CASE STUDY

How a Global Agricultural Leader Accelerated Plot-based Plant Measurements by 2.5x Using Drones

"By using PrecisionHawk's drone-based phenotyping solutions, large agriculture firms can greatly improve the accuracy and repeatability of critical assessments—ultimately delivering faster and more robust promotion decisions from their research efforts."

—**Thomas Haun**, SVP of Enterprise Agriculture Solutions

KEY ACHIEVEMENTS SUMMARY

Instead of taking plot-based crop measurements by hand, our client used drone-based aerial intelligence, making data collection:

2.5x	25%	More objective & repeatable	Standardized
more efficient	*more accurate*		

MANUALLY INSPECTING CROPS IS INEFFICIENT, ERROR-PRONE, AND RESOURCE-INTENSIVE

Global agricultural companies operate hundreds of research stations across the world. Research scientists run experiments at each station to develop products that maximize yields for many of the world's most important crops.

Monitoring and measuring plant growth—especially on a plot-level—is critical for agricultural companies seeking to maximize their investment in research and development of new seed technology. Traditionally, to measure, inspect, monitor and analyze crop-specific data, researchers or third-party contractors count and measure plants.

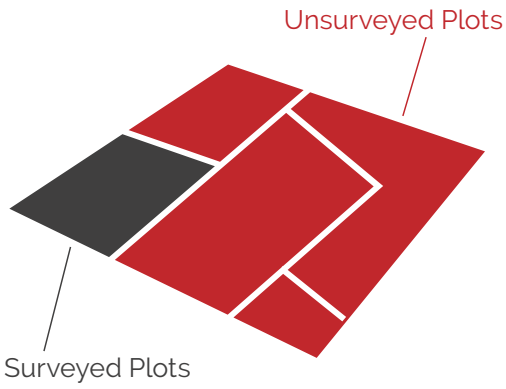
But this approach presents four key challenges:

1. EFFICIENCY
2. ACCURACY
3. OBJECTIVITY
4. DATA MANAGEMENT

EFFICIENCY

To survey manually requires an average of 11 paid labor hours per acre. To limit time and costs, agricultural companies typically only survey and inspect 10%–20% of research stations. While this can be supplemented with brief walking assessments for up to 40% of other locations, many plots are left unsurveyed. As a result, a wealth of valuable plant information remains inaccessible to researchers.

MANUAL SURVEYING



Avg. paid labor hours/acre: **11**

Area surveyed: **10-20%**

ACCURACY

Visually assessing plant growth introduces human error. Once the data is reported back from field collection, there is no way for research scientists to assess the accuracy of the data.

OBJECTIVITY

The assessment of each inspector is highly subjective as standardized assessments are difficult to implement within a large, geographically distributed staff—and even more challenging when working with third party contractors. Traditional methods of surveying plots, fields or research stations have no quantitative or qualitative support—other than the manual assessment results.

DATA MANAGEMENT

It takes seven years on average to finish research on a single crop breed. To maximize crop yield, data must be accumulated multiple times. Yet with the manual methodology currently used, it is difficult to rerun analysis or update analysis with new data—or measure against historic data.

AERIAL INTELLIGENCE IS TRANSFORMING RESEARCH PROCESSES AND OUTCOMES

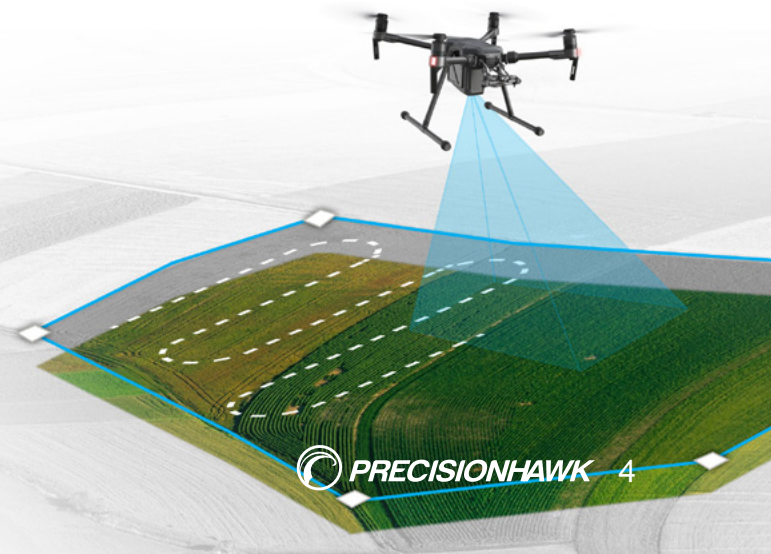
Global agricultural companies are investing in commercial drone technology to help address these challenges. One leading agricultural company that operates more than 325 research stations in the United States approached PrecisionHawk in 2015 to develop a pilot program.

To meet their needs, PrecisionHawk designed a sequence of aerial missions to test and measure the value of collecting data using drones:

1. **Baseline data—**Using a range of drone-based sensing hardware, capture aerial imagery of the research plots.
2. **Pilot project—**Then, analyze the baseline data to identify measurable plant traits. The researchers identified five traits and selected multiple research stations throughout the western hemisphere where PrecisionHawk would fly missions alongside company researchers. To assist the research team, PrecisionHawk built a custom automated algorithm to analyze the required plant characteristics.

At one pilot site, PrecisionHawk mapped a **400 acre field** containing 100 meter x 27 meter plots of recently emerged corn. The team elected to fly a DJI drone. They modified it with a specialized **camera with 18.5 mm focal length at 8 pixel depth,** including modifications to measure near-infrared multispectral imagery. To assess the orthomosaic data with various ground sample distances, the flight operations team flew **more than 100 flights at 50 meters, 70 meters, 100 meters and 150 meters.**

Once captured, the team uploaded the aerial imagery to PrecisionMapper, our cloud-based processing and analytics software. It created orthomosaics of the research plots and then used image-recognition technology to measure several plant traits from the emerged corn. The researchers then used the data to determine which seeds to promote.

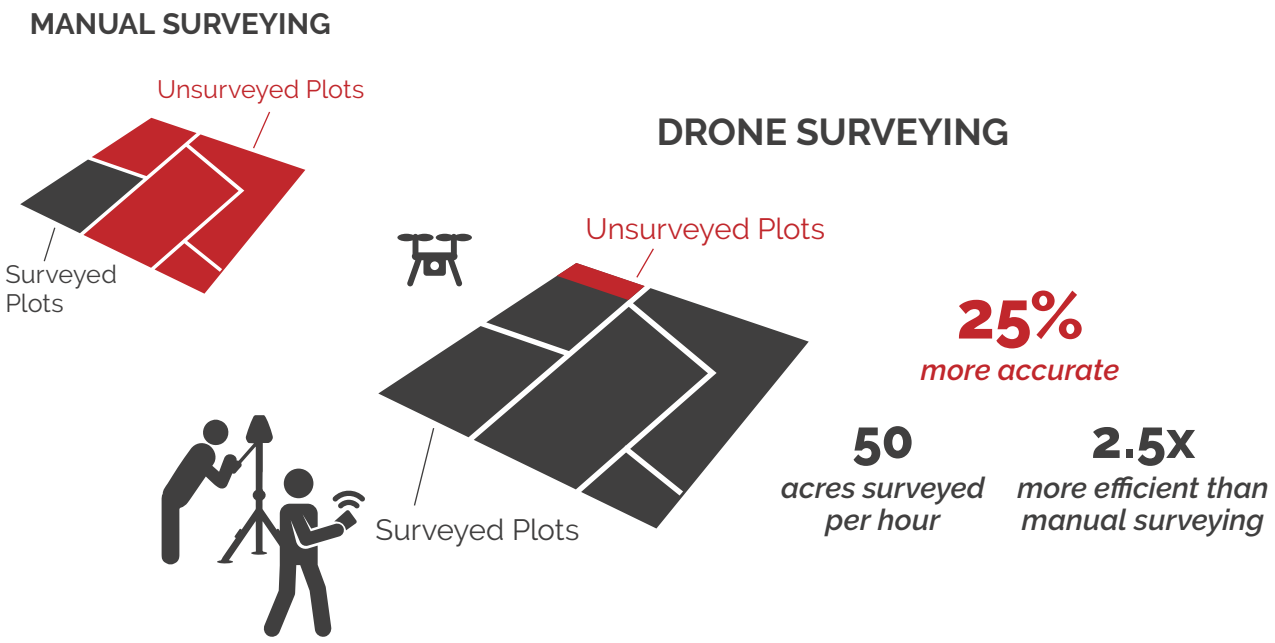


RESULTS

These missions demonstrated that the insight derived from a drone-based program can help address the four primary challenges that agricultural companies face in extracting precise and relevant data from their research stations:

1. **Efficiency—**A flight operations team of just two people can survey 50 acres per hour and collect all imaging data needed to measure five key crop traits. This means that data collection using drones is 2.5 times more efficient than traditional data collection methods.

2. **Accuracy—**Our flight operations team processed the data gathered through drone-based aerial intelligence and achieved a collectible resolution as high as 0.7 cm GSD. Over hand counts, this methodology was 25% more accurate than data gathered from manned aircraft or traditional surveying methods.

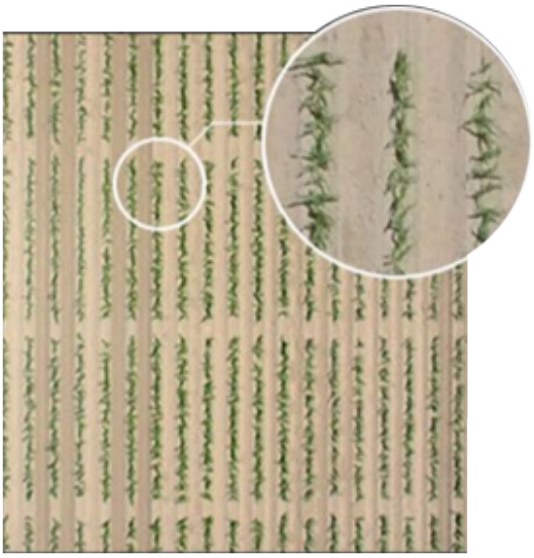


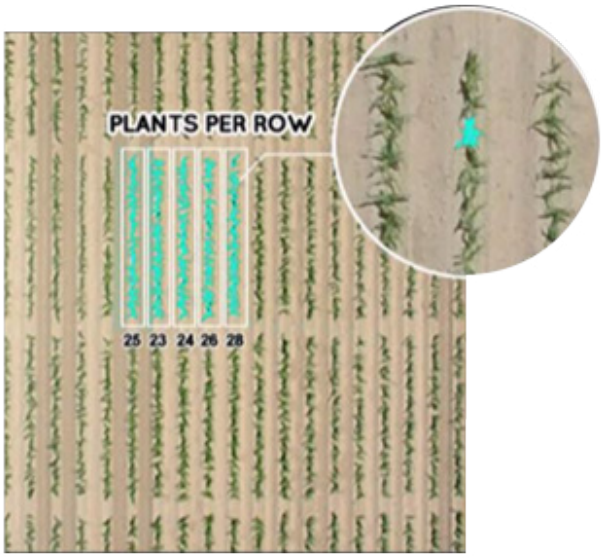
3. **Objectivity—**In building a custom algorithm to process the research company's aerial imagery, we ensured objective measurements and removed subjective analysis from the equation.

4. **Data management—**In addition to our custom algorithm, our agricultural partner uses PrecisionMapper, to run turn-key algorithms and analyze historical data to measure trends.

DEPLOYING AERIAL INTELLIGENCE THROUGHOUT THEIR ORGANIZATION

This project enabled our client to measure direct costs and better forecast an organization-wide deployment of a commercial drone program. By establishing a cost-per-plot for gathering data on two typical plant characteristics, research directors are able to determine how to integrate aerial intelligence into their existing systems and processes.





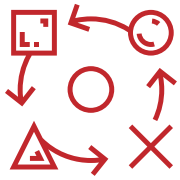
Using our services, our partner is building their capacity to fly drone missions at research locations across the globe—without deploying third-party flight teams. To achieve this goal, PrecisionHawk is training research scientists on deploying drones equipped with advanced remote sensors, such as multispectral and LiDAR, advising on procurement and teaching data scientists how to process and analyze drone-based aerial imagery.

ADDING AERIAL INTELLIGENCE TO YOUR RESEARCH

By adding drone-based aerial intelligence to their workflow, agricultural researchers can experience similar improvements in the accuracy of plot-based crop measurements and speed of data collection processes.

Those considering drone-based aerial intelligence can get started in three steps:

First, consider which measurement and analysis processes have the greatest impact on the business—of those, determine which are most in need of acceleration, improved accuracy, and/or more robust measurements.



Then, set goals for process performance and engage a partner that can help you design an aerial intelligence application that will achieve those targets.

Finally, conduct a brief, low-cost pilot to measure the technology's impact—data that you can use to determine the ROI of a prospective program.

To learn more about how to add drone-based data collection to your research toolset,

contact our agricultural solutions experts now. →