

Proposal to the Iowa Soybean Research Center

Title of Project: Integrated Research and Education Program for Use of Remote Sensing and UAVs for Enhanced Soybean Production.

Project Investigators:

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Project Collaborators:

- Dr. Peter Kyveryga, Director of Analytics, Iowa Soybean Association

Executive Summary: Historically, spatial management of agricultural productivity has been driven by georeferenced soil sampling to produce variable fertilizer recommendations or yield maps which quantify yields spatially across landscapes. Recent producer surveys suggest over 60% employ grid or similar spatial soil sampling techniques and over 70% of full time producers have adopted yield monitoring technologies. These technologies have become the foundation of spatial management in agriculture over the past twenty years.

Advanced in remote sensing technologies, specifically the commercial availability of high resolution imagery providers and the uses of Unmanned Aerial Vehicles (UAV), have opened new opportunities for spatial management which specifically address two fundamental issues associated with spatial yield or soil data. First, remote sensing allows producers to monitor crop conditions in-season which opens new opportunities for defensive applications of crop care products and more insightful discovery in crop production practices. Secondly, remote sensing technologies significant increase the spatial detail of crop health maps. Rather than being limited to the width of a combine commercial remote sensing tools can detect plant stress within individual crop rows which allows growers to drive out failure modes in their production practices caused by localized soil compaction, drainage problems, soil erosion, and diseases.

This project will launch an integrated research and educational program focused on uses of remote sensing imagery in agriculture and will establish two dedicated soybean remote sensing research and development sites for the continuous development of remote sensing tools and educational aides for Iowa soybean growers. During the course of this project commercial imagery from UAV, manned flights, and satellites will be collected throughout the growing season to quantify quality, use cases, and temporal issues with image capture. The research focus of the program will address the following subcategories:

- *Quantify the influence of timing of imagery collection on the ability to detect soybean stress and management problems.* The primary focus is to quantify the benefits of imagery throughout the season on the detection of water management, machinery, or pest factors that are causing yield limitations. The outcome should empower growers to collect imagery at the right time of the season to maximize value.
- *Quantify the repeatability and calibration requirements of commercial imagery sources for use imagery comparisons over time.* The primary focus is to quantify the repeatability of the various commercial imagery providers over the course of the growing season. Measurement accuracy is critical for data driven decisions and this research will provide knowledge into correction practices to ensure accurate in-season decisions.
- *Determine the spatial accuracy of commercial aerial imagery sources and develop recommendations for the use of the imagery in site-specific management.* Ultimately the value of aerial imagery is enhanced when used to provide in-season corrective actions. High resolution imagery can capture details within individual cropping rows and in some cases at the individual plant level. The primary focus of this task is to quantify the spatial accuracy of commercial imagery solutions and define practices for in-field benchmark correction and make quantify the influence on analyzing imagery over time.

These research results will be further incorporated into a grower focused education initiative to promote best management practices for using aerial imagery sources for in-season soybean decisions. This formal educational program will focus on web content and concise videos to share key decision support tools related to when and how to best use imagery in soybean production.