EVALUATING AND WORKING TO IMPROVE GEORGIA COTTON AND PEANUT SUSTAINABILITY PRACTICES USING THE FIELDPRINT CALCULATOR

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Abstract

Today, the term "sustainability" is at the forefront of the agricultural supply chain, including the producer, the manufacturer, and the consumer. Many sectors across the agricultural industry have developed production sustainability goals; however, it has been difficult to quantify these specific goals. Field to Market: The Alliance for Sustainable Agriculture presents a unique opportunity for producers with the use of their Fieldprint Calculator. The calculator analyzes and calculates a sustainability score on a grower's individual field based on their current management practices. The sustainability score is based on eight metrics: biodiversity, energy use, greenhouse gas emissions, irrigation water use, land use, soil carbon, soil conservation, and water quality. Across the state of Georgia, many cotton growers utilize conventional crop rotations that typically include the production of peanuts. For this study, approximately 45 cotton and peanut growers in Georgia have been enrolled to participate in the Fieldprint Calculator surveys and five new growers are being enrolled every year of the study. The main objective of this on-going research is to evaluate the relationship of sustainability practices between cotton and peanut production in Georgia and how they vary year-to-year. The following goals have been set for this project: create baseline sustainability data for cotton and peanuts, develop long-term sustainability benchmarks, and facilitate educational events for cotton and peanut growers. From this research we anticipate to be able to inform growers on areas of improvement so they can maximize and maintain a positive environmental impact. Individual yearly and long-term data will be utilized to determine production trends and develop recommendations for producers to become more efficient and sustainable.

Introduction

As we are growing closer to a population of 9 billion people by the year 2050, new and improved agricultural management practices will be sought to increase our food and fiber supply. However, with an increasing demand in production, consumers have voiced their concerns on sustainability practices in the agricultural industry. These environmentally-conscience concerns have been echoed throughout the supply chain as companies are trying to meet their consumer demands to purchase sustainably grown products.

In order to be sustainable in the agricultural industry, a grower must know the criteria to be labeled as such. Many have defined what it means to be sustainable however, there are three reoccurring criteria that have been used to define sustainability. These criteria include, plant and animal productivity, socio-economic viability, and environmental quality and ecological soundness (Pesek, 1994). Throughout the years, technologies have advanced giving growers the tools to track their production practices on the farm, relate them to sustainability practices and make the appropriate adjustments to seek their goal.

Field to Market: The Alliance for Sustainable Agriculture is a group of diverse organizations that represent the entire supply chain, including universities, agribusinesses, grower organizations, conservations groups, and public sector partners. This group is committed to assisting growers increase their productivity while tracking their environmental impact and making needed improvements using their Fieldprint Calculator. The Fieldprint Calculator is a free and confidential tool that helps growers manage their farming practices and sustainability outcomes. The use of the Fieldprint Calculator allows growers to compare their sustainability outcome scores to benchmarks in an enrolled project, as well as, state and national benchmarks.

Agriculture is a $73 billion industry in the state of Georgia. Of all commodities grown in the state, cotton and peanuts rank in the top 5 based on value, both being very valuable to the state's economy. Growers in the state typically grow both cotton and peanuts on a rotation. Utilizing the Field to Market Fieldprint Calculator will allow cotton and peanut growers to determine how their crop rotations intersect on their farm's sustainability.

Therefore, the objective of this research is to evaluate the relationship of sustainability practices between cotton and peanut production in Georgia and how they vary year-to-year. The following goals have been set for this project: create baseline sustainability data for cotton and peanuts, develop long-term sustainability benchmarks, and to facilitate educational events for cotton and peanut growers. From this research we anticipate to be able to inform growers on areas of improvement so they can maximize and maintain a positive environmental impact. Individual yearly and long-term data will be utilized to determine production trends and develop recommendations for producers to become more efficient and sustainable. Additionally, we hope this research will encourage other land-grant universities and Extension personnel to utilize these new technologies that will help track and improve sustainability practices in their state.

Material and Methods

This ongoing research began in 2014 with one grower and by the end of 2019 there were a total of 45 active growers enrolled into this project and the goal is to increase the active participants each year. Growers enrolled in this project have farms in the Southwest and Southeast regions of Georgia. Each year of the project, researchers have worked with county Extension Agents, who serve as liaisons, to contact and set up meetings with growers, as well as, assist in identifying potential growers to enroll into the project.

A survey was developed to capture all production data for one field for each producer so it could be easily entered into the Fieldprint Calculator. Data was collected during in-person interviews where participating growers were explained the purpose of the study and how information collected will be used. An hour-long interview was conducted to complete the questionnaire on the Field to Market Fieldprint Calculator. Questionnaire topics include crop rotations, tillage and irrigation practices, nutrient and fertilizer applications, chemical applications, as well as annual harvest yields. Following the interview, the responses were entered into the Fieldprint Calculator for each field that was collected.

Once data was entered into the Fieldprint Calculator, sustainability metric scores were calculated and presented in a report. Scores on the report are presented as a spidergram as well as a chart. Each of the field's scores were analyzed to interpret the sustainability level of each of the eight metrics.

The eight sustainability metrics are defined as:

Land Use
The land use metric measures the amount of land it takes to produce a unit of crop production (acres/unit of crop production). Lower scores indicate greater land use efficiency. Increasing yields, however, can improve the land use score.

Soil Conservation
The soil conservation metric calculates the soil that is lost to erosion caused by wind and water and is reported as tons of soil lost per acre. Lower scores indicate a lower amount of erosion, for example, a score of 0 indicates that no soil was lost during that production year.

Soil Carbon
The soil carbon metric measures the health of the soil and overall greenhouse gas emission reduction and is represented by the Soil Conditioning Index (SCI). The SCI is a representation of the crop residue and organic matter returned to the soil, erosion caused form wind and water, and soil-impacting field operations (soil tillage intensity rating).

Irrigation Water Use
The irrigation water use metric accounts for the amount of water, measured in acre-inches, required to produce a unit of crop. The amount of water applied during a harvest season is in direct control of the farmer.

Energy Use
The energy use metric evaluated the energy used in the crop production in one year starting with pre-planting through the first point of sale. This metric also includes the energy used for equipment operation, pumping of irrigation water, grain drying, and transportation. Energy use is expressed as British thermal units per unit of crop production and lower numbers indicate less energy used to produce a unit of crop.

Greenhouse Gas Emissions

The greenhouse gas (GHG) emissions metric evaluates four main energy sources – residue burning, methane emissions (from rice production only), nitrous oxide emission from the soil, and energy use. GHG is expressed as pounds of carbon dioxide equivalent per crop unit produced.

Water Quality

The water quality metric measures the loss of nitrogen, phosphorus sediment, and chemicals in water runoff from the fields. It is measured using the NRCS water quality index (WQI) and it ranges from 1-10, where the score closer to 0 is most desirable. This score can allow growers to know what practices can improve their water quality score.

Biodiversity

The biodiversity metric measures a farms ability to support diverse animal and plant communities. The Habitat Potential Index (HPI) is the tool that measures the potential that the land has to support biodiversity. The HPI score ranges from 0-100, where higher scores are desirable.

Once a grower's data has been entered and calculated into the Fieldprint Calculator, they can then be opted into a Fieldprint Project. Fieldprint Projects allow researchers to identify and promote continuous improvement of growers as a group rather than individually. Once all growers have been opted into its respective project, the researchers are able to evaluate environmental and sustainability statuses and trends of the project from year-to-year. Data collected individually as well as in the Fieldprint Project will be reported back to the grower and their Extension agent so appropriate improvements may be made in enhance scores in the future.

Results and Discussion

Once a grower profile has been created in Field to Market, a field assessment is completed and sustainability scores are generated based on the field's management practices from that year. The eight sustainability metrics that were evaluated and scored through the Fieldprint Calculator and are presented in a spidergram. The spidergram provides a visual comparison for the grower displaying their scores to project, state, and national benchmarks for the specific crop grown (Figure 1).

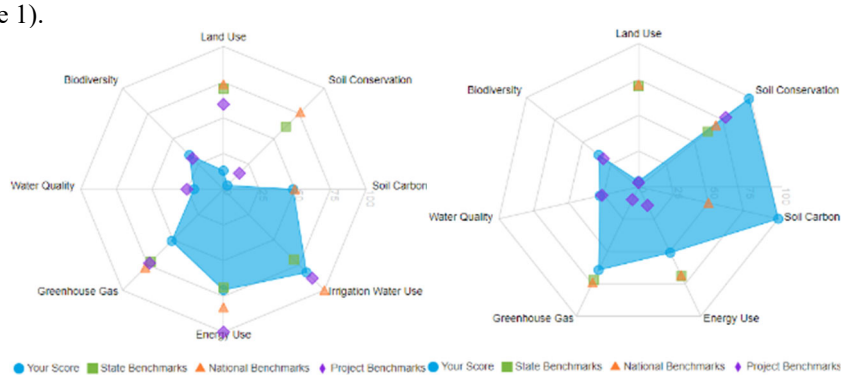

Figure 1. Cotton (left) and peanut (right) spidergrams comparing grower scores to state, national, and project benchmarks.

After compiling grower scores in the Fieldprint Calculator, the use of the Field to Market Quality Analysis tool will allow project coordinators to summarize and analyze project data sets for initial trends and correct any errors or outliers in the data. From the data collected in this project, the eight sustainability metrics can be analyzed by comparing cotton to peanuts and their crop years.

Throughout the study, cotton was the largest user of irrigation water and had greater greenhouse gas emission and energy use scores. The energy use metric is the generated by measuring the energy used to produce a unit of crop. In this study, cotton was seen to have an increased transportation energy which is caused by the miles traveled and fuel type used in transporting the product. In addition, energy used in fertilizer applications was greatest in cotton as compared to peanuts. Likewise, irrigation water use plays a factor into the energy use metric. The energy used to pump the water used for irrigation is accounted for in the metric. However, cotton had a more desirable soil conservation score and has a higher average of soil carbon as compared to peanuts. Peanuts have a higher water erosion and wind

erosion metric mainly due to the tillage and harvest methods associated with peanut production, decreasing its soil conservation scores. Peanuts in the state of Georgia are typically grown under conventional tillage practices and the digging process adds to the erosion potential of fields, thus, the negative impact reflected here on the erosion metrics. These comparisons between the two crops can be seen in the spidergrams in Figure 1.

With these general observations, we can begin educating growers on production practices that can improve these scores in the years to come. More data will be needed to clearly define trends across years and the sustainability relationship between cotton and peanuts.

Summary

The use of the Fieldprint Calculator from Field to Market is an important tool used to help growers understand the impact their management practices have on sustainability. To date, there are 45 actively enrolled cotton and peanut growers into the Field to Market project and five new growers are to be enrolled each year of the on-going study. Thus far, we have identified areas of major differences in cotton and peanut sustainability impacts. We have also identified areas such as irrigation water use, soil carbon, soil conservation, and energy use that can be targeted for improvement throughout the project. As we continue to collect more data and evaluate it for trends, we will work with growers and their Extension Agents to improve sustainability in Georgia cotton and peanut production.

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