



Mississippi Corn Promotion Board 2025 Progress Report



Project Title: Evaluation of UAS systems for Aerial Applications and Cover Crop Seeding

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Project Summary (Issue/Response)

Adoption of Unmanned Aerial Systems (UAS) for agricultural product applications (i.e., “spray drones”) is increasing exponentially. UAS offer significant benefits to growers and ag-industry professionals including cost reductions in equipment (e.g., more affordable than traditional ground and aerial application equipment) and product inputs (e.g., lower product rates, precision spot-spraying applications), and greater flexibility and control in the timing of product applications – particularly in challenging locations and/or conditions (e.g., wet, small, or irregular shaped fields, fields with obstacles present, tight weather windows when applications are urgently needed, or when traditional applicator services behind schedule or completely unavailable). Although sometimes exaggerated in retail marketing campaigns, these valuable, real-world benefits are directly contributing to the significant increase in UAS adoption for aerial applications. With UAS benefits and increasing adoption both duly noted, it must be acknowledged that aerial applications of agricultural products by UAS is an exceptionally new practice that requires thorough, prolonged scientific research – especially in the U.S. Eastern nations, particularly China, have utilized UAS in agricultural product applications for at least two decades due to their smaller field sizes, steeper terrain changes, and sparser manned air traffic. This is evident in Chinese-manufactured UAS technology, which has unfortunately outpaced U.S.-manufactured UAS technology to date. This is further evident by the near-universal prevalence of Chinese-manufactured UAS operating in commercial industry and studied in scientific literature. However, as of December 2025, all new foreign-manufactured UAS platforms are no longer authorized to operate in U.S. airspace. Furthermore, all new foreign-manufactured UAS parts and components are now prohibited from import and commercial sale in the U.S. This is a monumental development as new UAS regulations from the Federal Aviation Administration (FAA) are expected to be finalized in 2026 and will establish the framework for future UAS operations for years to come.

All these factors have been, and continue to be, proactively accounted for in this ongoing research project for MCPB and its companion project for MSPB. The issues at hand are that 1) UAS can deliver significant benefits, but their exact methods, performance, and agronomic efficacy remain largely unknown in U.S. crop production systems, and 2) U.S.-manufactured UAS come at a significant cost-premium over Chinese-manufactured UAS, and their reliability and potential return on investment remains in question. MSU’s response to these issues is to evaluate the methods, performance, agronomic efficacy, cost, and potential return on investment in Mississippi corn and soybean production systems using exclusively U.S.-manufactured UAS.

Project Results/Outcomes

Project results and outcomes in 2025 have focused exclusively on UAS methods and operational performance. This approach ensures that future research efforts, results, and outcomes focused on agronomic efficacy and potential return on investment are supported by fundamentally sound UAS methods and operations. In essence, without sound methods (e.g., proper UAS maintenance, proper sprayer/spreader flow rate calibration, proper pattern testing and swath width calculation, etc.) and operations (e.g., proper application rate calculation and delivery through appropriate flight altitude, speed, swath spacing, offset adjustments for wind speed/direction, etc.) it is impossible to achieve reliable research results into efficacy and return on investment. Project results include a series of six comprehensive spray pattern deposition and swath width testing experiments using three U.S.-manufactured UAS platforms, flown under both manual and autonomous control, at altitudes ranging from 10’ - 20’ above the application target, at speeds ranging from 10 mph - 20 mph, and target swath widths ranging from 15’ - 30’. Results also include the first initial trial of cover crop seeding. Similar pattern and swath width testing of dry materials (cover crop seed, granular fertilizer) remain ongoing in the final month of the project. For each experiment, subsequent data analysis was performed to calculate statistical results for deposition coverage (Cov), droplet spectrum (Dv0.1, VMD, Dv0.9), and droplet size classification (VF, F, M, C, VC). Additional testing and analysis was also performed to validate effective swath width and assess coverage uniformity. Comprehensively, across all test results to date, the primary outcome was tremendous variability in all statistical metrics of performance. All applications across all UAS platforms under comparable conditions exhibited variability. Variability was also documented within individual UAS platforms performing multiple applications under comparable conditions. This inconsistency is plausibly validated by the numerous reports of UAS applicators “streaking” fields in commercial crops. Furthermore, this inconsistency also increases concerns of off-target drift in UAS-based aerial applications. However, latter results appear promising as MSU was able to 1) identify off-target drift with 1 UAS platform which utilized under-rotor nozzles, and 2) eliminate this off-target drift with the second UAS platform which utilized a traditional trailing spray boom.

Project Results

Additional project results and outcomes included completion of the very first National Agricultural Aviation Research & Education Foundation (NAAREF) Self-Regulating Application & Flight Efficiency training clinic (Operation S.A.F.E.) exclusively focused on UAS-based applications (Figure 1). Seven MSU graduate students completed the training and received certificates. This training was invaluable and essential to accurate testing, data collection, analysis, and results calculation during the project.

Furthermore, testing in the Summer of 2025 was assisted by recently retired USDA ARS Aerial Technologies researcher Dr. Daniel Martin. During this time, MSU's Mississippi Agricultural and Forestry Experiment Station (MAFES) and Agricultural Autonomy Institute (AAI) provided additional funds to support the filming, production, and release of a comprehensive 13-part Spray Drone Training video series. The complete video series was released to the public in November 2025. It includes many instructional "How To" videos as well as multiple educational videos which capture MSU's research efforts to understand UAS methods and flight operations for aerial product applications supported by this MCPB project.

Finally, a comprehensive "MSU Spray Drone Research Update" presentation was given at the 2025 MSU Row Crop Short Course, among other presentations given throughout the year. In all outcomes described here, and in all corresponding MSU news releases, MCPB is acknowledged and thanked for its generous sponsorship of this ongoing research project.



Figure 1. MSU graduate students conduct pattern deposition and swath width testing of Hylion AG-272 UAS during Operation S.A.F.E. clinic with instructor Dr. Dennis Gardisser.

Project Impacts/Benefits

The impacts and benefits of this project cannot be overstated. Thanks to MCPB (and MSPB), MSU has acquired the largest U.S.-manufactured UAS fleet of any University in the country. Since acquiring the fleet, MSU has now generated the most comprehensive dataset on U.S.-manufactured UAS aerial application methods and operational performance of any University in the country (and likely the world, as most foreign countries continue to rely predominantly on Chinese-manufactured UAS). This was a strategic vision shared by Dr. Dodds and Mr. Dixon, which MCPB (and MSPB) brought to fruition with its support. As we approach the end of Year-2 for this project, the sweeping foreign-UAS restrictions which MSU rightly anticipated have now become reality. The results/outcomes of this project, though still modest, accurately represent the current state of U.S.-manufactured UAS performance in aerial product applications. At present, those product applications demonstrate high variability, but can and will improve - especially as new UAS platforms are released. In the meantime, Mississippi corn producers can, and should, please consider these research results and regulatory developments in evaluating any potential UAS purchase.

Project Deliverables

- NAAREF Operation S.A.F.E. Training Clinic - 7 MSU Graduate Students Received S.A.F.E. Certifications. MSU News Article published 6/6/2025 - [link here](#).
- Research Update provided to MS Department of Agriculture & Commerce (MDAC) - Bureau of Plant Industry (BPI) UAS Task Force to inform potential future State aerial application regulatory amendments specific to UAS product applications. 10/30/2025.
- Spray Drone Training Video Series. 13-part training series released to the public (free) to assist/educate all current and aspiring UAS applicators. MSU News Article published 11/18/2025 - [link here](#).
- "MSU Spray Drone Research Update" presented at 2025 Row Crop Short Course, plus 2 graduate student poster presentations. 12/8-10/2025.
- 20+ combined presentations and UAS aerial application flight demonstrations at various events, conferences, and field days.

Additional Questions

1. What value does this research give the grower? Describe any financial decision-making tools your project provides.

The greatest value provided through this research (thus far) is objective, real-world performance data for U.S.-manufactured UAS platforms to accurately inform equipment purchase/investment decisions by growers. This objective performance data is intended to counter-balance the marketing “hype” currently surrounding UAS (“spray drones”). Additionally, the objective data of this research combined with accurate UAS regulatory updates provides the greatest possible context and situational awareness to inform all growers’ decision-making when considering investment into ANY UAS platforms for aerial product applications. For example, MSU has consistently, and adamantly, cautioned against purchasing of Chinese-manufactured UAS even despite their appealing price point. This is because MSU was 1) keenly aware of the national security risks associated with Chinese-manufactured UAS platforms, and 2) confident in the forthcoming restrictions on Chinese-manufactured UAS platforms and their components. Growers who may have unknowingly purchased these UAS platforms without understanding the forthcoming risks/restrictions can no longer purchase essential parts and components for UAS maintenance, thereby greatly reducing the service life and potential return on investment of their purchase. This is financially detrimental for certain, but not nearly as detrimental as an outright ban of existing Chinese-manufactured UAS platforms - [which is still plausible](#) and would result in an outright loss of investment beyond any prior work/applications/value already performed/provided by the UAS.

With that said, MSU was also keenly aware of the of the considerable price premium and potentially lacking performance of U.S.-manufactured UAS. Therefore, it has been, and continues to be, our priority to objectively study these U.S.-made platforms to accurately inform growers’ UAS purchasing decisions. For example, a U.S.-made platform that costs 30%-50% more but is not at risk of a potential ban on the UAS or its serviceable parts offers peace of mind - UNLESS that same costly platform consistently delivers poor product applications, with poor agronomic results, which still results in poor return on investment and significant financial loss.

MSU intends to capture and quantify these variables (among others) as best as possible into a financial decision-making tool in Year-3.

3. List other sources of funding you have acquired over the past 2 calendar years.

Dr. Darrin Dodds:

- U.S. Environmental Protection Agency (EPA)
- U.S. Department of Agriculture (USDA):
 - Agricultural Research Service (ARS)
 - National Institute of Food & Agriculture (NIFA)
 - Foreign Agricultural Service (FAS)

Mr. Madison Dixon:

- Sugarcane Growers Co-Op of Florida
- National Science Foundation
- Inferno Armor, in collaboration with BSS Global
- Deere & Company; dba “John Deere”
- Mississippi Soybean Promotion Board
- Hearin Foundation