January/February 2012

RESOURCE

engineering and technology for a sustainable world

PUBLISHED BY ASABE – AMERICAN SOCIETY OF AGRICULTURAL AND BIOLOGICAL ENGINEERS

from the President

"It's easy to make a buck. It's much harder to make a difference." — Tom Brokaw

One world, one dream. One world, one crisis. When ASABE Executive Director Darrin Drollinger and I traveled to China in October 2011, our Chinese colleagues shared many examples of how we are interconnected with all citizens of the world. The need to provide food, fiber, feed, and fuel for all people challenges agricultural and biological engineers to use their knowledge and skills to improve agricultural production in both quality and quantity. Rather than just shipping food to other nations, the better approach is to help all nations increase production. Protecting the environment is also a global issue.

October 22, 2011, Chinese Society of Agricultural Engineering (CSAE) Biannual meeting in Chongqing, China, at Southwest University. *Left to right,* Dr. Chunjiang Zhao, Director and Chief Scientist of the National Engineering Research Center for Information Technology in Agriculture, Beijing; Darrin Drollinger, ASABE Executive Director; Sonia Maassel Jacobsen, ASABE President; Dr. Xiwen Luo, Academician of the Chinese Academy of Engineering and Professor at the South China Agricultural University, Guangzhou; and Dr. Ming Zhu, Director of the Chinese Academy of Agricultural Engineering and President of CSAE, Beijing.

One speaker stated that the cell phone of today is 100 times faster than the computers that were used to put a man on the moon. It's time to apply 21st century technology to agricultural production and environmental protection worldwide. Our meetings with the Chinese Academy of Agricultural Engineering (CAAE) and the Chinese Society of Agricultural Engineering (CSAE) resulted in an agreement to increase cooperation between the two societies. Stay tuned!

Sonia Massell Jacobsen
smmjacobsen@asabe.org

events calendar

ASABE CONFERENCES AND INTERNATIONAL MEETINGS

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

2012

Feb. 13-15	**Agricultural Equipment Technology Conference.** Louisville, Kentucky, USA.
May 26-June 1	**21st Century Watershed Technology Conference: Improving Water Quality and the Environment.** Bari, Italy.
July 8-12	**ASABE's 9th International Livestock Environment Symposium (ILES IX).** Valencia, Spain.
July 29-Aug 1	**ASABE Annual International Meeting.** Dallas, Texas, USA.

ASABE ENDORSED EVENTS

2012

Feb. 21-24	**40th International Symposium "Actual Tasks on Agricultural Engineering."** Opatija, Crotia. Contact: Silvio Kosuti, skosutic@mac.com.
Feb. 27-29	**46th Annual Convention Indian Society of Agricultural Engineers (ISAE) and International Symposium on Grain Storage.** GB Pant University, Pantnanger, India.
April 2-4	**Conference of Food Engineering 2012.** Leesburg, Virginia, USA.
July 8-12	**International Conference of Agricultural Engineering: CIGR-AgEng 2012.** Valencia, Spain. Contact: Murat Kacira, mkacira@cals.arizona.edu.
Aug. 11-13	**2nd Sino-U.S. Environment-Enhancing Energy and Bio-Chemicals Conference.** Shanghai, China.

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Congratulations, AE50 Winners!

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John Deere
600 Series HydraFlex™ Draper Platforms
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AE50 Salute to the Winners

At *Resource,* we annually roll out the red carpet for the AE50 awards program—the only one of its kind—to celebrate important new products and recent developments in agricultural, food, and biological systems. This issue is dedicated to the gifted engineers and their co-workers who creatively harness imagination and available resources to pursue exciting innovations. The issue showcases the winners and their ingenuity—and it's the silver anniversary of the AE50 competition!

For twenty-five years, companies from around the world have submitted AE50 entries, and every year a panel of international, industry-leading engineering experts selects 50 products that reflect the best engineering advancements for the agriculture and food industries.

This year's winning products include agricultural equipment and implements, grain storage structures, control systems, irrigation equipment, and more. Some of the award winners are patented and their names trademarked. Several companies have won multiple awards. And some of the products honored will, no doubt, set new standards for their industries.

At the beginning of every year, Hollywood salutes innovators in the movie industry with the Oscars. Here at *Resource,* we salute showstoppers as well, and we celebrate a milestone year in recognizing the best of the best.

Congratulations!

2620, 2623, and 2625 Tandem Disk Harrows

The John Deere 2600 Series Tandem Disk Harrow features transport dimensions and a maintenance-free disk gang bearing system providing up to 134 kg (295 lb) per blade for aggressive cutting action. The 5-section 15 m (49 ft 3 in.) model transports at 2 m (16 ft 3in.) wide by 4 m (13 ft) high. A 5 cm (2 in.) diameter gang bolt features a 3-bolt tensioning tool that generates over 18,144 kg (40,000 lb) of tension with only 17 kg-m (120 ft-lb) of input torque. Mechanical wing control is provided on 5 section sizes to deliver high soil leveling performance, using a standard hydraulic cylinder to provide on-the-go adjustment. Self-adjusting scrapers are disk gang mounted to maintain a tight fit between the scraper blade and spool.

John Deere, Ankeny, Iowa, USA
www.JohnDeere.com

4334 Self-Propelled Merger

With the 4334, Oxbo has redefined merging forage crops by using 34-foot, front-mounted pickup heads to eliminate driving over cut forage. The 4334 pickup heads deliver improved forage quality, increased maneuverability, windrow control, and fold back to a narrow 10-foot transfer width in under 20 seconds. Wide hoops and field-tested tines enable Oxbo mergers to pick up a wide range of forage crops. Front mounted heads improve maneuverability, especially at headlands, in field corners and in small field conditions. The operator has full view of continuous pickup heads, building better windrows for the harvester, and no longer needs to twist and turn to monitor crop flow. Fingertip controls provide on-the-go adjustment to raise, lower, fold, and unfold heads with a joystick and easy-to-use controls.

Oxbo International, Byron, N.Y., USA
www.oxbocorp.com

4940 Self-Propelled Sprayer

The 4940 Self-Propelled Sprayer applies crop protection products and liquid and dry fertilizers throughout the cropping season. The 4,543 L (1200 gal) solution tank, 37 m (120 ft) suspended boom, and four-wheel independent air spring suspension smoothly cover many acres per hour. A high-capacity filling system, chemical direct injection, and automatic solution system controls allow rapid and efficient loading and rinsing of crop protection products. Dry products can also be applied using the multi-compartment dry spinner box. Integrated steering guidance, boom height and section control, headland management, and application documentation systems give precise application control and record keeping using a single interface. A telemetry system provides managers with real-time updates of hours, location, utilization, service status, fuel usage, and dashboard updates.

John Deere, Moline, Ill., USA
www.JohnDeere.com/Sprayers

600 Series HydraFlex™ Draper Platforms

The 600 Series HydraFlex™ draper platforms harvest low-to-the-ground crops, such as soybeans, lentils, peas, consistently across the full width of cut when traveling over uneven terrain at high ground speeds. Using a true, fully flexible cutterbar, directly linked to the side draper belts and integrated with the HydraFlex™ system, the 600 Series provides a full 19 cm (7.5 in.) of cutterbar flexing over the entire width and flexes the side draper belts to allow maximum terrain-hugging capability. The HydraFlex™ flotation system allows modifying the cutterbar ground force weight, on the go, to match soft or hard soil conditions. This prevents cutterbar "pushing" and maximizes harvesting hours in a day. It is available in 11 and 12 m (35 and 40 ft) widths and is designed to deliver a higher level of productivity when used with John Deere's new S-Series combines.

John Deere Global Crop Harvesting,
Product Development Center, East Moline, Ill., USA
www.deere.com

600c Series Corn Head

The 2012 600C Series corn head modifies the current 600C Series to include many new features that allow corn growers to be more productive. The modifications utilize critical geometries to improve material handling, grain savings, residue processing, and serviceability. New features include plastic chain guides, ultra-high-strength steel main and row unit frames for weight reduction, intermeshing stalk rolls, chopping disconnect, deck cover lift assist, larger cut widths, and automatic header height control optimization. These features provide high-speed, highly productive harvesting even in tough conditions.

John Deere Global Crop Harvesting,
Product Development Center, Moline, Ill., USA
www.deere.com

6160 Pea Harvester with 4040 Stripper Head

The 6160 delivers power and fuel economy while increasing machine capacity. The cooling system lowers hydraulic operating temperature 20 percent and optimizes engine operating temperature with a variable-pitch engine fan, reducing power requirements and noise levels. With peak operating engine speed of 1550 rpm, fuel economy is maximized and power is increased by 30 horsepower. An enhanced control system allows more monitoring and diagnostic capabilities to minimize downtime. Advanced control of the hydraulic ground drive delivers independent adjustment of left and right front wheel speeds, improving steering in muddy conditions. Productivity is increased with the 4040 stripper head; its 50 percent wider conveyors increase throughput and eliminate feeding issues in heavy crops. The 4040 head also improves operator visibility and increases the harvester auto-leveling range.

Oxbo International Corporation, Byron, N.Y., USA
www.oxbocorp.com

6220 Trunk Shake Grape Harvester

The 6220 grape harvester removes grapes with minimal leaf removal and damage to the vine because its "trunk shake" harvesting head shakes the plant's trunk instead of engaging the canopy. The head can be configured to the widest range of trellis styles—from traditional vertical canopies to complex divided canopies. Using a three-fan cleaning system, bucket conveyance, and trash removal system, harvesting costs are reduced by eliminating the need for additional on-board sorting personnel and "walkers" behind traditional trunk shake harvesters. The standard limited-slip, four-wheel traction control system enables the 6220 to climb hills and power through any terrain during harvest. The 6220 was designed from the ground up to provide a custom, cost-effective harvesting solution that improves profitability and reduces labor in the field.

Oxbo International Corporation, Lynden, Wash., USA
www.oxbocorp.com

7R Series Tractors

The 7R Series has five new models rated from 200 to 280 engine horsepower. This tractor lineup is more globally competitive with improvements in power density and productivity while reducing fuel consumption, and the new compact chassis is capable of field, transport, and utility operations. In Western Europe, a tractor needs to be power dense, so structural castings, including the engine oil pan, were used with weight-saving strategies never before applied at John Deere. To further improve fuel efficiency and productivity, the latest technologies in drivetrain lubrication and oil management were used. In addition, these compact and maneuverable tractors provide efficient operation while ensuring that the emission-control equipment is transparent to the operator.

John Deere, Moline, Ill., USA
www.deere.com

9120 Raspberry Harvester

The 9120 is specifically designed to produce individual quick frozen (IQF) raspberries—the highest quality grade. Delicate berries are contained in cups and carried to the machine top for debris removal via a two-stage cleaning system. The lower fluid bed fan creates a gentle lifting action on the lightweight debris without disturbing the heavier berries; the upper fan then takes over to discharge the debris from the fruit stream. Fruit quality is maintained by minimizing the height of each conveyor transition and the number of transitions. The three-wheeled ground drive is highly maneuverable to increase uptime, while the unibody chassis maintains a consistent sorting height for reduced operator fatigue.

Oxbo International Corporation, Lynden, Wash., USA
www.oxbocorp.com

9R/9RT Series Tractors

The 9R/9RT Series consists of five new models rated from 360 to 560 engine horsepower. The new models and their features improve productivity and operating efficiency. Operator comfort is also improved with a new cab for both agricultural and scraper models. Significant improvements make the 9R Series the most versatile and productive four-wheel drive and high-horsepower track tractors ever built in Waterloo, Iowa. These tractors cover more acres in a day and are also more productive in the earthmoving industry.

John Deere, Moline, Ill., USA
www.deere.com

CEMOS (CLAAS Electronic Machine Optimization System)

CEMOS (CLAAS Electronic Machine Optimization System) is a machine settings and adjustment assistance system for use with LEXION combine harvesters. It is designed to guide the machine operator to optimal machine settings—balancing power, quality, safety, and efficiency. CEMOS uses an on-screen dialog that asks a series of questions to derive the best settings for the current conditions and for the crop being harvested. This function-specific dialog (crop flow, grain loss, throughput, grain quality, and returns) allows the operator to focus on one function or system at a time before moving on to the next. CEMOS can increase output by as much as 20 percent without compromising grain quality.

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

Cornrower Corn Stover Windrowing Attachment

The Cornrower, an attachment for a standard chopping corn header, provides windrowing of corn stover concurrent with the corn grain harvest. The Cornrower chops stover into small pieces and places them in a windrow without the material touching the ground, making a clean windrow of material that will bale easily into higher-density bales, with no dirt contamination and using no extra labor or machines. This saves fuel and labor by reducing the number of trips over the field to windrow stover, and it saves freight and storage costs by providing a material that makes dense bales. The Cornrower can also be used to make windrows of wet stover from high-moisture corn that can easily be chopped and ensiled, making available a feed source that is currently not utilized. James E. Straeter, president of New Holland Rochester, patented the Cornrower concept in 2010.

New Holland Rochester, Inc., Rochester, Ind., USA
www.newhollandrochester.com

Crop Cutting and Conveying System for the MacDon R85 Rotary Disc Header

The cutting and feeding system designed for the R85 disc header features a full-width (overshot) feed auger mounted behind five pairs (ten discs) of co-rotating cutting discs. The auger is built in two half-sections with a center-mounted support assembly attached to the back of the cutter bar cradle. Due to the span of the 5 m (16 ft) cutter bar and the width of the auger, the center support assembly provides a small amount of flex for the complete auger. The full-width feed auger allows the ten cutting discs to be oriented in the optimum rotational pattern to enhance cutting capacity and quality.

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

DSI Adaptive 3D Portioning™ System

The DSI Adaptive 3D Portioning™ system improves the portioning of boneless meat products. Yield is increased by vertical and horizontal cutting of optimal portions out of irregularly shaped meat. The system scans incoming meat, and software determines the most profitable use for each piece. Instructions are sent to waterjet cutters to create a main portion shape as well as nuggets or strips. The resulting main portion is then scanned and sliced with a precise horizontal band saw, which adjusts its height for each incoming piece and creates upper and lower portions of the desired shape and weight. Adding a new integrated horizontal slicer to the process leads to three-dimensional portioning and high performance for a process line.

John Bean Technologies Corporation, Redmond, Wash., USA
http://jbtfoodtech.com

PrecisionPac™ Herbicide Dispensing System

The PrecisionPac™ herbicide dispenser creates a customized herbicide mixture from active ingredients at the point of sale. The system can blend up to six components in various ratios to create a vast range of herbicide products. The PrecisionPac™ system also creates a precise unit-area package that is customized to match the field size or sprayer load specified by the customer. The system simplifies the supply chain for product manufacturers, it reduces inventory for distributors and retailers, and it provides customers with a customized product that they can use safely.

DuPont Crop Protection, Wilmington, Del., USA
www.precisionpac.com

E110 Solar KIFCO® Water-Reel®

The E110 Solar Water-Reel® is a DC-driven irrigation traveler. KIFCO added the latest improvements in low-speed, high-torque DC motors, batteries, solar panels, and trickle charging to the 38 to 98 Lpm (10 to 26 gpm) product range. A full charge provides about 40 hours of operation. The E110 comes standard with a 110 VAC charger. On a typical schedule of one retraction per day, the reel-mounted solar charger maintains the battery. The E110 requires no additional pressure or flow, which allows the use of low-head, high-uniformity devices and use in low-pressure, low-flow supply systems. For small farms, ranches, and organic operations, the E110 improves water and energy efficiencies and increases potential areas of use.

KIFCO, Inc., Havana, Ill., USA
www.kifco.com

Eclipse Tower and Catwalk Solutions

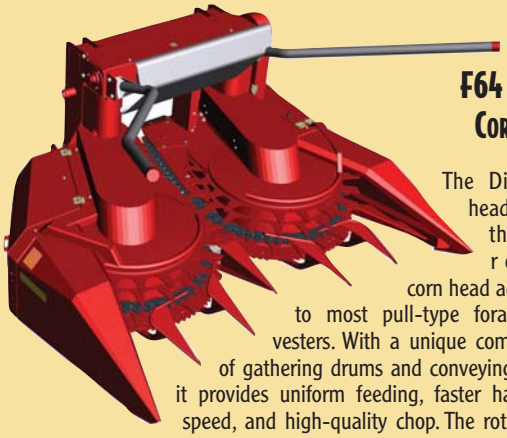
The Eclipse line of towers and catwalks is designed to support grain pump loop systems and equipment while providing easy access for maintenance and repairs. Eclipse provides an economic solution by utilizing a cold-formed "C-channel" design. This design produces economies in steel cost, manufacturing, transportation, and handling due to the low weight and ease of forming the pre-galvanized members, as opposed to comparable angle-iron systems. Eclipse's modular design allows for fast assembly and savings in labor cost. With a maximum tower height of 25 m (82 ft) and a catwalk simple span of 12 m (40 ft), the system can support up to a 0.4 m (16 in.) diameter loop with a 20,000 bushel per hour capacity.

Sentinel Building Systems, a division of Global Industries, Inc.
Albion, Neb., USA
ww.sentinelbuildings.com

Express™ End Cap

The Express™ end cap attaches to each end of an individual boom pipe and expels air from the boom pipe through the nozzle body's spray tip. The Express™ end cap improves the activation time of the nozzle body's diaphragm check valve (DCV). Faster on/off DCV activation promotes accurate application of agrochemicals while protecting the environment from over-application and misapplication of the targeted area.

HYPRO-Pentair Water, New Brighton, Minn., USA
www.hypropumps.com



F64 Rotary Corn Head

The Dion F64 header is a three-row rotary corn head adaptable to most pull-type forage harvesters. With a unique combination of gathering drums and conveying chains, it provides uniform feeding, faster harvesting speed, and high-quality chop. The rotary concept makes harvesting possible regardless of row direction and spacing. Using only three shafts, the header drive is simple, durable, and economical. The two gathering chains are made of heavy-duty O-ring chain with an exclusive open-link design. The cutting disks are belt-driven for smooth operation. The knife sections, made of hardened steel, are durable, maintenance free, and replaceable in a few minutes. The F64 header is available with a factory- or field-installed adapter kit for selected forage harvester models.

Development Forage Equipment, Inc.,
Boisbriand, Quebec, Canada
www.dionmachineries.com

GK H8 Bare Root Tree Digger

The newly designed H8 Tree Digger by GK Machine, uses a set of D4 undercarriages, driven by a 215 hp engine through a hydrostat, to provide the traction requirement for pulling the 75 cm (30 in.) wide blade through the soil 915 cm (36 in.) deep. An arched frame design causes less stress on trees as the point of clearance is pushed back closer to the blade as well as up with a larger tunnel height clearance. Optional Category 2 three-point mounts, with hydraulic side shift and 540 PTO motors, can power a flail, mower, or rototiller to further expand on uses. The standard pull arms for the undercutting blade also allow mounting of a tree chopper, which is used to prepare root stock trees for grafting.

GK Machine, Inc., Donald, Ore., USA
www.gkmachine.com

Graham Electric Planter Drive

The Electric Planter Drive (EPD) is available for new and used agriculture planters to replace ground and hydraulic drives. The EPD is accurate and economical. It offers individual row shutoff and variable-rate population, and it eliminates maintenance-intensive bearings, chains, and sprockets. Each EPD kit contains a control board, a weatherproof harness using Deutsch connectors, a housing, and four electric motors; a 16-row planter would use four kits. Each motor is rated for 5,000 hours of operation. The control board interfaces with any variable-rate controller, and the control algorithm is completely closed-loop for accuracy and instant adjustment to population rate changes. With the EPD, farmers can retrofit their existing ground-drive planters to state-of-the-art-technology while decreasing maintenance costs.

Graham Equipment, Wray, Colo., USA
www.grahamelectricplanter.com

Grain Buster

Using an approach similar to a drain snake, the Sukup Grain Buster provides a safe way to break up grain masses inside a bin. Instead of entering the bin, which can pose life-threatening danger, the Grain Buster operator works outside the bin using a variable-speed drill. The drill is attached to the end of a metal rod that extends through the bin wall and through a pipe mounted along the top of the bin sweep. On the other end of the rod is a short length of stiffened chain or cable. When the drill spins the rod, the chain or cable spins around over the center sump, breaking up any grain clumps caused by excessive moisture, freezing, build-up of fines, or crusting.

Sukup Manufacturing Co., Sheffield, Iowa, USA
www.sukup.com

Groundsmaster® 360 Quad-Steer™

The Groundsmaster® 360 is a 36 horsepower multi-purpose turf mower that uses a precision four-wheel steer system. This 1.8 m (72 in.) mower can trim around the smallest obstacles and even square corners without missing a blade of grass. The GM360 is highly maneuverable, yet it does not damage the turf in normal conditions. The steering geometry aligns all four wheels around a single turning point. The machine's center of gravity is positioned to maximize traction on slopes and maintain stability on slopes, allowing safe operation in varying conditions and terrain, such as sports fields, parks, golf courses, and other turf areas. The GM360 can also be outfitted with out-front quick-change attachments that enable year-round use for various tasks.

The Toro Company, Bloomington, Minn., USA
www.toro.com

Independent Grain Tank Cross-Auger Control

The independent grain tank cross-auger control for 30 Series Axial-Flow® combines separates the drive system, creating independent operator control of the grain tank cross-augers and the unload tube vertical and horizontal augers. This mechanical drive provides more control of the unload system and allows unloading of high-moisture or dense grain crops at full discharge rate with less chance of shearing the shear bolts. This also eliminates shoveling out the grain tank and reduces downtime. The control software reduces start-up torque by starting the unload tube augers first, followed by the cross-augers. The horizontal unload tube can be fully emptied even if the grain tank is not yet empty, reducing the weight of the unload tube and extending the life of the system.

Case IH Agriculture, Racine, Wis., USA
www.caseih.com

LoadOut: Yellow Box

The LoadOut: Yellow Box visual industrial control module enables a smartphone to become the central point for industrial process control. The hardware communicates seamlessly with software embedded on the mobile device, allowing the smartphone user to see video and data and have complete system control. Implementation can reduce labor costs by 50 to 200 percent, as such industrial processes normally require several people. The system allows personnel to remain a safe distance from noise, dust, and environmental conditions while reducing the need for dangerous climbing. An easy-to-use graphical interface and powerful algorithms enable sequential operation of gates, motors, pumps, or any other machinery, thus reducing unnecessary wear on mechanical components.

LoadOut Technologies, West Lafayette, Ind., USA
www.loadout.co

MagnaCut Fine Cut Chopper

The MagnaCut fine cut chopper is a new option for Case IH Axial-Flow® combines. It improves efficiency by reducing the power required to finely chop crop residue while harvesting. The chopper uses 40 rotating knifes in 20 pairs, secured with robust hardware with ample space for easy servicing. The reduction in knife count, from 120 to 40, reduces the required power by up to 30 horsepower while maintaining optimum straw length in a uniform discharge pattern. The power saved leads to higher vehicle productivity because of higher ground speeds and fuel savings. Operators also save money and time with a lower initial purchase price and fewer, easy-to-access blades to replace when worn. The larger-diameter mounting hardware also reduces shear potential, for less downtime.

Case IH Agriculture, Racine, Wis., USA
www.caseih.com

MowMax™ II Cutterbar for Durabine™ Disc Mower-Conditioner Headers

The New Holland MowMax™ II cutterbar includes patented, lubricated splines on spring-centered and piloted module interconnecting shafts that increase wear life by 200 percent over the previous design. The new design incorporates a patented feature that allows the cutterbar to be separated for repair work without removing it from the header. This decreases repair time by 50 percent and eliminates the need for jacks or hoists to lift and support the cutterbar for repairs. The cutterbar discs are profiled to enhance crop flow through the header while maximizing wear resistance. Due to increases in individual component strengths, the minimum shear force for the shock protection hub has been increased by 43 percent, minimizing nuisance failures that contribute to downtime.

New Holland Agriculture, New Holland, Penn., USA
http://agriculture.newholland.com

Multi Pro® 5800 Sprayer

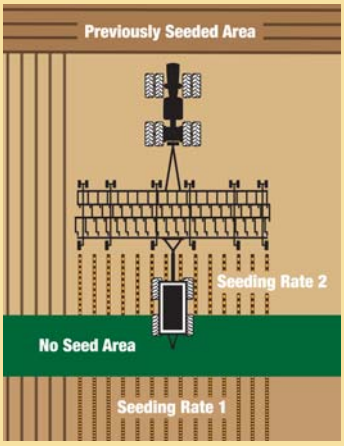
The Toro Multi Pro® 5800 sprayer is a 1,000 L (300 gal) dedicated spray vehicle that applies chemicals on golf courses, sports fields, parks, and other maintained turf areas. The Multi Pro® 5800 incorporates a pulse-width-modulated electronic controller with a variable-speed, six-diaphragm, positive-displacement pump. This system provides quick response and accurate rate control in varying speed and spray-width conditions. The pump combined with a new chemical tank design gives superior agitation and spray-out rates. Tank cleaning is accomplished with patent-applied-for twin spinning nozzles fed from an onboard 114 L (30 gal) tank. Convenient chemical loading is accomplished with an optional Clean Load Eductor system. Optional accessories are available.

The Toro Company, Bloomington, Minn., USA
www.toro.com

NexGen Commercial Bin Sweep System

The NexGen bin sweep system is a commercial-duty auger designed to operate on the grain bin floor and perform final unloading and cleanout when grain no longer flows by gravity. With heavy-gauge sheeting and structure, it remains inside the bin at all times—including under the grain column—to be started when final cleanout is required. The system includes features that allow automatic, adjustable control of the sweep progress and performance via electronic controls and "tractors" that push the sweep into the grain. These tractors, which are mounted to the sweep shield and remain in the bin, are the key to the system's operation. Optional zero-entry features allow for operation without entering the bin while the sweep is active.

Hutchinson/Mayrath, a division of Global Industries, Inc.
Clay Center, Kan., USA
www.hutchinson-mayrath.com



OmniSeed™ Air Seeder Control System

The Raven OmniSeed™ Series of air seeder controls provides an integrated platform for air cart monitoring, remote tank meter calibration, granular product control, liquid/ NH_3 product control, section overlap control, run blockage, real-time down pressure monitoring, and variable-rate control of up to five products. OmniSeed™ utilizes the Viper Pro field computer and is highly configurable to best fit budget and feature requirements. OmniSeed™ is a comprehensive system in that it not only provides the electronics but also the mechanics to control and monitor liquid and granular inputs. In addition to advanced seeder controls, the OmniSeed™ system is easily expanded to include Raven RTK-level guidance, high-speed internet access, wireless data transfer, and remote field computer support through the Slingshot family of products.

Raven Industries, Sioux Falls, S.D., USA
www.ravenind.com

PinPoint® Individual Nozzle Application Control System

Individual nozzle control for GPS overlap and turn radius flow compensation is now available for sprayers, anhydrous ammonia applicators, and liquid fertilizer applicators with Capstan's PinPoint® individual nozzle blended pulse application control system. This patented technology integrates CAN technology with Capstan's blended pulse application technology to solve application inefficiencies by providing consistent and accurate application quality, drift control, and droplet size control down to 1 m^2 resolution. Conquering field inefficiency, inaccuracy, and drift in the application industry can lead to the reduction of pesticide resistance in weeds while reducing the amount of active ingredient used, benefiting the environment while enhancing yields, profitability, and productivity for the producer.

Capstan Ag Systems, Inc., Topeka, Kan., USA
www.capstanag.com

QUADRANT 3300 Square Baler

The CLAAS QUADRANT 3300 is a new approach for a 1 m by 1.2 m (3 ft by 4 ft) square baler. The crop flow design, pre-packer design, and knotters increase the capacities of the baler. The pre-chamber has two sensors to measure the thickness of the top and bottom of the flake, creating greater bale density and uniform top-to-bottom bale shape in all crop conditions. The single-tie knotters rotate backward to take tension off while the knot is being tied. This allows for more plunger strokes per minute, more density, and higher throughput. The all-mechanical system has no timing chains. The monitor can adjust the bale density and length, and it tells the operator the average flake size, so the operator can decide whether to push the machine further.

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

RESPA® -CF Vortex HyperFLOW™ Cab Air Quality System

The RESPA® -CF Vortex HyperFLOW™ Cab Air Quality System comprehensively filters all cab airflow while continuously monitoring cab air pressure. It combines compact, high-efficiency mechanical separation technology with compact, high-efficiency filtration, powered low-restriction inline compact recirculation filtration, and real-time pressure monitoring. The Vortex HyperFLOW™ precleaner/filter/pressurizer mechanically removes over 90 percent of particulates down to 5 microns, prior to the air passing through the filter, by creating a vortex around the filter media, which passes debris along the sides and out the back of the filter housing. Clean air is then pushed through the proprietary MERV 16 filter and into the HVAC fresh air inlet. By removing most of the particulates from the airflow before the filter, the filter life is increased.

Sy-Klone® International, Jacksonville, Fla., USA
www.sy-klone.com

Robo-Sharpener

The Case IH Robo-Sharpener, made especially for Case IH True-Tandem™ 330 Turbo vertical tillage equipment, quickly and easily sharpens the wavy implement blades used to penetrate the soil and cut crop residues in minimal tillage. The patent-pending Robo-Sharpener is mounted directly to the gang of the implement during sharpening. This allows the operator to stand at a safe distance and use the sharpener anywhere a 110 VAC (20 A) power source is available. The Robo-Sharpener system sharpens a wavy or smooth blade in minutes using a grinding wheel mounted to a pendulous arm. It is equipped with wheels that allow it to roll along a rail from blade to blade, providing easy repeatability in sharpening a gang of blades quickly and safely.

Case IH Agriculture, Goodfield, Ill., USA
www.caseih.com

RoGator RG1300

The RoGator RG1300 is a self-propelled, high-clearance sprayer used exclusively in production agriculture for application of a wide range of crop inputs and crop protectants in liquid and dry form. The 2012 model features new styling with a proven drivetrain and a Tier 4 interim compliant AGCO 8.4 L diesel engine designed with e3 SCR technology. The cab offers all-around visibility while the machine is on the road or in the field, with noise levels up to 10 percent lower than the previous model. Improvements also include the overall weight distribution between the front and rear axles. The RoGator liquid system provides precision application with pressure variance and the ability for each boom section to be turned on or off, ensuring accuracy and costs savings.

AGCO Corporation, Duluth, Ga., USA
www.applylikeapro.com and www.agcocorp.com/na

RQ 800 "Viper" Automatic Packaging System

The RQ 800 "Viper" automatic packaging system allows swine producers to efficiently produce dose-size packages for artificial insemination. Using advanced controls and pump technology, the RQ 800 is capable of 1800 doses per hour while attaining accuracies of ±0.5 percent or better. It uses ethernet-based fieldbus communication to provide fast and accurate motion control and facilitates seamless expansion of additional or customer-specific features, such as check-weighers, sorters, conveyors, and RFID. The integrated display and controller eliminate the need for an external computer and allow the operator full diagnostic capabilities during setup and operation. All batch and operational information is displayed on the screen, providing the user with all necessary feedback during operation.

ReproQuest, Inc., Fitchburg, Wis., USA
www.ReproQuest.com

Safe T Home

The Sukup Safe T Home is a shelter that can be used for temporary or permanent housing of disaster victims and as housing for impoverished people. It can also be used for schools, churches, clinics, and other purposes. The Safe T Home is well ventilated and, with its aerodynamic shape and ballasted design, it can withstand hurricane-force winds. The structure is 5.5 m (18 ft) in diameter, with 2.4 m (8 ft) sidewalls, and a roof peak of 4.1 m (13.5 ft). The interior volume is 23.6 m^2 (254 ft^2). At $8,030, the Safe T Home is economical. It can be assembled in four hours with minimal tools and crew, and it can easily be taken down and erected elsewhere. The Safe T Home provides an economical, versatile, and portable solution to the problem of emergency shelter.

Sukup Manufacturing Co., Sheffield, Iowa, USA
www.sukup.com

Scorpio Spray Valve

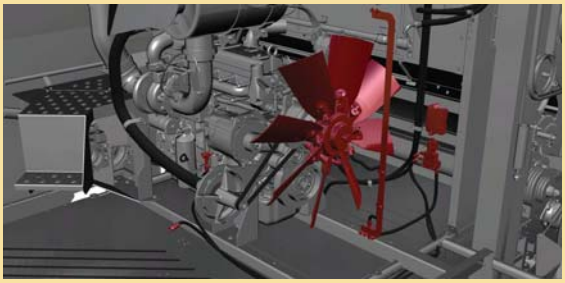
The Scorpio spray valve is a 12 VDC electronically actuated valve designed for mounting on the spray boom nozzle bodies of agricultural spray equipment. The Scorpio valve enables precise on/off spray control at field boundaries, in previously sprayed zones, and in environmentally sensitive areas. It uses an internal electronics package and magnetic latching design to reduce power consumption to levels 1,600 times lower than standard nozzle-mounted solenoid valves, while the flow capabilities are 2.5 times higher. The power management system and simple two-wire connection allow Scorpio valves to be used with standard commercially available spray controllers without intermediate systems to separate power and control circuits. The flow capabilities are compatible with leading-edge spray application practices and equipment.

HYPRO-Pentair Water, New Brighton, Minn., USA
www.hypropumps.com

Single Phase Centrifugal Dryer

The 5 m (16 ft) Single Phase Centrifugal Dryer provides greater drying capacity than previously available to farms with single-phase electrical power. This centrifual dryer has a converter that changes single-phase power into three-phase power. This permits the use of larger fan motors—potentially up to 50 horsepower—than could previously be used with single-phase power. The converter, not sold separately, mounts to the side of the dryer. It provides clean, balanced three-phase AC power that is more reliable than the power provided by external phase converters. With a built-in, variable-frequency drive, the phase converter allows the dryer motor to be soft-started, resulting in longer motor life and smooth, steady operation.

Sukup Manufacturing Co., Sheffield, Iowa, USA
www.sukup.com



SmartCooling™ on Gleaner S Series Combines

For Gleaner S Series combines, SmartCooling™ combines two technologies into one cooling fan package and reduces cleanout of the fan system from several times a day to once a harvest. SmartCooling™ monitors the engine temperature—automatically reversing the fan every 15 minutes for five-second intervals to blow out the radiator fins—and the coolers and rotary screen, which can become clogged with fine-particulate crop residue like soybean fuzz. In extreme conditions, the fan can reverse as often as every two minutes. The system also monitors the outside air temperature and varies the fan blade pitch accordingly. At temperatures below 20°C (68°F), the system reduces the fan blade pitch to nearly zero, reducing engine power requirements by 10 to 13 horsepower for improved fuel efficiency. Maintenance costs and machine downtime are also reduced.

AGCO Corporation, Duluth, Ga., USA
www.gleanercombines.com

S-Series Combines

The S-Series is an all-new lineup of combines from John Deere, with over 45 percent of the major separator components redesigned to deliver higher performance than the 70 Series STS combines that they replace. Included is the S690, a class 9 combine that handles 18-row corn heads and 12 m (40 ft) cutting platforms. The cab provides 30 percent more interior space, increased visibility, and an integrated refrigerator. An isochronous governor allows the separator's functional areas to operate at a constant speed under varying loads to enhance field performance. The S680 and S690 feature the largest factory-installed grain tank (400 bushels) and can unload 3.8 bushels per second. Class 6 through 9 deliver up to a 20 percent increase in cleaning shoe capacity, even on 12 percent slopes.

John Deere Global Crop Harvesting Product Development Center, East Moline, Ill., USA
www.deere.com

Steiger® 600 Tractor

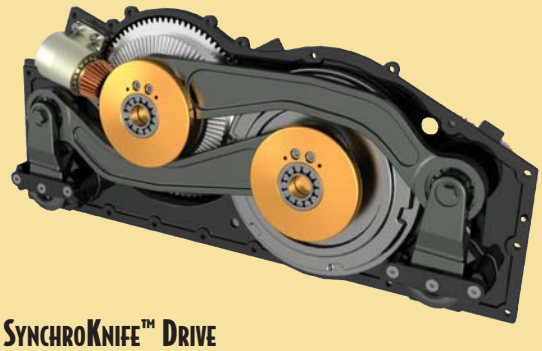
The Steiger® 600 is powered by an innovative 13 L, 600 horsepower, two-stage turbo engine powering an increased-capacity drivetrain that can be ballasted up to 30 tons (66,000 lb), the highest weight capacity in the industry. Although it requires a class 5 drawbar, a conversion option is included to facilitate use of existing class 4 drawbar implements. The fuel capacity has been increased by 50 percent with a tank holding up to 1,703 L (450 gal). Operator visibility has been optimized by use of a low-profile hood and properly positioning the intake and exhaust components. The redesigned interior accommodates leg room for the nearly doubled seat swivel of 40 degrees to the right to reduce operator fatigue and increase productivity.

Case IH Agriculture, Racine, Wis., USA
www.caseih.com

Sync2 Modular Piston Pump

The Sync2 modular piston pump is an expandable positive-displacement pump for transferring liquids with solids content. The dual pumping chambers provide a non-pulsing flow, ideal for feeding downstream processing equipment, while using less horsepower than conventional transfer equipment. Energy savings are accomplished by consistent material velocity and elimination of restrictions in the plumbing. A compact footprint and controllable flow rate make the Sync2 an easy fit into existing systems or new construction. The design of the flapper doors inhibits fiber build-up, while the top-down assembly allows all working components to be removed from the top using standard tools. The pumping chamber design and base construction allow for higher evacuation line pressures, enabling transfer of liquids over several kilometers.

GEA Houle, Drummondville, Quebec, Canada
www.gea-farmtechnologies.com/houle/en



SynchroKnife™ Drive

The SynchroKnife™ drive offered on the New Holland 880CF flex draper header is a patented center knife drive system. The double knife drive runs from a single hydraulic gearbox that requires only one PTO hook-up, uses only one driveline, and is mounted in the center of the header. This system works on the same basis as the two opposing knife drives used in larger headers, but it eliminates the vibrations caused by continually keeping the opposing knifes synchronized. The drive also eliminates complex drivelines, reducing maintenance needs and saving power while reducing overall crop losses from the header. It also reduces the non-functional header width by 16.5 cm (6.5 in.) on each end, reducing potential damage to standing crop that can be caused by header end sheets.

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

T8 Tractor Series

The T8 Tractor Series combines a long wheelbase in a tractor with limited overall length with maneuverability, stability, operator comfort, and versatility. The 3.5 m (136 in.) wheelbase combined with a sculpted hood and frame provides tight turning performance for row-crop applications. The fully integrated, close-coupled front hitch and PTO suit heavy tillage and high-capacity hay-cutting applications, but the tractor is also engineered for secondary cultivation, drilling, spreading, and transport applications as well as operation with a full-range of front-mounted implements. This universal-concept tractor also provides operator comfort with lower in-cab noise levels and improved ergonomics. The CNH "saddle" front axle suspension provides a 61 percent increase in suspended load capacity and a 31 percent reduction in cab bounce for stability in high-speed road travel, even with heavy three-point-hitch-mounted equipment.

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

T9.560 4WD Tractor

The T9.560 is a totally redesigned 4WD tractor. The chassis has been reconfigured to allow use in row-crop applications requiring 1.5 m (60 in.) tread settings and up to 500 rated engine horsepower. The ability to accommodate larger-diameter tires improves tractive capability with the narrow tires required in row-crop applications. The design also includes the option of four-corner cab suspension for increased ride comfort. The hood and cooling package were redesigned with consideration for improved visibility over the hood and easy access for cleaning the coolers. The T9.560 provides hydraulic flow to power large planters and seeders in the planting season and can power grain carts with the PTO option during harvest.

New Holland Agriculture, Burr Ridge, Ill., USA
www.newholland.com

TerraGator TG8400

The TerraGator TG8400 is a self-propelled four-wheel flotation applicator used exclusively in production agriculture for pre-emergence, pre-plant, and post-harvest application of a wide-range of crop inputs in liquid and dry form. To meet Tier 4 interim EPA regulations, AGCO has engineered its flotation applicators with Tier 4 interim compliant AGCO diesel engines with SCR technology. Coupled with a continuously variable transmission, the TerraGator TG8400 has the potential to increase productivity by 15 percent and use up to 25 percent less fuel compared with the previous four-wheel TerraGator.

AGCO Corporation, Duluth, Ga., USA
www.applylikeapro.com and www.agcocorp.com/na

VR1428 High-Capacity Wheel Rake

The VR1428 high-capacity wheel rake incorporates a patent-pending rake wheel suspension. This new suspension system maintains consistent weight on the ground through the wheels' vertical range of motion, resulting in longer tooth life and cleaner raking action in the field. Each rake wheel has a hydraulic lift cylinder that raises and lowers the rake wheel. The lift cylinders are hydraulically plumbed in conjunction with a nitrogen-charged accumulator. The accumulator provides improved suspension, allowing each wheel to go through its full range of vertical motion with a low amount of ground force change. The rake wheel suspension is easily adjusted with a single, tool-free hydraulic adjustment valve.

Vermeer Corporation, Pella, Iowa, USA
www.vermeer.com

WaterScout® SMEC 300 Soil Moisture/EC/Temperature Sensor

The WaterScout SMEC 300 soil moisture/EC/temperature sensor is an inexpensive sensor for monitoring three important parameters in the soil profile: moisture, salinity, and temperature. The electrical conductivity electrode is made of a pair of carbon pads, which provide a larger conductive surface than a screw or rivet. A combination of firmware and software was designed to create virtual channels to transfer measurements to a digital reader or a weather station. This allows sensor readings by an analog data logging system. The SMEC 300 also offers the ability to calibrate the EC sensor—an important feature, as changes in electrode geometry, temperature, and alteration of the conductive surface can affect how the sensor conducts electricity.

Spectrum Technologies, Inc., Plainfield, Ill., USA
www.specmeters.com

WR Series Self-Propelled Windrowers

The WR Series self-propelled windrowers feature electro-hydraulic controls operated by a virtual terminal. This technology provides more precise control over the primary windrower functions while incorporating fully integrated GPS autosteering with field speeds up to 16 mph, 45 percent faster than AGCO's previous-generation windrowers. This is made possible by the electro-hydraulic steering controls, which eliminate the need for mechanical linkages that can cause steering inaccuracies. Because the steering is electro-hydraulic, operators can adjust the steering sensitivity to better suit their driving preferences. The suspension has also been upgraded to accommodate faster speeds by using air-ride cab suspension, a semi-active air-ride seat, mechanical rear axle suspension, and radial tires.

AGCO Corporation, Duluth, Ga., USA
www.agcocorp.com

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10 MagnaCut Fine Cut Chopper
12 Robo-Sharpener
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CLAAS of America, Inc.
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Development Forage Equipment, Inc.
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DuPont Crop Protection
8 DuPont™ PrecisionPac™ Herbicide Dispensing System

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9 GK H8 Bare Root Tree Digger

GEA Houle
15 SYNC2 Modular Piston Pump

Graham Equipment
9 Graham Electric Planter Drive

Hutchinson/Mayrath, a division of Global Industries Inc.
11 NexGen Commercial Bin Sweep System

HYPRO-Pentair Water
8 Express™ End Cap
13 Scorpio Spray Valve

John Bean Technologies Corporation
7 DSI Adaptive 3D Portioning™ System

John Deere
4 2620, 2623, and 2625 Tandem Disk Harrows
5 4940 Self-Propelled Sprayer
6 7R Series Tractors
6 9R/9RT Series Tractors

John Deere Global Crop Harvesting Product Development Center
5 600 Series HydraFlex™ Draper Platforms
5 600C Series Corn Head
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7 Crop Cutting and Conveying System for the MacDon R85 Rotary Disc Header

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15 SynchroKnife™ Drive
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New Holland Rochester Inc.
7 Cornrower - Corn Stover Windrowing Attachment to a Corn Header

Oxbo International Corporation
4 4334 Self-Propelled Merger
5 6160 Pea Harvester with 4040 Stripper Head
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Vermeer Corporation
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A Silver Year of Innovations

This year's AE50 recipients, indexed above, join the ranks of many, over twenty-five years, who have been honored for their creativity.

In June 1984, *Agricultural Engineering* (now *Resource*) included "A Forum for New Developments" in a special issue on technology. Twenty-five 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 experts.

From this focus on identifying innovative technology, two years later the AE50 was born. Its intent was described as follows: "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 in product or systems technology."

Product nominations poured in. A panel of engineers was enlisted to review the entries, and in 1986 the first AE50 awards were bestowed on "applications intended for principle use in the production, processing, research, storage, packaging, or transportation of agricultural products."

The interest in new technology and innovative applications of existing technology remains constant. Over the years, the AE50 application process has specified that each entry must "have potential for broad impact on its area or industries served by agricultural, food, and biological systems engineering."

As was the case in the beginning, many of the products featured on the previous pages may be further improved as technology advances, and will in turn inspire further innovations.

For more information and an entry: **http://www.asabe.org/publications/resource-magazine/ae50-new-product-award.aspx**

Happy 25th Anniversary!

Forecast to 2022

Sunny and warm with a chance of disaster

Richard Worzel

The outlook for farmers is better for the next ten years than it has been for decades. Yet there are also some black clouds on the horizon that everyone should keep an eye on and prepare for. But let me start with the positive aspects.

Growing demand for food

The first driver of change that will work to the advantage of farmers is the rising demand for food. Part of this is due to the rising global population, which increases by an estimated 380,000 people a day. But of even greater importance is the rapid expansion of a middle class in many developing countries. And, as is frequently the case, China exemplifies this development.

According to the United Nations, the average Chinese citizen consumed about 1,600 calories a day in 1960. By 2000, this had risen to about 2,600 calories a day. In the same period, the Chinese population doubled, from 660 million people to 1.3 billion. As a result, the food consumption of China, as a nation, tripled in that 40-year period—an astonishing increase!

If you look at all of the developing countries—China, India, Brazil, Mexico, Malaysia, Indonesia, and so on—it is clear that unless there is some unforeseen disaster, or a smashing genetic breakthrough that raises productive capacity, the demand for food is going to grow far faster than the world's ability to increase food production, which, in turn, spells higher prices for farmers.

More revenue for farmers

The next positive development is that there are new revenue streams emerging for farmers. Traditionally, farmers made their money from the three F's: food, feed, and fiber. Now there are three additional F's emerging: industrial feedstocks, fuels, and (pardon the pun) farm-aceuticals.

Most farmers are familiar with the emergence of biofuels, and many have a bitter taste from the fools-gold rush into ethanol in the mid-2000s. Yet the fact that there was too much capacity chasing too small a market for ethanol does not negate the long-term potential for biofuels, including ethanol, as the world searches for ways of reducing dependence on petroleum.

Industrial feedstocks could replace things like plastics, for example, made from petroleum with those harvested from genetically tailored plants. This is a new area, but it has enormous potential and should be watched closely.

The production of pharmaceuticals from farms will come mostly from specialized produce, such as mushrooms and specially modified livestock. It will be a niche market, albeit an increasingly lucrative one, but it will also require specialized knowledge and techniques.

More niche markets

Beyond these developments is the emergence of a range of flourishing new niche markets for specialized foods. Today it costs about $10,000 per person to read someone's complete genome. Within 15 years, this cost will come down to about $100, which means that, over time, we will learn more and

more about how our environment, including the foods we eat, interacts with our bodies. This means that we will gradually be able to define optimized nutritional profiles for each individual—foods they should embrace, and foods they should avoid—and these profiles will be different for each person.

Collectively, this means that there will be specific kinds of foods, possibly GM variants of commodity farm products, that will be in demand for smaller and smaller groups of people. These groups will represent niche markets that can be served by nimble producers responding to rapid advances in our knowledge of genetics. You can see something analogous to this today in the emergence of growing niche markets for organic or gluten-free foods. These niches will command above-average prices, coupled with greater costs and difficulty of production. Yet the greater difficulty also makes these niches harder for competitors to enter, giving a disproportionate advantage to farmers who enter a given niche early.

Traceability on the increase

There is a widespread move toward traceability, and not just in food. Courier companies like FedEx and UPS have been investing heavily so that their customers can track individual packages from shipper to doorstep. Customs brokers, responding to rising security needs due to terrorist attacks, are moving toward global systems that can track individual items within a shipment all the way from a producer on one side of the world to a retailer on the other. Although they initially fought against the need for this level of traceability, shippers are finding that the resulting information allows them to offer better service, and charge premium prices.

Food safety scares, ranging from contaminated products made with milk from China, to lettuce and peppers contaminated with *E. coli* in the United States, to the BSE scare in Canadian beef, have pushed governments and consumers to demand greater transparency in where and how individual food products are produced. "From farm to fork" is a current slogan. This development, coupled with narrower markets for niche products, means that the need for food traceability will increase steadily over time.

Of course, traceability would not be practical without the enormous advances in computers and communications. But, remarkably, the IT revolution has barely begun. Over the next ten years, we can expect to see an increase in computing power per dollar invested of approximately 1,000 times. This is going to lead to the emergence of everyday robots, computer intelligence, and vastly more sophisticated tools to measure and manage agricultural productions in more profitable ways. Those who keep abreast of such developments will have a distinct edge over those who do not.

What about the potential disasters?

By definition, a disaster is something that catches us by surprise, but here are my best guesses for some possible future disasters:

Weather and climate

First, climate is changing, and that may lead to more violent storms, colder winters and hotter summers, changing weather patterns, and shifts in precipitation that may reduce the agricultural productivity of the Great Plains. At the very least, a warming climate, while it may increase the length of growing seasons, will also increase the incidence of weeds, diseases, insects, rusts, and so on. The worst thing about climate change is that it is literally unpredictable. For instance, last spring's unusually heavy rains delayed planting by a month or more in many areas.

Competition from afar

Next are the unknown, but almost inevitable, increases in competition from agricultural producers in developing countries. Even if those producers merely adopt 20th century farming techniques, their productivity could increase dramatically. This is likely to squeeze profit margins on major commodities, and I define a commodity as any product that sells primarily on price.

An economic crisis

Perhaps most worrisome is the potential for a renewed economic crisis. We can see from the problems in Greece, Ireland, Portugal, and Spain that the potential still exists for a renewed financial panic that could spread to other developed countries. In addition, there are less visible countries, like Belgium, in which an unexpected insolvency could catch markets by surprise.

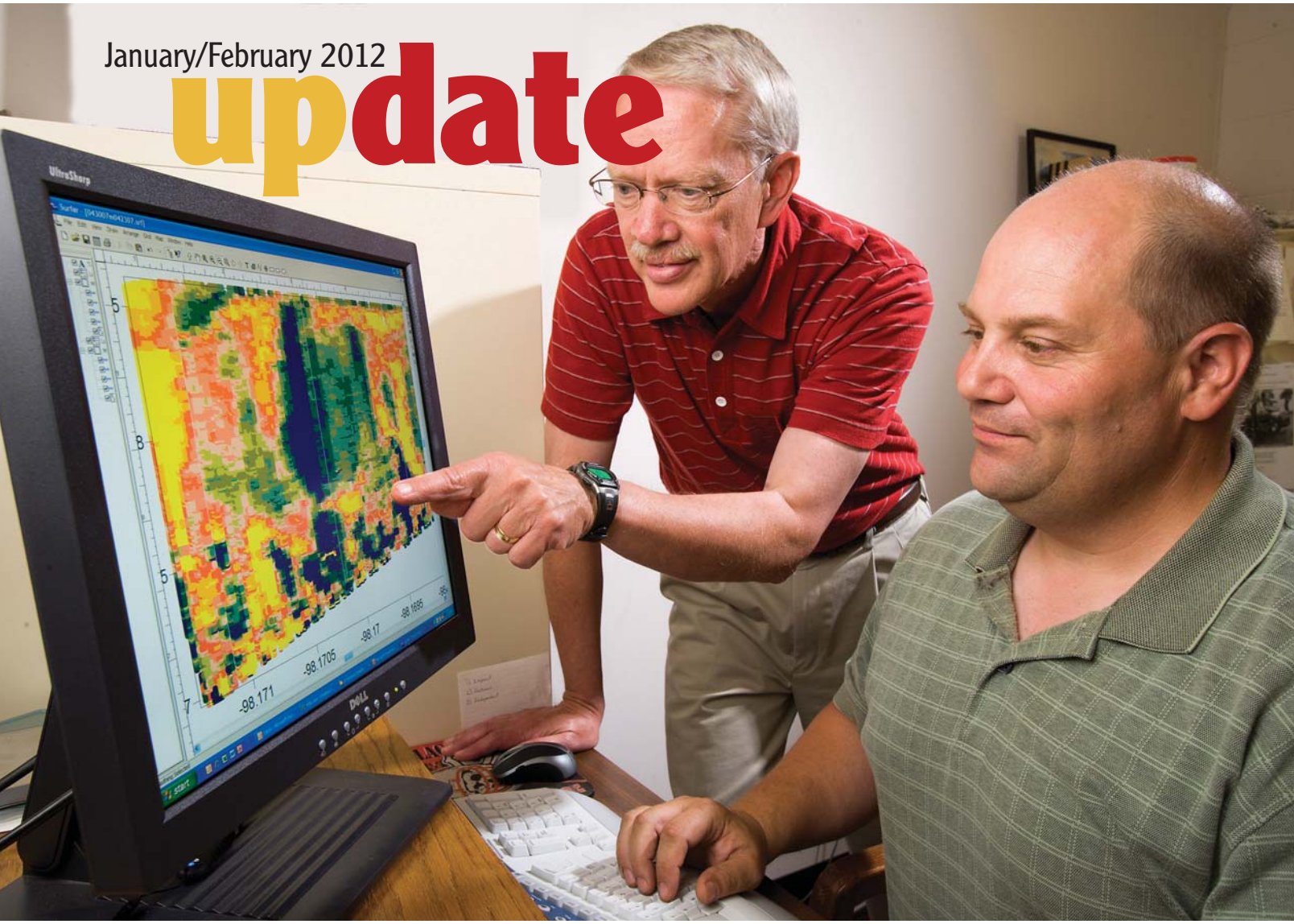
However, the potential disaster that worries me most is the possibility of a trade war.

China and America have squared off against each other, accusing each other of cheating on their currency and pursuing "beggar thy neighbor" trade policies. Other countries, like Germany, are piling on. In response, some are calling for protectionist policies—much like the policies that precipitated the Great Depression, when global trade fell by two-thirds in a four-year period from 1929 to 1933 because of trade disputes similar to the ones we are experiencing today.

I do not expect these things to happen, but prudent management includes planning for the unexpected. As we move into an increasingly complicated world, where change is not only accelerating but the rate of acceleration is increasing as well, it will be important to have a Plan B ready to deal with a Future B—a future that we may not expect but that we may well get.

All of us will be caught by surprise by the future. Those who succeed will be those who overcome their surprise the fastest and respond most constructively.

Richard Worzel is a consultant, author, and futurist. For more information, visit his website at www.futuresearch.com.



Roger Eigenberg (left) and Bryan Woodbury evaluate a soil electrical conductivity map of a vegetative treatment area. ***Photo by Stephen Ausmus, courtesy of USDA-ARS.***

With feedlot manure, it pays to be precise

In Brief: *The same precision farming techniques that work with crops can work with manure management on cattle feedlots. Agricultural engineers and* ***ASABE members Roger Eigenberg*** *and* ***Bryan Woodbury*** *map the distribution of manure and the flow of liquid manure in rain runoff. This research could lead to precision harvesting and precision application of manure to crop fields, while controlling nutrient losses, gas emissions, and odors.*

Eigenberg and Woodbury map manure distribution by slowly towing a GPS-equipped conductivity meter over feedlot pens and cropland. The meter estimates the amount and quality of manure in various places on the feedlot surface by measuring the manure's ability to conduct electricity.

Manure contains salt from feed supplements. Salt, in solution, is an excellent conductor of electricity.

The researchers used an ARS-developed computer program, called the Electrical Conductivity Spatial Analysis Program (ESAP), to choose spots on feedlots and in a hayfield to sample soils, rather than sample randomly. Eigenberg and colleagues used the program to associate high soil conductivity levels with manure solids and with the chloride in the salts found in manure.

These techniques could be used to help feedlot operators recover valuable byproducts from the feedlot surface, such as manure suitable for burning to generate steam. It could also allow selective harvesting for a fertilizer with a higher nitrogen and phosphorus content, by scraping from the "sweet spot" of the pen.

Eigenberg and Woodbury also mapped a hayfield designed to capture and use manure nutrients.

The scientists found that the liquid manure in rain runoff was being unequally distributed to the hayfield. So, they made adjustments to flow tubes, resulting in a more uniform runoff and a more effective treatment area.

For more information, contact Don Comis, USDA-ARS, donald.comis@ars.usda.gov.

New technology could capture ammonia from liquid manure

In Brief: *A new method of extracting ammonium from liquid animal manure could be exciting news for confined animal operations and environmental groups. The process utilizes filtering material designed for synthetic blood vessels.*

The method employs gas-permeable membrane technology that tests have shown could remove 50 percent of the dissolved ammonium in liquid manure in 20 days. The removed ammonium is "not scrubbed but captured," said **ASABE member Saqib Mukhtar**, AgriLife Extension engineer and interim associate department head of the Texas A&M University biological and agricultural engineering department.

By "captured," Mukhtar means that the ammonium is concentrated as ammonia sulfate, which as commercial fertilizer could potentially offset the cost of the removal process.

Though still in the lab-bench test stage, the technology shows great promise to solve a long-standing, expensive, and well-documented problem that confined-animal feeding operations such as dairies and feedlots face daily, Mukhtar said.

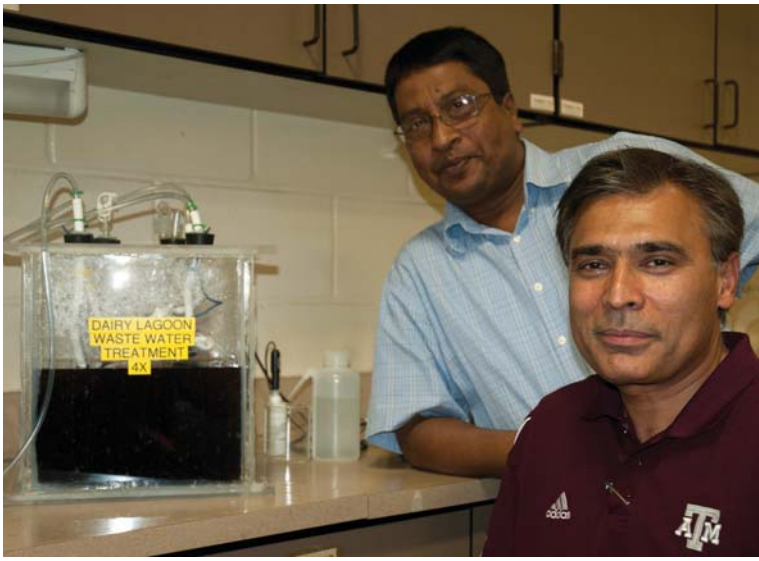
"Excessive ammonia emissions from animal feeding operations are considered a source of odor and environmental pollution," Mukhtar said. "Once emitted, ammonia may contribute to formation of fine airborne particulates in the presence of certain acidic compounds in the atmosphere. Also, ammonia emissions from improperly managed manure systems may contaminate groundwater and cause excessive vegetative growth in lakes and reservoirs. Ammonia may even be a constituent of nitrous oxide, a potent greenhouse gas," he said.

There are other methods of mitigating ammonia emissions from manure storage and treatment facilities, including acidic scrubbers that spray an acidic solution, bio-filters, and chemicals such as acidified clays and sodium hydrogen sulfate.

"Several of these methods have been promising, but high costs, lack of 'staying power' of chemicals and other additives, lack of ammonia recovery for beneficial uses, and the complex operation and management of some of the technologies have restricted their extensive use in animal agriculture," he said.

In comparison, the membrane technology that Mukhtar and his associates have been testing is relatively simple. Gas-permeable tubing is submerged in a tank of liquid manure. A very dilute solution of sulfuric acid is pumped through the tubing, which has a porosity of only 2 microns. A typical human hair is 70 microns in diameter.

The method takes advantage of a property of dissolved gases described by Fick's first law of diffusion. A high concentration of a dissolved gas, such as ammonia, will migrate to regions of lower concentration. As the concentration of ammonium is high in the liquid manure and low to zero in the permeable tubing, the ammonium is drawn into the tubing and out of the liquid manure. The migration is enhanced by ammonium being a base and chemically attracted to the acid in the tubing. The tubular membrane is expanded polytetrafluoroethylene, usually abbreviated ePTFE.



Saqib Mukhtar (foreground) and MD Borhan with a bench-scale test of a process that can extract 50 percent of the dissolved ammonium in liquid manure in 20 days. ***Photo by Robert Burnsm courtesy of Texas AgriLife Extension Service.***

The product has several uses, including blood filtration, synthetic blood vessels, and even dental floss, Mukhtar said, and once was prohibitively expensive. But with the expiration of several patents for this material and its uses, the cost has dropped dramatically, allowing its use in other applications.

Mukhtar said the next step is to scale up from the small bench model to a large tank, perhaps 379 L (100 gal). The team also wants to experiment with how little tubing can be used, and how dilute the acid solution can be, while still capturing about 50 percent of the ammonium within a reasonable amount of time. They are also looking ahead to learn how to economically scale up the process for use on the farm.

"Obviously, we can't use a 'gazillion' feet of tubing in a large manure lagoon," Mukhtar said. "Potentially, what we could do is divert some of the flushed manure in a much smaller basin and apply membrane technology to extract ammonia from it." The manure from which the ammonia has been extracted would then be transported back into the large lagoon, he said

"By doing this repeatedly, we could concentrate the ammonia as a relatively high pH solution of ammonium sulfate," Mukhtar said.

The team headed by Mukhtar includes Amir Samani Majd, a doctorate candidate; **ASABE member MD Borhan**, assistant research scientist; and John Beseda, student technician, all based in College Station, Texas. The team presented the results of their study in a paper at the ASABE Annual International Meeting in Louisville, Ky., in August 2011.

"Remember, we are capturing ammonia with this process," Mukhtar said. "Not just scrubbing it, as other processes do. We might be able to return part or all of the cost of the process as ammonium sulfate, an expensive fertilizer."

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Walter Bausch (left) and engineering technician Ted Bernard measure reflectance, canopy temperature, and ground cover of corn with their mobile platform. The wheels of the platform roll between the rows of fully mature corn, while the sensors on the end of the telescoping boom look down on the crop from 4.6 m (15 ft) above the canopy.

Growing crops and saving water in the West

In Brief: *Colorado is typical of much of the western United States in that the era of expanding irrigated agriculture has come to an end. In fact, the number of irrigated acres is declining. The State of Colorado estimates that this decline will continue because the current number of irrigated acres requires an amount of water that falls short of supplies by 10 percent. Welcome to "buy and dry" and limited irrigation to save water.*

Municipal and industrial users in cities along the Rocky Mountains are buying up farmland to get its water rights and then leaving the land idle—a practice called "buy and dry." An alternative to this is to have farmers limit their irrigation and sell or lease only the rights to their unused water, rather than sell the land as well. But that requires documentation of water saved that is sufficient for Colorado's "water court" and for approval by the state engineer's office. For this reason, **ASABE member Tom Trout**, research leader of the ARS Water Management Research Unit (WMRU) in Fort Collins, Colo., is measuring crop water use efficiency not by the traditional measure of crop yield per drop of irrigation water applied, but rather by yield per drop of water actually taken up by the crop. That measure, called a "crop water productivity function," eliminates all the water that does not enter a plant's roots.

"This method shows the actual strain on groundwater supplies because water used by crops is effectively lost, while most unused rain and irrigation water returns to the groundwater or flows into streams for use downstream," Trout says.

Trout is in the third year of a study to determine how much water four crops common to the High Plains region—corn, wheat, sunflower, and pinto beans—actually use. He is growing these crops in rotation and using drip irrigation on a 20 ha (50 acre) limited-irrigation research farm near Greeley, Colo. ARS operates the farm collaboratively with Colorado State University (CSU) at Fort Collins.

Trout's ARS colleagues in this study include **ASABE member Walter Bausch**, agricultural engineer, and Dale Shaner and Lori Wiles, plant physiologists, all at WMRU.

The data from this study will be used by the ARS Agricultural Systems Research Unit in Fort Collins to develop a computer-based decision support model to provide farmers with documentation of water savings and information on the economic viability of limited irrigation, crop by crop, to help farmers make decisions.

Water as a Crop

Regenesis Management Group, LLC, in Denver, Colo., has signed a cooperative research and development agreement (CRADA) with both ARS research units to create monitoring instruments and software for a web-based application being designed by the company and known as SWIIM, for Sustainable Water and Innovative Irrigation Management. This will allow farmers to treat water as a commodity, like corn, while sustaining economic and environmentally sound irrigation.

In a deficit irrigation study, corn on the left side was fully irrigated while that on the right received only half as much water and produced about half as much corn.
Photo by Tom Trout, courtesy of USDA-ARS.

As part of the CRADA, the study will be expanded to include one of the main irrigation methods that farmers use: running water down furrows between crop rows. ARS and CSU scientists have installed instruments on a 6 ha (15 acre) furrow-irrigated field to measure irrigation applications, runoff, and water percolating down through the soil. Regenesis Management Group will partly fund the research with the goal of developing the underlying science to legally support water transfers.

Will limited irrigation save water?

Farmers who use limited irrigation do not give crops the full irrigation amounts needed for maximum yields. Instead, they use partial irrigations timed to critical growth stages. Trout and his colleagues designed the original study to see whether limited irrigation is best economically for each of the four crops and to help farmers with irrigation timing, irrigation amounts, and other options. The four crops are being grown with six levels of irrigation, from full irrigation to only 40 percent of full.

The research farm was set up to enable precision water control and accurate measurements of water consumed. Use of drip irrigation eliminates the many variables found in furrow and overhead sprinkler irrigation. A series of meters and valves measures irrigation amounts, and a field weather station helps scientists predict the rate at which water is consumed—both transpired through plant leaves and evaporated from the soil surface. Actual soil water depletion is measured by moisture sensors down to 2 m (6 ft). Irrigation timing is based on both the predicted rates of crop water use and the soil water depletion measurements.

A mobile platform with digital cameras, infrared detectors, and an infrared thermometer is driven through the plots weekly to monitor crop growth and leaf temperature, an indicator of crop water deprivation.

So far, Trout has results for three seasons of limited-irrigation studies. For example, he found that corn yields varied from 85 bushels per ha (210 bushels per acre) for full irrigation down to 53 bushels per ha (130 bushels per acre) for the lowest irrigation level.

Tom Trout checks instruments on a weather station that predicts water consumption through soil surface evaporation and transpiration through plant leaves.

Should farmers sell corn or water?

Trout found that the corn plants on 0.4 ha (1 acre) of land need to consume about 2,271 kL (600,000 gal) of water—from irrigation and rain—to produce 200 bushels of corn. "After an initial amount of water to get the corn growing, the consumption rate stayed about the same through all six levels of irrigation—about 9,466 L (2,500 gal) per bushel of corn," he says.

This flies in the face of the traditional belief that crops use water less efficiently as they get more of it. In this experiment, Trout found that while that is true in terms of irrigation water applied, it is not necessarily true in terms of water consumed. In other words, there is no reduction in the amount of water that the corn takes in to produce each bushel, despite the reduction in the amount of irrigation water applied. This may make limited irrigation less attractive financially, at least for corn in this region.

"Corn farmers might do better financially to use full irrigation on a portion of their irrigated acres, rather than limited irrigation spread over all the acres," Trout says. "They could then sell or lease the water rights on the non-irrigated acres. Another option would be to grow a different crop that requires less water, if the economics of limited irrigation work for that crop."

These results are preliminary and may vary with changes in the timing of water applications, type of crop, or variety of corn.

The scientists plan to use computer models to test the results beyond the climate and soils on the research farm to a wide range of conditions throughout the central High Plains. Meanwhile, irrigated agriculture in the central High Plains will continue and will help meet the food needs of a growing world population, but it must be carefully managed to maximize crop yields for each drop of water that passes through a plant.

For more information, contact Don Comis, USDA-ARS, donald.comis@ ars.usda.gov. *Photos by Peggy Greb, courtesy of USDA-ARS, unless otherwise noted.*

Gonul Kaletunc, left, and Sudhir Sastry subjecting leafy greens to a gaseous sanitizer—more effective at killing pathogens such as *E. coli*. Photo by Ken Chamberlain, courtesy of Ohio State University College of Food, Agricultural, and Environmental Sciences.

Researchers tackle safety issues with leafy greens

In Brief: *Leafy green vegetables, power-packed with nutrients, are a growing part of the average American diet. Yet in 2009, leafy greens also made the Center for Science in the Public Interest's "Top 10 Most Dangerous Foods," due to a surprising number of foodborne illnesses linked to the seemingly innocuous salad staple. But a team of researchers with Ohio State University's Ohio Agricultural Research and Development Center (OARDC) is working on an answer.*

According to the Food and Drug Administration, 82 foodborne illness outbreaks between 1996 and 2008 were linked to the consumption of fresh produce. More than one-third of them were traced to leafy greens, accounting for 949 illnesses and five deaths. One outbreak alone, the 2006 contamination of spinach with *Escherichia coli* O157:H7, caused 204 illnesses, including 104 hospitalizations, 31 cases of hemolytic-uremic syndrome (a serious complication), and three deaths. In addition to the human cost, the economic impact of that outbreak was estimated at anywhere from $37 million to $75 million.

"Leafy greens—spinach, lettuce—are the most difficult type of fresh produce to treat," said Ahmed Yousef, food microbiologist and professor of food science and technology at Ohio State. "The leaves are porous. That allows the plant to respire, but it also makes it easy for pathogens to enter the leaf, not just stay on the surface. And leaves are much more sensitive to treatment than other types of produce. We have been trying to figure out how to kill microorganisms without damaging the leaf at the same time. There's not a large margin for error."

Freshly harvested leafy greens are often vacuum-cooled, washed, and sanitized with chlorine solution before packaging. "But research shows liquid sanitizers are not always effective, and sometimes they make the problem worse," said Ohio State food engineer Gonul Kaletunc.

The problems are twofold: air bubbles can form in the liquid sanitizer, preventing it from reaching portions of the leaf surface, and even when the sanitizer comes into contact with the leaf, it may not have enough time to penetrate the leaf deeply enough to reach microbes.

"If you have a bacterium sitting 1 mm (0.004 in.) inside a leaf surface cavity, and your sanitizer doesn't touch the bacterium, then it's not going to have any effect," said Sudhir Sastry, food safety engineer and leader of this effort.

That's why the team, armed with a $1 million grant from the USDA, has turned its attention to studying the effectiveness of gaseous sanitizers, including ozone and chlorine dioxide. "To get into the crevices of the leaf, it's got to be gas, not liquid," said Yousef.

Although gaseous sanitizers have a much better chance of reaching the pathogens that can sicken and kill, they also need specific conditions to work. And that causes a challenge, Sastry said.

"At the processing stage, everything is geared to speed, speed, speed," Sastry said, "But sanitizers, especially liquid sanitizers, are slow, slow, slow, which is not compatible with a high-speed operation. So, we looked at the whole process and thought, 'Why not apply the sanitizer when there is some time to let it work?'"

For example, larger processors use vacuum cooling for a half-hour or longer after the harvest and before the greens are transported for packing. "To use gas as a sanitizer, you need an airtight compartment," said Kaletunc. "You have that with vacuum cooling, and the vessels that are currently used can be adapted to use gas."

Another possibility is to subject the greens to a sanitizing gas during transportation. "Greens are in transit up to 96 hours," Sastry said. "Why not subject them to the sanitizing gas then, when there's plenty of time for it to work? We need to be able to incorporate a gaseous sanitization procedure into the produce chain's existing operations—that will be key."

An earlier Ohio State study, published in 2009 and conducted by Sastry, Yousef, and two of their graduate students, found that a treatment using ozone gas during vacuum cooling and transportation reduced *E. coli* on spinach leaves by up to 99.999 percent. In the current project, the researchers are studying possible combinations of gaseous sanitizers—both ozone and chlorine dioxide—and their partners at Iowa State University are examining the use of liquid organic acids combined with surfactants to determine if those would be as effective. Additional partners at New Mexico State University are preparing training materials for growers and processors. A half-dozen produce companies from across the United States have attended project meetings and expressed interest in the work, Sastry said.

Bobby Jones of The Chef's Garden in Huron, Ohio, a producer of specialty and heirloom vegetables, said the work is an important contribution to the industry. "Everyone knows that a new sanitizing technology is necessary," Jones said. "This research will benefit growers of leafy greens nationwide—but the fact that this work is being done in Ohio gives us a competitive advantage." Jones added that the project goes hand-in-hand with current work being done to develop the Ohio Produce Marketing Agreement, a collaborative food-safety standards effort for leafy greens between the Ohio Department of Agriculture, the Ohio Produce Growers and Marketers Association, and Ohio State University.

Sastry said it all comes down to safety. "If we apply the right techniques in the right place at the right time," he said, "we really can improve the safety of produce."

For more information, contact Martha Filipic, filipic.3@cfaes.osu.edu; Sudhir Sastry, sastry.2@osu.edu; Gonul Kaletunc, kaletunc.1@osu.edu; or Ahmed Yousef, yousef.1@osu.edu.

Secret of safe sprout production is very clean seeds

In Brief: ***A University of Illinois study that uses new technology to assess and compare the safety of radish, broccoli, and alfalfa sprouts concludes that the secret to keeping sprouts free of foodborne pathogens lies in industry's intense attention to the cleanliness of seeds.***

Once seeds have germinated, it's too late. Sprouts are extremely complex structures with a forest-like root system that conceals microorganisms. Just a few *E. coli* cells can grow to a substantial population during germination and sprouting, and it's very difficult to get rid of them all," said **ASABE member Hao Feng**, associate professor of food and bioprocess engineering.


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In his experiments, Feng used both the FDA-recommended dose of chlorine to kill microorganisms and a new sanitizer that was a combination of surfactant and organic acid. He used a laser-scanning confocal microscope to look at micro-slices of seeds and then employed computer software to get a three-dimensional view of their surface structure. This allowed him to calculate each seed's surface roughness.

Although *E. coli* could be eliminated on the alfalfa seeds because of the seeds' relatively smooth surfaces, broccoli and radish seeds have rough surfaces. Their texture renders these rougher seeds more susceptible to the attachment of pathogens and makes these microorganisms very difficult to remove, he said.

Low doses of irradiation can be successfully used on broccoli and radish seeds, but that treatment runs the risk of losing the sprouts' quality and immense nutritional value.

Feng also found that better results were achieved with broccoli sprouts when the sanitizer was used on small batches rather than large ones.

Feng assured consumers that sprouts are carefully tested for the presence of pathogens. "When there is one positive result, the entire batch is thrown out," he said.

Feng said this research demonstrates the importance of eliminating all pathogens on seeds before sprouting.

"The food industry must maintain very strict control in the sprout production process, focusing on the cleanliness of seeds and expending money and effort on prevention. Then consumers can be assured that these nutritious food products are safe to eat," Feng said.

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Santosh Soparawalla, left, and Fatkhulla Tadjimukhamedov demonstrate the miniature mass spectrometer used to detect chemicals on store produce. ***Photo by Mark Simons, courtesy of Purdue News Service.***

Comparing apples and oranges: Purdue handheld technology detects chemicals on store produce

In Brief: *Purdue University researchers recently took their miniature mass spectrometer grocery shopping to test for traces of chemicals on standard and organic produce. In the technology's first venture out of the lab, it successfully identified specific chemical residues on apples and oranges in a matter of minutes right in the produce section without having to peel or otherwise prepare a sample of the fruit.*

Henry Bohn Hass Distinguished Professor of Chemistry R. Graham Cooks and Zheng Ouyang, assistant professor of biomedical engineering, led the team that used the miniature mass spectrometer—which some have likened to Star Trek's "tricorder"—to test for a fungicide on oranges and a scald inhibitor on apples.

"We're trying to take powerful, sophisticated instruments out of the lab and into the real environment where they could help monitor fresh produce all along the supply chain from production and supply to the consumers," said Cooks, who is co-founder of Purdue's Center for Analytical Instrumentation Development. "This technology has the capability of testing for bacteria as well, such as *E. coli* or salmonella, and it only takes minutes as opposed to hours or even days for a standard laboratory test."

Mass spectrometry is a commonly used analysis method known for its sensitivity and accuracy; however, most available mass spectrometers require that a sample be specially prepared and placed in a vacuum chamber for analysis. Cooks and his team developed a technique, called ambient ionization, that allows critical steps to be performed in the air or directly on surfaces outside of a mass spectrometer. Molecules from the sample's surface are then vacuumed into the equipment for analysis.

Conventional mass spectrometers also are cumbersome instruments that weigh more than 136 kg (300 lb). The miniature mass spectrometer, called the Mini 10.5, is a handheld device roughly the size of shoebox that weighs 10 kg (22 lb).

"Accuracy is the price we pay for a much faster, cheaper, and easier technology that can be taken out into the field almost anywhere," Cooks said. "The Minis are not as precise as a standard mass spectrometer, but they would be a good first-line defense to indicate when additional testing is necessary."

Fred Whitford, coordinator of the Purdue Pesticide Programs, said the ability to sample food quickly would be a great benefit to the regulation industry.

"Sometimes a test result comes too late and the food is already out, which can be a serious problem," Whitford said. "Currently only about 2 percent of the food is pulled and tested, and perhaps a faster and cheaper test would allow more samples to be taken.

"Chemicals can be misused in a variety of ways," he said. "Sometimes they are applied in the wrong amounts, sometimes the crop is harvested too soon after chemical application, and sometimes a chemical is used that is not approved."

Graduate student Santosh Soparawalla and postdoctoral researcher Fatkhulla Tadjimukhamedov performed the grocery store field tests, which were limited to detecting the fungicide benzimidazole on oranges and the scald inhibitor diphenylamine on apples. Scald is a brown discoloration that appears on apples during storage.

"We could easily distinguish between treated produce, which had a strong signature for the chemicals, and organic produce, which showed no chemical residue on its surface," Soparawalla said. "This could be the first step toward a day when everyone will have the ability to make an informed decision of what they want to purchase and eat based on an analysis of the specific items."

In addition to the pilot test to validate the technology in the field, the team evaluated the quantities of diphenylamine, or DPA, present on a treated apple. The U.S. Environmental Protection Agency's limit for the concentration of DPA on an apple is 10 parts per million.

The team estimated that a concentration of 15 parts per million of DPA was present on an apple, but the margin of error for the test is large enough that the concentration could easily be within the regulated limits, Soparawalla said.

"These tests of apples demonstrate how this technology could be a part of a larger regulatory system. The experiments were not a robust scientific examination of the levels of chemicals present on produce," Cooks said. "The test is what's called a factor-of-two test, meaning that the actual concentration could be half or could be twice as much as the approximation. The results were not statistically above the legal limit, but it is food for thought."

For more information, contact: Elizabeth K. Gardner, ekgardner@purdue.edu; R. Graham Cooks, cooks@purdue.edu; Fred Whitford, fwhitford@purdue.edu; Santosh Soparawalla, santosh@purdue.edu; or Fatkhulla Tadjimukhamedov, ftadjimu@purdue.edu.

Dividing corn stover makes ethanol conversion more efficient

In Brief: *Not all parts of a corn stalk are equal, and they shouldn't be treated that way when creating cellulosic ethanol, say Purdue University researchers.*

When corn stover is processed to make cellulosic ethanol, everything is ground down and blended together. But a research team found that three distinct parts of the stover—the rind, pith, and leaves—break down in different ways.

ASABE member Michael Ladisch, distinguished professor of agricultural and biological engineering and director of Purdue's Laboratory of Renewable Resources Engineering, and his colleagues are trying to determine if there is a better method to process corn stover and optimize efficiency.

Cellulosic ethanol is created by using enzymes to extract sugars from cellulosic feedstocks, such as corn stover, grasses, and woods, and then fermenting and distilling those sugars into fuels.

Researchers grind the parts together and treat it based on what's needed to get at the hardest part. New research shows that there are major differences in degradability among the tissues.

Stover's pith, the soft core that makes up more than half the weight of a corn stalk, is the easiest for enzymes to digest. Rind is the most difficult, while leaves fall in between. Significant amounts of lignin, the rigid compound in plant cell walls, make the cellulose resistant to hydrolosis, a process in which cellulose is broken down into sugars.

Converting the rind only adds 20 percent more ethanol while requiring 10 times more enzymes, driving up the process price.

"Is that extra 20 percent worth the added cost?" asked ASABE member Nathan Mosier, associate professor of agricultural and biological engineering and co-author of the study. "If there is a way to separate out pith, you could burn the leftover rind to generate steam, creating energy needed to operate the plant."

Ladisch added that separating pieces of corn stover and treating them differently would be a new way of approaching cellulosic ethanol production. "It uses existing conversion technology, but it enables us to think about a new way of getting the most from that technology. There is absolutely no reason a ligno-cellulosic non-food material such as corn stalk cannot be used to make ethanol if you understand the science."

Ladisch said they would next work with colleagues to explore ways to improve the ability of enzymes to create sugars from cellulose and remove the compounds that inhibit those enzymes, as well as adapting the findings for other feedstocks such as switchgrass and wood.

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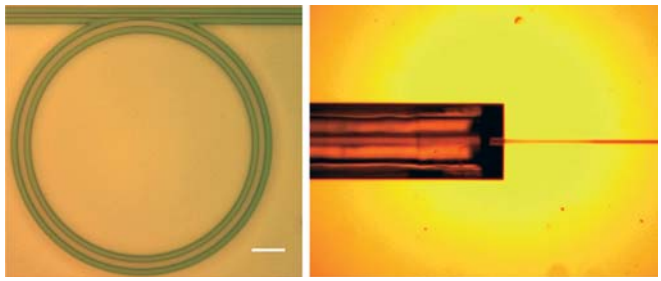
Microring device could aim in future optical technologies

In Brief: *Researchers at Purdue University and the National Institute of Standards and Technology (NIST) have created a device small enough to fit on a computer chip that converts continuous laser light into numerous ultrashort pulses, a technology that might have applications in more advanced sensors, communications systems, and laboratory instruments.*

Purdue researchers have created a tiny "microring resonator" small enough to fit on a computer chip. The device converts continuous laser light into numerous ultrashort pulses, a technology that might have applications in more advanced sensors, communications systems, and laboratory instruments. A grooved structure holds an optical fiber leading into the device. "These pulses repeat at very high rates, corresponding to hundreds of billions of pulses per second," said Andrew Weiner, the Scifres Family Distinguished Professor of Electrical and Computer Engineering.

The tiny "microring resonator" is about 80 micrometers wide, or the width of a human hair, and is fabricated from silicon nitride, which is compatible with the silicon materials widely used for electronics. Infrared light from a laser enters the chip through a single optical fiber and is directed by a structure called a waveguide into the microring.



The microring resonator (left) fits on a computer chip. A grooved structure (right) holds an optical fiber leading into the device. ***Photos courtesy of Birck Nanotechnology Center, Purdue University.***

The pulses have many segments corresponding to different frequencies, which are called "comb lines" because they resemble teeth on a comb when represented on a graph.

By precisely controlling the frequency combs, researchers hope to create advanced optical sensors that detect and measure hazardous materials or pollutants, ultrasensitive spectroscopy for laboratory research, and optics-based communications systems that transmit greater volumes of information with better quality while increasing bandwidth. The comb technology also has potential for a generation of high-bandwidth electrical signals with possible applications in wireless communications and radar.

The light originates from a continuous-wave laser, also called a single-frequency laser.

"This is a very common type of laser," Weiner said. "The intensity of this type of laser is constant, not pulsed. But in the microring the light is converted into a comb consisting of many frequencies with very nice equal spacing. The microring comb generator may serve as a competing technology to a special type of laser called a mode-locked laser, which generates many frequencies and short pulses. One advantage of microrings is that they can be very small."

The laser light undergoes "nonlinear interaction" while inside the microring, generating a comb of new frequencies that is emitted out of the device through another optical fiber.

"The nonlinearity is critical to the generation of the comb," said doctoral student Fahmida Ferdous. "With the nonlinearity we obtain a comb of many frequencies, including the original one, and the rest are new frequencies generated in the microring."

The findings are detailed in a research paper appearing online in the journal *Nature Photonics*.

Although other researchers previously have demonstrated the comb-generation technique, the team is the first to process the frequencies using "optical arbitrary waveform technology," pioneered by Purdue researchers led by Weiner. The researchers were able to control the amplitude and phase of each spectral line, learning that there are two types of combs—"highly coherent" and "partially coherent"—opening up new avenues to study the physics of the process.

"In future investigations, the ability to extract the phase of individual comb lines may furnish clues into the physics of the comb-generation process," Ferdous said. "Future work will include efforts to create devices that have the proper frequency for commercial applications."

The silicon-nitride device was fabricated by a team led by Houxun Miao, a researcher at NIST's Center for Nanoscale Science and Technology and the Maryland Nanocenter at the University of Maryland. Some of the work was performed at the Birck Nanotechnology Center in Purdue's Discovery Park, and experiments demonstrating short-pulse generation were performed in Purdue's School of Electrical and Computer Engineering.

The effort at Purdue is funded in part by the National Science Foundation and the Naval Postgraduate School.

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J. Alex Thomasson

POINT: ASABE Should not Advocate Policy to the Government

What is ASABE, fundamentally? Have you read our Constitution lately? If not, take a look and you'll notice that the Objects of the Society include promoting science, encouraging research, fostering education, advancing standards, increasing and extending association of members, encouraging professional improvement, and broadening the usefulness of our discipline.

The Bylaws and Rules elaborate on these Objects, and except for two phrases (Article B2, 3-c and 3-d), they do not mention involvement in public policy. The first of the two phrases encourages members, not ASABE itself, to participate in public affairs. Of course, we have the right to believe as we wish politically and to espouse our views as individuals, but the phrase in no way suggests that ASABE should espouse political views. In the second phrase, ASABE is charged with "cooperating with governmental agencies in matters involving" our discipline.

> "If we become political, then we diminish our value as an unbiased technical society. Moreover, we will likely divide our membership."

Clarification is provided in the associated policy statement: ASABE and Social-Political Issues (Adopted by Board of Directors, September 1971). Point 3 of this statement includes the following: "When clearly within the expertise of the Society's membership, ASABE through its officers, committees, or specifically constituted task forces may develop statements on proposed actions or problems. Statements will be limited to aspects relating to the technological-economical feasibility and practicality of proposed actions and alternatives. All statements will be presented as the professional judgment of those who formulated the statement and will not be presented as an official statement of ASABE." My argument here is not a legal one; there is no law against political advocacy by an organization such as ASABE, within limits. However, our Constitution and Bylaws along with supplementary statements make it clear that political advocacy is not in ASABE's charge.

And this is not simply an academic discussion. It has impact on what ASABE does and becomes. Having served recently on E-07 (Issues Management and Social Action), I can tell you that ASABE is frequently asked to endorse advocacy letters written by other organizations. For example, ASABE was recently asked to sign onto a letter stating, among other things, that the federal government should spend more on agricultural research. Whatever your opinion on such matters, the letter was clearly political advocacy, and it could be seen as particularly contentious because of the current economy and the federal budget situation. Rather than signing such a letter, ASABE could, well within its charge, opt to inform its members of political situations with a statement like the following: "Budget discussions on agricultural research are ongoing in Washington, and the potential exists for significant cuts. Please express your viewpoint to your congressional delegation." The key point is that a line must be drawn between providing information and recommending action.

Raising awareness of ASABE is a good and reasonable end, and it can be done without lobbying. Most members rightly desire to raise awareness of ASABE, and we should do so when it means commenting on technical issues like the ongoing LightSquared controversy, where the science and engineering are fairly clear-cut. On the other hand, a relevant argument against advocacy, such as recommending that the government spend more money, is that reasonable people (even within ASABE) can disagree about what's politically good for the country. ASABE should be active in commenting on clear-cut technical issues but should be very careful where these issues begin to rub up against politics.

ASABE is a technical society, not a lobbying organization. As members of ASABE, we have all joined in and implicitly subscribed to a particular set of documents that deal principally with our commonality as engineers. There are plenty of organizations lobbying for agricultural research funding or some other government policy, and we are all free to join such organizations. However, we must not allow ASABE to be used for lobbying; it is outside of our charge as an organization, it will appear to be done under the guise of scientific objectivity and diminish our value as an unbiased technical society, and it will divide our membership. I am a long-time member of ASABE, and I want what's good for ASABE over the long haul. In the current context, that means staying out of political advocacy.

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Daniel L. Thomas

COUNTERPOINT: Increasing ASABE's Visibility Requires a Stronger Advocacy Role

Alex is exactly right, and he explains the issue quite nicely. ASABE was established to address the technical issues and problems that occur in agricultural and biological engineering. However, given that foundation, how has our environment changed from what we have done in the past to what we are expected to do (or have the opportunity to do) in the future? Many of our fellow technical and professional organizations are taking a stronger role in informing our elected and government officials about issues of concern and being available to answer technical questions. In fact, the frequent changes that occur among our elected officials and in the leadership of many government agencies mean that we must be persistent in making sure they know we exist, and that we can be valuable in answering their critical questions.

For example, the American Society of Civil Engineers (ASCE) expanded the "Report Card on Infrastructure" to help make our aging infrastructure a more visible and critical issue. I don't believe that ASCE envisioned that the Report Card would only be valuable from an internal perspective. To replace our infrastructure over time, a huge investment is required, and the majority of those funds cannot be expected to come from the private sector.

> "Many of our fellow technical and professional organizations are taking a stronger role in informing our elected and government officials about issues of concern."

What are we allowed to do under our current tax-exempt status? Being a 501(c)(3) tax-exempt organization, a small portion of our income is allowed to be spent on advocacy issues without affecting our tax-exempt status. This ability exists for a reason!

To be an organization that important officials will consult—with questions that are appropriate for us to answer—we must be visible, easily accessible, and provide timely responses. How do we become more visible without veering into advocacy? I don't think that's possible. If we are attempting to be more visible, then we are advocating our own capabilities to those important officials. And that's appropriate. After all, ASABE is the most knowledgeable organization to approach for many of the fundamental questions related to bio-based energy, food security, environmental sustainability, etc. ASABE is also one of the best professional organizations to consult for issues associated with the collision of rural and urban land uses.

What should ASABE do to address this opportunity? In my opinion, we need to change the Bylaws and other governing documents to allow ASABE to increase its visibility, its accessibility, and its ability to provide timely responses to government and elected officials on important issues. We also need to establish fundamental policies on how ASABE stands on important issues. These fundamental policies should reflect the characteristics and feelings of the majority of the membership.

Without such policies in place, the ability of ASABE to respond quickly and accurately to upcoming issues will be drastically reduced. Of course, ASABE should not take a stand on issues that have not been adequately vetted by the membership in an appropriate process; the members must be provided the opportunity to comment on and recommend changes to any proposed policy. We should never allow a few people to think for our overall membership. However, a few representative people, working with our existing policies, could quickly and effectively present ASABE's position on important issues.

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Resource *magazine encourages your response to the views expressed. Please email your thoughts regarding Point/Counterpoint to mitro@asabe.org with the subject line, "Here's What I Think."*

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