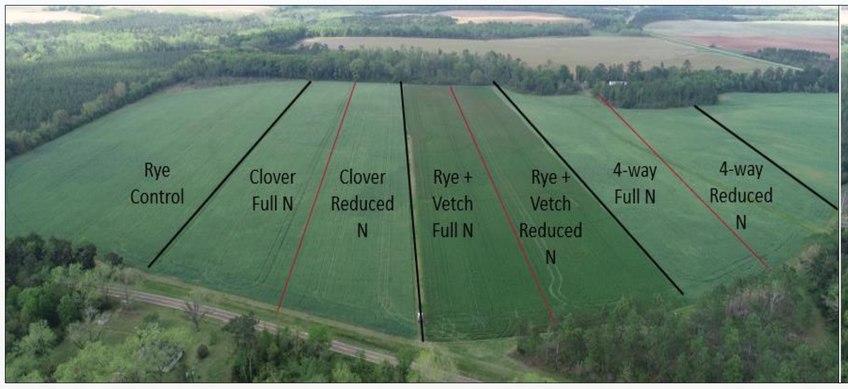

Figure 2. 2020-2021 cover crop treatment layout

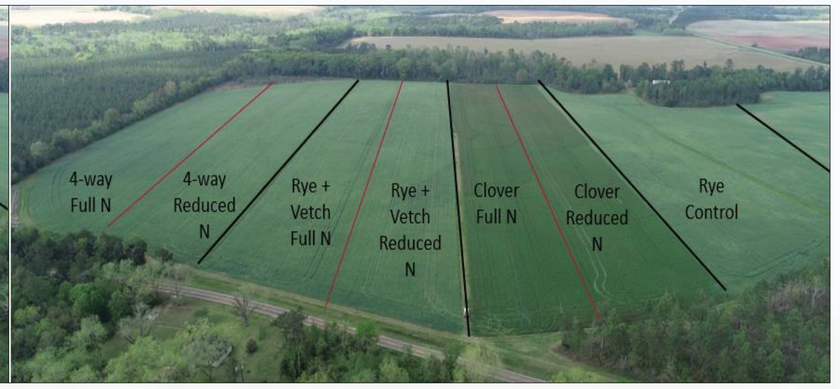

Figure 3. 2021-2022 cover crop treatment layout

Results

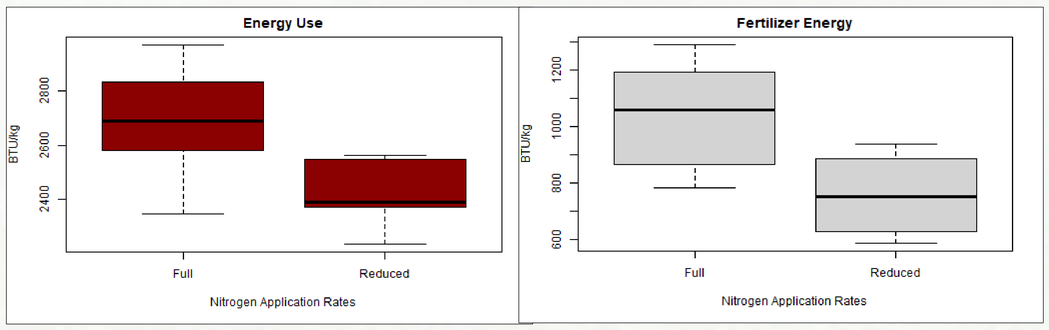

Figure 4. Energy use and fertilizer energy across years and cover crop treatments

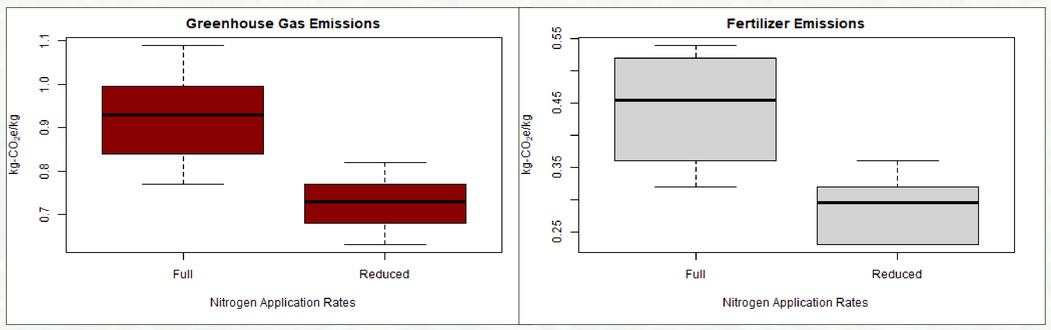

Figure 5. Greenhouse gas emissions and fertilizer emissions across years and cover crop treatments

Energy Use & Fertilizer Energy (Figure 4)**:**

- The energy use metric evaluates energy used in producing a unit of crop
- Crop protectants and fertilizer applications are the main contributors to energy use
- The reduction of N fertilizer reduced energy use and fertilizer energy on-farm

Greenhouse Gas Emissions & Fertilizer Emissions (Figure 5)**:**

- The greenhouse gas metric evaluates three main energy sources – residue burning, nitrous oxide (N_2O) from the soil, and energy use
- Fertilization requirements of cotton contributes to a higher rate of N_2O emissions
- A reduction in the total amount of applied N significantly reduced greenhouse gas and fertilizer emissions

Conclusions

- The Fieldprint Calculator was used to quantify and measure sustainability trends
- The implementation of cover crops provided benefits such as reduced N fertilization and improved energy use and greenhouse gas metric scores
- There were no differences in cotton yield across the two years, cover crop treatments, and N treatments
- The Fieldprint Calculator successfully documented improvements in on-farm sustainability with the implementation of cover crops and reduction of N fertilizer

Future Work

- Additional Fieldprint analysis will be conducted and evaluated for further trends in the other metrics
- A six-year, replicated cover crop trial at the Southeast Research & Education Center in Midville, GA will be evaluated for trends across the sustainability metrics

Acknowledgments

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