

# ISA 2022/23 Research Project

## On-farm soybean field trials using small, light-weight, autonomous planters

Update Report by Salin 247, Inc.  
for the  
**Iowa Soybean Association**  
April 1, 2023

### Project objective

The primary objectives of the “**On-farm soybean field trials using small, light-weight, autonomous planters**” are to (1) test and evaluate a Salin 247 small-scale, autonomous planter used for conducting on-farm trial (OFT) work, (2) collect and analyze the OFT data (i.e., seed population data), and (3) communicate the results of the OFT project and obtain farmer feedback.

### Salin 247 autonomous planter

For the 2023 OFT project, Salin 247 will be using an updated version of the autonomous planter that was used in field testing in 2022. The planter is an autonomous 4-row, 30” row planter powered by a 10-kwh Lithium Iron Phosphate battery. The prototype has four wheels (the version last season had tracks), each with a 5-kw electric motor, a 50-1 gearbox, and controller. The machine has a hydraulic system for raising and lowering the planter and also has an air compressor for air bag down force and pneumatic row cleaners. The machine is guided using software and RTK GPS. We have a custom-made base station that we bring to each field. The planter units are controlled by a Precision Planting 20/20 monitor. Seed population prescriptions are created using the Ag Leader SMS software including its field trial module.

*Salin 247 2023 planter ready to go to the field*



## Status of project tasks

The focus of work to-date has been on project planning. Below is a summary of tasks completed and tasks to be completed in the coming months. Planting is expected to begin as soon as soil conditions are acceptable (i.e., soil temps greater than 50 degrees Fahrenheit and around 35% soil moisture at planting depth).

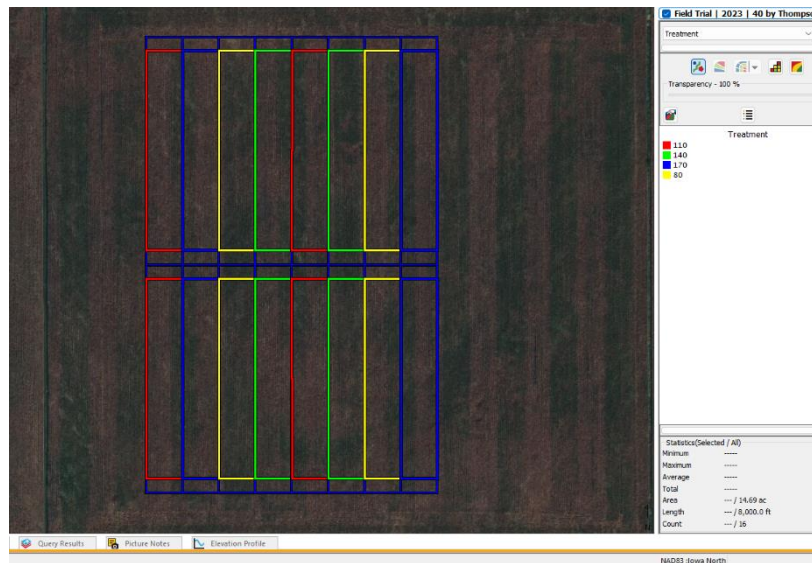
### *Project task status as of March 30, 2023*

<b>Broad tasks</b>	<b>Key tasks</b>	<b>Status</b>
Project planning	Finalize focus and scope of the OFT project	During the winter of 2023, ISA and Salin 247 finalized the focus and scope of the 2023 OFT project. Agreed to work with 10 growers in central Iowa and focus on evaluating alternative seed populations. It was decided not to evaluate row width and other variables during the project
	On-farm trial grower meetings	Salin 247 conducted informal meetings (in person and on the phone) with a handful of potential OFT growers during February and March. Salin 247 will enroll in the project one of the contacted growers. ISA staff has been contacting other potential OFT growers with the goal of enrolling nine growers.
	Grower protocol	ISA staff developed a grower protocol for the project that is being shared with all 10 growers
	Field trial design work	The project will focus on evaluating alternative seed populations. Four seed populations will be evaluated – 80K, 110K, 140K, and 170K seeds/acre.
Field trial implementation	On-farm trial preparation	Communication with selected OFT growers began in March and will continue into early April. Details about the OFT for each selected fields will be discussed with the OFT growers.
	Plant on-farm trial fields	Scheduled to begin as soon as field conditions are acceptable. It is hoped that planting will be completed in April but depending on weather conditions, work may spill into May
	Planter performance data collection	To be completed at time of planting
	Grower feedback data collection	To be completed at time of planting and weeks following planting
	Harvest data collection	Growers will collect yield monitor data at harvest time
	Data management & analysis	To be completed once all OFT project fields are harvested in the fall
	Project findings & conclusions	To be completed in the fall following harvest
Communicate project work & findings	Semi-annual reporting	This is the first of two semi-annual reports. The second will be completed once the OFT work is completed
	Field day	To be held in July or August this year
	Website information	Forthcoming once planting is completed
	Social media channels	Forthcoming once planting is completed

## Field trial design

Below is an example of a field trial design to be used with this trial. This example shows 500-foot plots that are 40 feet wide and have 50-foot buffers at the start and end of each plot. There are four populations with four replications.

*Example field design with four populations and four replications*



## Planter performance data to be collected

Listed below is the Salin 247 planter performance data to be collected at planting time. The data will be collected at the resolution determined by the Precision Planting 20/20 monitor as well as averages across each field.

- Planting speed
- Productivity (acres planted/hour)
- Seed population
- Duplicates
- Skips
- Ground contact
- Down force applied
- Good ride
- Soil temperature in the furrow
- Soil moisture in the furrow

This data will be mapped across each of the 10 fields.

## Energy use

Energy use data will be collected for each of the 10 OFT fields. Key data to be captured from each of the wheel motor controllers includes voltage and amps. This data is captured 100 times per second. Energy data is used to assess the amount of energy needed for planting under varying soil, planting speed, and other conditions.

## Navigation performance

We will be collecting navigation error data for each of the 10 fields. Navigation error is measured as the absolute center point distance from the pre-defined navigation (i.e., AB) line. We will be comparing navigation error under alternative field conditions as well as varying speeds of the planter.

### **Soil compaction data**

We will be collecting soil compaction data in each of the 10 fields. Measurements will be taken soon (i.e., same day) after planting. We use a digital penetrometer that takes PSI measurements every inch in the soil profile down to 18 inches. We will be selecting four locations in each field and take 10 probes for each of those four locations. In total, we will have 720 (4 location, 10 probes per location, 18 measurements per probe) soil compaction measurements per field. Samples 1 and 9 for each location will be probed in the Salin 247 planter wheel tracks so we can determine the extent of soil compaction caused by the Salin 247 planter.