

Growing Together

>>> 3Q | 2018

thrive[®]

Energizing Feed

Enogen[®] Feed Corn Supplies Cattle
With a More Efficient Nutrition Source

DESIGN-DRIVEN APPROACH SET
TO TRANSFORM SEED BREEDING

FARMSHOTS[™] MAKES DETECTING
PRODUCTION ISSUES EASIER

syngenta[®]

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ON THE COVER These Black Angus cows experience more readily available energy as a result of eating Enogen Feed corn, which helps convert starch to sugar more efficiently and rapidly during the digestive process. Photo: John Phelan

THIS PAGE This robust field of corn in Washington state is benefiting from the Attribute® trait stack. Photo: Syngenta

thrive   

Even if you love your print edition of *Thrive*, you'll still want to check out the magazine's website. You'll find more content and links to important resources to help you succeed in today's marketplace. The online version also makes it easy to share specific articles with others.



Scan this QR code to take the fast track to the *Thrive* website, or go to www.syngentathrive.com.



We welcome your story suggestions and comments about *Thrive*.

Please send them to thrive@syngenta.com. For more information, visit the Syngenta U.S. website at www.syngenta-us.com, or call the Syngenta Customer Center at 1-866-SYNGENT(A) (796-4368).

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Thrive is produced quarterly for a nationwide agricultural audience. Its purposes are to update readers on Syngenta products, research, services and solutions, and to provide them with the information they need to succeed in today's complex marketplace.



A New Era of Innovation

It's amazing what science-based innovation can unleash. The creation of new products, processes, jobs and even industries becomes infinitely more possible when unfettered scientific curiosity intersects with open-minded collaboration.

As rapid, simultaneous advancement takes place in our crop protection, digital ag and seeds businesses, Syngenta proudly joins our reseller partners in ushering in a new era of agricultural innovation. No time in history rivals our current ability to develop solutions and deliver them to growers faster, more cost effectively and with less impact on our environment.

A recent \$400 million commitment—allocated incrementally over the next five years—is fueling our momentum in seeds. Added to the more than \$1.3 billion Syngenta already invests annually in research and development, this extra seeds funding will enable us to better equip U.S. growers with the tools and services they need to optimize their productivity and potential return on investment. But Syngenta understands that growers can't wait for tomorrow to start overcoming the challenges they're facing today, especially since the world adds 200,000 more mouths to feed every day.

On the pages that follow, *Thrive* highlights some of the transformative technologies that are helping us address this urgency and unlock the full potential of plants. In one article, Syngenta experts explain how data analytics and mathematical modeling not only help us breed a greater quantity of elite plant genetics, but also give farmers the information they need to choose the exact seed that will perform best in their fields. Another article illustrates how breeding advancements, such as CRISPR-Cas genome editing, enable us to bring higher-yielding, better-quality hybrids and varieties to farms at an unprecedented pace.

Thrive also tells the stories of two specific seed technologies that are delivering greater opportunity and value to the growers who use them. Enogen® Feed hybrids offer dairy and beef producers a more efficient nutrition source for their cattle, and the Attribute® II trait stack gives field corn growers a sustainable way to incorporate sweet corn acres into their existing operations.

As plans for the 2019 planting season start taking shape, Syngenta is not just investing in technologies. We're also investing in people by hiring more agronomists, breeders and other local experts who can help our Golden Harvest® Seed Advisors and NK® seed retailers achieve their goals. After all, behind every great innovation we bring to market stands a great team, whose hard work, collaboration and diverse talents are making the dawn of a new era possible. 🌱



DAVID HOLLINRAKE
President of Syngenta Seeds, LLC
Region Director, Syngenta North America



DAVID HOLLINRAKE

“No time in history rivals our current ability to develop solutions and deliver them to growers faster, more cost effectively and with less impact on our environment.”



What's in Store

Stay up to date on new products, the latest product updates, news and upcoming events.

NEW PRODUCTS

New NK Hybrids and Varieties for 2019

Syngenta is releasing 32 new NK[®] corn hybrids and 18 new NK soybean varieties for the 2019 growing season. Developed with best-in-class genetics, the new NK corn hybrids offer growers high-performing options for their fields. In local trials, this new class has shown a 4.4 bushels-per-acre (bu/A) yield advantage, compared with DeKalb[®] brand hybrids, and a 5.4 bu/A advantage, compared with Pioneer[®] brand hybrids.*

The new NK soybean varieties protect against a range of yield-robbing diseases and pests, including sudden death syndrome, sclerotinia white mold and soybean cyst nematodes.

NK breeders and researchers use an award-winning system of data analytics to pinpoint the





The sun rises over a soybean field in rural Minnesota.

characteristics most likely to help maximize yields. As a result, they're able to deliver a range of new hybrids and varieties to market faster than ever before.

"In today's competitive industry, it's important for growers to have access to the most advanced technology," says Scott Erickson, soybean product manager for NK.

To learn more about NK seeds, visit www.nk.com.

*MyYield—2017 Syngenta internal trials in areas of product launch, Dec. 1, 2017



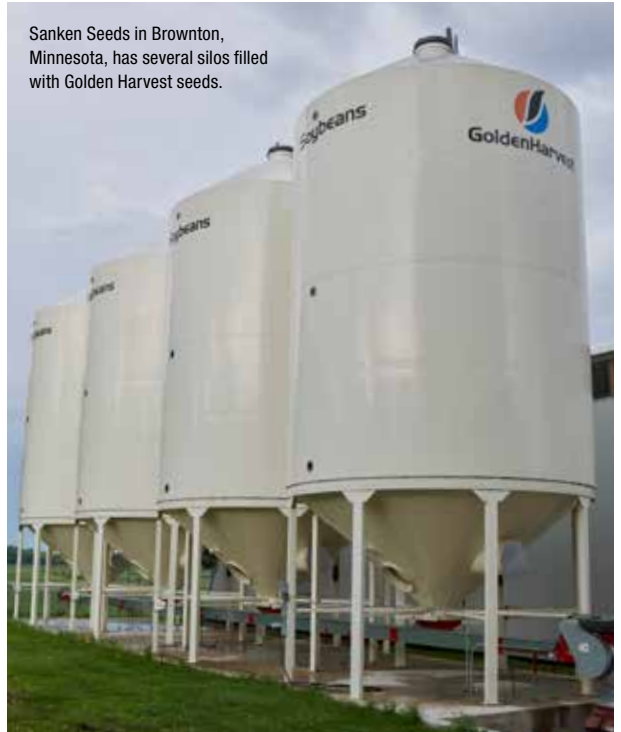
Golden Harvest 2019 Portfolio Expands

Golden Harvest® is growing its strong portfolio for 2019 with the release of 37 new corn hybrids—21 of which are from 16 new genetic families—and 17 new soybean varieties.

In trials against DeKalb®, Golden Harvest corn hybrids won an estimated 59 percent of plots with a 4.76 bushel-per-acre (bu/A) average yield advantage. Compared with Pioneer®, Golden Harvest corn hybrids won an estimated 57 percent of the plots and averaged 3.78 bu/A higher.*

(continued on page 4)

Sanken Seeds in Brownton, Minnesota, has several silos filled with Golden Harvest seeds.



WHAT'S *in* STORE

Golden Harvest soybeans are also performing well in trials. The 2019 class outyielded the Pioneer portfolio by 1.7 bu/A in more than 1,100 replicated trials and beat Asgrow® varieties by 0.8 bu/A in more than 500 replicated plots.*

For more information on the Golden Harvest portfolio, go to www.goldenharvestseeds.com or contact your local Golden Harvest Seed Advisor.

*Based on 2017 data from multiple locations across the U.S. and Canada



New AgriPro Winter Wheat Varieties Available

For the 2018 planting season, Syngenta has introduced five new AgriPro® brand winter wheat varieties that address local growing conditions. Consistently ranked in the top yield group of each region, AgriPro wheat varieties are known for their best-in-class disease packages, leading agronomics, outstanding yield potential and high-end-use quality. New winter wheat varieties include the following:

- > **SY Rugged** maximizes the potential for high yields across variable environments in Kansas, Oklahoma and Texas.
- > **SY 517 CL2** features good winter hardiness and straw strength for the South Dakota, Montana and Nebraska markets.



A field of AgriPro brand wheat grows strong in Garden City, Kansas.

- > **SY Benefit** is a consistent yielder with good mill and bake quality in the eastern Kansas and Oklahoma medium-maturity markets.
- > **SY Achieve CL2** has two-gene herbicide tolerance, resulting in high yield potential in Kansas and Oklahoma.
- > **Bob Dole**, a hard red winter wheat variety, features a good disease package with leaf and stripe rust tolerance, along with *Fusarium* head blight tolerance in Kansas and Oklahoma.

Visit www.agriproheat.com for additional information.

Some or all of the varieties may be protected under one or more of the following: Plant Variety Protection, United States Plant Patents and/or Utility Patents and may not be propagated or reproduced without authorization.



PRODUCT UPDATES

Cellerate Process Technology Delivers Opportunity

As ethanol plants seek new ways to be more competitive, advances in using corn kernel fiber for ethanol processes have shown significant promise in adding value through the diversification of product streams.

“Over the last decade, existing dry-grind ethanol plants have aimed to extract value out of the corn kernel through maximizing production and capture of ethanol, carbon dioxide, dried distillers grain [DDG] and oil,” says Miloud Araba, Ph.D., head of technical services for Enogen at Syngenta. “Cellerate® process technology converts corn kernel fiber into a diversified income stream and has been producing high-value D3 RIN-qualifying cellulosic ethanol on a commercial scale at Quad County Corn Processors [QCCP] in Galva, Iowa, since 2014.”

By combining Cellerate with Enogen® corn, QCCP has achieved a 26 percent increase in total ethanol production, higher protein feed coproducts and improved oil yield.¹

“Cellerate is a diverse process technology that adds value to protein, increases distillers corn oil production, creates cellulosic ethanol and produces low-carbon-intense ethanol, all while allowing additional throughput from a dry-grind ethanol facility,” says QCCP CEO Delayne Johnson.

With an EPA-approved D3 RINs pathway for more than three years, Cellerate process technology enables ethanol producers to leverage their existing infrastructure and significantly increase total production by using pre-existing assets, such as feedstock receiving and storage, product separation, and final product storage.

Together, Cellerate and Enogen corn can help deliver notable benefits to ethanol plants beyond what can be achieved through either technology alone, including



Enogen trait technology enhances the viscosity of corn mash.

increased throughput and yield, as well as a notable reduction in natural gas, electricity and water usage.² To find out more, visit www.enogen.com.

1. Based on third-party verification procedures performed in 2016 by Christianson & Associates PLLP, a firm of certified public accountants and consultants
2. QCCP commercial production from 2014 to 2018



NEWS AND EVENTS

Land.db Connect Integration Enables Data Automation

Ag Connections, LLC, a wholly owned subsidiary of Syngenta, has launched a new cloud-based solution, Land.db® Connect.

“Rather than spending their time entering data, growers can spend their time making decisions using the data,” says Rick Murdock, co-founder of Ag Connections, LLC. “We want to provide tools that help growers be more efficient, not add more work.”

Land.db Connect connects the John Deere Operations Center to Land.db, the software exclusive to the Syngenta AgriEdge Excelsior® whole-farm management program. This integration is the replacement product for the client-based Land.EC. Land.db Connect makes the transfer of data between equipment and the software even more seamless, bringing complete data automation closer to reality. “Data automation and connectivity are important in helping retailers and distributors connect with growers,” says Aaron Deardorff, head of digital agriculture solutions at Syngenta. “Integrations like this are core to our strategy and lead to improved communication and efficiency.”

Growers interested in this new integration should contact their Syngenta representative or visit www.agriedge.com for more information.

VOTE!

For Your Favorite #RootedinAg Finalist

Syngenta thanks everyone who entered the 2018 #RootedinAg contest and shared stories about the people who most nourished their agricultural roots. A panel of judges has narrowed the field of competitors to five finalists—each of whom has received a mini touch-screen tablet.

We now need your help in deciding who will be the grand prizewinner of a \$500 gift card and a \$1,000 donation to the winner’s favorite local charity or civic group.* Just go to www.syngentathrive.com, click on the #RootedinAg link under Special Features, and vote for the entry you think is most deserving. Your votes, along with our judges’ scores, will determine the winner. Online voting ends Sept. 15, 2018, with Syngenta announcing the grand prizewinner in October.

FOR MORE INFORMATION on the #RootedinAg contest and Official Rules, visit www.syngentathrive.com.



*NO PURCHASE NECESSARY. See Official Rules for more details.

UPCOMING TRADE SHOWS

As the 2018 harvest season gets closer, stop by our booth at either of the shows listed below to find out what’s new at Syngenta.

AUGUST 2018

28–30 Farm Progress Show, Boone, Iowa

SEPTEMBER 2018

11–13 Husker Harvest Days, Grand Island, Nebraska

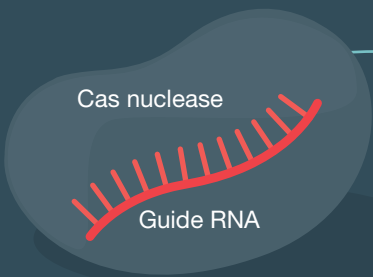
Targeting Yield and Quality

CRISPR-Cas genome editing technology complements an already robust plant-breeding innovation toolbox at Syngenta. While not a silver bullet, it's a simpler, more precise tool for making specific changes to a cell's DNA, which can help make the seed-breeding process more efficient, less time consuming and potentially subject to less regulation.

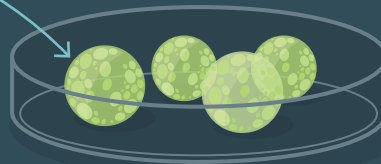
Illustrations by Lucy Reading-Ikkanda

HOW IT WORKS

1 The CRISPR complex is prepared. The complex consists of a guide RNA molecule that matches the genetic sequence of the gene targeted for editing and Cas nuclease.



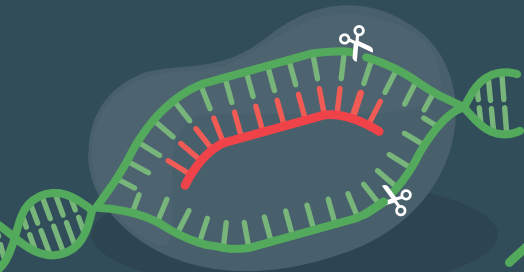
2 Scientists grow crop cells in a lab. The CRISPR complex is transferred into these cells.



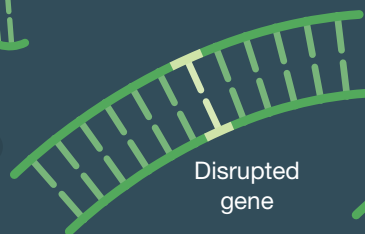
3 When the guide RNA encounters the target stretch of DNA inside the cell, the complex attaches, it unzips the DNA and the guide RNA binds here.



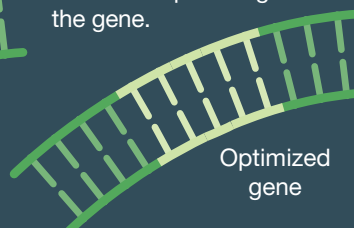
4 The Cas nuclease "snips" the double-stranded DNA at this location.



5 The cell will attempt to repair the break by joining the cut ends back together, making errors in the process. The errors effectively disrupt the gene.



If scientists package the CRISPR complex with a repair DNA template, there is a good chance that this repair DNA will enable a precise edit in the cell's genome, when the cell repairs the break. This allows for optimizing the gene.



GLOSSARY

Genome Editing

A breeding technique that improves on conventional breeding by making intentional, specific and beneficial changes in the plant genome, providing a similar outcome as via traditional breeding, but in a faster and more directed way.

CRISPR

An acronym for **C**lustered **R**egularly **I**nterspaced **S**hort **P**alindromic **R**epeats. A collection of DNA sequences found in bacteria that led to the discovery of CRISPR-Cas genome editing technology.

Cas Nuclease

A CRISPR-associated protein. A DNA-cutting enzyme with two active cutting sites—one site for each strand of the DNA's double helix.

Guide RNA

A DNA-homing mechanism that guides the Cas nuclease protein to where it needs to cut in the target genome.

CRISPR-Cas

A system in which the Cas nuclease makes a double-stranded break in DNA at a site determined by a short (~20 nucleotides) guide RNA.

A COMPARISON: Plant-Breeding Technologies

Genome Editing (e.g., CRISPR-Cas)

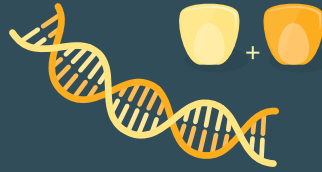


Genome editing allows precise editing of a gene **native to the crop** to achieve desirable traits.



CRISPR-Cas edits the gene "text."

Genetic Modification (GM)



GM incorporates well-studied genes **from any source** to achieve desirable traits.



GM inserts a new chapter.



1-3
edited genes in play



1-10
inserted genes in play



3-5 years
for research and development



10-12 years
for research and development



Challenges: Knowing what to edit and editing commercial germplasm



Challenges: Long timeline and high cost for product development

FARM AND MARKETPLACE BENEFITS

Genome editing promises to bring novel plant varieties into the hands of growers faster, delivering many potential benefits for the entire value chain.



Grower Benefits

- Improved disease resistance
- Improved drought tolerance
- Higher yields



Consumer Benefits

- Better food quality/nutrition
- Longer shelf life

A LOOK AHEAD

Syngenta crop technologies developed using genome editing are on track to reach the market in the beginning of the next decade. Relevant crops include:



Tomato



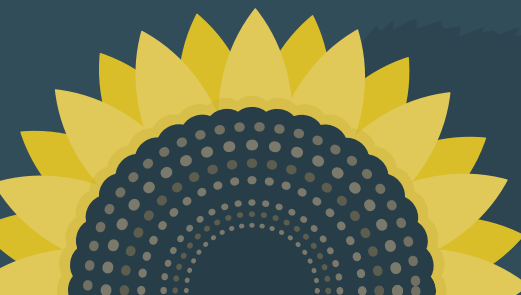
Corn



Soy



Wheat



Sunflower

The Future of Wheat

Hybrid wheat is expected to give birth to higher yield potential and more efficient use of resources.



It seemed a nearly impossible idea: hybridized wheat sold across North America in the first half of the 21st century. Wheat self-pollinates, so crossing it with other varieties has proved challenging. Still, what began as a promise in 2010 may be poised to become a reality in the early 2020s. By combining a broad genetic portfolio with a globe-spanning, prestigious research team, Syngenta is developing hybrid wheat that shows the potential of increased yield and sustainability.

“In the next five years, we’ll be targeting launches for growers across major wheat growing regions,” says Darcy Pawlik, head, cereals portfolio at Syngenta, North America. “When you combine the strong agronomic characteristics of our wheat portfolio, it will result in a very nice package for the farmer to take advantage of.”

Though it’s the top crop planted globally by acreage, wheat remains one of the few crops without a successful hybridized variety on the market in North America. But Carlos Iglesias, North American head of wheat seed development at Syngenta, and his team may soon add wheat to the list of crops that reap the benefits of hybridization, which can include improved, consistent yield and quality.

Riding the Cutting Edge

The secret to the wheat seed development team’s success is a process known as doubled-haploid technology.

“Because we’re using multiple lines of wheat, instead of just one, we should be able to unlock some of the diversity and get more improvements faster.”

—DARCY PAWLIK

Iglesias’ team uses corn to pollinate specially selected wheat plants. Because corn is distantly related to wheat, its pollen can induce the plant to make a seed, but that seed will only have one copy of the wheat’s genes—a haploid.

“We rescue that seed and treat it with a product that allows for normal duplication of the wheat parent’s genes,” Iglesias says. “Right away, we end up with a plant that is homozygous, which means it has pure genes from a single parent with the traits we want to see.”

These traits include high, consistent yield and vigor, high protein content, and robust root systems for better water use and nitrogen efficiency—all of which can add up to a greater potential return on investment.

“One great aspect of this technology is that doubled-haploid technology is natural,” Iglesias says. “We were able to take this process from nature and use it as a tool to work in our favor. There is absolutely no genetic modification in this whole process.”

Traditional breeding practices can take up to 12 years to produce a desirable cross. With doubled-haploid technology, Iglesias’ team can whittle down tens of thousands of wheat lines to a few, with the most positive attributes in just two years. The ability to explore the

vast array of traits from multiple parents enhances the capacity of Syngenta to provide a superior product.

“We continue to stay on track from a development perspective for all the breeding characteristics growers look for, such as insect tolerance, disease tolerance, harvestability and resiliency against drought,” Pawlik says. “We expect hybridized wheat to possibly amplify these effects by using multiple parents.”

That’s really the key with hybrids, Pawlik explains: “Because we’re using multiple lines of wheat, instead of just one, we should be able to unlock some of the diversity and get more improvements faster.” When added up, all of these characteristics can potentially maximize a farmer’s return on investment.

Commitment to Growers

In addition to these amplified effects, hybridized wheat is expected to have an increased sustainability score by producing more bushels, with the same amount of water and nitrogen, per acre planted. Sustainability, as it is referred to today, was not an initial goal for Syngenta when the hybrid wheat program began in 2010, Pawlik says. But as the program developed, customers talked—and Syngenta listened.

“Sustainability comes up as an issue that growers and consumers, in general, really care about,” Pawlik says. “As a result, we’re trying to more efficiently develop crops that can do more with less, whether that means less water, nitrogen or land. We want growers to get more yield for the same amount, or less, of their input.”

Exceeding Expectations

The North American cereals research team is one of the world’s most experienced, offering valuable insights into how hybrids respond to diverse weather and disease conditions. “We have experts, who have been developing wheat varieties for 30 years, and they’re working with a new generation of specialists, who bring the most up-to-date skills and technology to the table,” Iglesias says. “We’re lucky to have such a ripe, well-integrated educational environment.”

It’s also an environment that fosters a close connection to the real world of agriculture. “Our team gets to participate with the sales and marketing end of wheat as well, allowing us to hear feedback from farmers to help in future decision making,” Iglesias says. “It is invaluable input.”

Syngenta stands above its peers in its hybrid technology investment, and that investment is paying off. “We’re exceeding our expectations in what we hoped to see in factors like increased yield and performance,” Pawlik says. “We’re bringing to market a differentiated product from varietal wheats available today. This will be a step change in wheat production.”

Iglesias agrees. “We are seeing a qualitative jump in yield,” he says. “And we continue to aim for higher gains as our program matures.” 🌱 STORY BY ROBIN ANDERS

FORMULATED FOR THIS VERY MOMENT.

At hull-split timing, nothing else protects your almonds from navel orangeworm and peach twig borer like Besiege® insecticide from Syngenta. By combining two powerful and complementary modes of action, it gives you fast knockdown and long-lasting residual control. Plus, it comes in a convenient premix formulation, which makes it easier to protect your crop and your bottom line. To learn more about Besiege, visit SyngentaUS.com/Besiege

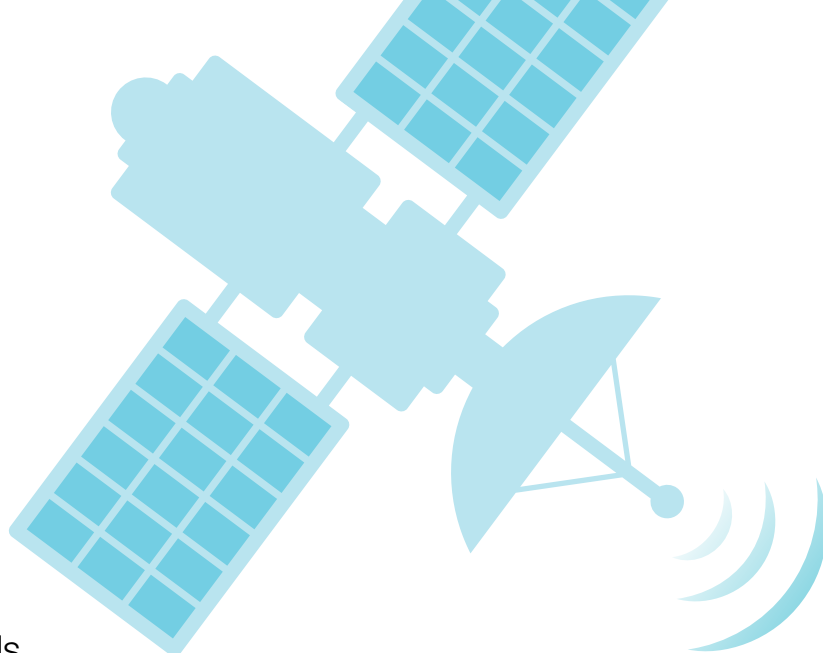
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Above and Beyond

FarmShots satellite technology assesses crop health, helping growers better manage their fields.



Q. How did you come up with the idea for FarmShots™ Satellite Imagery Service Provider, and how has it become part of the Syngenta suite of digital tools?

A. Josh Miller, key account manager for Digital Agriculture at Syngenta and founder of FarmShots, a wholly owned subsidiary of Syngenta: While working with agronomists a few years ago, I realized that farming operations had undergone tremendous growth over the past several decades. Backing up my observations, the U.S. Department of Agriculture's Economic Research Service reported this spring that the average farm size nearly doubled in just 25 years, going from 650 acres in 1987 to 1,201 acres in 2012. As the number of acres that growers manage expands, the challenge of detecting and controlling damaging pests, diseases and deficiencies also increases. I wanted to build a product that would help growers manage their farms more easily and efficiently.

FarmShots is a platform used by agronomists, retailers, farmers and insurance agencies to locate damage caused by diseases, pests and nutritional deficiencies in crops around the world. Using satellite imagery, we're able to detect that damage earlier, ensuring recommended treatments are accurate and applied before it's too late.

This year, Syngenta acquired FarmShots as an extension of the Global Digital Ag team. FarmShots was a great fit for the company's existing suite of digital ag tools and will help accelerate the growth of integrated crop management.

Q. How does this technology work, and how does it benefit growers?

A. Healthy, dense vegetation absorbs light. In contrast, unhealthy, less-dense vegetation reflects light. A satellite can see the differences in the amount of light absorbed

by different areas of the field, allowing us to generate a map of the plant health across the entire field. Growers and their advisers can use this map to isolate areas of the field where a condition may be negatively impacting a crop. They can also use the same map to precisely target where a crop protection application should go.

Satellite data is often the simplest piece of information to acquire about a farm. All we really need is the location of the farm and permission to access it, and we can handle the rest. This data allows Syngenta to give a lot of valuable insight to the grower, without asking for anything in return.

Growers can use the imagery analysis to detect problems early. Whether it's spotting application skips earlier or identifying irrigation issues quicker, this program helps growers find costly problems in fields, before they have a chance to impact yields.

Q. How can advisers use this technology to help growers?

A. Imagery is a great discussion point for growers and their advisers, who may include consultants, agronomists or crop protection resellers. In addition to being able to watch every acre for problems, growers will be able to show these images to their advisers to get recommendations for timely intervention.

Within the program, advisers can upload notes, photos and measurements to communicate more thoroughly with growers. Agronomists can use the maps to generate variable-rate prescriptions, so growers can precisely target trouble spots.

The program also includes historical data and imagery. With the historical imagery, advisers can help growers identify problem areas in advance to assist in planning at the start of the year. Multiyear records can help prevent some midseason cost surprises and give resellers



WATCH NEW VIDEO For an in-depth interview with Josh Miller, check out the new video posted to the *Thrive* website (www.syngentathrive.com).

“A satellite can see the differences in the amount of light absorbed by different areas of the field, allowing us to generate a map of the plant health across the entire field.”

—JOSH MILLER

JOSH MILLER
Key Account Manager,
Syngenta, and
Founder of FarmShots

the opportunity to advise their customers on potential applications. To help growers protect their fields for the future, the maps can also track problem areas and map out where weed resistance is becoming an issue.

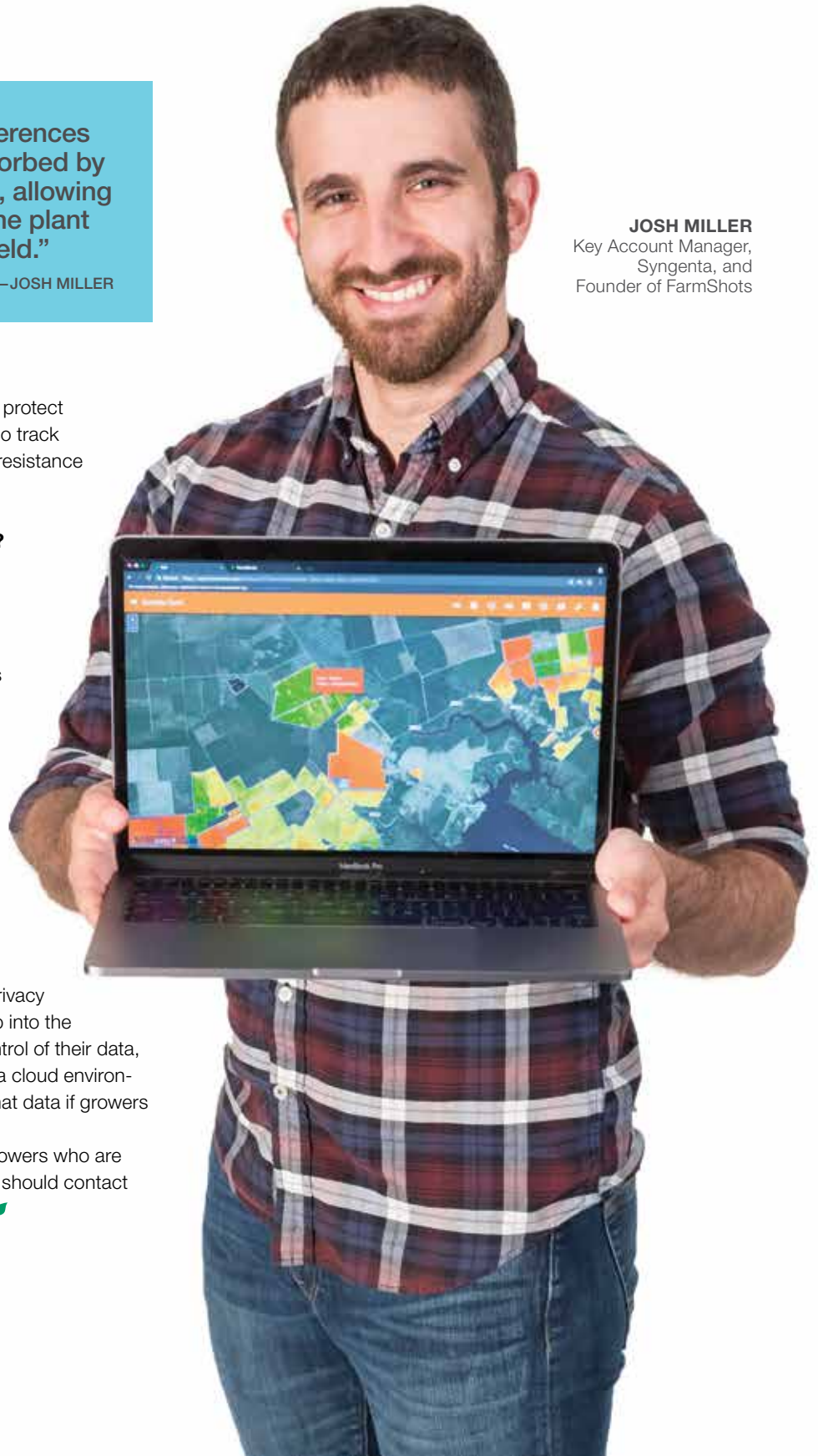
Q. How can growers access FarmShots?

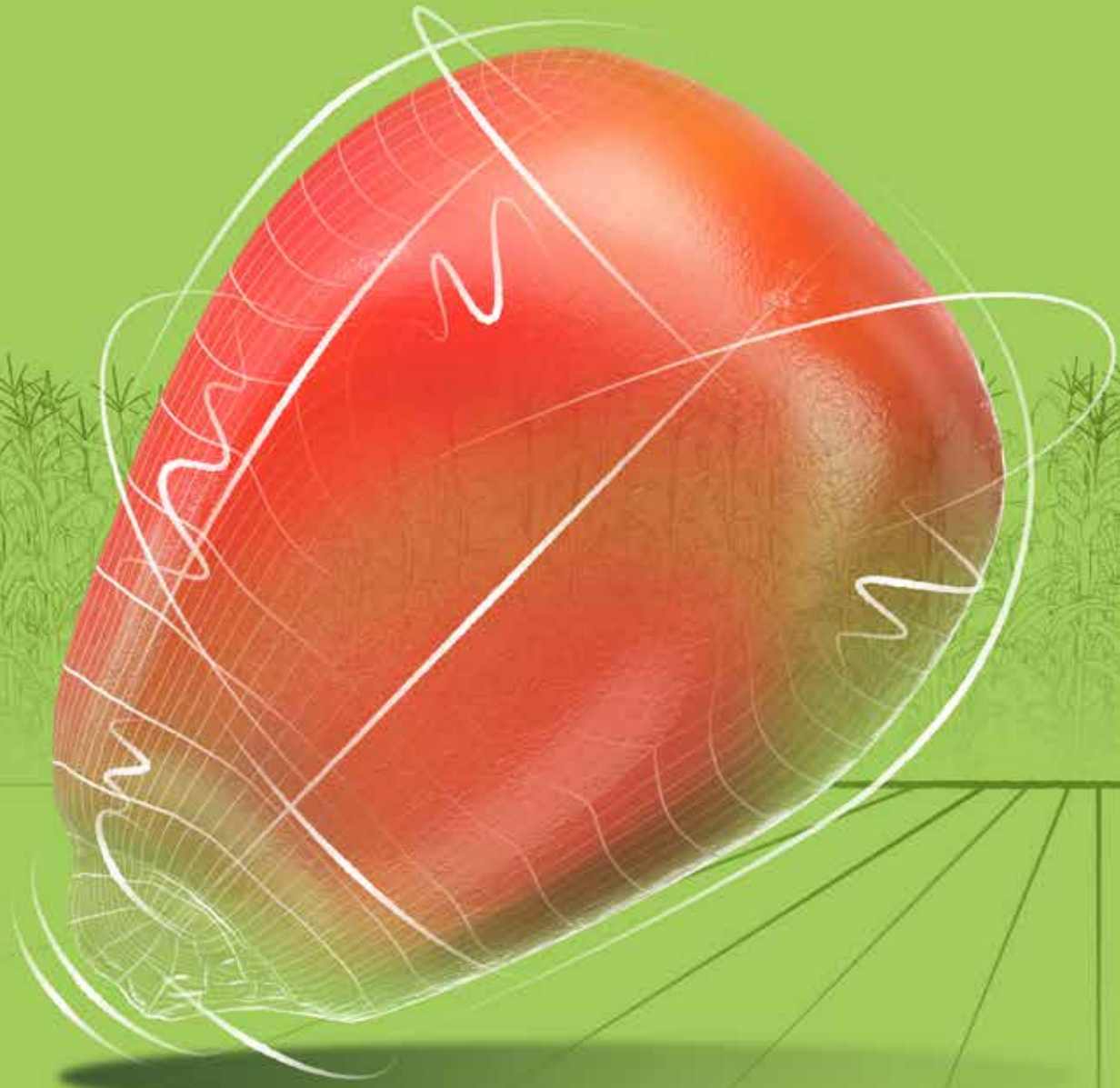
A. FarmShots is a web-based app available on all devices, including tablets, laptops and smartphones. It's now built into the AgriEdge Excelsior® program through an integration with Land.db® software. This integration is really what makes FarmShots unique and easy to use, especially for growers who are already enrolled in AgriEdge Excelsior. They can just log in to their personalized account or talk to their AgriEdge® specialist. If growers are already using Syngenta digital ag solutions, their farms are already set up for seamless integration with the FarmShots rate application tools, without any additional data entry from growers.

It's important to note the Syngenta privacy pledge remains intact for growers who tap into the FarmShots technology. They maintain control of their data, which continues to be securely hosted in a cloud environment. Advisers and others can only see that data if growers grant them access to it.

To learn more about this program, growers who are not already enrolled in AgriEdge Excelsior should contact their retailer or Syngenta representative. 🌱

INTERVIEW BY MIRIAM PAULSON





SEEDS B

Drawing on many scientific disciplines, Syngenta is devel



Y DESIGN

oping groundbreaking corn hybrids and soybean varieties.

By Casey Parrett | Illustrations by Ryan Etter

As the seed industry continues to change, Syngenta is changing, too, but not in a way growers and resellers have come to expect. During a time characterized by consolidation and other cost-saving initiatives, Syngenta Seeds is actually boosting its investment in product offerings, services, and research and development (R&D). It's also adding more experts, including agronomists and breeders, to its already stellar staff.

"We are committed to growing our seeds business and concentrating on growers who demand choice, technology and trusted agronomic advice," says David Hollinrake, president of Syngenta Seeds.

Underscoring this new era at Syngenta Seeds is a commitment to listening to what growers need, advancing its world-class germplasm, engineering new traits and innovating with emerging technologies.

Committed to Research and Development

Syngenta invests more than \$1.3 billion each year on global R&D and recently announced a \$400 million incremental investment in U.S. seed operations over the next five years. (See "NK Seeds Accelerates Innovation" on page 15 and "Golden Harvest Strengthens Its Roots" on page 17.)

"What we bring to growers are new crop technologies to help give them yield, yield stability and the potential for greater return on investment," says Michiel van Lookeren Campagne, Ph.D., global head of seeds research at Syngenta. These technologies come in the form of genetics and traits that offer disease resistance, drought resistance, insect control, herbicide tolerance and higher yields, complemented by innovations in digital and crop protection.

While Syngenta depends on NK[®] retailers and Golden Harvest[®] Seed Advisors to help deliver its seed products to farms, van Lookeren Campagne says he likes to visit as many growers as he can to gain a fundamental understanding of the challenges they face.

"Talking to growers in the field is always insightful for understanding what their problems are and how we can serve them better," he says.

Stand-Out Traits

The groundbreaking traits in the Syngenta corn and soybean portfolio are helping growers manage pests and other plant stresses more effectively, while also giving them unprecedented yield advantages.

Van Lookeren Campagne recalls a trip during which he realized the impact Syngenta Seeds R&D has globally. "I was driving through southern Brazil, and Agrisure Viptera[®] corn was everywhere. It was the only thing that was standing against the onslaught of Brazilian corn insect pests. As a scientist, that was really fantastic to see."

It's also rewarding for van Lookeren Campagne to see

how Viptera—a Syngenta trait that offers the most comprehensive above-ground corn insect control in the industry—and the rest of the Agrisure[®] family of traits are helping U.S. corn growers produce higher-yielding crops. Agrisure Duracade[®] is setting a new standard in corn rootworm control, while Agrisure Artesian[®] maximizes yield when it rains and increases yield when it doesn't.

Van Lookeren Campagne admits that a market fit for the out-of-the-box innovation his team first sees in the lab is not always clear, initially.

"You don't always know the full impact novel technologies may have, but you can sense their tremendous potential to benefit growers," he says. "The persistence of our people in R&D to guide promising technologies into novel products that address grower needs is something that makes researchers and Syngenta as a whole successful, ultimately leading to the success of our customers."

Take, for example, Enogen[®] corn, which is a game changer in the ethanol and animal feed market. (See "Nutrition Mission" on page 22.) "Enogen is something completely unique," van Lookeren Campagne says. "When we brought Enogen to market, it was unlike anything we'd advanced thus far."

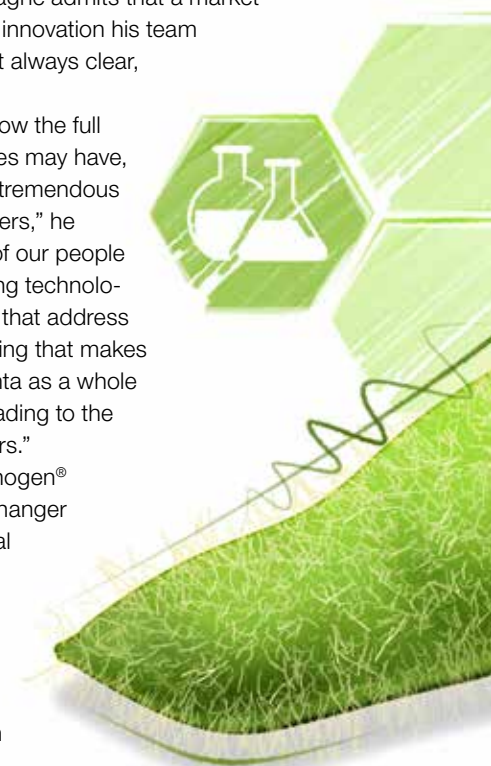
Innovative Approaches

With one of the world's largest germplasm pools and the grit to try something different, Syngenta is delivering genetic gain for yield at a faster rate than any of its competitors.

"Plant breeding has been going on for thousands of years," says Tim Kelliher, Ph.D., principal scientist in reproduction biology at Syngenta. "But how we conduct that breeding, how we incorporate genetics and how we improve crops have all really changed over the years."

Syngenta integrates mathematics, genetics, breeding, physiology and agronomy into its product development efforts. As a result, scientists are able to carefully select the right genetics to enhance crop performance the most.

"We're heading into a period of design-driven products," van Lookeren Campagne says. "It's teamwork across these disciplines that's going to make a product that is significantly different from existing technologies."





NK Seeds Accelerates Innovation

Agriculture is an industry that never stops evolving. NK® Seeds, a brand started in 1884, is no exception. Developed with leading technology and using award-winning data analytics, NK corn and soybeans are on the forefront of innovation.

Advanced Breeding

In a continuing effort to offer unique choice, Syngenta is pouring an incremental \$400 million into its seeds business over the next five years to support advanced breeding techniques and technologies. For the breeding and product selection team, this means big developments in the lab that will translate into a potentially substantial return on investment for NK growers in the field.

“We’re looking at exciting opportunities in the next five years that include expanding the depth of our product offering,” says Ben Ford, Ph.D., North American head of corn breeding at Syngenta. “Our team’s goal is to be able to bring forward the best genetics and quickly and reliably add in innovative traits that will help growers maximize their profit potential.”

To stay ahead of the competition, Syngenta breeders use a state-of-the-art trait introgression facility to boost breeding efficiency and precision. With one of the largest unique germplasm pools in the industry, the Clinton, Illinois, lab is home to the “Seed to Seed in Seven Weeks” concept, a proprietary soybean trait conversion capability that rapidly delivers new and advanced varieties to the market. This exclusive system allows seven generations of seed to be developed in one year, resulting in the highest-yielding germplasm with an elite genetic pool that pushes performance.

To enable continued innovation in the field, the recent investment made possible a new Trait Conversion Accelerator at the Syngenta Nampa, Idaho, research and development and seed production facility. Construction of the \$30 million site enhancement, expected to be completed in 2019, will house a majority of the Syngenta North American corn trait conversion work, previously done in open-field or semicontrolled environments.

“In the past, we were limited by the number of breeders and amount of resources to realize the full potential of what NK seeds can be,” Ford says. “The added resources from the commitment increase the number of breeders and research dollars per plot, giving us greater opportunities as we continue to develop products.”

Data Analysis

For the innovative minds who work at these Syngenta lab facilities, data analysis plays an integral role in product trialing and placement accuracy.

“We’re known for our strength in how we use the information we collect,” says Dwight Bostwick, Ph.D., North American head of product selection at Syngenta. “Through computational biology and data analytics, we’re able to make better decisions around product development and placement, while also determining what we need going forward. It isn’t about looking backward, but figuring out what will benefit growers in the future.”

To continue delivering industry-leading genetic gain, Syngenta is aggressively working in the emerging field of genome editing. Research in this field will lead to improved traits and greater success for both NK retailers and growers.

“Technology is something growers and retailers value, so it’s something NK values, too,” says Quinn Showalter, head of NK sales. “With more resources and funding now available, we can use technology to bring a more localized set of products to market, which will ultimately improve our portfolio and our customers’ experience.”

—STORY BY ALLI KUNKE

400

MILLION DOLLARS HAS BEEN ALLOTTED FOR FURTHER U.S. SEED OPERATIONS RESEARCH BY SYNGENTA.



“What we bring to growers are new crop help give them yield, yield stability and return on investment.”

In recent years, Syngenta has increasingly collaborated with data analytics experts, who are in the business of solving complex challenges. Syngenta positions advanced data analytics as the “next agriculture revolution,” creating the future era of plant breeding, where design supplants the traditional trial-and-error processes of the past and reduces the time required to develop new products.

“We want to drive innovation and accelerate discovery by joining new talent to agricultural challenges,” says Greg Doonan, head of novel algorithm development at Syngenta. “We’re fully utilizing quality data and advanced analytics during each stage of the R&D process, which results in increased productivity.”

But Doonan notes Syngenta doesn’t stop there. “We want that process to translate into an improved grower experience,” he says. “Utilizing the same data, we’re able to use mathematical modeling to determine how products are likely to perform in specific environmental conditions and place the right products for growers’ specific fields.”

Another important advancement that Syngenta is using is CRISPR-Cas technology. (See “Targeting Yield and Quality” on page 6.) CRISPR-Cas differs from conventional breeding and genetic modification in that it enables the precise editing of a gene native to the crop to achieve desirable traits, bringing greater precision and efficiency to plant-breeding programs.

“Gaining access to CRISPR-Cas technology allows us to accelerate the rate of innovation in the development of new plant varieties and bring novel traits into the hands of growers faster and with greater efficiency,” van Lookeren Campagne says. “Using this advanced technology will help us deliver on the 21st century’s food production challenges.”

All for the Farmer

At the end of the day, Syngenta recognizes what’s most important.

“A lot of the folks I work with at Syngenta have a connection to the farm,” Kelliher says. “As much as we are immersed in science, technology and working on developing the future of agriculture biotechnologies, we have a sincere mission in our hearts to make the lives of farmers easier.” 🌱



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www.syngentathrive.com/research

technologies to the potential for

—MICHIEL VAN LOOKEREN CAMPAGNE

Grower Whitey Sanken (left) and his Syngenta rep Bryan Kubes (right) confer on plans for the upcoming planting season at Sanken Seeds in Brownnton, Minnesota.



Golden Harvest Strengthens Its Roots

With company roots dating back to 1853, Golden Harvest® continues to deliver leading genetics, agronomy insights and service to farmers across the Corn Belt. As a result of an incremental \$400 million, five-year investment in seed at Syngenta, Golden Harvest Seed Advisors and farmers can look forward to a larger research team, more plant-trialing efforts and increased agronomy field support.

Genetic Gains

“Golden Harvest is dedicated to offering farmers a choice in high-yielding hybrids that perform no matter the soil type, weather conditions or pest pressures,” says Chad Stone, head of Golden Harvest East. “Looking ahead, a more robust research team will drive products to market faster than ever before.”

Farmers will benefit from a 58 percent increase in the introduction of new chassis or genetic combinations—expanding the number of new products delivered per year from 19 to 30.

“Additionally, trialing efforts, which help improve agronomic product placement, will grow by 33 percent, resulting in hybrids and varieties that perform even better in local growing environments,” says Clayton Becker, head of Golden Harvest West.

Whitey Sanken, a Minnesota corn and soybean farmer and Golden Harvest Seed Advisor, trusts in Golden Harvest because of the advanced corn hybrids and top-performing soybean varieties brought to the marketplace.

Not only do the Golden Harvest hybrids and varieties start the season strong, Sanken notes, but they’re also standing tall and yielding big come harvest, regardless of unwelcome conditions that might occur throughout the season.

“Golden Harvest corn and soybeans have excellent standability, despite the elements Mother Nature throws at us,” Sanken says. “We’ve seen the soybeans hold up great in the face of white mold and soybean cyst nematode pressures. We also have a lot of corn insect traits to work with, resulting from Golden Harvest continuing its research and development advancements.”

Greater Support

Agronomy and service are at the core of the Golden Harvest brand. In-depth agronomic knowledge is available to farmers all season long. And with expanding agronomist staffing, Golden Harvest Seed Advisor training and digital tools, farmers will have access to more personalized field recommendations and local, real-time data.

David Schlake, a Golden Harvest agronomy manager, is looking forward to providing even better service to the local farmers he serves in the West.

“We’re increasing trialing at the local level and leveraging digital, real-time ag capabilities to improve product placement,” Schlake says. “Correctly placing hybrids and varieties in the field is one of the single most important steps farmers can take to get the growing season off to a solid start.”

Greater data transparency will provide an increased understanding of how seed genetics, soil types and management practices can make a yield difference on individual farms.

“When we equip farmers with the right seed and local agronomic knowledge, we can help them unlock the genetic yield potential of their crops to maximize yield and return on investment in every field,” Schlake says.

—STORY BY KRISTIN DESUTTER



WEATHERING THE STORM

Not even
Hurricane
Maria could
stop the
Syngenta
Seeds R&D
engine in
Puerto Rico.

By Karyn Ostrom



A Syngenta temporary field employee delivers supplies to a local resident in the community of Las Mareas in Salinas, Puerto Rico.



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n the days leading up to the unwelcome arrival of Hurricane Maria in Puerto Rico, Liliana Sánchez Cortés, a Syngenta site manager, channelled her focus on the safety and well-being of her 45 Puerto Rico-based colleagues—and the maturing soybeans in the ground at the Syngenta research farm in Salinas. As her husband boarded up the windows of the home they share in Ponce with their two young daughters, Cortés and her team spent the weekend prior to the Category 4 hurricane harvesting soybean trials.

The sheer determination with which Cortés and her colleagues approached the prehurricane harvest conveys the significance of seeds research and development (R&D) activities conducted in Puerto Rico. For 35 years, this island territory has been a critical link in the life cycle of biotech crops.

Much of the hybrid seed planted throughout the world has, at some permutation during its development, been planted and harvested in Puerto Rico's continuous nurseries. The three Syngenta research farms in Puerto Rico are integral to bringing new corn hybrids and soybean varieties to growers throughout the Midwest.

"Puerto Rico is, in many cases, the first and most important location for the development of new crops," Cortés says. So when Hurricane Maria pummelled the island in September 2017—a critical time between growing seasons—the stakes were high.

An R&D and Economic Powerhouse

Thanks to a climate that can accommodate 52 weeks of planting and harvesting each year, Puerto Rico is an ideal environment for seeds R&D protocols. In fact, more than 85 percent of the commercial biotech seeds throughout the world pass through Puerto Rico, says Beatriz Carrión, executive director of the Puerto Rico

Agricultural Biotechnology Industry Association (PRABIA).

Conducting seed R&D activities in Puerto Rico yields a more efficient plant-breeding program, with a significantly expedited development timeline. There, researchers can use data from crops harvested in the fall to develop new hybrid and variety combinations that may be planted as early as the following spring.

The three research farms Syngenta operates in Puerto Rico—one in Salinas and two in Juana Díaz—support the robust Syngenta global breeding program for various crops, primarily corn and soybeans.

"Our operations in Puerto Rico are critical to the success of the Syngenta soybean breeding program," says José Aponte-Rivera, head of soybean breeding in North America at Syngenta. "Taking Puerto Rico out of the equation would result in a delay of two to three years for the development of a new soybean variety."

Just as Puerto Rico is integral to the productivity of the seed industry, the industry is an important contributor to the economic success of Puerto Rico. A PRABIA-commissioned economic impact study released in March 2018 reported that the ag biotech industry's operations in Puerto Rico represent more than \$65 million in net benefits for the local economy. And, as Carrión notes, that's a conservative number.

"When you consider the inter-industry multiplier effect, we're looking at a true benefit of nearly \$135 million," she says.

Preparations and Recovery

Weeks prior to Hurricane Maria, the island braced for Hurricane Irma, which aside from widespread power outages, left Puerto Rico relatively unscathed. Hurricane Maria, however, would prove different.

"It quickly went from 'thoughts and prayers' to actively preparing for a disaster," says David Flakne, senior director of state affairs at Syngenta, who monitored the storm's progress stateside.

As Hurricane Maria became increasingly imminent, Cortés



A forklift operator at the Rafael Hernández Airport in Aguadilla loads supplies from Syngenta in the U.S. onto a truck for delivery to the Food Bank of Puerto Rico and the south side of the island.



Gabriela Molina with Syngenta helps assemble contents for supply boxes that will help Puerto Ricans in need, following Hurricane Maria.



Left to right, foreground: Liliana Sánchez Cortés with Syngenta and Ivonne Bernard with the Food Bank of Puerto Rico lead a team of volunteers in Salinas, Puerto Rico.

mobilized her team, securing structures and harvesting plant material. In consultation with Aponte-Rivera, she also postponed planting of the next scheduled crop. “I knew what we needed to do,” she says. “Safety came first, but we also wanted to preserve as much plant material as possible.”

When the National Weather Service issued its first official hurricane watch on Monday, Sept. 18, Cortés immediately activated the company’s emergency plan, dismissed employees and made one final trip to the grocery store—which entailed a three-hour wait in the checkout line, before going home to hunker down. The hurricane reached landfall two days later.

The Immediate Aftermath

What happened next dominated the news globally, accompanied by images of buildings blown apart, landscapes stripped of vegetation and downed power lines. The Syngenta facilities, which had benefited from a \$6 million building investment project, completed in early 2017, experienced flooding. Structural damage also resulted in some destroyed plant genetic material. But in the midst of the devastation in surrounding communities on the southern part of the Island, Cortés counted her blessings.

More difficult to count were employees in the days following the event. Hampered by a debilitated communication infrastructure, it took nearly two weeks to account for Puerto Rico-based Syngenta employees, three of whom had lost their homes.

Meanwhile, in Wisconsin, Flakne embarked on the assignment of a lifetime: helping lead relief efforts. Empowered by the Syngenta management team and supported by a logistical dream team of Syngenta employees, representing a diverse cross-section of departments and functions, Flakne and the stateside team led efforts and organized two airlifts of emergency supplies to Puerto Rico in the weeks following the hurricane.

The first airlift, a joint effort with another agribusiness, delivered generators for the Syngenta facilities and all full-time Syngenta employees on the island, as well as satellite phones to help alleviate the communication issues. The second airlift was a 747 cargo jet charter containing 220,000 pounds of food, water and household goods, including 80,000 pounds of baby food and V8 juices from The Campbell Soup Company, which donated to the Syngenta airlift without hesitation, Flakne says.

The Long-Term Outlook

Within mere weeks of the hurricane, Syngenta was up and running, with new seedlings in the ground by mid-October. While operations weren’t back to normal—that would take many months—the team was able to get its work done and navigate lingering challenges, including the scarcity of seasonal workers who had previously supported operations at key times throughout the year.

Many of these seasonal workers had joined the post-hurricane exodus to the mainland and were no longer available. For Cortés, that has meant casting a wider net to bring in the nearly 500

HELPING THE WORKER BEES

In the days following 2017’s Hurricane Maria, Puerto Rico’s pollinators, which contribute significantly to the pollination of specialty crops and the island’s rich biodiversity, were visibly hungry and distressed. David Flakne, senior director of state affairs at Syngenta, learned of the pollinators’ challenges when he was organizing two airlifts of emergency supplies from the U.S. to Puerto Rico. “When we were organizing the second air charter, which included food and supplies for the people of Puerto Rico, our contacts on the ground happened to mention how the bees were swarming and in crisis,” Flakne says. “It occurred to me that the bees were without homes or food—and that we had an opportunity to help. Residents in Puerto Rico were being advised to put sugar water on their porches for the pollinators to feed upon, but that is not a permanent solution for sustaining pollinators.”



A bee gathers nectar from a flower in Casa Pueblo, Puerto Rico.

For the pollinators that had lost their food and forage sources, help came in the form of pollen-replacing protein patties and beehives, which were secured in collaboration with Pollinator Partnership and then airlifted to Puerto Rico for distribution to beekeepers. Pollinator Partnership is the world’s largest nonprofit organization dedicated exclusively to the protection and promotion of pollinators and their ecosystems.

Not only did the replacement food nourish the pollinators, but it also brought attention and awareness to these small but important contributors to production agriculture. And in an environment known for its resilient tropical vegetation, the pollinators are well on their way to rebuilding thriving populations one year after the storm.

seasonal workers needed. Increased training has been imperative to bring workers with little-to-no ag experience up to speed.

For Flakne, the relief efforts brought to light the true character of Syngenta. In addition to organizing the charters, Syngenta contributed \$200,000 to the Food Bank of Puerto Rico, which helped organize a series of food drives in which Syngenta employees, the local mayors and other community leaders participated. These desperately needed supplies were distributed in the communities near Syngenta facilities on the south side of the island throughout the remainder of 2017.

“Partnering with the Food Bank of Puerto Rico was such a natural fit,” Flakne says. “At Syngenta, the core of our business is about feeding the world. Helping provide food to the citizens of Puerto Rico was a very tangible way of demonstrating this commitment.”

Nutrition

Enogen Feed corn unlocks feed's energy potential, providing dairy and beef producers with an efficient nutrition resource for cattle.

By Darcy Maulsby | Photography by John Phelan



SEE MORE PHOTOS.

www.syngentathrive.com/farmproduction



Mission



Duane Kimball raises
Black Angus cows
on his farm near
Callaway, Nebraska.

When Duane Kimball started raising Enogen® corn four years ago, he wanted the premium he could earn from a local ethanol plant. When he started growing Enogen Feed hybrids for his beef cattle this past year, he became even more convinced of the technology's value.

"Enogen products are a win-win for ethanol and feed," says Kimball, who has farmed full-time for 21 years in central Nebraska, near Callaway. Today, he runs 200 cow-calf pairs and backgrounds or grows steers and heifers from weaning until they enter the feedlot. He feeds his cattle Enogen Feed corn from wean through finish and has also grown Enogen Feed silage.

The advantages Kimball has experienced with Enogen Feed products come from greater starch digestibility and more available energy. "The word I use to describe Enogen Feed corn is opportunity," says Easton Eggers, a grower account lead at Syngenta from Nebraska. "Not only can it help provide growers with additional revenue if they're supplying corn to an ethanol plant, but it also can help improve feed efficiency when they feed it to their livestock."

University research shows Enogen Feed corn can boost feed efficiency in cattle by an average of 5 percent.¹ Duane Martin, Ph.D., commercial traits manager for corn and soybean product marketing at Syngenta, has seen the data—and the results—firsthand.

"This feed efficiency benefit has been observed consistently with Enogen Feed corn," he says. "We see a consistent 5 percent efficiency gain at all stages of beef cattle production."¹

The Science Behind the Benefits

The value of Enogen Feed corn is linked to a naturally occurring enzyme called alpha amylase that enhances the breakdown of starch into sugars. Alpha amylase is present in human saliva, where it begins the chemical process of digestion. It's also present in corn, where it helps provide the sugars that help the seed germinate and grow.

During the early 2000s, Syngenta researchers studied ways to modify corn to carry a specific amylase trait that helps convert starch to sugar more efficiently. The original goal? Provide corn hybrids that enhance ethanol production efficiency. "The faster the starch in corn breaks down into smaller, simpler sugars, the better," Martin says. Enogen hybrids store this special amylase in the corn kernel's endosperm, ready to be activated when triggered by conditions in the ethanol plant, the animal rumen and/or the silage bunker.

Syngenta first offered hybrids with the Enogen trait in 2011. Enogen corn soon attracted attention beyond ethanol plants. University trials focusing on the benefits of Enogen Feed corn for cattle feed started in 2013. As University of

Enogen Fuel Footprint Expands

Enogen® corn enzyme technology, an in-seed innovation from Syngenta designed to enhance ethanol production, is rapidly gaining popularity among ethanol producers, including Nebraska-based Green Plains, which recently signed an agreement to use Enogen corn at all 17 of its ethanol plants.

"We have been using Enogen corn at a number of our locations for several years and have noted significant benefits, including enhanced yield and reduced energy costs," says Todd Becker, president and CEO of Green Plains. "Expanding those benefits throughout our entire ethanol platform, while investing locally, creates value for our growers and the communities where we operate."

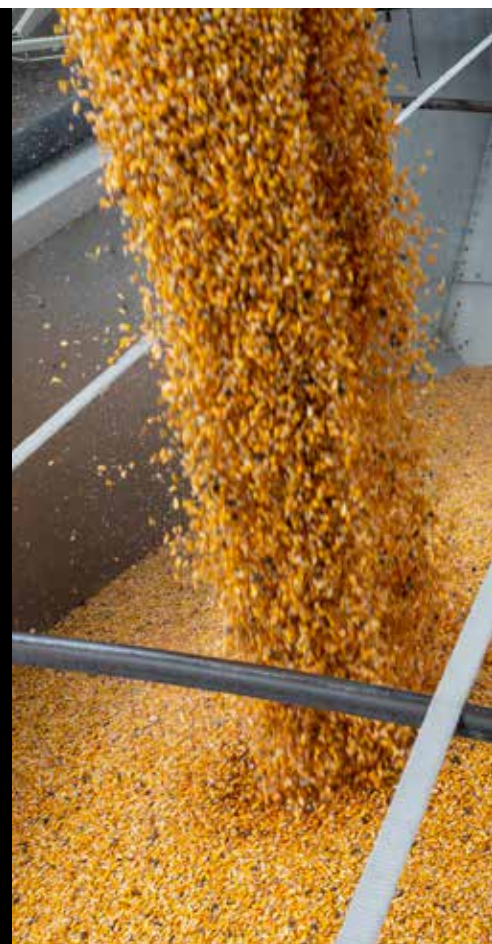
Green Plains purchases more than 500 million bushels of corn each year with a combined annual production capacity of about 1.5 billion gallons.

CHS Inc. has also signed an agreement to use Enogen corn in its ethanol production process. As one of the nation's largest suppliers of ethanol-enhanced gasoline, CHS will use the corn enzyme technology at its 130-million-gallon Rochelle, Illinois, facility.

"CHS is focused on helping its farmer-owners grow," says Mike Van Houten, CHS Rochelle facility manager. "The Enogen program provides benefits for our plant, but is also a big win for our local community with the premium to be paid on every bushel of Enogen corn brought to us." Several million dollars in premiums are expected to be paid annually to growers raising Enogen corn locally for the CHS ethanol plant in Rochelle.

As new plants come on board, Syngenta expects ethanol produced with Enogen corn to total approximately 2.5 billion gallons in 2018.

For more information about Enogen corn hybrids, contact a Golden Harvest® Seed Advisor or NK® retailer, or visit www.enogencorn.com.



Nebraska–Lincoln researchers published their results, the data confirmed that Enogen Feed corn improves feed conversion in feedlot cattle.²

“Because of the unique alpha amylase in Enogen Feed corn, the feed is highly digestible, which means animals can utilize more of the nutrition in corn,” says Eileen Watson, Ph.D., global project lead for corn trait projects at Syngenta. “It has been one positive benefit after another with Enogen Feed corn.”

Dale Blasi, Ph.D., an animal science professor and extension beef specialist at Kansas State University, has studied Enogen corn versus #2 yellow corn in feed rations for post-weaning cattle. “Our studies reflect real-world conditions that growing calves face here in Kansas,” he says. “Our first study showed a 5.5 percent increase in feed efficiency among calves that were fed Enogen Feed corn.”³

There appears to be more complete digestion with Enogen Feed corn, Blasi adds. “The amylase gene provides more readily available energy in the corn, which means cattle producers have the potential to get more bang for their buck.”

Researchers have observed feed efficiency gains whether calves were fed whole corn or dry-rolled corn. The scientists saw these positive results as early as day 14 in a 90-day study. In addition, researchers tended to see lower dry-matter intake with Enogen Feed corn, Blasi says.³

“I appreciate how Syngenta goes the extra mile to substantiate the science,” says Blasi, who has also conducted Enogen Feed silage research.

Better Animal Nutrition

Enogen Feed corn silage also interests Randy Shaver, Ph.D., a professor of animal nutrition and extension dairy nutritionist from the University of Wisconsin–Madison.

“In addition to the improved starch digestibility and higher levels of available sugars, there’s also an improvement in fiber digestibility with Enogen Feed corn,” Shaver says, who has been working with Syngenta since 2016 to study the feed efficiency of Enogen Feed silage and dry corn.

This research also appeals to John Goeser, a self-described “dietitian for animals” who oversees animal nutrition research at the Rock River Laboratory, Inc., in Watertown, Wisconsin. “The improved fiber digestibility is wildly intriguing, especially since the average dairy cow only digests 60 to 65 percent of the feed she consumes.”

The variation around this average digestion is substantial, with figures ranging from 50 percent to 75 percent, Goeser adds. “Improving these numbers could have big benefits,” he says.

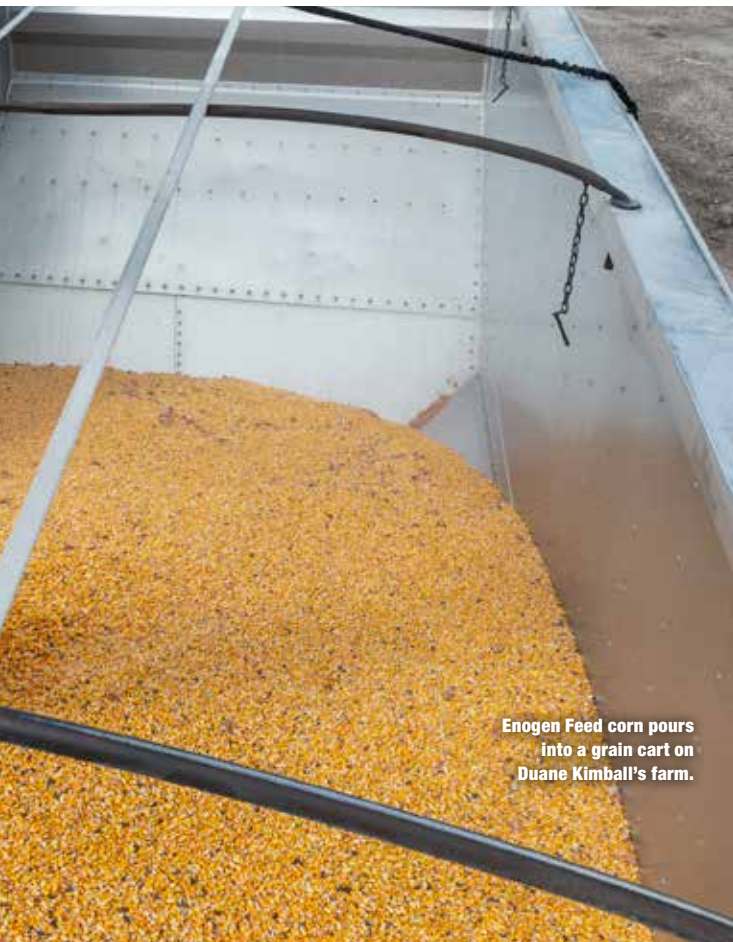
Practical, Proven Solutions

Syngenta also plans to expand Enogen Feed corn research into swine and poultry in the next few years. Eggers welcomes opportunities to have more data on the potential benefits of feeding Enogen Feed corn to livestock.

“With Enogen Feed corn, you don’t sacrifice yield or standability,” Eggers says, who adds that the Enogen trait is available in many corn hybrids from Syngenta. “You also have the flexibility to harvest Enogen Feed hybrids for grain or chop it for silage, with no additional agronomic challenges—unlike some silage-specific hybrids.”⁴

Martin encourages corn producers who grow their own grain or silage for cattle to take a close look at the benefits of Enogen Feed hybrids, with proven genetics and traits that deliver excellent agronomic performance. “There’s a big difference between Enogen Feed corn and other corn when it comes to feed efficiency,” he says. “It’s such a simple switch to make it part of your operation.”

For more information, visit www.enogenfeed.com, or contact your local Golden Harvest® Seed Advisor or NK® retailer. 🌱



Enogen Feed corn pours into a grain cart on Duane Kimball's farm.

1. University of Nebraska Lincoln Research Studies, 2013-2017; Kansas State University Research Study, 2017
2. University of Nebraska Lincoln Research Study, 2013-2017
3. Kansas State University Research Study, 2017
4. Enogen growers must comply with specific yet simple stewardship requirements.

A Sweet Deal

The Syngenta Attribute trait stack is giving field corn growers easier entry into the sweet corn market.

Growers continually seek opportunities that will maximize their farms' efficiency and profits. When those opportunities mean producing high-quality sweet corn made easy, the rewards can be especially sweet.

Syngenta develops its sweet corn hybrids with this premise—and growers' needs—top of mind. By giving field corn growers a sustainable way to incorporate sweet corn acres into their existing operations, these hybrids are helping to bring satisfaction to them, their families and anyone else who consumes their sweet corn.

Herbicide Tolerance

In 1998, Syngenta laid the foundation for its traited sweet corn offerings with the introduction of the Attribute® trait stack. Attribute sweet corn hybrids offer tolerance to LibertyLink® herbicide and contain a gene that expresses

Cry proteins for built-in, season-long control of key lepidopteran pests.

As the next evolution in its line of sweet corn hybrids, Syngenta introduced the Attribute II trait stack in 2014. Attribute II hybrids feature the power of Vip3A and Cry1Ab proteins, providing added protection from harmful lepidopteran pests,

while offering additional herbicide tolerances that other commercially available sweet corn varieties don't.

"Growers are looking for convenience," says Mark Jirak, Syngenta Eastern vegetable commercial unit manager. "They want a herbicide program that can go across their field and sweet corn acres, without having to worry about their herbicide choice damaging their sweet corn crops."

Attribute II can also help growers manage herbicide-resistant weeds in their fields, by offering tolerance to two different nonselective herbicides.

"Growers who are struggling with glyphosate-resistant weeds have the option of using either glyphosate or glufosinate," says Ryan Walker, Ph.D., head of global LSV (large-seeded vegetables) research at Syngenta.

Powerful Protection Against Insects

In addition to herbicide tolerance, Attribute II provides protection from harmful sweet corn pests, including European corn borer, corn earworm, fall armyworm and Western bean cutworm. Attribute II combines the Cry1Ab protein found in the Attribute trait stack with the proprietary Vip3A protein from Syngenta to provide broader, more effective protection against pests. These proteins bind to different receptors within an insect's midgut membranes, greatly reducing the risk of insect resistance.

"Attribute II has the best insect resistance by far," Walker says. "Based on trial data* and what we've seen in the field, it's head and shoulders above any other product in the market as far as performance goes—both in the range

"[Growers] want a herbicide program that can go across their field and sweet corn acres, without having to worry about their herbicide choice damaging their sweet corn crops."

—MARK JIRAK



Opposite page: This field of sweet corn flourishes with the built-in protection of the Attribute trait stack.

of insects it protects against and its ability to help growers maintain damage-free ears to harvest.”

The high-level protection that Attribute II offers can also help growers cut down on insecticide sprays, saving time and money while reducing the impact on the environment.

“If you’re looking for environmentally friendly tech that can help you reduce your number of insecticide sprays, Attribute II is the best thing that’s out there,” Walker says.

No Task Too Small

Growers with smaller operations who have used Attribute II for its insect control capabilities have also seen its benefits. Jirak advises his brother Ron, who runs the family farm they grew up on, Jirak Brothers Produce, in Tampa, Kansas. Ron also sells the farm’s sweet corn directly to local residents and grocery stores.

To maintain the operation’s success, Jirak Brothers Produce depends on Attribute II sweet corn hybrids. “My brother uses Attribute II on the farm because the worm

control is unsurpassed,” Jirak says. “When you’re selling to consumers who are used to buying sweet corn without any damage, it becomes an issue when your corn has worms. Attribute II gives us the best opportunity for worm-free corn, which is especially important when we sell produce at the farmers market or at the family’s roadside stand.”

For smaller acreages or planted areas, Syngenta offers Attribute II in convenient smaller-size 2,500-seed packets.

Jirak says that advising the home farm operation gives him a unique perspective on trait selection and efficacy. “I’m able to experience firsthand the benefits of using Attribute II on my family’s farm,” he says. “This real-world vantage point makes my work with these traits at Syngenta even more relevant and rewarding.”

STORY BY CHRIS CONWAY

*Data comes from Galen P. Dively, Ph.D., Department of Entomology, University of Maryland, who conducted individual sweet corn field trials at 15 locations across seven states (NC, VA, WV, MD, DE, NJ and NY) in 2017. The purpose of the trials was to compare the insect control efficacy of different *Bt* hybrids with nonexpressing isolines.

FEATURED VARIETIES

The Attribute® II trait stack is available in a number of TripleSweet® corn varieties with different characteristics to meet grower needs and consumer demands:



Aspire is a yellow variety ideal for main-season plantings in the Midwest and Northeast. Aspire sweet corn can reach maturity in approximately 80 days for earlier harvest. With built-in Attribute II protection against key lepidopteran pests and tolerance to glyphosate and glufosinate herbicides, Aspire offers growers the opportunity to maximize marketable ears.



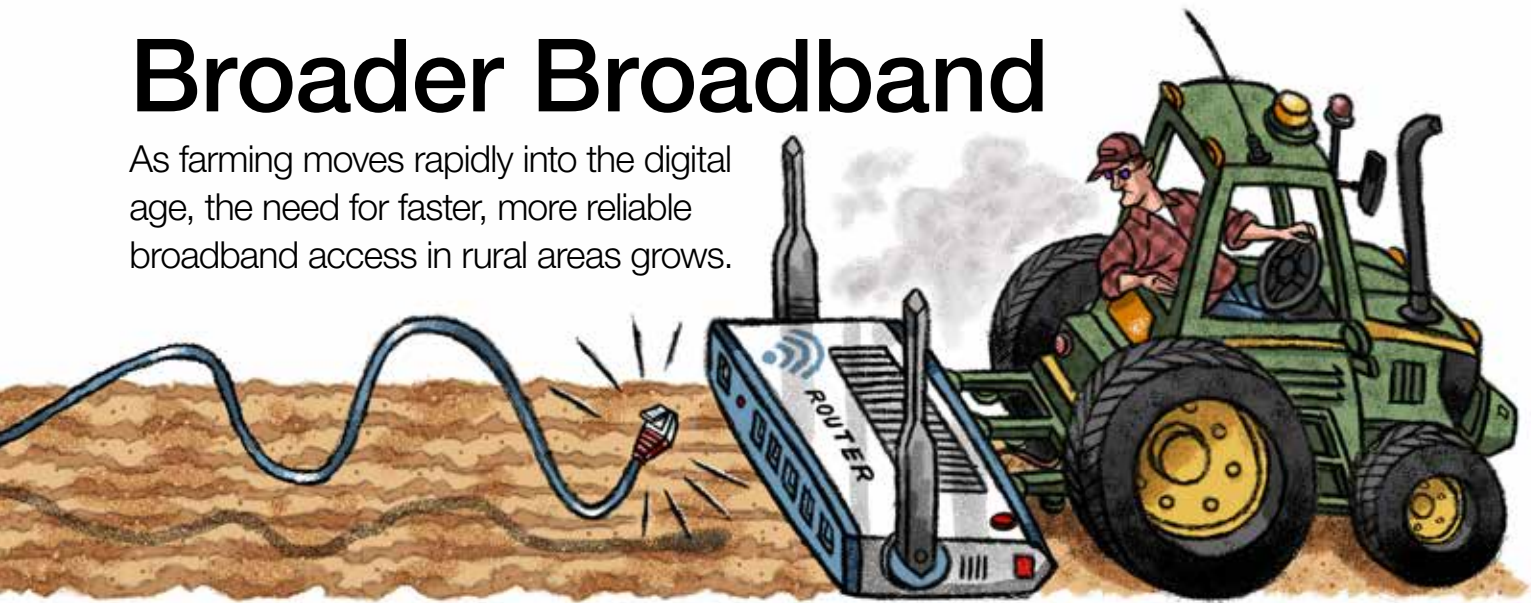
Remedy is a BC0805-type sweet corn with improved insect resistance through the Attribute II trait stack. With consistently high yields, Remedy produces long ears with tender, sweet kernels for excellent eating quality. This bicolor variety reaches maturity in approximately 82 days to meet grower needs.



Milky Way is a white variety that is well-suited for local and roadside markets in the Midwest and Northeast and reaches maturity in approximately 82 days. Protected by the Attribute II trait stack, Milky Way offers growers and consumers excellent ears to meet market expectations with outstanding eating quality and consistent yields.

Broader Broadband

As farming moves rapidly into the digital age, the need for faster, more reliable broadband access in rural areas grows.



Today, broadband is truly a necessity, not a luxury. Defined by Congress as the capability that allows users to “originate and receive high-quality voice, data, graphics and video” services, it’s essential to economic development, public health and educational opportunities—and with the rise of data-driven farm technologies, it’s essential for American agriculture, too.

The Rural Shortfall

In small rural communities, broadband connects residents to online distance learning, telemedicine services and new customers in the global online marketplace. When communities access broadband services, incomes rise and unemployment falls.

“It goes back to when the telephone first started,” says Janie Dunning, a consultant with Missouri Farm Bureau. “Initially, it was believed to be a luxury, and then they found out quickly how essential it was to everyday life. That is broadband now. That is the technology world that we live in.”

But some 39 percent of rural Americans—roughly 23 million people—lack access to broadband services, according to the Federal Communications Commission (FCC).

Smarter Ag

For agriculture, broadband access becomes more essential all the time.

“It’s hard to separate out digital tools and precision ag tools from standard tools now, because digital technology is built in to how things are done now,” says Joe Ben Bogle, business lead with Ag Connections, LLC, a wholly owned subsidiary of Syngenta. “So, it’s important that farming communities be put online.”

Hunter Carpenter, director of public policy at the Agricultural Retailers

Association, agrees. “Not only will broadband allow farmers to stay connected to the ever-increasing global connectivity of things, but it also allows for machine-to-machine technology enhancements and incredible technological advances to assist with things like moisture-level monitoring and field mapping,” he says. “It allows machines to talk to one another and share information.”

Connectivity also reduces downtime for growers, because it allows for real-time monitoring and diagnostics from the dealer when a piece of equipment breaks down.

“We believe that precision agriculture and technological advancements will do for agriculture what mechanization did in the 20th century, in terms of yields,” Carpenter says.

Banding Together

The issue of broadband access is getting attention from many directions today, which is what is needed to get results, Dunning says. Ag commodity and trade groups are essential to these efforts—including the machinery dealers. “These dealers can’t sell their smart machines to farmers if they don’t have internet access,” she says.

State-level partners are needed, too, Dunning says. “A lot of the states that are doing well in broadband have a state broadband fund, which is a grant fund used to leverage broadband infrastructure development. Getting the state involved through legislation, funding and a coordinated repository, like a state broadband office, is essential.”

At the federal level this year, Congress has passed, and the president has signed, an appropriations agreement that included bipartisan legislation reauthorizing the FCC and spurring the development of next-generation wireless services, says Senator

“We believe that precision agriculture and technological advancements will do for agriculture what mechanization did in the 20th century, in terms of yields.”

—HUNTER CARPENTER

Jerry Moran, R-Kan. “This legislation, which included \$600 million to USDA [U.S. Department of Agriculture] for a rural broadband pilot program, streamlines broadband expansion in rural America and reaffirms Congress’ commitment to telecommunications infrastructure.”

Also this year, a precision ag connectivity act has been introduced in both the House and the Senate. “Basically, what it will do is start a task force between the FCC and USDA to look at how precision broadband connectivity in rural America can increase and enhance ag,” Carpenter says. “That has been one of the things that we’ve been pushing for on Capitol Hill.”

In January, the USDA also released the Agriculture and Rural Prosperity Task Force Report, which identified more than 100 recommendations to help improve life in rural America. The recommendations, which include legislative, regulatory and policy changes, center around e-connectivity as well as quality of life, rural workforce, technology and economic development.

Rural Broadband in Action

At Ag Connections, located in rural Murray, Kentucky, the recent introduction of broadband access has been a game changer. “It’s allowed us to continue to have our office in our rural location and grow our company,” Bogle says. “We get 40 or 50 calls a day from growers, and we need to remotely connect to them and give them training and advice.”

Those customers are using Land.db®, a state-of-the-art record keeping and farm-management system that’s part of the Syngenta AgriEdge Excelsior® program. The software allows growers to create maps of their fields, record product use and measure performance across their fields. “It also helps them meet regulatory compliance and communicate with business partners, like landlords,” Bogle says.

Knowing many customers don’t have broadband access yet, Ag Connections created Land.db with the capability to work offline when necessary. “A grower can still enter information into the system, whether it’s scouting information, application information, anything they’re doing in that field,” says Aaron Dearnorff, head of digital agriculture solutions at Syngenta. “Then once they travel to an area that has connectivity, all of that data will be sent into the cloud system that Land.db is built on, and the grower can access it on his or her phone or laptop.”

But many of today’s ag technologies are not able to work offline, which is why so many individuals and groups are working toward greater access. “Closing the digital divide and giving rural communities and members of our ag community broadband access will help ensure that those in rural areas can connect to internet users worldwide, succeed in the online economy and partake of educational opportunities that enable them to find future entrepreneurial success,” Senator Moran says. “The ability of our rural communities to be economically competitive is strengthened by broadband access.” 🌱

STORY BY SUZANNE BOPP

The Evolution of Agriculture

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Ripple Effect

Syngenta offers potato farmers blight hotlines, salutes this year's Crop Challenge winners and supports FarmHer programming and events.

HOTLINES

Potato Blight Hotlines Keep Growers Informed

Syngenta will continue partnerships with several key potato disease researchers through the potato blight hotlines in 2018. Growers in Idaho, Michigan, North Dakota, Oregon and Washington can get updates on local conditions and disease pressures by calling the hotlines. To access this information as quickly as possible, growers can subscribe to receive text message alerts when the hotlines they choose are updated.

"These researchers are valuable sources of information for growers in their areas," says Kiran Shetty, Ph.D., Syngenta technical development lead. "I'm pleased that we can help them spread their insights as wide as possible among the growers they serve."

See below for subscription and hotline details. For more information about what Syngenta brings to the potato industry, visit www.syngentaus.com/potatoes.

Pathologist/Affiliate	Hotline Number	To subscribe for text alerts, send text:
Kasia Duellman, Ph.D. <i>University of Idaho</i>	1-800-791-7195	BLIGHTID to 97063
Jaime Willbur, Ph.D. <i>Michigan State University</i>	1-888-379-9012	BLIGHTMI to 97063
Neil Gudmestad, Ph.D. <i>North Dakota State University</i>	1-888-482-7286	BLIGHTND to 97063
Ken Frost, Ph.D. <i>Oregon State University</i>	1-800-705-3377	BLIGHTOR to 97063
Dennis Johnson, Ph.D. <i>Washington State University</i>	1-800-984-7400	BLIGHTWA to 97063



Midgrowth foliage covers a potato field in Yakima County, Washington; the snow-covered Cascade Mountains are in the distance.



AWARD WINNERS

2018 Syngenta Crop Challenge in Analytics Winner Announced

Syngenta and the Analytics Society of INFORMS recently recognized a team from the International Center for Tropical Agriculture (CIAT) in Colombia as the winner of the third annual Syngenta Crop Challenge in Analytics, which fosters cross-industry collaboration between agriculture and data analytics experts to help address growing global food demands. CIAT is a not-for-profit research and development organization that aims to reduce poverty and hunger in developing countries by helping farmers improve crop production sustainably.

The winning team—which included Andres Aguilar, Hugo “Andres” Dorado Bentencourt, Sylvain Delerce, Michael Caraccio, Juan Camilo Rivera, Maria Camila Gomez, Steven Humberto Sotelo and Anestis Gkanogiannis—was awarded a \$5,000 prize for its submission, “Speeding Up Maize Hybrids Breeding Schemes Using Machine Learning.”

Challenge participants used a real-world data set to develop models that predict how well corn hybrids will perform in untested locations, so that plant breeders can make better decisions regarding which hybrids to commercialize.

“The winning submission represents the type of analytical thinking that can enable sustainable agriculture for the future,” says Dan Dyer, head of seeds development at Syngenta. “This annual competition gives Syngenta a way to reach and collaborate with data analytics experts, who can help us confront the challenge of global food security.”

For more details about the Syngenta Crop Challenge, please visit www.ideaconnection.com/syngenta-crop-challenge.



Crop Challenge Committee Chair Nicolas Martin (far left) and Dan Dyer, Syngenta (far right), present the award to the first-place winners from The International Center for Tropical Agriculture (from second to left): Hugo “Andres” Dorado Bentencourt, Andres Aguilar and Sylvain Delerce (second from right). Also pictured: team supervisor Daniel Jimenez (third from right).



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Lighting the Way

FarmHer illuminates the contributions of women in agriculture—and inspires a new generation to pursue farm-related careers.

Entering its third season, “FarmHer on RFD-TV” is a series about women who play an integral role in American agriculture. Its success has spawned other related shows and events across the country, including a FarmHer radio series and podcast, an “I Am FarmHer” national event and a “Grow by FarmHer” series of regional events.

FarmHer is the brainchild of journalist and photographer Marji Guyler-Alaniz, and it spotlights the many farm women who make significant contributions to agriculture on a daily basis. “I’m inspired every single day by the strong, resilient women who care so deeply about their families and farms, and who deal with agriculture’s ups and downs,” she says.

Wendell Calhoun, communications marketing manager at Syngenta, agrees. “FarmHer shows the importance of

diversity of thought,” he says. “It’s opening minds and doors for young women in agriculture.”

Syngenta has supported the FarmHer television series since its inception and will again be a presenting sponsor for FarmHer’s third season, which begins in September. “Syngenta was our very first sponsor, and its commitment and support mean so much to me,” Guyler-Alaniz says.

This fall the Syngenta #RootedinAg spotlight segments in each episode will feature the next generation of FarmHers. Syngenta encourages women from ages 18 to 30 to submit videos talking about how their agricultural roots have guided them in their lives and careers. The segment is intended to inspire, educate and empower young women, Calhoun says.

Susan Woodruff, an NK® district manager, says she can relate to those stories. “My parents worked side by side on the farm,” she explains. “My mom was such an integral part of our farming operation, so I always knew farming wasn’t just for men. I think it’s impactful that FarmHer tells the stories of women in other agricultural careers.”

Woodruff and several other Syngenta employees attended the 2017 “I Am FarmHer” national event. For Woodruff, one of the take-home messages was the importance of social media as a vehicle for networking with female farmers from around the country. She reads the blogs and posts of women who raise everything from dairy cows to vegetables.

While the national event is geared toward women and men of all ages, the “Grow by FarmHer” regional events feature educational and inspirational programs more targeted to millennials.

FarmHer’s season three is set to inspire with episodes featuring women in a variety of roles, including a female rice grower, a woman who manages her family’s cattle ranch, a female horse trainer who works with the Budweiser Clydesdales and a woman who owns an aerial application service.

“We’ll cover unique stories about people doing unique things in agriculture,” Guyler-Alaniz says. “The message is about taking what you have and making it better.” To view some of the highlights from seasons one and two, go to www.syngentathrive.com/farmher. 🌱 STORY BY LYNN GROOMS

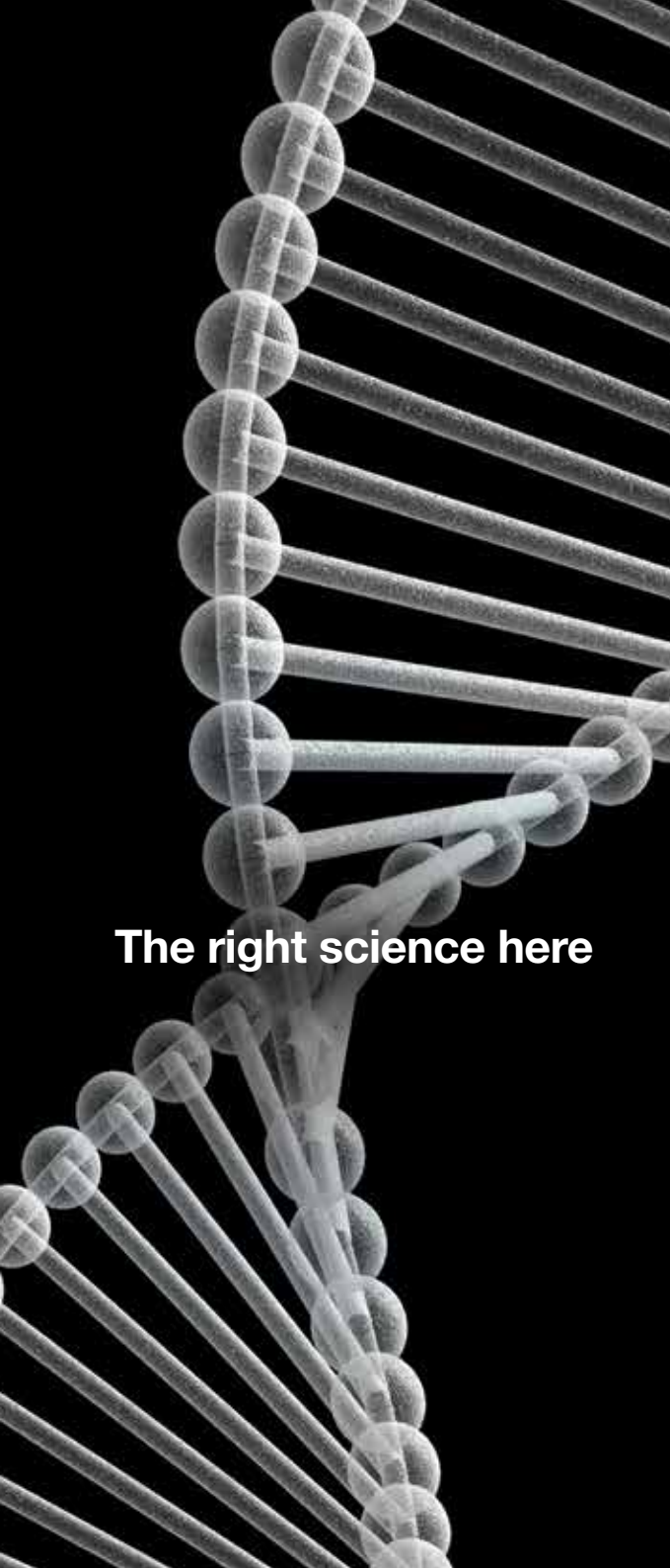


“I’m inspired every single day by the strong, resilient women who care so deeply about their families and farms, and who deal with agriculture’s ups and downs.”

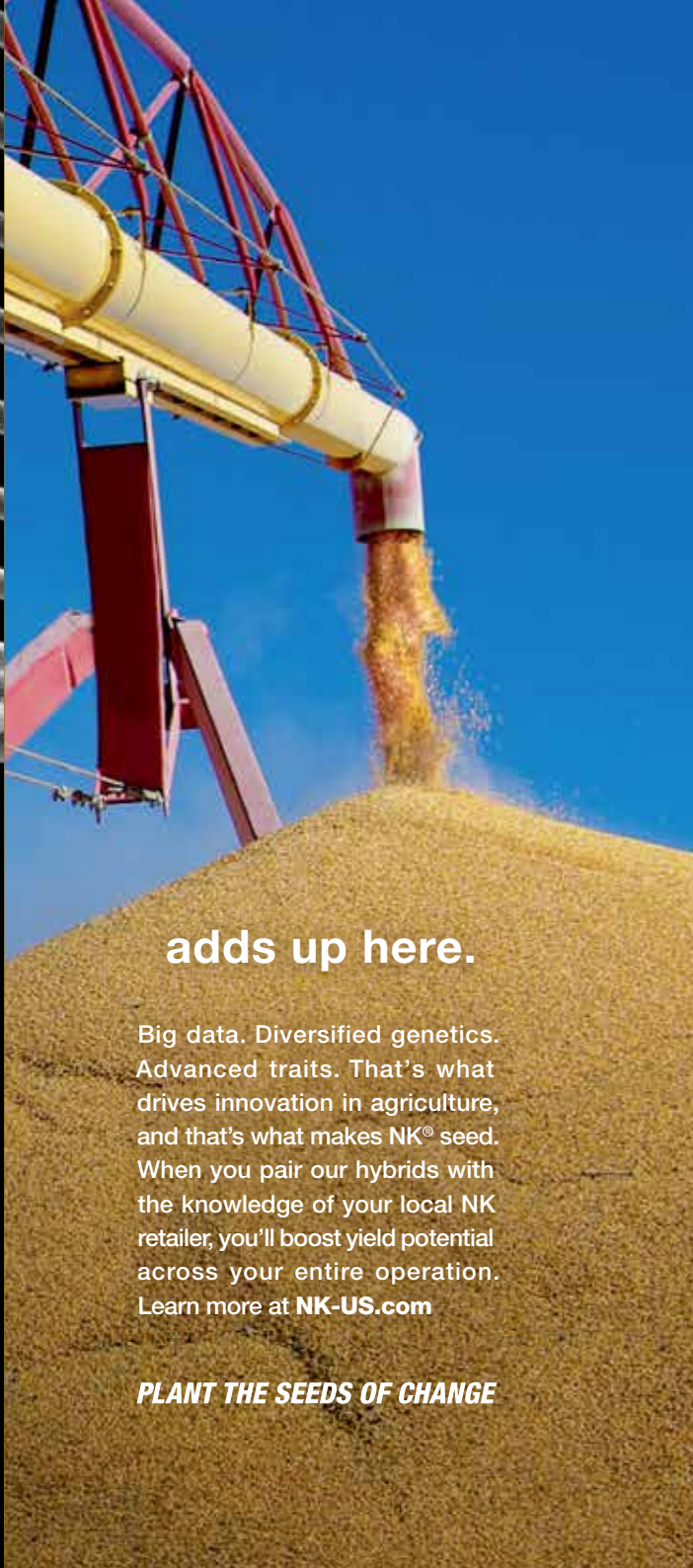
—MARJI GUYLER-ALANIZ



Opposite page: Marji Guyler-Alaniz (right) visits FarmHer Jennifer James (left) at her rice farm in Arkansas for season three. This page: Carey Portell, a cattle farmer in Missouri, will also be featured in season three of "FarmHer on RFD-TV."



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