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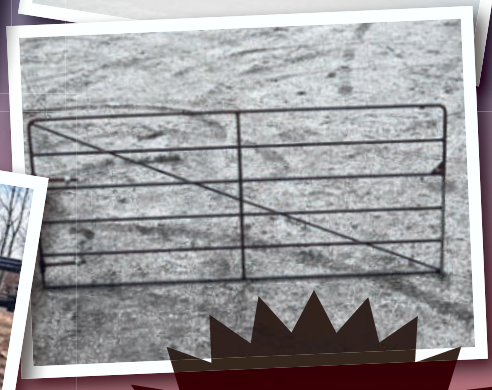

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Regional Publisher - Kevin Shaw

Managing Editor - Scott Waltman
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Advertising Director - Christy Orwig
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EDITORIAL:
605-622-2304 or 800-925-4100
farmforum@aberdeennews.com

CIRCULATION:
605-229-5555 -or- 800-925-4100
customerservice@aberdeennews.com

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SDSU encourages innovation to enhance agriculture

Relationships, connections spark creative ideas to solve problems

By Connie Sieh Groop
Special to the Farm Forum

Innovative ideas flourish on the campus of South Dakota State University in Brookings because of the nurturing atmosphere. The expertise of one professor is tapped to oversee several areas that feed and develop projects integral to the agriculture community.

Dr. William "Bill" Gibbons is an industrial microbiologist, a distinguished professor, and works with the Technology Transfer Office, the Agricultural Experiment Station, and is the Interim Associate Dean for Research, College of Agriculture, Food and Environmental Sciences.


Dr. William "Bill" Gibbons

He's truly excited about the Precision Agriculture program which has almost 100 students currently majoring in this first-in-the-nation program, along with more including it as a minor. Recently, the old Seed House on campus came down and construction of the new Raven Precision Agriculture Center began, with completion planned for the Fall of 2021.

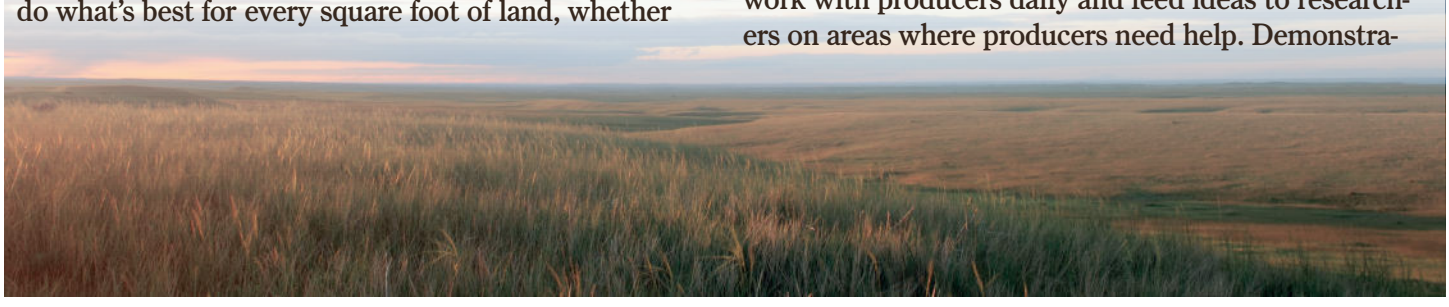
"Many think of precision ag only on the crop side, but it also includes livestock production, conservation and environmental quality, and the interplay between all these elements. Precision ag provides the toolbox that will enable greater efficiency, allowing producers to do what's best for every square foot of land, whether that is crop or forage production, pastureland or range, wildlife habitat, or any combination thereof. Increasing diversification will provide greater economic and ecosystem stability, while allowing us to rebuild soils and soil health through regenerative agriculture practices."

During the next 10 years, he believes there will be a tremendous expansion of no-till practices and re-integration of livestock as operations move to diversify. Despite increasing moisture challenges, producers have shown that no-till can work in wet conditions by improving soil structure and porosity, allowing soils to absorb and hold water subsurface. No-till practices and diverse crop rotations rebuild the soil by fostering a healthy diversity of soil microbes that feed plants and vice versa, resulting in increased soil organic matter.

A new program, "Every Acre Counts," focuses on marginal lands impacted by wet conditions, saline or sodic soils, and eroded areas such as hilltops. Millions of acres of cropland across South Dakota are affected by these challenges, with over 7 million acres impacted by saline conditions alone. Trying to produce a crop on these areas can hurt the producer's bottom line. The goal is to switch these areas into alternative uses such as forages, grazing lands, and/or wildlife habitat that will be more profitable for producers, while providing ecosystem benefits to society in general. Precision ag technology makes it much easier to "farm around" these areas than was possible even five years ago.

Fresh ideas

What are the sources of ideas for many of the projects at SDSU? Gibbons emphasized that SDSU and other Land Grant Universities benefit from the dynamic network of contacts that Extension personnel have throughout each state. These Extension specialists work with producers daily and feed ideas to researchers on areas where producers need help. Demonstra-



tions and field days at SDSU's Research Farms and Field Stations, and at cooperating producer sites, provide additional opportunities for SDSU faculty and staff to network with producers on a one-on-one basis.

"Adding to this diversity are the new ideas brought in by our recently hired research and extension personnel, along with the youth who continue to take over the farms and ranches from the prior generation. The university welcomes new ideas, whether they come from new students, faculty, or producers, along with our more experienced faculty and producers." Gibbons emphasized that being open to unconventional ideas is often where future innovations are born. At the SDSU Dairy Bar, alumni fondly remember when Shirley Seas, manager of the SDSU Dairy Processing plant, had the wild idea of chopping up Oreo cookies and mixing them into vanilla ice cream in the 1970s, creating "Cookies and Cream" ice cream. About that same time, SDSU Microbiologist Paul Middaugh built the nation's first dry mill ethanol plant on the SDSU campus, started an industry that now provides 15% of the US liquid fuel market and produces a high protein livestock feed co-product.

More recent innovative ideas come from working with industrial partners like Raven Applied Technology. These companies support faculty research projects and senior design projects. They can provide a rapid pathway to transition research developments into commercialization through technology licensing agreements. These interactions with industry often provide faculty and students with unique perspectives on problems and challenges. The interaction of people with unique skill sets and different backgrounds often leads to highly transformative innovations. "I like the quote of Oren Harari, Business Professor at the University of San Francisco who noted that the 'electric light bulb wasn't discovered by incrementally improving the candle.' It took a new perspective to make that transformative leap in technology."

Gibbons said, "We designed the Raven Precision Agriculture Center to encourage people from different disciplines to spend time with one another. Offices and labs are intermixed, and we strategically scattered break areas and collaboration spaces throughout the building. Innovations often arise in casual conversations when someone shares a research or technology challenge, and others with different skill sets offer suggestions that build into a completely different way of addressing the initial problem. The Center will also have spaces where companies can join with us in this innovation ecosystem."

Challenge to connect projects

Connecting people and projects advances ideas in several ways.

For Gibbons, "In my role in the SD Experiment Station, I get the opportunity to annually review hundreds of research reports from our faculty and staff. The goal of each researcher is to advance the knowledge base in their core area, and it is rewarding to see their efforts bear fruit and provide valuable impacts to our stakeholders and the agricultural community."

An especially exciting side benefit of these annual project reviews is being able to see potential connection points between different projects. A finding or innovation made by one researcher on a particular project might have an even more impactful benefit to a researcher in a completely different area. Bringing these individuals together can lead to discussions and problem solving that neither would have likely imagined on their own. Gibbons said, "That's exciting for me to see this come together."

A recent example involved bringing together animal science, computer science, and natural resource faculty to develop systems that will monitor range conditions and livestock performance, condition, and health on a continuous basis. "We want to use machine learning to convert digital images into actionable decisions that can be more rapidly and frequently implemented to ensure rangeland health, animal health and performance, and profitability."

"Working at a highly collaborative institution like SDSU is fun and very rewarding because of the people we get to work with, the problems we get to address, and the innovative solutions we develop," Gibbons said. "In fact, creativity is one the five core values highlighted in SDSU's strategic plan, Imagine 2023."

USDA RESEARCH *is driving Technological Innovation*

USDA scientists and researchers reported 320 new inventions in 2018

The U.S. Department of Agriculture (USDA) released its annual Technology Transfer Report, which highlights innovations from scientists and researchers that are solving problems for farmers, ranchers, foresters, and producers; and creating opportunities for American businesses to thrive. Yesterday, Secretary Perdue discussed the release of the Technology Transfer Report at the Forbes AgTech Summit held in Salinas, CA during a fireside chat with Mike Federle, the CEO of Forbes.

USDA's Technology Transfer Report revealed 320 new inventions from USDA laboratories in fiscal year 2018, along with 471 licenses, 120 patent applications and 67 actual patents. Discoveries include a repellent made from coconut oil to ward off blood-sucking insects that cost the cattle industry more than $2.4 billion annually, technology that keeps almond crops from being lost to heavy rains, and a treatment for peanut allergies.

"Long before anyone ever coined the modern-day phrase of 'technology transfer,' it was part of the culture at USDA to deliver solutions to the people of America," Secretary Perdue said. "Today, USDA is still helping to drive technological innovation – both on the farm and off. Studies show that every dollar invested in agricultural research returns $20 to our economy. Innovations produced by USDA scientists and through public-private partnerships add value to American agriculture and the U.S. economy, create jobs, and help American producers compete in the global marketplace."

Innovation highlights mentioned in the report include *(with corresponding page numbers from the report)*:

A new bio-based insect repellent that uses fatty acids derived from coconut oil to ward off blood-sucking insects that cost the cattle industry more than $2.4 billion annually. *(p. 117)*

Energy-saving new technology using sequential infrared heat and hot air to simultaneously dry and decontaminate wet whole almonds, a crop worth $5.33 billion a year in California. *(p. 111)*

A system for removing nitrate from contaminated water and recycling it for re-use as fertilizer. *(p. 131)*

A treatment for peanut allergy. *(p. 115)*

A test strip for major foodborne pathogens that reduces testing time from 24-72 hours to about 30 minutes, allowing food to be tested more often at less expense. *(p. 384)*

A vaccine against Streptococcus suis that may markedly improve the health and welfare of pigs while reducing the use of antibiotics. *(p. 123)*

Using gene editing as a tool to engineer an African swine fever vaccine. *(p. 123)*

The discovery of a hormone – asprosin – that controls the desire to eat, making it a potential tool for the prevention and treatment of obesity and type 2 diabetes. *(p. 110)*

A set of time-series maps that can help forest resource managers plan strategically for how changing climate might affect the geographic distribution of wildfires in the Pacific Northwest. *(p. 288)*

A technique that detects the dreaded Zika virus in mosquitoes by simply shining a special beam of light on a whole mosquito for less than three seconds – an approach that is 18 times faster and 110 times cheaper than the current alternative. *(p. 117)*

"Adapt-N," an online tool that provides small- to large-scale corn growers in 26 states with low-cost soil carbon assessment and greenhouse gas (GHG) accounting capabilities. *(p. 394)*

A soy-based resin that can replace traditional anti-fouling boat paint without containing copper that can accumulate in underwater environments. *(p. 383)*

A safe, new insecticide for use on the fruit fly – methyl benzoate – which was found to be 5 to 20 times more toxic to fruit fly larvae. *(p. 147)*

Development of the first U.S. hard-white waxy high-yielding winter wheat, which can be used to develop novel whole grain products and is a more efficient substrate for ethanol production. *(p. 141)*

USDA issues the report each year on technology-transfer activities for the USDA, Agricultural Marketing Service (AMS), Animal and Plant Health Inspection Service (APHIS), Agricultural Research Service (ARS), Economic Research Service (ERS), Foreign Agricultural Service (FAS), Food Safety and Inspection Service (FSIS), Forest Service (FS), National Agricultural Statistics Service (NASS), National Institute of Food and Agriculture (NIFA), Natural Resources Conservation Service (NRCS), and Rural Development (RD).

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WSSA Asks:
Is Unmanned Aerial Weed Control Ready for Takeoff?

Weed Science Society of America

Scientists with the Weed Science Society of America (WSSA) say unmanned aerial vehicles (UAVs) may soon revolutionize weed management. And it's easy to see why.

UAVs, often referred to as drones, can travel where it is hard to navigate by ground – from flying over dense forests to hovering over lakes, streams and other bodies of water. And when equipped with the right tools, researchers say they can be quite effective at both finding and treating problem weeds.

Just consider the following findings from John Nowatzki, a scientist at North Dakota State University:

UAV USED TO APPLY HERBICIDES. This image shows a UAV/drone applying herbicides to a research field at Texas A&M University. The system is equipped with a four-nozzle boom and has a capacity of over five quarts. *Photo courtesy of Texas A&M Weed Science.*

Weed Identification and Mapping

UAVs equipped with cameras and other sensor technologies have successfully measured weed density and have been used to identify and map multiple weed species with greater than 90 percent accuracy. They also have been used to detect differences in canopy temperatures between glyphosate-susceptible and glyphosate-resistant weed species – data used to identify resistant weeds with an accuracy level of more than 95 percent.

One downside: Analyzing data collected by UAVs takes time, and that can mean a costly delay in weed management decisions. Researchers say artificial intelligence tools can eliminate the lag as computers learn to identify and map weeds on the go. More work must be done, though, to develop the massive databases of weed images needed for machine learning.

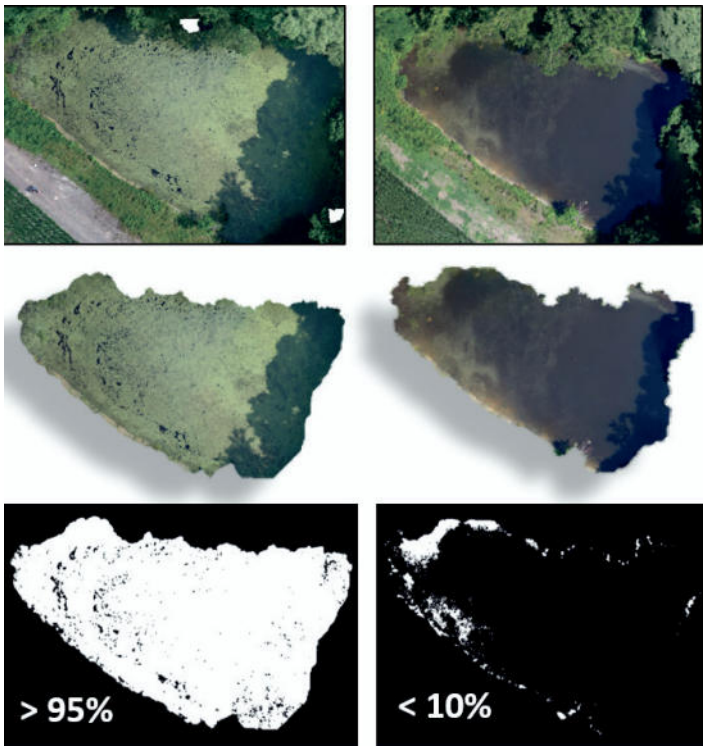
Aerial Application of Herbicides

Researchers are currently testing a semi-autonomous UAV spray system guided by global positioning system (GPS) coordinates fed into the UAV's flight planner. They've found that UAVs can hover over targeted treatment areas with an accuracy of one to two feet – improving the precision and safety of herbicide applications.

Before such systems become widely used in agriculture, though, researchers say it is important to learn more about spray drift patterns, the impact of droplet size, and the environmental and health impacts of UAV-based herbicide applications. Such information will be critical to the U.S. Environmental Protection Agency (EPA) as it works to establish policies that will address acceptable UAV use patterns, herbicide labeling, and regulatory, safety and enforcement issues.

But those investigating UAVs as a tool for weed control are upbeat about the potential. With the appropriate computer processing capacity and battery power, UAVs may one day become fully autonomous – able to identify weeds and make site-specific herbicide applications in real-time, all as part of a sustainable, site-specific weed management system.

"It's easy to imagine early response programs to spot-treat potentially resistant weeds that escaped a previous treatment," says Muthu Bagavathiannan, Ph.D., of Texas A&M University. "Doing so could greatly



UAV USED TO MONITOR RESPONSE TO WEED TREATMENTS. These UAV images show the impact of a herbicide treatment applied to a farm pond infested with duckweed and watermeal. The images at left show the pond before treatment, while the images at right show the pond one month after treatment.
Photos courtesy of Andrew W. Howell, North Carolina State University.

improve weed control and minimize weed seedbank replenishment, while reducing the amount of herbicides used."

UAVs for Aquatic Weed Management

Aquatic weed management is an area where UAVs can really shine. Weed mapping is crucial to assessing the risk of plant invaders that threaten vital water resources. But it can be a tough task to accomplish by boat or shoreline observations.

According to Rob Richardson, Ph.D., of North Carolina State University, UAVs equipped with high-resolution cameras can quickly travel over bodies of water to detect new weed infestations, estimate the biomass of submersed or floating weed beds, and monitor weeds before and after treatment.

"UAVs give us a timely, low-cost way to reach areas of a waterway that would otherwise be inaccessible by boat due to shallow water, lack of launch facilities, or the presence of stumps, rocks or other hazards," Richardson said. "They can be an important tool for rapid response and for making better-informed weed management decisions."

UAVs can also be used to apply treatments to specific areas over broad swaths of weedy invaders, Richardson says. Research is underway to explore important aquatic treatment variables – from the most appropriate applicator nozzles to best practices for managing spray drift.

Farmers spoon feed nutrients to crops through ***subsurface irrigation system***

Drip tape system delivers fertilizers into root zone

By Connie Sieh Groop
Special to the Farm Forum

Keith and Ron Alverson of Chester, SD, provide precision nutrient management in one of their fields through sub-surface irrigation. Much like the other precision tools they use, the aim is to place nutrients in the root zone where they are most needed.

Keith said, "We're putting the nutrients right at the root level. It's like giving each plant a tiny IV line."

The Alversons worked with NutriDrip, a company from Kansas who handles Netafim. Subsurface drip Irrigation is described by Netafim as a method of irrigating a crop via underground drip tape.

Small pressure regulated emitters are evenly spaced on the drip tape allowing growers to evenly irrigate their entire field.

The system delivers water and nutrients across the field in pipes called 'dripperlines' featuring smaller units known as 'drippers.' Each dripper emits drops containing water and fertilizers, resulting in the uniform application of water and nutrients directly to each plant's root zone, across an entire field.

Keith said, "The system really allows us to spoon-feed the nutrients for the growing crop. As a result, we anticipate being able to have the nutrients spread out over the growing season, potentially lowering the amount of fertilizers applied, especially on a per bushel basis."

Setting up the system and transitioning from the pivot to drip was a big step, but once installed, you learn how it works and transition.

Keith and Ron Alverson of Chester, SD, installed subsurface irrigation on one of their fields in 2017. *Photo courtesy of SDCorn*

"The biggest benefit is the opportunity for nutrient application and the management of it," he said. "It creates an opportunity to time the application down to what week and what time of day. It provides a lot more management capacity than if deciding to side-dress, top-dress or apply the nitrogen in the spring which is limited by when you can get the tractor and fertilizer applicator in the field.

Rates can be adjusted for the different zones in the field and can be applied through the growing season as needed. "We use it to apply nitrogen but we want to expand to phosphorus, boron and micronutrients in coming years."

The system was installed in the fall of 2017. "Typically, with the pivots, we'd put on 8 inches of water on our soil types. In 2018, because of conditions, we put on 4 ½ to 5 inches. This year, we put on 2 inches because of the rains. It came down to when to apply the nutrients more than the moisture."

The soils where they irrigate have corn yields from 140-160 bushels per acre on dryland corners and using center-pivots boosts the yields to 200 or more. This system should provide an increase in the yield but due to wind damage in the area doesn't make it a good year for comparisons.

This year, "With the system, we're putting on 25-50 lbs. of nitrogen with as little as 3/16" of water. We need just a small volume of water to get the nutrients out there. In the last two years, we scheduled around rains and the conditions didn't let us optimize the system. But it allowed a learning curve."

Tim Wolf, an agronomist with Netafim, said the last three years has seen growth in the installation of sub-surface irrigation with several thousand acres installed in South Dakota.

"With drip irrigation, the focus is on water but at least half of the system advantage is to deliver nutrients to the plants. Even in a year like this, when farmers don't need water, it has a huge impact on delivering nutrients. Some use it almost exclusively based on nutrient delivery. Farmers know that those areas that get a lot of rain, it washes away the mobile nutrients from the roots. Replacing those and positioning them in the root area in the quantity that meets the plant needs is a big advantage in any year."

The impact can mean an increase of 50-bushel, 75-bushel or even 100-bushel per acre improvement in a year based on nutrient delivery.

Wolf said they customize systems to fit the grower's fields. They estimate a cost of $1,500 to $1,800 an acre, for a turnkey fully-installed system that the grower can start working with right away. The gain in yield helps pay for the cost. The efficiency of nutrient delivery can also mean using less fertilizers. Some growers who would use 1-lb. of nitrogen per bushel are now using .7 to .8 lb. per bushel. By putting the nutrients in place when the plants need it, it's a more efficient strategy. Even by using less, farmers are seeing better yields.

With the Alversons, the drip lines are placed about 12 inches deep. Wolf said a lot of guys still want to do some tillage so this works with less aggressive tillage or no-till situations.

As far as concerns about freezing temperatures, Wolf said the dripper line will drain itself, with emitters every 20 inches with no risk of damage. They position the infrastructure below the normal frost line. Some install a self-drain or blow out the system with air to care for the infrastructure and the sub-mains that bring the water to the field. "We can manage frost concerns."

"Getting the crop in the ground and harvested is a challenge," Keith said. "We're trying to grow more with less and we're looking at this system to help."

HORSCH introduces the Omnis FT Tillage Tool

Horsch

HORSCH, a global manufacturer of seeding, planting, tillage, and application equipment, announces an expansion of its North American primary tillage line by launching the all-new Omnis FT into the North American marketplace in fall 2019. Engineered and built at the company's Mapleton, North Dakota, facility, this new concept in primary tillage incorporates innovations pioneered by HORSCH both domestically and abroad.

The Omnis FT is ideal for breaking up compaction and providing consistent soil tilth in conditions where residue has already been properly sized and distributed by the combine. One of the unique features of the product, when compared to other shank-type primary tillage concepts, is the overall shank spacing. The thorough horizontal fracture is accomplished by four ranks of shanks spaced on 15-inch centers with 1,800 pounds of trip force. Each shank is equipped with the HORSCH MulchMix shins that aggressively turn and mix soil/residue and create and uniform soil structure. The thorough mixing of soil/residue also accelerates the decomposition process. A variety of tips are available along with bolt-on sweeps.

"One of the unanimous points of feedback that we have gotten over the years when farmers see our European concepts is the desire for thorough horizontal fracture and tilth versus 'ripping' soil," says Jeremy Hughes, Product Manager at HORSCH. "The act of 'ripping' really does nothing to promote uniformity in soil structure. With Omnis FT, soil can be tilled down to 10 to

11 inches and thoroughly across the working width of the machine, giving a fully tilled uniform soil structure. This provides uniform water infiltration, uniform soil warming, uniform residue/soil blending, and also an unrestrictive environment for optimum root growth.

One of the main advantages of the Omnis FT is the ability to work at variable depths. It can go down to 10 or 11 inches for breaking up compacted zones, or it can run shallower, depending on the desired tillage. Another noticeable feature on the Omnis FT is the large-diameter tires for transport and field operation. "One big complaint we hear with primary tillage tools is tires. Small tires on a heavy machine results in getting stuck. Large diameter tires give a tremendous advantage in those unexpected circumstances," says Hughes.

A wide range of options are available depending on field conditions. "We have made the Omnis FT a very versatile concept with the ability to mix and match options on a standard base unit to meet individual needs," says Hughes. A choice of rolling basket, leveling tines, or a three-bar heavy harrow complete the rear of the Omnis FT according to what type of soil finish is desired. An optional rear hitch is available for towing a fertilizer caddy or a pull type finisher, or the unit can be ordered without anything on the rear.

"For several years we have been working in North America with various European primary tillage techniques along with analyzing domestic technologies," says Hughes. "Our goal has been to take those unique global primary tillage techniques and incorporate them into a domestic concept. With Omnis FT, that vision is now a reality."

"When looking at the basics of what we want to accomplish with primary tillage, the first is to accelerate decomposition of harvested crop residues and second is to start the creation of a uniform seedbed soil structure," says Hughes. Harvesting technology today has evolved to effectively manage crop residues, whether it be through fine cut straw choppers or through chopping corn heads. With proper sizing and uniform spreading of harvested crop residues, this is the initial first step of seedbed preparation. After the combine, primary tillage is the next step toward making a seedbed for the next crop. By having residue already sized during harvest, the Omnis FT uses shanks only for tillage, making it a simple yet affective primary tillage concept.

Optional cutting coulters are available if working in longer, less-prepared residue conditions. With the cutting coulter option, one coulter is dedicated in front of each shank. "We learned over the years with air seeders that one coulter in front of each shank makes for cleaner residue through-put while balancing the machine better. We took this experience and put this concept as an option on Omnis FT," says Hughes.

Omnis FT will be launched in fall of 2019. The range will include 11-foot rigid, 16-foot rigid, 21-foot rigid, 21-foot folding, and 26-foot folding versions. For more information contact your local HORSCH dealer or email info.us@horsch.com

John Deere Launches
Rugged, Heavy-Duty Compact Utility Tractors

New tractors are a simple, reliable solution designed for heavy workloads

Deere & Company

Designed with the operator in mind, the new John Deere 3D Series compact utility tractors, including the 3025D, 3035D and 3043D models, offer a powerful, affordable and easy to use solution for a wide range of jobs. Equipped with a gear-drive transmission and available in three horsepower offerings, the 3D Series tractors are designed to tackle everything from pulling and hauling to cutting and tilling.

"Our customers need rugged, tough machines that can tackle a variety of jobs, just like they do. Whether they own large acreage and want a simple, reliable machine for a variety of jobs, or grow crops, like fruits and nuts, and need a durable support tractor, the versatile 3D Series provides a great solution," said DeMark Cole, product marketing manager, John Deere. "Customers are demanding a gear-drive transmission in the compact utility tractor market, and our 3D tractors provide just that – a simple, dependable, affordable gear-drive machine."

The 3D series features three horsepower levels: 25HP (18.2kW), 35HP (25.5kW) and 43HP (31kW), a weight of 2,778 pounds (1,260 kilograms) and a hauling capacity of 4,000 pounds (1,814 kilograms).

One of the most notable features on the 3D Series is the gear-driven transmission, with two ranges and four speeds each, offering a total of eight in forward and reverse. The location of the fender-mounted gear shift lever provides superior comfort and enhanced control by avoiding the awkward movement of shifting gears between the knees. The rugged drivetrain and heavy-duty components such as a large spiral bevel gear provide maximum durability and increase torque and power to the ground.

A long wheelbase and wide stance increases machine stability and provides a smooth ride, even over the toughest of terrains. The 3D was designed to offer smooth and effortless steering, boasting a tight turning radius and hydrostatic steering system which allows for consistent maneuverability with minimal effort required by the operator.

Featuring an easy-to-reach rear-mounted fuel tank, the 3D Series holds up to 10 gallons (37.85 L), giving users the ability to operate a full eight-hour day without refueling. By locating the fuel tank at the machine's rear, the operator can easily fill the machine and avoid spilling diesel over the hood of their tractor. In addition, rear fuel tank placement increases overall engine performance.

The 3D models are compatible with the all-new John Deere Quik-Knect System. Utilizing one connector for the tractor PTO shaft and another for the implement, Quick-Knect prevents twisting or forcing to line-up the splines when attaching rear implements. Operators now simply slide the tractor and implement connectors together until they click into place.

Additionally, the 3D units deliver strong drawbar performance and boast a three-point hitch that can lift nearly 1,600 pounds. Rear-mounted implements are easy to align and attach with optional telescope draft, saving time and effort.

The 3D Series is available with a 300E Loader, adding to the versatility of the tractor. The two-pump hydraulic system allows users to easily steer and lift the loader at the same time. While one pump is dedicated to steering, the second manages other hydraulic functions.

The 3D machines can also be equipped with optional halogen or LED work lights, increasing the area of visibility for improved productivity and maximized overall operating time.

The new models are backed by the John Deere full machine standard two-year warranty, which promises to fix any defects in materials and workmanship for two years after delivery, or 2,000 hours. And the 3D's powertrain is covered by a six-year, 2,000 hour warranty.

To learn more about the new 3D Series, as well as the full line of John Deere compact utility tractors, visit www.JohnDeere.com or contact your local John Deere dealer.

Underwater Drone

offers exciting ways to study water quality

By Connie Sieh Groop
Special to the Farm Forum

Drones flying through the sky assist the ag world in collecting data. At Dakotafest, a drone operating underwater drew a great deal of attention at the South Dakota State University Extension tent. It's a huge change in the way researchers can study water quality in lakes and streams.

SDSU Junior Alex Masloski showed how the drone worked in a pool within the tent. He is from Blaine, MN.

SDSU students JJ Dooyema, Luverne, MN, left, and Alex Masloski of Blaine, MN, showed the underwater drone at Dakotfest. *Photo by Connie Sieh Groop*

"Currently, grab samples are collected at a few points in lakes and streams to determine water quality. In a lake that means you need a boat to drive to a location, take a sample, then move to another location, take another sample and repeat. With the drone, I can program it to use a GPS system designed to work underwater to follow a predetermined path. The drone will automatically drive along the programmed path, collecting water quality data every few seconds with a cluster of sensors. We take the data back to SDSU to visualize it, but we hope to map out the water quality data in real time. The goal is to fill in the gaps left by grab samples taken at a few points and provide in-depth, real-time data."

The drone costs about $30,000 and weighs 35 lbs. Tethered by a Teflon line with a 350-lb. load limit, it is battery-operated and it sends the information it sees to a laptop so the researchers can see the data as the drone moves about. The team is working on mounting a cluster of electronic sensors used to test the water in real-time.

Because the drone is submersible, it allows testing at different depths and the water quality can vary by depth. For example, disturbance of sediments at the bottom of a lake can decrease clarity near the bottom, while changes to discharge rates can impact the clarity of streams and rivers. The cluster of water quality sensors can measure several water quality indicators such as salinity, turbidity (or clarity), nitrates, and chlorophyll levels. The sensors can provide these measurements much more rapidly than traditional grab samples, and when integrated with the drone, will allow repeatable measurements at many spatial points in the water body.

Funded through the SDSU Department of Agricultural & Biosystems Engineering, Masloski's internship has him working with Aaron Franzen, SDSU Assistant Professor of Agricultural & Biosystems Engineering, and Rachel McDaniel, SDSU Assistant Professor & Water Resource Engineer, who will put the drone to work.

Masloski began working on the drone project in January 2019. Along the way, with the help of Franzen, he used his engineering skills to build and program the drone which will be used McDaniel's research team to study water quality. The drone arrived at SDSU

in kit form, including an electronics bundle that contains much of the same electronic hardware that is used to control aerial drones. Masloski assembled the drone as an upgraded heavy-lift variant, configured the software, and wrote manuals for future researchers that need to pilot it after his graduation from SDSU. Drone operators pilot the drone using an Xbox 360 controller which is intuitive for students who often have experience with video games.

At Dakotafest, Masloski turned the controller over to one of the young people fascinated by the exhibit.

Under the watchful eye of SDSU student Alex Masloski, Gabriel Aughenbaugh, DeSmet, got a chance to try the drone, easily catching on to the controls. *Photo by Connie Sieh Groop*

Gabriel Aughenbaugh, whose family farms near DeSmet, got a chance to try the drone, easily catching on to the controls. He said, "It was hard to turn [the drone] but it would be pretty neat to have that in the pond to see the bullheads."

The water quality sensor array on the system is most commonly used on its own, with data downloaded after sampling from the boat. Masloski is working on integrating the drone and sensor array to provide real-time water quality data collection and visualization on a map showing where the measurements are located.

"Doing this is really cool stuff. It combines learning engineering to develop the drone and programming the drone for use underwater. I also learned what environmental details to look for underwater."

They can use the drone in any body of water that is deep enough to cover the drone. The camera at the front of the drone provides a real-time view of the scene in the system's front. The drone pilot can use the live video feed to watch for unexpected events or findings and mark the 3D location as a spot for future testing. It also has a grabber that can take samples from plants or sediment found in the water body.

In working on the project, Masloski learned more about how agricultural and biosystems engineers work together to provide solutions. "I walked in with four semesters of college under my belt when I started working on this project. SDSU provided me with the resources and guidance to use what I've learned to get real-world experience to develop innovative technology. Extension provides a lot of research and practical applications that people can use in agriculture. While working on the drone this summer, I also shared what I've learned through public outreach at events like Dakotafest."

The drone offers a whole different look at the underwater world. "When you look at a patch of weeds from the surface, it's hard to know what is in the water around them. It's untouched territory that is so much different from what we see from the surface. You can learn so much more when the drone can dive below the water and show you what's there."

"The drone is very intuitive for college students who have played video games," McDaniel said. "Combining the drone with the sensors allows us to get a very good picture of water quality. We'll use it as a teaching tool and a research tool to understand water quality in 3-dimensions. This project emphasizes the diverse topics addressed by agricultural engineering by combining several topics covered in the major including mechanical engineering, signal processing, and environmental engineering."

Shown at right is SDSU Student Alex Masloski who worked on the drone project and at left, John McMaine who assisted Alex at Dakotafest. He is a water resources Extension faculty member in the ABE department. *Photo by Connie Sieh Groop*

KUHN Releases New Optidisc® Elite Cutterbar

Kuhn North America is excited to announce the introduction of the new KUHN Optidisc® Elite cutterbar.

Farmers strive to produce the best forage possible for their animals. The new Optidisc Elite cutterbar design has an even lower profile, while retaining the performance and reliability features of the original Optidisc cutterbar. Developed in partnership with farmers through testing in fields around the world, the Optidisc Elite cutterbar has the performance to meet today's demands for high-quality hay.

The Optidisc Elite's low profile cutterbar creates a smooth, clean cut with minimal ash incorporation due to a very flat cutterbar angle even at low cutting heights. Additionally, differential disc spacing utilizes narrower spacing at the diverging discs for extra knife overlap to create a clean cut even when the grass is short or light. Wider spacing of the converging discs provides more space for the crop to pass from the cutting area; improving the cut quality. Free-rotating Fast-Fit® knives also help enhance cutting quality and provide longer knife life.

KUHN's patented Protectadrive® disc bearing stations are designed to shear outside the gear case upon striking a major obstacle, protecting the gears inside the cutterbar. The equal sized gears in the cutterbar allow maximum power transfer with even torque loads across the full cutting width. Maintenance and downtime are minimized with a lubed-for-life design requiring no routine oil changes.

The Optidisc Elite cutterbar is now available on select KUHN GMD mowers and FC mower conditioners.

GoatThroat Pumps

strives to keep farm workers healthy and safe while handling hazardous chemicals

With a legacy of manufacturing quality closed-transfer-system equipment, GoatThroat Pumps continues to support agribusiness by providing ready to use solutions for safe handling of plant protection products that are vital to putting food on Americans' tables.

Using Closed and Sealed Systems for Loading and Mixing Plant Protection Products. *Courtesy Photo*

There are some occupations that are known to be high-risk with potentially life-threatening conditions, such as firefighters and police officers; while other jobs may seem safe, but can still pose health risks if workers are exposed to hazardous materials.

Agribusiness workers, such as farmers and farm workers, are frequently exposed to potentially harmful herbicides and pesticides, which can lead to severe, long term health issues. According to the National Center for Biotechnology Information, a study conducted in Iowa and North Carolina found that the rate of prostate cancer was higher among growers than other residents. In fact, farmers and those exposed to soil and plant treatments were 20 percent more likely to report having prostate cancer. Exposure and improper handling of pesticides can also cause non-life-threatening health conditions such as skin and eye irritation, reproductive problems, and can also have a long-term effect on the nervous system.

Pesticides handlers are more exposed at the initial loading and mixing phase today than they were decades ago, yet many are still using antiquated methods that have not evolved with the soil and plant treatments. Outdated "tipping and pouring" methods originated when the concentration levels of pesticides were much lower. Today, they have very high concentrations so farmers can dilute the treatments themselves and use the product more efficiently.

It is important to educate workers and employers about the dangers and introduce preventative measures that mitigate risk. With safe work practices, personal protective equipment (PPE), and the proper closed-transfer-system equipment for loading and mixing, workers are able to avoid potentially hazardous, and sometimes costly, situations. Additionally, federal and state agencies work hard to keep up with the evolving agriculture industry by introducing new safety standards that protect farmers and pesticide handlers.

The EPA's Worker Protection Standard (WPS), for example, is specifically aimed at reducing the risk of pesticide poisoning and injury among agricultural workers and pesticide handlers. The WPS offers occupational protections to over 2 million of our agricultural worker neighbors.

Another recent example is the EPA's new requirements for handling paraquat dichloride (paraquat), which will help to prevent avoidable fatalities and other serious injuries from mishandling the Restricted Use Pesticide. Focused on additional education and implementing safer handling of the herbicide, the new EPA requirements include special training, special certification, and new and special closed system packaging containers, which also requires new special closed system equipment to be developed and in use by September 2020.

Closed systems can dramatically improve the safety and efficiency of pesticide transfers and subsequent mixing. A closed transfer system reduces unnecessary exposures by removing the liquid from its original shipping container and transferred through connecting hoses, pipes, and/or couplings that are sufficiently tight to prevent exposure of any person to the pesticide concentrate, use dilution, or rinse solution. This eliminates worker exposure from over-pouring, spilling, or releasing vapors. In fact, California, the largest agriculture-producing state, required a closed transfer system for mixing and loading for certain pesticides long before the EPA issued new requirements. For the last two decades, the U.S farming community has been able to eliminate spills, reduce material waste and keep workers safe by using GoatThroat pumps to safely mix, load and apply plant and soil treatments that are vital to putting food on people's tables.

For example Jon DiPiero, who managed Ricci Vineyards, a small wine grape vineyard in Sonoma, turned to GoatThroat Pumps when looking for a safer, more efficient way to transfer pesticides for mixing and spraying that also complied with California's closed system requirement. His research showed that GoatThroat systems are simple to use, eliminate chemical exposure to the handler and are considered to be a best practice for agriculture.

"The pump is closed, sealed, and allows containers to remain in an upright position, it complies with state regulation and virtually eliminates the potential for all forms of chemical exposure," says DiPiero.

According to DiPiero, a multi directional spray attachment also enables rinsing of every corner of container without having to pour into it and shake it. He said this helps to minimize exposure when cleaning a container for reuse and complies with California "triple rinsing" requirements.

"Whether for pesticides, herbicides, fungicides, or liquid fertilizers, a closed and sealed pump design helps with the safe production or mixing of any liquid chemical," says DiPiero.

Wolsey company offers improved designs for *sheep equipment*

By Connie Sieh Groop
Special to the Farm Forum

Glenn Jungemann of Wolsey raised sheep for 45 years and knows that good equipment is essential to working animals.

He explained. “As I get older, I want to continue to be active in the industry. This tub-and-alleyway makes is easy to maintain my 500 ewes.”

Livestock handling can be difficult. Jungemann saw the need for quality equipment that was easy to set up. He wanted something that was more consistent, was of higher quality and could move sheep and goats better than what was on the market. What he designed makes it much more enjoyable to work sheep.

The business started in March when he had Spink Colony near Frankfort build some designs for his use. Others saw them and wanted to purchase them. Glenn formed a corporation called Glen Specialty Equipment. Included in the company are Mike Roman, who is in charge of sales and product development; Spink Colony, who are in charge of design and fabrication, and Glenn Jungemann, who is in charge of operations.

These livestock tub and allies are very portable and can be pulled behind the pickup without any issue. It can be used for sorting, working, and vaccinating. An ultra-sound table or a tip-table can be added on the end.

The alley is 15-feet long and the tub has a radius of 6 feet. “We have a pass-through gate in the alley. It easily holds 25 lambs and 15 ewes. As sheep get used to going through, we don’t use the crowd gate, they just flow through as they become familiar with the system.”

The 3-way sort works with one hand utilizing a cutoff gate, to curtail the flow of livestock in a one-handed process.

“You just have to use one hand,” he explained. “It closes off in fractions of seconds since it’s spring loaded. It closes on its own, too.”

Jamason Larson of Langford bought the alleyway and said, “I can set up the alleyway, and with my 6-year-old daughter behind the sheep with the rattle paddle, it works really well to work my 350 ewes. I’ve got my own lambing jugs that fit right into it. I like the portable set-up as it takes only 5 to 10 minutes to set up and away we go.”

This shows the Sheep Sorting Alley built by Glen Speciality Equipment at Wolsey. *Photo courtesy of Glen Specialty Equipment*

Another customer, Tammy Basel of Union Center said, "I like the three-way sort and the way the gate is designed to hold the animals when the chute is full. It features bars at the bottom of the alley. When sheep back up, they feel it on their hocks and stop backing up and go ahead. The cage on top of the alley is very helpful as it keeps sheep from jumping out."

Tammy said that in 2 ½ hours, they worked 700 ewes, leaving enough time in the day to handle other chores.

They also make a 20-foot freestanding feed bunk that can be attached and is also very portable.

And best of all, Jungemann says the product is surprisingly affordable.

The products have been popular at the farm shows, including the SD State Fair. They've been at ewe and ram sales in Billings, MT, and Newell, SD. "People understand who we are and what we build."

"We strive not only for customer service but for customer satisfaction with our relationships. We want customers to enjoy the experience."

Inquiries may be sent to:
sheepequipment@gmail.com or
call **Mike 605-295-0317** or **Glenn 605-350-4724.**
Sheepequipment.net

AeroVironment Advances Drones in Farming

with donation of more than 90 Quantix Drone & AV DSS Ecosystems to 35 University Agriculture Departments across the US

AeroVironment, Inc. (NASDAQ: AVAV), a global leader in unmanned aircraft systems for both defense and commercial applications, today announced its 2019 Quantix & AV DSS University Collaboration Project. The project's focus is to advance academic research, applications and crop production practices to improve the future of farming through the use of unmanned aircraft systems (UAS) and advanced data analytics.

University of Louisiana Monroe UAS major Stephanie Robinson holds the Quantix drone, donated by AeroVironment to the school's Precision Agriculture and UAS Research Center. *Photo Courtesy of The University of Louisiana, Monroe*

Through the project, AeroVironment has donated more than 90 Quantix™ hybrid drone & AV DSS™ ecosystems to the agricultural departments of 35 universities throughout the U.S., including Purdue University, The Ohio State University, Cornell University, University of Louisiana-Monroe, University of Florida, University of Georgia, North Dakota State University, Cal Poly San Luis Obispo and many others.

Participating universities will employ AeroVironment's Quantix hybrid drone & AV DSS data analytics platform in a variety of in-field trials, application usage studies and precision agriculture systems research covering areas such as crop nutrient & input management, artificial intelligence for detecting weeds, pests and diseases, and improved accuracy of crop yield prediction. Participating universities will share their hands-on experience, along with use-case insights that can improve in-field performance and advance the adoption of drone-based technologies for the agriculture industry.

"Working with industry leaders such as AeroVironment allows our program to stay on the forefront of the UAS field. The donation of two drones to our program will allow us to provide outstanding hands-on experience to our students," said Paul Karlowitz, director of operations, University of Louisiana Monroe's Precision Agriculture and UAS Research Center.

Featuring automated precision flight operation and an innovative VTOL (vertical takeoff and landing) hybrid design, Quantix is purpose-built for crop scouting, and can survey up to 400 acres in just 45 minutes. During flight, integrated sensors capture high-resolution color and multispectral imagery via dual 18 megapixel cameras. On-board processing wirelessly transmits true color and NDVI imagery to the included operating tablet as soon as the drone lands, allowing growers to investigate issues while still in the field. For more detailed analysis, Quantix seamlessly integrates with AV DSS to perform advanced image processing and data analytics, including True Color, NDVI, GNDVI, canopy coverage, anomaly detection and more, providing users with deeper insights into plant emergence, vegetative health, inputs and resource management.

"AeroVironment's donation of Quantix & AV DSS will enable participating universities to quickly and easily gain the on-demand field intelligence they need to advance multiple areas of agriculture research, while enhancing the understanding and application of drone-based technology," said Rick Pedigo, vice president of business development at AeroVironment. "With on-demand access to high resolution imagery and advanced data analytics, we're preparing the latest generation of farmers to employ drone technology (Quantix & AV DSS) throughout their farming practices, improving crop production and farming efficiencies for years to come."

"Working with the team at AeroVironment moved our drone-based agriculture research forward beyond what we could have done otherwise," noted professor Quirine Ketterings, Cornell University Nutrient Management Spear Program. "Ultimately, our goal is to develop accurate corn yield predictions based on in-season nitrogen applications to achieve an optimal economic return for the producer."

Farm Dog scouting app enables the use of TerrAvion imagery to guide efficient scouting

High-Resolution Imagery Flawlessly Integrated with Best-in-Class Agricultural Scouting App

TerrAvion

Adding functionality to the high-quality image data TerrAvion provides, compares to adding whipped cream on top our your favorite pie; it makes it only better. The integration of TerrAvion high-resolution imagery in the Farm Dog mobile scouting app gives agronomists a way to effortlessly view your TerrAvion data layers on your phone or tablet while you are in the field scouting. Detecting whether there are problem areas on acres that need inspecting from your office and focusing on those areas only is a tremendous time-saver. Once you start scouting, Farm Dog provides a simple way to record field observations and share your findings with team members. Farm Dog lets you customize your data the way it works best for you and shows easy-to-select growth stage and pest names to match your local situation.

"Farm Dog's unique and award-winning platform with its straightforward way to record field data such as pest type and severity level offers tremendous convenience for our customers," says Amariah Fuller, Chief Product Officer at TerrAvion, "helping them in the field adding notes easily to the issues they detected with TerrAvion imagery in their office. Moreover, Farm Dog's mission to help growers reduce pesticide use, protect yields, and to be good environmental stewards aligns closely with TerrAvion's vision on supporting agriculture sustainability."

"TerrAvion aerial imagery integration has been requested by Farm Dog users across the US due to its recognized brand and proven value among growers and agronomists. It is a testament to TerrAvion's powerful, continuously growing imagery dataset how much time our users will be able to save with this integration," says Liron Brish, CEO of Farm Dog. "Growers need to be able to quickly and easily know where to look for pest and diseases in their fields. With the aid of TerrAvion's data, they can go directly to problem spots, note what is going on, and make an informed treatment decision quickly and effectively. We are excited that by working together, Farm Dog and TerrAvion are able to provide actionable insights to growers."

One of the advantages of TerrAvion subscription aerial imagery is the frequency, which makes sure that you have data around the key events in your fields. The timing and frequency of the data allow an excellent alignment to learn whether certain inputs are needed. Farm Dog's field scouting platform enables users to:

- Easily record field data such as pest type, severity level, photographs, and geo-markers;
- Send field notes to other stakeholders directly and automatically from the field;
- Review field history and field treatment efficacy to arrive at improved treatment decisions.

The TerrAvion platform then enables to make, for example, variable-rate zoning maps to effectively treat those areas with what you noted in the Farm Dog app.

ADAMA Announces New Ag Service: ADAMA Eagle Eye™ Powered by Agremo

ADAMA US, a leading global crop protection company, announced today a new service offering for its customers. ADAMA Eagle Eye™ powered by Agremo offers an advanced analysis of aerial data and imagery that helps growers protect yields more efficiently through user-friendly maps, statistics and other practical tools.

Insights from this web-based tool lead to lower production costs and higher yields for growers looking to turn their drone-collected images into actionable and accurate data. ADAMA Eagle Eye powered by Agremo analysis reports use aerial footage to simplify field scouting and take the guesswork out of crop progress.

The technology is backed by Agremo, a company that focuses on simplicity in precision agriculture. ADAMA Eagle Eye powered by Agremo uses high-end technology that's easy to use, easy to grasp, and easy to run to help drone operators and agricultural consultants and producers achieve higher outputs. The technology was successfully applied in more than 100 countries on more than 100 crop types, for various plant counting and plant health analytics.

Jake Brodsgaard, CEO at ADAMA US, said, "We're excited to offer this extended service to our customers and contribute to the effective use of agriculture inputs. This advanced technology, coupled with ADAMA's broad portfolio of solutions, extends the value we bring growers."

New Holland celebrates 45 years of Twin Rotor technology *by rolling out new combine updates*

2020 models to feature best-in-class grain quality, lowest losses and increased capacity

Celebrating 45 years of New Holland-pioneered Twin Rotor® technology, 2020 will mark an exciting year for the agriculture equipment leader in combines. The CR Series 2020 models will feature a significant power upgrade, updates in the revolutionary proactive IntelliSense™ system, and significant cab and capacity improvements to bring more profit to farmers' bottom lines.

Next year will mark 45 years since New Holland originally introduced its Twin Rotor combine in 1975, the TR70 with 145-168 horsepower. 2020 models include the CR8.90 with a Cursor 13 engine and 571 peak horsepower (up 54 horsepower from 2019) and the CR7.90 with a Cursor 9 engine and 460 peak horsepower. The CR8.90 is now the most powerful Class 8 combine on the market, designed for the toughest harvesting conditions, including the challenging green stem soybean. These models are designed to deliver outstanding capacity per hour with the same remarkable grain quality and low losses as the previous series. The 2020 models, built in Zedelgem, Belgium, feature increased horsepower and Stage V emission certified engines as part of New Holland's clean energy leadership position in the market.

"This is truly our best combine yet for green stem soybean harvesting," says Luiz Miotto, combine product marketing manager for New Holland, North America. "Our focus is that the operator gets the highest yield possible from their fields even in the most challenging conditions, with maximized power, capacity, grain quality and uptime. These features, along with low grain losses, result in more grain in the bin, protected from weather, for more sustainable and profitable harvesting."

The benefits of the New Holland CR combine are also confirmed by an independent third-party, PAMI, and as reported the CR combines can deliver more productivity by harvesting more acres per hour with less fuel and fewer losses over the competition. Per the PAMI study, on a 5,000-acre farm (2,500 wheat and 2,500 canola), operating the New Holland CR combine translates into greater savings and returns due to faster harvesting and lower combine losses. The result is $23,000 in total savings to the grower, or $4.60 per acre.

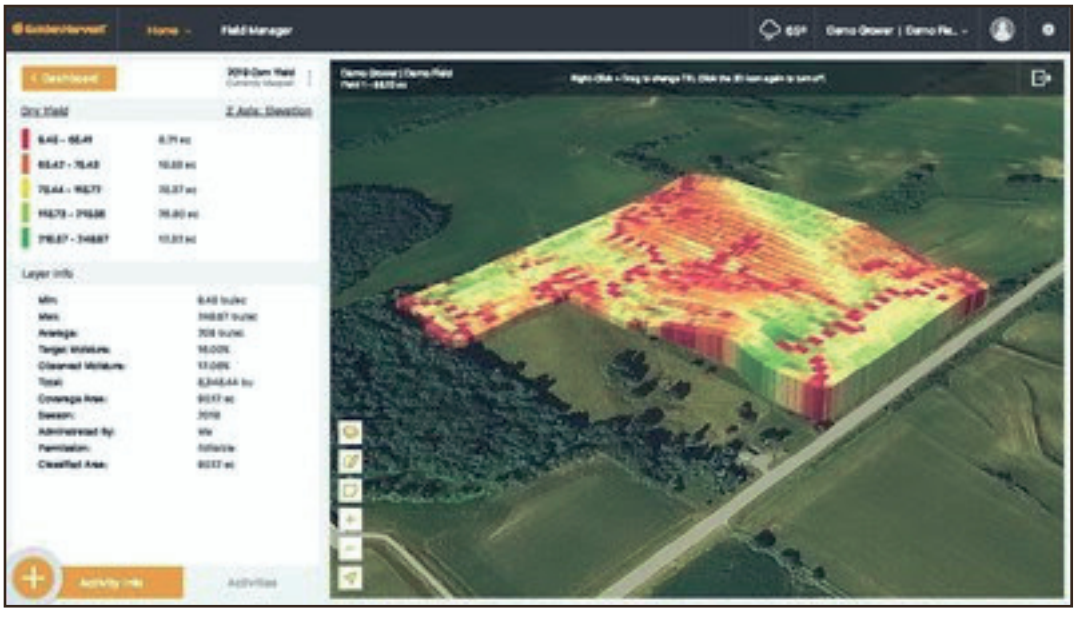
One of the CR Series' most revolutionary features is the full-line integration of IntelliSense technology. New Holland's IntelliSense is a proactive, automatic combine setting system capable of selecting the best settings out of 280 million possibilities. The information from various sensors is analyzed by the computer and adjustments can be made every 20 seconds, following the strategy set by the farmer, such as Maximum Capacity or Best Grain Quality. By constantly adjusting the combine settings, the system can increase daily productivity by up to 20 percent. For 2020 models, IntelliSense can manage barley crops and introduces an advanced mode to further enhance its capabilities.

"The Twin Rotor combines have showcased the ultimate in harvesting performance since their introduction 45 years ago," Miotto says. "Our team of engineers were ahead of their time. Since then, we have taken significant steps forward in the technology to continue to stay at the forefront. The 2020 models will continue that legacy with our highest-performing models to date."

Other important updates for the 2020 models, made to match the enhanced capacity and productivity, include a darker cab interior which reduces driver fatigue during night operation, the addition of two USB ports and a modern cab climate control panel for more comfort, and a clean grain elevation with 10 percent more flow capacity. These models will also feature an optional Dynamic Feed Roll (DFR) Reverser, enabling the operator to clear DFR blockages from the cab, reducing downtime in the field.

Golden Harvest connects with John Deere Operations Center for

farmer-focused data integration



Farmers who grow Golden Harvest® corn or soybeans will soon have more data integration available to enhance their on-farm decision-making. This fall, Golden Harvest is connecting with the John Deere Operations Center through John Deere's API services so that farmers will be able to receive better recommendations via E-Luminate®, the Golden Harvest digital ag platform.

This is the first data integration for E-Luminate, which is available on desktop and as a mobile app. E-Luminate already helps farmers fine-tune hybrid and variety placement, as well as support management decisions throughout the season, via high-resolution imagery. Now, integration with the John Deere Operations Center will provide an automatic and seamless assimilation with yield data to improve seed decisions.

"To unlock data's full potential, it needs to be available in the tools that farmers actually use," said Justin Welch, Syngenta digital product manager. "Bringing together John Deere – one of the largest trusted data advisors – with E-Luminate means Golden Harvest farmers will be more empowered than ever to make informed, impactful decisions."

This winter, farmers will be able to share harvest data with their Golden Harvest Seed Advisors automatically via E-Luminate to inform seed decisions for next season. This connection will help farmers to capture the full value of their Golden Harvest seed investment.

E-Luminate is provided free of charge to Golden Harvest farmers as a value-added service available through Golden Harvest Seed Advisors.

"We're investing in digital tools because actionable data helps farmers get the full benefit from their seed purchase," said Welch. "We believe E-Luminate and services like it should be included in the cost of doing business. When you buy seed from a Golden Harvest Seed Advisor, you're not only going to get top-performing corn and soybeans, but also the recommendations and trusted service you need to maximize your profit potential."

Yellow Field Pea market
provides alternative crop

These are some of the PURIS field peas that were on display at Dakotafest this summer. *Photo by Connie Sieh Groop*

By Connie Sieh Groop
Special to the Farm Forum

Puris Yellow Field Pea varieties are alternative crops drawing interest from a number of farmers within the state of South Dakota. Last year, about 7,000 acres of yellow field peas were planted, and overall yellow field peas have been grown for almost a decade in South Dakota. Puris, headquartered in Minneapolis, took over operation of the South Dakota Pulse Processors LLC's facility in Harrold during the latter part of 2018 so that has helped to develop the market.

"We are an 'end-to-end' producer of organic and non-GMO pulses and soybeans that provide protein for finished foods. It all started with our own germplasm of seed varieties which first started being developed in 1985," according to Renae Larson, Marketing Lead for Puris.

Renae Larson is the Marketing Lead for PURIS. *Photo by Connie Sieh Groop*

"PURIS contracts with farmers to produce proprietary seed varieties. Following harvest, PURIS purchases the peas back from the producers and processes them at the PURIS Pea Processing facility in Iowa where pea flour is made. From there, the pea flour is used as a raw material for the Pea Protein Isolate process at the PURIS facility in Turtle Lake, Wisconsin, which separates the flour into starch, fiber, and protein. Currently, plant based proteins are very popular in the U.S. and pea protein, fiber, and starch are important ingredients for several types of plant based foods. Plant based meat, dry beverage blends, protein bars, ready-to-drink (RTD) beverages, to name just a few."

Larson said that peas like cool temperatures so they can be planted in March and April depending on a grower's location. The peas germinate at 36 degrees and mature in 90 days. Yellow field peas do not like wet feet, to be planted in high moisture. Most years, yellow field peas miss the high heat index during the summer. However, this year, the peas were planted late due to a wet spring and some plants suffered as a result of the heat and wet conditions. Despite the wet start to the season and the heat affecting the yellow field pea production, there were area that yields reached 56 bushels to the acre or more.

"Puris contracts the yellow field peas at a higher price than the U.S. market. It is a closed loop system and an internal market demand, which allows PURIS to offer producers a fixed price at a very competitive level," Larson said.

The contracts are a buyer's call contract, so on-farm storage is necessary until the peas are delivered to PURIS processing facilities. PURIS' extensive breeding work has produced genetics that have shatter resistance during the time of maturity as well as high yielding characteristics adapted for a wide geographical area. PURIS provides ingredients that are soy free and gluten free, which means producers who also grow corn and soybeans need to have separate bins for the peas and need to wash out the bin(s) and equipment before handling and storing the peas.

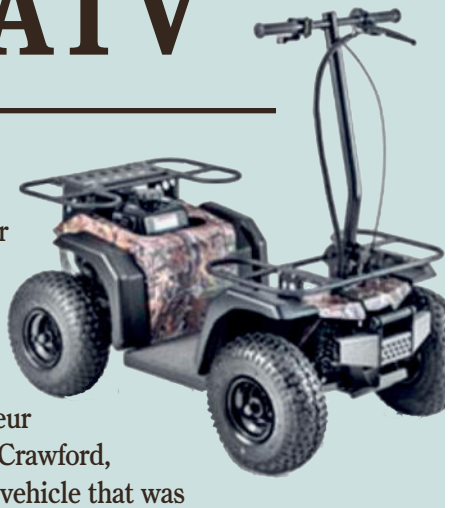
"PURIS has an agronomist that works with the producers to provide guidance in regards to raising yellow field peas successfully," Larson said. "Many growers have never grown peas before, as it is an immature market, so there are methods PURIS can help the producers with based on twenty years of R&D of yellow field peas. The agronomists help scout and let the farmers know how to determine how to handle and harvest efficiently."

The peas provide a good crop in producer's rotation as they add nitrogen to the soil, have lower input costs and a cover crop can be planted following harvest.

"PURIS is excited about the operations of the facility located in Harrold, and the opportunity to work with the local producers and the great people of South Dakota," Larson said.

Interested in growing for PURIS?
Visit **www.purisfoods.com/growers** or email **seed@purisfoods.com.**

Nebraska Company builds new type of ATV



After producing commercial fertilizer spreading/spraying equipment for the landscape market for the last 12 years, Nebraska entrepreneur and engineer, Brice Crawford, set out to develop a vehicle that was compact, lightweight, and functional. His new company, Rogue10 Inc., has recently developed a new stand-on ATV called the Ripper. The goal of the Ripper is to provide users with a vehicle that was as easy to use as a golf cart, as fun to ride as a stand-on scooter, and as practical as an ATV.

The Ripper is a stand-on ATV that is intended to transport a rider and gear. Its compact design and low weight means that it has very little impact on the environment. It is powered by a proven Honda engine and includes front and rear racks for hauling tools, coolers, hunting gear, fishing gear and more. It can be driven in the standing position or there is a seat option as well. The handlebars can be folded for easy transport and it is light enough to lift into the back of a truck or SUV. It is the perfect vehicle for camping, hunting, fishing, farm or utility.

The company's headquarters and manufacturing facility is in Lincoln. Previously, Brice Crawford, successfully built and sold Rocket Mobility, an all-terrain wheelchair manufacturer. Most recently, he sold his fertilizer spreading/spraying equipment company, Ground Logic, to Briggs and Stratton, a Fortune 1000 company.

For more information on the company and products, please visit www.ripperatv.com. To contact Brice Crawford, call 531-500-5900 or email brice@rogue10.com.

Fendt® unveils the New 900 Series Tractors
at 2019 Farm Progress Show

Five all-around workhorses are designed and built for North American producers to deliver unprecedented fuel efficiency, uptime and crop-friendly benefits

Fendt®, a worldwide brand of AGCO (NYSE: AGCO), introduced fully redesigned Fendt 900 Series tractors to North American producers at the 2019 Farm Progress Show, Aug. 28-30 in Decatur, Illinois.

Five new Fendt 900 Series tractors range from 296 to 415 HP and are all-around workhorses designed specifically to meet the needs of producers in North America and deliver unprecedented fuel efficiency, uptime and agronomic benefits.

These new Fendt tractors offer many of the cutting-edge technologies of the Fendt 1000 Series and are built upon Fendt's 90 years of engineering innovation and manufacturing excellence for unequalled reliability.

They are powered by six-cylinder, 9.0L MAN engines with the low-rev engine concept working in unison with the Fendt tractor management system (TMS) and Fendt stepless VarioDrive continuously variable transmission (CVT). With this combination, the engine operates at a maximum engine speed of 1700 rpm, providing exceptional pulling power, using less fuel and reducing wear on the engine components.

Each tractor is backed by Fendt Gold Star Customer Care, assuring more value and more uptime. This includes a full warranty for 36 months or 3,000 hours plus all scheduled maintenance, including the cost of oil, filters, belts and maintenance items during this time.

Designed to fit any operation as the primary high horsepower tractor, they offer a light base weight with high ballasting capabilities, are compact and maneuverable, easy to configure and adapt to any operation and fea-

ture the Fendt-exclusive VarioGrip™ in-cab, tire inflation system that helps reduce yield-robbing compaction.

The five new Fendt 900 Series tractors are all-around workhorses built upon Fendt's 90 years of engineering innovation and manufacturing excellence. The 900 Series tractors are designed specifically to meet the needs of producers in North America and are available in five models ranging from 296 to 415 HP. They feature many of the cutting-edge technologies first introduced on the Fendt 1000 Series in agile, crop-friendly machines that will handle any task a crop producer, large-scale cattle operation or custom farming operation faces. As with all Fendt machines, they deliver unmatched reliability and are backed by the Fendt Gold Star Customer Care full warranty and service for 36 months or 3,000 hours.

"If you've dreamed of having a totally reliable, high horsepower tractor that can tackle nearly every job on your farm and help lower your operating costs, the Fendt 900 Series tractor is one you will want to take a serious look at," says Andrew Sunderman, tactical marketing manager for high horsepower tractors. "Fendt engineers designed and built these tractors with the goal of lowering the operating costs and providing optimum use for our customers."

"To do that, they used technologies in common with the Fendt 1000 Series tractors, such as a MAN engine that operates with Fendt's low engine-speed concept and the Fendt VarioDrive CVT transmission. These technologies have brought our 1000 Series customers a huge benefit that can clearly attribute savings to the bottom line. We fully expect to see the same level of performance and fuel efficiency in this smaller, more maneuverable package," Sunderman says.

The 900 Series includes five models, the 930 (296 HP), 933 (326 HP), 936 (355 HP), 939 (385) and 942 (415 HP). The powerful, six-cylinder, 9.0L MAN engine with the low-rev engine concept works in unison with the Fendt tractor management system (TMS) and Fendt stepless VarioDrive continuously variable transmission (CVT). This combination allows the engine to operate at a maximum engine speed of 1700 rpm, providing exceptional pulling power while using less fuel and reducing wear on the engine components. Each of these design aspects helps reduce the cost of ownership over the life of the machine. Even more impressive than the low maximum engine speed is the tractor's ability to deliver maximum torque from 1150 to 1400 rpm for maximum pulling power and effective power transfer, which maintains the desired ground speed and reduces wheel slip for minimal impact on the soil.

Row crop-friendly features benefit crop productivity, operation efficiency

"Our goal is to bring customers tools that help them increase their productivity while lowering their capital and input costs per acre," Sunderman says. "To that end, the 900 Series tractors are designed to fit any operation as the primary high horsepower tractor. They offer a light base weight with high ballasting capabilities, are compact and maneuverable, easy to configure and adapt to any operation and feature the Fendt-exclusive VarioGrip™ in-cab, tire inflation system that helps reduce yield-robbing compaction."

The operating weight of the five Fendt 900 machines ranges from just under 25,000 lbs. up to 42,000 lbs. Their convenient front mono-block ballasting system, with weights from 1918 lbs. (870 kg) to 5512 lbs. (2500 kg), lets the operator quickly re-ballast the tractor for the job at hand. They are compact and agile. The narrow transaxle combined with the pull-in turn action provides a shorter, smoother, more precise turn for

better maneuverability in tight spaces and with narrower implements. The maintenance-free double-wishbone front-axle suspension system also provides industry-leading ride comfort and stability on the road. With nearly 8 inches of vertical travel, it also ensures stable ground contact and traction on uneven field terrain.

The Fendt VarioGrip tire inflation system allows the operator to deflate tire pressure from the cab with the push of a button, providing up to 15 percent more tractive power and improved ground contact with reduced soil compaction in the field. This Fendt-first innovation also allows automatic tire inflation before traveling down the road, to improve handling and fuel efficiency at road speeds up to 31 mph. VarioGrip is controlled through the Varioterminal, which takes the guesswork out of achieving the right tire pressure for the best results. An extensive selection of wheel and tire options offers nearly limitless combinations to fit the needs of any operation.

Industry's best warranty and service

Each Fendt 900 Series tractor is backed by Fendt Gold Star Customer Care, assuring more value and more uptime. This includes a full warranty, with no deductible, for 36 months or 3,000 hours and all scheduled maintenance, including the cost of oil, filters, belts and maintenance items during this time. In the rare case of a breakdown, Fendt dealers provide industry-leading parts support. If the part isn't available from the dealer, it will be shipped via the fastest option from the nearest AGCO Parts Distribution Center or the factory. Highly trained technicians use the latest technology to quickly diagnose problems at the farm or the shop to save Fendt owners time and money through reduced downtime and lower service fees.

Equipped to match a wide range of implements and jobs

The new 900 Series tractors have a wide range of implement connections at the front and rear to operate a varied combination of front and rear implements, providing more versatility than any tractors in their power class. The tractors offer both front and rear 3-point hitch with position control and responsive load-relief control, front and rear PTO, two front and six rear electrohydraulic double-acting valves, as well as fender controls for the linkage, valves and PTO. The standard rear 3-point hitch offers an impressive 21,500 lbs. of lift capacity, while the optional front 3-point hitch can lift up to 12,310 lbs. for even more versatility.

The 900 Series is available with three hydraulic pump options providing up to 113 gpm of hydraulic oil flow through the optional dual-pump, dual-circuit hydraulic system. The Fendt-exclusive dual-circuit hydraulic system provides two levels of hydraulic capacity, keeping full capacity on reserve until the tractor is paired with an implement with high hydraulic demands, such as a large planter. This reduces horsepower needed for less demanding work and ensures the tractors can power the most demanding implements today and well into the future. The system also provides higher flow at lower engine speeds for better fuel efficiency and less engine noise for a better operator experience. Just like the other Fendt tractors before it, the 900 Series features separate hydraulic oil reservoirs for the implement and vehicle hydraulic systems, ensuring adequate flow while preventing cross-contamination in the hydraulic oil and extending the service interval to 2 years or 2000 hours.

Operator comfort and convenience is Fendt hallmark

True to Fendt tradition, the 900 Series doesn't disappoint when it comes to operator comfort and ease of use, making long hours in the field shorter and less stressful for operators with ranging levels of experience. The quiet, roomy Life cab includes the Fendt-first Profi joystick, comfortably positioned on the armrest. It repeats the easy-to-learn-and-use color-coded control buttons found in all Fendt tractors, so moving from one Fendt to the next is a natural and stress-free transition.

Fendt also originated the touchscreen central control system. The 900 Series includes the latest 10.4-inch Varioterminal for control of all tractor settings and adjustments, implement control, guidance, cameras, documentation and more. This system is set up and field ready from the factory for immediate on-farm use.

For operator comfort, Fendt uses more air than any other manufacturer. In the Fendt 900, air is employed in the cab suspension system and air-ride seat. Air brakes for the machine and air brake controls for towed implements provide smooth, effective and reliable stopping power. Fendt's exclusive front suspension design also contributes to ride comfort.

A sleek, narrow hood design and nearly 60 square feet of glass surrounding the operator offer a full 360 degrees of visibility. In addition, the 900 Series offers the same state-of-the-art lighting system found on other Fendt tractors. With a full package of optional LED lights, this lighting system will produce up to 66,860 lumens, providing clear visibility around the tractor even when operating at night. The cab also features a heated, laminated windshield and a segmented windshield wiper with 180- and 300-degree wiping for improved security and visibility.

New Infotainment system available only on Fendt 900 Series

The Fendt 900 Series' new and exclusive Infotainment system provides state-of-the-art audio, full and easy-to-connect Bluetooth™ capability and personal connectivity to the farm field. Strategically positioned high-fidelity speakers provide excellent audio quality and user experience. A USB port on the Varioterminal connects the operator's smart phone or tablet to the Infotainment system, and convenient touchscreen control through the Varioterminal eliminates the need to independently operate and power the smart device.

"To truly understand and appreciate the innovations and class-leading features, capabilities and comfort of the Fendt 900 Series tractors, we invite producers to come see this tractor at the Farm Progress Show and other major farm shows this fall and winter, and at their local Fendt dealer," Sunderman says. "We're confident they'll appreciate what they see."

For more information on Fendt tractors, see your Fendt dealer, or click on http://www.fendt.com/us.

Valley® Irrigation Unveils Industry-First, Over-the-Air Updates for Smart Panels

Valley® Irrigation, The Leader in Precision Irrigation®, is proud to announce another industry first: the ability to push updates "over the air" to their ICON® control panels. This ag tech advancement is available automatically through the built-in Valley ICON Link.

Over-the-air updates will make irrigation management much simpler and less timeconsuming for growers:

- This industry-first feature ensures ICON panels are kept up to date with the latest improvements. Updates pushed wirelessly over the cloud mean growers no longer have to update panels in-field via a USB drive or direct connection.
- These over-the-air updates will save growers the expense of a service call when installing firmware updates, as well as the time driving to each control panel and manually installing them.
- In addition, it will allow even more responsive service from Valley dealers and technicians; the latest updates can be pushed out to everyone instantly, rather than taking multiple trips to the field.
- The Valley ICON Link must be activated to utilize this feature.

"This new innovation furthers the Valley tradition of helping growers become more advanced and efficient," said Andy Carritt, Vice President, Product Development. "This industry first will be with updates functioning similarly to the smartphone updates most people are familiar with – but for their smart panels.

Valley ICON panels are the most advanced in the industry, offering complete control and the most intuitive, dynamic touchscreens available. Over-the-air updates represent another leap forward in a total remote management platform to help growers gain control of their irrigation.

In conjunction with Valley 365TM, their single sign-on solution coming in early 2020, Valley remote management options are the industry's most comprehensive yet easy-to-understand technology tools. Valley offers complete, connected crop management to help growers make better decisions, save time, maximize irrigated acres and have peace of mind.

Shur-Co® Introduces Electric Gate Opener System

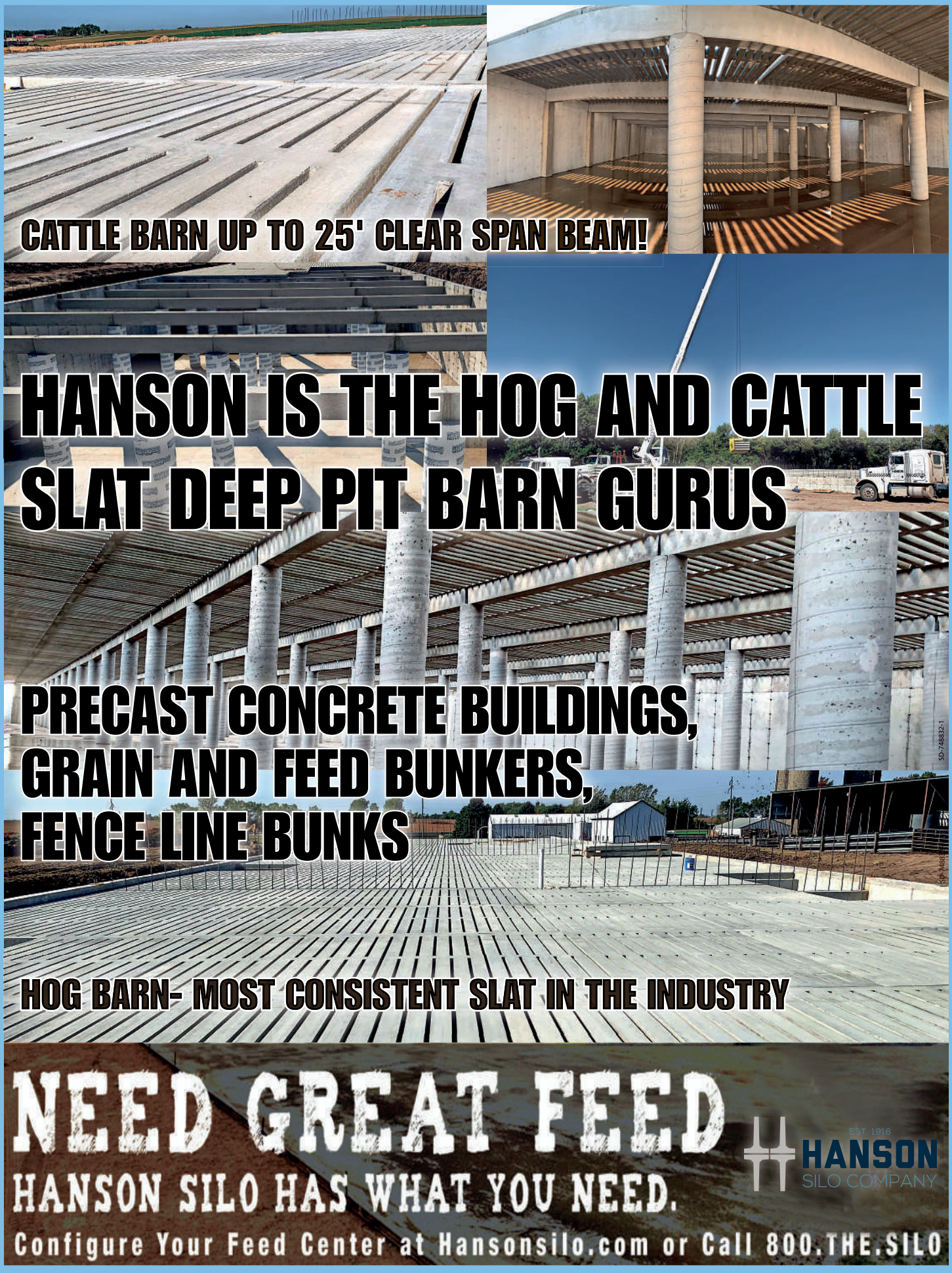
Yankton, SD - Shur-Co® is pleased to announce the expansion of its SMARTechnology™ product family with the addition of the Shur-Co® AutoGate™ electric gate opener system.

The AutoGate™ electric gate opener opens and closes farm swing gates with the push of a button on your SMART3™ remote. This system can be operated from the safety of the truck or tractor cab. It can fully open or close gates up to 16-feet wide with one quick press of a button. The gate opens or shuts completely in 10 to 15 seconds, safely and easily. The open-side travel limit is configurable via Shur-Co's SMART3™ app, with a maximum travel of 100 degrees. There is also a safety feature that provides automatic shut-off if the gate if obstructed. The system comes with a 20-Watt solar panel for convenient battery charging.

The AutoGate™ kit is complete with the following:

- Linear Actuator
- SMART3™ Remote Compatibility
- Maintenance-Free 12V Battery
- Control Box
- Solar Panel
- Heavy-Duty Mounting Bracketry

Shur-Co's AutoGate™ system can be found at all Authorized Shur-Co® Dealers. For more information on Shur-Co®, please call 800.474.8756 or visit us at www.shurco.com.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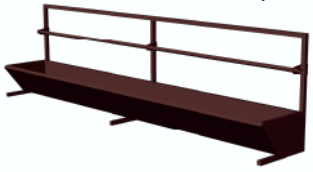


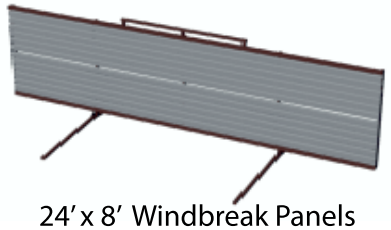
10 Ga Fenceline Feedbunks
Regular or Calf Style

10 Ga Tube Leg Feedbunk
Available In 28", 38" and 43"

Bottomless Bunks
Made from 10 Ga Steel

Continuous Fence
Available In 4, 5, 6, and 7 bar
Clips and Splicers Included

Bow Gates
Available In 6', 8', 10', 12', and 16'



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