USING THE FIELD TO MARKET FIELDPRINT CALCULATOR TO ESTABLISH TRENDS IN COTTON AND PEANUT SUSTAINABILITY METRICS

Kaylyn Groce
Wesley M. Porter
University of Georgia
Tifton, GA

Abstract

Today, many sectors of the agricultural supply chain are seeking sustainably produced food and fiber products. In many parts of Georgia, producers have the ability to grow cotton and peanuts in a conventional crop rotation due to the state's unique agricultural landscape. Field to Market: The Alliance for Sustainable Agriculture provides the ability for researchers and producers to evaluate crop sustainability with the use of their Fieldprint Calculator. With the use of this tool, sustainable practices in a single crop year may be quantified by measuring eight metrics. These sustainability metrics include energy use, soil carbon, land use, water quality, irrigation water use, soil conservation, greenhouse gas emissions, and biodiversity. Therefore, the main objective of this on-going research study is to evaluate the relationship of sustainability practices between cotton and peanut production in Georgia and how they vary from year-to-year. In 2017, 25 cotton and peanut growers were enrolled, and the enrollment has increased to 45 growers as of 2021. As multiple years of data have been collected, we can begin to identify trends in the sustainability metrics across both crops. These trends will serve as a base-layer for growers making improved production practices to increase overall on-farm sustainability. Thus far, researchers have identified four of the eight sustainability metrics that are shared between cotton and peanuts which can be improved. The four metrics include soil carbon, soil conservation, irrigation water use, and energy use. As we work with the growers along with their Extension Agents, we hope to implement new technologies and management programs to improve these metrics and see an overall improvement in cotton and peanut sustainability.

Introduction

As the world's population continually increases, the need for agricultural products increases simultaneously. With these developments, consumers have deepened the demand for food and fiber products that are sustainably sourced. Sustainability has been widely defined; however, there are reoccurring themes which are used to define it. Many definitions provide three pillars of sustainability: social, economic, and environment (Pesek, 1994). In agriculture, economics and the environment are two crucial pillars of sustainability which will directly affect crop producers. Growers who are making conscience management decisions to positively impact the environment, hope to produce a high-yielding crop to increase overall profit.

As growers begin or continue to implement new and improved management practices on their farms, there has not been a way to quantify their farm's sustainability. In recent years and with the help of new technologies, multi-stakeholder initiatives (MSIs) have been used to help calculate and quantify management practices by developing sustainability metrics (Konefal, 2015). One MSI who has been at the forefront of this movement in sustainability is Field to Market: The Alliance for Sustainable Agriculture. Field to Market has developed the Fieldprint Calculator to take yearly crop management practices and convert them into quantifiable scores based on eight sustainability metrics. These eight metrics include: land use, energy use, water quality, soil conservation, greenhouse gas emissions, soil carbon, irrigation water use, and biodiversity.

In Georgia, cotton and peanuts play a significant role in the state's agriculture industry. With the state's unique landscape, many growers in the southern region of the state have the ability to grow both cotton and peanuts in a conventional crop rotation. As interest in measuring on-farm sustainability has risen across many sectors of the agriculture industry, researchers sought a way to measure the relationship of sustainability between these two economically viable crops. The use of the Field to Market Fieldprint Calculator will allow researchers and growers to measure on-farm sustainability for multiple years. Utilizing this tool will help to identify trends and differences in scores from year-to-year in cotton and peanuts. Therefore, the objective of this on-going research is to utilize the Field to Market Fieldprint Calculator to evaluate the relationship of sustainability practices in cotton and peanut production and how they vary year-to-year in Georgia.

Materials and Methods

Research began in 2017 with 18 cotton and peanut growers and has grown to 45 active participants in 2021. Each year of the project, 5 new growers are to be added who are identified by county UGA Extension Agents. All growers and their farms are located in the southern region of Georgia as this is where a majority of the cotton and peanut production takes place (Figure 1). For data collection, researchers worked with county Extension Agents in each county to contact and set up a yearly meeting with the participants to collect the data.

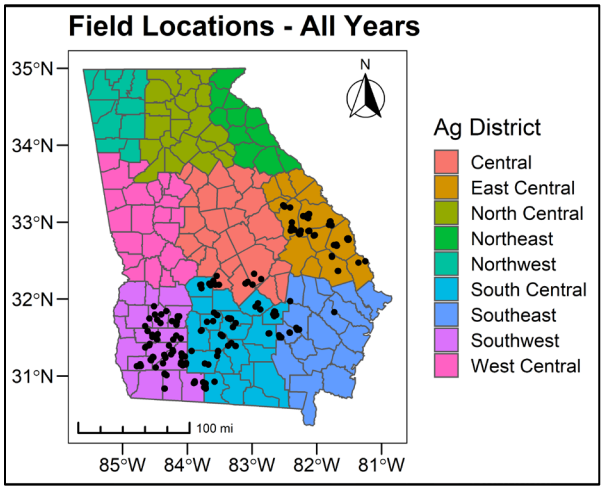

Figure 1. Field and grower locations in Georgia.

Once meetings are set up with the growers and their county Extension Agent, an hour-long interview is conducted to collect cotton and peanut field management information based off the Fieldprint Calculator questionnaire. Researchers converted the online questionnaire format into an offline file to allow the collection of field information when internet access is not available while on the visits. After the questionnaire is completed, researchers present a yearly grower report to the participants. This report includes the definitions of the eight Field to Market metrics (Field to Market, 2022) as well as examples of management practices that growers could implement to help improve that specific score. Once field information is entered into the Fieldprint Calculator and the data is analyzed, a spidergram presents the scores for each sustainability metric for that crop year. In addition, spidergram comparisons are provided to those growers with one or more years of data collection (Figure 2). The grower scores are presented on the graph with the addition to project, state, and national benchmarks. These benchmarks give the grower an insight on how their scores compare to growers who are participants in the project and those growing cotton or peanuts across the state and nation. Providing a side-by-side comparison of these spidergrams provides the grower a better understanding on how the individual grower's metrics change from year-to-year. If there are drastic changes in scores, a grower may look back and see what changed in their crop management practices or differences in major weather events which could have affected those score changes.

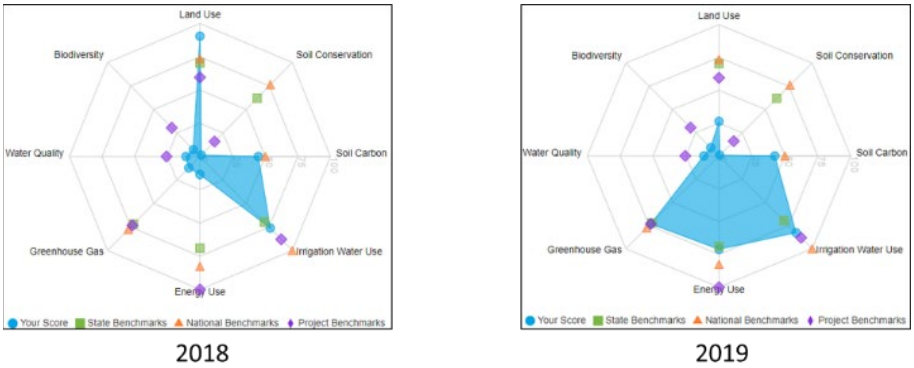

Figure 2. Spidergram comparison between a cotton field in 2018 to a cotton field in 2019.

Results and Discussion

Data from 2017 through 2020 was analyzed for trends across the eight sustainability metrics and the two crops. Of the eight sustainability metrics, trends were evaluated in the energy use and greenhouse gas emissions metrics. Energy use measures the energy used in a single year of crop production beginning at pre-planting through the first point of sale (Field to Market, 2022). Components evaluated in the energy use metrics include application, irrigation, crop management, post-harvest procedures, seed, and transportation. Figure 3 show the component breakdown of the energy use metrics for the cotton crop from 2017-2020. The peanut energy use component breakdown is shown in Figure 4. Across both cotton and peanuts, application was the greatest contributor to energy use across all years. Application includes trips across the field to apply fertilizers, pesticides, and plant growth regulators. The post-harvest and seed components in peanuts also contributed to a greater proportion of the energy use component as peanuts require more post-harvest management than cotton production. However, transportation was greater in cotton as compared to peanuts.

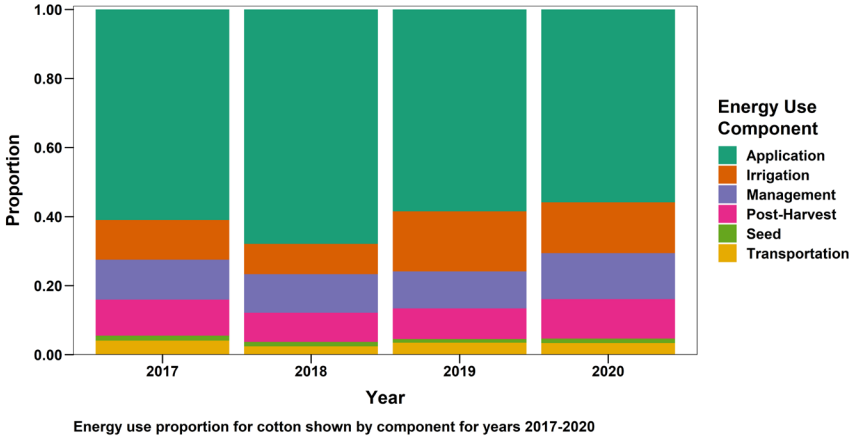

Figure 3. Energy use proportions for cotton shown by component from 2017-2020.

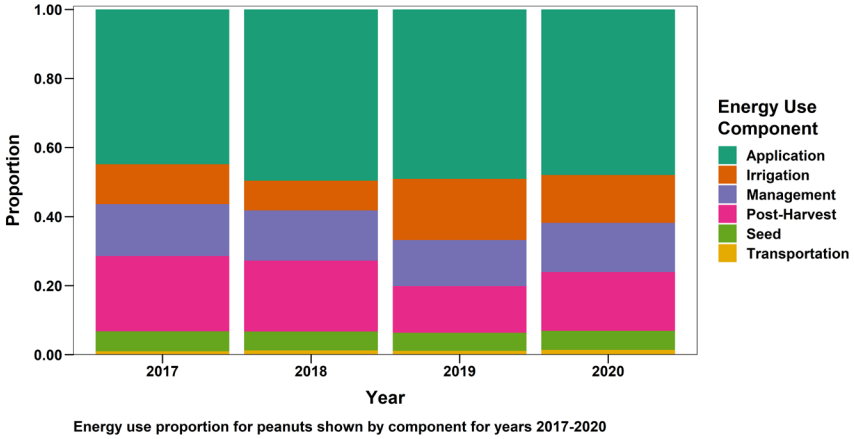

Figure 4. Energy use proportions for peanuts shown by component from 2017-2020.

Similar to energy use, the greenhouse gas emission metrics components were evaluated for cotton (Figure 5) and peanuts (Figure 6). The greenhouse gas emission metrics measure four main energy sources – methane emissions (from rice production only), residue burning, nitrous oxide emission from the soil, and energy use (Field to Market, 2022). Components for greenhouse gas emissions include application, irrigation, management, nitrous oxide, post-harvest, residue burning, seed, and transportation. When evaluating trends between cotton and peanuts, peanuts contribute to a greater amount of nitrous oxide emissions from the soil. Peanuts, a leguminous crop, has the ability to fix atmospheric nitrogen to be utilized by the plant, reducing the need for synthetic nitrogen applications. Cotton has a greater potential of emitting a greater amount of nitrous oxide into the environment since it requires a greater amount of nitrogen fertilizer applications. Due to the environmental and sandier soil conditions in the region, nitrogen can get

lost through soil erosion, runoff, or leaching. Irrigation was a contributor to greenhouse gas emissions in both crops; however, peanuts irrigation had a greater contribution.

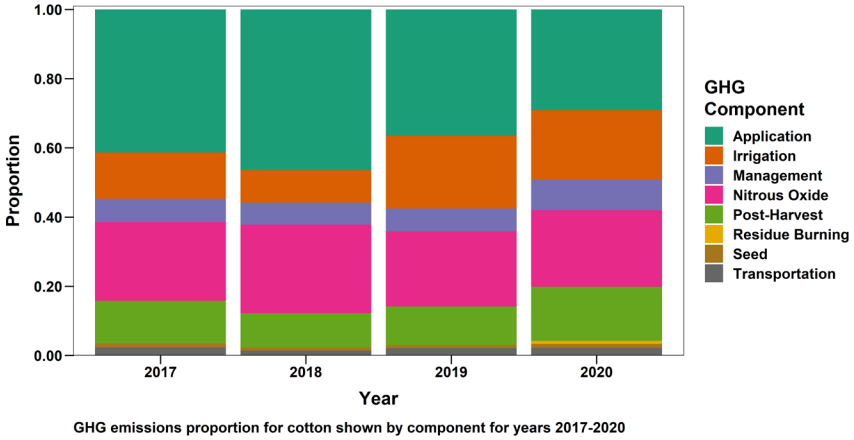

Figure 5. Greenhouse gas use proportion for cotton shown by component from 2017-2020.

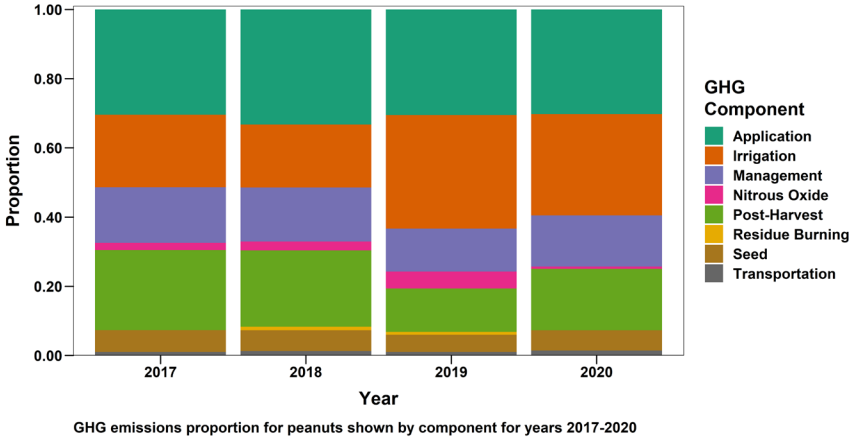

Figure 6. Greenhouse gas use proportion for peanuts shown by component from 2017-2020.

Conclusion

The use of the Fieldprint Calculator created by Field to Market is an important tool to quantify and analyze sustainability metrics in cotton and peanut production. Providing growers with yearly grower reports which explain and compare their yearly results, allow for a better understanding of their farm's sustainability status from year-to-year. When evaluating current trends in the energy use and greenhouse gas emissions metrics, trends are being established. Analyzing these trends can help better on-farm management decisions.

As this research continues, grower meetings will resume to collect 2021 cotton and peanut field information. With the help of county Extension Agents, five new growers will be identified to enroll in this project. Additionally, as growers provide their yearly field information, it is important to provide adequate feedback and management suggestions to help aid in the improvement of their sustainability scores throughout the course of this project.

References

Field to Market®: The Alliance for Sustainable Agriculture – Fieldprint® Calculator. (2022) Internet site: calculator.fieldtomarket.org/#/

Groce, K. and Porter, W. (2021) Evaluating and working to improve Georgia cotton and peanut sustainability practices using the Fieldprint Calculator. Proceedings 2021 Beltwide Cotton Conferences.

Konefal, J. (2015) Governing sustainability transitions: multi-stakeholder initiatives and regime change in United State agriculture. Sustainability ISSN 2071-1050.

Pesek, J. (1994). Historical prospective. In *Sustainable Agriculture Systems* (J.L. Hatfield and D.L. Karlen, Eds), pp. 1-19. London: Lewis Publishers.