2024 AG AVIATION EXPO
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Aerial Application Technology Research Session

Monday, November 18, 2024 | 10:15 AM – 12:15 PM
Fort Worth Convention Center | Fort Worth, TX

At this meaty session, you'll get a science-based overview of the cutting-edge research underway to support your operations from some of the industry's top aerial application researchers. Researchers have been working on most of these projects over the past several years and are eager to help make your applications more efficacious, make you an even better environmental steward and your application business even more advanced. To get a sample of what to expect, check out presentations from recent years

This session consists of 6 consecutive 20-minute presentations as specified below

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Presentation 1
10:15 - 10:35

Title: Development and Use of Vision-Based Swath Analysis System

Author: Randy Price, PhD

Abstract: A "build-it-yourself" paper swath analyzer, like the Swath Gobbler, was developed using vision-based software to detect droplets and patterns on paper. The system is constructed with easily accessible materials, and the software may be released on GitHub for public use. Additionally, a vision-based string analyzer that uses a vacuum system to collect strings up to 3000 ft long for long-distance pattern analysis in sugarcane fields will be discussed. These systems were used to analyze coverage and uniformity differences for spray patterns applied with drones using various nozzle types.

Bio: Dr. Randy Price is an Associate Professor at the LSU AgCenter, Baton Rouge, Louisiana. He continually works on new equipment and methods to help the agricultural spray plane industry and is a certified Operation S.A.F.E. analyst.

Presentation 2
10:35 - 10:55

Title: Pattern Testing – Droplet Size Matters

Author: Rob Ching

Abstract: A new look at pattern testing and the challenges of accurate droplet size detection will be discussed. The keys to determining accurate pattern characterization and droplet analysis will be discussed. A walkthrough of pattern testing efforts used to evaluate an innovative nozzle will be presented to illustrate the process. Additionally, the essential need for accurate droplet detection will be discussed.

Bio: Rob Ching is a Michigan aerial applicator, Operation SAFE Analyst and co-creator of DropFlight, an iOS app developed for aerial spray pattern testing. Rob's development work in pattern testing is centered on enabling applicators to collect their own droplet size and swath characterization data, empowering them to verify proper setup of their aircraft spray systems.

Presentation 3
10:55 - 11:15

Title: Applying Machine Learning Techniques for Image Classification in Agricultural Applications

Author: Chenghai Yang, PhD

Abstract: Machine learning, a subset of artificial intelligence (AI) that enables computers to learn from and make decisions based on data, has been increasingly used for various agricultural applications. This presentation provides a brief overview of how different machine learning techniques can be used for crop classification, weed identification, and pest damage assessment. A case study is presented to demonstrate how the random forest classification technique was applied to Sentinel-2 satellite imagery for accurate identification of different crop types. This presentation offers aerial applicators and other interested users a brief introduction to machine learning techniques, highlighting their potential to create precise prescription maps for targeted applications of agricultural production and protection materials.

Bio: Dr. Chenghai Yang is a Research Agricultural Engineer with the USDA-ARS Aerial Application Technology Research Unit in College Station, TX. Dr. Yang's research focuses on the development and application of remote sensing technologies for precision agriculture and pest management. His recent efforts include developing low-cost imaging systems for manned and unmanned aircraft and comparing their effectiveness with satellite imagery for assessing crop conditions for site-specific applications of crop production and protection materials. Dr. Yang has authored or co-authored over 170 peer-reviewed journal articles. He is a Fellow of the American Society of Agricultural and Biological Engineers and a member of several other national and international professional societies.

Presentation 4
11:15 - 11:35

Title: Elevating Spray Precision with Advanced Nozzle Control using Pulse Width Modulation (PWM)

Author: Adam Madison

Abstract: In agricultural applications, the precision of spray nozzles is essential for optimizing resource use, improving efficiency, and minimizing environmental impact. This presentation examines advancements in nozzle control technology, focusing on pulse width modulation (PWM) to enhance spray precision. By integrating sensors, adaptive algorithms, and real-time feedback, we can develop a system that adjusts nozzle parameters dynamically to varying conditions. This approach improves spray distribution accuracy, reduces waste, and enhances liquid delivery effectiveness. Results show significant improvements in spray uniformity and resource efficiency, highlighting the potential of advanced nozzle control in revolutionizing aerial spraying techniques.

Bio: Adam Madison is a Field Technical Specialist with 10 years of experience at Capstan Ag Systems, specializing in the SwathPRO spray system. His extensive knowledge and technical expertise have played a crucial role in implementing and optimizing the SwathPRO system for pilots, ensuring efficient and precise spraying operations.

Presentation 5
11:35 - 11:55

Title: Measuring the Effect of Adjuvants on Droplet Spectrum in Aerial, Drone and Ground Applications Using a High-speed Wind Tunnel.

Author: Ulisses Antuniassi, PhD

Abstract: The objective of this work was to evaluate the effect of adjuvants on the droplet spectrum generated by different devices in the simulation of aerial, ground and drone spraying applications, using a high-speed wind tunnel. The hydraulic nozzles for ground and aerial application, as well as rotary devices used in aerial application and drones were installed in a wind tunnel equipped with a Sympatec Helos particle analyzer and subject to different air flow speeds. Several spray solutions were evaluated, the first being the dilution of a SC formulation fungicide in water, and the others containing this fungicide in tank mix with adjuvants (modified vegetable oil, guar-based polymer, silicone-based surfactant, and non-ionic surfactant based on ethoxylated nonyl phenol), all adjusted label rates. Spray volume was adjusted to 100 L/ha on ground applications and 10 L/ha for aerial and drone applications. The volume median diameter, the percentage by volume composed of droplets smaller than 100 µm and the relative spam data were generated. The results showed that there was interference from the adjuvants according to each type of droplet generator (tips with and without air induction and the rotating nozzle), as well as there was interference from the air flow. The performance of the hydraulic and rotating nozzles was different depending on the different adjuvants, just as the nozzles with and without air induction reacted differently to the presence of the various adjuvant technologies.

Bio: Agronomist, PhD in Agronomy, Professor at Sao Paulo State University (UNESP), Botucatu/SP - Brazil. Over 35 years of experience in Agricultural Engineering, focusing on application technology, ground sprayers, aerial application, UAV spray application, spray solutions, formulations, adjuvants, spray drift and good agricultural practices.

Presentation 6
11:55 – 12:15

Title: Rice Levees as Potential Barriers for Reducing Spray Drift

Authors: Brad Fritz, PhD

Abstract: A field study examining the potential for rice levees serve as barriers to intercept and reduce off-target movement of aerially applied sprays, much like windbreaks and hedgerows, is being conduct. Aerial spray treatments will be applied over two locations, one with a levee directly downwind of the application site, the other without a levee. Off target deposits will be measured downwind of the application site and compared for both field sites. This work is being conducted at the request of, and in cooperation with USA Rice in response to ongoing regulatory concerns and need for identifying new strategies for mitigating spray drift.

Bio: Dr. Brad Fritz is an agricultural engineer and serves as the Research Leader of the USDA ARS Aerial Application Technology Unit in College Station, Texas. His areas of research include spray drift measurement and methods of mitigation, understanding the role spray nozzles and formulations play in the droplet size being applied and optimizing aerial application technologies and methods to enhance on target deposition and reduce off-target impacts. He is an active member of a number of professional organizations including the American Society of Agricultural and Biological Engineers, the American Society of Testing and Materials, the American Mosquito Control Association, and the National Agricultural Aviation Association.