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SOWING SEEDS for the FUTURE

Cover crops have proven to help farmers but can they help your business, too?

THE NEEDS OF modern agriculture have driven the seed industry to focus on higher-yielding varieties for various cash crops, such as corn and soybeans. Now, farmers are beginning to place that same attention to detail on cover crops, which are planted post harvest to improve the soil quality of growers' fields in the years to come.

"The whole movement is expanding rapidly, and most of it stems from farmers," says Ron Althoff, agronomist and Midwest sales representative for Saddle Butte Ag, based in Tangent, Oregon. "There are a few seed sales reps and companies promoting it, but this is mostly farmer driven, which makes it exciting."

Althoff says that while Indiana can be seen as the flagship of the cover crop community, the practice is also picking up steam in other U.S. states. "There are a lot of new areas coming on board," he says, noting that soil improvements, yield increases and weed control are the primary reasons farmers are jumping on board. Other benefits include increased earthworm populations and more nitrogen in the soil.

"To be conservative, I'd say we're seeing an increase of 25 percent in the number of acres planted each year," Althoff says.

Research has been a key factor in the growth trend, which has resulted in more farmers asking for better cover crop seed varieties. "There's a great deal of research out there that can quantify the benefits of using cover crops, and that has led to increased adoption," says Matt Ruark, a University of Wisconsin—Madison assistant professor of soil science.

Researching Mixes and Cocktails

One primary area of research involves determining what mix of cover crop species work best together. Cereal grains, grasses, legumes and brassicas are all popular options, depending on what end result farmers are looking to achieve.

Blends of around two or four species are usually referred to as a mixture. Blends that include 10 or more varieties are often dubbed "cocktails," according to Ruark.

"There are a lot of unknowns in cover crop mixes," Ruark says. "It's hard to quantify because we don't have a lot of research on those cocktails yet." It might be three years before there is any significant data to share about a particular mix, he adds.

Dave Robison, forage and cover crop manager for the Wisconsin-headquartered Legacy Seeds, Inc., agrees that there is much to learn about these larger mixtures. "Using six or even 10 different species in a mixture isn't a bad thing, but it can be a little more challenging for folks to manage," Robison says. "I suggest starting off with something a little simpler and then if they want to be more adventurous with more species, they can."

A lot goes into selecting the perfect mix for each farmer, and seed suppliers need to help guide farmers through that process.

"It's different for different folks," Robison says. "Someone who wants to graze cattle on a cover crop might want to use a different mix than someone else."

> "Every seed company talks about improving profitability for farms, but if those hybrids go into unhealthy soil, you're going to be limited."
> — Dave Robison

For suppliers, adding cover crops to the company's catalog doesn't just translate to more items to sell; it can mean a longer selling season. "Adding more cover crop options truly extends the selling season than we would have had," Althoff says.

More than that, farmers who buy cover crop seed tend to be more satisfied with the performance of their corn and soybeans. "Yes, you'll sell more seed, but what it does for us is enhance the whole farm's profitability by giving them the best yield on their corn and soybeans," Robison says.

In fact, offering customers a research-backed selection of cover crops is one way to stand out from competitors. "Every seed company talks about improving profitability for farms, but if those hybrids go into unhealthy soil, you're going to be limited," Robison says. "The greatest limiting factor to higher corn and soybean yields is not the genetics of the variety, it's the poor health of the soil."

Knowing this, cover crops should be considered a companion to cash crops. "If we can improve the soil health, which will make the hybrids reach their highest potential, it will help customers be more profitable," Robison says. "We need to match hybrids to the right soil, and that will make every part of a farm more profitable."

At that point, seed companies have shifted from just offering a product to also offering a service. "You're not just selling seed, you're selling the potential to get the best out of that seed," Robison says.

Seed salesmen might face hesitation when working with farmers who don't own the land they're farming. Tom Kaspar, a plant physiologist at the U.S. Department of Agriculture's Agricultural Research Service National Laboratory for Agriculture and the Environment in Ames, Iowa, says it can be hard to reach that segment of operators.

"How do you convince people to apply cover crops to land they don't own?" he asks. Working with and informing those non-operator landowners can help.

"A lot of landowners realize they don't want erosion either," Kaspar says. "They want protection and improvement for the soil for the future."

First Steps to Ensure Success

In order to protect the market, Althoff urges seed companies to educate themselves before jumping in.

"The business is getting big enough now that we might start to see companies come into the market trying to make a quick sale, but if they end up selling farmers something that won't work, it will cause a setback," he explains.

The Midwest Cover Crop Council website is a good online resource for suppliers looking to understand more about what benefits each crop or mix offers, as well as when, where and how to plant it for the best results. The website even features a cover crop selector tool, which can be narrowed down to the county level in most Midwestern states.

"It's important for seed companies to understand seeding rates, planting windows, planting methods and if a certain crop will survive the winter and how to terminate it in the spring," adds the University of Wisconsin's Ruark.

Even companies that already offer cover crops have a lot to learn. There's a lot of new research being done each year and it's important to continually revisit and reevaluate what cover crop varieties can best serve your customers in your specific region.

"We need to educate farmers because often times, they'll see an article about a new species and want to try it, but co-ops and seed providers shouldn't sell them something that is going to be difficult to make work in their area," Kaspar says.

He expects the future to bring even more cover crop variations and varieties to the marketplace, so ongoing research will continue to be crucial. "We're just barely scratching the surface as far as potential," Kaspar says. **Melissa Shipman**

HOW TO HAVE THE GMO TALK — THE RIGHT WAY

Sometimes, talking to friends and family can be a challenge for employees in the seed industry. Here are some tips to help you talk about what you do, and why it's important.

Chris Davison, Head, Corporate Affairs, Syngenta Canada.

Janice Person, Director of Social Media, Monsanto.

Kenda Resler-Friend, External Communications and Media Relations Leader, Dow AgroSciences.

Fran Castle, Global Brand and Media Communications Senior Manager, BASF Plant Science.

CONSUMERS AND THE general public have many questions about the seed industry and the role of biotechnology and genetically modified organisms. Battling negative perceptions, and clearing up misconceptions, is an ongoing challenge.

"For those of us engaged in biotechnology, we see how polarized the conversation has become and it can be intimidating to enter the conversation," says Janice Person, director of Social Media for Monsanto. "We also find ourselves heavily rooted in data and information and seeing the emotions expressed are so different than the knowledge we have; it's hard to wade into."

For this reason, some employees at biotechnology firms tend to be reluctant to talk about what they do. With this in mind, *Seed World* asked communication experts for talking points to help you discuss what you do, and why it's important.

How can employees equip themselves with to have a successful GMO conversation?

Fran Castle (FC): For casual conversations with family and friends, we encourage employees to not only talk about the benefits of the technology, but to also understand the arguments of those who oppose GMOs. Last year, the industry launched *GMOAnswers.com*, an initiative committed to responding to questions people have about how their food is grown.

Kenda Resler-Friend (KRF): It's a matter of connecting employees' knowledge with an approach they are comfortable using in talking about GMOs. Finding the right words and tone comes with practice. Our opportunity is to effectively engage in constructive conversations with an uninformed and/or misinformed public one conversation at a time.

What tips do you have to help employees have a successful GMO conversation?

Janice Person (JP): It's important to be conscientious, credible, courteous, compassionate, calm, cautious and creative. I usually think about engaging in a way where I am true to me and think of it as a conversation rather than a debate.

Chris Davison (CD): Become familiar with the accurate information available, ask questions if you don't understand something and encourage others to seek out information.

KRF: We urge every employee to be open to talking about GMOs and answering questions, while being candid and transparent in those conversations. We reinforce that it is important to support the concept of choice, both for farmers and consumers.

What main messages should employees consider when talking about their work?

JP: Canned messages don't work too well; they sound canned. But when we talk about how we personally have the confidence in the products so that we feel comfortable serving biotech products to our children or how we have personally seen the positive impact on the environment, those are experiences we can share that have real staying power for others.

FC: GMO technology has been extensively researched and studied and is safe. Plant biotechnology is a natural progression of conventional plant breeding, which has been going on for 10,000 years.

KRF: Innovation is so important to all parts of making our lives better, including our food. Through the benefits of biotechnology, the hard work of farmers and a stable food supply chain, our diet choices in the U.S. are abundant, safe, nutritious and affordable.

CD: GM food products are the most extensively tested and regulated in the entire food sector. Testing by independent public authorities and scientists throughout the world, including national and international food standards bodies, continues to demonstrate that approved GM plants are just as safe as conventional varieties. **Mark Halsall**

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A group of FuSE participants toured INCOTEC, Enza Zaden and the Seed Biotechnology Center at the University of California, Davis.

EXECUTIVES IN THE MAKING

Celebrating its 10th anniversary, the Future Seed Executives initiative continues to build momentum. To recognize this milestone, *Seed World* has followed up with the committee's founders.

IMAGINE ATTENDING THE American Seed Trade Association's Corn, Sorghum and Soybean Seed Research Conference and Seed Expo, known to most as CSS & Seed Expo, in downtown Chicago — there's hundreds of people, rows upon rows of exhibitors, numerous receptions and everybody knows somebody, except you.

In 2003, that's exactly how Jim Schweigert, now president of Gro Alliance, felt. Unknowingly, Schweigert, who had just come back to the family business as marketing manger, confided his frustration to Seedway's Don Wertman, who was the chairman of ASTA at the time.

"Well, why don't you do something about it," Wertman told Schweigert. And, that's the spark that got the Future Seed Executives (FuSE) started. Today, FuSE is formally organized as a sub-committee of ASTA's Management Skills Committee.

"For anyone who comes into the industry, there's always that fear factor of not knowing anyone," says Cassie Misch, who chairs the FuSE Committee. "With FuSE, you have an automatic network already established."

Misch, a key account lead with GreenLeaf Genetics in Minnetonka, Minnesota, credits Schweigert for putting his thoughts to action. "FuSE not only connects people, but it helps industry newcomers gain confidence and exposes them to an array of big picture seed industry issues."

In getting FuSE off the ground, Schweigert was joined by TJ Lawhon, who was with Delta King, a sister company of Lawhon Farm Services; David Nothmann, who was with Monsanto's Corn States; and Alexis Ellicott, who was ASTA's director of international programs.

The four worked together with ASTA's leadership to set up a committee that had staying power and filled a need within the industry. "We knew it needed to have a purpose, it needed to be something that we could implement and it needed to provide education," Schweigert says.

> "For anyone who comes into the industry, there's always that fear factor of not knowing anyone. With FuSE, you have an automatic network already established."
>
> — Cassie Misch

Not long after the official formation of FuSE, Lawhon transitioned to the retail side of the business, which was Lawhon Farm Services, and served as general manager for six locations in northeast Arkansas and oversaw 75 employees. When the company was sold, Lawhon stepped in to manage the finances of the parent company, also called Lawhon Farm Services. Two years

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later, that business was sold and Lawhon decided to go to law school at the University of Arkansas at Little Rock William H. Bowen School of Law. Today, Lawhon is an associate at Dover Dixon Horne PLLC and stays connected to the seed industry through various legal matters involving agricultural issues.

"One of the biggest obstacles in entering into a leadership role is having the confidence in knowing your answers are right versus always having to bounce your ideas off others," Lawhon shares. "I developed confidence through trial and error and experience — making a decision, sticking with it and learning from my mistakes. FuSE gives younger people a place to start and grow into those leadership roles."

"If you're at the right meetings, meeting the right people and doing the right training, the rewards will come. Invest in yourself and think about how you can become as valuable as possible to your company."

— Jim Schweigert

Lawhon says he's proud to be a part of the group that started FuSE. "It feels good to know that we were able to start and leave behind something that helps young leaders connect with each other and grow their abilities," he says.

Schweigert says the leaving behind part was hard, but necessary for FuSE to really take hold and become a sustainable committee with fresh faces and new initiatives.

Karen Withers of Pennington Seed was the first committee chair outside of the founding four. She was followed by Mindy DeVries of Monsanto. "Karen and Mindy played a pivotal role in taking FuSE to the next level," Schweigert says.

Today, more than 20 individuals comprise FuSE's organizing committee and FuSE has a presence at all of ASTA's meetings. FuSE is also beginning to extend its presence to other industry organizations, such as the Independent Professional Seed Association. It has a number of initiatives and provides learning and networking opportunities throughout the year.

Schweigert credits his career trajectory directly to his involvement with ASTA and the FuSE Committee. "If you're at the right meetings, meeting the right people and doing the right training, the rewards will come," Schweigert says. "Invest in yourself and think about how you can become as valuable as possible to your company." **Julie Deering**

Jim Schweigert, Gro Alliance president, set the wheels in motion for FuSE.

FuSE FURTHERS EDUCATION

The Future Seed Executives of the American Seed Trade Association is designed to educate and support future seed industry executives, namely those with fewer than seven years of seed industry experience. The programs are designed as regional opportunities to expand learning, cultivate management skills, promote networking and improve the general understanding of the seed industry. The following are a few of the programs FuSE hosts.

Educational Units — These are one- to two-day workshops cohosted by FuSE and an ASTA member company with the purpose of educating participants about the business and operations of the industry host. Each unit has an overarching theme relevant to the respective host company. Local agribusinesses and educators are actively engaged during the unit to provide a broader view of the value chain during the experience.

Roundtable Discussion Groups — These are one-hour conference calls and webinars led by senior industry members to educate participants about industry topics, current trends and major events.

Campus Connections — This program brings college undergraduates to ASTA's annual convention and pairs them with a mentor. They learn about multiple facets of the seed industry and career options.

Industry Meeting Programs — Mini Educational Units are held in conjunction with other industry meetings to engage the FuSE members already participating in the industry.

For more information about FuSE and to get involved, visit **Amseed.org/education/fuse** or find them on Facebook.

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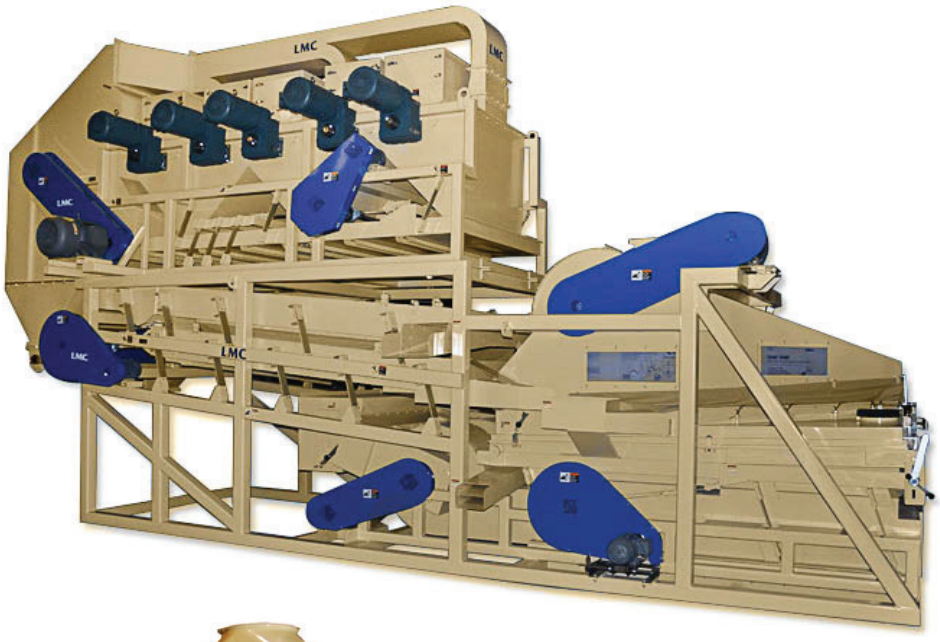

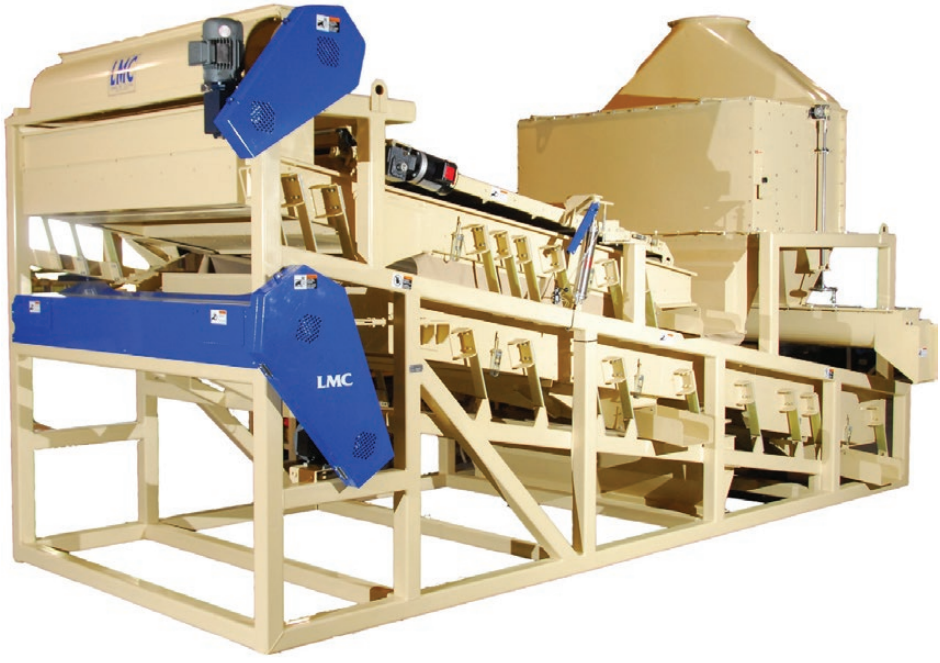

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Seeds of Distrust Spur GMO Labeling Bills

A growing number of U.S. states are considering some form of mandatory labeling for GMO-derived food products. *Seed World* explores the impact such a system could have on the seed sector and what experts in the agriculture and biotechnology fields have to say about it.

IT WAS 10 years ago this past April that rules for the mandatory labeling of foods containing genetically modified organisms came into effect for all member countries of the European Union.

As a result of GM Food and Feed Regulation No. 1829/2003, everything from maize to flour, oils, tomatoes and even wine that contain GM ingredients must now carry a label indicating this information. However, products such as meat, milk or eggs from animals that consumed GM animal feed do not require labeling.

The question is whether the United States could soon follow suit in labeling foods that contain GM ingredients. Currently, only genetically enhanced food that contains a significantly different nutritional property requires a label.

While the federal government has shown little interest in the notion of mandatory labeling for GMOs, several states have proposed their own legislation. Maine and Connecticut passed labeling laws in 2013 and more than two dozen other states are considering proposals, which would require genetically altered food to be labeled.

A recent *New York Times* poll indicated that 93 percent of Americans feel foods containing GMO ingredients should be identified. The agriculture industry has responded by saying there is no need for a labeling system in the U.S. and such a move will result in higher prices and fewer choices for consumers.

Options Exist

As director of communications for Biotechnology Industry Organization, which is the world's largest trade association representing biotechnology companies, academic institutions, state biotechnology centers and related organizations across the U.S. and in more than 30 other nations, Karen Batra says a mandatory labeling system in the U.S. could end up being redundant because the National Organic Program already prohibits the use of genetically modified materials in select items, which must be labeled.

"There are already volunteer-based food labeling programs that work perfectly well in this country and provide those kinds of labels for consumers if they want to make that kind of choice," Batra explains.

On the other side of the Atlantic, Beat Späth is director of Green Biotechnology Europe, a division of EuropaBio — an association that represents more than 2,000 companies active in the biotechnology sector across Europe, including the pharmaceutical, industrial technology, food and agricultural sectors. Späth says he's not sure there is anything for the U.S. to learn from the European model.

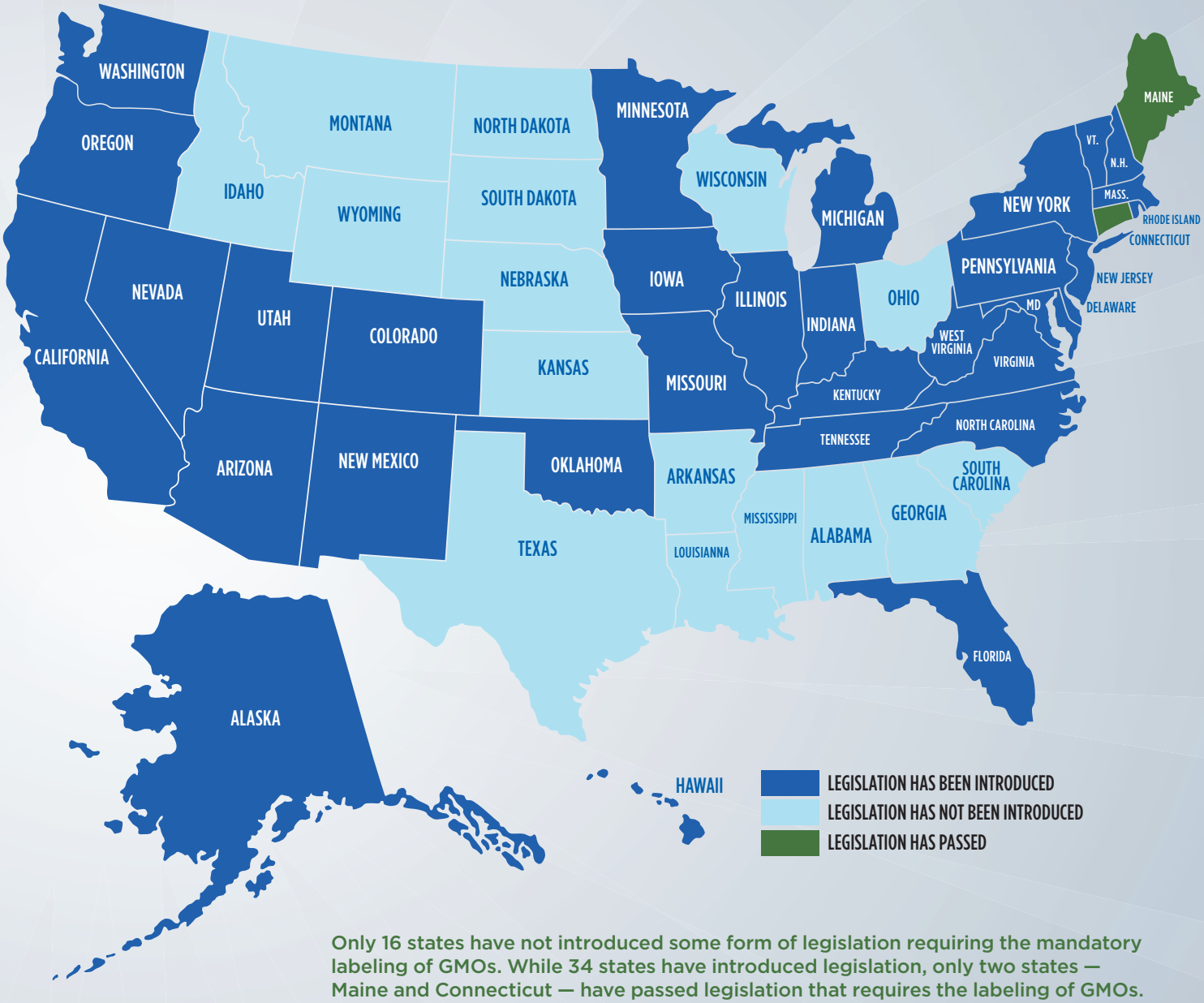
"We don't have a position or any efforts from outside to change the policy in Europe, but it may not be an ideal system for the U.S.," Späth says. "If there is a decision to go for some kind of GMO labeling in the U.S., the details will determine the impact."

But the question of a labeling policy is a very principled one. "Do you want to identify foodstuffs by the quality of the product or the method that they were produced," asks Garlich von Essen, secretary general for the European Seed Association. "In Europe, we chose the latter; however, we cheated ourselves."

Because Europe is highly dependent on feed imports, products derived from livestock don't fall under this labeling requirement. "Consumers live with the false expectation that there are no GMOs in Europe," von Essen says.

As part of the seed industry, the American Seed Trade Association has taken the position that opposes mandatory labeling of food products that contain ingredients that have been improved using genetic engineering technology. The association believes that "such mandatory labeling requirements are neither necessary nor scientifically defensible, and would run contrary to federal policy established by the U.S. Food and Drug Administration." ASTA also reports that any state law requiring mandatory labeling of foods developed through genetic engineering would create competitive disincentives in the state among different agricultural sectors.

GMO LABELING LEGISLATION BY STATE



Only 16 states have not introduced some form of legislation requiring the mandatory labeling of GMOs. While 34 states have introduced legislation, only two states — Maine and Connecticut — have passed legislation that requires the labeling of GMOs.

State	2014
Alaska	HB215 and SB158
Arizona	Ballot Initiative
California	SB1381
Colorado	Ballot Initiative
Florida	Ballot Initiative
Hawaii	SB2521

State	2014
Kentucky	HB441
Maryland	HB1191 and SB778
Missouri	SB533
New Jersey	S91 and A1359
New York	A3525 and S3835
Oklahoma	HB2942

State	2014
Oregon	HB4011
Pennsylvania	HB1770 and SB653
Rhode Island	H7042 and S2226
Tennesee	SB1878
Utah	HB205
Washington	HB2143
West Virginia	HB2153

"There is hardly any biotechnology in use in Europe ... they have a less sustainable ag production system and their consumers pay higher prices."

— Karen Barta

As part of Europe's food technology sector, Beat Späth (pictured center) questions what the U.S. can learn from Europe when it comes to labeling GMO foods.

Uncertainty Looms

Terry Wanzek and his family operate TMT Farms, an 11,000-acre wheat, corn and soybean farm near Jamestown, North Dakota. Wanzek, who also operates a seed cleaning plant, says it's too early to say precisely what impact mandatory labeling for GMOs could have on the seed sector, but he has serious reservations.

"As a seed dealer, I think we would have fewer problems providing segregation and isolating and providing the seed for producers who want to grow for whatever market, but there's a cost to that," Wanzek says. "I hear a lot of producers say, 'we'll give consumers what they want but who's going to pay for it?' It's all connected in my mind."

BIO's Batra shares Wanzek's concerns. She says there is no doubt that mandatory labeling will result in higher prices for consumers. "There's more to it than just implementing a law or changing product packaging," she says. "There are all kinds of costs associated with implementing a program like this, and those costs are ultimately going to be passed on to the consumer in the form of higher prices."

Batra adds that recent studies have shown mandatory GMO labeling could cost the average American household as much as an additional $400 a year.

Claire Parker, a spokesperson for the Coalition For Safe Affordable Food (CFSAF), which comprises a variety of organizations from the American Soybean Association to the National Restaurant Association, is concerned that mandatory labeling could result in fewer food choices for U.S. consumers.

Slapping labels on food items containing GMOs would likely stigmatize those products, she says, prompting retailers to discontinue stocking them on their shelves. Manufacturers will be forced to add warning labels for safe ingredients until they can find more expensive, non-GMO alternatives.

"We want to ensure that consumers have access to safe, affordable food and a full range of options," Parker says, noting that CFSAF wants any labeling decisions to be based on scientific data, rather than politics.

Labeling Limits Choice

Späth says the EU's decision to adopt mandatory GMO labeling has resulted in fewer choices for consumers in member countries. While some labeled items, such as chocolate bars, can still be found, most retailers simply refuse to stock food products above the 0.9 percent threshold that requires the GMO label.

"There's no real choice for people who would want to buy [GMO products] because there's almost nothing available," Späth says. "People who want to buy non-GMO stuff can buy organic and products with GMO-free labels. There is a choice on one end of the spectrum but not on the other."

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Farmer, seed dealer and state senator, North Dakota's Terry Wanzek has reservations about the idea of labeling GMO-derived foods.

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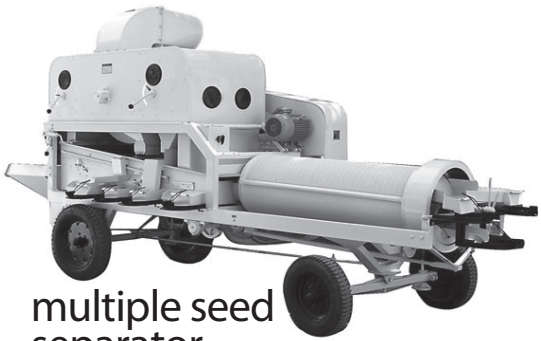

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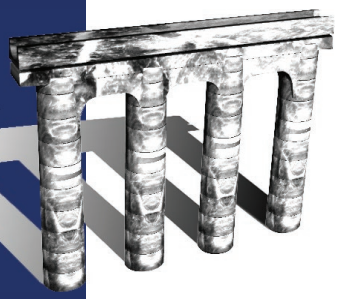
However, with the rapid adoption of GMOs and biotechnology, the world is in an entirely different place today than in 2003 when the European Commission adopted the labeling rule. "If the U.S. were to deploy the labeling requirement, you would have to label virtually everything," von Essen says. "This could be an opportunity to further develop the non-GM market, but that's a niche market. Europe is the complete opposite."

BIO's Batra says it would be a serious mistake if the U.S. were to follow Europe's lead when it comes to food labeling. "There is hardly any biotechnology in use in Europe and as a result they have a less sustainable ag production system and their consumers pay higher prices," she says.

Parker says current efforts to adopt state-by-state legislation is "unworkable and will cause confusion among consumers." And on April 9, 2014, a bipartisan group of lawmakers co-sponsored a bill, known as the Safe Accurate Food Labeling Act, which if passed could undermine state efforts.

Championing the bill is U.S. Rep. Mike Pompeo from Kansas who says "we have got a number of states that are attempting to put together a patchwork quilt of food labeling requirements with respect to genetic modification of foods … that makes it enormously difficult to operate a food system." Pompeo adds that the campaigns in some of these states aren't really to inform consumers, but rather aimed at scaring them. "What this bill attempts to do is set a standard," he explains.

CFSAF believes that, if passed, the proposed bill will remove confusion and uncertainty associated with a 50-state patchwork of GMO safety and labeling laws. The bill reaffirms the U.S.



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Food and Drug Administration as America's sole authority on food safety and labeling requirements, and requires the FDA to:

- Conduct a safety review of all new GMO traits before they are introduced into commerce.
- Label foods containing GMOs only if a health issue is found with that trait.
- Establish federal standards for companies that want to voluntarily label their products for the absence or presence of GMO food ingredients.
- Define the term "natural" for its use on food and beverage products so that food and beverage companies and consumers have a consistent legal framework that will guide labels and inform consumers.

While groups such as CFSAF, the American Farm Bureau Federation and the Grocery Manufacturer's Association applaud the proposed bill, the National Farmers Union opposes it.

"Our member-driven policy supports the authority of lower levels of government and opposes preemption by federal standards," says Roger Johnson, NFU president. "This legislation would pre-empt state actions to label foods containing GMOs. Surveys have consistently shown that consumers want more information about their food, not less. The prevalence of state-led efforts to label GMOs only corroborates these findings."

The CFSAF is supportive of legislation that would require the FDA to review all new traits before they are introduced to consumers and establish standards for companies that wish to voluntarily label their products.

Parker says it's important to note that CFSAF supports mandatory labeling by the FDA if, based on science, there are any health or safety issues with GMOs.

Food Safety Concerns

Food safety was one of the primary reasons why mandatory labeling was introduced in the EU. Späth says many Europeans had lost trust in the food industry following the BSE or mad cow disease crisis in the late 1990s and early 2000s, and felt public institutions hadn't done enough to protect them.

"In the past few years, there's been an awful lot of unjustified criticism of the European Food Safety Authority," Späth says. "It looks like trust has been reduced in the past few years. GMOs are really one of the scapegoats. A lot of people are worried despite the fact our food has never been safer, and that's been proven over and over — GMOs in particular."

Despite the adoption of GM Food and Feed Regulation No. 1829/2003 in Europe, research shows most consumers don't pay attention to food labels. The CONSUMERCHOICE project called "Do European Consumers Buy GM Foods?" conducted a series of studies from May 2006 to October 2008, which included the exploration of purchasing choices in the Czech Republic, Estonia, Germany, Greece, the Netherlands, Poland, Slovenia, Spain, Sweden and the United Kingdom. It's important to note that GM-labeled products were not found on the market in four of these countries: Slovenia, Greece, Germany and Sweden.

In examining the purchasing behavior of consumers and comparing it to their perceptions, researchers found that half the respondents (49.8 percent) said they "did not" buy GM-labeled food. But based on bar-code scans, 48 percent of GM buyers thought they had not bought GM-labeled food, while almost 23 percent of non-GM buyers thought they had bought GM-labeled food. Additionally, 30 percent claimed not to know. The study states that "labeling was demanded by participants, yet few of them actually looked at the labels when buying food."

This research only corroborates what Wanzek, who is also a North Dakota state senator, already knows. Having fought a moratorium on the introduction of biotech wheat more than a decade ago, Wanzek doesn't believe the general public is clamoring for mandatory GMO labeling. He says a small but vocal group has made it a political issue rather than a safety issue.

Von Essen can relate. "In Europe, GMO labeling is used as a campaign tool," he says. "If the label is based on science, then it's just information and we don't mind it. But does the label read 'by the way, this product is the most-tested and most-verified' or 'we don't know how this will affect your long-term health?' Is it a tool for information or a tool for campaigning?"

It remains to be seen if U.S. lawmakers will keep food labeling at the federal level or leave it in the hands of consumers to decide within their own states. Regardless of what happens, it will set an important precedent for science, both in the U.S. and internationally.

Jim Timlick and Julie Deering


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protecting pollinators

A NEW HIVE FOR BEE CARE RESEARCH

This article is part of *Seed World*'s ongoing Protecting Pollinators series, brought to you by Bayer CropScience. Here, you'll discover the answers to help improve bee health and stewardship as researchers uncover them. In this article, you'll learn about Bayer's new North American Bee Care Center, which is home to apiologists, biodiversity specialists, eco-toxicologists and beekeepers.

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bee care

On average, beekeepers lost 32 percent of their colony and some reported losing as much as 70 percent of their colonies in 2013, reports Donald Parker of the National Cotton Council of America.

As the integrated pest management manager for the NCC, bees are one of the insects on Parker's mind. He's concerned that efforts to protect pollinators will restrict some of the crop protection products available to cotton farmers. He says that many farmers understand that colony collapse is a concern for agriculture, as honey bees are responsible for between $1.2 billion and $5.4 billion in agriculture productivity in the U.S. But Parker says most farmers don't understand how the issue relates to their farm.

Parker explains that beekeepers get higher honey yields in fertilized irrigated areas versus forested conservation areas and that's where farmers come into the picture.

"Often times, beekeepers ask local farmers if they can put their bees out in a field and they say yes, but don't even know the person's name," Parker says. "That's one reason why we are working to improve communication between beekeepers and farmers."

Jim Dempster, an apiarist at the Eastern Bee Care Center Technology Station in Clayton, North Carolina, holds up an educational prop that displays different components inside of a honey bee hive.

The decline of pollinators has been top of mind for many businesses. As a result, the Pollinator Partnership was formed in 1997 to protect pollinators critical to food and ecosystems through conservation, education and research.

Laurie Davies Adams, Pollinator Partnership executive director, says the non-profit organization through its Corn Dust Research Consortium gave grants to Iowa State University, The Ohio State University and the University of Guelph to observe corn fields during the planting season with the goal of reducing honey bee exposure to dust emitted from the fan exhaust of planters during the planting of treated corn seed. The first year of research has been completed and the group is funding a second year, which

QUICK FACT

Did you know that June 16-22, 2014, is National Pollinator Week? Seven years ago, the U.S. Senate unanimously approved and designated a week in June as National Pollinator Week. This marked a necessary step toward addressing the declining pollinator populations. What will you do that week to show your support?

focuses on follow-up evaluation, information dissemination and adaptive management.

Having worked in the bee care area of for more than 25 years, Bayer CropScience also has a long-term relationship with pollinators. In fact, the company's commitment to pollinators, specifically honey bees, was on full display April 15 as employees, stakeholders, researchers and industry leaders gathered to celebrate the grand opening of Bayer's North American Bee Care Center. Located at its headquarters in Raleigh, North Carolina, the $2.4-billion center brings together significant technological, scientific and academic resources with the goal of promoting improved bee health, product stewardship and sustainable agriculture.

Becky Langer, Bayer CropScience Bee Care program manager, says that the Bee Care Center was really an evolutionary process that brings all the different working components together to improve communication, collaboration, stewardship and research.

SEARCHING FOR ANSWERS

The Bee Care Center houses researchers who study many different areas that affect the health of honey bees. Langer says they have projects focusing on the varroa mite, small hive beetle, and forage and habitats.

"As our society grows, we are losing some of our natural habitats," Langer says. "Some acres that have traditionally been planted with forages are shifting to row crops. We've partnered with Project Apis m and the Pollinator Partnership to look at native drought resistant plants and developing forage habitats."

In their quest to search for answers, Bayer is collaborating with many other organizations and universities. As part of that collaboration, graduate students from across the country will rotate through the center, while working on their research projects. Two graduate students have already taken up residence for the summer at the Bee Care Center.

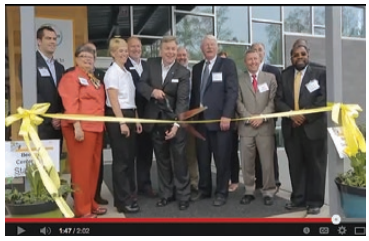
Langer also says that they're forging new partnerships with FFA and 4-H to inform youth. "We're working to educate youth so as they grow and move forward, they'll have a good knowledge base to make decisions from," Langer says.

The Bee Care Center places a great deal of emphasis on education and has already given numerous tours. To-date, more than 300 individuals have toured the state-of-the-art facility.

A 6,000-square-foot, state-of-the-art facility, Bayer CropScience's North American Bee Care Center comprises a honey extraction room, a hive workshop and an interactive educational room.

All of these efforts build upon one another to improve stewardship for a sustainable bee population. As a part of that effort, Bayer launched its Fluency Agent, which replaces the traditional graphite and talc powders and is designed to reduce dust. "It's a win-win situation for everyone," Langer says. Be sure to check out **SeedWorld.com/Pollinators** for more information.

HIGHLIGHTS FROM THE GRAND OPENING



More than 200 people came to witness and celebrate the grand opening of Bayer CropScience's North American Bee Care Center. Speakers included Jim Blome, Bayer CropScience president and CEO; Steve Troxler, North Carolina Agriculture Commissioner; and Rich Linton, North Carolina State University dean of the College of Agriculture and Life Sciences. Check out this video at **SeedWorld.com/Pollinators** and listen to the highlights from the day's events.

Newman Moves Priorities Forward

ASTA's Craig Newman reflects on his year as chairman.

FOR AGRELIANT GENETICS' Craig Newman, 2013/14 has been years in the making as he has worked his way up through the ranks of the American Seed Trade Association and helped elevate industry issues through work on Capitol Hill and his involvement in communications and educational initiatives.

In an interview with *Seed World*, Newman shares his thoughts about his year as chairman and his involvement with ASTA.

***SW:* As your year as chairman comes to a close, what are you most proud of?**

CN: During my year as chairman, ASTA's board of directors and I have worked to boost member participation, increase educational opportunities and continue to implement ASTA's five-year strategic plan. In the 131-year history of ASTA's annual convention, this is the first time it's being held in Indianapolis, Indiana, which is not only the crossroads of the United States, but also the crossroads of ASTA. Two-thirds of the members are within driving distance of Indianapolis, which makes it easier for people to participate. To help increase educational opportunities for members, we are partnering with Purdue University to host a Seed Leadership Program, which sold out — so there's clearly a need there.

SW: As you've become increasingly involved with ASTA, how has your perception of the organization changed?

CN: As I've progressed in leadership roles with ASTA, my knowledge level has increased as has my appreciation for the organization. I didn't know what I didn't know when I first joined the ASTA board. Even when I was in a top management role within our company, my awareness of the issues ASTA works on was really limited. I became extremely grateful that someone was watching out for our industry and our company — intellectual property rights, phytosanitary issues, educating policymakers at the state and national levels. I was extremely impressed by the professionalism and knowledge level of the staff and they continue to excel and provide solutions to overarching industry issues.

SW: Given your knowledge and experience, what's your view of the future for the seed industry?

CN: All companies — large and small — benefit from ASTA's work. Despite what you might read about consolidation within the industry, the association and the industry are both healthy and thriving. ASTA has more than 700 members and continues to grow. There is so much innovation and excitement within the industry right now; it's a great place to be. In the next three to five years, the protection of intellectual property will continue to be a priority, as well as harmonizing phytosanitary rules. We'll continue to work on domestic policy, such as GMO labeling. Seed as an innovation is amazing; farmers don't necessarily realize what all goes into every bag of seed they plant. The work ASTA does really benefits farmers. It is "First-the Seed."

Working on behalf of the entire seed industry, Craig Newman stresses the importance of participation within ASTA to help move industry issues forward at the state, national and international levels.

SW: What do you want others to know about ASTA?

CN: If people want to be heard, they need to get involved. Everybody can participate and have input into the future of their industry. **Julie Deering**

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Boom Times for Sorghum

More and more acres in the United States and around the world are being planted with this hardy, drought-resistant grain. The growing number of uses for sorghum is a big reason why.

SORGHUM IS ONE of the most versatile crops around and has a growing list of uses. This hardy, drought-resistant grain has commonly been used as livestock feed, but is now carving more space in the biofuel market. It can serve as a feedstock in ethanol production, as well as a biomass crop to help fuel power plants. But sorghum is also used to make such things as gluten-free bread and fiberboard, and is a key ingredient in many Chinese wines.

According to Tim Lust, CEO of the National Sorghum Producers (NSP), these are boom times for the sorghum industry. NSP is a trade organization focusing on legislative and regulatory activities affecting the American sorghum industry.

Lust says the number of acres planted for the three main types of sorghum — grain, forage and silage — are growing. NSP estimates nearly 100 million acres of grain sorghum were planted around the world in 2013, with U.S. grain sorghum acreage tipping 8 million acres. For the U.S., that's a 35 percent increase from 2012, and the prospects for 2014 are even better. "Most of the private analysts say we will be up another half a million acres this year," Lust says.

Some of these acres will produce sorghum seed earmarked for export markets. "Mexico has always been a very strong market for the U.S. sorghum seed industry," Lust says, listing China and Ukraine as two other main seed buyers. "Ukraine has been a significant increase for us globally on the seed and genetic sides. With the unrest there, we're a bit concerned as that has been a very strong market."

China is a growing market and there is increased demand not only for U.S. grain sorghum but also sorghum seed, Lust says,

PARTNERING TO IMPROVE SORGHUM

Most recently, DuPont Pioneer and the United Sorghum Checkoff Program announced a collaboration to advance genetic tools and opportunities for grain sorghum. Under a three-year collaboration agreement, the Sorghum Checkoff will leverage the seed technology program at Pioneer for a total investment of $800,220.

"This collaboration will help increase sorghum farmer productivity and profitability," says Kay Porter, DuPont Pioneer senior research manager. "We believe this collaboration will lead to new innovations to develop stronger and higher yielding sorghum varieties."

As part of the collaboration, researchers will focus on three genetic projects, which include:

- A search for a haploid inducer line, the first step in the development of double haploid sorghum breeding programs. If successful, this development would lead to a major leap forward in the speed of sorghum breeding.
- The development of a high throughput, precision screening method for stress-induced stalk lodging, which targets an important agronomic challenge for sorghum farmers
- The development of non- and low-tillering sorghum hybrids, which would allow sorghum farmers to leverage precision techniques.

CONGRATULATIONS CRAIG NEWMAN

Thank you for your service as 2013-2014 ASTA Chairman of the Board. Your leadership and dedication to the seed industry is sincerely appreciated. Congratulations on a great year!

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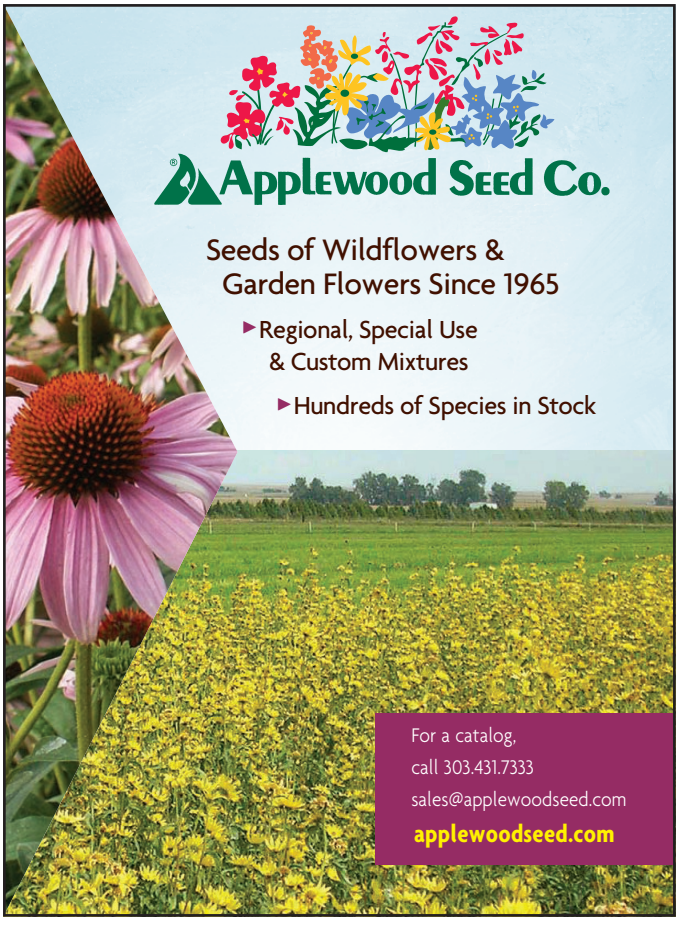
adding that certified seed is an important component of the sorghum seed trade, both domestically and internationally.

Water Efficiency Drives Demand

The demand for sorghum doesn't just stem from an increase in the number of end uses, but Lust attributes sorghum's global growth for its durability in varying environmental conditions. "The ability of sorghum to do well with less water is a huge driver," Lust says.



"It is a good fit in many different geographic areas — it's capable of being grown on about 80 percent of the world's land."

However, as demand for sorghum and its various end uses continues to increase, the industry anticipates further growth in terms of investment in the crop from private companies. Lust says the industry has already seen a substantial increase in private investment in recent years, which has fueled sorghum research and development, particularly in genetics.

"Genetic improvement has been a major priority and an area where we needed investment," Lust adds. "We went through a period when we didn't have much private industry investment. We need that investment, to remain competitive and take advantage of all the genetic potential that is in the crop."

End-Use Segmentation on the Rise

Much of this investment flows from large corporations that dominate the U.S. sorghum industry, according to Tracy Talley, owner of Texas-based Justin Seeds, which sells some forage sorghum seed products. He maintains consolidation in the sorghum marketplace has contributed to increased end-use segmentation.

"There are just a handful of companies that are doing the breeding work, and in the public sector that breeding work has fallen off in the past decade," Tally says. "The only people coming in to fill that gap are a few larger companies. This consolidation has increased segmentation throughout the industry."

Lust agrees that like corn, the sorghum market will continue to see strong end-use segmentation, which will influence the direction of future seed development and breeding efforts.

"Sorghum has tremendous genetic diversity, so a lot of discussions are about what quality traits can we do with sorghum that fit a specific end-use market," Lust says. "There's value in different end uses based on different traits. If there's enough value, you will continue to see that segmentation."

So what exactly are growers looking for in new sorghum traits? "Anytime surveys are done, yield is No. 1," Lust says, adding that things like herbicide resistance are also always on growers' minds. Talley says enhanced drought tolerance is another sought-after trait, particularly in the primary sorghum-producing areas.

Some traits, though, are often tightly linked to specific end uses. For example, sorghum with higher starch content or "a more fermentable and extractable starch" has real value in the biofuel market, Lust says.

In addition to grain, forage and silage, there are a couple of sorghum types — biomass and sweet — that are grown on far fewer acres (less than 100,000 for each in the U.S.) but are starting to attract significant interest, and more importantly, investment dollars for research. More dollars equals advances in sorghum breeding and varietal development.

"Our seed companies have made some really spectacular genetic advancements on sweet and biomass sorghum," Lust says. **Mark Halsall**

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Seed Treatments

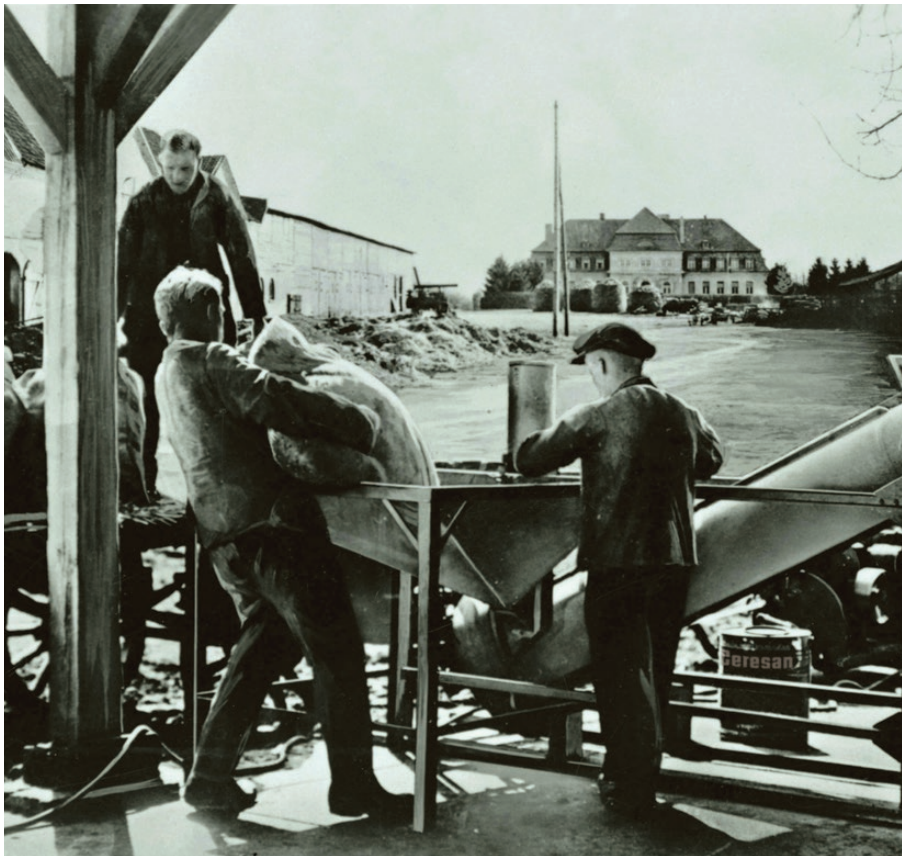
THERE'S NO DOUBT that seed treatments have taken the seed industry by storm during the past 10 years.

Globally, it's estimated that the seed treatment market was worth $2.29 billion in 2012 and is expected to reach $4.19 billion by 2018, according to a seed treatment market report published by Markets and Markets in 2013. Among all seed treatment products, insecticides form the largest segment and accounted for nearly 51.7 percent of the global seed treatment market in 2012, while fungicides comprised 34.8 percent of the market.

Results on the farm drive demand as soybean growers in the southern U.S. gain an average of 3.5 bushels per acre with the application of seed treatment products, according to CropLife America.

There are four approaches to seed treatments — to protect, to eradicate, to disinfect and to enhance. The key market players are Bayer CropScience, BASF, Nufarm and Syngenta. Several other players are emerging in the seed treatment market with products ranging from traditional chemistries to bio-based products.

While their popularity has grown in recent years, seed treatments aren't new; they've been around for thousands of years. According to CropLife America, the earliest reported use of a seed treatment dates back to 60 A.D., when wine and crushed cypress leaves were used to protect seed from storage insects. The active component in this mixture was likely hydrogen cyanide.



Contract seed treatment became a viable business after the 1929 launch of Bayer CropScience's Ceresan.

Bayer CropScience released its first seed treatment, known as Uspulun, in 1914 after chemist George Wesenberg discovered that chlorophenol mercury controlled fungal pathogens in cereals without impairing germination. Today, there are more than 100 seed treatment products on the market.

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Martin Gruss, head of Bayer CropScience SeedGrowth Products, discusses seed treatments.

Researchers and product specialists at Bayer CropScience study, test and analyze seed treatment products rigorously to help farmers protect the seed and get the most from their crop.

CropLife America reports that in 2011, more than 90 percent of the corn seed planted in the U.S. received some kind of seed treatment. Additionally, all soybean seed treatment fungicide combinations included at least one product that is active against rhizoctonia.

So if seed treatments have been around for centuries, why all the buzz about it now?

According to Ray Knake of Ray Knake Consulting, there are several reasons: improvements in active ingredients that can be applied to the seed; changes in farming practices that result in seeds being planted earlier; increased input costs that necessitate maximum crop production; and the fact that there's no alternative to below-ground pest control post-planting.

Martin Gruss, who is head of Bayer SeedGrowth Products, says that as the value of seed has increased, seed treatments have become increasingly important. "As farmers have adopted new technologies, such as precision planting, and the cost of seed has gone up, they expect that every seed put into the ground will come up, emerge and establish well," Gruss says. "Our job is to continuously develop new products to control pests and diseases."

Monitored by the U.S. Environmental Protection Agency under the Federal Insecticide, Fungicide and Rodenticide Act, seed treatments undergo a rigorous, science-based risk-benefit assessment during the registration and development of these active ingredients.

"The use of seed treatment technologies by farmers is an effective tool to provide the necessary protection of seeds for a strong, healthy start," says Andy LaVigne, American Seed Trade Association president and CEO. "Using seed treatments delivers a very precise application that shields seeds from the insects and diseases that exist in the soil. This protection ensures that the plant has a greater opportunity to grow a strong root system which is the foundation of a healthy, productive plant."

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CURRENT EFFORTS

Gruss, who's been with Bayer for 36 years, says the company is unique in that it has four areas of competency related to seed treatments — products, coatings, equipment and service. "We are the only company that has research and development efforts in all four areas," Gruss says.

One of Bayer's newest product innovations is Poncho/VOTiVO, which combines an insecticide with a biological for pest control and added yield potential on corn, soybean and cotton seed. Gruss says Bayer is the first company to combine a chemical insecticide (Poncho) with a biological (VOTiVO). According to Bayer, in more than 150 replicated soybean field trials in 2011 and 2012, Poncho/VOTiVO provided an average yield advantage of 1.5 to 2.5 bushels per acre.

Kurt Metzger, a seed solutions specialist with Iowa-based MaxYield Cooperative, says it takes less than half a bushel of yield to pay for the VOTiVO investment and that payoff has occurred in nearly 74 percent of field trials.

The right combination of seed treatments can pay off in more ways than one. "We talk about investing $13 to $15 an acre on seed treatment, which often creates a 3- to 4-bushel yield bump," Metzger says. "At $12 beans, that's a 2-to-1 return for farmers."

On the equipment side of the seed treatment business, Bayer has recently launched its On Demand System, which is a highly sophisticated application that completely automates recipes and documentation of the treatment.

Researchers work to develop seed coatings.

"WE TALK ABOUT INVESTING $13 TO $15 AN ACRE ON SEED TREATMENT, WHICH OFTEN CREATES A 3- TO 4-BUSHEL YIELD BUMP. AT $12 BEANS, THAT'S A 2-TO-1 RETURN FOR FARMERS."

— KURT METZGER

"Nearly 80 percent of soybeans are treated downstream, and growers usually have their seed treated the day before or the day of planting," explains Kerry Grossweiler, Bayer SeedGrowth equipment and coatings manager at Bayer CropScience's North American headquarters. "The On Demand system is the ideal solution because it is the first and only fully automated seed application system developed to make treating seeds easier, more accurate

asta first-the seed
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and more efficient. The On Demand system is a key component in the quick turnaround of soybeans, because it can treat up to 2,000 pounds per minute." Not only is On Demand fully automated, but it was also designed with product stewardship and inventory management in mind.

Another important player in the seed treatment market is BASF, which offers a portfolio of inoculants, colorants, and biological and chemical seed treatments. BASF offers the inoculants Nodulator for use on lentils and peas, Vault HP plus Integral for use on soybeans and Vault Liquid plus Integral for use on peanuts. The latter two are a result of Becker Underwood's BioStacked Technology, which combines complementary biological components to achieve greater yield. These inoculants serve as a carrier for rhizobia, which help to fix nitrogen.

On the fungicide side of things, BASF offers Stamina, which controls or suppresses disease. Stamina can be used for treating alfalfa, barley, corn, oats, rye, sorghum, sugar beets, sunflower and wheat. Additionally, Stamina F3 Cereals can be used for treating barley, oats, rye and wheat.

"The seed has its most potential before farmers ever open the bag," says AJ Woodyard, who serves as a technical crop production specialist for BASF. "Everything after that negatively impacts it. Vault HP helps with nodulation, while the fungicide helps develop the root system. This allows growers more flexibility in planting and can help maximize yield potential."

"THE SEED HAS ITS MOST POTENTIAL BEFORE FARMERS EVER OPEN THE BAG. EVERYTHING AFTER THAT NEGATIVELY IMPACTS IT."
— AJ WOODYARD

But the technology and products change so quickly, farmers really depend on their local agronomist or seed dealer in selecting the best seed treatments for their needs. This is the true service that companies can provide farmers — making sure they get the right product for their local environment.

WHAT'S AT THE FOREFRONT OF SEED TREATMENTS?

One of the biggest opportunities for seed treatment growth lies in those crops that are typically left untreated, such as cereals, Bayer's Gruss says.

"There's a lot of seed that goes untreated that could benefit," he says.

"Today, Bayer is working on a seed treatment package that would allow use on rice while the seed is presoaked," Gruss says. "Treating rice seed is not a common practice, so we are trying to make it so that the processing side of things wouldn't have to change to accommodate the seed treatment." Bayer is in the late field-testing stage and fine-tuning it before they present the product to key stakeholders, Gruss says.

While looking at seed that's not typically been treated is one future approach, biological seed treatments and plant extracts are the latest newcomers to the seed treatment scene.

Biological seed treatments and plant extracts are commercially used on large amounts of seed, according to a paper by CropLife America. Some have received EPA registration with specific pest control claims, while others are being sold as yield enhancers or as products that will improve plant health and vigor.

BASF's Becker Underwood has a strong foothold in the biologicals sector. It is the world's largest producer of beneficial nematodes and it provides the leading bio-control solution for locusts in Africa, Australia and Asia.

As consumers continue to demand food with fewer chemical residues and farmers consistently seek ways to preserve the effectiveness of their pest control tools, biologicals are primed for growth.

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future GIANTS of the seed industry

MEET THE FUTURE OF THE SEED INDUSTRY

With an outstanding pool of nominees for the Future Giants of the Seed Industry Award, the team at *Seed World* introduces the top three candidates.

WHILE THE SEED industry is often focused on attracting more young, skilled and talented people, it sometimes forgets to recognize those who are making a difference and are passionate about the industry.

Each year, *Seed World* — in partnership with the Future Seed Executives, an initiative of the American Seed Trade Association — sponsors the Future Giants of the Seed Industry Award, which is presented at ASTA's Annual Convention during the Future Seed Executives (FuSE) meeting. This year, we had several outstanding nominees. Below are the top three candidates. Be sure to watch their career paths as they will be the ones setting the course for the seed industry in the future.

Meet Chris Boomsma

A graduate of Purdue University's Ph.D program in agronomy, Boomsma went to work for Dow AgroSciences in 2009 as a crop physiologist and agronomist. During the past five years, he's transitioned into the area of adaptation development leader and currently serves as agronomic traits product characterization leader. The added responsibilities didn't come without work. Boomsma has been active in the American Society of Agronomy and ASTA.

"Chris has been instrumental in reaching out across a large company, such as Dow AgroSciences, to pull experts together to collaborate and solve common research problems together," says James Parks, who was Boomsma's direct supervisor from 2009 to 2013. "He is a consistent generator of new ideas that are well thought out and highly respected by his peers." Today, Boomsma is working with a team at Dow AgroSciences to help develop and execute the company's precision agriculture strategy.

"Chris is a great ambassador for the industry, and is effective in encouraging students to think seriously about careers in the field," says Tony Vyn, who served as Boomsma's Ph.D mentor. "I don't know of any young person more qualified to make a significant impact on the seed industry's pursuit of corn stress tolerance and physiology-based yield advancements."

Research in the seed industry brings together low- and high-tech research tools, laboratory and field research settings, and the daily employment of both well-established and leading-edge scientific discoveries. "Being a scientist, I naturally enjoy the multi-functional, cutting-edge nature of research in the modern seed industry," Boomsma says. "It's a real privilege to work in this industry at this time."

Meet Dakota Lueken

Hailing from Colesburg, Iowa, Dakota Lueken recently graduated from Iowa State University with a bachelor's degree in agronomy and an emphasis on plant breeding. The 22-year old spent the past two summers working for DuPont Pioneer where he served as a maize product development seed science intern and as a herbicide trait characterization and development intern.

As the maize product development seed science intern, Lueken traveled to eight states and focused on characterizing stress emergence by scoring stand counts, vigor and other phenotypic traits that resulted from unfavorable conditions. He also developed and performed his own proprietary seed science research project, which he presented to DuPont Pioneer employees and fellow interns. As the herbicide trait characterization and development intern, Lueken assisted in conducting field trials that characterized the varying effects of different herbicides on DuPont Pioneer soybeans.

His work ethic, passion for the seed industry and summer internships earned him a full-time position with Pioneer.

"Dakota is a rare individual who has the capacity and passion to be a plant breeder," says John Latham of Latham Hi-Tech Seeds. Latham, who knows Lueken as Noble Ruler (president) through his Alpha Gamma Rho activities, believes Lueken shows tremendous leadership ability and will be a rising star in the seed industry. Most recently, Lueken has entered into DuPont Pioneer's Emerging Leaders Program and moved to Constantine, Michigan, where he serves as a production agronomist for one of the company's corn production locations. Lueken is responsible for field inspections, continuing grower relations, contracting, bin sampling and assisting with research projects.

"I would tell those looking to pursue a college education that agronomy is a great place to start," Lueken says. "Not only does it expose you to the crop production aspect of agriculture, but it also exposes students to how instrumental science is to agriculture. There are so many other aspects to consider when

growing corn than just what seed to plant. A degree in agronomy opens many doors to all sorts of companies, as it demonstrates an understanding of the science behind the production, which makes you very marketable."

Meet Bethany Olson

Also a recent graduate of Iowa State University, Bethany Olson has chosen to focus her efforts on agricultural business and international agriculture. She served as a corn marketing intern in 2013 for DuPont Pioneer and had the opportunity to work directly with DuPont Pioneer's senior corn marketing manager.

Olson grew up on a farm in Jewell, Iowa, which has helped her excel. "When Bethany started with DuPont Pioneer, she quickly noticed that many growers were lost with the technology options they now have on their farm," says Reed Mayberry, who Olson reported to during her internship. "Her focus became making these solutions easier for customers to understand by putting the first-ever DuPont Pioneer Corn Insect Pest Management piece together."

Olson continued her leadership and innovation by developing a unique marketing tool, which measured side-by-side comparisons of two drought products head-to-head in the field. "At last check it had more than 10,000 views on You Tube," Mayberry shares.

Not only has Bethany started running ahead in the seed industry, but that same energy made her an NCAA athlete competing on Iowa State University's cross-country and track teams.

Since graduation, Olson has entered into DuPont Pioneer's Emerging Leaders Program and has been selected as one of two individuals from Pioneer to participate in the DuPont Commercial Development Program.

At the beginning of June, she moved to Hedrick, Iowa, where she works as a production agronomist focused on soybeans. After nine months there, she will relocate to Bloomington, Illinois, where she will serve in a sales and marketing role.

"As the younger generation steps into the seed industry, we have a tremendous amount of information to learn from older and wiser generations," says Olson, who is 22. "We want to learn as much as we can from those with knowledge and wisdom from many years of industry experience and know that we only have a short amount of time to do it.

"Fortunately, I've had great mentors and been able to work with many different people who have been excited about helping me learn and grow as a young person in this industry. I hope that the more seasoned generations have confidence in us [younger generations] and our ability to step up to the plate to tackle the challenges of our time." **Julie Deering**

FUNDING REMAINS CRITICAL TO FUTURE RESEARCH PROJECTS

SOCIETAL CHALLENGES SPUR AN UPTICK IN AVAILABLE RESEARCH DOLLARS, BUT THE COMPETITION IS FIERCE.

DURING THE PAST decade, there's been a growing concern from the university and research community about the future of science and innovation due to a lack of federal funding. The budget deficit and economic downturn in 2008 certainly didn't do anything to help.

According to the Organisation for Economic Co-operation and Development, the percentage of U.S. gross domestic expenditure on research and development funded by the government declined from 47.1 percent in 1982 to 33.4 percent in 2011, which means the U.S. trails nine OECD nations in this percentage. While U.S. research and development declined, global R&D investments increased 1.8 percent to $1.496 trillion, according to the "2013 Global R&D Funding Forecast" sponsored by Batelle. Additionally, data from the National Science Foundation shows that during the past 10 years, R&D expenditures as a share of economic output have remained nearly constant in the U.S., but have increased by nearly 50 percent in South Korea and nearly 90 percent in China.

So what do these numbers mean? The Association of Public and Land-Grant Universities call it an "innovation deficit: the widening gap between the actual level of federal funding for research and higher education and what that investment needs to be if the United States is to remain the world's leader."

Research funded by the National Science Foundation, the National Institutes of Health, NASA, and the Departments of Defense, Energy, Agriculture and Commerce has led to life-saving vaccines, lasers, MRIs, touch screens, GPS and even the Internet. More than half of America's economic growth in recent decades has been thanks to innovation, much of which resulted from federally-funded scientific research. Innovation has made the U.S. the leading economic power in the world.

But scientists and business leaders agree that a growing deficit means the U.S. could lose its lead in science and technology. America's investments in research and education are now flat or declining, while others such as China, Singapore, Korea and others in the EU are dramatically increasing their funding in those areas.

Collaboration Sustains

Due to funding cutbacks, many research institutions have had to find new and innovative ways during the past few years to continue their research projects and many believe they have forged new paths to maintain critical funding for projects today and well into the future, and it's called collaboration.

Research remains a crucial building block on the road to new and innovative technologies making their way to the marketplace, and many U.S. organizations and institutions are committed to ensuring this continues to happen.

The University of Georgia has witnessed many changes during the past decade and not all have been good. Cutbacks have occurred not only in ongoing project funding, but also in staff resources. However, a sense of change might be in the air.

"Funding investments, particularly by the U.S. Department of Agriculture, in the past few years have been increasing, and this is very good news," says Harald Scherm, University of Georgia professor of plant pathology and assistant dean for research. "I feel like we might be turning a corner. During the past decade, many universities witnessed a decline in funding, but we have also forged new paths to continue our work through collaborations at the university level, as well as through private and public partnerships."

"We try to address the critical needs of today, as well as provide the tools that producers will need in the next three to five years and even five to 10 years down the road."

— Sonny Ramaswamy

Scherm believes that collaboration on research projects is a step in the right direction to better use funding. He says the notion of collaboration has changed the way University of Georgia scientists conduct business. "We look to other state universities conducting similar research to see if there is a way to collaborate and better use funding dollars for both institutions," Scherm says. "In many projects, this works well within the parameters of sharing research."

Leaders Assess the Needs

The need for funding remains greater than ever, says Sonny Ramaswamy, director of USDA's National Institute of Food and Agriculture. This need applies to agricultural and seed research, but also other research disciplines including childhood obesity, food security and food production, he explains.

According to a recent report published April 2014 by the International Food Policy Research Institute (IFPRI) titled, "Public-Sector Agriculture Research Priorities for Sustainable Food Security," the ability to deliver sustainable food security will be challenged by population growth, constrained natural resources and climate change. The report stresses, "As population and income growth and climate change place pressure on our ability to feed the world sustainably, investments in agricultural productivity are essential to dealing with these challenges."

"We try to address the critical needs of today, as well as provide the tools that producers will need in the next three to five years and even five to 10 years down the road," Ramaswamy says. "The needs of today can be quite different from what the needs in the marketplace will be in five to 10 years. At NIFA, we are always asking what can we do better to prioritize the needs of the future."

Funding made available by NIFA is decided based on the priorities the agency has proposed for the year. "For example, in 2014 we have a competition for water, which we will invest $30 million over five years," Ramaswamy says. "The priorities vary from year to year, but thematically we are investing in 'societal challenges' such as food security, climate, water, obesity and nutrition, food safety and sustainable bioenergy. We are also investing in the fundamental food and agricultural sciences and education for the future."

Both Scherm and Ramaswamy agree that developing a firm strategic direction and remaining focused are key to advancing future research projects that will make a difference in the U.S. and around the world.

"Determining strategic direction is key to accomplishing a return on investment," Ramaswamy says. NIFA's planning process starts at the top with Congress, the President of the United States and the secretary of USDA. From this point, NIFA expands its process to the Federal Register and hosts listening sessions with various associations representing entomologists, plant breeders and producers throughout the U.S.

"It's crucial to address the needs of all sectors of the agricultural community from the bottom up and from the top down," Ramaswamy explains. "It's at this point that a strategic direction can be formed."

Allen Van Deynze, director of research at the University of California's Seed Biotechnology Center, says that strict focus is key to future research. "It's an ongoing process and it's one that you have to be 10 years ahead of," he says. At the university level, Van Deynze remains focused on the needs of today and the future by talking regularly with those in the industry, which includes other research institutions, seed companies, seed developers and growers. "It's important to have a target, but in order to reach that target you must know your market."

"As we have had to consolidate during the past few years, those in the seed, plant and genetics research fields have found valuable partnerships with private institutions, such as breeding and genetics companies to help fund our research capabilities."

— Harald Scherm

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Fierce Competition for Funding

Van Deynze agrees that continued funding is critical. With concerns of climate change, drought-stress and the ever-growing disease and weed tolerant problems, he says the need for future funding and grants made available to the scientific community has also increased. "We always have to be one grant ahead," Van Deynze says. "We need to think ahead to what will be innovative and beneficial in 10 years."

But Van Deynze says that funding for research has not grown at the same pace as the need for research. "When applying for a grant these days, we are usually one of 100 or one of 200 … and sometimes it's the luck of the draw on being awarded a grant," he says.

Georgia's Scherm agrees. "We have become very talented at writing proposals," he says. "It has become a necessity in terms of furthering future research."

It is a very selective process for those in need of funding, states Van Deynze. While funding dollars might seem harder to come by in the competitively growing world of research, private sector funding has become an alternative in finding additional investment dollars. "You cannot count on funding from one sector alone, such as the USDA, to develop all of the new technologies that will be needed down the road," Van Deynze says.

Scherm notes that private and public partnerships are vital to future research and investment at the university level. "As we have had to consolidate during the past few years, those in the seed, plant and genetics research fields have found valuable partnerships with private institutions, such as breeding and genetics companies to help fund our research capabilities," Scherm says.

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A recent report by IFPRI states, "Productivity increases will be essential, as will increased resilience to extreme events, particularly higher temperature and more variability in rainfall. These outcomes will need to come from some combination of improvements of the plant and animal genetic material used by farmers, both new material and much better dissemination of existing material and the management practices that are needed to take advantage of it. Both types of activities require new resources and, in many cases, changes in public policy. For some food sources, the private sector will see a financial incentive to invest in the needed productivity and resilience enhancements. But in many parts of the developing world, additional public-sector investments, both national and international, will be required."

To address the above challenges, USDA's NIFA remains committed to focus its resources on supporting programs that provide foundational knowledge, as well as programs that will create substantial impacts by addressing critical issues that impact the long-term viability of agriculture.

"There is always the need to put food on the table so agricultural research is key, but we also have to think of the externalities," Ramaswamy says. "Obesity and cardiovascular disease in our population is a growing concern. Also of concern is the onslaught of more diseases affecting plant growth and how climate change might affect the profile of wheat, which could constrain future food production and impact the nutritional quality of wheat in five to 10 years. It's these issues that need to be addressed today for the future."

> "We always have to be one grant ahead. We need to think ahead to what to what will be innovative and beneficial in 10 years."
>
> — Allen Van Deynze

While some say the future is to be determined, scientists and researchers are collaborating and working to pave that path — to solve the challenges ahead. America's future prosperity and national security depend on it. **Shannon Schindle**

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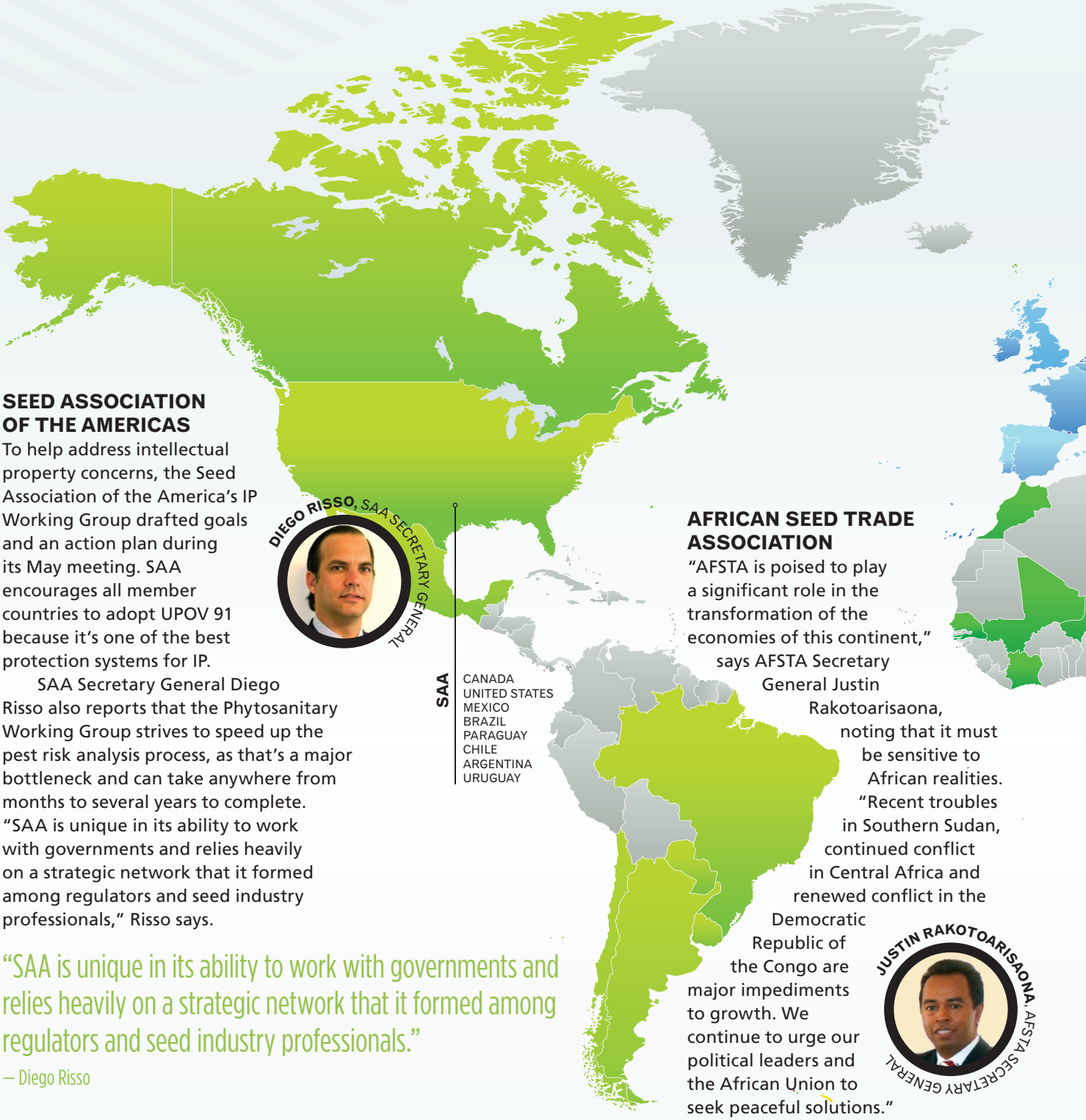

SEED ASSOCIATION OF THE AMERICAS

To help address intellectual property concerns, the Seed Association of the America's IP Working Group drafted goals and an action plan during its May meeting. SAA encourages all member countries to adopt UPOV 91 because it's one of the best protection systems for IP.

SAA Secretary General Diego Risso also reports that the Phytosanitary Working Group strives to speed up the pest risk analysis process, as that's a major bottleneck and can take anywhere from months to several years to complete. "SAA is unique in its ability to work with governments and relies heavily on a strategic network that it formed among regulators and seed industry professionals," Risso says.

SAA

CANADA
UNITED STATES
MEXICO
BRAZIL
PARAGUAY
CHILE
ARGENTINA
URUGUAY

"SAA is unique in its ability to work with governments and relies heavily on a strategic network that it formed among regulators and seed industry professionals."

— Diego Risso

AFRICAN SEED TRADE ASSOCIATION

"AFSTA is poised to play a significant role in the transformation of the economies of this continent," says AFSTA Secretary General Justin Rakotoarisaona, noting that it must be sensitive to African realities. "Recent troubles in Southern Sudan, continued conflict in Central Africa and renewed conflict in the Democratic Republic of the Congo are major impediments to growth. We continue to urge our political leaders and the African Union to seek peaceful solutions."

EUROPEAN SEED ASSOCIATION

"They [politicians and NGOs] see Europe's future in local, bio-diverse and preferably organic farming," says Garlich von Essen, ESA secretary general. "What they tend to disregard or deliberately ignore is how dependent Europe is already on large scale imports and that these tend to come from professional high-tech farming, including from GMOs." Together with numerous EU agri-food chain operators, the seed industry has repeatedly called upon the EU institutions to provide legal certainty for the industries concerned and give up on its unrealistic 'zero tolerance' approach, von Essen says.

GARLICH VON ESSEN, ESA SECRETARY GENERAL

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ASIA-PACIFIC SEED ASSOCIATION

This year APSA is celebrating its 20th anniversary, which will be the theme not only for the association throughout the year, but also of the Asian Seed Congress. The congress will be jointly hosted by APSA and the Hong Kong Seed Trade Association at the Venetian Macau, in Macau, China Nov. 10-14, 2014. To celebrate the anniversary, the association will relaunch its official publication, *Asian Seed*, with a new design, says Tom Burns, APSA director. Simultaneously, the organization will unveil a revamped website with greater access and ease of use for members and congress attendees.

TOM BURNS, APSA DIRECTOR

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SAA Spearheads Priority Working Groups

Members of the Seed Association of the Americas met the first week of May in Buenos Aires, Argentina, to address four priority issues — biotechnology, intellectual property, seed treatment and phytosanitary matters.

To better address the priority areas, SAA formed four working groups. "We are working to strengthen each of these groups and increasing communication within for improved preparedness," says Diego Risso, SAA secretary general. "SAA connects with all the regulators in the Americas and is the primary forum for those in the seed industry to address their concerns."

Regarding biotechnology, SAA members had proactive discussions in order to update their low-level presence position paper. Risso reports that the SAA team is working closely with the Southern Agricultural Council and the North American Biotech Initiative to address LLP issues. Risso says the working group is learning about each country's adoption level of new breeding techniques and how regulations are proposed.

"One of our biggest concerns is that seed treatment might become a trade barrier," says Jerry Monk, SAA president. "To address this, we are developing two databases, one to address frequently asked questions and the other to serve as a reference of all the seed applied products."

To help address IP concerns, the working group drafted goals and an action plan during its May meeting. SAA also encourages all member countries to adopt UPOV 91 because it's one of the best protection systems for IP.

In addition, Risso reports that the phytosanitary working group strives to speed up the pest risk analysis process, as that's a major bottleneck and can take anywhere from months to several years to complete.

"We continue to improve our communications with national regulators and strive to bring all parties around the table to develop solutions to trade barriers," Risso says. "SAA is unique in its ability to work with governments and relies heavily on a strategic network that it formed among regulators and seed industry professionals. If you or your company wants to get involved in working to find solutions to these challenges, we welcome your participation. All you need to do is be a member of your national seed association and ask to join the SAA discussions. The more participation we have, the better off the seed industry will be."

Uncertainty Looms for Europe's New Seed Laws

For the past year, European Union Member States and the European Parliament have been discussing an overhaul of the common legislation on seed marketing, plant health and official controls as part of a wider package intended to further harmonize and modernize EU policies across the food chain.

While things progressed as expected for most parts of the legislative package, variety registration and seed marketing rules sparked opposition from non-governmental organizations. In March 2014, Members of the European Parliament rejected the proposal and called upon the Commission to present new text to the new Parliament, which will be elected at the end of May.

"This rejection is proof of just how political, rather than technical, the debate around seed became during the course of this campaign," says Garlich von Essen, European Seed Association secretary general.

Von Essen also senses a strong discord between what the professional seed and farming sectors expect of the seed law and what politicians and NGOs consider instrumental in changing the EU's agricultural policy.

"Where seed companies and farmers explained the importance of quality and performance and certified seed health for an internationally competitive agriculture in Europe, many were opposed," von Essen says. "They see Europe's future in local, bio-diverse and preferably organic farming. What they tend to disregard or deliberately ignore is how dependent Europe is already on large scale imports and that these tend to come from professional high-tech farming, including from GMOs."

> "This is playing to the latent anti-Americanism of some groups ... There are groups that don't see open markets and free competition as valuable, but rather as threats."
>
> — Garlich von Essen

While the fate of the new seed law hangs in the balance, Europe seems to be in for much of the same in regards to its approach to biotechnology and genetic modification. In fact, it seems the block is set to agree that in the future individual EU Member States, rather than the EU, will make decisions on authorizations, von Essen says. Such a transfer of competence back to the country level might complicate the situation of exporting countries and companies even further as political majorities, and with that regulatory requirements, will not only be different but might change frequently.

Together with numerous EU agri-food chain operators, the seed industry has repeatedly called upon the EU institutions to provide legal certainty for the industries concerned and give up on its unrealistic 'zero tolerance' approach, von Essen says.

The Transatlantic Investment and Partnership Agreement (TTIP) currently under discussion between the U.S. and the EU, was seen to provide an appropriate forum to discuss how to possibly work with agreed standard testing protocols or a mutual recognition of standards by the two parties.

But this again is meeting strong and well-orchestrated opposition from groups that claim a 'lowering' of standards to an U.S.-like level is unacceptable. "This is playing to the latent anti-Americanism of some groups as well as capitalizing on the recent NSA spy-gate affair," von Essen says. "There are groups that don't see open markets and free competition as valuable but rather as threats."

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Still, the EU and U.S. seed industries have addressed negotiators with a joint set of proposals for a successful TTIP. After a meeting in Washington, D.C., in early 2014, a follow-up with the EU administration is planned for later this year.

Additionally upcoming discussions for the EU seed industry concern the revision of rules for organic farming, including the rules for use of organic seed, and the practical implementation of new obligations under the so-called Nagoya Protocol of the Convention on Biological Diversity where the EU has been amongst the first to set new requirements. "There won't be a shortage of new challenges — and we still have some old left," von Essen says.

African Seed Trade Association

The African Seed Trade Association hosted its annual congress March 4-7 in Tunis, Tunisia. In its 14th year, AFSTA represents the interests of the African seed industry, provides a forum for interaction and information exchange among key stakeholder groups and promotes the development of the seed industry in Africa.

The 2014 Congress was the biggest yet and comprised 303 delegates from companies, national associations, governments and partner organizations representing 48 countries, reports Justin Rakotoarisaona, AFSTA secretary general. "AFSTA is poised to play a significant role in the transformation of the economies of this continent," he says, noting that it must be sensitive to African realities. "The potential for agriculture to drive inclusive economic growth, improve food security and create opportunities for millions of Africans is enormous."

However, Rakotoarisaona says political stability remains AFSTA's biggest challenge. "Regional conflicts continue to hurt our business," he says. "Recent troubles in Southern Sudan, continued conflict in Central Africa and renewed conflict in the Democratic Republic of the Congo are major impediments to growth. We continue to urge our political leaders and the African Union to seek peaceful solutions so that our people can live up to their economic potential."

"Regional conflicts continue to hurt our business. We continue to urge our political leaders and the African Union to seek peaceful solutions so that our people can live up to their economic potential."
— Justin Rakotoarisaona

The congress was preceded by a half-day workshop on international systems to develop an enabling environment to provide food security and economic development by strengthening the seed sector. The workshop was hosted by the International Seed Testing Association, the Union for the Protection of New Plant Varieties and the Organisation for Economic Co-operation and Development.

Rakotoarisaona explains that during the past year, AFSTA created two special interest groups, one for field crops and one for vegetables, to give focus to the development of strategies for unlocking this latent potential in those two sub sectors. Also, an aflatoxin project has been launched in the east African region to help mitigate aflatoxins in crops.

Additionally, the newly formed Seed Trade Association of Ghana began holding meetings in April with the goal of enhancing trade in quality genuine seeds.

Starting next year, AFSTA plans to publish its first annual magazine highlighting seed industry issues in Africa. And last, the 2015 Congress will be held in Victoria Falls, Zimbabwe, March 3-5.

Asian Pacific Seed Association

This year APSA is celebrating its 20th anniversary. In doing so, the organization will relaunch its official publication, *Asian Seed*, with a new design, says Tom Burns, APSA director. Simultaneously, the organization will unveil a revamped website with greater access and ease of use for members and congress attendees.

Additionally, Burns says APSA members have several important events to look forward to. A few of these events include an APSA-Food and Agriculture Organization (FAO) workshop on hybrid rice in Bangkok, which will be held in July; a study tour to New Zealand later in the year; and the Asian Seed Congress, which will be held Nov. 10-14 in Macau, China.

Julie Deering

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Registration Review

Is there one ideal variety registration model that every country should adopt? Variety registration is not a one-size-fits-all scenario but there are certain characteristics that every variety registration system should have: flexibility and a market-driven focus.

A RESPONSIVE AND efficient seed regulatory system contributes to the success of a country's crop production sector. However, each country has its own regulations when it comes to variety registration.

As the seed industry evolves, it's becoming more clear that while these variety registration systems around the world can differ, one common theme needs to exist for seed industries to ensure their end users are successful — a flexible variety registration system that meets the needs of the various value chains of the many different crops found in that country.

Streamline the System

"Varietal registration systems can slow farmer access to new, improved varieties," says Bernice Slutsky, senior vice president of domestic and international policy for the American Seed Trade Association. "Modernizing and streamlining the system, no matter the country, will be important so that farmers have a wide array of options."

To that end, the Canadian government has taken a leadership role. This past year it began reviewing Canada's crop variety registration system with the goal of streamlining it.

Stakeholders were asked to consider four alternatives in an issues and policy paper prepared by Agriculture and Agri-Food Canada, the Canadian Food Inspection Agency and the Canadian Grain Commission. Options ranged from allowing flexibility in the current, recently revised system to eliminating the federal government's role in the variety registration process completely.

The following results were collected after the comment period ended in November:

- Allow the flexibility inherent in the current variety registration system to emerge, which was supported by 37 percent of respondents.
- Streamline the regulatory process by requiring that all crops meet minimum registration requirements with the option for some crops to have merit assessment through an independent assessment process, which was supported by 27 percent of respondents.
- Streamline the regulatory process by maintaining a minimum level of federal government oversight, and eliminate any merit assessment or performance data under the variety registration system, which was supported by 17 percent of respondents.
- Withdraw the federal government's role in variety registration, allowing industry or third parties to assume these functions, which was supported by 13 percent.

Now that the results have been distributed, Patty Townsend, CEO of the Canadian Seed Trade Association, says, "the next steps are to develop a proposal for consideration by the minister, but we do not know what the time frames will be."

> "The marketplace should determine what is grown. Farmers are smart; they can make decisions on which varieties to plant."
>
> — Ken Nelson

CSTA has released a policy statement, which highlights various points that should be incorporated. CSTA requests that any revisions to the variety registration system maintain current exemptions from registration such as corn and the ability to exempt crop species, types and kinds from registration (with a first priority of exempting oilseed type soybeans from registration). In addition, the policy statement calls for all crop species, kinds and types to be placed in Part 3 of Schedule III of the Seeds Regulations, providing government oversight but removing merit requirements and the need for a recommendation from a recognized recommending committee, except where the value chain for the crop kind provides the rationale and consensus for the crop kind to remain in Part I or Part II. If crop kinds are to remain in Part I or Part II, new operating procedures for making a registration recommendation must be developed to ensure an efficient, flexible and predictable system.

"AAFC, CGC and CFIA are reviewing the results to help inform the development of a streamlined variety registration system," says James Watson, AAFC media analyst.

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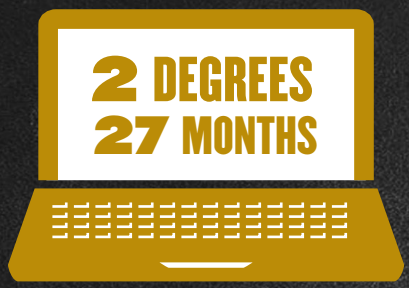

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Meet the Market's Needs

Ken Nelson, president of Alberta-based K L Nelson Associates Inc. and breeders representative for KWS-UK, says Canada has work to do to improve its variety registration process. He feels the Canadian system needs to be market-based versus regulatory-based.

"The system in Canada is regulatory-based, whereas the United States and Australia have market-driven systems," he says. "The marketplace should determine what is grown. Farmers are smart; they can make decisions on which varieties to plant."

While it's hard to compare variety registrations from country to country, Nelson says that as nations look to streamline their systems, they need to look around the world for successes and then apply that to their own needs — all while keeping the market in mind. "Is variety registration in line with the needs of the commercial industry? That's what we need to ask," he says. "Can new varieties come through the system fast enough to meet the needs of the marketplace? Variety registration systems have to be highly responsive."

The United States doesn't have a formal variety registration system in place, but relies on the marketplace to determine which varieties best meet the needs of farmers.

"It's preferable to offer the market and farmers ample freedom to make varietal choices and allow the market to drive decisions about which varieties can be purchased," Slutsky says. "This system allows new varieties to be more quickly introduced into the market and adopted by farmers, thus giving farmers more immediate access to the benefits of new advances in breeding."

But governments and industries must keep in mind the varying dynamics at play from country to country. There's no one variety registration or variety commercialization model that will meet the needs of every country.

Canada's options paper on variety registration and the results assessment were compiled by a working group from Agriculture and Agri-Food Canada, the Canadian Food Inspection Agency and the Canadian Grain Commission. The group has just released its summary of the consultations, which is available at: **goo.gl/EokS7I**

One Size Doesn't Fit All

"There is no 'one model,' even within Canada," Townsend says. "The variety registration system needs to be flexible to accommodate the needs of the value chains of the many different crops in Canada. For example, for some crops, the needs are for a regulated system that evaluates performance and quality, while other crops have no need for variety registration.

"We need a flexible, transparent and nimble system that can ensure our plant breeders and variety developers have the tools they need to give farmers and their customers access to varieties that best suit the needs of their businesses," Townsend adds.

According to ASTA's Slutsky, Canada's variety registration system is headed in the right direction

"If a country chooses to have a variety registration system, the goal should ultimately provide farmers with options of the newest, highest-quality seed possible to optimize success and productivity," she says. "If a variety registration system is not consistently implemented, is not objective and is not timely and predictable, farmers' options for variety selection will be limited." **Julie McNabb**

COMPARING CORN

What does the variety registration process look like for corn around the world?

Canada: Corn is exempt from variety registration because the value chain requested exemption in 1996. Although corn is not subject to variety registration in Canada, the seed of field corn must be of pedigreed status to be sold in Canada.

Argentina: Varieties used in counter-seasonal production do not need to be registered or commercially approved.

China: China has a mandatory variety registration system that applies to maize.

United States: A formal variety registration system does not exist. The U.S. relies on the marketplace to determine which varieties best meet the needs of farmers. However, the U.S. Department of Agriculture's Seed Regulatory and Testing Division, located in Gastonia, North Carolina, offers a variety name check for agricultural and vegetable seeds. This helps seed companies check for variety names to prevent mislabeling under the Federal Seed Act Regulations.

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DEVELOPMENT WORK IS very rewarding, but it can also be frustrating. While you know what needs to change, the process of change at a community or industry level seems to move at glacial speeds. In writing this column, I've just returned from a two-week stint working in Liberia, making my way from Bong to Bomi, Nimba, Montserrado and Margibi. All are along Liberia's main economic corridors.

Working on behalf of Seed Programs International on a vegetable seed project, my job was to assess one of the program's partners, determine the need for seed, identify potential distribution partners, collect data on successes and failures and provide agronomic advice to seed users.

In Liberia, the definition of a farmer could be someone who has a few plants in their backyard or it could be a person with two to three acres growing crops for commercial production. Regardless of size, all of the work is done by hand with machetes, hoes and axes. Liberia receives approximately 180 inches of rainfall annually, but that's all within a few months; it's either wet or dry. Plants are often sown into hillsides where water can be channeled. Intercropping is very common. Palm oil and rubber trees are planted far apart with other crops, such as pineapple, ground nuts, okra and green crops, planted in between.

Agriculture accounts for about half of Liberia's gross domestic product, and the majority of Liberians depend on agriculture for their livelihood. Fighting hunger and increasing food security remain priorities for the government of Liberia and its people. Families must choose whether resources will be put toward educating their children or providing food. It's not an "and" situation. Resources are not plentiful and this is a daily decision for far too many.

As the ultimate source of food, seeds are considered precious — they are not distributed in bulk like in the U.S., but in small quantities ranging from 25- to 100-gram packets. Most seeds have been saved locally. Like U.S. farmers, Liberian farmers rely on good germination rates; however, their perception of commercial seed is substandard compared to what we think of as high-quality seed.

Three factors affect seed quality — time, temperature and humidity. As much international development activity is devoted to the tropics and sub-Saharan Africa, it is a foregone conclusion that moisture and temperature must be considered. However, time might be the most critical factor.

Seed quality declines over time, even under the best storage conditions and management. Conditions necessary for germination and emergence are very species-dependent. Overall, vegetable seeds are highly variable in their ability to withstand stress. Seed quality and vigor go hand-in-hand.

Donated seed might sit in a U.S. retail outlet for up to six months before being designated for donation. Already the germination level might be below what is commercially desirable in the U.S. Each time the clock ticks, seed quality drops and this begins even before seed is shipped to international destinations.

Once seed reaches its intended destination, the clock continues to tick. Dave Bender, program manager for Seed Programs International, indicates that unless timing is precise, seed might be held until optimum planting seasons arrives. This could be six months after arrival.

Many of his partners do not have access to refrigeration or even relatively cool, dry storage areas. In some cases seed remains subject to direct sunlight. From my time in Liberia, the morning and evening "cool" temperatures were about 80 degrees Fahrenheit while relative humidity ranged from 74 to 94 percent. By any standard, this represents a warm and moist environment and the rainy season had yet to arrive.

Physically damaged seed, perhaps from insect feeding, can bring about rapid seed quality degradation. I watched workers plant commercially-obtained field beans from Ghana. They indicated the seeds were of high quality and when I polled the group, they thought the germination rate would be in the 80- to 85-percent range. However, 50 percent of the seeds exhibited significant insect borings into the body of the seed. Additionally, numerous hila had heavy insect or disease damage. In my opinion, less than 50 percent had the potential to germinate.

To add it all up, it's possible that seed might be stored in the U.S. or in Africa for six months or more before reaching its destination in Liberia, where it might be held for another six to 12 months under warm, moist conditions and perhaps even in direct sunlight. Seed quality is diminished. Now, compound that with insects feeding on the "good" seeds. Seed quality is significantly deteriorated.

What results might the smallholder farmer expect? How will he feel about his seed provider? How might he interpret the true value of professionally produced seed? He may erroneously perceive little value beyond that of locally grown and saved seed.

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Naoki Yaya, a graduate of the Plant Breeding Academy, gives a radish breeding demonstration to a Plant Breeding Academy class on a field tour to Sakata Seeds in Salinas, California.

TRAINING THE FORCE

To solve the world's biggest challenges, the seed industry relies on a highly skilled workforce, and the University of California, Davis, works to prepare those individuals.

CHILDHOOD STUNTING IS one of six key issues identified by the World Health Organization, which has set out to reduce the number of children less than five years of age affected by stunting by 40 percent by 2025. In Africa, nearly 40 percent of all children display signs of stunting, according to WHO data. Caused primarily by malnutrition, stunting affects more than just physical appearance. Long term, it means poorer school performance, a decreased learning capability, and lower work and production capacities.

WHO isn't the only one helping to reduce stunting. It's a condition that members of the Seed Biotechnology Center at the University of California, Davis, are working to remedy through its Plant Breeding Academy in Africa.

The African academy is a 13-month program — designed to address the small number of plant breeders being trained in traditional academic programs — that teaches the principles of plant breeding to seed industry personnel. The first session was launched in December 2013 in Nairobi, Kenya, in partnership with the New Partnership for Africa's Development (NEPAD), which is part of the African Orphan Crops Consortium.

The academy plans to sequence, assemble and annotate the genomes of 100 traditional African food crops to guide development of vegetables, fruits and other agricultural products that are more robust and nutritious.

"We're not talking about corn or soybeans," says Allen Van Deynze, Plant Breeding Academy co-founder and UC-Davis plant science researcher. "It's baobab, finger millet — crops we don't eat or even think about in North America, for the most part."

Agriculture and the seed industry are booming, and both have come into the spotlight as being pivotal toward solving global challenges. "Somewhere around 2005, the industry started recognizing that there's a tremendous need for plant breeders but we didn't really have a supply of them," Van Deynze says.

That's where UC-Davis and the Plant Breeding Academy come into play. Van Deynze, Rale Gjuric, Kent Bradford and their colleagues at the Seed Biotechnology Center have established Plant Breeding Academies around the world. The premium professional certificate program has been available since 2006 in the U.S., Europe and Asia. Although the curriculum is similar across locations, the African Plant Breeding Academy is a higher-level course because it's designed to train Ph.D. breeders active in the field, most of whom work for public institutions.

"The academy is driven by industry as opposed to the public sector, but there's also a need in the public sector as people

retire," Van Deynze says. "A lot of people thought molecular biology and transgenics were more fascinating than kicking dirt in the field. We had fewer people going into plant sciences, in general, especially plant breeding. That trend is changing now."

Education Affords Advances

The Plant Breeding Academy not only affords more people the opportunity to work toward crop improvement, but also gives people a chance to advance professionally, thus creating a better life for themselves and their families.

"Companies invest in their employees and say 'we're going to put you through this program so you can advance; we think you can do it,'" Van Deynze says. "They use the program to recruit and maintain quality employees, and it's worked. Most companies that have sent us one student have sent another one. For us, that's the best evaluation we can get."

Peter Salm, a commercial plant breeder since 1967, encouraged his colleague Bill Colfer to further his education by enrolling in the Plant Breeding Academy. "Peter shared with me his applied expertise for 16 years and recommended that I continue my development by attending the academy," shares Colfer, who serves as the artichoke breeding manager for Plant Science Inc. and considers Salm his mentor.

With the support of his company, Colfer started his coursework in 2011. "The program required significant effort on my part, but it was worth every minute I invested," says Colfer, who finished the course in 2013.

Although he's based in the United States, Colfer enrolled in the European Plant Breeding Academy. "This turned out to be very fruitful," he says. "Not only did I expand my knowledge as a plant breeder, but I also expanded my knowledge of the European breeders and the programs they work in, promote and serve. This included men and women in a wide range of field crops, as well as vegetables and fruits. We weren't sharing trade secrets, but rather the various ideas and methods."

That's just the sort of experience Van Deynze says makes the Plant Breeding Academy such an effective program. "The companies we visit are really quite open with the students," he says. "They don't tell us their company secrets, because it's their competitors they're talking to, but companies are mature enough to say 'I can tell you what I'm doing, but you don't have my germplasm and that's really my strength.'"

Colfer continues to work for Plant Sciences Inc. "Continuing education has always been a professional goal of mine," Colfer says, adding that his increased knowledge around theory and the vast number of disciplines exercised in plant breeding has been very gratifying.

One of the people who helped conceive the idea for the Plant Breeding Academy was George Kotch, now a regional vice president of research and development for vegetable seed breeding group HM CLAUSE in Davis, California.

"I came to UC-Davis and said 'you know, we're in desperate need of people who know plant breeding,'" Kotch says. "Some of our high-performing employees are coming out of master's and bachelor's programs and they really don't know anything about commercial plant breeding. You have this pool of people who want to step up but don't have a vehicle to bring them to that higher level, because they lack training. I thought maybe there could be a way to create a mini-program so they could be pulled out of their normal job for a week, come back to school and get retrained for plant breeding."

To take part in any of the postgraduate Plant Breeding Academies offered around the globe, students need at least a bachelor's degree in plant biology, with a minimum of an introductory class in genetics and statistics. They also need experience in the seed industry, and a desire to become a plant breeder. Traditionally, the program is two years of study with six in-person sessions. Due to its interactive nature, the class size is limited to 20.

To-date, the Plant Breeding Academy has awarded 124 certificates of completion, which helps put more minds to work searching for keys to crop improvement.

The Business of Seed

Unlike the Plant Breeding Academy, the Seed Biotechnology Center's Seed Business 101 course targets promising new employees and new managers. "It's designed to shorten the learning curve for people new to the seed industry," says Van Deynze. "For example, someone could be in marketing in another industry but now works in the seed industry. This sort of crossover happens frequently."

Seed Business 101 also educates employees about different departments and functions within a seed company. "This allows them to better communicate with their colleagues, as well as have opportunities to move within a company," he says.

During the course, students get involved in real-life scenarios. They are put in charge of a fictional seed company, complete with financial details, inventories and even a complete history of the company. "The students are basically immersed in the business of this company, and work on case studies dealing with different functional areas of the company," says Rale Gjuric, Seed Business 101 course instructor and organizer. "They have to work as a team and come up with solutions to problems."

The course focuses on the five major functional areas of a seed company — plant breeding research, production, operations, sales and marketing, and administration.

The goal is to enhance each participant's career performance and help him or her avoid costly mistakes, says Gjuric. It's not just a course for young people. "We get a lot of senior people, from financial managers to legal experts, all coming from different industries," Gjuric says. "They have to understand how a seed company works throughout all its functional areas."

Participants walk away with a broad understanding of the major aspects of a seed company's operations and a cross-departmental knowledge of best practices for profitability, taught by instructors who have been there and know the inner workings of the seed business. "They are experienced — many are retired or are former members of the seed industry," Gjuric says.

Van Denyze adds that the course's instructors are one of the things that make it so effective. "It's taught by people who've been in the seed industry for 20, 30 and 40 years — former CEOs and presidents. These guys just love to do that," he says.

It's the strong background of its instructors that has earned the Seed Business 101 course rave reviews from those who have taken it. Ken Piecharka, production manager at the Canadian-based pedigreed seed company HyTech Production Ltd., took the Seed Business 101 course in 2013.

"The instructors spent a lot of time preparing case studies," Piecharka says. "They had an incredible amount of personal experience. I learn best from hearing examples, stories from real-life cases, and that was how it was delivered. I don't know if there could be more knowledgeable people than the three instructors we had."

Piecharka took the course because he was going through a career transition. "There are not a lot of courses like this. I needed structured training from real industry experts," he says.

Fill the Gaps

The goal of Seed Business 101 and the Plant Breeding Academy, Van Deynze says, is to inject some much-needed new blood into the seed industry. "In agriculture, we can guarantee you a good job at the end of a graduate degree," Van Deynze says. "There are very few sectors that can say the same."

Industry praises the efforts of UC-Davis and its Seed Biotechnology Center. "They are the conduit for private companies to interface with UC-Davis," says HM CLAUSE's Kotch. "Many universities are internally focused, but the UC-Davis group is far more externally focused. We do as much as we can with them, because they understand us and we want to support them. That's a pretty rare interaction these days."

Hopefully one day all that external focus will help find a solution and put a stop to childhood stunting and malnutrition in Africa and around the world. **Marc Zienkiewicz**

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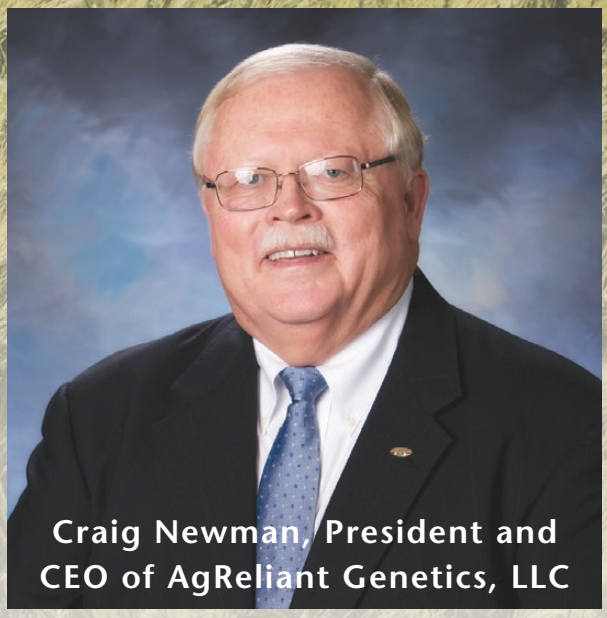

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CROSS POLLINATION

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NOW IS THE TIME TO DEAL WITH UNAPPROVED GM CROPS

"We've got to figure a solution out to make sure we're not handcuffing the U.S. corn farmer or the seed companies," says Greg Konsor, general manager of grain operations for Gavilon Group, LLC. "At some point in time, the industry has to deal with it. Now is the time to deal with it." Konsor was responding to the company's recent decision to accept a new type of GMO corn — Syngenta's Agrisure Duracade variety, which is not approved by China or the European Union.

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Through its Health Bucks and Stellar Farmers' Market programs, New York City's Department of Health and Mental Hygiene helps customers learn about and buy fruits and vegetables. The Health Bucks program distributes $2 Health Bucks coupons to consumers for the purchase of fresh fruits and vegetables at farmers markets. Supplemental Nutrition Assistance Program participants who use their benefits at participating markets receive a $2 coupon for every $5 spent in SNAP benefits, which is a 40 percent increase in purchasing power. Since the program began in 2005, the number of participating markets has grown from about five in 2005 to 138 in 2012.

DEFLECTING DUST

"In North America, for example, one major project is helping to reduce dust emissions during seed treatment at large industrial farms," says Peter Ohs, senior global stewardship manager for Bayer CropScience. "Major operators in the United States and Canada use big machinery, often with a central tank for seeds. It's crucial to keep things flowing to reduce emissions and environmental contamination." Bayer has developed a new fluency agent based on polyethylene wax to replace the commonly used talc. It keeps the seeds flowing through the planter, but reduces dust emissions. Ohs adds that modification kits for planters can also successfully reduce environmental exposure. "Deflectors can significantly reduce dust by redirecting it to the soil and releasing it into or close to the soil at a reduced speed," Ohs says. "As a result, environmental contamination is reduced by 90 percent, as confirmed by German authorities."

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PROTECTING FARM DATA

After meeting in Kansas City with a dozen leading U.S. agricultural industry players, the American Farm Bureau Federation says it has more work to do to find consensus on a set of standards aimed at protecting farm data privacy, according to a recent *Reuters* article. "We need clarity so everyone knows what the rules are," says Ron LeMay, chairman of Kansas City-based FarmLink, a farm data analytics provider. "There is a lot at stake. There is a huge benefit by being able to muster all the information. We need to get it right." LeMay says that one of the issues deals with permissions when farmers sign up for an app and agree to certain terms and conditions. "This ultimately will be made part of the contracts between farmers and contractors," he says. According to the AFBF, the issue lies with determining who will spearhead the drive toward a common standard for data produced on farms as the industry aims to turn information into profit and productivity, projected to be a multi-billion dollar industry in the coming years. During the past year, there has been a surge in the collection and analysis of farm data across the United States.

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THE GREAT LABEL DEBATE

The Council for Agricultural Science and Technology has joined the debate surrounding the mandatory labeling of genetically engineered food, releasing an issue paper that looks at the arguments for and against labels, the costs involved with labeling and experiences in countries that use mandatory labeling. "Bottom line, we need better communication regarding the scientific issues and the possible legal and economic consequences of mandatory GMO food labels," says Alison Van Eenennaam, task force chair of the CAST report.

Excerpts from the report's summary include:

"All domesticated crops and animals have been genetically modified in some way; there is no science-based reason to single out GE foods and feeds for mandatory process-based labeling. Wide-ranging evidence shows that GE technology is equally safe to conventional breeding."

"Mandatory GE labeling would increase U.S. food costs. The size of this increase will depend on choices made in the marketplace by suppliers and marketers, and what products are included in labeling requirements. If, as in other countries, sellers move to non-GE offerings in response to mandatory labeling, food costs could rise significantly and these increased costs would exact a greater burden on low-income families. If, on the other hand, food suppliers choose to label virtually all products as containing GE without testing or segregation, increases in costs might be minimal."

"Independent objective information on the scientific issues and the possible legal ramifications and economic consequences of mandatory GE food labels needs to be provided to legislators and consumers, especially in states with labeling initiatives on the ballot, to help move the national discussion from contentious claims and counterclaims to a more fact-based and informed dialogue."

TOP-RANKING RESEARCH EXPENDITURES

Texas A&M AgriLife Research was ranked No. 1 in U.S. agricultural sciences expenditures for fiscal year 2012, the latest year for which figures are available, according to the National Science Foundation. The university accounted for more than $176.4 million of the nearly $3.3 billion spent on agricultural research by more than 30 universities. "This ranking is not about being No. 1 just to be No. 1," says Craig Nessler, AgriLife Research director. "It's about positively impacting the lives of Texans, our fellow citizens across the nation and people worldwide with important scientific discoveries in agriculture." Nessler says the gains are also important because research budgets had a 17.5 percent cut and lost millions of dollars in earmark funding in recent years. Not only did AgriLife Research achieve the No. 1 spot on the expenditures list, its total was $25 million higher than any of the other top five universities in the past four years. "The increase in research expenditures is important because it means faculty researchers have additional opportunities to do top-level scientific studies," Nessler says. **"A SCIENTIST'S PASSION FOR RESEARCH SHOULDN'T HAVE TO BE INTERRUPTED TO SEARCH FOR FUNDS IN A SHRINKING ECONOMY."**

CHINA'S CORN CONUNDRUM

Various economic analyses by groups in the United States estimate that anywhere from $2 billion to $3 billion in economic losses have been sustained by the corn, distillers grains and soy sectors since the enforcement of a zero-tolerance policy on Syngenta's Agrisure Viptera MIR 162 corn technology in U.S. export shipments to China, where the trait has not yet been approved for import as food or feed.

"It's a watershed-type of moment," says Gary Martin, president of the North American Export Grain Association. "It's pretty dramatic if the United States can't supply the Chinese market."

According to Karl Setzer, a market analyst for MaxYield Cooperative in West Bend, Iowa, the decision is 100 percent economics. "If China was facing a corn shortage or really needed the corn, it wouldn't be a problem, because they've probably been importing that [Syngenta variety] for the past three years," he says.

"IT'S PRETTY DRAMATIC IF THE UNITED STATES CAN'T SUPPLY THE CHINESE MARKET."

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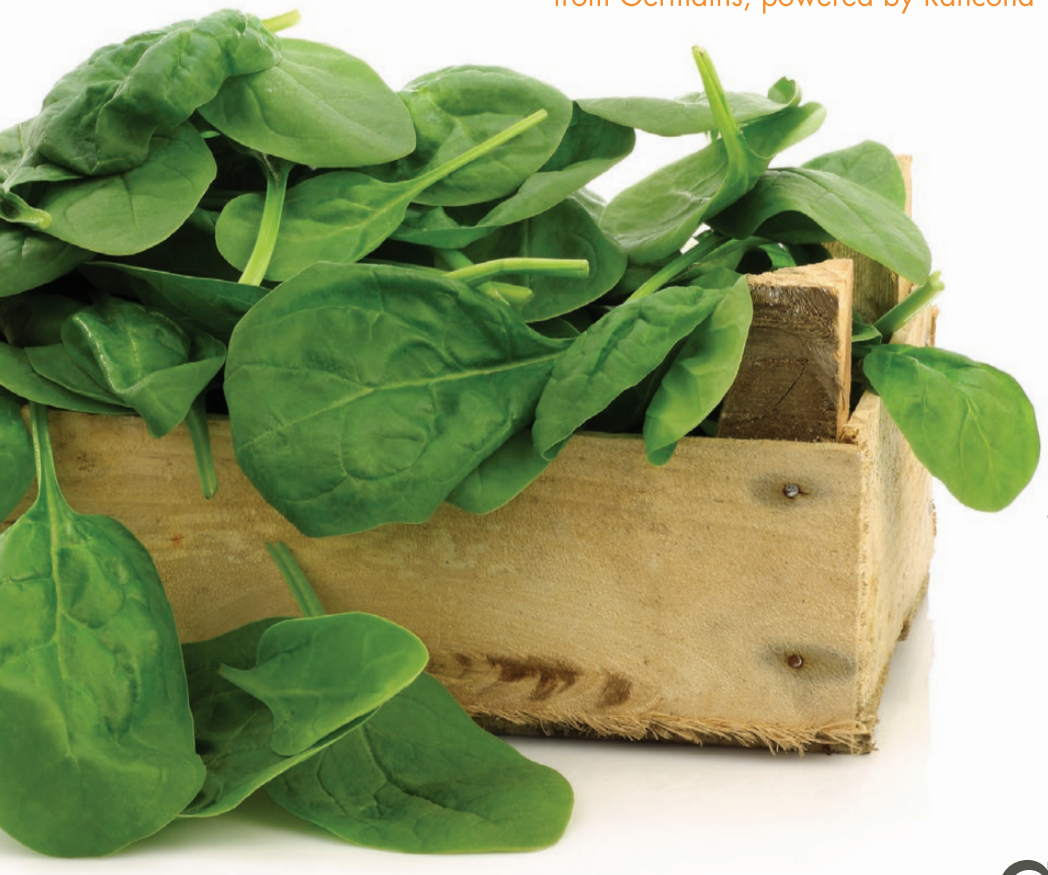

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NATIONAL

EPA SEEKS COMMENTS ON NEW PRODUCT

The U.S. Environmental Protection Agency is holding a public comment period on the proposed regulatory decision to register Enlist Duo, which contains glyphosate and the choline salt of 2,4-D, to control weeds in corn and soybeans genetically engineered to tolerate 2,4-D. If finalized, EPA's action will provide an additional tool to reduce the spread of glyphosate-resistant weeds. The proposal would impose requirements on the manufacturer, including robust monitoring and reporting to EPA, and grower education and remediation. This proposal would also allow EPA to impose additional restrictions on the manufacturer and on the use of Enlist Duo if resistance to the pesticide develops. EPA will review all comments prior to reaching a final decision, which the agency expects to issue in late summer or early fall.

NEW PATENT AWARDED FOR INNOVATION IN CORN

California's Ceres Inc., an agricultural biotechnology and seed company, has been awarded a U.S. patent for a genetic sequence derived from corn, covering uses of the gene in research, product development and seed production. The company believes that its gene could be useful in regulating plant development and key biosynthetic processes. Ceres plans to offer seed companies a commercial license to the innovation, including an opportunity for exclusivity in certain crops. "We are currently evaluating the potential market for this gene among corn seed companies and the applicability of our patented invention in the development and production of improved corn hybrids," says Richard Hamilton, president and CEO of Ceres.

RESEARCH YIELDS NEW AG TECHNOLOGIES

Researchers at Montana State University have developed new technologies in the areas of biotechnology and agriculture that are patent-pending and available for licensing. At MSU's College of Agriculture, researchers have developed rust resistance in wheat, which could provide a solution to a spreading pathogen that has already destroyed crops in Africa and Asia. The non-genetically modified trait that has been re-created in varieties of wheat has shown resistance to a pair of rust strains, Ug99 and Yr27, which have emerged in recent years. Globally, the three types of wheat rust (stem, leaf and stripe rust) are the most economically damaging diseases that attack wheat. The development of rust-resistant wheat varieties is estimated to have saved more than $1 billion annually for more than four decades.

RESEARCH SHOWS FOOD FROM GM CROPS SAFE

The Crop Science Society of America, which represents more than 6,000 crop scientists, released a statement supporting the use of plant biotechnology and opposing mandatory labeling of foods derived from GM crops. Analyses of more than 25 years of research, representing thousands of independent studies, shows that GM crops are as safe as crops derived from traditional breeding methods. Since GM crops pose no significant health risks, requiring labels for foods with GM crops could falsely alarm and mislead consumers. "The research overwhelmingly shows that GM crops are safe and pose no significant health or environmental risks," says Stephen Baenziger, chair of the CSSA Science Policy Committee. "In the light of such evidence, CSSA sees no basis for the mandatory labeling of GM foods."

BAYER SUBMITS NEW SEED TREATMENT TO EPA

Bayer CropScience has an application pending with the U.S. Environmental Protection Agency for the registration of ILeVO seed treatment. If approved, ILeVO would be the first product to provide soybean seedlings protection from the soil-borne pathogen *Fusarium virguliforme* — the fungus that causes sudden death syndrome. During research and field trials, ILeVO seed treatment protected soybeans from early-season infection and reduced late-season leaf chlorosis and necrosis that leads to leaf, flower and pod abortion. The active ingredient in ILeVO is systemic and moves from the seed into the tissue of the stem and roots of soybean seedlings. Bayer anticipates EPA registration for ILeVO by the end of 2014. If registered this year, Bayer expects ILeVO will be available for the 2015 growing season.

MARRONE BIO SUBMITS BIOFUMIGANT TO EPA

Marrone Bio Innovations Inc., a global provider of bio-based pest management and plant health products has submitted MBI-601 EP, a biofumigant, to the U.S. Environmental Protection Agency for registration. The product controls and suppresses plant parasitic nematodes, insect pests and soil-borne plant diseases in agricultural and horticultural soils. "We expect MBI-601 to fill a real need for high-value fruit, vegetable and ornamental growers," says Jim Lappin, MBI's vice president of product management and business development. "MBI-601, a naturally occurring, biologically-based fumigant, will provide an alternative to the traditional synthetic materials. As we further develop the product, additional uses may include post-harvest, turf, silviculture and seed treatments."

NUE TECHNOLOGY RECEIVES PATENT

Arcadia Biosciences Inc., has announced that the United States Patent and Trademark Office has granted the company a key patent for its Nitrogen Use Efficiency technology. The patent covers the use of NUE technology in monocot crops such as wheat, rice, corn, sugar cane, sorghum and barley, offering significant benefits to both growers and the environment. Arcadia's NUE technology enables farmers to increase crop yield per unit of nitrogen fertilizer applied. The patent further expands Arcadia's NUE patent portfolio, which includes NUE technology patents already granted in China, Vietnam, Australia, Mexico, Europe and other key geographies for monocot crop production. Additional patent applications are pending in multiple jurisdictions.

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INTERNATIONAL

FRANCE DEFINITIVELY BANS GROWING GM CORN

France's majority senate has approved a standing ban on MON810, a type of genetically modified corn. Even though the GM corn has been cleared by the European Union, the French senate says it poses a risk to the environment. The lower house of parliament in France had already adopted a law confirming the ban last month. "This law aims to give a legal framework to our country, to ensure that a ban is applied," according to French Agriculture Minister Stéphane Le Foll. France adopted a decree in March halting the sowing of Monsanto's insect-resistant MON810 corn, the sole GM crop allowed for cultivation in the European Union.

PARAGUAY APPROVES NEW CORN HYBRID

Paraguay's Ministry of Agriculture has approved a new genetically engineered corn event. The new GE corn, MON89034 x TC1507 x NK603 Powercore was developed by Monsanto and Dow AgroSciences. Powercore is a corn hybrid that comprises two herbicide-tolerant genes and three genes resistant to pests of economic importance in Paraguay. This event combines the control of major corn pests, such as fall armyworm, sugarcane borer, corn stalk borer, corn earworm and black cutworm, and tolerance to glyphosate and glufosinate herbicides. This event has already been approved in Argentina, Brazil and Uruguay.

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EU PARLIAMENT FAILS TO AGREE ON SEED LAW

Following a debate in plenary, the European Parliament concluded its first reading of the Commission's proposal for a modernization of the EU's seed law without putting forward any concrete amendments. "The European Parliament has given away an important opportunity to shape a new and modern seed law for breeders, seed producers and farmers in Europe," says Garlich von Essen, secretary general of the European Seed Association. "For the first time, the European Parliament had true co-decision power in this policy area. It's a pity that it has failed to use it constructively."

EUROPABIO LAUNCHES GM FORUM

EuropaBio has launched Growing Voices, a digital forum designed to help consumers learn about the reality of genetically modified crops and to facilitate dialogue between consumers and non-industry experts from farming, academia and politics. "GM offers real opportunities to develop crops that provide better resilience to extremes of weather and land conditions. There is the potential to add extra nutrients that can directly help people in developing countries who are vulnerable to nutrient deficiencies in their diets. As the world's population continues to increase, access to these technologies becomes even more important," says Owen Paterson, secretary of state for environment, food and rural affairs in the United Kingdom.

SUSTAINABLE DHA OMEGA-3 CANOLA

A significant milestone has been achieved by Australia's long-chain omega-3 canola research collaboration when it produced DHA oil levels equal to that found in wild fish. The collaboration was formed in 2011 between Nuseed, the Commonwealth Scientific and Industrial Research Organization and the Grains Research and Development Corporation. "We recently achieved our target DHA oil levels, giving us encouragement that we are on the right path to deliver a commercially viable alternative omega-3 oil source," says Malcolm Devine, Nuseed's global innovation lead. The collaboration is now moving into full development pre-regulatory stages with both field and lab performance trials. "We aim to have seed available for commercial production by around 2018, provided key development milestones are achieved and the required regulatory protocols are met."

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An in-depth overview on the global seed industry.

From investments in Africa's seed industry to Canada's mustard and sunflower seed growers, countries around the world rely on the seed industry for economic support.

STATUS**AFRICA**

ANALYSIS SHOWS investments in fledgling seed companies with local focus could net big returns for African food production on small farms, according to the Alliance for a Green Revolution in Africa (AGRA).

Locally-owned African seed companies participating in a program to offer high-yield crop varieties to smallholder farmers across the continent have collectively become the largest seed producers in sub-Saharan Africa, shows data from a new report released at the Grow Africa Investment Forum alongside the World Economic Forum on Africa.

The analysis by AGRA reveals 80 small- to medium-size African seed companies in 16 countries are on track to produce more than 80,000 metric tons of professionally certified seed in 2014.

"The rapid growth of local seed companies over a very short time period is a testament to the entrepreneurial spirit percolating in communities across Africa and to the pent-up demand among Africa's smallholder farmers for improved, high-yield crop varieties," says Joe DeVries, director of AGRA's Program for Africa's Seed Systems (PASS).

AGRA launched PASS in 2007 to inject new energy into Africa's commercial seed sector, which was failing to provide African farmers with a steady supply of locally-adapted, improved crop varieties — something that farmers elsewhere in the world take for granted. The stagnant state of commercial seed production often is cited as a key reason why yields per hectare in Africa for staple crops like maize are up to 80 percent below what farmers outside of Africa achieve.

According to the report, "Planting the Seeds of a Green Revolution in Africa," PASS started out working with a handful of companies that together produced about 2,000 metric tons of seed.

Today, it's partnering with more than 80 companies across the continent that produce professionally certified seed for an array of African staple crops including maize, cassava, millet, rice, sorghum, beans, sweet potato, cowpea, groundnut, soybean and pigeon pea. These companies are focusing on varieties "carefully selected by local crop breeders for their compatibility with specific African agricultural environments." — Alliance for a Green Revolution in Africa

STATUS**CANADA**

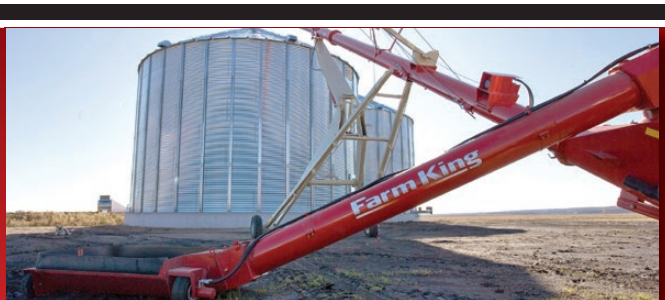
CANADIAN MUSTARD and sunflower seed growers received support from the federal government to increase export sales abroad.

Agriculture Minister Gerry Ritz made the $230,000 funding announcement to the Canadian Special Crops Association (CSCA). In a release, it says the money will help boost international trade efforts.

"The multi-year Agri-Marketing funding will enable Canada's special crops industry to deliver innovative, healthy and sustainable foods consistently and reliably to markets around the world," says Gordon Bacon, CEO of the Canadian Special Crops Association.

Specifically, the industry will focus on two projects directed by the Saskatchewan Mustard Development Commission and the National Sunflower Association of Canada. The initiative's purpose is to improve variety options for mustard and sunflower seeds, focusing on health and nutritional benefits.

According to the release, the Canadian pulse and special crop industry had an export value of more than $3 billion in 2013. The investment was made through the Agriculture



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and Agri-Food Canada's AgriMarketing Program, offered under the Growing Forward 2 policy framework. — Amanda Brodhagen, Farms.com

STATUS CHINA

CHINA'S CROP seed companies have declined in number during the past three years due to mergers and acquisitions, and the government encourages them to become globally competitive, a senior official said during a May 20 press conference.

The number of seed enterprises in China decreased to around 5,200 from more than 8,700 in 2011, down by 40 percent, shared Yu Xinrong, China's vice minister of agriculture

The number of Chinese seed companies whose registered capital exceeds 100 million yuan ($16.2 million) jumped to 106, up nearly 200 percent during the period, Yu reported. The combined sales volume of the country's biggest 50 crop seed companies accounted for more than 30 percent of the total, and the top 10 industry leaders spent a total of nearly 600 million yuan ($96.2 million) on research and development annually.

Beijing encourages mergers and acquisitions of domestic crop seed companies and supports them to improve R&D, production, management and service capabilities to narrow their gaps with global leaders, Yu said.

The country's combined crop seed export volume has surpassed $300 million annually, data from the Ministry of Agriculture revealed. — WantChinaTimes.com

STATUS PAKISTAN

HEAVY MACHINERY worth millions of rupees, purchased for the agriculture department's seed industry project under the Agriculture Development Fund (ADF) in 2012, has been found to be of poor quality, with its purchase overshadowed by mismanagement.

Districts officials of the project have expressed dissatisfaction over the machines' functioning and demanded a probe into the purchasing deal.

A source within the Agriculture, Livestock and Cooperative Department told *The Express Tribune* that as the machines did not meet the required specifications, they were hampering operations of the department in various districts across the province. The total budget of the project was 40 million rupees ($404,520) while the eight machines cost an estimated 7.3 million rupees.

The short tender notice for the machines was floated on July 13, 2011, in a national English daily. The tender included seed processing plants, seed treatment equipment and power generators. The tender for seed cleaning machine/processing plant or seed grader was specified to clean 1.5 to 2 metric tonnes of seed per hour.

A six-member purchasing committee was constituted Sept. 30, 2011. According to a department notification, the body was delegated powers under the Khyber-Pakhtunkhwa Procurement of Goods, Works and Services Rules 2003, for purchasing the equipment under the seed industry project's ADF during 2011-12.

A source within the department said the committee was kept in the dark during the purchasing process, which he claimed was against rules and regulations.

A committee member, Abdul Rehman, who served as assistant director (seed) in the department said, "I was not consulted despite the fact that the committee was formed for supervising the procurement process. This was completely against our terms of responsibilities," he added.

The source said the seed grader machine wanted in the initial sketch was not purchased and some eight other machines, not meeting the required specifications, were purchased due to which most of them are lying non-functional.

The copy of the original sketch also shows that the eight machines were not purchased according to the requirements.

A seed storekeeper in DI Khan, Jamil Khan, said the seed cleaning machine cannot be brought into use as it lacks necessary equipment to operate fully. He said the new machines only clean three bags of seeds in one hour and they need one that can clean 20 to 25 bags in the same period. — Kamran Khan, The Express Daily

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PEOPLE NEWS

Haplotech, a privately-owned and independent technical service provider in plant breeding, has hired **Roger Watts** to assume responsibilities in business development and project management. Watts will take the lead on several new projects including P3 Hybrids programs in wheat and canola. Previously, Watts was a DuPont Pioneer senior research associate.

Syngenta has hired **Ryan Findlay** as industry relations lead for cereals and diverse field crops, including sugarbeets, sunflowers and alfalfa. Findlay will manage the company's relationships with commodity and agricultural associations. **Terry Stone** has been appointed industry relations lead for vegetable and specialty crops. **Jill Wheeler** has been named head of sustainable productivity in North America and will be responsible for ensuring The Good Growth Plan from Syngenta is embedded into the company's North American business and stakeholder engagement plans.

Dow AgroSciences has announced a new leadership structure for its businesses in North America. **Rajan Gajaria** has been promoted to the new position of global leader of North America and Latin America. Gajaria succeeds **Stan Howell,** who has been named global general manager for AgroFresh, a DOW business that is a global leader in advanced proprietary technologies for the horticulture and agronomic markets. In addition, DOW announced three new management roles in the U.S. regional commercial unit. **Susanne Wasson** has been named U.S. crop protection leader. **Ben Kaehler** will take on the new role of U.S. sales leader, while **Brian Barker** has been named general manager of U.S. Seeds.

The board of directors of **Keygene Inc.** has appointed **Fayaz Khazi** as CEO, effective immediately. "We are confident that under Fayaz's leadership, Keygene Inc. will continue with the development of innovative crop improvement research and will expand our business in North and South America with emphasis on major American crops, such as soybeans and corn," says Arjen van Tunen, chairman of the board of directors and CEO of Keygene N.V.

BioDiagnostics Inc., an independent seed testing laboratory serving the needs of the global seed industry, has added **Farhad Ghavami** as manager of molecular breeding and genomic technologies. With Ghavami's guidance, BDI will expand its DNA extraction services by offering a high-throughput pure DNA extraction service for less than the cost that most seed companies spend on do-it-yourself kits. Ghavami will also spearhead BDI efforts to increase its level of genomic selection and association mapping services, upgrade the current bioinformatic offerings and make molecular breeding a more accepted and understood practice in the industry.

PRODUCT NEWS

KeyGene has announced that the automated and robotized plant phenotyping facility, known as **PhenoFab**, has expanded its digital phenotyping service portfolio for additional **crop and seed applications**. The new phenotyping applications allow the crop protection industry to test and precisely measure the effects of their products on the growth of plants and their well-being. Such studies help to precisely define the combined effects of the seed/chemical/biological treatment on the growth of various crops for different genotypes under different growing conditions. The ability to measure even the smallest growth differences provides customers vital feedback to improve their products and boost their research and development efforts, according to KeyGene.

A new agreement provides **CNH Industrial N.V.** and **The Climate Corporation** the opportunity for factory integration of select precision planting technology into CNH Industrial agricultural planters designed to optimize planting performance. The non-exclusive agreement "will allow CNH Industrial to provide producers the next level of customization and **seed delivery technology** in the market," says Dave Larson, CNH Industrial vice president, agricultural equipment portfolio strategy. "It will allow us not only to pair the technologies and services of our companies, but to evolve them together to deliver significant improvements in planting efficiency and yield."

BUSINESS NEWS

Pinnacle Agriculture Holdings LLC has acquired **Frontier Chemical LLC**. Headquartered in Beattie, Kansas, Frontier Chemical was formed in 2007 providing crop protection chemicals for area growers. The business has grown 10-fold from its original volume, as it continues to provide a full line of chemical products, as well as select seed products. Pinnacle has also acquired **Harvey's Agricultural Solutions LLC** and **3-D Agronomy**. Michigan-based Harvey's will operate as part of Pinnacle's Providence Agriculture brand. Harvey's two locations will provide ag solutions including fertilizer, crop protection chemicals, seed and other value-added services.

Precision BioSciences Inc. has been working with **Syngenta** to develop advanced agricultural products using the first fully-synthetic genome editing technology. Researchers at Syngenta have successfully used engineered nucleases based on Precision's proprietary ARCUS technology to insert genes of interest into desired locations in the corn genome with unprecedented efficiency. The ARCUS-derived nucleases were found to be highly effective, leading to an extension of the Precision-Syngenta collaboration.

Evogene Ltd., a plant genomics company that specializes in enhancing crop productivity, has entered into the field of plant

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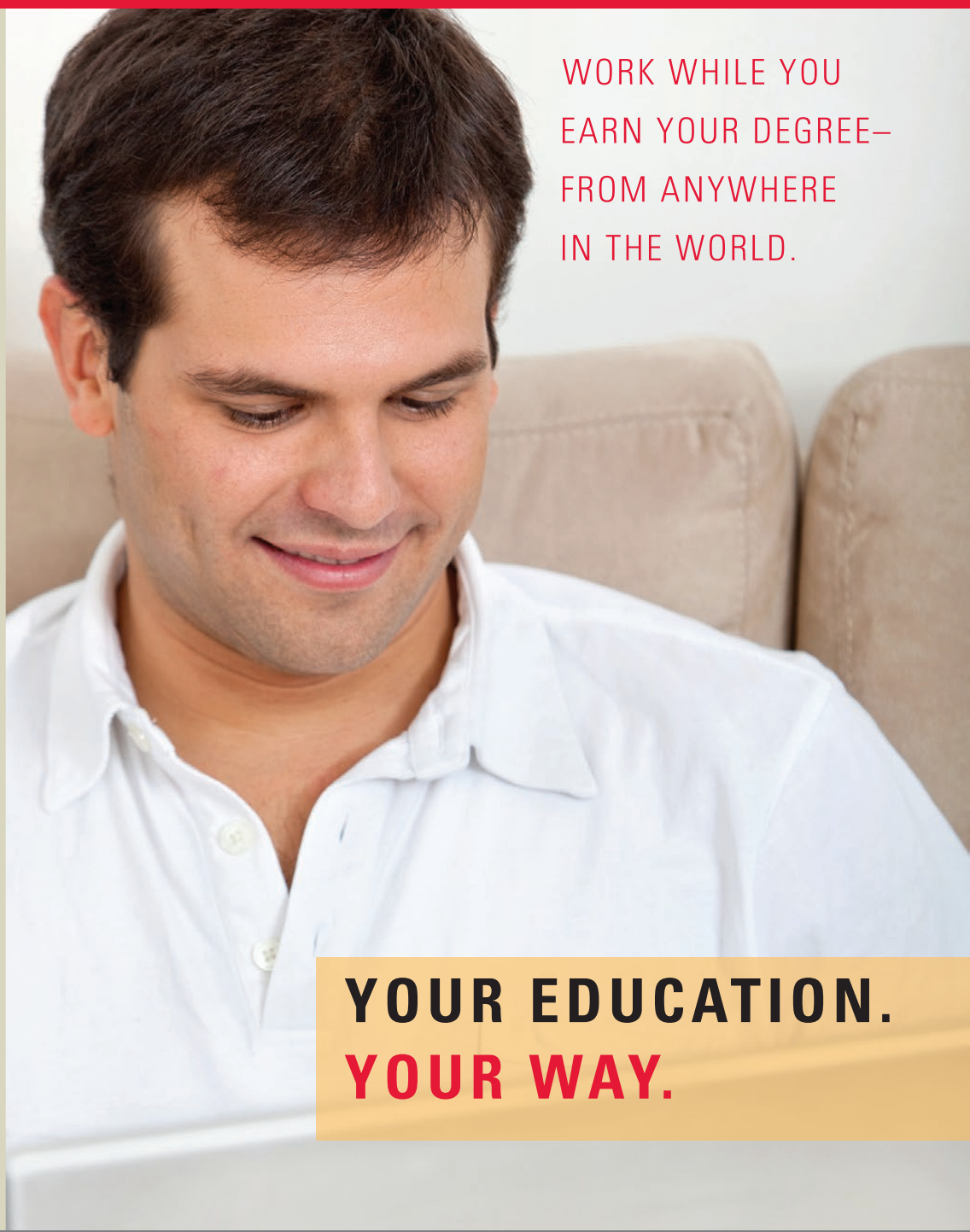

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insect resistance and control. The company's initial activities will focus on developing seed traits, which display resistance to corn rootworm and soybean aphids. Evogene's insect-resistance activities will focus on an innovative approach to the discovery of microbial genes responsible for insecticidal activity. "The first insects to be targeted are two of the industry's most devastating insects," says Ofer Haviv, Evogene's president and CEO.

Bayer CropScience has officially opened its **North American Bee Care Center** at its headquarters in Raleigh, N.C. The $2.4-million center brings together significant technological, scientific and academic resources, with the goal of promoting improved honey bee health, product stewardship and sustainable agriculture.

The global strategic relationship between the **Royal Barenbrug Group** and **Dow AgroSciences** has led to the opening of Barenbrug do Brasil, which specializes in plant breeding, seed production and processing of pasture seeds, including Brachiaria hybrids and forage legumes, for the Brazilian market. With the most modern and advanced seed processing and coating line in Latin America, Barenbrug will focus on high-quality seed. Barenbrug do Brasil's grass breeding facilities will concentrate on producing a portfolio of tropical and temperate grasses.

INDUSTRY NEWS

A new report from **PG Economics** titled *GM Crops: Global Socio-Economic and Environmental Impacts 1996-2012*, reveals that crop biotechnology continues to provide major environmental benefits and allows farmers to grow more, while using fewer resources. "Half of the farm income gains and the majority of the environmental gains associated with changes in pesticide use and reductions in greenhouse gas emissions occurred in developing countries," says Graham Brookes, director of PG Economics and co-author of the report.

The third **National Climate Assessment** report has been released and is similar to previous climate assessments. The authors conclude that climate change is already happening across the U.S. The report documents how climate change is altering agriculture and forestry systems and evaluates how these systems are likely to be affected. The authors found that climate disruptions to agricultural production have increased in the past 40 years and are projected to increase during the next 25 years. By mid-century, these impacts will be increasingly negative on most crops and livestock. Many agricultural regions will experience declines in crop and livestock production from increased stress due to weeds, diseases, insect pests and other climate change-induced stresses.

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  - Database/fingerprinting (DB)
  - Consulting

Iowa State University engineers and plant scientists are working together to design better crops that will tolerate climate change, produce higher yields and feed more people. The effort to develop smart plants brings combines engineers, who are fluent in measuring water and nutrient flows, running high-performance computer simulations and visualizing huge amounts of complex data, with plant scientists, who can breed and improve plants, identify plant traits, understand genomics and study soil and environmental impacts on plants. The team, led by Daniel Attinger, ISU associate professor of mechanical engineering, will attempt to use the principles of engineering and physics in plant breeding.

DuPont Pioneer scientists have made a significant advancement in developing corn plants that successfully withstand drought stress. In an upcoming edition of *Plant Biotechnology Journal,* Pioneer scientists reveal a new finding that higher-yielding corn plants succeed under drought conditions when naturally occurring ethylene stress hormone levels in the plant are reduced through a transgene. "It's not just about improving productivity for farmers, we also need to maintain and improve sustainability of our land and water resources," says Jeff Habben, DuPont Pioneer scientist and lead author of the article.

A new study shows that soybean plants can be redesigned to increase crop yields, while requiring less water and helping to offset greenhouse gas warming. The study is the first to demonstrate that a major food crop can be modified to meet multiple goals at the same time. Led by Darren Drewry of **NASA's Jet Propulsion Laboratory** in Pasadena, California, the study found that by redesigning soybean plants in various ways, it's possible to increase soybean productivity by 7 percent without using more water. Soybean plants also could be redesigned to use 13 percent less water or to reflect 34 percent more light back to space without a yield loss. The study has been published in *Global Change Biology*.

The **International Wheat Genome Sequencing Consortium** has announced that it will receive approximately €1 million during the next six months from **Bayer CropScience** to support physical mapping of several wheat chromosomes. The goal of Bayer's contribution is to accelerate the consortium's wheat genome sequencing effort by enabling the completion of physical maps for all 21 chromosomes. These maps are the foundation for obtaining a complete reference sequence of the hexaploid bread wheat genome, expected by 2016-17. The DNA sequence of the wheat genome will provide an essential tool for identifying and studying the function of wheat genes.

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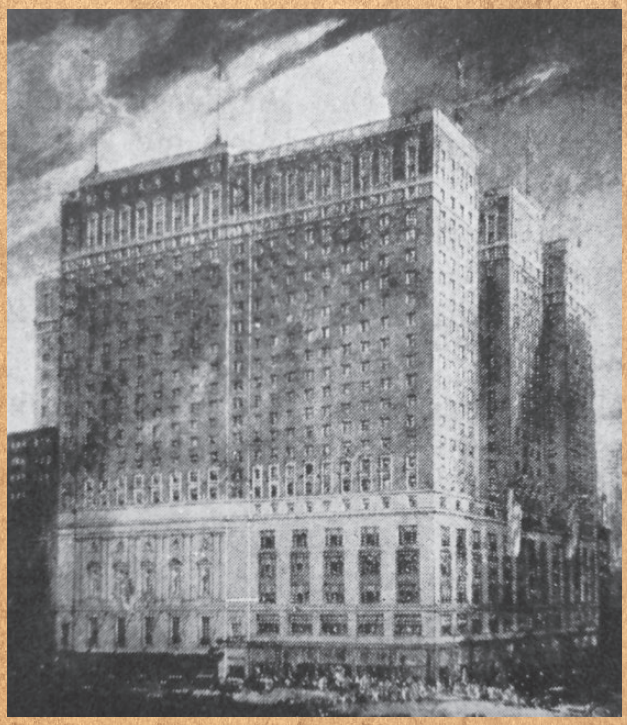
1940

ASTA Convention in Chicago

Chicago was chosen as the meeting place for the 1940 convention of the American Seed Trade Association. The dates set are June 24, 25, 26 and 27, and the popular Palmer House will be the headquarters. This was decided by the Executive Committee of the association at its winter meeting held at the Palmer House on January 14. The central location of Chicago was the factor which determined the selection, due to the fact that the association is desirous of drawing as large an attendance as possible to the June meeting because the trade has so many difficult and unusual problems to cope with this year, which will be brought up for discussion and solution.



Chicago's historic Palmer House was home to the 1940 ASTA Annual Convention. The hotel is now owned by the Hilton chain and operates under the name Palmer House - A Hilton Hotel.

At the time the convention is held next June, the new Federal Seed Act will have been in operation long enough for the field seed dealers to know how this law is operating and how it is being enforced. Due to the fact that the new Act, as it relates to vegetable seeds, will not become effective until August 9, 1940, it is expected that considerable discussion will be held regarding the rules and regulations governing the enforcement of the law in that connection. There are, of course, a number of other matters of vital importance to seedsmen, which will be brought before the meeting, so there is very good reason why seedsmen should start now to make definite plans to attend the Chicago convention.

James A. Burdett, director of the National Garden Bureau, says there will be ample space available for trade exhibits this year.

1943

ASTA Conditioning the Trade for War

Conditioning the trade for war and all of the ramifications of wartime regulations and duties seemed to be the subject of the annual meeting of the Farm Seed Division of the American Seed Trade Association at the Palmer House on January 11.

Stanley Folsom, 1943 ASTA Farm Seed Division chairman.

"The seed industry, as well as all business in general, has experienced many divergent problems during the past several years," said ASTA Farm Seed Division Chairman Stanley Folsom. "On the whole, we have received gratifying considerations from

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Seeds by Design Celebrates 20 Years of Creating Seed Market Trends

In April of 2014, *Seeds by Design* will have completed its 20th year of breeding and producing a versatile selection of vegetable varieties for the Home Garden Seed Market. To celebrate the occasion, this year's Spring Garden Trials will feature a *20th Anniversary Party*.

The 2011 Summer Field Trials featured basils of every color, and a fabulous view!

2014 Anniversary Special Events will extend the through the summer and into fall. Come visit our trials and production fields and meet the team on any or all of these dates.

April 14, 2014: We will highlight cool-season products at ***Spring Garden Trials and 20th Anniversary Party!***
August 22, 2014: Warm season varieties will be showcased at our ***Summer Field Day.***
October 10, 2014: Celebrate Autumn at our ***Fall Festival and Open Day at the Pumpkin Patch***.

***Seeds by Design*: The Story**
In April of 1994, Patty Buskirk and partners launched ***Seeds by Design***, a wholesale seed business, with the idea that the company would produce and sell vegetable seed varieties to the home garden market. They soon realized that customers were desperate for unique products. Home gardeners—the ultimate foodies—desired a distinctive garden-to-table experience. They began to offer multi-colored carrots, specialty peppers, unique salad greens, unusual eggplants, sweet, seedless watermelons, and other impossible-to-resist varieties that earned raves from home gardeners and commercial growers alike. An industry leader, ***Seeds by Design*** produces over 3000 different varieties of seed on its 1200 acres annually in the Northern Sacramento Valley and in other locations, and the breeding program boasts nine All-America Selections (AAS) winners and many other popular vegetable varieties.

The Future

Owner, Chief Breeder, and General Manager Patty Buskirk has played an active role in the Seed Industry right from the start, and continues to hold board positions in AAS (All-America Selections) and HGSA (Home Garden Seed Association). The company remains focused on bringing customers the highest quality seed along with the one of the most diverse product line in the industry.

A hard-working staff of fewer than 20 keeps an ever expanding line of seeds in production, new breeding projects evolving, and customers returning. "Our company growth has been moving steadily upward," reports Buskirk. "Our objective is to offer quality with plenty of biodiversity, something for every customer."

Seeds by Design *welcomes communications with current and potential business customers, and home gardeners. Contact us anytime with*

- Questions about varieties on the website
- Queries about Custom Production, or the development of Unique Specialty Varieties
- Information about how to purchase products from our seed dealer network
- Opinions, concerns, and comments are always welcome

the Department of Agriculture and are appreciative of the understanding and cooperation shown by them. The American people have been obligated for their protection to assume a heavy burden; the burden of raising and maintaining the best-equipped and best-fed army the world has ever known, as well as aiding in the feeding of starving people of the ravaged nations of Europe. The American people have acknowledged with heartening acceptance the raising of food.

"But this is not enough. We must also have increased production of food. To this end we as a group accept our part. Our part is the responsibility of careful growing, processing and grading to assure both a quantity and quality harvest. The responsibility of keeping ourselves informed of the latest findings of science, the latest development in treatment of both soil and seed and of growing methods to achieve increased production is all-important. In addition we must pass this information to the growers and to our agents to give their supervision during the growing period.

"This is no small responsibility. If, after this conflict, we are able to furnish the seed to produce the necessary food, it will mean a long step toward rehabilitation and one of the principles of the Four Freedoms will be established — freedom from want."

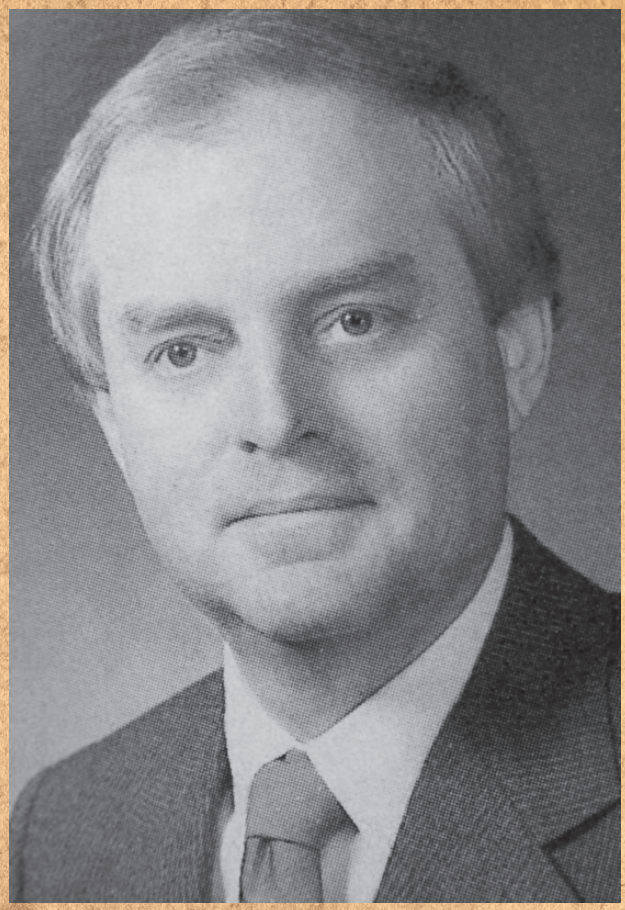
1989

The Micro and Macro Environment: An ASTA President's View

One of the definitions of "environment" is "the aggregate of social and cultural conditions that influence the life of an individual community." Specially attuned to this definition of environment is the American Seed Trade Association's new president, Jerry Peterson. As ASTA president, Peterson will oversee the collective conditions (or actions) that influence the life of the American seed community.

Interestingly, Peterson is also interested in the seed industry's influence on an even larger environment — American farmland and groundwater. This point came up in a recent interview, when Peterson was asked what major things he would like to see ASTA accomplish during the next year. "I'd like to see an improved level of awareness and responsibility of the seed industry to environmental questions," says Peterson, pointing out he applauds the continuing efforts of companies that are developing plants with natural resistances to pests and diseases and that do not require such large amounts of chemical inputs. "I believe the low-input sustainable agriculture issue is becoming much more realistic. And, we are seeing increasing concern from environmental groups and government policy makers," he notes.

Peterson, who owns his own forage and lawn grass seed company, notes current environmental concerns



Jerry Peterson, 1989 ASTA president.

will definitely impact seed businesses. As a forage seed marketer, he may stand to profit, because alfalfa seed consumption could bloom as more farmers, universities and environmentalists identify alfalfa and other legumes as feasible alternatives to chemical fertilizers. "A major growth area is the use of annual alfalfa for spring planting and fall plow-down," he says, noting farmers can benefit from getting several cuttings of hay and from rebuilding soils. In fact, he believes the ability to identify such growth markets will help seed companies succeed in the 1990s.

Moreover, customers might soon demand viable alternatives. Peterson says a recent University of Iowa farm safety survey of farmers indicates they were very concerned about the potential harmful effects of exposure to chemicals used in pesticides and herbicides. In fact, farmers ranked exposure to chemicals as a more serious health concern than stress, tractor accidents and other health problems. "We could make some very positive inroads with our customers if we identified for them that we, as an industry, are working on natural pest and disease resistance in our research, and that soon there will be products on the market reflecting these improvements, either within the seed or found in seed enhancement 'coatings' applied to the seed," he says.

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JAN. 24-27, 2015
Tampa Marriott Waterside Hotel & Marina | Tampa, FL

132nd ASTA ANNUAL CONVENTION
JUNE 17 – 20, 2015
Washington Marriott Marquis | Washington, D.C.

FARM & LAWN SEED CONFERENCE
NOV. 8-9, 2015
Westin Crown Center | Kansas City, MO

CSS 2015 & SEED EXPO
DEC. 7-11, 2015
Hyatt Regency Chicago | Chicago, IL

55th VEGETABLE & FLOWER SEED CONFERENCE
JAN. 30 – Feb. 2, 2016
Disneyland Hotel | Anaheim, CA

133rd ASTA ANNUAL CONVENTION
JUNE 2016
Portland, OR

FARM & LAWN SEED CONFERENCE
NOV. 6-7, 2016
Westin Crown Center | Kansas City, MO

CSS 2016 & SEED EXPO
DEC. 5-9, 2016
Hyatt Regency Chicago | Chicago, IL

56th VEGETABLE & FLOWER SEED CONFERENCE
JAN. 28 – Jan. 31, 2017
Disney's Yacht & Beach Club Resort | Orlando, FL

134th ASTA ANNUAL CONVENTION
JUNE 2017
Dates and Location TBD

FARM & LAWN SEED CONFERENCE
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GIANT VIEWS print

At the Cutting Edge of Agricultural R&D, Microbial Science Helps to Feed The World

Marcus-Meadows Smith, CEO

Peter Wigley, Head New Zealand Operations

It's no secret that the world needs more food. According to the United Nations World Food Program, more than 870 million of the world's population are malnourished, and malnutrition contributes to the death of 2.6 million children each year.

By 2050, feeding the global population will mean agricultural yields must increase by 70 to 100 percent, while facing the challenges of limited arable land and fertilizers, climate change and salinization, in a confined regulatory environment. What is less known is the largely-untapped potential of microbes — trillions of agricultural 'little helpers' ready to help maximize crop yields in almost any environment.

Living inside and around every part of the plant, from flowers and fruit to roots and the soil microbiome, microbes perform a critical role for plants through complex relationships that have evolved over millennia. Known as microbials, they contribute to yield through a variety of interacting mechanisms including plant growth stimulation, enhanced nutrient acquisition and increased stress resistance.

It is the potential to harness these interactions that has given rise to the fastest growing segment of the agrichemical industry; microbials are increasingly being integrated into conventional agriculture. It's not surprising then, that many of the large agrichemical, seed and fertilizer companies have recognized their potential and are now investing heavily in microbial research and development and product development.

Researching Yield Boosters

Microbes help increase crop yields. Products such as soil stimulants and biofertilizers reduce a plant's dependence on mineral fertilizers by solubilizing inaccessible stores of potassium and phosphate locked up in the soil, or by fixing nitrogen from the air. Many products produce plant growth hormones and other compounds that accelerate growth and help plants resist environmental stresses. Biopesticides can replace or complement chemical pesticides within a conventional spray program, effectively killing pests without leaving regulated chemical residues on the food. Many of these products can be accessed as proprietary seed treatments, on-farm seed applications, as sprays or granular products.

Our ability to harness the world's microbial diversity to improve crop yields is in its infancy. Research to-date has focused on identifying the effects of single microbes on crop growth. While examining the effects of these single microbes can add a piece to the puzzle, microbes rarely, if ever, operate on their own. They are part of a dynamic interplay between the plants and other microbes that is constantly responding to the environment.

New DNA-sequencing techniques, similar to those used to analyze the human gut microbiome, are used to analyze entire microbiomes of crops. These microbiomes have been likened to 'second genomes' that interact with the crop genome, and like the microbes in the gut, they can result in benign, beneficial or harmful effects. The aim of this research is to identify and harness beneficial interactions, and genetic techniques can be used to identify microbially-mediated plant genes associated with specific crop traits. This opens the way to the future merging of crop genetic technologies with beneficial plant-microbial genetic variability.

Practical techniques are also emerging to use this new information to identify synergistic combinations of microbes, or consortia, that together promote crop growth more effectively than single microbes. At BioConsortia, we're using a model similar to plant breeding to screen hundreds of thousands of microbes at a fraction of the cost and time of the conventional R&D model of testing microbes from a library one-by-one. BioConsortia selects, identifies and isolates the microbes within a single iterative R&D technology that ensures the consortia is compatible and the most effective at improving almost any plant phenotype. BioConsortia has demonstrated, in a wide range of crops, that it can significantly improve fertilizer use efficiency, yield and even percentage sugar content.

The time-frame to develop genetically-modified crop traits using conventional models is 12-15 years, and it takes eight to 10 years to get synthetic pesticides to market, whereas the wide diversity and speed of evolution of microbial communities mean that harnessing their potential is only limited by our ability and creativity to identify and select those populations that improve crop traits and growth.

Time is short to figure out how to produce more food for the world. Microbes provide the greatest potential to increase sustainable crop yields effectively and quickly with the least harm to the environment. Our challenge is to harness this potential and implement its promise in crops around the world.

Marcus Meadows-Smith and **Peter Wigley** of BioConsortia.

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