SCSB Final Report

General Information

Principal Investigator(s) Name(s): Michael Plumblee
Organization: Clemson University
Date: 1/2/2020
Quarter: Final Report

Proposal Information

Title: Determining the Optimum Planter Downforce Settings in Soybean
Amount Expended to Date: $8,480 ~ 100% (The majority of this budget has been allocated to purchasing fertilizer (potash), planter gauge wheels, plot work supplies, and paying a graduate student stipend to work on this project)

Project Summary

Small-Plot – Edisto REC: Barnwell County, SC

The results from the static downforce trial at Edisto REC resulted in no soybean yield differences in tillage type (conv or strip), gauge wheel type (narrow or normal), or static downforce rate (0-300lbs). Soil was compacted more in conventional tillage within the planted row compared to strip-tillage after planting. It is suspected that the conventional tillage prepared a "fluffy" bed and therefore the planter was able to compact the soil more than the strip-tillage. There were no differences in soil compaction readings (penetrometer) between gauge wheel types. Planter downforce rate did vary soil compaction where 0 to 100lbs of downforce had significantly less compaction in the planted row than 300lbs of downforce. Overall plant heights at harvest were also greater in strip-tillage compared to conventional tillage. Although plants were taller, they did not contribute to a significant yield increase. There were no differences in soybean emergence 1 or 3 days after the first plant emerged regardless of tillage type. Gauge wheel type did however, produce differences in emergence at the 3 day after emergence count, where the normal gauge wheel had better emergence than the narrow gauge wheel. This is likely due to the narrow wheel burying the seed deeper when planting and creating a trench in the ground. Planter downforce rate (0-300lbs) did not vary soybean emergence counts. Upon further investigation with this research, data displayed that where planter downforce was increased over 150lbs soybean seed was planted at a deeper depth. The overall outcome of this location was that planter downforce, gauge wheel setup, and tillage type did not significantly affect soybean yield. However, some measured factors such as soil compaction, seeding depth, and soybean emergence were influenced by these factors, which could limit yield in the right conditions.

Large-Plot – Coastal Plain ~ Active Downforce:

The results from the active downforce trial in the coastal plain resulted in no soybean yield differences in active downforce rate (50-200lbs). Soybean plant emergence counts were significantly different where the 50lbs rate of downforce had more plants emerge 1 day after emergence. Three days after emergence resulted in the 50 and 100lbs rates of downforce to

have more plants emerge than the 150lbs rate of downforce. Soil compaction was also greater where more than 150lbs of downforce was applied compared to 50 and 100lbs downforce rates. Conversely, plant heights at harvest were greater at the 50 and 150lbs rates compared to the 200 lbs rate of downforce being applied. Overall, planter downforce did not contribute to additional yield, but downforce did affect soybean plant height, soil compaction within the row, and soybean emergence counts.

Small-Plot – Simpson REC: Anderson County, SC

The results from the static downforce trial at Simpson REC resulted in no soybean yield differences in tillage type (conv or no-till), gauge wheel type (narrow or normal), or static downforce rate (0-300lbs). It is probable that the environmental conditions (extreme drought and insect pressure) of the 2019 growing season overcame any differences that may have been observed. Aside from grain yield, soybean emergence was affected by planter downforce rate where emergence counts 3 days after initial emergence were greater at planter downforce rates above 150lbs. Tillage also affected soybean emergence where no-till had greater emergence than conventional tillage 1 day after initial emergence, however, 3 days after emergence, conventional tillage had greater soybean emergence than no-till. These results are likely a result of limited rainfall and dry conditions shortly after planting, where the undisturbed soil in the no-till conditions had more moisture at planting. Last, tillage type also affected soil compaction where no-till had significantly greater soil compaction than conventional tillage. The overall outcome of this location was that planter downforce, gauge wheel setup, and tillage type did not significantly affect soybean yield. However, some measured factors such as soil compaction, and soybean emergence were influenced by these factors, which could cause yield-limiting conditions. Additional site-years would greatly benefit this research due to extremes in weather.

Large-Plot – Upstate ~ Active Downforce:

The results from the active downforce trial in the Upstate resulted in no soybean yield differences regardless of active downforce rate. No other measured variables were affected by active downforce at this location. Again, these results are likely due to the extreme drought that took place in this region during the 2019 growing season.

Key Performance Indicators

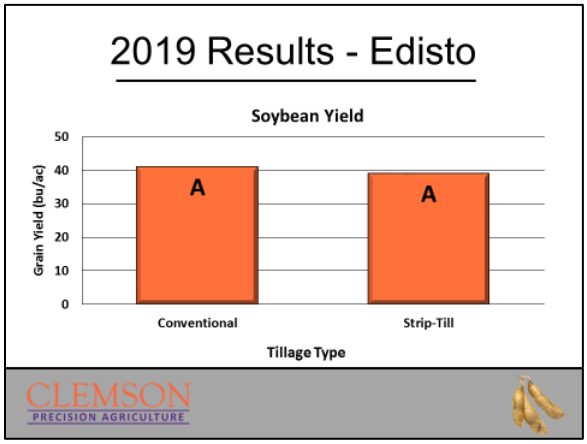
The KPIs used in this research were to evaluate whether or not soybean benefited from planter downforce technology, as well as, to evaluate whether downforce technology affected soybean emergence, thus contributing to uniform emergence and improved yield. These KPIs were measured through grain yield, plant measurements, emergence counts, soil compaction readings, and seed depth measurements. All KPIs were met through the data collection of this project. The varying environmental locations (coastal plain vs Upstate) compounded with the treatment structure used, allowed for many aspects of planter downforce to be evaluated in soybean. Ultimately, in the Upstate location, weather conditions likely hindered treatment effects, therefore additional site-years would be beneficial. Further research to continue evaluating planter downforce technology in soybean would be beneficial to SC Soybean growers in determining overall benefit and return on investment.

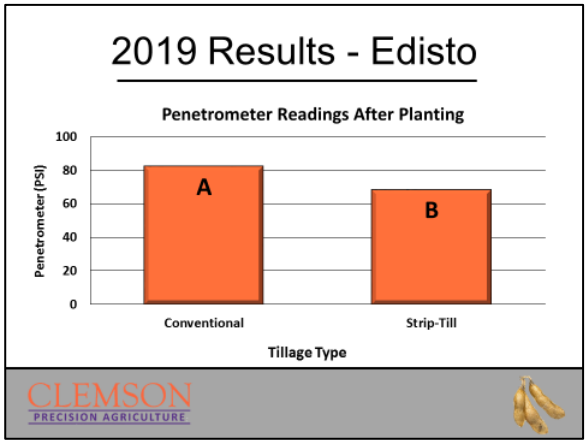
Next Steps

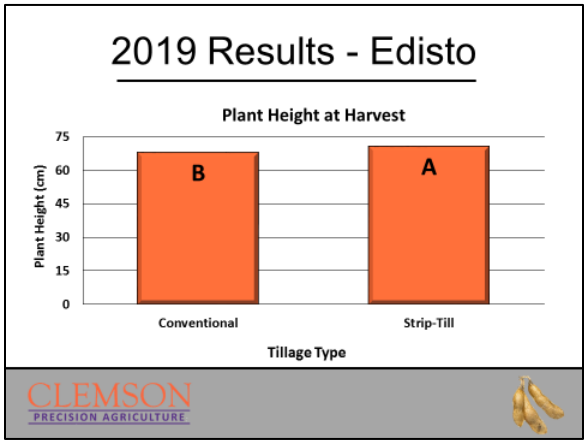
The next steps for this research would be to present the findings at local, regional, and national meetings, field days, and through other news outlets. In addition, to continue this research for one more year with at least two locations to confirm or deny the findings in 2019 across multiple environments, weather patterns, locations, and years. Additional sites with varying levels of crop residues may be beneficial as well. Upon conclusion of this research in 2020 recommendations could then be scientifically made to SC Soybean growers. Furthermore, this research could be published in an academic journal to further support planter research in soybean production in SC.

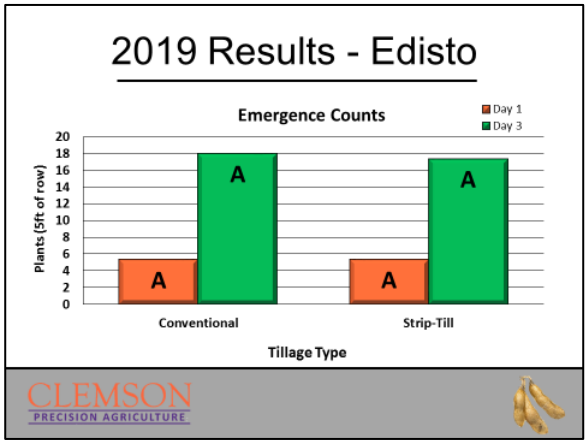
Additional Information

The following slides are graphical forms of the data that were mentioned in the text above.

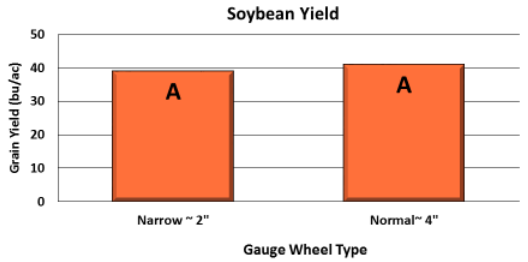






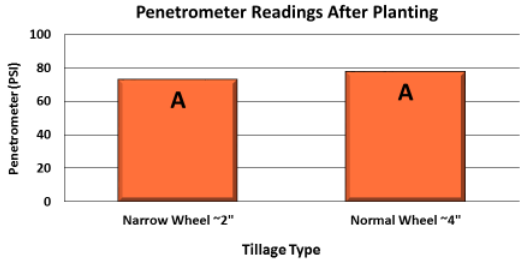


2019 Results - Edisto



CLEMSON PRECISION AGRICULTURE

2019 Results - Edisto



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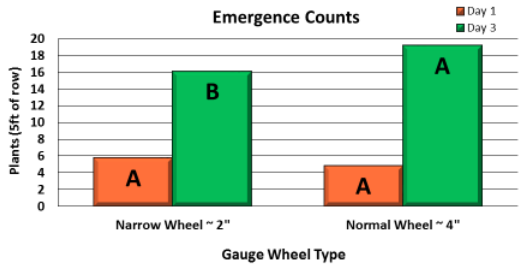

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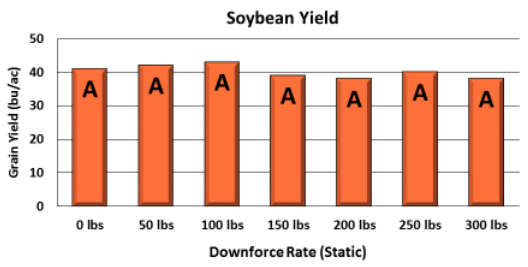

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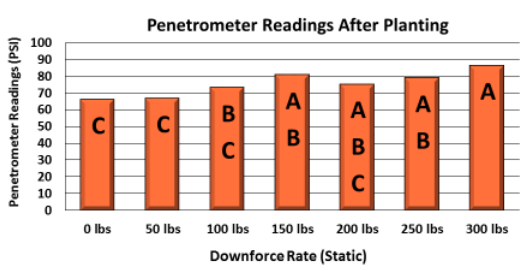

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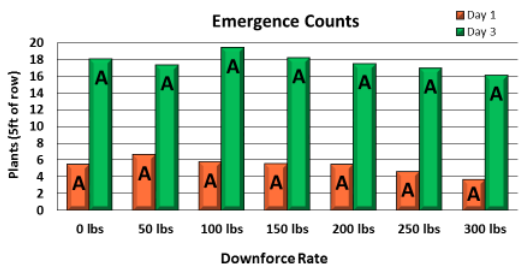

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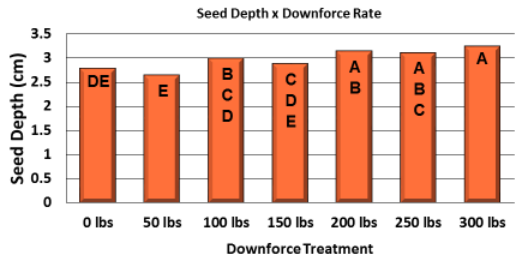

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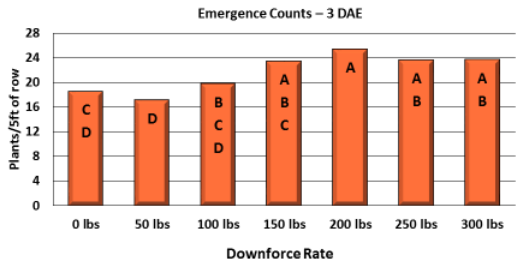
2019 Results - Simpson



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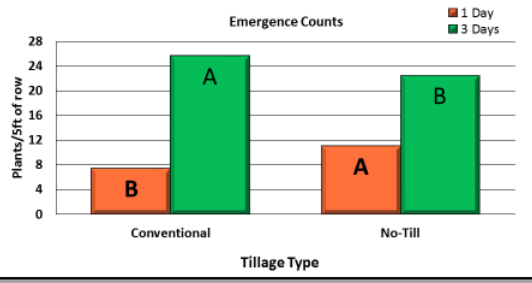

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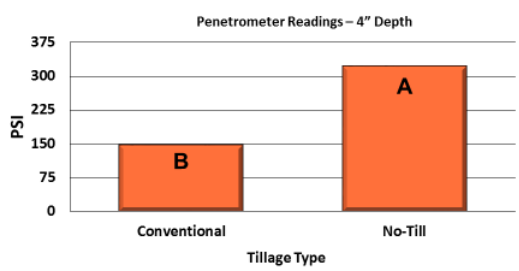

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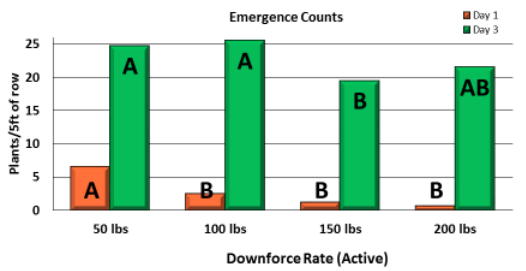

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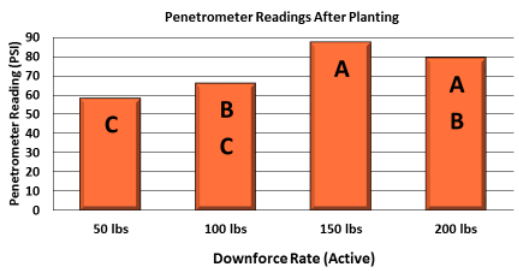

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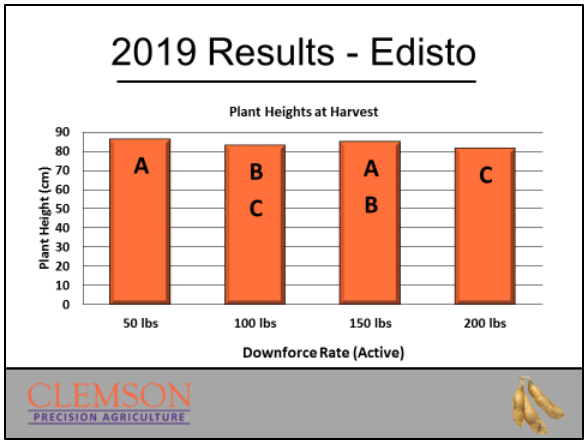

Prior to submission, reports should be saved as a pdf document using the following naming convention; 2019Date(yrmoday)_(PI Last Name)_(Abbreviated Proposal Title)_Final.