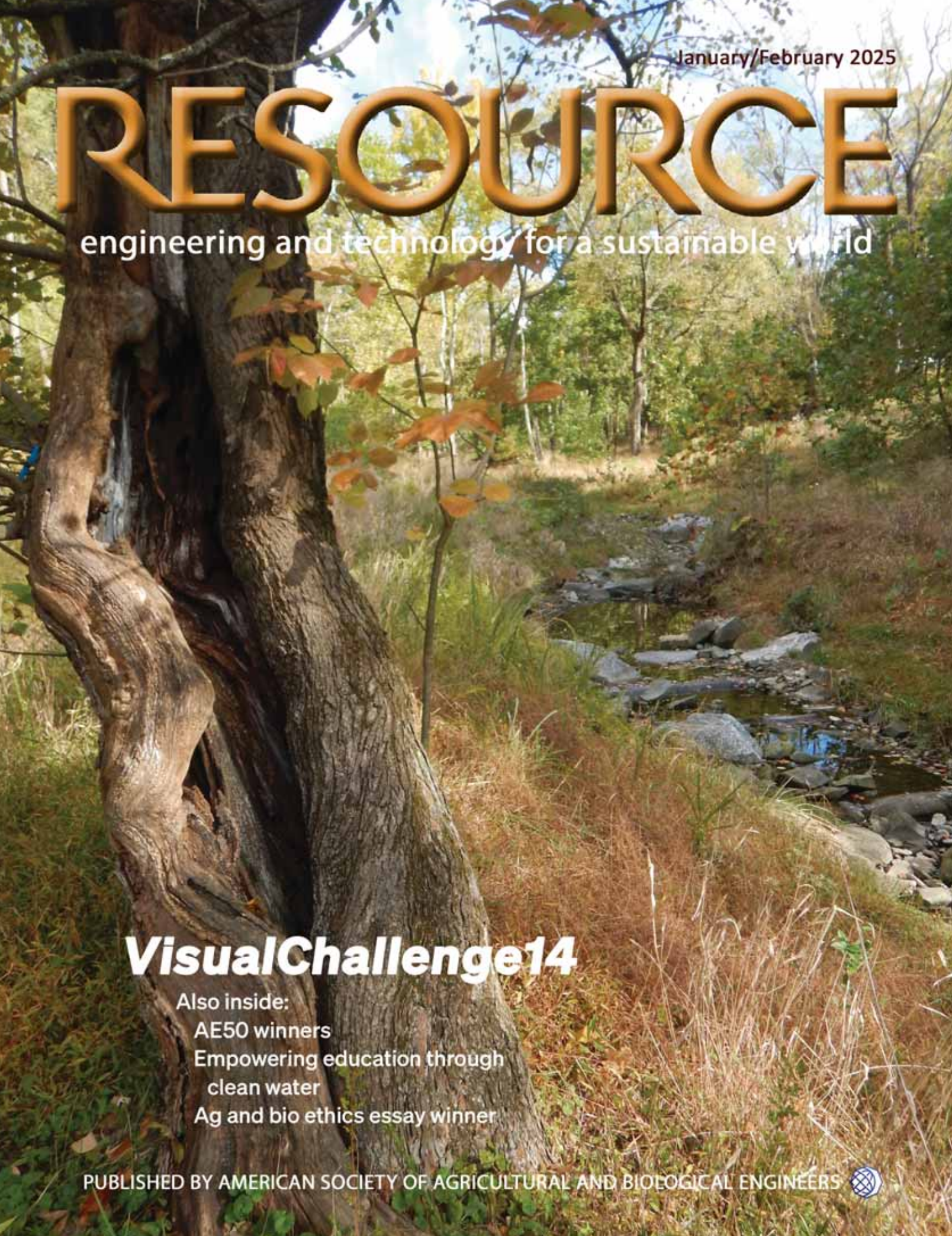
January/February 2025

RESOURCE

engineering and technology for a sustainable world



VisualChallenge14

Also inside:

- AE50 winners
- Empowering education through clean water
- Ag and bio ethics essay winner

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Leading the Future

The fall season was in full force with section meetings, trade shows, and board meetings. I had the pleasure to attend meetings of both the Quad Cities Section and the North Carolina Section to connect with local members and kick off our Leading the Future campaign. Both sections hosted informative and relevant programs, highlighting our challenge to increase productivity while decreasing inputs.

I also had the privilege to host the fall meetings of the Foundation Board and the ASABE Board of Trustees in New Holland, Pennsylvania. We dedicated a full day to a foresight workshop in which we challenged our current orthodoxy and defined our vision of success for the next five to ten years. As you can imagine, this was a very dynamic discussion. The results will help guide our actions and maximize our impact.

In this issue of *Resource,* we recognize the technical innovations in our industry. The AE50 Awards celebrate the most impactful new products of the past year. In many cases, these products have been in development for years and were only released to the market in 2024. The AE50 Awards provide well-earned recognition to the engineers who work hard to drive innovative solutions in agriculture. Congratulations to all the winners!

The annual Visual Challenge in this issue is another opportunity to celebrate what we do. How do you describe your work to others? What better way to showcase the diversity and impact of our work than through beautiful images! This is the 14th year for the Visual Challenge, and the entries continue to add artistic depth to our technical expertise.

We also celebrate innovations in how we work together, and this issue includes the winning entry in the annual Student Ethics Essay competition. This competition encourages students, and all of us, to consider ethics as a fundamental part of our professional development.

To those featured in this issue, and to all ASABE members, I congratulate you on your achievements in the past year. We have many new opportunities in front of us in this new year, and we are ready for the challenge!

I'm grateful for the opportunity to serve as ASABE President and advocate for our profession. Together we are Leading the Future of agriculture and biological engineering!

Doug Otto
doug.otto@newholland.com

upcoming events

ASABE CONFERENCES AND INTERNATIONAL MEETINGS

To receive more information about ASABE conferences and meetings, call ASABE at 800-371-2723 or email mtgs@asabe.org.

2025

Feb. 9-12	**Agricultural Equipment Technology Conference (AETC).** Louisville, Ky., USA.
June 2-5	**3rd U.S. Precision Livestock Farming Conference** (endorsed event). Lincoln, Neb., USA.
July 13-16	**ASABE Annual International Meeting.** Toronto, Ont., Canada.

2026

Jan. 11-17	**ASABE Global Symposium on Sustainable Microirrigation Advances: Drop to Boom.** Aguadilla, Puerto Rico, USA.
Feb. 8-11	**Agricultural Equipment Technology Conference (AETC).** Louisville, Ky., USA.
July 12-15	**ASABE Annual International Meeting.** Indianapolis, Ind., USA.

2027

July 18-21	**ASABE Annual International Meeting.** New Orleans, La., USA.

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Think Green! The poly-bag protecting this magazine can be recycled. Just toss it in with your other recycling.

ON THE COVER:

Stream Tree by **ASABE member Jena Smolko**. This tree with many stories sits adjacent to a completed stream restoration project and appears to almost resemble a meandering stream channel itself. See page 22 for all of our ***VISUALCHALLENGE*14** entries.

ASABE
Engineering a Sustainable Future
American Society of Agricultural and Biological Engineers
2950 Niles Road
St. Joseph, MI 49085-9659, USA
269.429.0300, fax 269.429.3852
hq@asabe.org, www.asabe.org

RESOURCE

engineering and technology for a sustainable world

January/February 2025

ASABE AE50 outstanding innovations AWARD

FEATURES

DEPARTMENTS

Cheers to the winners!

The AE50 Award program, celebrating companies for their recent developments in agricultural, food, and biological systems is proudly sponsored by *Resource* magazine. From the many entries submitted in 2024, an expert panel selected the products, showcased on the following pages, for recognition. The award-winning products are those ranked highest in innovation, significant engineering advancement, and impact on the market served.

The products represent the diversity of agricultural and biological engineering, as well as the variety of companies that continue to bring advanced technology and exciting innovations to the marketplace. This year's AE50 recipients join the ranks of many who have been honored for their ingenuity in product development—saving producers time, costs, and labor, while improving user safety as well.

The AE50 Awards had their beginning in June 1984, in a special issue of *ASABE's Agricultural Engineering* (now *Resource*), in which 25 new techniques, inventions, and innovations were showcased. The featured items were drawn from product information solicited by the Society and screened by a panel of engineers. From this focus on identifying innovative technology, two years later the AE50 Award program was born. As the announcement stated, "Acceptance in the marketplace is the highest accolade any new agricultural product can receive. But for innovative developments in the last 12 months, a singular honor is to be named one of the year's Agricultural Engineering 50 outstanding innovations." Product nominations poured in. An enlisted panel of experts reviewed the entries, and in 1986 the first AE50 Awards were presented.

Interest in new technology and innovative applications of existing technology remains constant. Over the years, many award-winning products were patented and their names trademarked. Some were further improved as technology advanced, and with time, won another AE50. But the most important yearly constant: all winning entrants continually strive for excellence, and we are pleased to honor their work with the highest honor in the only awards program of its kind. Cheers to the winners!

5ML Tractor Cab

Deere & Company
Moline, Illinois, USA
www.deere.com

The 5ML tractor is specifically designed for orchards and vineyards. This low-profile cab arrives from the factory and is equipped with innovative features that boost operator efficiency. It offers a spacious interior with a flat floor, ample headroom, exceptional visibility, programmable LED lighting, a customizable digital display, and conveniently located controls, all of which help reduce fatigue and enhance productivity. Other features include limb lifters to protect crops and a Category IV filtration system that keeps dust and chemical particulates out of the cab. The 5ML also includes JDLink™ and optional AutoTrac™, seamlessly integrating into Operations Center™ for 24/7 access to information.

9RX 710, 770, and 830 Tractors

Deere & Company
Moline, Illinois, USA
www.deere.com

The John Deere 9RX 710, 770, and 830 four-wheel-drive tractors are designed to enhance productivity, serviceability, and efficiency. The new e21™ transmission has improved responsiveness and extended operating range with even gear shifts for smooth shifting and ease of operation. The JD18™ engine delivers industry-leading horsepower with a 10% power bulge and meets emission standards without DEF. The updated cab features increased floor space, improved visibility, and a brand-new cab suspension that offers the ultimate operator experience. 9RX tractors incorporate all the latest precision ag technologies that customers have come to expect from John Deere. The launch of these tractors reaffirms John Deere's commitment to delivering cutting-edge solutions that provide producers with the tools they need to achieve their goals.

300M Series Self-Propelled Sprayers

Deere & Company
Ankeny, Iowa, USA
www.deere.com

The all-new 300M Series expands John Deere's line of self-propelled sprayers with two smart, compact, and highly maneuverable models: the 332M (with a 3200 L tank, 175 hp four-cylinder PowerTech™ engine, and boom widths up to 28 m) and the 340M (with a 4000 L tank, 225 hp six-cylinder PowerTech™ engine, and boom widths up to 36 m). Both models feature a front cab with Category IV air filtration for operator comfort. All-wheel steering, automatically adjustable tread, and a 50:50 weight distribution make work possible even in difficult conditions. Both models are equipped with the latest John Deere Precision Ag essentials, including a StarFire™ receiver, G5Plus universal display, JDLink™, PowrSpray™, and individual nozzle control for optimal spray accuracy.

4840E Elevator

Flory Industries
Salida, California, USA
www.goflory.com

The 4840E elevator is the first-ever battery-electric elevator for the nut harvesting industry. The 4840E elevator transports nuts on a conveyor belt from the bankout wagon to the hopper trailers without the noise and fuel cost of a diesel engine. It includes an industry-first load-sensing feature that reduces the conveyor speed when a reduced crop load is detected. This saves energy and prevents the crop from bouncing out of the conveyor. Current diesel-powered elevators spend over 90% of the day idling. The 4840E electric elevator aims to improve the cost of ownership and the overall component life by delivering power on demand utilizing the Cat® 600-volt battery.

Accuforce™

Innotag Distributions, Inc.
Beloeil, Quebec, Canada
innotag.com

Accuforce™ is an innovative active force and swath control system for row-crop cultivators. This system provides force control for maintaining ideal depth at high speeds and allows quick lifting of individual row units at the end of a row. The system can be installed at the factory on Innotag row crop cultivators or as an aftermarket upgrade on many existing models of row crop cultivators. Compatible with ISOBUS displays, the user interface supports the task controller for automatic swath control and provides row-by-row control, with each row unit having its own force measurement and adjustment. The system is designed to support cultivators with up to 24 rows and 25 row units.

Active Slope Adjustment™

John Deere GmbH & Co. KG
Zweibrücken, Germany
www.deere.com

Active Slope Adjustment (ASA™) for John Deere combines provides active material re-distribution on the cleaning shoe. During sidehill operation, a variable-speed conveyor located in the front chaffer below the return pan distributes material from the downhill side to the uphill side before the material enters the cleaning shoe. This lateral conveyor is attached to the shaking frame and spans the entire inner machine width using two rubber belts, which are connected by aluminum slats to convey the material. The belt assembly is hydraulically driven, and the belt direction and speed are determined by the tilt angle and crop type. Due to its active pre-cleaning attributes, performance can also increase on level land and in high grain and MOG conditions. The system is easily retrofittable to existing John Deere combines.

AF Series Combines

Case IH
Racine, Wisconsin, USA
www.caseih.com

Case IH has designed the revolutionary AF Series combines to create industry-leading in-field capacity. With both dual-rotor and single-rotor configurations, the AF9, AF10, and AF11 combines add more options across row crop and small grain applications in the Class 9 and 10+ categories, providing maximized crop flow, higher ground speeds, higher capacity, faster unload rates, and subscription-free, next-level connectivity. New radar spread automation technology automatically adjusts the residue spreader speed for uniform distribution over 50 feet, even in windy conditions. Featuring the industry's largest grain tank and fuel-efficient 13 L and 16 L engines, producers can cover more acres in less time with the power and efficiency to handle any crop condition.

Application Lift System

AGCO
Duluth, Georgia, USA
Parts.AGCOcorp.com

AGCO's Application Lift System allows sprayer operators to change application systems as needed (such as between dry and liquid materials) at their own locations, improving the versatility of their sprayers and ensuring more effective use of applied products. Prior to the Application Lift System, additional equipment, such as cranes or loaders, was required to change application systems, increasing the cost and difficulty of the task. The Fendt Rogator features adjustable elevation that the Application Lift System can use to perform most of the exchange, and the push of a button lifts the application system off of the machine. Optional chain hoists are available to help with making final adjustments as well as for changing application systems on sprayers that do not have adjustable elevation.

Auto Select Pulsing with Multi Rate

Deere & Company
Ankeny, Iowa, USA
www.deere.com

The ExactApply™ nozzle control system has been available for years, providing consistent spray across sprayer speeds, during turns, and in variable-rate applications. Auto Select Pulsing increases the flow rate range of ExactApply™, while Multi Rate enables multiple flow rates across the sprayer boom. Previously, Auto Select changed the flow rate by selecting from two nozzles (A or B) to create three effective flow rates (A, B, and A+B), while Auto Pulsing changed the flow rate with pulsed duty cycles of 15% to 100%. Auto Select Pulsing allows Auto Select and Auto Pulsing to be used together, leading to a larger operating range for variable-rate applications. Multi Rate further enhances performance by allowing up to eleven different flow rates to be applied simultaneously across the sprayer boom width.

Automatic Productivity Management 2.0 on Magnum™ Tractors

Case IH
Racine, Wisconsin, USA
www.caseih.com

New for Case IH Magnum™ tractors, all 21x5 PowerDrive transmissions will have Automatic Productivity Management 2.0 (APM2.0). As skilled farm labor becomes rarer, it becomes increasingly important that tractors operate at peak productivity without operator intervention. Driveline automation is a required step toward this autonomy. APM2.0 manages the driveline and engine to control ground speed while optimizing fuel economy and preventing engine stalls. APM2.0 provides intuitive operation by using the up and down gearshift controls to modify the ground speed target while making quick speed changes, keeping the controls the same as when operating without the system. Advanced features of APM2.0 include the ability to set two speed targets, as well as setting engine and transmission.

Axial-Flow® 260 Series Combines

Case IH
Racine, Wisconsin, USA
www.caseih.com

Case IH Axial-Flow® 260 Series combines incorporate the latest technology, starting with an all-new software experience featuring two high-resolution, high-visibility Pro 1200 displays. Using Remote Display Access, trusted partners can view the display information remotely. RowGuide Pro eliminates manual corrections by combining GPS and advanced software for seamless row tracking, even when crossing waterways and row gaps in the field. An enhanced steering system ensures smooth and efficient movement through the field and reduced effort in headlands. The 260 Series combines also feature Harvest Command™ combine automation, ActiveTrac four-roller hydraulic suspended track system, a new red leather seat with air conditioning and massage, and FieldOps, the industry-leading operations management solution that allows access to the data anytime, anywhere.

Bridgestone VX-TRACTOR Tire

Firestone Ag
Nashville, Tennessee, USA
www.firestoneag.com

The VX-TRACTOR radial tractor tire from Firestone Ag was engineered for traveling significant distances and for frequent hauling between field and storage. The VX-TRACTOR tire delivers 45% more wear resistance due to up to 20% more lug volume, with a new triple-defense compound that protects against stubble and extends durability. The overlapping lugs increase ground contact and reduce vibration at the 40-mph speed rating, which is crucial for on-road transport. The patented involute lug design reduces slip and energy loss for reliable traction and effective cleanout in various soil conditions. The robust casing is designed to carry heavy loads, while the flexible sidewall provides smooth travel for operator comfort in varied terrain and road conditions.

C-Series Air Carts

Deere & Company
Moline, Illinois, USA
www.deere.com

The John Deere C-Series Air Cart integrates the latest in seeding technology to provide producers with the most productive, accurate, and smart air seeding carts in the industry. Major modifications include a complete frame-up redesign, incorporating tank scales and ActiveCal™ across the lineup. The standout feature of the C-Series air carts is the all-new metering system with AccuRate™ meters, which significantly improves seeding accuracy. Localized economic agronomic decision (LEAD) trials showed up to 4.5% increase in accuracy across the field. Additionally, the EZCal™ system offers push-button calibration before seeding, making it up to 75% faster than the manual bag method. The C-Series air carts also feature blower automation, allowing operators to set a target blower speed from the cab, ensuring consistent airflow as conditions change.

C500 Series Corn Head

Case IH
Racine, Wisconsin, USA
www.caseih.com

The C500 Series corn head from Case IH provides significantly increased capacity and grain savings. Highlights of this new corn head include spring-free, self-adjusting deck plates across each row unit to absorb stalk-to-stalk variability, with no operator involvement or additional maintenance requirements, as well as the industry's largest cross auger at 23.6 inches, up from the previous 15.75 inches, an increase of nearly 50%. Additional advances include longer maintenance intervals, improved total cost of ownership, and enhanced operator convenience and uptime. Overall, the C500 Series corn head has been designed to allow producers to harvest corn cleaner and faster.

CLAAS Earlage Adapter

CLAAS of America, Inc.
Omaha, Nebraska, USA
www.claas.com

The CLAAS® earlage adapter couples a combine corn head to a CLAAS JAGUAR® forage harvester. This innovative product allows side-to-side contouring of the corn head for precise ground following with large heads. The drum on the earlage adapter is extra wide, so it can move the crop more effectively from the corn head into the narrower feed rolls of the forage harvester. The drum is also larger in diameter and closer to the feed rolls, which reduces ear throw and increases capacity, and it floats up and down to move the crop more effectively. The earlage adapter converts the combine autopilot data so the forage harvester can read the signal, and the deck plate can be adjusted with the multi-function control inside the forage harvester.

CLIPS™

Indigo Ag, Inc.
Boston, Massachusetts, USA
www.indigoag.com

The CLIPS™ device is an innovative seed treatment application system that consists of a sealed pod containing a dry flowable product. The pod clips to the interior of a bulk seed box and remains sealed until the seeds are released from the bottom of the seed box at the time of planting. CLIPS simplifies the process of treating corn and soybean seeds with flowable biological products by integrating the treatment process into the bulk storage and delivery of the seeds. It allows biological products to be applied on seed up to two years in advance, with no extra steps for the retailer or the producer. CLIPS provides fast, reliable application of dry powder formulations, while sidestepping restrictive concerns about on-seed stability and planting windows.

CropSpeed Monitoring System

New Holland Agriculture
New Holland, Pennsylvania, USA
www.newholland.com

An industry first, the CropSpeed Monitoring System for FR Forage Cruiser self-propelled forage harvesters uses a spout-mounted radar sensor to monitor crop flow leaving the machine. Detecting any change in its rate in relation to the harvester's forward speed, the system has the potential to reduce blockage likelihood by 40% and makes dense plugs less likely to occur. By mitigating blocking, CropSpeed lets the harvester run at maximum capacity, load, and speed, allows less skilled operators to work with more confidence, and increases driveline durability by avoiding abrupt stops. If a plug occurs, time spent unblocking is decreased by 90%.

EDI Driveshafts

Bondioli & Pavesi, Inc.
Ashland, Virginia, USA
bondioli-pavesi.com

EDI (Electronic Data Interchange) driveshafts are equipped with sensors and ECUs that monitor the working parameters of the driveshaft and transmit the data in real-time to improve the productivity of the entire tractor-driveshaft-implement system. PTO driveshafts can now be compatible with IoT and can communicate with the implement and the tractor. Sensors are available for torque, rotational speed, axial force, and vibration. The ECU can transmit and record this data, along with calculated power and joint angles, for use in predictive maintenance and diagnostics. Operating limits can be set and monitored for improved efficiency and reliability. Communication to the tractor's display can be done via CAN/ISOBUS. Mobile devices can connect via NFC or Bluetooth. The data can also be transmitted to a cloud service for remote access and storage.

FC Series FlexCorn™ Header

MacDon Industries Ltd.
Winnipeg, Manitoba, Canada
www.macdon.com

MacDon's FC Series FlexCorn™ header brings the one-pass residue management of MacDon's OctiRoll residue management system to a flexing corn header. The FC Series FlexCorn header uses two pivoting wings with more than 15° of movement to independently track steep terrain and uneven ground conditions, so producers can use a wider header without leaving corn in the field. Featuring MacDon's FluidMotion hydraulic flex, the FC Series FlexCorn header ensures that producers get the most from their harvest. Using ISOBUS control, producers can adjust the flex cylinder pressures from the cab to support over 98% of the header's weight. The FC Series FlexCorn header is available for John Deere, New Holland, Case IH, and Claas combines in 12-row and 16-row configurations with 30-inch spacing.

FD261 FlexDraper®

MacDon Industries Ltd.
Winnipeg, Manitoba, Canada
www.macdon.com

At 61 feet wide with 50-inch deep drapers, the FD261 FlexDraper® has the highest capacity that MacDon has ever produced. Compared to the 50-foot FD250, the FD261 offers an additional 22% of overall productivity. The FD261 FlexDraper provides 61 feet of true ground-following flex, and the close reel-to-cutter bar relationship ensures efficient heads-first crop flow over the entire width of the header. The 61-foot width is also an ideal solution for controlled-traffic farming. MacDon's innovative upper cross auger system keeps crops from getting held up on the ends for uninterrupted crop flow across the header width.

Fendt ErgoSteer

AGCO
Duluth, Georgia, USA
access.agcocorp.com

Fendt ErgoSteer is a retrofittable joystick that allows precise ergonomic control of Fendt tractors during in-field operations. ErgoSteer allows the operator to sit in a comfortable, stationary position while maintaining complete control over the tractor without wasted movements. All FendtONE tractors with Profi+ from the 500 Series to the 1000 Series with the latest software can use ErgoSteer. The ErgoSteer software includes options to set the steering sensitivity based on the operating environment, as well as a return-to-center function to keep the tractor driving straight ahead when no input is received on the joystick.

Fendt Momentum 30FT Planter

AGCO
Duluth, Georgia, USA
www.fendt.com

The Momentum 30FT planter provides high-speed operation and accurate seed placement for smaller farms with challenging planting conditions. With a 100-bushel seed bin and 800-gallon liquid fertilizer tank, the Momentum 30FT provides unmatched capacity for a 30-foot planter. Factory-installed options include dual-band fertilizer openers and row-by-row and turn-compensated fertilizer application. Pinch rows are eliminated by the in-line tandem transport wheels with high-flexion tires. The optional Load Logic system reduces soil compaction by hydraulically transferring weight across the planter every second and regulating the tire pressure. The SmartFrame's vertically contouring toolbar provides up to 52 inches of row unit travel to maintain ground contact and ensure uniform planting depth.

FieldNET Advisor - Whole Farm Water Management

Lindsay Corporation
Omaha, Nebraska, USA
nextgen.myfieldnet.com

Lindsay's FieldNET AdvisorTM for digital irrigation scheduling has been updated to use remote sensing data to calculate crop evapotranspiration, which now allows growers to enroll their entire operation in 30 seconds or less. As a result, growers can easily adopt a digital water management solution for their entire operation that provides weather forecasts, satellite imagery, soil moisture predictions, and irrigation recommendations that they can execute using a smart phone. Grower feedback on this update has been very positive due to its ease of use and because the update uses satellite imagery directly providing a more accurate calculation of evapotranspiration.

FM9380 Electromagnetic Flowmeter

TeeJet Technologies LLC
Springfield, Illinois, USA
www.teejet.com

The TeeJet FM9380 electromagnetic flowmeter offers flexibility, accuracy, and reliability for field sprayers and fertilizer application equipment. Electromagnetic flow measurement provides high precision and requires no moving parts, which means no wear or maintenance. The advanced design of this flowmeter results in an industry-leading flow range of 0.6 to 150 gallons per minute. The practical result of this wide flow range is the ability to accurately measure flow from a single nozzle or a full boom. The FM9380 offers convenient flanged liquid connections and LED indicators to confirm power and flow status. Constructed from polypropylene and stainless steel, the FM9380 is compatible with most crop protection products.

IHT Cooling Mats

IHT Group
Winnipeg, Manitoba, Canada
www.ihtgroup.ca

IHT Cooling Mats are designed to optimize the comfort and welfare of sows and boars while increasing feed intake and production. The standout feature of these mats is their ability to provide consistent and targeted cooling through a water circulation system, ensuring a healthy thermal range for animals. Unlike traditional cooling methods, IHT Cooling Mats use a patented, energy-efficient system that circulates water uniformly across the mat's surface, reducing heat stress and improving overall animal performance. This advanced water-based cooling technology represents a significant upgrade from existing products by offering superior temperature control, energy savings, and durability so producers can ensure that their animals remain comfortable and healthy, leading to increased efficiency and profitability.

Implement Control Mode (ICM) with eDrive Kit

Deere & Company
Moline, Illinois, USA
www.deere.com

John Deere is leveraging its award-winning Electric Variable Transmission (EVT) technology with the newly developed Implement Control Mode (ICM) to electrify the AirSep potato harvester from Spudnik Equipment Company. ICM powers a John Deere eDrive Kit installed on the harvester's cleaning fan, which enables independent control of the fan speed, a critical component for the separation of potatoes from unwanted material such as dirt and rocks. This independent control also reduces bruising of the crop, increasing harvest value for the producer. With this development, the fan speed is independent of the engine speed, which can then be adjusted for challenging soil conditions. Operators can maintain an optimal engine speed, ground speed, and airflow, ensuring that potatoes are harvested effectively while leaving debris in the field.

LEXION 8900TT Combine

CLAAS of America
Omaha, Nebraska, USA
www.claas.com

The Class 10 LEXION 8900TT combine offers enhanced performance and productivity over the current Class 10 LEXION combines for maximizing harvest potential in even the most challenging conditions. The 8900TT's enhanced performance results from a 13% horsepower increase from the 16.2 L MAN Tier V engine. The CLAAS-designed Dynamic Power management system enables the 8900TT's engine to automatically adjust its power output on demand to maintain optimized power and fuel consumption while ensuring maximum power when unloading on the go. The 8900TT is equipped with the same features as other LEXION combine models, including the APS Hybrid Synflow processor, which is comprised of tangential threshing and dual axial rotor separation. Each system's speed is independently adjustable, manually or autonomously, to adapt to changing conditions.

Milk Sustainability Center

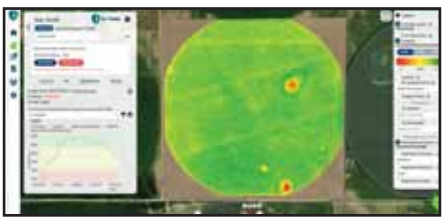
John Deere GmbH & Co. KG
Kaiserslautern, Germany
Dairy Data Warehouse BV
Assen, Netherlands and DeLaval, Tumba, Sweden
milksustainabilitycenter.com

The Milk Sustainability Center provides dairy farmers with nutrient use efficiency (for N, P, and K) and milk carbon footprint score (in CO_2e per kg ECM) for an entire farm or for individual fields or herds. Barn and field data are aggregated automatically to minimize manual data entry. The Milk Sustainability Center provides recommendations, benchmarking, scenarios, and economic analyses in real-time for sustainable and profitable decision-making.

Modular Tramline System for Early Riser® 2160 48 row 20-inch Large Front-Fold Planter

Case IH
Racine, Wisconsin, USA
www.caseih.com

The Modular Tramline System for the Case IH® Early Riser® 2160 48 row 20-inch Large Front-Fold planter offers industry-leading 20-inch planter tramline compatibility, productivity, and performance. The Modular Tramline System is tailored to the swath sizes of a grower's equipment fleet while minimizing the number of unused tramlines in a field. The Modular Tramline System consists of unique offset head bracket assemblies supporting one 80-foot swath and/or two 40-foot swaths with 24-inch row spacing on 120-inch centerline tramline rows. These modular tramlines reduce the risk of running over plants on subsequent passes through the field with narrow (less than 20-inch wide) track or tire-equipped tractors, liquid fertilizer applicators, and/or sprayers. The result is increased yield potential, increased productivity, and reduced operator fatigue.



N-Time® Advanced

Sentinel Fertigation
Ithaca, Nebraska, USA
www.sentinelfertigation.com

N-Time® Advanced software analyzes multispectral satellite imagery to provide nitrogen application recommendations throughout the growing season. The variable-rate N application maps show spatially appropriate N rates for zones derived from the imagery using calibrated N sufficiency values for each pixel in the field image. The application rates are adaptive to the crop growth stage and require little data to be delivered accurately. These variable-rate maps can be used for either sidedress or fertigation. Rates can also be summarized at field level for producers who do not use variable-rate application. On-farm trials with N-Time Advanced's scheduling capabilities demonstrated $25 per acre improvement in profitability and 30% improvement in N use efficiency compared to standard management. N-Time Advanced is available throughout the U.S. through web browsers and mobile devices.

New Holland IntelliSense™ Bale Automation and Case IH Large Square Baler Automation

CNH America LLC, New Holland and Case IH Brands
New Holland, Pennsylvania, USA
Racine, Wisconsin, USA
www.cnh.com

These automation systems use LiDAR (light detection and ranging) to digitize the field surface, representing the swath position and swath cross-section. This proactive sensor data is processed with reactive bale sensor data and then communicated to the tractor, automating both the ground speed and swath following without operator input. An industry first, New Holland IntelliSense™ Bale Automation and Case IH Large Square Baler Automation offer a simplified operator experience, decreasing fatigue, and increasing throughput while enhancing operator awareness and safety. More consistent crop feeding means that both experienced and inexperienced operators can achieve improved bale quality.

NL720 Fertilizer Spreader

New Leader Manufacturing
Cedar Rapids, Iowa, USA
www.newleader.com

The NL720 is a high-efficiency, high-precision, high-output fertilizer spreader. Accuracy is achieved by controlling the granular product from the bin to the spinner system. The spinner system is composed of multiple independent chutes that precisely distribute the material to the spinner disk. This allows better control of the pattern shape and width. The 120-foot spread produces a 33% increase in acres covered per hour, while throughput has increased by 25%. An intuitive control system allows the operator to focus on spreading, rather than setup. No manual adjustments are needed, and maintenance is low, with no grease points and tool-free removal of components.

OutRun™

PTx Trimble
Westminster, Colorado, USA
www.outrunag.com

OutRun™ enables a tractor to pull a grain cart without a driver, allowing producers to increase or maintain their productivity when labor is hard to find. As a self-contained kit, OutRun supports existing decades-old tractor models. OutRun also uses its own communication infrastructure to ensure reliable operation regardless of the available cellular coverage. Using an intuitive interface, a combine operator can position a grain cart near the field. OutRun navigates around the field, avoiding unharvested land and using existing paths to reduce soil compaction. When summoned to unload the combine, the grain cart approaches and matches its speed and distance to the combine, allowing on-the-go unloading. The combine operator can then send the grain cart to a predefined unloading zone.

PetriClear® Lighting System

Percival Scientific, Inc.
Perry, Iowa, USA
www.percival-scientific.com

PetriClear is a plant growth lighting system that is enhanced with infrared LEDs to eliminate condensation on plant tissue cultures, thereby reducing contamination risk, and increasing tissue growth. PetriClear manages the infrared LEDs to selectively apply heating to petri dishes stored in an insulated cabinet. By increasing the differential between the surface temperature and the interior dew point of a petri dish, the system reduces condensation. This permits accurate replicability of experiments compared to conventional fluorescent lighting systems. Percival's PetriClear lighting with infrared LEDs is one of the best ways to reduce condensation in single-stacked petri dishes in environmentally controlled chambers.

Quadtrac Heavy-Duty Suspension

Case IH
Racine, Wisconsin, USA
www.caseih.com

The Case IH Quadtrac Heavy-Duty Suspension (HDS) system is the first fully suspended track system offered on an articulated 4WD tractor. This hydraulically suspended track system offers improved operator comfort by reducing vertical acceleration at the seat base by an average of 42% during roading and by up to 81% at 7 kph (4.3 mph). The roller and idler wheels all have independent vertical movement of up to 8 inches. The roller wheels also feature independent axial movement of up to 5° for superior ground conformance. The 6% longer footprint compared to the standard Quadtrac further minimizes ground pressure and soil compaction without adding electronics or extra maintenance. The HDS system retains the automatic track tensioning and best-in-class seals of the standard Quadtrac.

R1 FR Front-Mounted Rotary Disc Header

MacDon Industries Ltd.
Winnipeg, Manitoba, Canada
www.macdon.com

MacDon's R1 FR is the industry's widest front-mounted rotary disc header for a tractor three-point hitch system. This design matches current production systems by maintaining 16-foot or 13-foot cut widths for common raking and merging practices. When paired with MacDon's R1 pull-type rotary header, the R1 FR can double the productivity of a single power unit by providing up to 32 feet of cutting width. MacDon's R1 FR is offered with the industry's widest steel inter-meshing rollers to handle crop drydown requirements. With a full-width baffle mounted to the conditioner and protective forming shields, the R1 FR can provide a narrow five-foot windrow that fits under the tractor's tires.

ReconBlockage™ for Strip Till

Precision Planting
Tremont, Illinois, USA
www.precisionplanting.com

A blocked run on the strip till bar can cost time and money during fertilizer application. Using acoustic sensors to detect flow variance by section, ReconBlockage™ instantly alerts operators of blocked runs, preventing skips and associated yield loss. Each acoustic sensor works like a stethoscope, avoiding issues with buildup that can plague optical sensors. The sound that the sensor detects travels down an auditory tube to an ECU, where the sound is interpreted. The processed signal is then sent to an iPad app, alerting the operator of issues with fertilizer flow. No longer are operators flying blind when applying fertilizer.

Row Crop Precision Cultivator

Salford Group, Inc.
Salford, Ontario, Canada
salfordgroup.com

Salford's Row Crop Precision (RCP) cultivator combines durability with precision guidance technology. The RCP's innovative sweep design allows cultivation speeds up to 12 mph, significantly reducing the time required to complete each pass. The RCP features camera-based row guidance to accurately detect crop rows, along with a 20-inch side shift system to avoid crop damage. The cultivator is compatible with section control to automatically lift row units based on a coverage map. This reduces potential crop damage on headlands and point rows. The row units easily adjust to changing crop conditions. Hydraulic down-pressure ensures that each row unit remains engaged, and separate down-pressure adjustments can be made for wheel track rows to combat soil compaction. All adjustments can be controlled through the in-cab display.

RTV-X1130 Utility Vehicle

Kubota Tractor Corporation
Grapevine, Texas, USA
KubotaUSA.com

Kubota's RTV-X1130 utility vehicle was designed with the new Pro-Konvert system to expand the capabilities of the cargo bed with multiple, tool-less configuration options. The six-foot long cargo bed features three drop-down sides and a back tailgate, essentially converting it into a flat bed, along with the ability to divide the bed into subcompartments for handling various types of cargo. The cargo bed is constructed of heavy-duty steel, with 26 cubic feet of storage and a load capacity of 1,212 pounds, and comes with a sprayed-on bed liner. With the inclusion of a hydraulic dump and enhanced bed lock feature, users can have greater control and safety over their cargo and achieve precise material placement.

See & Spray™ Premium

Deere & Company
Ankeny, Iowa, USA
www.deere.com

See & Spray™ Premium sees, targets, and kills in-season weeds using advanced cameras and machine learning that distinguishes crops from weeds and selectively sprays only the weeds. While it reduces non-residual herbicide use similar to other See & Spray™ technologies, See & Spray™ Premium also delivers a hit rate comparable to traditional broadcast spraying, all at operating speeds up to 12 mph. That means less herbicide, lower costs, and less impact on the crop and the land.

Trelleborg TM1 ECO POWER Tire

Yokohama TWS
Wakefield, Massachusetts, USA
www.trelleborg-tires.com

The TM1 ECO POWER tire provides high traction on hard soil and superior operator comfort. With 65% of its components sourced from bio-based and recycled materials, this product also addresses environmental concerns while delivering exceptional performance on various terrains. In addition, with its ultra-low rolling resistance, this tire maximizes battery usage and reduces fuel consumption. As agriculture evolves, the demand for greater efficiency is increasing. The TM1 ECO POWER tire combines superior performance with eco-sustainability for a more efficient and responsible future.

UltraFeed™ Pickup

New Holland Agriculture
New Holland, Pennsylvania, USA
www.newholland.com

The UltraFeed™ pickup is a new header designed to meet the ever-increasing capacities of FR Forage Cruiser self-propelled forage harvesters. With active crop guidance, the swath is first pre-compressed using a single large-diameter steel roller windguard. From there, crop is collected with the pickup reel that features quick-change tines while a guide plate directs crop into the auger. The large-diameter hydraulically lifting auger features paddles to move crop into the forage harvester's rolls. Both the pickup and auger are automatically adjusted to optimize the chopper's pace. The header's belt-powered driveline eliminates chains, chain tensioning, and lubrication while automatic greasing further enhances serviceability. These features reduce the cost of ownership and help operators maximize the capacity of their machine and daily productivity.

V-FLEX Knife Drum

CLAAS of America, Inc.
Omaha, Nebraska, USA
www.claas.com

The V-FLEX knife drum for CLAAS JAGUAR® forage harvesters has been engineered to be 2 to 3 dBA quieter than its predecessors. With a refined 10° knife angle, it offers a 1.5% increase in operating efficiency. The drum is equipped with six replaceable knife rings, allowing easy swaps between different configurations, such as installing all the knives or using only half the section to achieve a longer cut length. The knives have been enhanced with 20% more hard surface material, extending their wear life by 20% compared to their predecessors. The newly designed hook on the back of the knife holder is engineered to flex upon impact with large rocks, mitigating the risk of costly damage.

Valmar AB640 Pull-Type Air Boom Applicator

Salford Group, Inc.
Salford, Ontario, Canada
salfordgroup.com

Salford's Valmar AB640 pull-type air boom applicator pairs newly designed 90-foot stainless steel booms with a high-capacity 640 cubic foot hopper. Achieving application speeds up to 14 mph, the AB640 covers up to 137 acres per hour, significantly boosting productivity compared to standard 70-foot booms. To increase its versatility, the AB640 features a 100 cubic foot micro bin with dedicated metering. This allows consistent low-rate application of a wide range of granular products, with the option to apply two products in the same pass. The Raven Rate Control Module (RCM) ensures accurate coverage with variable rate and left/right section control capabilities, reducing overlap and minimizing excess application. By covering more acres per hour with fewer field passes, the AB640 reduces soil compaction and fuel consumption.

Walkabout Mother Bin

Walkabout Mother Bins LLC
Faulkton, South Dakota, USA
www.motherbin.com

The Walkabout Mother Bin (WMB) provides 6000 bushels of in-field mobile storage designed to increase productivity during grain harvest. The WMB is the difference between harvesting a crop at near 100% efficiency or the accepted efficiency of just 60% to 70% without a mother bin. Typically, a combine with a full tank must stop numerous times to wait for grain trucks, whose arrival is unpredictable because of delays at the elevator. Even high-output combines (2000+ bushels per hour) must stop during the peak harvesting period if no empty trucks are available. With its 6000-bushel capacity, the WMB breaks this long-accepted bottleneck in harvest productivity. Trucks can be loaded at 900 bushels per minute via the WMB's augur and be back on the road in minutes, quickly clearing space for more freshly harvested grain.

Your product could be here in 2026!

If your company will bring a new product to market for 2025, consider nominating it for an AE50 award. ASABE is proud to sponsor AE50, the only awards program of its kind, celebrating product innovations in the areas of agricultural, food, and biological systems.

Our online nomination process begins in August, check our website (www.asabe.org/AE50).

Index of AE50 Winners by Company

AGCO
Application Lift System
Fendt ErgoSteer
Fendt Momentum 30FT Planter

Bondioli & Pavesi, Inc.
EDI Driveshafts

Case IH
AF Series Combines
Automatic Productivity Management 2.0 on Magnum™ Tractors
Axial-Flow® 260 Series Combines
C500 Series Corn Head
Modular Tramline System for Early Riser® 2160 48 row 20-inch Large Front-Fold Planter
Quadtrac Heavy-Duty Suspension

CLAAS of America, Inc.
CLAAS Earlage Adapter
LEXION 8900TT Combine
V-FLEX Knife Drum

CNH America LLC, New Holland and Case IH Brands
New Holland IntelliSense™ Bale Automation and Case IH Large Square Baler Automation

Dairy Data Warehouse BV
Milk Sustainability Center

Deere & Company
5ML Tractor Cab
9RX 710, 770, and 830 Tractors
300M Series Self-Propelled Sprayers
Auto Select Pulsing with Multi Rate
C-Series Air Carts
Implement Control Mode (ICM) with eDrive Kit
See & Spray™ Premium

Firestone Ag
Bridgestone VX-TRACTOR Tire

Flory Industries
4840E Elevator

IHT Group
IHT Cooling Mats

Indigo Ag, Inc.
CLIPS™

Innotag Distributions, Inc.
Accuforce™

John Deere GmbH & Co. KG
Active Slope Adjustment™
Milk Sustainability Center

Kubota Tractor Corporation
RTV-X1130 Utility Vehicle

Lindsay Corporation
FieldNET Advisor - Whole Farm Water Management

MacDon Industries Ltd.
FC Series FlexCorn™ Header
FD261 FlexDraper®
R1 FR Front-Mounted Rotary Disc Header

New Holland Agriculture
CropSpeed Monitoring System
UltraFeed™ Pickup

New Leader Manufacturing
NL720 Fertilizer Spreader

Percival Scientific, Inc.
PetriClear® Lighting System

Precision Planting
ReconBlockage™ for Strip Till

PTx Trimble
OutRun™

Salford Group, Inc.
Row Crop Precision Cultivator
Valmar AB640 Pull-Type Air Boom Applicator

Sentinel Fertigation
N-Time® Advanced

TeeJet Technologies LLC
FM9380 Electromagnetic Flowmeter

Yokohama TWS
Trelleborg TM1 ECO POWER Tire

Walkabout Mother Bins LLC
Walkabout Mother Bin

Get Involved in YPC: It's Your Path to Shaping the Future

As we celebrate excellence in agricultural engineering with the AE50 Awards, highlighting the year's most innovative products, it's clear that young professionals are entering our field at an extraordinary time. The rapid advances in smart technologies, autonomous systems, and data-driven solutions are transforming agriculture, and our fresh perspectives are more important than ever. For those of us early in our careers, we can contribute to these innovations while building meaningful professional connections.

Global collaboration series

The 2024-2025 YPC executive team has embraced this innovative spirit through the Global Collaboration Series, which recognizes that breakthrough solutions often emerge from cross-border partnerships. This series kicked off in August with an insightful session featuring **ASABE Fellow Kasiviswanathan Muthukumarappan and ASABE member Daniel Uyeh,** who shared their perspectives on defining global collaboration and navigating its challenges and opportunities.

The series continued in September with Lila Carden, associate professor at the University of Houston, who provided insights on "Tools and Technologies for Global Collaboration in Agricultural and Biological Engineering." In October, the series culminated with an engaging panel on "Building Sustainable Partnerships for Global Collaboration" featuring **ASABE members Patrick Sours, Manuel Reyes, and Ajay Shah.**

To help put these global insights into practice, YPC includes subcommittees that provide direct pathways for young professionals to influence technological innovation.

Technical standards development

The Technical Committee Involvement Subcommittee exemplifies this mission by connecting members with opportunities to shape developments in agricultural engineering. While contributing to technical standards might sound daunting at first, this subcommittee provides a welcoming entry point where young members can progress from observing committee meetings to actively participating in working groups and standard reviews for emerging technologies.

The fresh perspectives and recent education of young professionals help to bridge the gap between traditional practices and innovative solutions, ensuring that standards keep pace with technology while remaining practical. A recent webinar featuring **ASABE member Andres Ferreyra** demonstrated how these evolving technical standards support the implementation of AI, IoT, and advanced analytics.

Other YPC subcommittees

The International Communication and Outreach Subcommittee strengthens these collaborative efforts by fostering global knowledge exchange, while the AIM YPC Events Subcommittee creates networking opportunities that spark new collaborations. YPC offers other subcommittees as well, each providing unique opportunities for young professionals to contribute their skills and perspectives to advancing agricultural engineering.

Events that connect and inspire

These collaborative efforts come together at ASABE events throughout the year. The Annual International Meeting (AIM) features technical sessions that highlight new developments in agricultural engineering, often including presentations by previous AE50 Award winners.

The Agricultural Equipment Technology Conference (AETC) demonstrates the latest advances in machinery and automation, while the Alliance for Modernizing African Agrifood Systems (AMAA) Conference explores how innovative technologies can address challenges in global food security.

Make your mark in YPC

As we look at this year's AE50 Award winners and contemplate the future of agricultural engineering, it's clear that young professionals have a vital role to play in driving innovation. Whether by developing new technologies, shaping industry standards, or building global partnerships, YPC provides multiple ways for early-career engineers to make their mark.

Today's new ideas become tomorrow's award-winning technologies, and today's connections foster tomorrow's breakthroughs. By engaging early in your career—through YPC subcommittees, technical committees, or community initiatives—you will help shape the future of agricultural engineering while building lasting professional relationships.

ASABE member and YPC Promotional and Communication Representative Savannah Roth, Graduate Student, North Carolina State University, Raleigh, USA; saroth2@ncsu.edu.

Empowering Education through Clean Water

EWB-UMN's Project in Malawi

Sophia Zafari

St. Pius Primary School in Malawi.

In the rural heart of Malawi, the daily struggle for clean water has long been an obstacle to education. For the students and teachers of St. Pius Primary School in the Zomba district, this struggle has shaped every aspect of the school day, from hygiene and health, to the precious time spent learning in the classroom.

To address this problem, the Engineers Without Borders chapter at the University of Minnesota (EWB-UMN) and the NGO (non-governmental organization) Freshwater Project International (FPI) are working with the St. Pius community. The project's goal is simple: to provide reliable access to clean water and transform the students' education in the process.

Understanding the challenge

St. Pius Primary School lies just outside the town of Magomero, about 30 km from the city of Blantyre. The school is nestled among the scattered clay brick homes and crop fields that are typical of rural Malawi. With water available from just a single hand pump, located half a kilometer from the school, the students had to make multiple trips every day to fetch water.

The students also had to cross a road to reach the pump, and some students had been struck by passing vehicles. This grueling routine took a toll on the students' ability to focus on learning.

The latrines at the school were another challenge. Limited access to water meant that hygiene was difficult, especially in the overburdened boys' and girls' latrine blocks. With no handwashing stations, preventable illnesses impacted school attendance. The teachers and staff also felt the effects, with limited access to clean water compounding the challenges of maintaining a healthy learning environment.

Recognizing the profound impact that the lack of water had on the school community, EWB-UMN, FPI, and the St. Pius community formed a collaboration to come up with a sustainable solution.

Clean water empowers education

The solution proposed for St. Pius Primary School is not a quick fix; it's a long-term strategy to improve the school's entire water system. As the first step, in October 2023, the project team dug a new borehole to provide an adequate water supply.

The importance of ABE skills

The water distribution project for St. Pius Primary School in Malawi exemplifies how the expertise of ag and bio engineers can transform communities. By integrating the principles of ag and bio engineering, the team ensured that the water system is tailored to the school's needs, accounting for factors like local usage, soil conditions, and long-term sustainability.

Specifically, the team conducted hydraulic calculations to ensure that the system could maintain consistent pressure and flow at multiple locations throughout the school. This included determining optimal pipe diameters, elevations, and flow rates. The team also analyzed the borehole water to verify that it was safe and in compliance with Malawi National Standards.

UMN students work with locals to dig a pipe trench.

In August 2024, the team dug trenches for a distribution system and laid piping. Sinks were installed at multiple locations to provide access to the water, and local contractors constructed an elevated water tank to provide consistent pressure and flow, as well as latrines to improve sanitary conditions.

Several additional tasks are ongoing and will soon be completed. These include the installation of a pump at the borehole, connecting the borehole to the distribution pipes, and enlarging the latrine tanks to increase their capacity for long-term use.

Once these tasks are completed, the project will deliver on its goal of improving the school's water and sanitation systems. The impact will be immediate: more time for learning, better hygiene, and fewer illnesses.

The project also reflects a commitment to sustainability and practicality. The design ensures that the system can supply enough water to meet the needs of the 2,500 students and staff without exceeding the borehole's capacity. The pump and the water tank, which is large enough to meet daily needs, will ensure that the system is reliable even in the event of a power failure.

Most important, the system will be easy for the community to operate and maintain, ensuring that the benefits will continue for years after the project's completion.

The technical aspects

The technical aspects of the project relied on a combination of engineering expertise and community input. Topographic data collected on an initial assessment trip helped the team determine the best location for the borehole, while modeling software, including SolidWorks, EPANET, and AutoCAD, provided a detailed design for the system.

The water tank, made of reinforced concrete, is installed five meters above the distribution pipes to ensure adequate water pressure. The HDPE pipes are buried underground to protect them from sunlight and ensure their longevity. HDPE piping is familiar to the local contractors and easy to work with, which ensures that the system can be easily maintained by the community.

The teachers, administrators, and village chiefs were consulted at every step to ensure that the system would meet the school's needs, and cultural considerations were a big part of these discussions. This collaboration between the project team and the community ensured that the technical solution was appropriate, and it fostered a sense of ownership among the people who will use the system.

A transformative experience

While the impact of the project on St. Pius Primary School is clear, it has also provided a great learning experience for the UMN students. Through this project, the students had a unique opportunity to apply the theoretical knowledge they gained in the classroom to a real-world challenge. Working on the ground in Malawi allowed them to see firsthand the impact of their engineering decisions.

The students' experience was further enriched by the professional engineers who worked with them throughout the project. These mentors helped the students navigate the challenges of an international development project, including everything from engineering issues to cross-cultural communication. This mentorship ensured that the project met professional standards, and it gave the students a much deeper understanding on what it means to be a working engineer.

For many of the students, this was their first time working on a project of this scale, and the mentorship was a key factor in building their confidence. They learned how to manage the technical aspects of the project as well as the logistical, financial, and interpersonal

Thanks to ASABE's Giving Back Fund

ASABE's Giving Back Fund played a pivotal role in enabling this project. This funding covered critical infrastructure costs, including the materials for trenching, piping, and latrine installation. The collaboration between EWB-UMN and ASABE's Giving Back Fund demonstrates how engineering solutions can create meaningful, lasting change. For more information, see www.asabe.org/GivingBack.

The project team leaders meet with community members.

challenges that come with implementing any large-scale infrastructure in a remote area. The professional engineers helped the students gain insights into project management, leadership, and problem-solving in a way that just can't be replicated in a classroom.

The project also offered the students a chance to cultivate the soft skills that are critical for success in engineering. The students were in constant communication with the community members, contractors, and local authorities, learning how to balance the technical requirements with other, non-technical issues. This experience taught them the importance of adaptability and open-mindedness.

Building cultural awareness

While the technical aspects of the project were critical, the success of the project also depended on understanding the local culture. The team made significant efforts to improve their cultural awareness, beginning with the initial assessment trip. During this trip, they surveyed the local students, teachers, and community members about their water usage and preferences, gaining valuable insights into daily life in the Zomba district.

Cultural awareness continued to be a priority throughout the project. Weekly team meetings included presentations on Malawian culture, language, and customs, helping the team members understand the broader context of their work. By incorporating local words and phrases into their interactions with the community, the team showed respect for the culture and built stronger relationships with the people they were there to help.

Sustainability and long-term impact

As the project moves toward its final stages, the focus is on ensuring that the new water system will serve the school for years to come. Once the project is complete, community members will be trained in operating and maintaining the system. This emphasis on sustainability is a cornerstone of EWB-UMN's approach, ensuring that the benefits of the project extend well beyond the initial implementation.

For St. Pius Primary School, the completion of this project will mark a new chapter in the school's history. No longer will students need to walk long distances to fetch water and miss out on valuable classroom time. Instead, the school will have its own water supply, fostering a healthier, more productive learning environment.

A model for the future

This project is about more than installing a pump and pipes. It's about empowering a community and helping students focus on their education without the distractions and health risks associated with inadequate water access. It's also a reminder that engineering, when done with empathy and understanding, has the power to transform lives.

Students at St. Pius Primary School will soon be able to turn on a tap, wash their hands, and return to their lessons without interruption. And with that simple action, the future of the entire community will begin to change. For the UMN students, the experience will last just as long, as they carry the lessons learned from this project into their future careers.

Sophia Zafari, Senior Fundraising Officer, Engineers Without Borders, College of Science and Engineering, University of Minnesota, Minneapolis, USA; zafar030@umn.edu.

A student paints a mural that reminds children to wash their hands.

ASABE Foundation Work in Focus

E-06 Launches the ASABE Ambassadors Program

Brian Huenink

The Foundation Liaison Committee (E-06) is here to help the ASABE Board of Trustees and the ASABE Foundation Board of Trustees connect creative ideas with funding. Now, with a new development specialist on the team, E-06 is gearing up for an exciting 2025.

In the ecosystem of fundraising, two audiences bookend the work: the project leaders and the donors. E-06 lives in the middle, reaching out on one hand to engage with members to learn about their current projects and new ideas. On the other hand, E-06 will work with the newly appointed ASABE Ambassadors to build relationships with potential stakeholders, both within the membership as well as with companies, grant-making organizations, and the general public to raise funds.

Those funds support member-led projects, important and innovative work that impacts our world for the good, and E-06 is right there, sharing the outcomes with donors and thanking donors for making an impact on the world through ASABE.

This fresh perspective on the work of E-06 will be as complex and nuanced as ASABE itself. The ASABE Ambassadors will begin as a pilot program that is slated to roll out in January with training for the inaugural volunteer Ambassadors, many of whom have already been identified and officially invited to take on the new role. The training will center on best-in-class methods for building relationships with their networks and inviting their colleagues, including their employers, to invest in the work of ASABE member-led projects.

This first group of ASABE Ambassadors will work to raise funding for the following Board of Trustees-endorsed priorities for the year:

- Circular Bioeconomy Systems Institute (CBSI)
- Alliance for Modernizing African Agrifood Systems (AMAA)
- Agriculture Equipment Technology Conference (AETC)
- Annual International Meeting (AIM).

E-06 will engage with the leadership of these projects and events to determine the fundraising goals and to craft messaging to attract donors and sponsors.

E-06 and the ASABE Ambassadors are eager to deploy this new strategy and amplify fundraising to "promote engineering in food, water, energy, fiber, and the environment" so that ASABE stays a global leader in creating solutions for a healthy planet and a sustainable future with plenty of food, water, fiber, and energy for everyone.

For more information on the ASABE Foundation, visit www.asabe.org/Get-Involved/ASABE-Foundation.

ASABE member and E-06 Committee Chair Brian Huenink, Manager of Engineering, Small & HVC Operator Station, John Deere, Cedar Grove, Wisc., USA; HueninkBrianM@JohnDeere.com.

VisualChallenge14

FOCAL POINT

Images of Agricultural and Biological Engineering

For the past 14 years, *Resource* has asked ASABE members and their colleagues to communicate with images—statements without words—to celebrate the visual aspects of agricultural and biological engineering. After the call went out this year for *VisualChallenge*14, we were excited to see the submissions. On the following pages, you will see some of our favorites.

We thank our many contributors who focused in on the profession, finding beauty and meaning. Their work comes to life in these images, showing those outside the field: "This is what we do."

We hope these photos provide a glimpse into the variety of activities, workplaces, and surprises that an ABE career can offer. In 2025, remember to pull out your camera or phone and take a shot for next year's Visual Challenge!

ASABE member Len Ring, P.E., Ring Irrigation Engineering, Lethbridge, Alberta, Canada.

Wind, water, and land

Here we are in the southwest corner of Alberta, Canada, near the Oldman River Reservoir, on the eastern slope of the Rocky Mountains. This image shows four things that we are very proud of in Alberta: the Rocky Mountains (Alberta shares these majestic peaks with British Columbia) and our cattle industry, irrigation, and wind power (Alberta is Canada's leader in all three).

ASABE member Ekramul Haque Ehite, **Principal Scientist - Early Engagement and Deviceability, GSK, Collegeville, Pennsylvania, USA.**

Pot of gold at the end of the rainbow

The Pocono Mountains in northeastern Pennsylvania are named from the Munsee word pokawachne ("the creek between two hills"). For many Tri-State area residents, the Poconos, as a natural resource, are as precious as a pot of gold. On this lucky day, we got a dazzling double rainbow among the verdant hills.

ASABE member AJ Both,
Professor and Extension Specialist, Rutgers University, North Brunswick, New Jersey, USA.

Buttercup (#920) and the herd: Solar grazing

Beef cattle graze among the panels of a vertical bifacial agrivoltaic system at the Rutgers University Animal Research Farm in New Brunswick, N.J., illustrating the compatibility of these two different production systems.

ASABE member Brian McLaughlin, Safety Psychographics LLC, Notre Dame, Indiana, USA.

New and old

Harris Family Farm Foundation in Galien, Michigan: grower and provider of fresh produce to families in need in Berrien County. Recently rehabbed their veteran barn to be utilized as a better place to sort and pack the produce—an interesting mix of original timbers and new wood and roof.

ASABE Fellow Art Johnson, P.E.,
Professor Emeritus, University of Maryland, College Park, Maryland, USA.

Dinnertime

Having an orchard requires annual pruning, but the removed twigs and branches do not have to be a complete waste. Our cows and sheep loved apple prunings and treated them like choice salad in the midwinter. We would load the apple branches on the trailer behind our Allis Chalmers "C" tractor and bring them to the pastures where the animals were located. The animals frequently couldn't wait until the branches were unloaded before they started to nibble on the ends. They eagerly followed the load until we stopped. This made it sometimes difficult to unload the branches and move the tractor and trailer out of the way while the sheep crowded in to get the best choice bites. The animals ate the branches at every opportunity they had.

ASABE Member Jena Smolko,
Engineer and Project Manager for stream restoration projects, Baltimore County Department of Environmental Protection and Sustainability, Maryland, USA.

A view of my work space

Here is a picture of a typical day at work. It's just one reason why I really enjoy what I do in stream restoration.

ASABE Fellow Gerald E. Rehkugler, P.E.,
Professor Emeritus, Cornell University, Ithaca, New York, USA.

Harvesting hay with proven technology

This image shows how previous agricultural engineers built durability into their machines. Today's design engineers and standards work takes into account durability as well as electrical and mechanical compatibility, advanced technology, ergonomics, and safety and health.

ASABE member Karl Wild, Professor, University of Applied Sciences Dresden, Dresden, Germany.

Making hay while the sun shines

Agrivoltaics provides a way to generate solar power without losing valuable farmland. Here, a field is used for both electricity and agriculture at the test facility of the University of Applied Sciences Dresden.

Fieldwork and data review

Two soil scientists stand by a pickup truck in a sorghum field in Texas, reviewing data sheets and a soil sampling tube on the truck bed. Surrounded by lush sorghum plants and under a clear sky, the image captures a blend of relaxation and focus as the researchers engage in their work.

ASABE member Yasas Gamagedara,
PhD Candidate and Graduate Research Assistant, Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi, USA.

A scenic road to soil sampling

This image showcases the natural beauty along a winding dirt road that leads to a soil sampling site at Matador Wildlife Park in Texas. The vast landscape, dotted with trees, is typical of the untouched environment of the park. This peaceful scene provides a glimpse of the quiet enjoyment that often occurs during fieldwork.

ASABE member Michaël Gagnon-Bouchard, Director of Research and Innovation, Groupe Anderson Inc., Ham-Nord, Quebec, Canada.

Teaming up for baleage

Machines congregate at sunset for baling, wrapping, and transporting round bales near Chesterville in Quebec, Canada.

ASABE member Brian McLaughlin, Safety Psychographics LLC, Notre Dame, Indiana, USA.

The sun sets

Cass County Indiana Agribusiness Park ethanol plant at sunset.

Are Large Language Models (LLMs) Ready for Agricultural Applications?

Unveiling the ethical landscape of LLMs: Opportunities and imperatives in agriculture

Ketan Shende

Editor's note: **ASABE member Ketan Shende,** a graduate student at Kansas State University, took first place in the 2024 Ag and Bio Ethics Essay Competition by submitting "an original work of up to 1,500 words on an ethics topic impacting the practice of professions related to agricultural and biological engineering, systems, or technology." Open to undergraduate and graduate student members of ASABE and IBE, second place went to **ASABE member Yanqui Yang,** Pennsylvania State University, "Fields of Automation: Navigating the Ethical Terrain of AI and Robotics in Agriculture" and third place was awarded to **ASABE member Ranjan Sapkota,** Washington State University, "Ethical Implications of Automating Human Jobs in Agriculture: Balancing Technological Advancements with Labor Concerns."

Congratulations to our 2024 finalists, who presented their essays at the 2024 Annual International Meeting in Anaheim, California. Check out these winning essays at asabe.org/Awards-and-Competitions/Student-Awards-Competitions-Scholarships/Ethics-Essay-Competition.

Large language models (LLMs) have witnessed a remarkable surge in popularity, similar to the proliferation of innovations within the artificial intelligence domain in recent years. They have sparked a great interest among researchers, developers, and industry leaders due to their exceptional capabilities of generating information, providing a conversational experience, and notably answering a wide array of questions (Chang et al., 2023). For instance, prominent LLMs like GPT, BERT, Llama, and Lamda have accumulated significant traction and have been embraced by diverse audiences (Zhao et al., 2023). Researchers and industry practitioners, who have invested considerable time, effort, and capital across distinct advancements of artificial intelligence, foresee LLMs as the next groundbreaking innovation capable of addressing complex challenges. With major industry players open-sourcing their cutting-edge models, the utilization of LLMs is poised to become widespread, envisioning diverse applications across various domains due to their robust training on a large corpus of information.

The advent of LLMs on the internet prompted many subject matter experts to swiftly explore and adopt them for specific use case scenarios. Variants such as AgriBERT (Rezayi et al., 2022) and Agronomy Assistant (Silva et al., 2023) for agriculture, ClimateBERT (Webersinke et al., 2021) for climate-related tasks, and others like BioGPT for healthcare, ChatLAW for legal domains, and FinGPT for financial tasks emerged rapidly. Despite being extensively trained heavily on diverse information sets, concerns arise regarding the verification of the information used, evidenced by instances of erroneous outputs and inaccurate conclusions. Alongside this, issues such as bias, privacy, prejudice, copyright infringement, behavioral anomalies, inefficiencies, and misinformation further underscore the complexities associated with LLM usage. Consequently, stringent ethical standards must be established as gatekeepers before deploying LLMs in applications targeting mass audiences.

Privacy of personal and business information

Primarily conversational in nature, LLMs thrive on information to refine their models and fine-tune responses. When employed to advise farmers on agronomic decision-making, the necessity for personal information arises, potentially leading farmers to disclose confidential business and personal data (Weidinger

et al., 2022). Despite some parent LLM firms implementing privacy policies with word limits, instances of inadvertent public disclosure of personal information have been documented. Thus, robust ethical guidelines must be in place to mitigate such breaches and prevent the use of personal or sensitive business information for training susceptible models. These guidelines will help farmers to not share any data which might directly or indirectly hamper them.

Addressing bias

Bias remains a persistent challenge across machine learning and deep learning applications, including LLMs. There has been evidence where the biases are manifested at various stages, beginning with disparities in access to technology. Developed nations with higher levels of digital literacy stand to benefit more from LLM accessibility compared to developing and underdeveloped nations. Furthermore, if LLMs are trained primarily for scenarios applicable to developed farmers, smallholding or remote farmers may struggle to relate to the solutions recommended (Turpin et al., 2024). Lastly, failure to accurately contextualize critical factors such as geographical information, weather conditions, agronomic practices, and dynamic field attributes may lead to erroneous interpretations and discriminatory outcomes. Studies indicate that LLM output decisions can be influenced by factors such as race and location, potentially complicating productivity disparities and increasing tensions between races. Therefore, measures should be taken to make LLMs ethical in terms of creating unbiased recommendations. A contextual ethical guardrail should be in place that will consider these bias-generating factors instead of just assuming them.

Ensuring data quality

At times, the training of LLMs may encounter challenges arising from insufficient or conflicting information. This issue can arise when scientific data is scarce, leading to training on potentially contradictory or misleading information. Consequently, if the generated recommendations prove ineffective, it could result in erroneous farming strategies and significant financial losses in crop cultivation. Moreover, as LLMs rely on word embeddings, misinformation can be exploited by malicious actors, facilitating data poisoning, and further compromising accuracy (Das et al., 2024). This deterioration in data quality can undermine the efficacy of LLMs, ultimately detracting from their intended purpose (Hataya et al., 2023). Establishing ethical norms for data quality is imperative when granting public access to LLMs to uphold the integrity of subsequent applications built upon them.

Combating malicious exploitation

The practitioners of technology have the potential to launch deliberate attacks on LLMs, aiming to propagate sabotaging information. Extensive evidence exists highlighting the misuse of language models for malicious purposes (Tamkin et al., 2021), rendering them to be potent weapons capable of inflicting substantial harm. Consequently, LLMs remain tempting targets for individuals seeking to exploit them for vindictive purposes. Crafting prompts designed to manipulate the model into producing harmful recommendations can result in the disclosure of sensitive information for malicious ends. Hence, it is important for LLMs to incorporate robust ethical filters to prevent the generation of such detrimental outputs. While such actions carry repercussions, governmental intervention in the form of a legal ethics committee becomes necessary to address such scenarios to protect the farming community.

Legal complexities

In addition to the aforementioned techno-ethical concerns, various legal complexities also emerge. Duplication issues may arise during development stages and when comparing model outputs, potentially leading to copyright infringements as models trained on vast datasets may inadvertently produce content that mirrors existing works. Also, LLMs are susceptible to hallucinations, wherein they confidently generate incorrect responses due to factors like training data quality, methodologies, and other variables (Duan et al., 2024). If such LLMs are used for any agronomic decision making, this can largely affect the farmer since these decisions are irreversible. Hence, outputs from LLMs should undergo careful curation and verification before dissemination on platforms for the public.

Preserving human ingenuity

Additionally, a dependency factor inevitably arises, fostering reliance on LLMs as a fallback option. This reliance may suppress the emergence of indigenous human ideas at various stages of development, whether during the initial brainstorming phase or during the actual transformation of ideas into reality. For instance, if LLMs are entrusted with decisions regarding crop growth strategies or the application of pesticides and

insecticides, it's crucial to ensure that they are equipped with comprehensive information about the dynamic variables involved before placing full reliance on their recommendations.

Conclusion

Large language models are here to stay due to their firmly established brilliance and are poised for even broader applications as we advance, particularly in addressing specific challenges within agriculture. This fusion of LLMs and agriculture offers tremendous opportunities, yet it also amplifies ethical concerns, as mentioned earlier. While LLMs accelerate research and business across agricultural domains, they concurrently confront significant vulnerabilities that can compromise their effectiveness. Given the diverse stakeholders involved in agriculture, any breach of sensitive information could undermine user confidence in this technology. It falls upon technology providers and extension personnel to educate end users, such as farmers or growers, on the utilization and implications of LLMs and their applications.

Enhancing clarity and comprehensibility is crucial, and clear documentation and communication of LLM workflow is a must to foster trust and enable informed decision-making. Flexible and responsive management is necessary to adapt to the evolution of LLM applications. Robust privacy protection measures are essential, incorporating rigorous safeguards to uphold farmers' trust, ensure legal procedures, and secure sensitive data used by LLMs. Prioritizing fairness and equity entails developing bias-free models, conducting regular bias audits, and fostering diverse development teams to incorporate a broad spectrum of perspectives. Safety and security measures must be implemented to shield LLMs from both unintended failures and malicious attacks. Inclusive public engagement is paramount in LLM policymaking processes, ensuring that a diverse range of perspectives and needs is considered.

Therefore, stringent ethical frameworks and safeguarding measures along with educational probes are imperative for every facet of human interaction with LLMs, especially in agricultural applications. By implementing such measures, we pave the way for reaping the benefits of this technological synergy and convergence.

ASABE member Ketan Shende, Graduate Student, Kansas State University, Manhattan, USA; kshende@ksu.edu.

Further Reading

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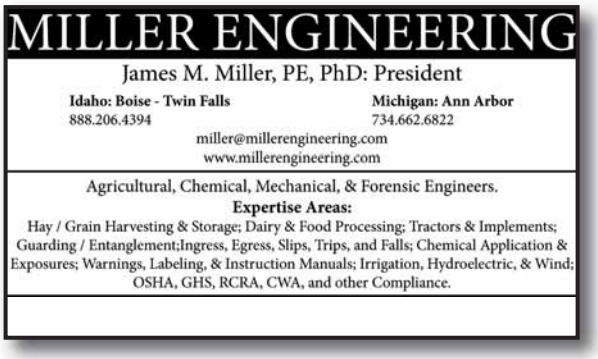

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