News from NSF AgTech Engine in North Dakota

Summer 2025 Newsletter

Message from Dr. Hollie Mackey, NSF AgTech Engine in North Dakota CEO

Dear Friends, Partners, and Supporters,

As we turn the page into the new season, I'm proud to share the latest updates from what has been a remarkable Summer of transformation, innovation, and growth for our organization and community.

In our Spring newsletter, we introduced a significant milestone in our journey: the rebranding of FARMS to the NSF AgTech Engine in North Dakota. While the name *FARMS* reflected our roots and long-standing dedication to rural innovation, this transition marks a bold step forward in aligning our identity with our mission: solving for food security through AgTech innovation.

This change is part of a national initiative led by the National Science Foundation to rebrand each of the nine Regional Engines, ensuring our names clearly reflect the critical work we are doing. The NSF AgTech Engine in North Dakota now more powerfully communicates our commitment to agricultural technologies that strengthen regional economies, foster sustainability, and support a resilient, tech-enabled food system.

But this new name is not just a label—it's a launchpad. Over the past months, we've expanded our capacity and welcomed three outstanding professionals whose expertise in innovation, finance, and scalable systems will help accelerate our impact across North Dakota and beyond.

We've seen projects like Whitewater take center stage, demonstrating the real-world potential of AI-powered soil moisture mapping, and celebrated groundbreaking work like Bison Guard—a visionary fusion of robotics, AI, and Native American knowledge in regenerative bison management. We've supported early detection of invasive species, advanced AI in crop disease diagnostics, and empowered teachers to bring precision agriculture into classrooms across the state.

We've also gathered thought leaders, growers, and change-makers at the North Dakota Controlled Environment Agriculture Conference, showcasing how Controlled Environment Agriculture can reshape food production for colder climates—and how locally grounded initiatives like Wozu Thima are setting the standard for community-led food sovereignty.

As I shared during the North Dakota Water Resource Foundation's Annual Irrigation Water Tour, the Engine's work is not only about advanced science, but use-inspired research—science in service of the people who steward our land, feed our families, and shape the future of agriculture.

Whether you're a grower testing new technologies in your field, an educator shaping the next generation, or a community leader advancing resilience through innovation—you are part of this Engine.
And I want to thank you.

Thank you for growing with us, building with us, and believing in what's possible when we combine innovation with purpose. The future of agriculture is collaborative and deeply rooted in place—and we're honored to help lead that future from right here in North Dakota.

Dr. Hollie Mackey
CEO, NSF AgTech Engine in North Dakota

From FARMS to NSF AgTech Engine: Reflecting Our Evolving Mission

In our Spring newsletter, we introduced an exciting new chapter in our journey: the rebranding of FARMS to the NSF AgTech Engine in North Dakota. While the name FARMS has served us well—representing our roots, values, and dedication to rural innovation—it is time to retire it in order to more fully embrace our mission: solving for food security through AgTech innovation.

We remain deeply committed to our partners, producers, educators, and innovators across North Dakota and beyond. This rebrand marks not an end, but a bold step forward in amplifying our impact and accelerating transformative change in agriculture.

Thank you for growing with us.

AgTech Engine Welcomes New Team Members

Expanding Capacity to Drive Innovation in North Dakota and Beyond

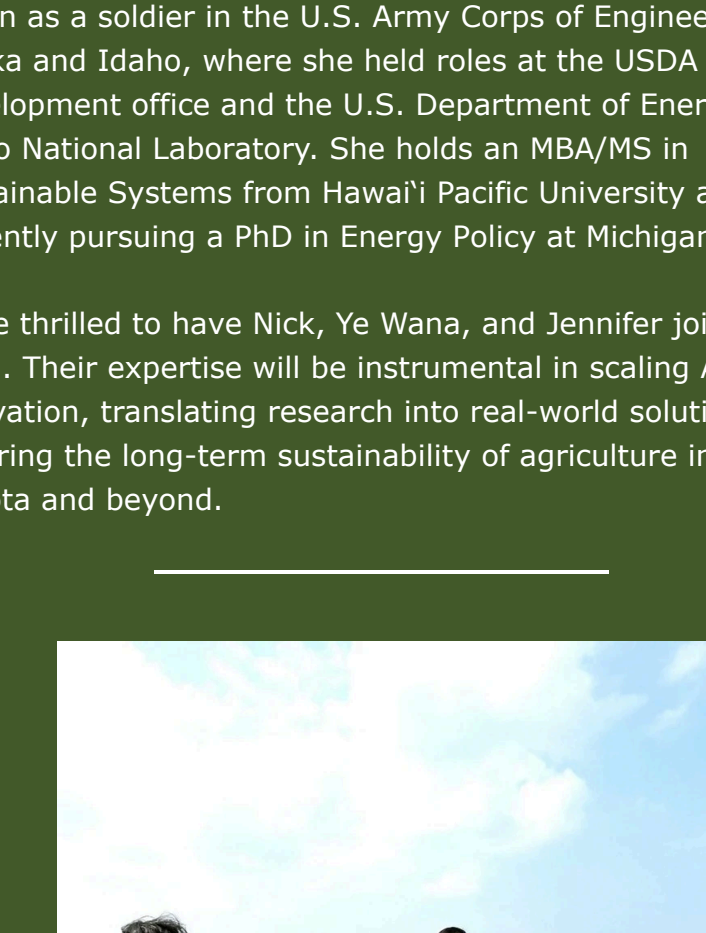
The NSF AgTech Engine in North Dakota is proud to announce the addition of three outstanding professionals to our growing team. Each brings a unique set of skills, experiences, and perspectives that will help advance our mission of solving for food security through AgTech innovation.

Nick Bittner, Innovation Manager, Research and Development Translation
A fourth-generation North Dakota farmer and seasoned research engineer, Nick brings deep roots in agriculture and a diverse background spanning education, biomedical engineering, advanced manufacturing, and precision agriculture. He has managed large-scale farm operations and launched a UAV business supporting crop health monitoring and water drainage elevation tracking in the Devils Lake Basin. Nick also currently serves as Director of Research and Development on the NASA M-STAR research grant at Cankdeska Cikana Community College, further reinforcing his commitment to innovation and applied research in agriculture.

Ye Wana Hlaing, Finance Analyst and Operations Specialist
With a global perspective on economic development and financial strategy, Ye Wana brings extensive experience in international research, public diplomacy, trade, and financial operations. He holds an MBA from the Asian Institute of Technology and an MS in Global Studies from Oklahoma State University. His expertise in research coordination and economic analysis will strengthen the Engine's operational capacity and support data-driven decision-making across projects and partnerships.

Jennifer Rachels, Innovation Manager, Scalability and Replicability
Jennifer's career reflects a lifelong dedication to community development and sustainable systems. Originally from Georgia, she has served in the Peace Corps in Romania and worked on infrastructure and development projects with organizations such as Habitat for Humanity, the Department of Transportation, and multiple U.S. Department of Defense entities. Her work has taken her from Hawai'i—where she began as a soldier in the U.S. Army Corps of Engineers—to Alaska and Idaho, where she held roles at the USDA Rural Development office and the U.S. Department of Energy's Idaho National Laboratory. She holds an MBA/MS in Sustainable Systems from Hawai'i Pacific University and is currently pursuing a PhD in Energy Policy at Michigan.

We're thrilled to have Nick, Ye Wana, and Jennifer join the team. Their expertise will be instrumental in scaling AgTech innovation, translating research into real-world solutions, and ensuring the long-term sustainability of agriculture in North Dakota and beyond.



NSF AgTech Engine-Supported Wheat Disease Diagnostic System Demonstrates Breakthrough Accuracy

An AI-powered wheat disease diagnostic system developed by Dr. Rex Sun, Associate Professor of Agricultural and Biosystems Engineering at North Dakota State University (NDSU), is showing exceptional promise in early trials. Backed by the NSF AgTech Engine, the system is poised to revolutionize crop disease detection and management.

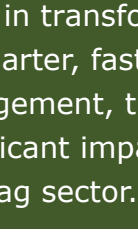
Utilizing AI models with hyperspectral images, Dr. Sun's diagnostic tool goes beyond conventional methods by not only identifying wheat diseases but also quantifying their presence in the field. This dual capability allows for more targeted and timely treatment recommendations—supporting both immediate disease management and long-term prevention strategies.

Lab results have shown an impressive over 90% accuracy rate in disease detection, significantly advancing the precision and reliability of plant health monitoring. The system will soon transition from controlled lab testing to real-world grower field trials, marking the next phase in its development and potential adoption.

What sets this technology apart is its adaptability. Dr. Sun is already working to expand the model's application to other key crops, including soybeans, flax, sugar beets, and strawberries, with more to follow. This versatility could prove essential in addressing broader food security challenges through advanced diagnostic technologies.

Other key collaborators for this project include NDSU Plant Pathology Professor Dr. Zhaohui and Agricultural Biosystem Engineering Postdoc Dr. Sunil GC.

Supported by the NSF AgTech Engine, this research highlights the powerful role of technology in transforming agriculture. By equipping farmers with smarter, faster, and more accurate tools for crop health management, the diagnostic system stands to make a significant impact on productivity and sustainability across the ag sector.



Whitewater Project Showcased at ND Water Resource Foundation's 2025 Water Tour

The innovative Whitewater moisture mapping project, developed through a partnership between the NSF AgTech Engine and Aperture, took center stage at the North Dakota Water Resource Foundation's Annual Irrigation Water Tour this June. The event drew stakeholders from across the region, highlighting the intersection of cutting-edge technology and sustainable agriculture.

During the luncheon keynote, Dr. Hollie Mackey, CEO of the NSF AgTech Engine, emphasized the organization's focus on "use-inspired research" to address the complex challenges of food production in the 21st century. "We're investing in technologies that are not only scientifically advanced but also rooted in real-world applications," Dr. Mackey stated. She shared how the AgTech Engine is actively collaborating with rural and Tribal communities to ensure the next generation of farmers and ranchers is equipped with the tools and knowledge to thrive in a rapidly evolving agri-tech landscape.

Joining Dr. Mackey was Dr. Zachary Kabelac, founder of Apeture and developer of Whitewater. He presented on the use of artificial intelligence that fuses satellite imagery and weather data to build daily soil moisture maps that can guide precision irrigation without putting a sensor in the ground. "This technology enables farmers to make hyper-local decisions about water use," Dr. Kabelac explained. "By mapping soil moisture variations within a single field, we help growers reduce water usage, lower operating costs, and increase yields, and lower operating costs with minimal effort."

In the afternoon, tour participants visited a field near Oakes, ND, owned and operated by Steve Hansen, a local grower and Whitewater project partner. Hansen is one of the first producers in the state to test the system in live field conditions.

"I've been farming here for over 20 years, and I've never seen anything like this," Hansen said. "With Whitewater, I can see exactly where the soil needs water—and where it doesn't. It's already helping me cut back on irrigation without affecting crop health. That's a win for my bottom line and for our water resources."

The visit to Hansen's field gave attendees a firsthand look at how agtech innovation is being applied on the ground, offering a compelling example of the future of sustainable agriculture in North Dakota and beyond.

As interest in the Whitewater project grows, the NSF AgTech Engine and its partners continue to build momentum toward their mission: combining advanced technology with local knowledge to create resilient and efficient farming systems.

Whitewater Project Advances Toward Scalable Moisture Mapping Technology

The Whitewater project continues to make strong progress, remaining on track with its projected timeline. This innovative initiative is focused on refining a cutting-edge moisture mapping model, is currently undergoing detailed data analysis that integrates satellite imagery, environmental data models, and critical feedback from growers.

By the conclusion of the 2025 harvest, the project will have collected a full growing season of data collection across its test sites—marking a major milestone in validating the model's performance and utility for growers.

In August, the Whitewater partners began strategic discussions around market fit and commercialization, aiming to transition the technology into widespread agricultural use. Central to this effort is the NSF AgTech Engine in North Dakota, which plays a pivotal role in scaling and bringing the product to market alongside project collaborators.

The moisture mapping model is built on a robust dataset dating back to 2018, forming the foundation for detailed soil hydrology models. Leveraging satellite technology, the system can be deployed and accessed from virtually anywhere, providing real-time insights into field-level moisture variability.

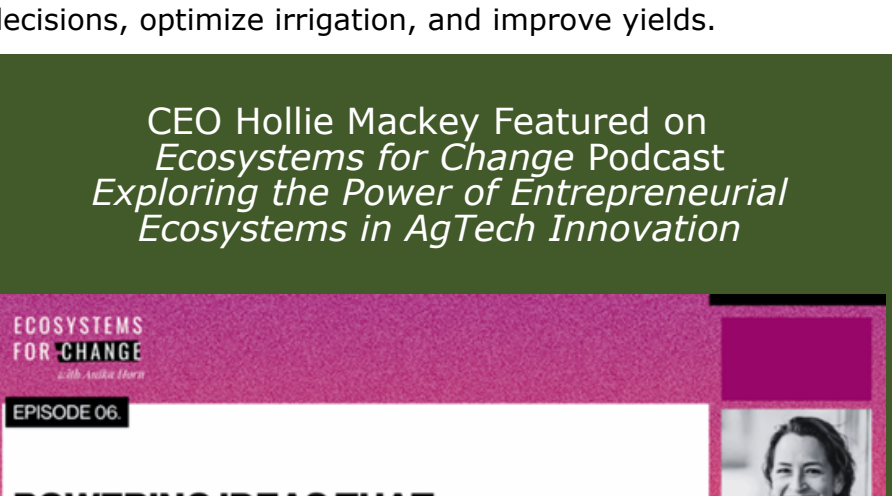
As the project enters its second year, a key focus will be evaluating the return on investment (ROI) for growers adopting the technology.

"Moisture sensors only provide a snapshot of moisture content across a field," explains Kyle Courtney, an Oakes-area farmer and project partner. "I don't look at my rain gauge anymore, because it just tells me how much rain fell at my house, not across my fields. The Whitewater moisture map provides a much more accurate soil moisture profile across my land based on several variables. It's essentially a better-informed version of a rain gauge."

As development continues, the Whitewater Project represents a promising step forward in precision agriculture—giving farmers a powerful tool to make data-driven decisions, optimize irrigation, and improve yields.

CEO Hollie Mackey Featured on *Ecosystems for Change* Podcast

Exploring the Power of Entrepreneurial Ecosystems in AgTech Innovation

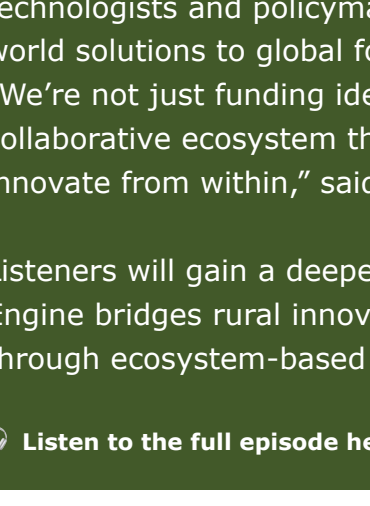

ECOSYSTEMS FOR CHANGE
with Anika Horn
EPISODE 06.
POWERING IDEAS THAT FEED THE WORLD
Dr. Hollie Mackey
CEO, FARMS, North Dakota Advanced Agriculture Technology Engine
THE BUILDER PLATFORM

This summer, Dr. Hollie Mackey, CEO of the NSF AgTech Engine in North Dakota, was featured as a guest on the *Ecosystems for Change* podcast, hosted by Anika Horn. The podcast, known for highlighting leaders in entrepreneurial ecosystem building, explores how communities can foster innovation and long-term impact through collaboration.

In the episode titled "*Powering Ideas that Feed the World*," Dr. Mackey shares insights into the AgTech Engine's mission and the unique role its ecosystem plays in accelerating agricultural innovation. She discusses how the Engine convenes varied partners—from farmers and researchers to technologists and policymakers—to create scalable, real-world solutions to global food security challenges.
"We're not just funding ideas; we're cultivating a collaborative ecosystem that empowers communities to innovate from within," said Mackey during the interview.

Listeners will gain a deeper understanding of how the AgTech Engine bridges rural innovation, equity, and economic growth through ecosystem-based strategies.

🎧 **Listen to the full episode here:** Powering Ideas that Feed the World



2nd Annual North Dakota Controlled Environment Agriculture Conference Brings Innovation to Bismarck

The promise of Controlled Environment Agriculture (CEA) as a solution to food security challenges across North Dakota and the nation took center stage at the 2nd Annual North Dakota Controlled Environment Agriculture Conference, held in Bismarck this August.

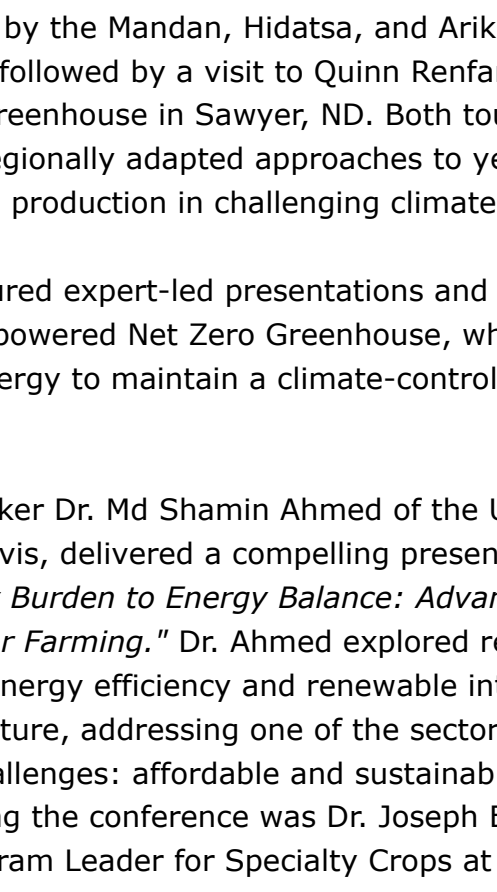
Hosted by the NSF AgTech Engine and its partners North Dakota State University (NDSU) and United Tribes Technical College (UTTC), the two-day conference gathered experts, growers, and innovators to explore the future of sustainable, energy-efficient agriculture.

The conference opened with immersive site visits showcasing innovative applications of CEA technology. Attendees toured the NG2 Greenhouse, a natural gas-powered facility owned and operated by the Mandan, Hidatsa, and Arikara Nation in Parshall, ND, followed by a visit to Quinn Renfandt's geothermal greenhouse in Sawyer, ND. Both tours highlighted regionally adapted approaches to year-round fresh produce production in challenging climates.

Day two featured expert-led presentations and a tour of UTTC's solar-powered Net Zero Greenhouse, which integrates renewable energy to maintain a climate-controlled growing environment.

Keynote speaker Dr. Md Shamin Ahmed of the University of California, Davis, delivered a compelling presentation titled *"From Energy Burden to Energy Balance: Advancing Carbon Neutral Indoor Farming."* Dr. Ahmed explored recent advances in energy efficiency and renewable integration in indoor agriculture, addressing one of the sector's most persistent challenges: affordable and sustainable energy use. Also headlining the conference was Dr. Joseph E. Munyaneza, National Program Leader for Specialty Crops at the USDA Agricultural Research Service (USDA-ARS). Dr. Munyaneza provided an overview of USDA-ARS's national research initiatives supporting CEA, emphasizing the importance of innovation and cross-sector collaboration in accelerating agricultural resilience.

The conference highlighted the critical role of partnerships—between tribal nations, academic institutions, government agencies, and private innovators—in advancing the field of Controlled Environment Agriculture. As the demand for sustainable food production grows, events like this serve as a catalyst for collaboration, knowledge-sharing, and real-world implementation.



Wozu Thima Project Showcased at Statewide Controlled Environment Agriculture Conference

The intersection of innovation, culture, and food sovereignty was on full display splay at the 2nd Annual North Dakota Controlled Environment Agriculture (CEA) Conference, where Cetan Wanbli Williams, Innovation Manager with the NSF AgTech Engine, presented on the impactful work of the Wozu Thima Project.

Held in Bismarck in August, the conference served as a platform for diverse voices in agricultural technology, including Indigenous-led initiatives that are reshaping regional food systems. Williams' presentation highlighted the Wozu Thima greenhouse project, a collaborative effort between the NSF AgTech Engine and Wozu, a regenerative agriculture initiative rooted in the Standing Rock Sioux Tribe.

"Wozu" is the Lakota word meaning "to plant," and the project embodies a holistic approach to land, cultural, and social regeneration. The initiative uses walipini greenhouses, a sustainable growing method designed to extend the growing season in cold climates. With foundations built four to six feet underground, walipinis retain heat more effectively than traditional greenhouses. The word "walipini" comes from the Aymara language, meaning "place of heat" — a fitting name for a design that originated in the highlands of Bolivia and is now gaining traction in northern climates, including North Dakota.

Bison Guard: Pioneering Robotic Shepherding and AI for Sustainable Bison Management

In a blend of Tribal stewardship, robotics, and artificial intelligence, the Bison Guard project is developing a potentially new standard for animal management and regenerative agriculture. Led by Dr. Armstrong Aboah, Assistant Professor of Civil, Construction & Environmental Engineering at North Dakota State University (NDSU), and supported by the NSF AgTech Engine, the project brings together advanced technology and Native American values to revolutionize bison herd management on the Standing Rock Sioux Reservation.

Developed in partnership with Wozu, an organization dedicated to regenerative land, cultural, and social practices, Bison Guard is more than a technology project—it hopes to be a model for community-centered innovation with wide-reaching ecological, cultural, and economic impacts.

Bison Guard, while in its early stages, is integrating technologies with intention to support natural herd movement, animal welfare, and sustainable land practices. Bison Guard is being designed to overcome long-standing challenges in bison management. These challenges include lack of continuous monitoring, delayed response to escapes, limited herd health data and behavioral insight, and difficulty in predicting herd movement. By addressing these, the system enhances efficiency, resilience, and sustainability.

Bison Guard hopes to reduce bison loss through real-time alerts and rapid response, minimized animal stress via noninvasive monitoring methods, improved animal welfare through proactive health detection, optimized labor and energy use, promotion of regenerative agriculture, and support for Tribal-led conservation and innovation.

Canada Thistle Detection Project Targets Invasive Weed Before It Reaches Farmland

A research initiative led by Dr. Arjun Upadhyay, Postdoctoral Research Fellow at North Dakota State University, is taking aim at the early detection of Canada Thistle—a persistent and invasive weed that threatens both cropland and grazing areas across the Northern Plains.

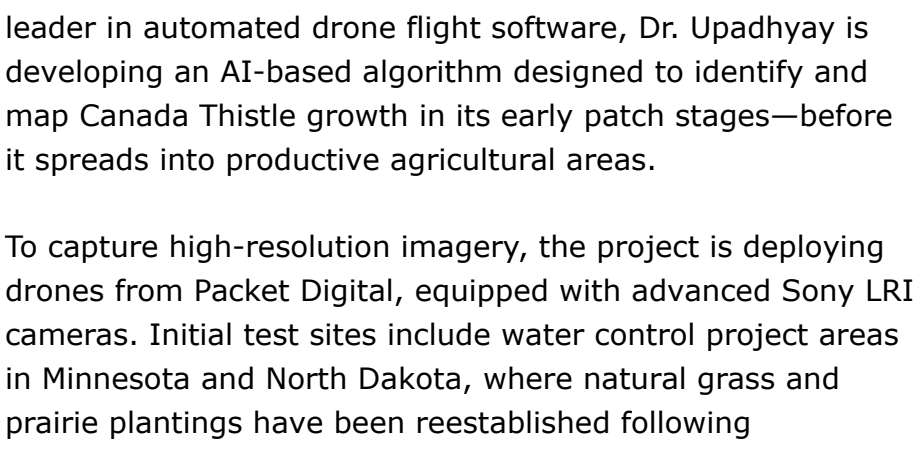
In collaboration with the NSF AgTech Engine and Botlink, a leader in automated drone flight software, Dr. Upadhyay is developing an AI-based algorithm designed to identify and map Canada Thistle growth in its early patch stages—before it spreads into productive agricultural areas.

To capture high-resolution imagery, the project is deploying drones from Packet Digital, equipped with advanced Sony LRI cameras. Initial test sites include water control project areas in Minnesota and North Dakota, where natural grass and prairie plantings have been reestablished following engineering work. Additional testing will also be conducted on Conservation Reserve Program (CRP) lands, offering a diverse landscape for validating the algorithm across different environments.

"This work is about proactive land management," says Dr. Upadhyay. "By detecting thistle in non-crop environments before it migrates, we can reduce the ecological and economic costs of invasive species on working lands."

The project will gather a full season of growth data by the end of Fall 2025, with onsite field trials scheduled to begin in September 2025. These trials will evaluate the performance of the detection system in real-world settings and guide further refinements.

By combining aerial imaging, machine learning, and advanced drone automation, this project represents an important step forward in using technology to support conservation and protect farmland from costly infestations.



NDSU Extension and NSF AgTech Engine Empowers Ag Educators with Precision Agriculture Training

In a forward-thinking initiative aimed at equipping the next generation of agricultural leaders, the North Dakota State University (NDSU) Extension Service hosted a professional development course for secondary school agriculture teachers across the state. The course, titled "Integrating Precision Ag Into Your Classroom," took place in August and focused on bringing cutting-edge agricultural technologies into high school curricula.

Educators participated in hands-on sessions and received comprehensive lesson plans on core precision agriculture topics, including:

- Global Positioning Systems (GPS)
- Geographic Information Systems (GIS)
- Economics of Precision Agriculture
- Artificial Intelligence in Agriculture
- Variable Rate Nitrogen Application

The training aimed to support teachers in preparing students for the rapidly evolving agtech landscape. Participants explored how modern technology is reshaping decision-making on the farm and learned practical strategies to integrate these tools into existing classroom instruction.

A key highlight of the event was the support from the NSF AgTech Engine, which provided GPS equipment to all attendees for use in their classrooms. This contribution ensures that students will not only learn about precision ag concepts but also gain valuable experience working with real-world tools.

"Empowering educators with resources and relevant content is critical for the future of agriculture," said Carmel Miller, Extension AgTech Engine Workforce Coordinator, NDSU Extension. "By introducing students to these technologies early, we're helping build a stronger, more tech-savvy agricultural workforce."

This initiative reflects NDSU Extension's continued commitment to fostering innovation and collaboration in agricultural education across North Dakota.

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