Report of Activities for 2018-2019 project entitled 'Improving seed quality and timing of late-season desiccation in indeterminate soybeans

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Funding from the Georgia Soybean Commission was generously awarded for the year 2018, with a no-cost extension granted for 2019 to Abraham Baldwin Agricultural College (ABAC). This project allowed for a two-year investigation of several research questions that provide valuable information for foliar fertilization in late reproductive stages on determinate soybeans and the timing of spraying an herbicidal harvest aid on indeterminate soybeans for the potential to improve harvest timing and grain quality. In year one (2018), approximately 2 acres of soybeans were planted in late May in a rainfed environment, with two maturity groups chosen for the experiments. In year two (2019), approximately 2 acres of soybeans were planted in early June in an irrigated field (center pivot), with two maturity groups. All field experiments were conducted at ABAC's J.G. Woodruff Farm.

Foliar Fertilization:

Objectives:

There currently does not exist a clear production guideline for soybean growers in Georgia as to how to manage for top quality in grain (i.e. pod harvest index, protein content, seed weight). There is no standard for what supplemental N to provide that could improve grain fill and seed protein content. Most soybeans are not given adequate Nitrogen (N) during grain filling to result in maximum potential for grain quality. While soybeans are often considered self-sufficient through symbiotic N fixation via nodulation, soybeans in late-reproductive stages can experience some N deficiency. This limits N movement towards the pod and into the grain. This is usually exacerbated by drought and heat during the grain-filling stages.

For the first experiment a maturity group VII determinate soybean was planted only in 2018 in a and split into a randomized complete block design with the treatment application of a urea foliar fertilizer in the late-reproductive development of the soybeans. This study was designed to test four rates of Urea-N fertilizer (0, 6.7, 13.3, 20.0 lb. N acre-1) applied in a foliar application during pod set at the R4 growth stage on the soybean grain yield, whole-plant N concentration,

and grain N concentration. Pod and plant tissue samples were taken immediately prior to and one week after application, as well as final yield. Remote sensing data was also collected using an unmanned aerial system (UAS) equipped with a multispectral camera to analyze treatment effects according to two spectral indices- NDVI and NDRE – known indices that correlate to vegetation greenness and plant N status. The spectral data was regressed against pod and tissue N concentrations and final yield.

Deliverables:
No significant yield or N concentration differences occurred from the control treatment (0 lb. N acre-1). This is likely due to the late timing of N fertilizer application. Additionally, a weak, negative correlation existed between NDVI and N concentration. This is the first known Georgia study to use drone reflectance imagery to correlate to soybean growth and development. Future research could include an earlier N application timing at R2 growth stage to encourage a greater number of pods to set on the plants. This reflects much of the previous research looking at supplemental N application on soybeans.

Harvest Aid Application Timing
Objectives:
Un-known for soybean farmers is when to properly time application of an herbicidal harvest aid to maximize grain yield but create a timed harvest window for protecting yield and grain quality. Current knowledge of soybean development suggests that applying paraquat at R7 stage in soybeans will best time the grain development. This research aimed to remove ambiguity of the herbicide label and to collect remote sensing data that could be used as a predictive tool for when to apply.

For the second experiment a maturity group IV indeterminate soybean was planted in 2018 and in 2019 both a group IV and group VI were planted. Treatments of paraquat were applied to early, middle, and late timings. In 2018, all the treatments fell within a 10-day spray window during late R6 to early R7, while in 2019 the treatments were sprayed bi-weekly beginning at early R6, late R6, and early R7 to provide a longer window for treatment analysis. Prior to applications in 2019, pod and seed moistures were collected. Then once fully desiccated, samples were collected for yield. Remote sensing data was also collected using an unmanned aerial system (UAS) equipped with a multispectral camera to analyze treatment effects according to two spectral indices- GNDVI and NDVI.

Deliverables:
Data collected in 2018 demonstrated no difference in yield among application timing within the short 10-day window. The benefit provided an earlier harvest, without sacrificing yield or quality. In 2019, there was a yield penalty and differences in the GNDVI with the early spray at early R6, but reduced impact with the late R6 application in both the maturity groups. Initial image analysis indicates that there is a strong correlation to GNDVI and seed moisture and final yield, suggesting that this could be a powerful decision tool to properly time harvest aid application.