

Growing Together

➤ 1Q | 2019

thrive[®]

RISING TO NEW HEIGHTS

Breeders Develop Wheat Products
to Meet Market Demands

GET AHEAD OF WEED
RESISTANCE – AND
STAY THERE

CULTIVATING
VALUE IN TODAY'S
MARKET

syngenta[®]

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ON THE COVER The Syngenta wheat quality lab in Berthoud, Colorado, houses a lab where researchers test milling and baking performance of various wheat varieties. Photo: Willie Petersen

THIS PAGE Left to right: Retailer Colten Katz, Syngenta rep Danzey Nickel and grower Jim Katz are ready to unload Syngenta products for use on Jim's farm in Lewis, Kansas. Photo: Jason Ryman

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.



Forward Planning

With all that goes into preparing for the new year, one worry that shouldn't keep you up at night is the availability of crop protection products. At Syngenta, we believe the delivery of the right product to the right place at the right time lies squarely on our shoulders, not yours. That's why we've been tapping into our expansive network of global and local resources for months to make sure a more limited supply of raw materials, combined with increasing transportation and energy constraints, doesn't impede the flow of our products to you this year.

In today's market, where commodity prices are low and the cost of growing crops is on the rise, the importance of what we do to assess supply and demand is amplified. Understandably, in this environment, price is becoming a more important factor in many purchasing decisions. But, like you, we don't want pinching pennies at the beginning of the season to cost growers bushels at harvest.

This issue of *Thrive* describes what we're doing to make sure you and your growers can extract the most value from your Syngenta product investment. In one article, you'll see how we're increasing operational efficiencies within our purchasing, manufacturing and distribution functions to aggressively manage our internal costs, without sacrificing the high level of quality and service you deserve. In another, you'll read how we're leveraging our long-term relationships with supplier and channel partners to ensure product availability and responsive, reliable delivery. As one article notes, our relationship-building efforts also extend to policymakers to make sure the product registration process remains science-based, so that growers have the tools they need to profitably manage their farms.

Woven throughout the pages that follow, you'll see how we're continuing to invest in our portfolio, which includes 136 crop protection products and counting. These brands fit into various points along the price spectrum, giving you the flexibility to help individual growers decide which product will give them the greatest return on their investment.

In these uncertain times, you need partners who offer stability, leadership and trust. Syngenta has the people, portfolio and infrastructure to provide all three, so you can spend less time worrying about product availability and more time profitably growing your business. Throughout 2019 and beyond, we look forward to working with you to secure a more prosperous path forward for you and your customers. 🍀



AUSTIN PARRISH
Head, Business Planning
Syngenta Crop Protection, LLC



AUSTIN PARRISH

“Price is becoming a more important factor in many purchasing decisions. But, like you, we don't want pinching pennies at the beginning of the season to cost growers bushels at harvest.”



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



What's in Store

Stay ahead of the curve with new products, the latest product updates, news and upcoming events.

NEW PRODUCTS

E-Luminate Helps Farmers Select the Right Product

Golden Harvest has announced the rollout of E-Luminate®, an exclusive digital offering that draws on extensive agronomic data to help farmers make more informed seed-selection decisions. This unique seed-placement tool is available to Golden Harvest® Seed Advisors for use with their customers.



A grower sprays winter wheat to control weeds in the Palouse region of Washington state.



“When used in combination with Talinor herbicide, Axial Bold will give growers the complete package for cross-spectrum grass and broadleaf weed control in their cereals crop.”

—BRENT LACKEY

It allows them to have field-level discussions around selecting the right seed, based on key agronomic factors, including soil characteristics and pressure from weeds, diseases and insects. Powered by the precision of statistical analysis, recommendations using E-Luminate reflect actual performance comparisons across varieties by year and region, with results appearing in a visual dashboard that compares and contrasts seed varieties.

“Golden Harvest offers a diverse portfolio of corn hybrids and soybean varieties to maximize yield in a wide variety of environments,” says Bruce Battles, head of seeds agronomy at Golden Harvest.

“But high-quality seed is only part of the equation. Product placement is crucial for realizing optimal yield. A number of factors can make seed selection a real challenge. E-Luminate simplifies the equation.”

To learn more, contact your local Golden Harvest Seed Advisor or visit

www.goldenharvestseeds.com.



Axial Bold Grass Herbicide Registered for Cereals

Syngenta has received registration of Axial® Bold grass herbicide from the U.S. Environmental Protection Agency for use in the 2019 growing season, giving wheat and barley growers a new option for superior grass control.

“Axial Bold was built on the foundation of Axial brands, the industry standard for grass control in cereals,” says Brent Lackey, herbicide product lead at Syngenta. “When used in combination with Talinor® herbicide, Axial Bold will give growers the complete package for cross-spectrum grass and broadleaf weed control in their cereals crop.”

Trials show that with its two active ingredients—pinoxaden and fenoxa-prop—Axial Bold delivers improved consistency and broad-spectrum control of top grass weeds, including wild oat, yellow foxtail, Italian ryegrass, green foxtail and barnyard-grass. For more information, visit www.syngenta-us.com/labels/axial-bold.

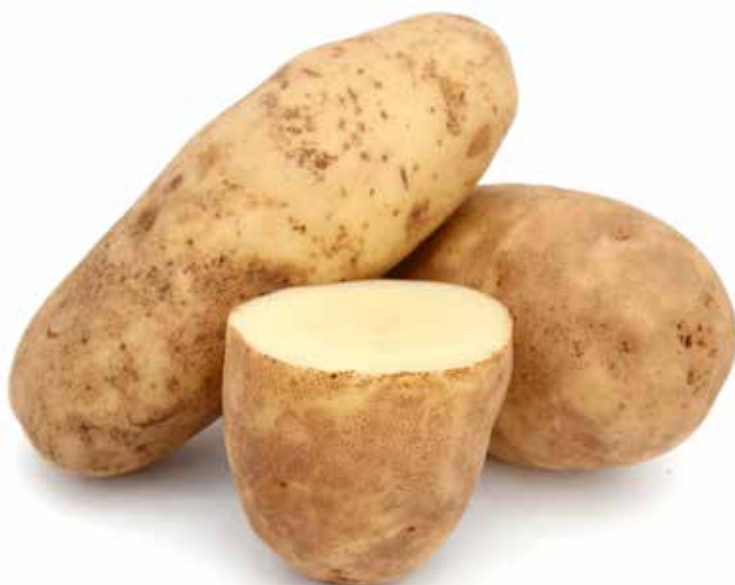


Gramoxone Magnum Herbicide Will Combine Ease and Efficacy

Upon registration from the Environmental Protection Agency, soybean growers will have a new tool in the fight against resistant weeds for 2019. Gramoxone Magnum™ premix herbicide will combine two complementary active ingredients, S-metolachlor and paraquat, to deliver fast-acting residual burndown of emerged weeds, including Palmer amaranth and waterhemp. Formulated for ease of handling and broad tank-mix compatibility, Gramoxone Magnum will target two alternative sites of action to glyphosate for effective control in no-till and double-crop systems. Backed by leading expertise and reliable Syngenta service, Gramoxone Magnum will offer the trusted performance of two proven brands so growers can start clean in their seasonal fight against resistant weeds.



PRODUCT UPDATES



Elatus Expands Opportunities for Potato Growers

Elatus® fungicide, which provides excellent control of soilborne diseases in potatoes, can now be used under a 2(ee) recommendation for suppression of *Verticillium* wilt. Damage from this disease leads to early crop senescence, approximately three to four weeks before potatoes reach maturity. As a result, tubers do not size, and serious yield losses can occur.

As the only in-furrow technology containing a proven strobilurin paired with a powerful SDHI fungicide, Elatus helps improve crop emergence, produce a more uniform crop stand and enhance crop health for optimal tuber-size distribution. And with additional key import tolerances expected for the 2019 season, Elatus can help protect potatoes grown for both domestic and export markets. (See “On the Level,” page 26.)

For more information, go to www.syngentaus.com/elatus.



NEWS AND EVENTS

NK Corn and Soybeans Help Maximize ROI

Harvest 2018 found NK again delivering high yields on farms across the U.S. Backed by extensive Syngenta research and development, NK® corn and soybeans consistently topped key competitors.

This performance reflects nearly a decade of genetic gain for the revitalized NK corn portfolio. In 2018 trials conducted by Farmers’ Independent Research of Seed Technologies (FIRST), the new NK0886-3010 brand secured 14 finishes in the top 10, including nine in the top five with yields as high as 275.2 bushels per acre (bu/A).

Results also showed NK soybeans continuing their winning streak. For example, S27-M8X brand placed in the top 10 in seven FIRST trials.

“We innovate with a singular focus: to help farmers thrive by maximizing their ROI [return on investment] potential,” says Quinn Showalter, head of NK Sales. “These results show we’re delivering on that promise.”



TRADE SHOWS AND CONFERENCES

To find out what's new and exciting at Syngenta in 2019, please visit our booth at any of the trade shows listed below.

FEBRUARY 2019

- 13–16 National Farm Machinery Show, Louisville, Kentucky
- 28–March 2 Commodity Classic, Orlando, Florida

MARCH 2019

- 1–2 Mid-South Farm & Gin Show, Memphis, Tennessee

Field Perspectives

Three Syngenta sales representatives share their insights on what lies ahead in 2019 for the agricultural communities they serve.

In a market where commodity prices are low and the costs of doing business are rising, growers and resellers need reliable local partners who can help them overcome some of the challenges they will encounter in 2019. The men and women who make up the Syngenta Crop Protection salesforce are committed to being those partners. In the sections that follow, three top Syngenta sales representatives from different areas of the country describe how they stand ready to work shoulder to shoulder with their customers to help secure a winning season.

Krista Tavares,
WESTERN REGION

Growers in my region face immense challenges every day. The largest is the constant flow of anti-pesticide regulations in California. So many of these requirements, often not based in science, result in growers either having important crop protection tools taken away or being saddled with increased limits on when, where and how they can spray.

Another limiting factor in California is water. Insufficient storage and reduced allocations to agriculture, due to several factors, including environmentalists' pressure, have severely reduced the acres growers can farm. These challenges, combined with decreasing commodity prices and increased input costs, are creating a complicated environment in 2019.

The best part of my job, though, is helping growers find cost-effective, value-added solutions that can keep crop production levels high. Apart from helping them find the right product for the job, I also try to help growers stay ahead of and in compliance with regulations through outreach and training. I constantly fight to keep these crop protection tools in growers' tool belts by engaging with local officials and telling agriculture's story to anyone who will listen.

While farming faces many pressures from external forces, its future is still bright, thanks, in part, to the investment Syngenta is making in technology. For example, fungicides like Orondis® for citrus and, upon registration in California, Miravis® Prime for grapes, will change the way growers farm in my state for the better. It's a very exciting time to be part of agriculture—and the Syngenta family.



Rows of romaine lettuce grow on a farm in central California.

“The best part of my job ... is helping growers find cost-effective, value-added solutions that can keep crop production levels high.”
— KRISTA TAVARES



KRISTA TAVARES
Syngenta Sales Representative

Chris Peters,

MIDWEST REGION

The environment farmers are facing is anything but simple in my region. Growers are seeing key inputs—including fertilizer, seed and chemicals—all priced higher than a year ago. An abundant inventory and higher-than-expected U.S. production have created a significant downturn in commodity prices, forcing corn and soybean



A grower and an AgriEdge specialist discuss crop plans in a cornfield in Medford, Minnesota.

“As a Syngenta sales rep, I can offer tailor-made solutions like AgriEdge Excelsior whole-farm management program and use the full breadth of the Syngenta portfolio to meet a grower’s individual needs.”

—CHRIS PETERS

Syngenta portfolio to meet a grower’s individual needs. My experience in ag retail and my agronomic knowledge also allow me to offer unique insight when partnering with retailers, so they can expand their value as trusted advisers to growers.

While the short-term market outlook for 2019 appears challenging, I’m optimistic about the future of U.S. agriculture. In the last decade, we’ve made exciting technological and agronomic advancements with many more innovations in the Syngenta pipeline. Those advancements help farmers produce more grain with greater efficiency than ever before, and they will continue to help keep American agriculture at the forefront of global production.

farmers in my area to make business decisions based on a highly uncertain price outlook.

When you consider the challenges growers are facing in 2019, it becomes apparent that retail suppliers will also face a challenging year. As they help growers navigate the volatile climate, retailers must evaluate each grower’s needs and craft an agronomic solution that maximizes his or her economic return.

Many basic manufacturers bring cookie-cutter programs to market that don’t always address specific customer concerns. As a Syngenta sales rep, I can offer tailor-made solutions like AgriEdge Excelsior® whole-farm management program and use the full breadth of the



CHRIS PETERS
Syngenta Sales Representative

Duane Hobbs,
SOUTH AND EAST COAST REGION

Low commodity prices combined with rising costs threaten the profitability of each and every farm in my region. Growing, or at least maintaining, a return on investment for farmers and retailers in this environment is one of our biggest challenges.

We're helping our customers overcome this challenge by assisting them in building sound business plans with sensible agronomic solutions, based on a clear understanding of what's important to them. Instead of asking how they can survive the year, my progressive farmers want to know how they can grow a bigger, better crop than the year before.

At Syngenta, our goal is to help farmers and retailers increase not only the quantity, but also the quality of every crop they grow. Our product line is built on multiple modes of action and good scientific efficacy. Take our corn herbicide portfolio, for example. Acuron®, the first residual corn herbicide that provides four active ingredients and three sites of action, sets the standard for performance on resistant weeds and crop safety. But other products in our extensive corn herbicide brand ladder also meet production needs, while accommodating the challenging budgets many growers have today.

Additionally, we're developing one of the strongest fungicide portfolios in the industry. Recent product introductions—including the Orondis brand fungicides and Miravis brand fungicides, which contain the active ingredient Solatenol®—provide innovative solutions to major diseases in row crops, peanuts, potatoes, fruits and other vegetables. And our insecticide products continue to provide consistent performance and reliability.

Innovation is the engine of American agriculture. When farmers are working, they expect the rest of the agricultural industry to work alongside them. That's what we strive to do at Syngenta—work side by side with our customers to bring them the tools they need to be successful. 🌱 INTERVIEWS BY SUSAN FISHER



Ripe Fuji apples are ready for harvest in Adams County, Pennsylvania.

“At Syngenta, our goal is to help farmers and retailers increase not only the quantity, but also the quality of every crop they grow.”
—DUANE HOBBS



DUANE HOBBS
Syngenta Sales Representative

Nurturing Innovation

By supporting ag startups, Syngenta Ventures is helping to foster improved agronomic practices in the coming decade.



Back in 2012, Travis Bayer and Eric Davidson weren't focused on crops. Bayer was teaching biochemistry at the University of Oxford. Davidson was a research associate for the Center of Synthetic Biology at the Imperial College in London. But that spring, the U.K.'s Environment Agency issued a dire warning. More than half of Britain was in drought—the country's most severe water shortage since 1976. "It was a big problem, an important problem, and we thought that as biochemists, we could bring a unique perspective," Davidson says.

The next year, he and Bayer launched Sound Agriculture, a startup with a mission: to create a suite of products that mitigate drought stress, decrease fertilizer needs and increase crop yields. "We think of what we do as drug discovery for plants," says Davidson. "We look for ways we can signal to plants to be ready for stress or to tolerate stress to be more productive."

Syngenta Ventures

Environmental pressures like drought confront growers across the globe, and they can exacerbate the many other demands growers face. The challenges are intertwined, coming from every direction, including profitability requirements, food-supply-chain demands and nutrient shortages.

"For better or worse, growers are going to have to evolve how they deal with those pressures," says Derek Norman, who heads up Syngenta Ventures, one of the world's first venture capital groups dedicated to agriculture. Since he joined Syngenta Ventures in 2009 as one of its founding members, Norman and his team have committed to identifying entrepreneurs, like Davidson and Bayer, who are developing new tools growers can use to battle these pressures.

When members of the research and development (R&D) group at Syngenta first identified Sound Agriculture as a promising new startup, both they and the Syngenta Ventures team immediately recognized the potential for a strategic partnership. "Between fertilizers and chemistry, growers haven't had a lot of options for products that enhance yield and make their crops more resilient to abiotic stresses," Norman says. "Sound Agriculture was taking a novel approach to discovering new products that could be tools for growers. We invested in them last year and have been very pleased with their progress."

Investing for the Long Run

Today, Sound Agriculture is one of more than 15 companies in Syngenta Ventures' portfolio. There's no one-size-fits-all formula for the ideal Syngenta Ventures investment. It's more about casting a broad net and finding companies that share its vision for making growers' farms more sustainable and more profitable. "We spend time getting to know the people. We try to understand the technologies," Norman says. "We look at the business model, the market size. We try to be sure the company has strong competitive advantages. It's an iterative process, during which time we really try to get to know the leadership teams of these companies."

Syngenta Ventures views these investments as long-term partnerships, he adds. "We become personally committed to the success of our portfolio companies."

That means Syngenta Ventures team members participate in board meetings, help steer strategy and business development, share Syngenta resources, and help the companies expand their professional networks, which is useful for recruiting talent.

Take AgriMetis, a Syngenta Ventures' portfolio company that

develops natural products to protect crops from weeds, diseases and insects, as an example. “The Syngenta R&D group helped AgriMetis develop its testing capabilities,” Norman says.

“Over the years, we’ve developed strong relationships with others at Syngenta, beyond just the Syngenta Ventures team,” Davidson says. “They’ve been instrumental in helping us think through our business model to identify the types of things we do that are unique. Early on, their ability to evaluate new technologies through global field trials really stood out to us. Just the scale and quality they offer is unlike anything we could achieve on our own.”

Predicting the Future of Ag Technology

Norman collaborates with a team of seven professionals in the U.S. and Europe. Their talents, he says, reflect three pillars of a successful venture ag-focused group. First, the group must understand what’s happening on the farm. “That’s critical to being able to look ahead and understand the forces affecting growers,” he says.

Second, technical expertise is essential. “A lot of the companies we evaluate are developing novel technologies,” Norman says. “If we can speak their language, we can build relationships.”

Finally, Norman says that a good venture capital team must be savvy enough to make commitments and decisions that play over a long time period, often more than five years. Making good decisions today requires understanding future challenges. “In the last 10 years, the whole ag-technology sector has changed and blossomed before our eyes,” he says.

Satellite imagery and drones, for example, felt like the stuff of sci-fi novels when Syngenta Ventures was founded, but now

they’re common sights in ag offices and fields across the world. One portfolio company, Phytech, draws on spatial imaging, hyperlocal climate information and agronomic modeling to help farmers improve their profitability.

“All of these tech trends are creating these opportunities,” Norman says. “Given how we see technologies and grower challenges evolving, our

team needs to be able to identify the key themes and investment opportunities now that will be important to growers in the future.”

When Syngenta Ventures’ portfolio companies are successful, so is Syngenta. “When we help create successful companies, we have a real impact on agriculture,” Norman says. “Our core mission is to help create new tools to make growers more profitable. For us, it’s all about the collaboration to maximize that success.”

STORY BY ROBIN SUTTON ANDERS

THE HERBICIDE UPGRADE THAT’S BRINGING WEEDS DOWN.

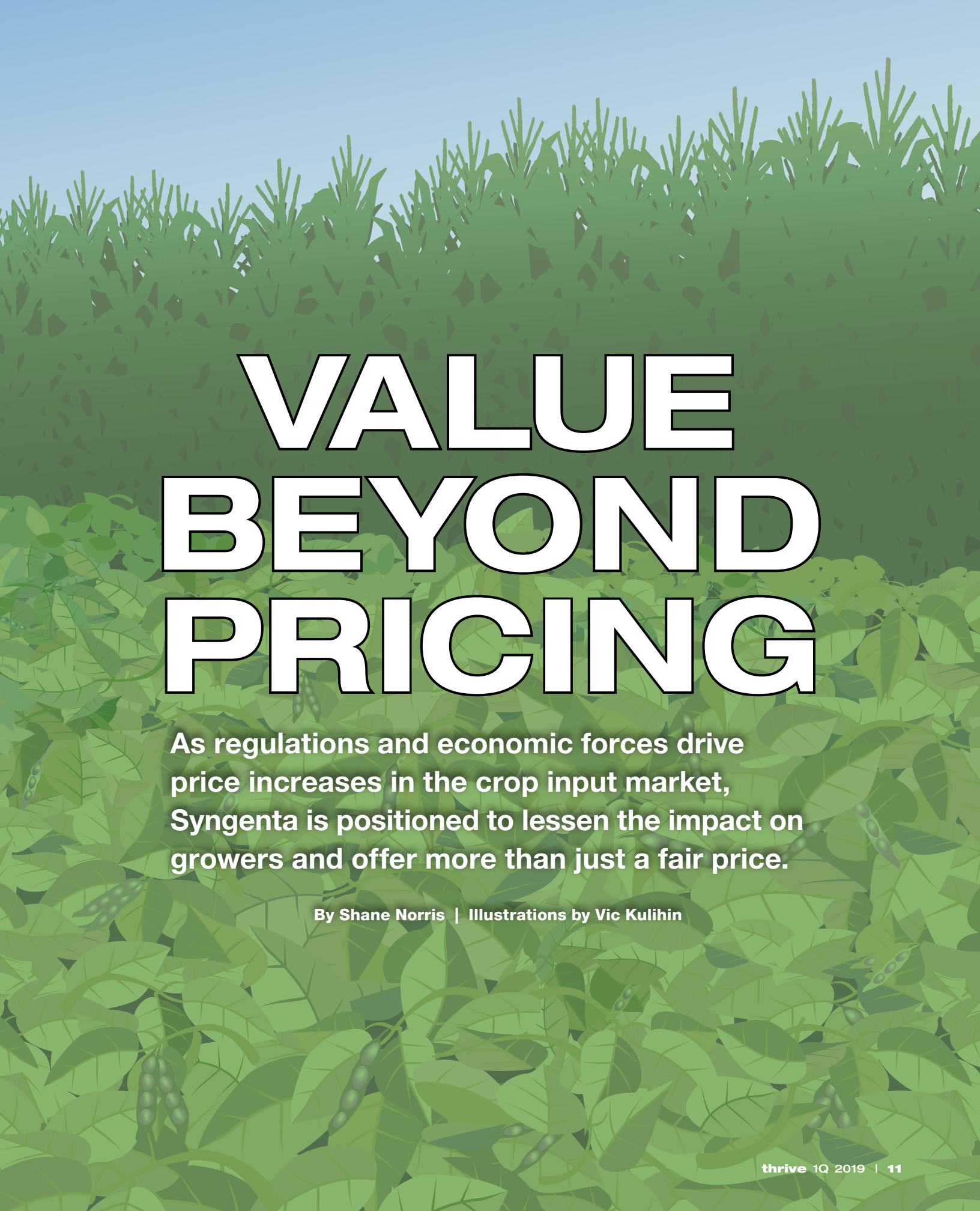
Farmers who use Acuron® herbicide know that tough broadleaf weeds, which once seemed to be laughing at everything thrown at them, can finally be silenced. Thanks to one of four effective active ingredients, called bicyclopyrone, weeds like giant ragweed, waterhemp, Palmer amaranth and marehail can be stopped all season long. Go to UpgradeYourHerbicide.com to get the last laugh.



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VALUE BEYOND PRICING

As regulations and economic forces drive price increases in the crop input market, Syngenta is positioned to lessen the impact on growers and offer more than just a fair price.

By Shane Norris | Illustrations by Vic Kulihiin

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early everyone has experienced sticker shock. Open up the cable bill and find a higher rate than last month. Pull up to the gas pump and see that the cost per gallon has risen overnight. No matter where they appear, price hikes are never welcome.

Today, higher-priced manufactured goods—from

cosmetics and pharmaceuticals to agricultural products—are a particularly unwanted trend. As the 2019 season gets underway, growers and resellers who are feeling the sting of more costly crop inputs are looking to product manufacturers like Syngenta for support.

The Driving Forces

To find solutions to problems, it's often helpful to understand what's causing them. Austin Parrish, head of business planning at Syngenta, says the factors driving up crop input prices fall into three broad categories: fewer raw materials, higher

transportation costs and less-certain trade dynamics.

According to Parrish, the primary driver of raw material shortages is the increase in environmental controls governments are placing on foreign manufacturers. In regions of the world where these raw materials originate, many production facilities are shutting down to make improvements required for more stringent regulatory monitoring and protocols.

"While there may be an unfavorable short-term impact from these shutdowns, the long-term impact for the people living in these areas is actually quite positive,"

Parrish says. "Some production zones are generating a lot of smog, and the governments in charge of the zones are focused on trying to clean it up."

Unfortunately, this effort to improve the environment is reducing overall product availability, which drives up costs not only in agricultural markets but in consumer markets as well.

Couple those challenges with changes in the transportation industry—domestically and abroad—and the problem is compounded. As with environmental regulations, the transit issues are a direct effect of an otherwise positive trend.

"Ultimately, it's about doing what's right for our customers and making sure they have quality products when they need them at a value that makes sense for their operations."

—JOHN DAVIS

BETTER IN BULK

As with any purchase, buying crop protection products in bulk has its benefits. Syngenta offers a bulk program for retailers who purchase early. With nonbulk orders, packaged products are sent to distributors, who then send them to retailers. With bulk orders, Syngenta delivers product directly to retailers, who keep tanks on location for storage.

"The retailers can get the product in one shipment or multiple shipments," explains Stephanie Neese, national bulk equipment specialist for Syngenta. "They're not dealing with bottles or smaller packages, so there's less to recycle. All around it makes things simpler."

Both retailers and growers benefit from the lower price and convenience of a bulk order.

"The bulk tanks allow us to hold a lot of our in-season needs ahead of time, which keeps our supply ahead of demand," says Brent Deppe, agronomy department manager with Key Cooperative in Grinnell, Iowa. "But for the products we'll need to ship in-season, my Syngenta rep and I can plan ahead and have those orders set up and ready to place."

Each season, retailers like Deppe count on Syngenta to make sure they have product in stock before a grower needs it—and at the best value they can offer. Deppe understands that in uncertain times, every benefit he can provide to his customers can help them receive a better return on their product investment.

"I think it's twofold. Some of the pricing incentives that we can pass on by ordering early helps," says Deppe, whose cooperative has expanded its bulk storage to 20 tanks across 10 locations. "And having a constant and reliable supply source for our growers is critical in our business. Syngenta is really helping us meet the current and future needs of those growers."

“With the economy improving in the U.S., we’ve seen the overall labor market tighten, which means fewer people are looking for jobs in many sectors, including transportation,” says John Davis, head of crop protection finished product processing for Syngenta, North America. “At the same time, as various industries improve, there’s been a huge demand for logistic services to help move more products from point A to point B, which is increasing costs for trucking and rail.”

In addition, the Electronic Logging Device (ELD) mandate requires truckers to use ELDs to monitor the number of hours they are behind the wheel—even when they are waiting in line to load and unload their cargo. As a result, transit times are growing longer for drivers who are forced to keep a tighter rein on their hours.

According to Parrish, uncertainty around foreign trade, especially regarding tariffs, is poised to alter the equation even more. “The first two rounds of tariffs didn’t impact us too heavily,” he says. “But round three and the potential round four will most likely have a large impact on the price of chemicals we use to manufacture our products—be they the active ingredients or the formulation components that go into our finished goods.”

Meanwhile those trade issues are also hitting growers directly, when it comes to the prices they’re receiving for their commodities.

“We’re seeing grain prices, particularly for soybeans, well below what we’ve experienced in the past,” says Brent Gloy, partner at Agricultural Economic Insights. “A lot of the grain that had been going to China now has to go somewhere else, and it’s usually more expensive to get it there.”

Those increasing pressures make it more important than ever for growers to find a partner who is not only working to mitigate price increases but can also offer value outside of just the sticker price.

Balancing the Scale

Parrish and others at Syngenta who began working to proactively lessen the burden of the costs to customers in 2018 understand that each challenge requires its own set of solutions.

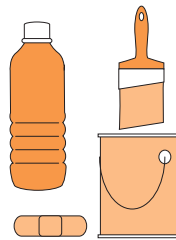
“We’re not simply passing all these costs on to growers,” Parrish says. “We recognize it’s a difficult time, since an elevation in crop commodity prices isn’t accompanying the cost increases, so we’re looking at operational efficiencies and other areas to mitigate our costs.”

Syngenta has comprehensive plans in place to improve operational efficiency heading into 2019. Given its global footprint, the agribusiness is in a good place to continue managing its manufacturing costs by using long-term,

What’s Driving Up Costs?

Despite rising costs, Syngenta is committed to providing the products and services growers and resellers need to maximize their success.

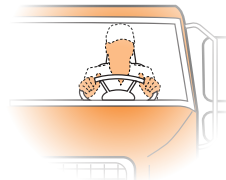
RAW MATERIALS



20 LARGE INDUSTRIES, including **pharmaceuticals, plastics and paints**, are vying for many of the **same raw materials used in crop protection products**.

MORE THAN 40% of **Chinese manufacturing facilities** have recently **closed** down due to regulatory concerns, causing a **shortage** of key **U.S. crop protection ingredients**.

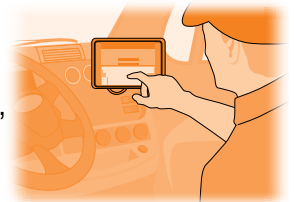
SHIPPING COSTS



NATIONWIDE TRUCK DRIVER SHORTAGE is forcing shippers to **pay a premium** in bonuses and to **prioritize shipments**.

ALSO

The **ELECTRONIC LOGGING DEVICE** mandate is increasing transit times for truckers who must **log all work hours**, including time spent waiting in line for loading and unloading.



36 MILLION-TON **INCREASE** in demand for **chemical shipments** across industries is expected by **2020**, which is **+1.8 million shipments**.

BUT ONLY

1 IN **12** trucks will have the **proper equipment** to help **move the freight** on time.

DELIVERING VALUE

To bolster innovation while minimizing the impact of cost increases, Syngenta has put steps in place throughout the supply chain to help soften the impact of a down market.

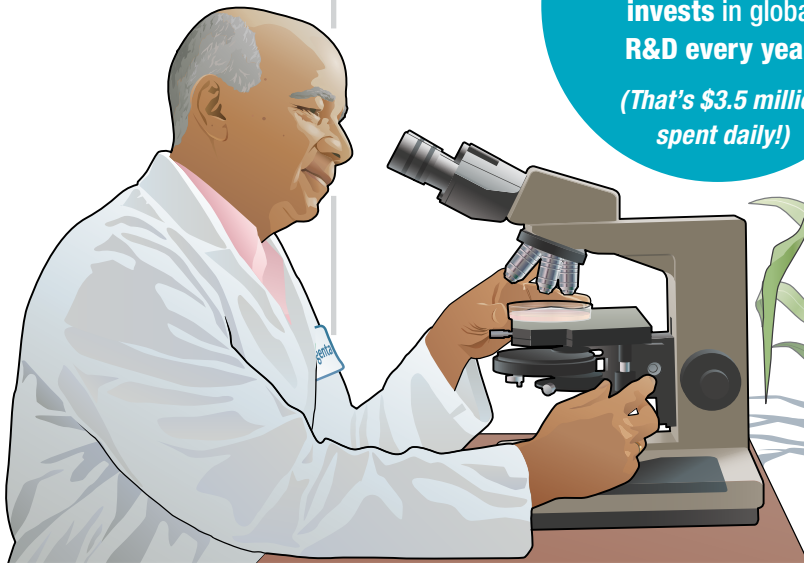
IN THE LAB

\$90 MILLION

and **10.8 YEARS** are the industry averages for **bringing a new active ingredient** to the **market**.

\$1.3 BILLION is the amount Syngenta invests in global R&D every year.

(That's \$3.5 million spent daily!)

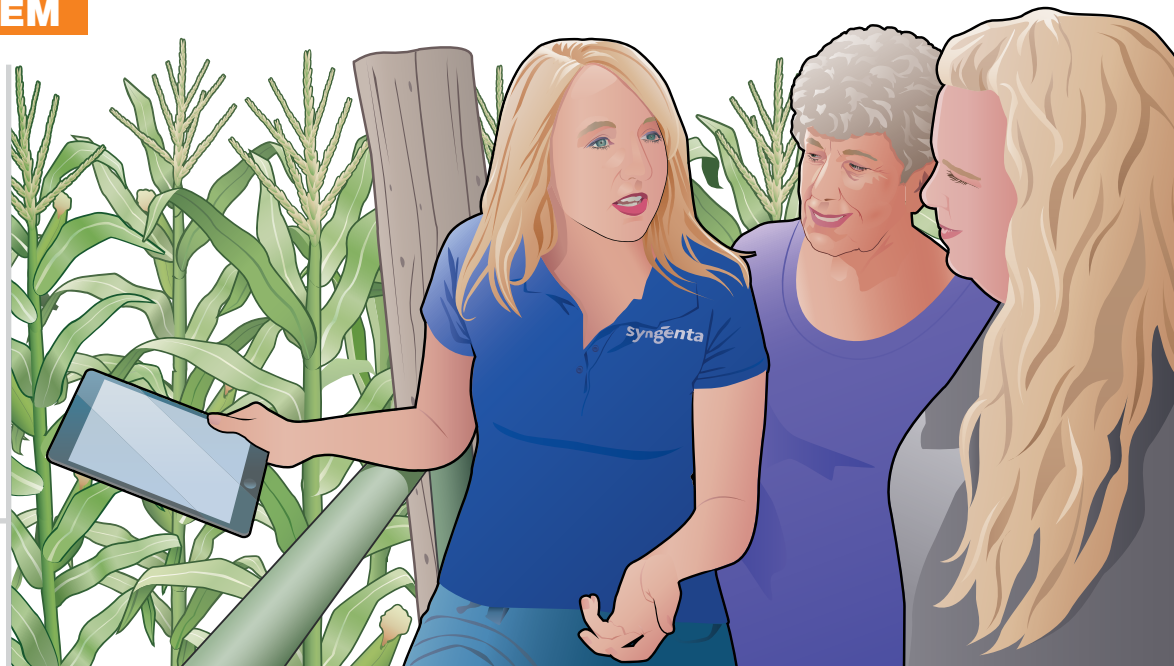


SUPPORT SYSTEM

250+

NUMBER OF EXPERTS

Syngenta has in **sales and agronomy** at the **farm level** in the U.S.



IN THE FIELD

The Syngenta **industry-leading portfolio** includes

37
SEED TREATMENTS

34
HERBICIDES

44
FUNGICIDES

21
INSECTICIDES

+
4 NEW ACTIVE INGREDIENTS and
15 NEW BRANDS
will be introduced
to the market
BY 2020.



strategic relationships with a number of raw-material suppliers. Additionally, Syngenta maintains partnerships with more than 20 trucking companies and 17 bulk shipping terminals to help ensure timely deliveries.

“We’ve had a long history of using lean manufacturing techniques and continuous improvement methods,” Davis explains. “Every year, our teams are looking at how they can drive and improve manufacturing efficiency and how they can reduce waste and energy usage. Ultimately, it’s about doing what’s right for our customers and making sure they have quality products when they need them at a value that makes sense for their operations.”

Those efficiencies don’t go unnoticed by customers, either. Agronomy Department Manager Brent Deppe at Key Cooperative in Grinnell, Iowa, works with his Syngenta rep, Alex Ogren, year-round and counts on the company’s reliable logistics.

“From a logistical standpoint, Alex and I will do a lot of preplanning ahead of any ordering deadlines and forecast our way through the year. It’s a pretty seamless process,” Deppe says. “We’re fortunate enough to have the relationship in place with Syngenta that if we have a late spring or some issue that changes our forecast, we usually get an instant response and see product turn-around pretty quickly.”

Nonstop Innovation

While teams at Syngenta are working to absorb cost increases as much as possible, the company hasn’t slowed its industry-leading pace to develop innovative new tools for the farm. For example, its goal of bringing four new active ingredients and 15 new brands to the market by 2020 is still firmly in place.

“Our success really depends on our customers’ success,” Parrish says. “And for them, it’s not always about looking at the cost side of the equation, but rather focusing on the return on investment our crop protection portfolio provides.”

To maintain a powerful portfolio, Syngenta invests \$1.3 billion into research and development each year. Much of that goes toward the development of new crop protection products, which can cost up to \$286 million per product and take more than 10 years to develop. Additionally, Syngenta couples its innovative product portfolio with more than 250 experts in sales and agronomy at the farm level across the country.

“The key for us has been having visibility and transparency with Syngenta,” Deppe says. “I’m sure 2019 will bring a few surprises. But given the relationship and trust we have with Syngenta, I know we’ll be able to handle whatever comes our way.”

IN TRANSIT

Syngenta has formed **PARTNERSHIPS** with

17 BULK TERMINALS,
A DEDICATED RAIL
CAR FLEET



20 TRUCKING
COMPANIES.




BREAK THE WEED SEED BANK



SEE MORE PHOTOS.
www.syngentathrive.com/farmproduction





Left to right: Colten Katz, Jim Katz and Danzey Nickel confer on the coming season in a no-till cornfield on Jim's farm in Lewis, Kansas.

GROWERS SHOULD TAKE A PROACTIVE APPROACH TO MANAGING RESISTANCE AND KEEPING THEIR HERBICIDE PROGRAMS EFFECTIVE.

BY DARCY MAULSBY | PHOTOGRAPHY BY JASON RYMAN

TROUBLESOME WEEDS are nothing new, but farmers on the western plains of Kansas knew something was changing, when kochia became even tougher than normal to manage in 2010. Then, not long afterward, herbicide resistance took the state by storm.

“We saw our first resistant Palmer amaranth around 2012,” says Colten Katz, a partner at Turon Mill & Elevator, Inc., in Turon, Kansas. “Now, about 90 percent of the pigweed in the state is resistant to glyphosate.”

Palmer amaranth, marehail and kochia are three of the hardest weeds to manage in the region and have earned Kansas an unwanted distinction. “Kansas is third in the nation, behind California and Illinois, in terms of unique resistant weeds,” says Katz, whose family farm is located in south-central Kansas.

Pigweeds, including waterhemp and Palmer amaranth, tend to be the driver species with herbicide resistance,

notes Aaron Hager, Ph.D., an associate professor and Extension weed specialist at the University of Illinois. “Resistance reflects an evolutionary process,” he says. “Once resistance exists in a waterhemp population, it doesn’t go away.”

While it can take a while for resistance to take hold, there’s

no turning back after resistant seeds—spread by birds, wildlife, the movement of farm equipment and other methods—take root.

“Resistance is a slow build at first,” says Dane Bowers, technical product lead for herbicides at Syngenta. “But eventually, things reach a tipping point, and resistance can explode.”

Glyphosate resistance revealed just how abruptly this transformation can occur in corn and soybean fields. “Glyphosate was cheap and effective,” says Ethan Parker, Ph.D., a Syngenta research and development scientist at the Vero Beach Research Center in Florida. “When growers started using it intensively, though, resistance to glyphosate developed much faster than they expected.”

Resistance isn’t just a chemistry issue. (See “Manage Metabolic Resistance,” page 19.) In the rice fields of Asia, one weed developed resistance as a result of hand-weeding practices, says Gordon Vail, Ph.D., technical product lead for herbicides at Syngenta. People pulling weeds would skip the barnyardgrass that looked like rice, which allowed the weeds to reproduce.

Any sort of weed-management practice, if it’s the only method used year after year, will promote changes in weed populations, Hager says. Despite the intense weed pressure

many growers are facing today, low commodity prices can make it tempting to choose the cheapest weed-management option.

“Making a living in farming is challenging, especially now,” Bowers says. “Going with the cheapest option, however, could provide a poor return on investment, if it’s not the right solution to manage your weeds. Can you afford to take such a high risk in times like these?”

Stop Filling the Weed Seed Bank

The ultimate goal of an effective weed-management program is to prevent weeds from going to seed. “One miss and you can have a few million weed seeds enter the weed seed bank,” Vail says. “Then weed management becomes an uphill battle.”

The good news is that there are ways to mitigate the risk of resistance while managing weeds effectively. “Being proactive is the key,” Parker says.

Options include:

- > Planting cover crops
- > Using tillage, when appropriate
- > Chopping out resistant weeds by hand, if necessary
- > Developing an effective resistance-management program that includes overlapping residual herbicides and multiple effective sites of action

“While resistance is an evolutionary process, we can influence the rate of this process,” Hager says.

With the Resistance Fighter® program from Syngenta, growers can depend on localized solutions from Syngenta agronomy experts who live and work in their area. The program also offers growers many effective pre-emergence and post-emergence herbicides to help them manage difficult weeds.

One proven pre-emergence option for soybeans is Boundary® 6.5 EC herbicide, which delivers early-season grass and broadleaf control. It provides two effective sites of action against weeds like waterhemp and Palmer amaranth that are resistant to glyphosate, PPO and ALS inhibitors. Its combination of active ingredients knocks weeds out early with residual control that keeps them down.

Another option is BroadAxe® XC herbicide, which provides excellent control of driver weeds like waterhemp and Palmer amaranth, with the addition of morningglory and kochia—weeds in the upper Midwest that evade most other herbicides.

“We’re getting smarter about the weed-management products we use and the application timing,” says Katz, who applies BroadAxe XC around mid-March for early-season weed management and long-lasting residual control.

Katz also relies on Prefix® herbicide to manage grass and broadleaf weeds. Application flexibility means growers

“Every farmer I know is willing to invest more, if it means the difference between fighting weeds and not having them.”

—COLTEN KATZ

can apply Prefix either pre-emergence or early post-emergence in soybeans, with residual control that lasts up to five weeks. Prefix also has a tank-mix compatibility profile that enables it to enhance most popular herbicide programs.

“By the time we apply Prefix, there’s still some residual weed control from BroadAxe XC, so we’ve got a really good start with weed control,” says Katz, who uses the same products on his family’s farm that he recommends to his customers. “It’s always better to prevent weeds from emerging than to try to control them later.”

Proprietary Resistance Fighter modeling from Syngenta shows that residual herbicides—like Boundary 6.5 EC, BroadAxe XC and Prefix—also help maintain the viability of Roundup Ready 2 Xtend® soybeans and dicamba herbicide technology in resistance-management programs.

Season-long weed management continues with Flexstar® GT 3.5 herbicide to combat weeds that are difficult to manage with glyphosate alone or resistant to glyphosate and/or ALS-inhibitors. It contains two active ingredients for use in soybeans and cotton.

“There are players and pretenders in the crop protection business,” says Katz, whose company has been in business since 1892. “I like the consistency, quality and safety of Syngenta products. Syngenta has never let us down.”

Upgrade to Acuron

When it comes to weed control in corn, Katz and his father, Jim, who farms near Lewis, Kansas, like Acuron® herbicide

from Syngenta. Acuron contains four active ingredients and three effective sites of action for multi-targeted control of giant ragweed, common ragweed, Palmer amaranth, waterhemp, marehail, kochia, cocklebur, morningglory and other weeds.

“Acuron has done a really good job of controlling weeds for us,” Jim Katz says. “We’ve tried some other products and generics that didn’t work well, and they cost us lots of money. It’s worth spending a little more money on Acuron to get a clean field.”

Effective weed management also helps maximize yield potential. In 2016, university and Syngenta trials comparing Acuron to competitors, including Corvus® and Verdict®, showed average yield advantages of 10.5 and 16.5 bushels per acre, respectively, with Acuron, Vail says.*

Successful weed management for any crop requires taking the long view, he adds. “Investing in the right management practices and weed-control products up front pays dividends for years to come.”

Growers are becoming more proactive about resistance management, says Katz, who promotes a “start clean, stay clean” philosophy. “Every farmer I know is willing to invest more, if it means the difference between fighting weeds and not having them.”

*Acuron 1X PRE herbicide compared to Corvus 1X PRE herbicide—Head to head in 18 Midwestern replicated trials, 2016
Acuron 1X PRE herbicide compared to Verdict 1X PRE herbicide—Head to head in 15 Midwestern replicated trials, 2016

MANAGE METABOLIC RESISTANCE

What if it were possible for weeds to not only resist the herbicides used today, but herbicides that haven’t even been developed yet?

“It’s possible with metabolic resistance, which is a scary form of herbicide resistance,” says Dane Bowers, technical product lead for herbicides at Syngenta.

To understand metabolic resistance, it helps to look first at target-site resistance. Historically, this is the type of resistance that farmers deal with most often. “Every herbicide has a specific target site in a plant,” says Aaron Hager, Ph.D., associate professor of weed science at the University of Illinois. “The herbicide has to bind to that target site and effectively shut it down to kill the weed.”

Resistance can occur when changes in the target site stop the herbicide from effectively binding there. “It’s like when you spill water on cardboard puzzle pieces and warp them,” says Ethan Parker, Ph.D., a research and development scientist at the Syngenta Vero Beach Research Center in Florida. “Those pieces no longer fit.”

On the other end of the spectrum, non-target-site resistance, or metabolic resistance, is more complex. In this type of resistance, weeds develop the ability to rapidly metabolize or break down the herbicide before it can cause significant damage. Most of the triazine herbicide resistance in waterhemp in Illinois, for example, is coming from metabolic resistance, Hager says.

“The weed develops a hypersensitive response that shifts into overdrive and allows the weed to metabolize the herbicide and survive,” Hager says.

Scientists don’t yet know how many genes might be involved in metabolic resistance. It could be one or two, or 200, Hager adds.

Whether you’re dealing with metabolic resistance or target-site resistance, the management method remains the same: Use multiple effective herbicide sites of action. Also, incorporate diversified cultural practices, like crop rotation and cover crops, Parker says. “Being a good steward is the key to managing resistance issues.”

Photo: A cover crop of turnips grows in a no-till field.





THE BAKER AND THE BREEDER

A continued commitment to quality sets the AgriPro® brand wheat portfolio apart, while supporting the needs of a dynamic value chain.

By Karyn Ostrom

Clockwise from left: At the Syngenta wheat quality lab in Berthoud, Colorado, lab manager Cathy Butti operates a mixograph; a wet yeast solution sits next to loaves of bread from the Canadian bread process; quality technician Brigette Maestas conducts a test; the greenhouse at the Berthoud lab supports limited spring wheat breeding trials; the Berthoud-based team analyzes grain, including hard wheat shown here, at various milling processing stages.



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www.syngentathrive.com/research



As an assistant plant scientist at Syngenta, Joy Battistone carries out her tasks with diligence, focus and precision. Her daily routine, however, is not consumed with the tasks one might associate with a research and development (R&D) professional. For the past two decades, she has donned an apron,

instead of a lab coat, and spent her workdays baking cookies and loaves of bread at the Syngenta wheat quality lab to evaluate how various experimental Syngenta wheat varieties will perform—not in the field but in a bakery.

“All varieties have inherent end-use quality characteristics that can’t necessarily be predicted by breeders,” Battistone says. “The information we provide, based on the tests and evaluations we conduct at the wheat quality lab, helps breeders determine whether or not to continue with the development of certain varieties, which can save them time and resources early on in the R&D process.”

Location, Location

Located in Berthoud, Colorado, a sleepy town near the foothills of the Rocky Mountains, the Syngenta wheat quality lab is home to a full mill and bake lab, which has been in operation since 1979. There, Cathy Butti, Syngenta wheat quality lab manager, and her team receive grain harvested from experimental wheat varieties from Syngenta wheat breeders throughout North America—varieties that have excelled in yield and agronomic evaluations and for which breeders are seeking information on end-use characteristics, like protein content, gluten strength and other factors that are vital for millers and bakers.

“All of us who work at the Berthoud site are very passionate about quality,” Butti says. “Since quality is not determined solely by

genetics, there will always be a need to assess it. Our objective is to provide breeders with reliable and consistent data on essential end-use quality characteristics for hard and soft wheat experimental lines throughout the various regions and wheat classes of the U.S. and Canada.”

Five-hundred miles away, in the heart of the Wheat Belt, Breeding Lead Sarah Battenfield, Ph.D., and a team of Syngenta wheat breeders, based in Junction City, Kansas, are tasked with developing new AgriPro® brand wheat varieties. To say their work is complex would be an understatement, given the crop’s natural means of reproduction by self-pollination, an extended growing cycle that translates to significant gaps between crop generations, three distinct genomes comprising modern wheat’s genetic profile, and an ongoing quest to deliver high-yielding varieties that produce high-quality grain.

For Battenfield and her colleagues, end-use quality is just one of many factors considered during the R&D process. They monitor and evaluate yield and agronomic characteristics, like disease resistance, first and foremost. Only experimental varieties that perform as well as or better than existing commercial varieties in the field proceed to the next stage of the screening process at the wheat quality lab.

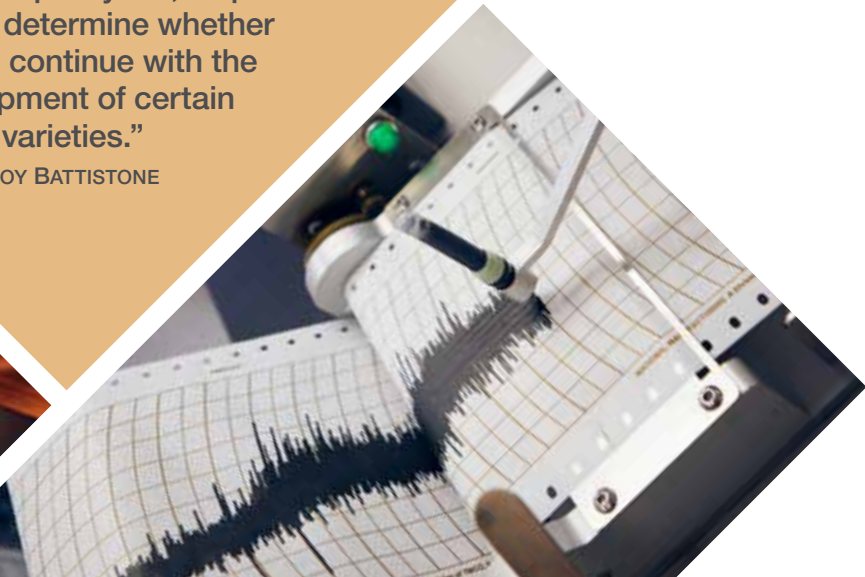
“Quality is an absolute,” says Battenfield, who turned her attention to wheat quality as a doctoral student. “As breeders, we are always looking for the next best variety, and we are the gatekeepers ensuring that new varieties have high-quality characteristics. Having the support and wealth of knowledge from the quality lab makes it possible for us to understand quality-related implications when making decisions about the future of our commercial wheat varieties.”

Up to the Test

When wheat samples arrive at the wheat quality lab, workers organize them and assign to them unique barcodes, which accompany the samples throughout the various

“The information we provide, based on the tests and evaluations we conduct at the wheat quality lab, helps breeders determine whether or not to continue with the development of certain varieties.”

—JOY BATTISTONE



iterations of milling and baking tests. These testing protocols follow the procedures established by the American Association of Cereal Chemists International.

Tests vary by wheat class and development stage but may include sophisticated imagery technology to assess grain protein and hardness, milling processes to examine potential flour yield, and specialized instruments to measure properties that are critical to the success of industrial baking operations. Testing the mixing properties of flour, for example, requires a mixograph, a pin mixer that combines small samples of flour and water to produce dough, while recording the resistance of the dough. The resulting mixogram, a collection of graphs, not unlike a Richter scale reading, provides valuable insight into gluten strength, absorption, mixing peak time and mixing tolerance.

In the bake lab, Battistone's cookie- and bread-baking work isn't as carefree as it might sound. Baking for the purpose of evaluating end-use characteristics requires consistency, repetition and complete focus. The baking protocols Battistone employs are thoroughly scientific—from the number of times and the direction in which the cookie dough is rolled, to the orientation of the bread dough roll when placed in the loaf pan, seam side down.

"Consistency is really important so we can ensure that flour is the only variable that changes and that the wheat variety is the only unique factor being evaluated," Battistone says.

Battistone analyzes several capacities of the baked goods. For a cookie, which is made using soft wheat, the primary distinguishing characteristic she looks for is cookie diameter, but top grain—the vast network of textured cracks in the cookie's surface that is desirable in a sugar cookie or snickerdoodle—is also key. For lines evaluated for Canadian bread products, Battistone evaluates the break and shred—which is the loaf-top ratio or the way in which the bread rises above the confines of the pan. Also important is the color of the loaf—analyzed with the help of a specialized color booth—as well as the inner texture of the cut loaf, which should be soft, silky and slightly spongy to the touch. Generally, for all products, the least amount of flour a baker can use to fill their packaging is most desirable as long as other characteristics are good.

The Pursuit of a Better Crop

As Battenfield presses onward in pursuit of developing wheat varieties with end-use quality characteristics, a photograph depicting her childhood self in her father's wheat field reminds her why she has chosen this path.

"I grew up with wheat," she says. "It's where I came from and what I know. I've seen firsthand how difficult it is to be a wheat farmer, and in my role, I'm doing what I can to help farmers grow better crops." 🌱

Left to right: Assistant Plant Scientist Joy Battistone analyzes pan bread attributes of a rising pup loaf in the Berthoud facility's bake lab; a mixograph at the Syngenta wheat quality lab measures the resistance of dough, when mixed, and provides valuable information about the flour's gluten strength, flour water absorption and other mixing characteristics.

AGRIPRO DELIVERS QUALITY

Quality is an important hallmark of the Syngenta AgriPro® brand wheat portfolio. For decades, the company has been delivering wheat varieties with better-than-acceptable quality standards. According to Paul Morano, AgriPro key account manager, this self-imposed obligation to quality is rooted in integrity and business sustainability.

"Quality is absolutely essential to the long-term success of U.S. wheat producers," he says. "As the world's largest commercial cereals seed breeder, we plant our varieties on a lot of acres, and we want those varieties to deliver high-quality grain for millers and bakers, in addition to favorable yields for growers."

Each year, Syngenta generates more than 20,000 new experimental wheat lines from research sites across the U.S. and Canada. Its scientists screen these experimental lines at more than 150 testing locations and 90,000 yield plots for agronomic characteristics, regional adaptation and yield potential. Syngenta also evaluates the lines for milling and baking quality to help breeders determine which ones should advance to the next stage of testing.

As a result of this rigorous and localized research process, AgriPro wheat varieties are top performers that consistently rank in the top yield group in every U.S. region.

"We are fortunate to have a deep genetic pool and a tradition of quality," Morano says. "Our breeders and commercial teams are also very much in tune with the needs of the market and the grower, who is always front and center when it comes to building our portfolio."



Corey Dathe, an AgriPro rep, examines a stalk of AgriPro wheat in Crookston, Minnesota.

Top of the Class

The 2018 Syngenta Agricultural Scholarship winners aspire to help feed the world's growing population.



Every applicant of the 2018 Syngenta Agricultural Scholarship had a unique spark that first ignited his or her passion for agriculture.

For Uzoamaka Abana, the 2018 national winner at the master's level, that spark was her grandmother's self-sufficient farm in Nigeria. She recalls being fascinated, as she watched crops bear fruit and livestock develop to provide meat. But as a young child visiting her grandmother's village, she also developed a deep, personal understanding that agriculture could be challenging.

"My grandmother's crops and animals did not do well at times, which inspired me to want to figure out why and how it could be done better," Abana says.

Based on those formative experiences, Abana has decided to pursue a career in agriculture and help farmers be more productive, so they can provide food for their

communities and the growing worldwide population. She is currently a graduate student in plant science at Tennessee State University.

Joining Abana in the 2018 scholarship winner's circle is Sierra

Williamson, the bachelor's-level winner who is majoring in food and agricultural business at the University of Minnesota.

Williamson's unique spark to pursue a career in agriculture was her family. She was raised in rural Minnesota, where her father and grandfather worked in the seeds business. They instilled in her a respect for the farmers who helped put food on her table.

While growing up, Williamson sought out leadership and volunteer opportunities to learn and grow within the agriculture industry. "The National FFA Organization has been a source of inspiration in choosing the direction of my future," Williamson says. "My FFA journey has opened doors to opportunities as a student and is leading me to a promising future."

Supporting Education

In addition to this year's two national scholarship winners, Syngenta awarded the fifth-annual Syngenta Agricultural Scholarship to five other regional winners in October. The scholarships will help bolster their academic and career aspirations. These students represent the future of the agriculture industry, and Syngenta is proud to support agricultural education through the scholarship program.

The winners of the regional scholarships at the master's and bachelor's levels are all promising students focused on careers in agriculture. Bachelor's-level winners were Jake Johnson (Mississippi State University), Kayla Beechinor (Washington State University) and Dana Mulligan (Virginia Tech). At the master's level, recipients were Alexa Davis (University of Nebraska–Lincoln) and Kaitlin Hadaway (Washington State University).

For these winners and all of the other 2018 applicants, the centerpiece of the scholarship application was an essay in which they told their personal stories of how they became "rooted in ag." Applicants described the event, person or moment in their lives that ignited their passion for agriculture and inspired them to pursue a career in the field. While all of the winners of the 2018 Syngenta Agricultural Scholarship found their way into agriculture

Above: Syngenta Agricultural Scholarship winners Sierra Williamson (left) and Uzoamaka Abana (right) join Wendell Calhoun, Syngenta communications manager, at the 2018 awards ceremony in Minneapolis.

along different paths, they all share the same lofty goal—to help feed the world.

Meeting Future Challenges

The global need for food is exploding, as the world's population rises and available farmland diminishes, creating a vital challenge for the agriculture industry. Both Abana and Williamson say this challenge is part of what drew them into agriculture and inspires them to pursue careers in the field.

Abana will use her scholarship to complete her master's degree, and she plans to be involved in agricultural extension services. In that role, she aspires to be a "dedicated and proactive member of a dynamic and highly motivated research team."

Williamson will use the award to continue her degree with a long-term objective of solving the "problem of providing adequate food to feed the world." In her scholarship essay, she writes, "I hope my career will contribute to meeting future food demands, making sure food supplies are safe and nutritious, creating safe farming environments, and providing jobs to those who have none."

Empowering Students

Past scholarship winners have found the award instrumental in furthering their studies and giving shape to their future career goals.

Abigail Han, the 2017 national bachelor's scholarship recipient, says the award has enabled her to pursue opportunities, without the added financial stress that internships and other activities can bring.

"Getting the scholarship changed my perspective of myself in this industry," Han says. "It has empowered me to go out and find opportunities in this field that I wouldn't have sought otherwise."


After graduation, Han will return to Kansas to complete a yearlong research co-op with the Land Institute and then plans to pursue a doctorate in an agricultural-related field.

Aimee Uyehara, the 2017 master's-level winner, is currently earning her doctorate in plant biology at the University of California, Riverside. She says the scholarship has given her the confidence boost and financial stability to pursue a higher degree and become a mentor, much like the professors who inspired her.

"I want to contribute to the field in the form of mentorship and provide research experience for undergraduate students," Uyehara says.

Syngenta is proud to support these and other students' continued education, as they help shape the future of the agriculture industry. For more information on how to apply for the 2019 Syngenta Agricultural Scholarship, visit www.syngentaus.com/scholarships. 🌱

STORY BY CHRIS CONWAY

A young boy with blonde hair, wearing a grey long-sleeved shirt and blue shorts, is running away from the camera down a dirt path in a lush green cornfield. The corn plants are tall and vibrant green. In the background, there are rolling green hills, a line of trees, and a farm with several silos and a red barn under a cloudy sky.

"I hope my career will contribute to meeting future food demands, making sure food supplies are safe and nutritious, creating safe farming environments, and providing jobs to those who have none."

—SIERRA WILLIAMSON

A young boy runs alongside a Wisconsin cornfield.

On the Level

When countries set different maximum residue levels, those regulations can impact access to export markets and new crop-protection technologies.

Any time a new pesticide is registered for use on a food or feed crop in this country, the U.S. Environmental Protection Agency (EPA) establishes a maximum residue level (MRL) for that crop protection product and crop. In simple terms, MRLs are the highest levels of pesticide residue legally tolerated in or on food or feed.

It sounds straightforward, but as countries around the globe modernize their food standards programs, they often establish their own national MRLs, which may be different from those established by the EPA. The potential gap between U.S. approvals and foreign Import Tolerances (ITs) or MRLs is a trade issue that affects all pesticides. With one out of every three planted U.S. acres bound for export, the lack of global MRL harmonization is a growing concern.

A Trading Standard

MRLs are always set at far lower levels than any toxicologically

significant levels; and because of this approach, residue levels are not about safety, says Heidi Irrig, North America MRL and senior regulatory manager for Syngenta.

The method regulators use to calculate MRLs ensures a wide safety margin. First, researchers conduct multiple field trials under the principles of Good Laboratory Practices to determine the maximum amount of residue

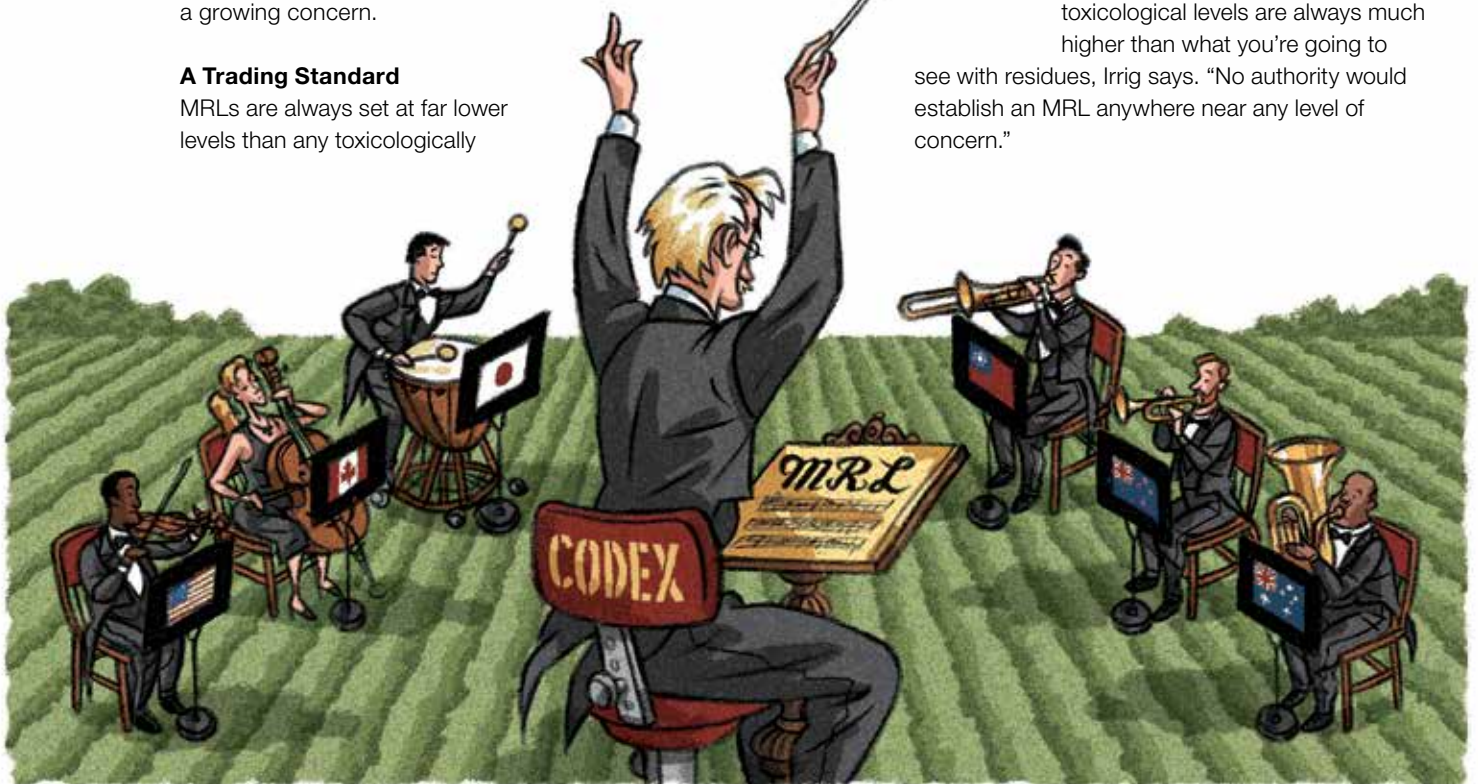
that could remain on the crop, when growers apply the pesticide according to the product's label instructions. Then, authorities like the EPA look at consumption data—how much a person might consume in a day or a year—to calculate realistic exposure scenarios.

Toxicology studies determine the level of exposure that could have any adverse effect on animals, humans or plants; and those toxicological levels are always much higher than what you're going to

see with residues, Irrig says. "No authority would establish an MRL anywhere near any level of concern."

"At Syngenta, we understand the desire to have MRLs established around the world when we introduce a product."

—HEIDI IRRIG



Trade Troubles

This risk-based model of assessing the hazard of a chemical and probable exposure from dietary consumption is the legal standard in the U.S. and many other countries—including Japan, Canada, Australia and New Zealand—and it's consistent with obligations under the World Trade Organization (WTO).

"In the case of agriculture, the WTO requires members to base their measures on an assessment of the risk, and risk is defined by the Codex Alimentarius Commission (Codex) as hazard times exposure," says Daniella Taveau, a former trade negotiator with the EPA. The Food and Agriculture Organization of the U.N. and the World Health Organization established Codex as the body to protect consumer health and promote fair practices in food trade. Importantly, WTO membership requires adoption of Codex standards, unless a country has scientific justification for deviating from the standard.

"But many countries continue to maintain protectionist regimes by establishing measures related to MRLs that are really a guise for restricting trade," she adds. For example, the European Union (EU) has one of the most trade-restrictive frameworks in the world when it comes to MRLs and agricultural biotechnology.

At the heart of the EU regulatory framework is a hazard-based approach. "The EU regulators have said they're not going to take exposure into consideration," Irrig says. "If a chemical is hazardous, they just don't review it any further." A lot of chemicals probably won't pass these hazard-based criteria, she adds.

"While precaution is part of regulatory frameworks around the globe, it is possible to abuse the use of precaution," Taveau says. "Hazard-based approaches that don't consider exposure pathways are inconsistent with modern science and are a clear violation of members' obligations under the WTO to base measures on an assessment of the risk."

The Case of Elatus Fungicide

Fortunately, progress toward harmonizing MRLs around the world continues to occur. Recently, there was an important breakthrough with MRLs, which positively affects the ability of more potato growers to use Elatus® fungicide.

"We had harmonized MRLs for benzovindiflupyr, the active ingredient in Elatus, in most of the U.S. potato export markets, except Taiwan," Irrig says. "This is an example of the complexity of MRLs: Potato growers often decide to use a product or not based on whether MRLs exist in all export markets. The lack of an MRL in Taiwan was keeping an excellent product from being used."

In September of this year, Taiwan officially proposed an

MRL of 0.02 ppm [parts per million] for benzovindiflupyr, the same as the U.S. MRL.

"Taiwan is likely to officially establish this MRL by the end of this year, in time for the next potato growing season," Irrig says. "This is huge news; we are now able to offer a great product to potato growers for the control of *Rhizoctonia* or black dot and silver scurf." Elatus also has a Section 2(ee) label for *Verticillium* wilt, which no other fungicide in the potato market has. A 2(ee) provision allows growers to use pesticides under certain limited conditions that are not specified on the label.

Synchronizing the Globe

Having MRLs established around the globe could help eliminate such issues, and there's work going on toward making that happen, Irrig says. Codex, comprised of independent science reviewers from governments around the world, establishes MRLs (known as Codex MRLs or CXLs) for use by countries that do not have national food standards programs or establish national MRLs. The Organization for Economic Cooperation and Development, made up of 36 member countries, is another venue working on standardizing testing and data requirements used to establish MRLs. Meanwhile, organizations like CropLife America and CropLife International, which are composed of agricultural chemical registrants, are discussing ways to facilitate and advance harmonization. Syngenta participates in and supports those efforts, too.

"At Syngenta, we understand the desire to have MRLs established around the world when we introduce a product," Irrig says. "Our dream is to introduce a product and have a grower use it in the U.S., according to the label, without having to worry about where their crop is going and whether an MRL has been established in the export market—that's our goal."

About MRLs

The potential gap between U.S. approvals and foreign import tolerances or MRLs is a global trade issue that affects all pesticides. The approach of Syngenta regarding MRLs is all about transparency and engaging proactively with our channel customers, growers and exporters to present current MRL information. Syngenta is engaged in ongoing international efforts to harmonize MRL standards. As MRLs may change from time to time, please check with the Environmental Protection Agency and U.S. Department of Agriculture Foreign Ag Service Global MRL Database (www.globalmrl.com/db#query) for a complete list. 🌱

STORY BY SUZANNE BOPP

Stay in Bounds

Growers and applicators should use caution and all the information and tools available to mitigate spray drift.

Pesticides play a key role in making cropland more productive. But exposing unintended sites, including non-target crops, to chemicals through spray drift can result in wasted product, crop damage and thousands of dollars in claims. More importantly, it can cause injury to people, livestock and environmentally sensitive areas.

Spray drift can happen during pesticide application, when droplets or dust travel away from the target site. To reduce the chances of accidental pesticide movement, the agricultural community, including Syngenta, is investing in research and development geared to improve spray nozzles and pesticide-delivery technology.

“Syngenta has made significant investments in the science of spray drift,” says Mark Ledson, leader of the application technology group in formulation development at Syngenta. “And we work with regulators and university Extension specialists to communicate to users best practices for mitigating spray drift.”

A Next-Generation Nozzle

One example is the partnership between Syngenta and Pentair Hypro, a spray nozzle manufacturer. Together, the two companies have engineered the new-generation Pentair Hypro® 3D Nozzle. It alternates backward and forward on a boom to provide three-dimensional coverage of vertical targets, including grass weeds, soybeans, cereals and soil clods.

The nozzle also helps to reduce drift by 60 percent to 75 percent at low pressures, compared with a standard flat fan without air induction. That level of drift reduction allows more product to cover plants and provide better pest control, says Nick Fleitz, an agronomist at Pentair Hypro.

“We’ve developed protocols in wind tunnels and field tests. And Syngenta has tested the nozzle all over the globe, including in Brazil, under intense disease and insect pressures.”

—NICK FLEITZ



The Hypro 3D nozzle was co-developed with Syngenta to provide enhanced coverage while reducing spray drift.

“We’ve developed protocols in wind tunnels and field tests,” Fleitz says. “And Syngenta has tested the nozzle all over the globe, including in Brazil, under intense disease and insect pressures.”

Fleitz reports that the Syngenta fungicide field trials in soybeans in Brazil showed a 10 percent yield increase using the 3D nozzle, versus other standard nozzles, due to better coverage and canopy penetration.

Balancing Efficacy and Spray Drift Mitigation

Coverage for many pesticides, including the Syngenta portfolio of crop protection brands, is best with small droplets, but can also be good with larger spray droplets, such as those resulting from air-induction nozzles. The key is finding the sweet spot between optimal efficacy and drift mitigation, Ledson says.

To help growers and applicators reach that sweet spot, equipment manufacturers like John Deere are on a constant quest to develop new technologies. For example, John Deere’s ExactApply™ nozzle-control system maintains consistent droplet size and pattern across a wide range of speeds, while reducing drift. This John Deere system also offers pulse-width modulation that allows the sprayer to operate at a consistent pressure and droplet size, regardless of sprayer speed and application flow rate.

Pulse-width modulation systems can maintain nozzle flow rate across a wide range of sprayer speeds and minimize overlap with individual nozzle control and flow-turn compensation, according to University of Nebraska research.

Check the Label

No one nozzle fits all spraying conditions. To help growers and applicators determine which nozzle may be best suited for the intended use, pesticide manufacturers, including Syngenta, have added recommendations on specific nozzle types to their product labels over the past several years.

Product labels also include information on carrier rates, droplet sizes and drift precautions, along with additional guidance that may prohibit applications under certain weather conditions.

“At Syngenta, we take spray drift mitigation very seriously,” Ledson says. “In the long run, the consequences of repeated spray drift can mean that growers lose access to key control tools in their toolboxes. We want to be part of the solution, so we encourage our customers to read our product labels carefully.”

Drop by Drop

Besides pesticide manufacturers, many groups are available to advise growers and applicators on how to prevent or minimize drift. One such group is the National Pesticide Information Center, which offers the following general guidelines:

- > Adjust nozzle(s) and pressure to make droplets larger than 150 microns. Larger droplets fall faster, so they are less likely to drift with the wind.
- > Use additives that reduce droplet size sparingly.
- > Apply pesticides during wind speeds of 3 to 10 mph. Higher wind speeds can increase the risk of drift. The University of Arkansas Research and Extension Service concurs and adds that because wind is the main cause of herbicide physical drift, growers and applicators should avoid spraying when wind speeds exceed 10 mph or on gusty days.
- > Keep the spray boom height set only high enough to provide adequate nozzle pattern overlap.
- > Avoid spraying during the heat of the day, when evaporation is more likely.
- > Avoid applications when there is fog hanging in the air. It may indicate that a temperature inversion, which can increase the risk of pesticide drift, is taking place.
- > Direct sprays away from property lines. Keep the wand or hose as close as possible to the target.
- > Follow sprayer travel-speed recommendations from product labels, nozzle manufacturers, equipment manuals and Extension guidelines.

With the start of the pesticide application season just around the corner, Ledson encourages growers and applicators to follow these guidelines and contact their local Syngenta representative with any specific questions that may arise. 🌱 STORY BY LYNN GROOMS

CALCULATE THE APPLICATION RATE

GPA: Recommended spray volume from product label

GPM: Gallons per minute

mph: The appropriate travel speed for equipment and application conditions

W: Nozzle spacing in inches

GPM (per nozzle) = $\frac{\text{GPA} \times \text{mph} \times \text{W}}{5,940}$

Davis, Jason A. and others. "Mitigating Pesticide Spray Drift," University of Arkansas Cooperative Extension Service, www.uaex.edu/publications/pdf/FSA2179.pdf.



Ripple Effect

Syngenta proudly recognizes this year's #RootedinAg winner, the Farm Manager of the Year and a company researcher named as a Future Giant of the Seed Industry.

HONORS & RECOGNITIONS

Syngenta Scientist Named Future Giant of the Seed Industry

Seed World magazine, in partnership with the Future Seed Executives of the American Seed Trade Association, has named Qingli Liu, Ph.D., principal scientist at Syngenta, its 2018 Future Giant of the Seed Industry. This esteemed award recognizes people who demonstrate potential to help shape the industry's future.

As project lead for soybean and sunflower disease control at the Syngenta Innovation Center in Research Triangle Park, North Carolina, Liu has spent the past five years developing broad resistance strategies that could provide new options to control disease beyond fungicides.

Liu's most significant achievement to date is discovering a method that allows Syngenta to produce soybeans with tolerance to Asian soybean rust, a disease that costs farmers more than \$2 billion annually. The disease can cause up to 80 percent yield loss in Latin American fields, with potential for complete defoliation if left untreated. He is currently working to apply his methodology to other crops affected by major diseases.

"Qingli is an exemplary role model for his colleagues and peers—both at Syngenta and within the seed industry," says Michiel van Lookeren Campagne, Ph.D., head of global seeds research at Syngenta. "He is much more than a scientist. He is a connector and influencer



Qingli Liu, principal scientist at Syngenta and 2018 Future Giant of the Seed Industry



who brings motivation to teams to go beyond what is expected—a true leader who can navigate the challenges inherent in seeds research and development.”

Farm Manager of the Year Honored

Dick Isaacson, founder and owner of Agri-Management Services in Marion, Iowa, has received the 2018 Professional Farm Manager of the Year Award. This annual award, co-sponsored by Syngenta, Farm Journal's *AgPro* magazine, and the American Society of Farm Managers and Rural Appraisers (ASFMRA), recognizes farm managers who display excellence in client service and a commitment to agriculture.

For more than 40 years, Isaacson has worked in the agriculture industry. Since forming his company as a sole proprietorship in 1990, he has grown his business considerably and added support and professional team members, including his son, Ben. Currently, Agri-Management Services has more than 50 clients in six



Dick Isaacson is the 2018 Professional Farm Manager of the Year Award winner.

states. For three consecutive years, it has retained 100 percent of its clients, due largely to Isaacson's excellence in client service, expertise in farming practices and strategic approach to minimizing production risk.

Also, key to Isaacson's success is his involvement in ASFMRA. "Dick has been active in the Iowa chapter of the ASFMRA, serving as education director and past president," says Darrell Limkeman, Isaacson's friend, fellow ASFMRA member and the 1998 recipient of the Farm Manager of the Year Award. "During his term as president, Dick did a top-notch job planning and executing state programs, with his work often rivaling national programs."

To view a video about Isaacson's dedication to the industry, go to www.farmmanageroftheyear.com or www.syngentathrive.com/community.



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Performance assessments are based upon results or analysis of public information, field observations and/or internal Syngenta evaluations.

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“[Qingli] is much more than a scientist. He is a connector and influencer who brings motivation to teams to go beyond what is expected.”

—MICHIEL VAN LOOKEREN CAMPAGNE

Family Roots

The 2018 #RootedinAg contest winner pays tribute to the strong bond she shares with her grandfather.

When the bull was in the pasture, Katharine Girone kept to the road. It was safer to walk the roads of rural Varna, Illinois, than to brave the beast. The cars were infrequent and offered no real disruption, other than a

momentary breeze that ruffled the long grass and corn-stalks. Besides, the distance from Girone's house at the south end of the pasture to her grandparents' homestead at the center of the property was only an eighth of a mile.

"Spending those early years out in the barn with supervision, but also being trusted with the life of a young animal, was one of those things that is ingrained in my brain."

—KATHARINE GIRONE

Girone made that walk more times than she could count. The journey was usually worth it; visiting her grandparents' property promised hard work, but it also promised welcome. There, in the place that had sheltered her family since long

before her birth, her grandfather Kenneth McKee instilled the values that shaped her. There, she came to know what it meant to work in agriculture and to be part of a family tradition that spanned five generations.

"Spending those early years out in the barn with supervision, but also being trusted with the life of a young animal, was one of those things that is ingrained in my brain," Girone says. She has taken those lessons into her adult life and into her role as a 4-H program coordinator at the University of Illinois in Pekin.


Girone is the winner of the fifth-annual *Thrive* #RootedinAg contest from Syngenta, which asks growers and other ag industry professionals across the U.S. to tell the stories of the people who most nourished their agricultural roots. In her essay, Girone chose to honor her intergenerational bond with McKee.

"Understanding that you're part of a family tradition beyond your own generation is just so impactful," Girone says.

Her moving story certainly made an impact with the online voters and panel of judges, who, together, chose her as the contest's 2018 grand prizewinner. As one of the five finalists, she also received a mini touch-screen tablet from Syngenta.

"We're proud to honor Katharine, and we thank everyone who shared stories about the people who helped instill their love of agriculture," says Wendell Calhoun, communications manager at Syngenta. "We understand that passion, and we credit it for our drive to develop innovative, practical solutions for the growers of today and tomorrow."

As a part of her prize, Girone will receive \$500. Additionally, Syngenta will make a \$1,000 donation to the Tazewell County 4-H program in her grandfather's name.

To read Girone's winning #RootedinAg essay, visit www.syngentathrive.com.  STORY BY GLENN BERTRAM



Left: Katharine Girone, the 2018 #RootedinAg contest winner, has modeled her ag journey after the lessons her grandfather Kenneth McKee taught her.



Katharine Girone and her grandfather Kenneth McKee enjoy a peaceful moment together on their family farm in Varna, Illinois.



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