

Highlights

RYE IN THE SKY: CALIBRATION AND DISTRIBUTION PATTERN ANALYSIS WITH COMMERCIAL UAS

Personnel from the NSDL joined Auburn University's Precision Ag Research Team to investigate operational parameters of multiple commercially available Unmanned Aircraft System (UAS) platforms. One platform tested was the NSDL's recently acquired Hylio Ares HYL-150 (Fig. 1).

Flights were performed at Auburn University's Biosystems Engineering Unit at the E.V. Smith Research Center according to **ASAE S386.2** "Calibration and Distribution Pattern Testing of Agricultural Aerial Application Equipment" testing guidelines. All models were subjected to spreading cereal rye seed, a common winter cover crop species used in regenerative agriculture systems, at three application rates (20, 40, & 60 lb/ac) and three overlap spread widths (maximum manufacturer recommended swath, 20 feet & 16 feet). After each flight, cereal rye seed was removed from collection pans and placed into individual bags for data analysis (Fig. 2 and 3, respectively).

Dynamically Speaking

As the National Soil Dynamics Laboratory looks forward to another year of agriculture research, I am happy to say the new NSDL state-of-the-art research buildings on Auburn University's Research Park are moving closer to reality. Construction contracts are in place, and contractors are working on construction details. We expect to see activities on site by June 1st. Also, I would like to announce after more than 30 years of distinguished service, Dr. Thomas R. Way, Agricultural Engineer, has retired. Throughout his career, Dr. Way made significant contributions to fundamental engineering principles of "soil dynamics", particularly in areas of tire traction performance and soil compaction characteristics of agricultural vehicles. He is recognized as a leading international expert in this field. In addition, Dr. Way's research has played a pivotal role in advancing conservation tillage practices and enhancing soil health across the Southeastern United States.



H. Allen Torbert
Research Leader

Results indicated the HYL-150 exhibited favorable coefficient of variation (CV%) values compared to other platforms tested at all three swaths tested. However, understanding the capabilities of the HYL-150 seed spreading system are in their infancy. Future iterations of the system from Hylio will improve the platform's overall usability and performance across different application settings. Various UAS technology is continually updated and refined, while new systems also become available. Therefore, we will continue to perform additional testing to update our data and transfer the technology to our stakeholders.

This research can provide guidance to producers seeding cover crops with a drone equipped seed spreader, prior to harvest of their summer crop. This aerial seeding method reduces field and crop impacts of traditional equipment coupled with fuel savings to reduce inputs. Research-driven seed calibration methods ensure growers apply their desired seeding rate and provide potential



Fig. 1. The Hylio HYL-150 preparing to pass over the trays. Observers ensure the flight path crosses directly over the center-most collection pan.

... UAS continued

cost savings by reducing instances of over-application. Early establishment of cover crops fosters soil health benefits, such as building organic matter, supporting microbial activity and diversity, while preventing growth of cool season weeds. This spring we will continue de-



Fig. 2. Collection pans are setup in-line, spaced 2' on center, perpendicular to the drone's flight path. Tray dividers are used to reduce the cereal rye from bouncing out of the collection pan.

veloping our seed spreader technology, while adding sprayer application testing to our activities. In addition, we plan to integrate other UAS opportunities when possible into our regenerative cropping system experiments.

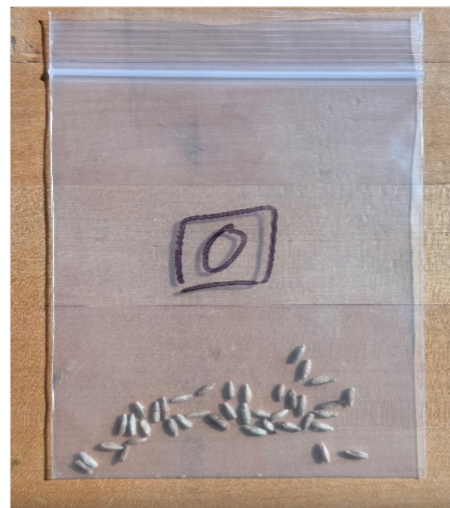


Fig. 3. Cereal rye from the pans are bagged and counted prior to being weighed in the lab. The "o" on the bag denotes the pan location, this one being in the center of the flight path.

Recent Selected Publications

All our publications are available on our website:

<https://www.ars.usda.gov/sea/nsdl>

Barbosa, J.Z., Mendes, E.J., Sass, A.L., Magri, E., Araujo, E.M., Prior, S.A., Motta, A.C., Shizuo, M. 2025. Calcium and silicon precipitation in *Pinus taeda* needles in response to soil application of cellulosic residue. *Floresta e Ambiente (Forest and Environment)*. 32(3):e20240048. <https://doi.org/10.1590/2179-8087-FLORAM-2024-0048>.

Barbosa, J.Z., Motta, A.C., Poggere, G., Prior, S.A. 2025. Winners of the Brazilian soybean yield contest: climatic, soil, management, and economic factors. *Oil Crop Science*. 10(4):294-302. <https://doi.org/10.1016/j.ocsci.2025.07.003>.

Bhatta, A., Prasad, R., Chakraborty, D., Watts, D.B., Torbert III, H.A., Kleinman, P.J. 2026. Evaluation of Alabama phosphorus index using edge of field data. *Journal of Environmental Quality*. 55:e70152. <https://doi.org/10.1002/jeq2.70152>.

Brar, G.S., Malhotra, K., Kumar, R., Lamba, J., Way, T.R., Prasad, R., Adhikari, S. 2025. Elucidating the impact of broiler litter and pine-wood biochar on metal retention and leaching in undisturbed soil columns using simulated rainfall. *Journal of Hazardous Materials Advances*. 20:100860. <https://doi.org/10.1016/j.hazadv.2025.100860>.

De Albuquerque, C.G., Motta, A.C., Lammel, D., Barbosa, J.Z., Gavelaki, F., Prior, S.A., Dieckow, J. 2025. Chemical characterization of soybean stover shows potential to mitigate soil acidity in Brazil. *Bragantia*. 85:e20240110. <https://doi.org/10.1590/1678-4499.20240110>.

Koneti, S., Prasad, R., Chakraborty, D., Watts, D.B., Torbert III, H.A. 2025. Effect of broiler litter stockpiling methods on ammonia and greenhouse gas emissions. *Poultry Science*. 104:105979. <https://doi.org/10.1016/j.psj.2025.105979>.

Livingston, R.M., Mayfield, M., Zhao, C., Potnis, N., Strayer-Scherer, A., Martin, K.M. 2025. Data collection and transcriptome analysis of *Triticum aestivum* samples from Alabama revealed the presence of barley yellow dwarf virus. *Frontiers in Agronomy*. 7:1721047.

Malhotra, K., Lamba, J., Way, T.R., Prasad, R., Srivastava, P. 2025. Effect of poultry litter application and preferential flow on metal loss in pastures. *Journal of Environmental Management*. 391:126415. <https://doi.org/10.1016/j.jenvman.2025.126415>.

Mcdonald, M.B., Hennessey, A.V., Johnson, P.P., Gladfelter, M.F., Merrill, K.L., Tenison, S.E., Ganegoda, J.S., Hoang, T.C., Torbert III, H.A., Beck, B.H., Wilson, A.E. 2025. Repeated low-dose copper algacide treatments promote beneficial phytoplankton and zooplankton communities. *Journal of Environmental Management*. 394:127502. <https://doi.org/10.1016/j.jenvman.2025.127502>.

Popoola, T.O., Chakraborty, D., Ray, P., Prasad, R., Torbert III, H.A., Watts, D.B., Fasina, O. 2026. Efficacy of untreated and treated biochar variants in environmental phosphorus management. *Environmental Technology & Innovation*. 41:104822. <https://doi.org/10.1016/j.eti.2026.104822>.

Torbert III, H.A., Prior, S.A., Kavetskiy, A.G., Yakubova, G.N., Donner, D., Runion, G.B. 2026. Mapping of soil elements for precision agriculture using neutron-gamma technology. *Advances in Agronomy*. 195:1-66. <https://doi.org/10.1016/bs.agron.2025.09.002>.

Yakubova, G.N., Kavetskiy, A.G., Gautam, S., Prior, S.A., Torbert III, H.A. 2025. Soil chemical composition and texture determinations using neutron-gamma analysis. *Soil and Tillage Research*. 256:1016912. <https://doi.org/10.1016/j.still.2025.106912>.

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MAPPING OF SOIL ELEMENTS FOR PRECISION AGRICULTURE USING NEUTRON-GAMMA TECHNOLOGY

A challenge in soil science research is the disconnect between experimental plots and real-world applications. Traditionally, measurements for research begin with small plots where precision and repeatability are achievable. But when results are scaled up to large fields, variability present in all fields makes using the findings difficult. However, advancements in precision agriculture now enable us to manage fields in very small areas so that inputs and management can be adjusted to account for this variability. The real challenge is the difficulty in mapping the field accurately to account for this variability. Traditionally, mapping is done by taking many soil cores which is labor intensive and requires expensive laboratory analysis. This process must occur before you can start to make the map, and if you do not take enough cores, the map will be wrong.

A promising alternative to this traditional method is a new technology developed at NSDL that requires no soil coring to perform multi-elemental analyses in the upper soil profile. This patented technology for scanning large soil volumes across landscapes is called Mobile Inelastic Neutron Scattering (MINS) and is now commercially available (Fig. 4). A neutron ray is used to stimulate soil atoms and create gamma rays which can be analyzed to

determine elemental soil content. This data can be used to quickly provide detailed and accurate field maps.

Recently, we published a review of this technology that goes into great detail as to how it works and how it is being used commercially. It includes examples where we used this novel method to measure soil carbon across an entire field to capture the field variability and compares it to the traditional soil coring method. It also addresses a lot of the various questions we have often been asked such as safety to both the operator and soil organisms. The publication can be found at the following link: <https://doi.org/10.1016/bs.agron.2025.09.002>.

This commercial method offers a powerful tool to unite the rigor of soil science with operational needs of modern precision agriculture. MINS has no effect on soil's chemical or biological components and different soil types will not impact results. MINS eliminates huge variability associated with point sampling and delivers large field measurements within 4 mg C/cm³ that has been shown to be 80% more accurate compared to traditional core sampling.



Fig. 4. General view of the MINS measurement system in the field.

Upcoming Events 2026		
Dates	Meeting	Location
July 14 - 16	58 th Annual American Peanut Research & Education Society Annual Meeting	San Juan, Puerto Rico
July 21 - 23	27 th Annual Southern Peanut Growers Conference	Panama City Beach, FL
July 26 - 29	81 th SWCS International Annual Meeting	St. Louis, MO
Oct. 20 - 22	Sunbelt Ag. Expo	Moultrie, GA

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VIRAL DIVERSITY OF COTTON APHIDS IN ALABAMA

COTTON FIELDS

The cotton aphid (*Aphis gossypii*) (Fig. 5) is an important agricultural pest with a broad host range and plays a key role in transmitting plant viruses, including cotton leafroll dwarf virus (CLRDV), a pathogen detected in U.S. cotton fields in recent years. Despite its economic significance, little is known about the diversity of viruses carried by this aphid in cotton production systems in the southeastern United States, particularly how these viral communities vary across geographic locations. Characterizing both the diversity and spatial patterns of these viral communities is important for understanding aphid biology and their potential impacts on crop health.

To profile the viral community associated with cotton aphids, specimens were collected from 15 cotton fields across five counties in Alabama (Fig. 6) and subjected to high-throughput genetic analysis. A diverse assemblage of viruses was identified and assigned to at least seven viral families, including groups known to infect insects as well as plant-associated viruses. Representative viral sequences were validated using additional molecular approaches. Viral composition differed across geographic locations, with distinct viral profiles observed across counties.

Notably, CLRDV was detected in aphid-derived genetic data. Its presence is consistent with its circulation in cotton production systems and highlights the role of aphids in mediating CLRDV transmission between plants. The detection of additional viruses further shows that cotton aphids harbor a complex mixture of viruses with different biological roles.

This study also identified three novel iflaviruses. Complete genome sequences were determined for all three viruses, and two were shown to replicate in aphids, indicating active infection. Field surveys showed that these viruses occur at low prevalence, although their biological effects on aphids remain unknown.



Fig. 5. Winged adult and nymph cotton aphids feeding on a cotton leaf.

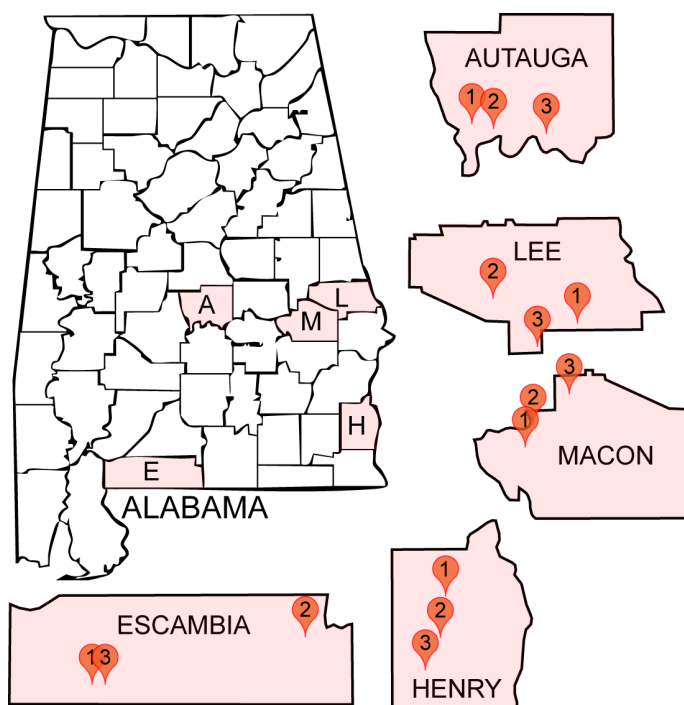


Fig. 6. Sampling locations across five Alabama counties, with three cotton fields sampled in each county.

Overall, this work presents a comprehensive assessment of viral diversity in cotton aphids in Alabama cotton fields and reveals clear geographic variation in viral composition among counties. By documenting both insect-associated viruses and plant-infecting viruses within aphid populations, this study provides a basis for further investigation into how viral communities may influence aphid biology, virus transmission, and cotton production systems.

Happenings

ARS-NSDL technician, Carter Bonnell, showcased research efforts for agricultural UAS research through a flight demo of the Hyllo spraying and spreading drone to early education students to develop their interest in agricultural careers. (~175 participants)

Dr. Kip Balkcom was invited to present information about planting date and nitrogen considerations for cereal cover crops to participants that included growers, scientists, and industry representative (~60 people) at the Wiregrass Cover Crops Field Day in Headland, AL.

Dr. Kip Balkcom was invited to present information about planting date and nitrogen considerations for cereal cover crops to participants that included growers, scientists, and industry representative (~60 people) at the Cover Crops and Soil Health Field Day in Shorter, AL.

Send updated contact information, questions, comments, and/or suggestions to: NSDL-Highlights@ars.usda.gov

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