



SEPTEMBER 2022

BAYER CROP SCIENCE SUSTAINABILITY PROGRESS REPORT



With our business, we aim to make meaningful contributions to the United Nations

SUSTAINABLE
DEVELOPMENT GOALS

Foreword

We are now more than two years into the global pandemic. The impact it has had on our lives, our health and our economies has been severe and will be felt for quite some time still. While it appears as though the worst of the pandemic is now behind us, new and old challenges are emerging – from war and food shortages to global supply chain disruptions and the growing impact of climate change.

Against this backdrop, the need for a sustainable and secure global food system has never been clearer – or more urgent. These last two years have been immensely challenging for communities all over the world. But we have also witnessed the impressive resilience that humankind is capable of when collaborating toward a common goal.

When we at Bayer rolled out our vision “Health for all, Hunger for none” in 2020, we were setting our sights on some of the biggest challenges the world faces. The challenge for us, however, is not setting the vision but turning it into reality. That is the intention behind our 2030 commitments: providing women in low- and middle-income countries (LMICs) with access to modern contraception; helping people in economically or medically underserved communities with self-care; and supporting smallholder farmers in LMICs with products, services, and partnerships.

In our Crop Science division, we set our own targets to help realize that vision by advancing a sustainable future for agriculture. That is why, alongside our commitment to supporting smallholder farmers, we are innovating with new solutions to substantially reduce in-field greenhouse gas emissions and minimize the environmental impact of crop protection in all the major markets we serve.

In this progress report, we want to demonstrate not only how we are working toward achieving these goals but also how sustainability is already a fundamental driving force behind our business. Climate change, the pandemic, food insecurity and many other global challenges call for new approaches, not business as usual. This means that we must move beyond the conventional separation between sustainability and strategy and ensure that sustainable practices are part and parcel of all that we do.

Making these ambitious commitments was only the first step of our journey toward a healthier future. With this report, and others like it, we intend to hold ourselves accountable against our targets. This way, we can ensure that we are, in fact, creating the best possible outcomes for farmers and the food system while at the same time minimizing agriculture’s impact on the planet.

To turn our vision into reality, we need deep and lasting changes to our global food and agriculture systems. This can only be achieved with more innovation and stronger collaboration among key stakeholders, including the farmers themselves. Because only together can we drive the wider transformation that is needed to create a sustainable future in agriculture – for the benefit of people, nature, and planet.

Frank Terhorst,
Head of Strategy & Sustainability
at Crop Science, a division of Bayer AG



Only together can we drive the wider transformation that is needed to create a sustainable future in agriculture – for the benefit of people, nature, and planet.

Welcome Message

We face a fundamental paradox in agriculture. While farmers have the challenge of producing more food for a growing population, agricultural activity is a major contributor to greenhouse gas emissions, which in turn exacerbate the threat to food security and rural livelihoods. Innovation and digital solutions are the answers to this paradox, and it's imperative that agriculture as an industry makes promoting climate-healthy farming practices a top priority.

A more sustainable future for agriculture isn't a numbers game. As businesses, governments and other stakeholder groups, we must all challenge ourselves to measure and acknowledge the impact our activity has on the environment. An important part of this is to demonstrate how exactly we are minimizing that impact.

The United Nations' Sustainable Development Goals (SDGs) have set important benchmarks for the international community. As we progress toward those goals, our focus must be on collaboration and collective action.

By upholding high standards at Bayer, and transparently reporting on our own progress, we want to demonstrate how we're living up to our commitments and, in turn, encourage others to hold us accountable.

This Crop Science Sustainability Progress Report complements our annual Bayer Sustainability Report. It focuses on the Crop Science division's specific contributions toward shaping a sustainable future for

It's imperative that agriculture as an industry makes promoting climate-healthy farming practices a top priority.

agriculture. Clearly, there are still areas where we come up short, but we're working hard to identify and close those gaps as we develop more advanced methods for monitoring our impacts.

While climate change is a huge concern for our world – and with farmers on the front lines – agriculture impacts our environment in other ways too, such as contributing to biodiversity decline, excessive water use and pollution, as well as health and safety issues. These diverse challenges form the basis for our sustainability focus areas – each of which is the theme of a dedicated chapter in this report.

Above all else, this Progress Report underscores our commitment to transparency, partnership and dialogue. We know we're not alone in the pursuit of a more sustainable future. So much of the progress we cover in this report is a result of collaboration across various groups, including farmers, industry partners, policymakers and other key stakeholders.

Working together, we can break the fundamental paradox in agriculture to create a food system that is more sustainable and resilient – one that delivers measurable outcomes and progress for all.

Jessica Christiansen,
Head of Sustainability at Crop Science,
a Division of Bayer AG



About this report

Each year, alongside a broader Integrated Annual Report, Bayer AG publishes a [Sustainability Report](#). Its purpose is to provide an account—across all three of our divisions, Pharmaceuticals, Consumer Health and Crop Science—of our advanced sustainability strategy and transparently document the company's sustainability-related achievements in detail.

This **Crop Science Sustainability Progress Report** is meant to supplement the Bayer AG Sustainability Report by providing a closer look at the many ways the Crop Science division is promoting sustainable agriculture and creating the best possible outcomes for farmers.

The information in this report is tailored to ESG-focused audiences that rate, benchmark, and want to learn more about how we embed sustainability into our business and seek to make a positive contribution to the global food and agricultural systems. Our purpose for creating this report is to go beyond stating our commitments to sustainability and transparently demonstrate the actions we're taking, the measure of their impacts, and how we're constantly evolving our business to improve our impact on the environment and add value for farmers and society.

In addition to serving as a vehicle to share information with our ESG stakeholders, this report is about transparency and accountability more broadly. Our intention is to highlight the areas where we are focused on improving our operations and creating sustainable solutions in agriculture. But we openly acknowledge there are gaps: ones that we know we need to fill and ones that we still need to identify. It is our hope that readers will explore the links to other resources where they can learn more about many of the topics covered, engage with us directly, and ultimately help hold us accountable as we progress toward our 2030 commitments and, more importantly, our **Health for all, Hunger for none** vision.

For comments, feedback, or general inquiry
please contact sustainabilityexcellence@bayer.com





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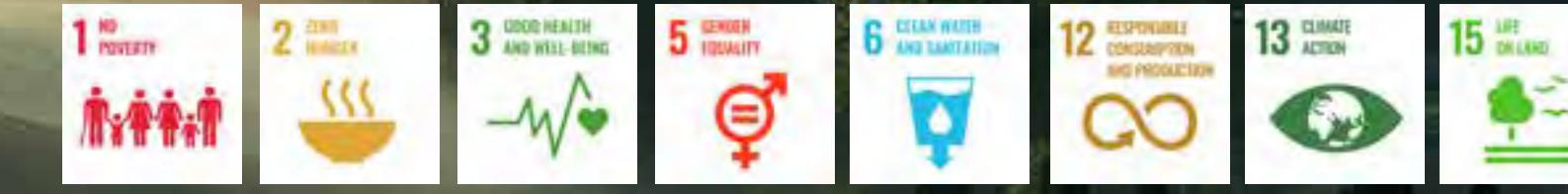
DEMONSTRATING GOOD GOVERNANCE

Can companies truly be trusted to hold themselves accountable for the steps they promise to take toward a rapid transition to a more equitable and sustainable economy? We think so.

We can't skip to the finish line when it comes to reaching our targets for 2030. Accountability means reporting on the progress we make day in and day out: how we are getting there is just as important as where we are going. Good governance, clear leadership and transparency are the keys to holding ourselves accountable every step of the way, and we use these as standards while taking into consideration our three main areas of governance: environment, social inclusion and hunger.

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Sustainability – part of Our Corporate Strategy

The Bayer AG vision of **Health for all, Hunger for none** is the focal point for strategy across all divisions at Bayer. We hold ourselves to a high standard of accountability when it comes to our Sustainable Development Strategy. Bayer has sustainable development objectives and targets embedded into its strategy and business model.

Through our sustainability report and additional adhoc reporting, we disclose how we have identified and prioritized relevant sustainable development topics on which Bayer has a clear impact.

These principles for the whole Bayer organization carry through within the Crop Science division. In this chapter, we will highlight the most impactful stories on sustainable agriculture that complement and link to other reporting across the organization as well as other chapters of this report.



*Environmental Social Governance

LMICs: low- and middle-income countries;
¹These targets are accounted for in the long-term variable compensation of the Board of Management and the managerial employees.

Governance – Our path to become an impact generator



Werner Baumann,

Chairman of the Board of Management and Chief Sustainability Officer of Bayer, has personally assumed responsibility for sustainability implementation.



Rodrigo Santos,

Member of the Board of Management of Bayer AG and Head of Bayer Crop Science Division, also responsible for the Latin America and Africa regions on the Group Board of Management; deeply committed to shaping a more sustainable and digital future of agriculture using science, innovation and technology to help farmers, the society and the planet.

Our sustainability targets are not only being integrated into the company's decision-making processes – **Bayer was also one of the first industrial companies in the world to have measurable sustainability targets that carry weight in the long-term remuneration of its management staff, including the Board of Management.**

Clear Leadership

Our governance system starts with the Board and highest-level members acting with responsibility and accountability for our Sustainable Development Strategy. Board members have sustainable development objectives and incentives to reward the effective delivery of relevant company strategies and initiatives.

Bayer also has a dedicated **ESG (Environmental, Social & Governance) Committee** in its supervisory board that is guided by the work of our **Bayer Sustainability Council**. This council is a group of independent external experts from the areas of healthcare, nutrition, agriculture, environmentalism and sustainable finance representing a broad range of experiences, views and geographies. The Sustainability Council is helping us further develop the sustainability elements of our business strategy and provide guidance on the contribution that we can make with our research and development. It independently examines Bayer's progress in the implementation of our sustainability targets and oversees the advancement of social innovations by the Bayer foundations. The Council reports annually on the progress of its work, and also promotes cooperation with networks in the areas of society, education, industry and politics.

Building Trust through Transparency

We are committed to building trust with our customers, informed consumers, investors and beyond. Through transparency, we intend to strengthen our customers' and stakeholders' confidence in our products.

Our **Bayer Societal Engagement (BASE) Principles** give us guidance and form the basis for our activities, grounded in our mission "Science for a better life" and illustrating our determination to make a significant, positive contribution to addressing some of the most pressing challenges of our time. These BASE Principles **guide our interactions with everyone – our employees, patients, customers, consumers, business partners, public policy stakeholders, scientists, critics and our shareholders worldwide.**



This commitment also requires us to provide transparency about our forms of lobbying: **our lobbying activities are guided by fairness, integrity and transparency, as well as fact-based information, and our Code of Conduct for Responsible Lobbying sets out binding rules for our involvement in political matters.**



Learn more about our Code of Conduct for Responsible Lobbying and our Sustainability Stakeholder Engagement on our website.

Transparency in Reporting:

As our products and activities concern the sensitive areas of health and nutrition, they lead to inquiries and the desire to understand what we do. Against this background, we endeavor to build and strengthen trust – for which transparent conduct is essential.

In our annual Sustainability Report, we aim to provide transparent and in-depth insights into both our sustainability strategy and our sustainability performance. This Sustainability Report supplements the nonfinancial statement pursuant to the CSR Directive Implementation Act (CSR-RUG) that is published in the combined management section of our Annual Report.

The Bayer Group's Sustainability Report applies the requirements from ESG reporting frameworks and standards including, for example, the United Nations Global Compact (UN GC), Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB) and Taskforce on Climate-related Financial Disclosure (TCFD). Information needed for SASB and TCFD disclosure is additionally published in separate documents.

At Crop Science, we supplement Bayer AG reporting with additional content in several ways. First, we create in-depth special reports for more controversial topics related to our business. By doing so, we can transparently engage with a broad audience about topics that, without data and clarity, can cause skepticism. We also create additional content for external reports like the Food & Agriculture Benchmark, the Nature & Biodiversity Benchmark and the Access to Seeds Index of the World Benchmarking Alliance, as well as the CDP reports on Climate, Water and Forests.

 [Read our 2021 Sustainability Report here.](#)



Bayer Science Collaboration Explorer:

Building transparent platforms like **our transparency register for science collaborations** with external partners allows us to make information accessible for a wide range of audiences. With this new platform, we are publishing information related to our scientific collaborations with external partners.

We also disclose information from various areas of our work and openly communicate how the safety of our products is assessed.

Bayer Transparency Platform:

Through our Crop Science Transparency website, we make safety-relevant studies that regulatory authorities use to approve crop protection product registrations accessible to the non-commercial public. **Bayer was the first company in the agriculture industry to make safety-relevant data on crop protection products and genetically modified crops publicly accessible.**

OpenLabs:

Initiated in 2020, OpenLabs offers the public an opportunity to observe our scientists during a two-day event as they carry out a safety registration study. Here, the participants learn how we collect data on the safety of our crop protection products by complying with guidelines such as Good Laboratory Practice (GLP). We have developed a virtual visitor platform that enables our scientists to engage with visitors online in live events, starting in 2022.



You can read more about OpenLabs here.

With better governance and a high standard for transparency, we are holding ourselves accountable to benefitting the planet, people and their food supply.

Sustainable impact across the value chain

While most of this sustainability progress report is focused on the sustainability outcomes “downstream,” referring to our products on farmers’ farms, for example, **it is important to highlight the work we are doing to generate impact through owned production and “upstream,” referring to producers and suppliers we work with.**

Across the Bayer organization, and so including Crop Science, **we are working towards reducing our scope 1 & 2 emissions by 42% by end of 2029 compared to our 2019 baseline.** To ensure this aligns with a global 1.5°C pathway, we had our target validated and endorsed by the Science Based Targets initiative (SBTi). This initiative is a collaboration between the Carbon Disclosure Project (CDP), the United Nations Global Compact, the World Resources Institute (WRI) and the World Wide Fund For Nature (WWF). To accomplish this target, we take efforts to utilize more efficient in- and outward ventilation systems, move to climate-neutral technologies, such as geothermal energy for heating and cooling, **and switch to electricity purchased 100% from renewable sources.**

Bayer has set out specific criteria for its own procurement of green energy, including the proximity of energy production facilities to Bayer sites, the use of new sources of generation and a focus on wind and solar power. They are based on the “next generation green power” guidelines from the WWF.

We aim to reduce greenhouse gas emissions along the value chain through cooperation with suppliers and customers by at least 12.3% in 2029 compared to 2019. This target has been approved by the Science Based Targets initiative.

Additionally, Bayer has joined with other ambitious companies to drive progress as part of the chemical industry’s “Together for Sustainability” initiative. We are also a member of the CDP Supply Chain Initiative and are in direct contact with key suppliers.

Bayer is on a path to become climate neutral by 2030 in its own operations. The remaining emissions after reduction will be offset by purchasing certificates from climate protection projects with recognized quality standards.

The offset projects are related to our business. Based on our business purpose, we focus on Natural Climate Solutions relating to forest and agriculture. Additionally, we invest in innovative projects and foster development of voluntary carbon markets.

Another way we are striving for minimal environmental impact of our activities is through our net-zero deforestation commitment in our supply chain, which we discuss in the biodiversity chapter of this report (Chapter 5).

Ensuring the sustainable use of water at production sites

Alongside our downstream activities covered in Chapter 6 of this report, we are also reducing the amount of water used by our production sites. As pointed out in our Global Water Position, Bayer aims at protecting water resources and improving water use efficiency both within the company and beyond.

Responsible water usage is a cornerstone of our commitment to sustainable development. To this end, we strive to reduce our water withdrawal across our operations and supply chain, and for this, we commit to complying with international, national and local legislation to protect water resources, using them as sparingly as possible and further reducing emissions into water. We also support the CEO Water Mandate of the U.N. Global Compact with the goal of working with key stakeholders to develop sustainable strategies for water usage.

One target we have already achieved was to reach 100% coverage of our sites located in water-scarce areas with a water management system by 2020.

Bayer is on a path to become
climate neutral
by 2030
& **Net Zero**
by 2050
in its own operations

Inclusivity throughout our business model

At Bayer, we are constantly working toward creating a world where everyone has access to essential services – be it health, nutrition or education. Here, we present some projects that either already have or will have a major impact toward achieving this aim. While much of the downstream impact we have generated is through our global work with smallholder farming (Chapter 2 of this report) and sustainable use (Chapter 7), social inclusion is a critical component of our governance that ripples across the value chain.

Our Human Rights Policy clearly details the strong standards Bayer uses to guide our decision-making process. These standards require all employees around the world to act with fair and lawful conduct toward other employees, colleagues, business partners and local communities. To reinforce our human rights policy, we support and adhere to the United Nations' Universal Declaration of Human Rights and a number of globally recognized declarations for multinational enterprises, which you can read more about in our [Human Rights Policy](#).

A critical component of our human rights policy is setting sustainable standards that the Bayer group requires its suppliers and subcontractors to share. We established these principles through our [Supplier Code of Conduct](#), which details key standards around pillars of ethics; people and labor; health, safety and environment; quality; and governance and management systems.

One factor of our human rights policy that we hold to a particularly high standard is our stance against modern slavery, forced or compulsory labor and human trafficking – contemporary realities that require unilateral cooperation from business, governments and stakeholders up and down the value chain to put an end to.

In 2021, we prepared a [dedicated training on human rights](#), which includes the topics of modern slavery, human trafficking and forced labor, in the form of an e-learning program. **More than 85% of our employees received this training in sessions totaling more than 215,000 hours. With this training, employees learn how to identify, analyze and address cases of human rights violations.** The issue of human rights has also been an integral element of training measures for the management of our country organizations since 2021.



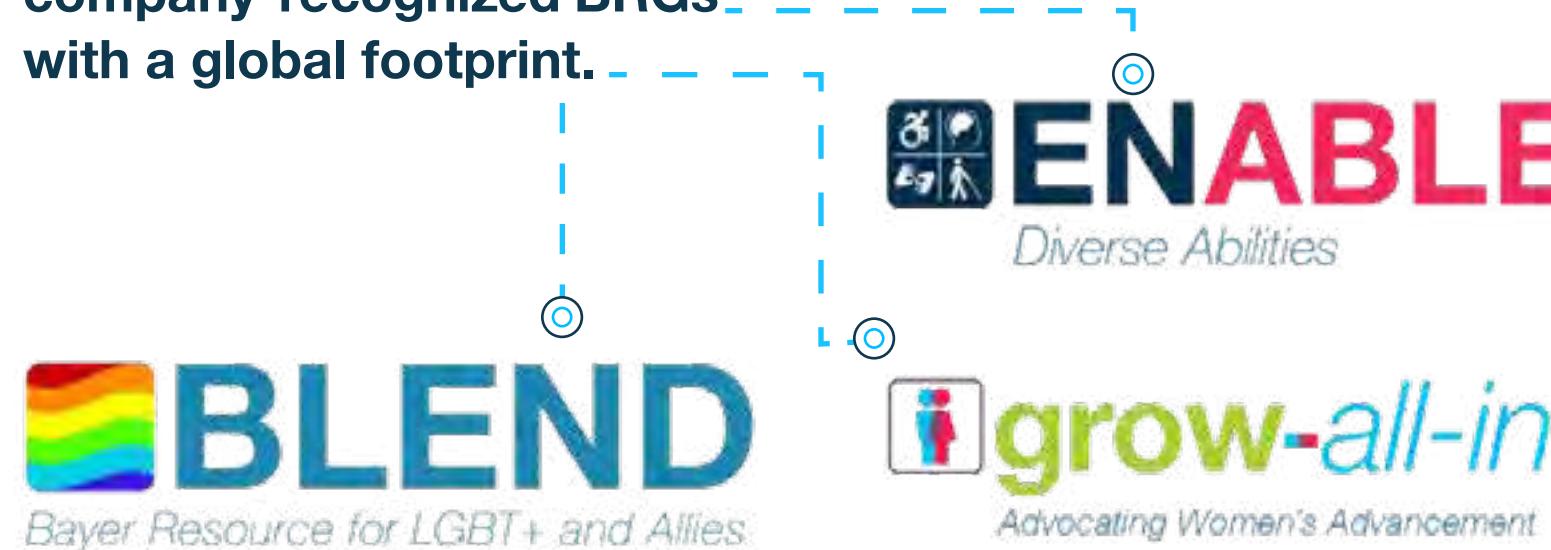
Diversity, equity and inclusion within Bayer operations

Crop science shares in the Bayer group goals for furthering diversity, equity and inclusion across the division. Some targets established that we are striving for include: establishing gender parity at all management levels by 2030. The proportion of women in the Group Leadership Circle, the highest management level in the Bayer Group below the Board of Management, increased again compared to previous years. By the end of 2021, it was made up of 27% women (compared to 6.5% as reported in 2010) and 73% men (2010: 93.5%).

In addition, we want to significantly strengthen further dimensions of inclusion and diversity in the company in the coming years; and we want to increase the proportion of people with disabilities in the workforce to more than 5 percent by 2030.

Various business resource groups (BRGs) are also in place to give a voice to diverse constituencies within our company and to our customers. These business resource groups assist Bayer with cultivating an inclusive workplace and bringing targeted products and services to our customers. Participants of these company-sponsored BRG's work together to promote inclusion within Bayer and provide a multicultural lens to Bayer's engagement for our customers and the communities we serve.

Below are 3 of the 9 company-recognized BRGs with a global footprint.



Inclusion is an important factor for all our operations, as demonstrated by the smallholder farming chapter of this report. In addition, here are some more ways in which we are working to ensure gender equity.

Gender Inclusive Programs:

- // [Partnership with Asian University for Women based in Bangladesh: Bayer AG and Asian University for Women form a partnership to support women's education in Asia](#)
- // [Bayer partners with GIZ and MAVIM to empower rural women](#)
- // [Better Life Farming](#)
- // [Community partnership in Africa: through our sites in Africa, our teams provided maize meal to families during the Covid-19 pandemic. We distributed more than 9000 bags of maize meal in 2020 and continued the initiative into 2021, extending it to provide hot meals for school students.](#)

Our stake in the food system

Our core mission at Bayer is Health for all, Hunger for none. As leaders in our industry, it is our responsibility, and our great honor, to develop programs, tools and technologies that help put nutritious vegetables, fruits and wholesome grains on every table.

The Zero Hunger Private Sector Pledge

The Zero Hunger Pledge is a demonstration of our commitment to help end hunger by 2030. This pledge was created as part of the UN Food Systems Summit Coalition of Action for Achieving Zero Hunger, one of the emerging multistakeholder coalitions from the UN Food Systems Summit process. We commit to contribute USD 160 million to achieve Zero Hunger in developing countries between 2022 and 2030, with multiple partners.

The Zero Hunger Pledge aligns governments, agencies, civil society and businesses with the 10 high-impact intervention areas from the CERES2030 evidence, a unique research project by scientists from Cornell University, the International Institute for Sustainable Development (IISD) and the International Food Policy Research Institute (IFPRI) that provides practical recommendations on how to end hunger by 2030 worldwide and on a lasting basis.

According to Ceres2030, the investments needed can be categorized as “Empower the Excluded”, “On the Farm” and “Food on the Move”, and there are several ways for private companies to contribute to the Zero Hunger Pledge. We are aligning our investments and business operations more clearly and strongly with this new evidence on effective ways to achieve these goals. **The core business investments and in-kind contributions we commit to are:**

	Vegetable Seeds	Arize Hybrid Rice Seeds	Better Life Farming Expansion Studies	BayG.A.P.	Modern Breeding Project	Total Commitment
Investment in education, training and vocational programs for rural youth			x	x	x	
Investment in extension services and R&D, especially for women	x					
Agricultural interventions and innovation to support sustainable practices		x	x		x	
Support adoption of climate resilient crops		x				
Scale up farm level interventions in water scarce regions		x				
Reduce post-harvest loss by focusing beyond cereals to fruits & vegetables and other parts of the value chain	x					
Invest in infrastructure, regulations, technical assistance (TA) and services to support SMEs in the value chain			x			
Regions	Africa, Asia	Asia	Asia	Asia, Africa, Latin America	Africa	
Years	2022-2030		2022	2022-2025	2022	
Financial commitment (Million USD)	101	52.2	3	2.5	1.2	160

Sources: *The Zero Hunger Pledge* | *ZHP coalition*

We welcome the Zero Hunger Coalition and endeavor to support efforts to advocate for, align with and add resources to achieve zero hunger and nourish the future. We further invite development partners to provide appropriate technical and financial support to accelerate implementation of the Zero Hunger Coalition, with the overall goal of facilitating private investment.

At Bayer, we are committed to being part of the food system transformation and look forward to building long and mutually beneficial relationships with producers, governments, private sector actors, donors, and other players in the countries where we operate and invest.

Addressing Food Loss and Waste to Enable “Hunger for none”

A key metric for holding true to our Zero Hunger Pledge, and the **Bayer group vision of Health for all, Hunger for none, is through supporting stakeholders to reduce food loss and waste (FLW) by 50% in 2050, a target set by the United Nations Sustainable Development Goals (SDG 12.3).**

With its existing solutions and priorities, Bayer is uniquely positioned to drive value chain collaboration and education in the subject of reducing food loss and waste. As a topic that perfectly complements our existing corporate values and enables the world to achieve its shared sustainability goals, reduction of FLW is a key strategic priority for Bayer and our stakeholders.

Enabling reduction of FLW by



Co-creating with stakeholders along the value chain



Promoting sustainable agriculture

By strategically building our portfolio of solutions to help farmers to, on and beyond the farm, we align growth for our business with sustainable agriculture. This means we generate impact along the entire value chain, from disease and pest-resistant genetics through breeding, chemical and biological crop protection and other methods we've explored throughout this chapter, all the way to ensuring that our products have consumer preferences in mind and can survive the passage from farmers' fields to consumers' kitchen tables.





We sell Ansal® in 16 countries in Africa and Asia Pacific, helping smallholder farmers to achieve higher returns of investment from their fields.



Innovations in agriculture can help to reduce food loss and waste on and beyond the farm

How do we tackle food loss and waste along the value chain?

We offer innovative solutions to help farmers reduce food loss and waste on and beyond the farm.

For example, Ansal® is a tomato variety with great shelf life and fruit firmness. These characteristics contribute to lower postharvest losses in India from about 20-25% to less than 8-10%, resulting in ~23% less kg of CO₂e per kg of marketable crop (versus the same leading competitor variety), as more food reaches the end consumer.¹ This innovation placed Bayer among the 20 most climate friendly companies in 2021.²

Another example, is the Seminis® Orange Candy melon SVMA6558. During trials in Spain, this variety demonstrated up to a 19% reduction of losses in the field, as result of less cracking and good field holding.³



De Ruiter



Seminis



Learn more about our impactful innovations and other Seminis and De Ruiter varieties and their benefits, such as the Strabena tomato variety with its excellent attachment to the vine and good shelf life, which reduces the need for plastic packaging and protects against losses during processing & handling.

¹ A climate impact analysis by the Wageningen University using the Agro-Chain Greenhouse Gas Emissions (ACE) calculator

² By European Seeds Magazine

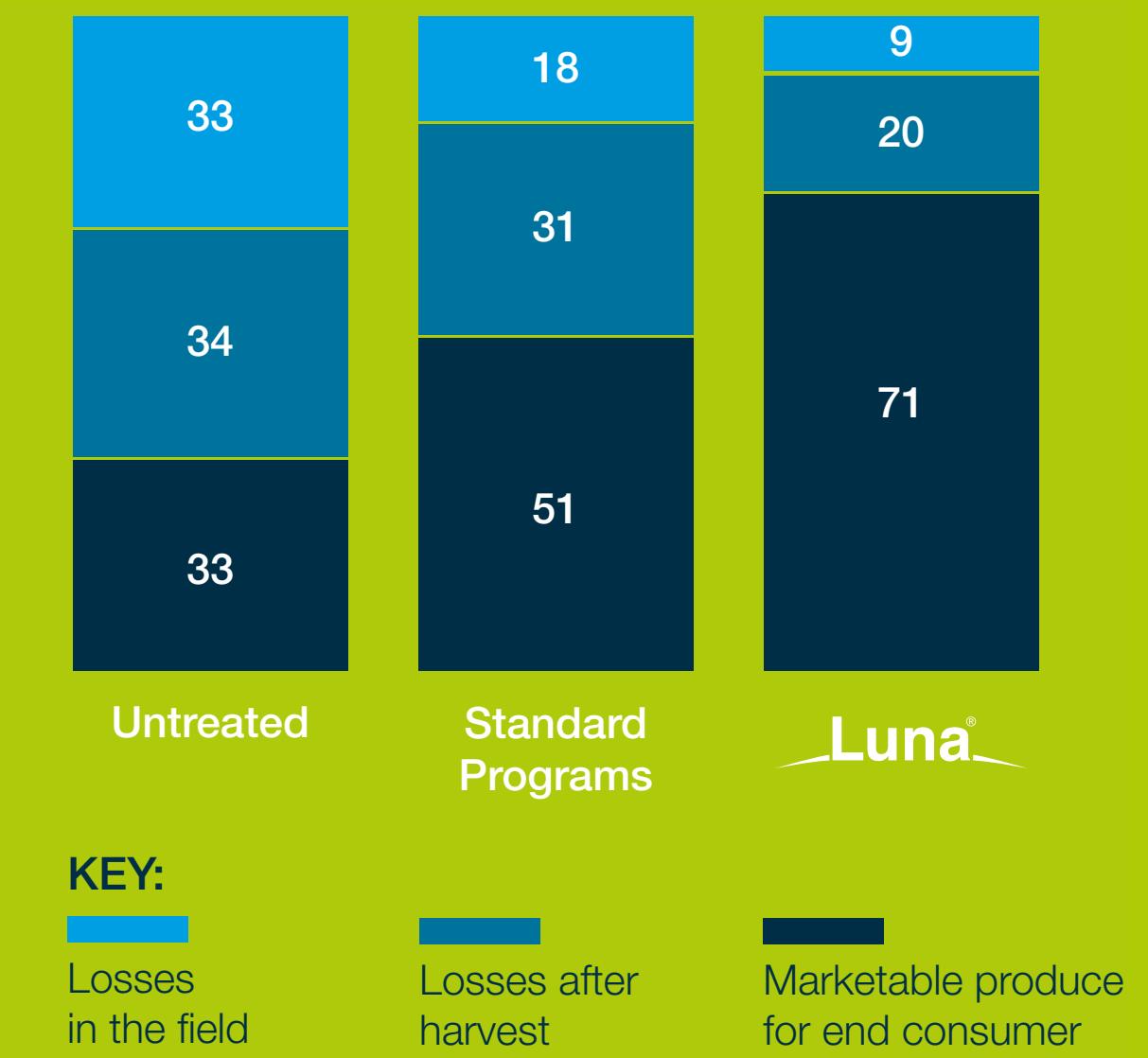
³ In comparison with the Seminis' previous variety and measured during three years in twelve locations in Spain.

1.3 billion
tons of food are wasted worldwide, each year⁴

Our Luna® fungicide works against this issue; it offers control of latent diseases. The result is fewer spores and mycelium on and in the fruit at harvest and therefore less development of fungi in the Food Chain and at home.⁵

⁴ World Food Programme

⁵ Compilation of 20 Bayer Crop Science trials with 13 different Fruits & Vegetables crops



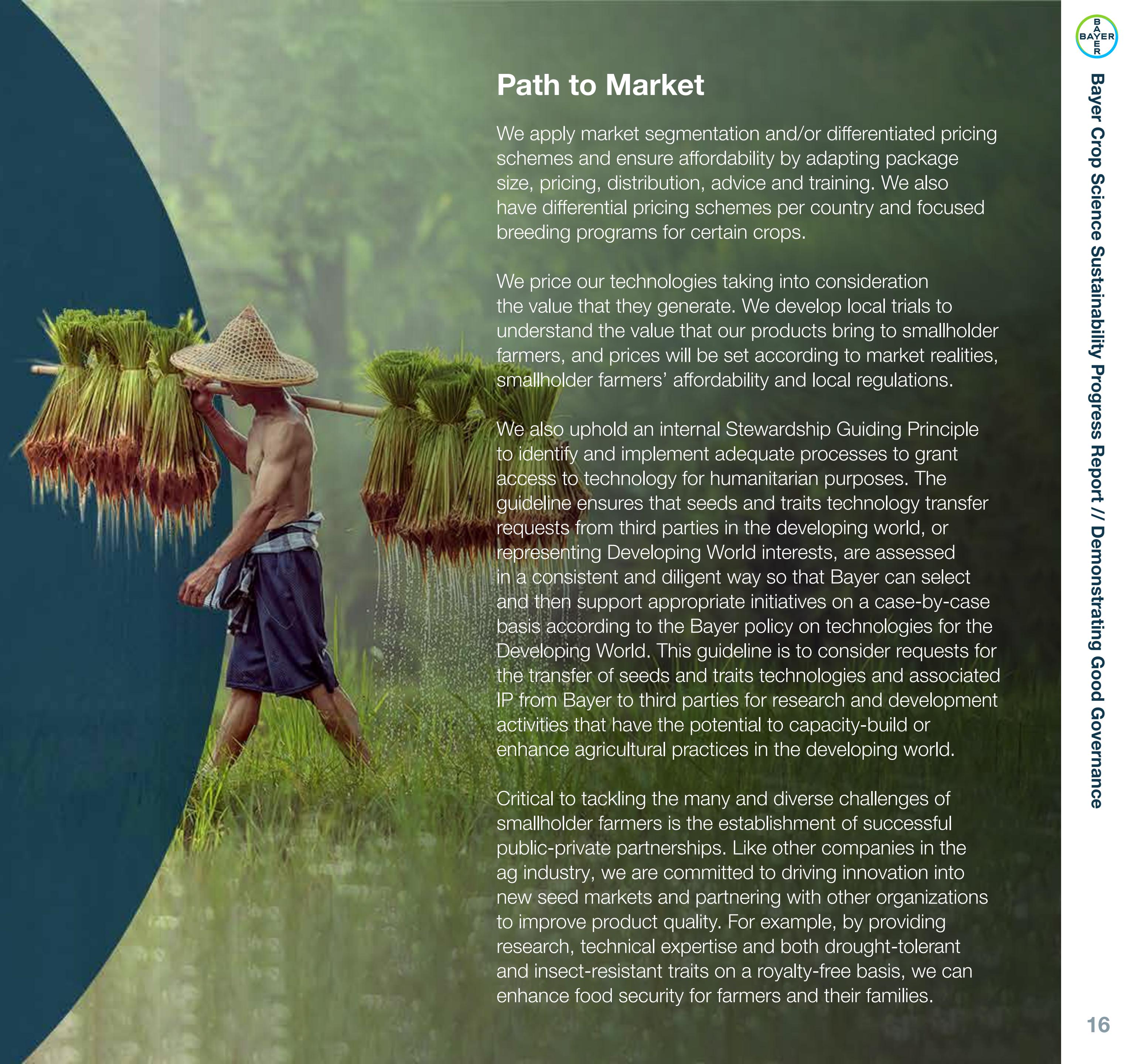
Access to our innovation

As communities fight poverty, hunger and malnutrition, it's our responsibility to expand the reach and impact of Bayer's global breeding resources. **Supporting the advancement of agricultural science for the benefit of farmers, consumers and the planet through partnerships and contributions is at the core of who we are as an innovation company.** These global partnerships are aimed at knowledge sharing as well as germplasm and data contributions, working to improve the availability of high-performing seeds for farmers.

The partnerships we pursue are often cross-sector and focus on supplementing the skillsets of local researchers and farmers by sharing our team's knowledge and experiences. They prioritize the inclusion and diversity of local culture and gender representation, driving a positive impact by connecting unique local know-how with Bayer's global insights. We believe that the solutions with the greatest impact for agriculture's biggest challenges will be reached through collaboration that brings together diverse insights.

We also use our scale for good through germplasm and data contributions to breeding and seed bank programs across a variety of crops and world regions. Our large global testing footprint, vast germplasm library and extensive genetic characterization data are unmatched in the industry. As a company that's passionate about the advancement of ag science and – most importantly – seeing that advancement make a positive impact for farmers as quickly as possible, the opportunity to enable this kind of benefit sharing is exciting for our team. We are involved in many projects and programs dedicated to advancing agriculture around the world.

For example, Bayer collaborates with The World Vegetable Centre in Asia and Africa, an international non-profit research and development institute. The institute's mission is to reduce hunger by increased production and consumption of vegetables. One way to reach the goal is by providing germplasm to partners like Bayer that can develop improved varieties for smallholder farmers. Another example is Bayer's collaboration with the Asia and Pacific Seed Association (APSA) which strives to promote, develop, research and market quality seeds. These collaborations can boost smallholder business, while improving the quality of inputs and access to resources that support food security.



Path to Market

We apply market segmentation and/or differentiated pricing schemes and ensure affordability by adapting package size, pricing, distribution, advice and training. We also have differential pricing schemes per country and focused breeding programs for certain crops.

We price our technologies taking into consideration the value that they generate. We develop local trials to understand the value that our products bring to smallholder farmers, and prices will be set according to market realities, smallholder farmers' affordability and local regulations.

We also uphold an internal Stewardship Guiding Principle to identify and implement adequate processes to grant access to technology for humanitarian purposes. The guideline ensures that seeds and traits technology transfer requests from third parties in the developing world, or representing Developing World interests, are assessed in a consistent and diligent way so that Bayer can select and then support appropriate initiatives on a case-by-case basis according to the Bayer policy on technologies for the Developing World. This guideline is to consider requests for the transfer of seeds and traits technologies and associated IP from Bayer to third parties for research and development activities that have the potential to capacity-build or enhance agricultural practices in the developing world.

Critical to tackling the many and diverse challenges of smallholder farmers is the establishment of successful public-private partnerships. Like other companies in the ag industry, we are committed to driving innovation into new seed markets and partnering with other organizations to improve product quality. For example, by providing research, technical expertise and both drought-tolerant and insect-resistant traits on a royalty-free basis, we can enhance food security for farmers and their families.

Intellectual Property Rights

We are an innovation-driven company with significant investment in R&D. It is important to find measures that secure the investment in R&D because the result of our innovation may be easily copied by competing companies. Therefore we advocate for high standards of intellectual property protection that should be internationally aligned.

As a major contributor to agricultural research and development globally, we invest significantly, inter alia, in plant breeding innovations including biotechnology, and we are therefore an active participant in discussions and arrangements concerning plant-based intellectual property rights.

Breeder's Exemption

Commercial varieties of Bayer are generally not subject to contractual clauses or other provisions that prohibit the use of commercial genetic material for further breeding or otherwise limit the breeder's exemption. Bayer supports the breeder's exemption within the framework of Plant Variety Protection rights.

In addition, in the context of patent rights in Europe, Bayer has supported a limited breeder's exemption so that the rights of a patent covering a commercial variety shall not extend to breeding of new varieties using such commercial varieties, provided that:

- 1 Commercialization of a new variety that is covered by the patent shall require the authorization of the patent holder.
- 2 Stewardship and liability issues under applicable regulatory restrictions are properly addressed.

Farmer's Privilege

We appreciate the vast diversity of agricultural practices, as well as the importance of indigenous knowledge and the preservation of local varieties. We listen to our customers, the farmers, and want to learn from them how sustainable solutions for agriculture can help them. The Plant Variety Protection (PVP) / Plant Breeder's Rights (PBR) laws based on the International Union for the Protection of New Varieties of Plants (UPOV) 1991 Convention, as well as the Biopatent Directive in the EU, may optionally allow farmers to reproduce and replant the farm-saved seed of the protected variety on their own farm without the consent of the PVP / PBR holder, provided that the legitimate interests of the breeder are taken into account. In some countries, replanting farm-saved seed that is subject to patents would be considered patent infringement.

To the extent that the use of farm-saved seed would be permitted by local legislations, Bayer Crop Science takes the view that:

- // The legitimate interests of the breeder should be met by the ability of the breeder to require **a fair remuneration for use of the farm-saved seed**.
- // **Under no condition can the farmer's privilege be invoked to engage in trading of any seeds of a protected variety by any person or legal entity**, without the consent of the breeder.

We do not plan to assert our intellectual property rights against smallholder farmers who save seeds on their farms for private and noncommercial use in order to avoid extreme poverty. Instead, **we want to work together with these smallholder farmers to introduce them to the world of commercial farming and enable them to improve their livelihoods**.



Free access to patented innovation for small vegetable breeding companies in the EU

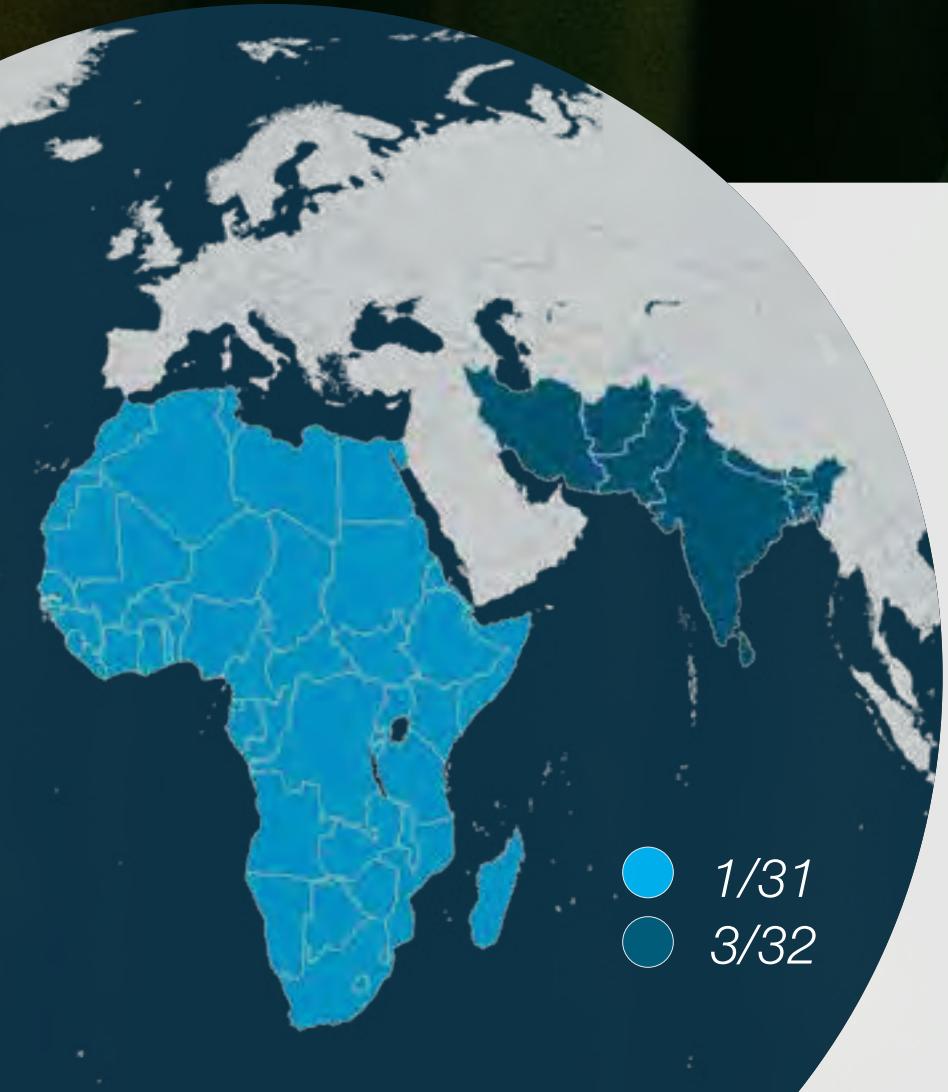
Bayer offers small vegetable breeding companies in the European Union¹ access, free of cost, to our European patents on traits in vegetables, which are in the Euroseeds PINTO² database and licensable by Bayer. With this initiative, we want to address concerns that small breeding companies especially may have regarding access to patented innovation. **Bayer openly welcomes other owners of intellectual property rights to provide similar initiatives.**

We also entertain discussions with a range of stakeholders and associations to share the proposal across the industry. Should this approach be proven as a workable solution in Europe, its applicability in other geographies could be considered.

Intellectual property rights play an important role in innovation, including developments in plant breeding to make vegetables and crops more resilient, less demanding of resources and higher yielding. These innovations help to meet sustainability goals, mitigate the impact of climate change and support food security. You can find more information on our position on intellectual property rights on our Principles and Positions page.

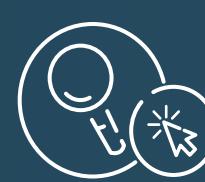
¹ Company (i) registered in a Member State of the European Union, (ii) operating in the business of breeding and selling seeds of vegetable varieties in Europe, and (iii) being a small enterprise according to the definition of the European Commission Recommendation 2003/361/EC (available here in several EU languages).

² PINTO (Patent Information and Transparency On-line) was created with the aim of improving transparency regarding plant varieties that might fall under the scope of patents or patent applications.



Access to Seeds

In the three regional rankings of the Access to Seeds Index | World Benchmarking Alliance, we achieved an outstanding result in 2021. Bayer ranked highest of 31 companies in the regions of Western & Central Africa and Eastern & Southern Africa. Bayer ranked 3rd highest of 32 companies in the South & South-East Asia region. **The ranking published by the World Benchmarking Alliance assesses and compares measures undertaken by seed companies to increase smallholder farmers' productivity and thus improve food security.**



Learn more about our efforts demonstrating good governance

// Sustainability Management

// The Sustainability Council of Bayer

// Supervisory Board Committees

// Stakeholder Dialogue

// Code of Conduct for Responsible Lobbying

// Our Collaborations with External Partners

// Food Chain Partnership

Have questions or would like to discuss governance and transparency directly with us? Please reach out!

Engage on LinkedIn
Jessica Christiansen
Crop Science, a division of Bayer AG

ENABLING THE SMALLHOLDER FARMER

Farming on a two-hectare plot in sub-Saharan Africa, Afiya works sunup to sundown. Toiling to earn an income and feed her family, Afiya's success is often at the mercy of the weather. If it doesn't rain as expected, Afiya's whole farm pays the price. And with it, her livelihood. Even when the weather cooperates exactly as it should, Afiya still has a difficult time making ends meet. Afiya is a smallholder farmer.

Our work supporting smallholders contributes to the following U.N. Sustainable Development Goals



- / 20 Smallholders, big roles
- / 21 Growing our commitment to smallholder farmers
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Smallholders, big roles

Smallholders have an enormous impact on the world's nutrition

Smallholder farmers are those who farm on less than 10 hectares of land. And **while their plots may be small, their impact on the world's nutrition is huge.** They're responsible for feeding more than half (50%) of the populations of low- and middle-income countries, all while living on incomes averaging \$2/day.

As independent farmers, smallholders must each play the role of manager, laborer and salesman. **They are often responsible for the food security of their community.** Which means the daily threats of adverse weather, disease and pests endanger not only their livelihoods but the nutrition and prosperity of their entire communities.

In order to increase their yields and their incomes, smallholders often resort to cutting down trees so they can expand their plots.

While this deforestation increases greenhouse gas emissions and reduces the planet's ability to absorb carbon gases from the atmosphere, it is often the only way for these farmers to escape poverty.

To accomplish our mission of feeding the world's growing population while also reducing our strain on the earth's resources, **our own efforts to enable smallholders must be big.** Because they make up more than 97% of the world's farmers, our path to sustainability starts on their small plots of land.

Our path to sustainability starts on their small plots of land.



97
percent

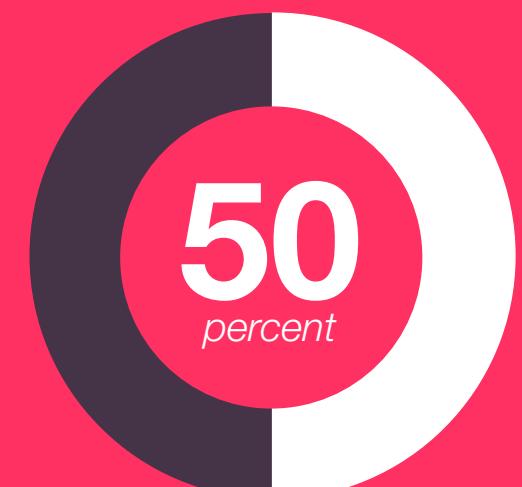
of the world's farmers are smallholder farmers.

They work on



10 hectares of land or less

Responsible for feeding over



of low- and middle-income populations

Earn on average less than

\$2 USD

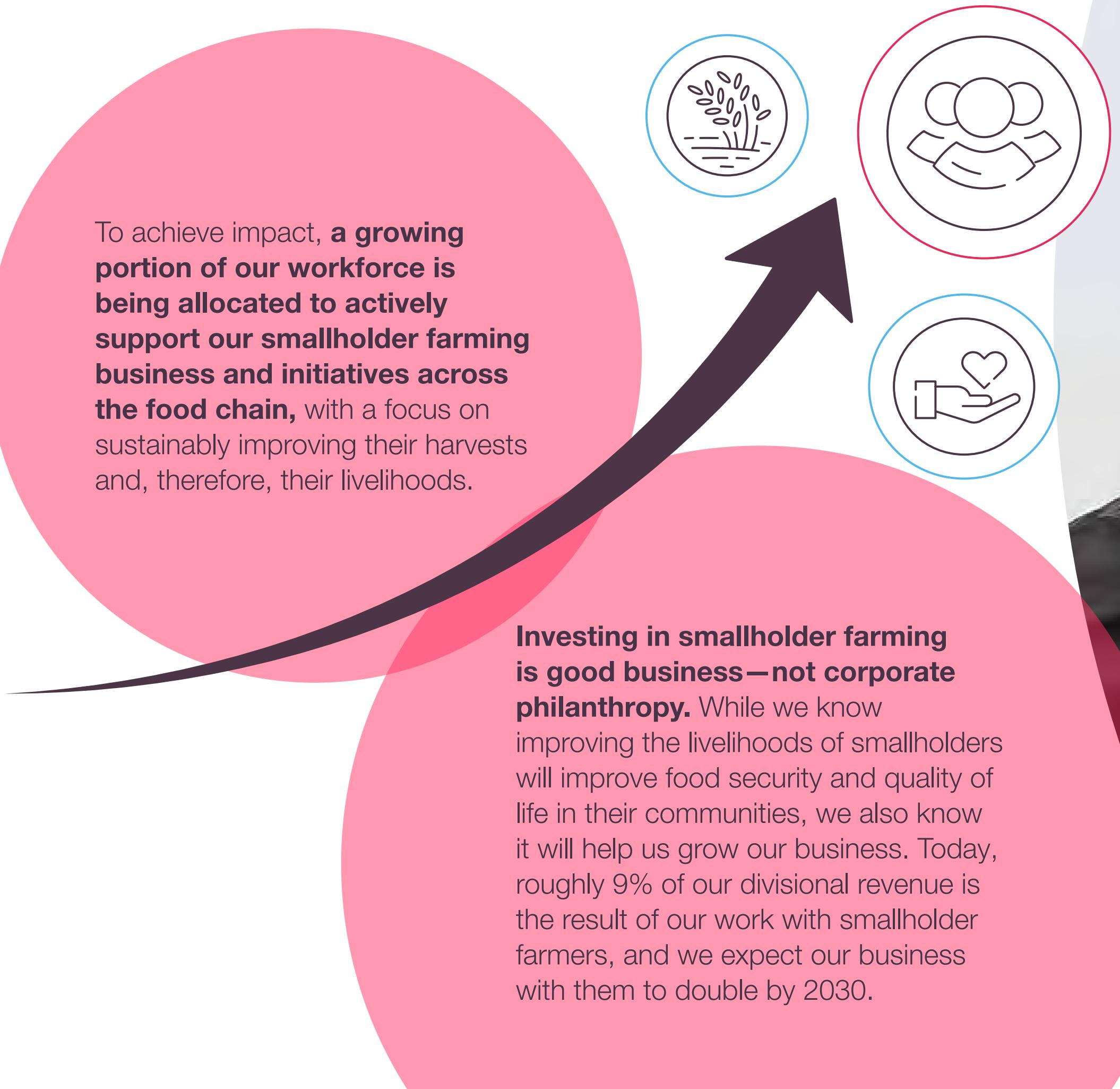
per day



Growing our commitment to smallholder farmers

Investing in their (and our) future

We are doubling down on our efforts to provide smallholder farmers with more sustainable practices, improved incomes and better lives. We've pledged unwavering commitment to the United Nations Sustainable Development Goals (SDGs). Recognizing urgent action is required, we are dedicated to reaching 100 million smallholder farmers in low- and middle-income countries with products, services and partnerships by 2030. **From providing access to agronomic education to creating unique products and partnerships, our efforts will help further multiple SDGs.**



We plan to extend our reach to smallholders from

49M to 100M
2021 / 2030

We expect our revenue with smallholders to double by broadening our reach and helping farmers generate tangible income growth

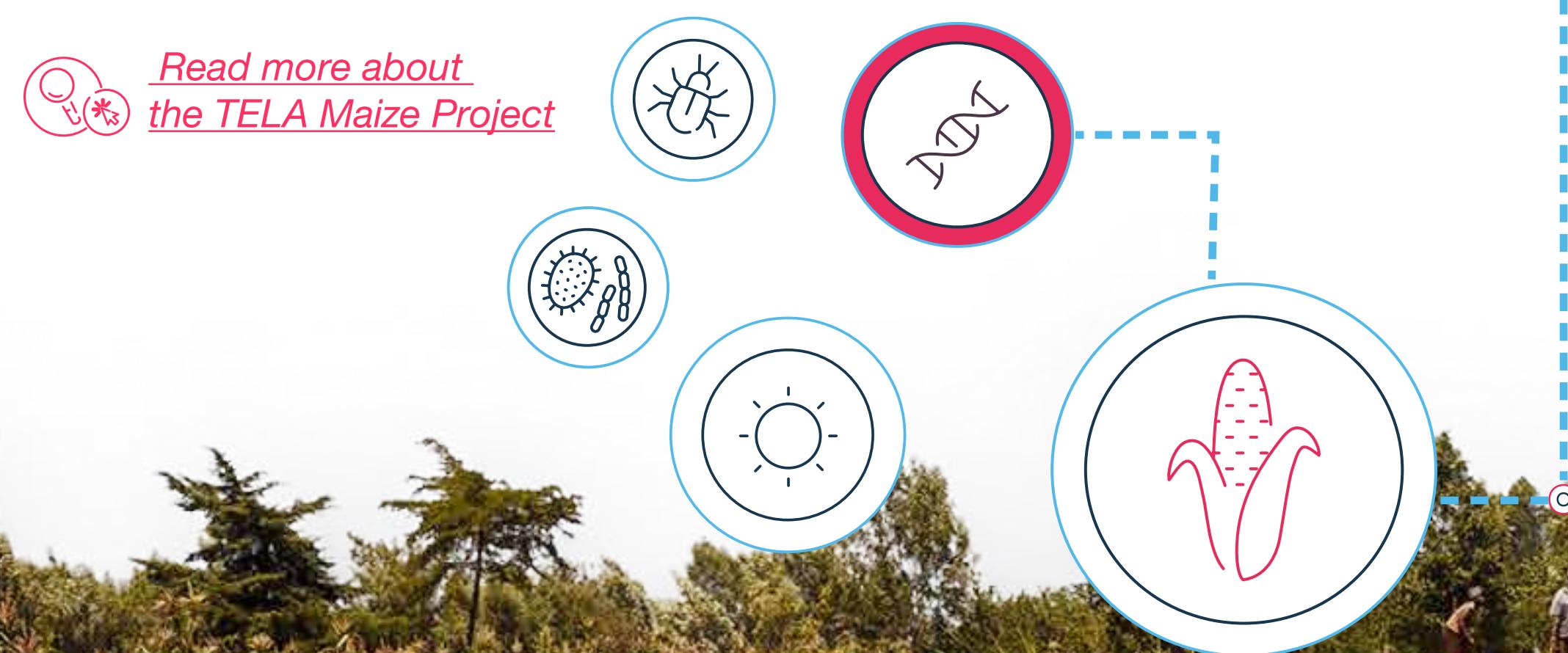


Providing livelihood-changing products

Our increased focus on smallholder farmers means an increase in products tailored to their needs. Just one example of this is our TELA Maize partnership project.

In Nigeria, maize is a food staple – making up a large portion of the nutrition of Nigeria's population. However, severe drought paired with infestations by fall armyworm and stem borer pests have made conditions for growing maize incredibly difficult. This has meant significantly lower yields and income for smallholder farmers in Nigeria. And, without its staple to rely on, much of the country has become food insecure.

For years, our world-class scientists have been hard at work with external partners on a solution to end this devastating problem. And the fruit of the years of investment, development, testing and working through the regulatory process is a game-changing technology—TEL A Maize. **TEL A Maize is genetically modified to tolerate drought and resist fall armyworm and stem borer insects.** It has recently been granted approval by the Nigerian government for evaluation and open cultivation, making it closer to becoming commercially available to Nigeria's smallholder farmers. With the likelihood of a commercial introduction in the 2023 growing season, TEL A Maize will play a major role in laying the foundations to ensure that Nigeria's smallholder farmers are profitable and more of Nigeria's people are food secure.



Making it easier for smallholders to escape poverty

While our products are created with the utmost care and expertise in order to grow our business, our ultimate vision remains Hunger for None. We have pledged to never enforce our intellectual property rights against smallholders for private, non-commercial use of farm-saved seed. Their efforts to escape poverty and provide nutrition for their families are our efforts as well. Instead, we will work collaboratively with them to integrate them into the world of commercial farming. Their livelihoods are our top priority.

We do not plan to assert our intellectual property rights against smallholder farmers who save seeds on their farms for private and noncommercial use in order to avoid extreme poverty

 *Read more about the big impact smallholders have on food security*



Helping smallholders access inputs, know-how and opportunities

Leading an alliance of private sector organizations

In order to help improve the yields of smallholder farmers, **we must first help them improve how they operate.** In partnership with the World Bank's International Finance Corporation (IFC) and Netafim, along with many local partners and government initiatives, we established the **Better Life Farming Alliance**. At its core, the alliance aims to provide smallholders with the education, modern technology and resources to grow their small farms into commercially viable and sustainable farming businesses. After all, when we can ensure smallholders' profitability and longevity, we can improve food security for all those around them and also help minimize their ecological strain.

The Better Life Farming Alliance Commitments



Smallholders supporting smallholders – Better Life Farming Centers

As independent farmers, smallholders often toil in relative isolation, despite the fact that dozens of other smallholders may live and work within miles of each other. As a key component of the alliance, **we created the Better Life Farming Center platform. Part supply store, part educational hub, each of the more than 1600 Better Life Farming Centers is geographically positioned to connect hundreds of independent growers.** A short visit to the center provides each smallholder farmer with the products, education, financing and support to help their businesses thrive.

more than
1600
Better Life Farming Centers



BETTER LIFE FARMING



One of the most challenging aspects of running a remote farm is ensuring your crops get to the right people for the right price before they spoil. It's this critical "last mile" that often creates a break in the supply chain and eats into smallholders' profitability. By being a central hub, Better Life Farming Centers connect all links in the chain, ensuring farmers' products get to the right people who can sell them at the right price in time to be consumed. This leads to greater income for farmers as well as greater nutrition for the communities around them.

The ingrained adaptability to local circumstances makes the BLF Center model scalable and adjustable within active countries, as well as in other countries. The center concept allows entrepreneurs to cater directly to local needs and link relevant local partners to provide tailored smallholder solutions.

Who better to run each center than a farmer from that same community? We train, educate and supply a local smallholder to own and operate each center. In turn, these individuals become the central mentor and connector within their communities. We call them agri-entrepreneurs.

[Read more about the Better Life Farming Alliance.](#)

Empowering entrepreneurship

Ranju Singh grows cereals and vegetables on her small farm in Jharkhand, India. With an immense passion for educating women in the trade of farming, as well as empowering the talents of young girls, Ranju joined the Better Life Farming alliance as an agri-entrepreneur in 2020.

Prior to joining the alliance, Ranju was also a small-scale seasonal seed seller. She traveled from village to village, visiting other farmers. However, she could only sell seeds to the farmers who happened to be on hand exactly when she arrived.

Now, as a Better Life Farming agri-entrepreneur, Ranju is proud to supply fellow farmers with access to an ecosystem of solutions, all tailored specifically to their geographic needs. And all from a central hub that serves to connect the farming community.

Because of her passion for mentoring, her abundance of expertise and her steadfast spirit, the local smallholders all lovingly refer to her as “Didi,” which, in Hindi, means “older sister.”



[Read Ranju's story](#)



Creating stronger livelihoods

While the Better Life Farming Alliance is not the sole solution needed to improve the livelihoods of smallholder farmers, it has made tremendous impact. Reaching across India, Indonesia and Bangladesh, the program has helped improve the success of more than 600,000 (estimated) smallholder farmers.

The majority of these farmers have seen their incomes grow exponentially. In our pilot community of Varanasi in Uttar Pradesh, India, farmers' chili yields more than tripled between 2016 and 2020. And their net incomes increased from around U.S. \$600 annually to U.S. \$3,300. As we expand our focus to more crops and more geographies, we expect to see this same level of improvement in farmers' livelihoods.

By improving the practices of smallholder farmers, we have also been successful in improving the futures of women in farming. In Indonesia, more than 20% of the Better Life Farming Centers are owned and run by female agri-entrepreneurs. If we simply provide the education and tools, smallholder farmers of every kind can thrive.

We're staying future-focused

With our company goal of reaching 100 million smallholders by 2030, we look to expand the Better Life Farming Alliance into more regions throughout Southeast Asia, Africa and Latin America. We also look to create more value-chain partnerships to expand our footprint as well as reach more female farmers. With the right education, access and support, all smallholder farmers can enjoy better practices and better lives.

2030 Goal:
Support
100M
Smallholders



Enabling collaboration during crisis with Better Farms, Better Lives

The Better Farms, Better Lives initiative has proven indispensable during a time of global crisis. Throughout the COVID-19 pandemic, the initiative has helped to maintain farmers' incomes and ensure local food supplies. Bayer and local NGO partners, supported by local governments, have distributed kits containing free commercial samples of high-quality hybrid seeds, crop protection products, face masks and personal protective equipment. More than 2 million kits have been distributed since 2020.

After the project concluded in 2021, an IFC-led impact assessment in India indicated an increase in productivity and income for smallholder farmers in key geographies.

Fun fact: Better Life Farming Centers have also served as health services hubs, hygiene education centers, COVID-19 testing locations and, in one instance, even as an outdoor yoga studio to promote mental wellbeing and assist those dealing with stress.

**2 Million
Since 2020**

Smallholder Farmers reached with Better Farms, Better Lives



Seed Samples



Crop Protection



Personal Protective Equipment



In 2021, the United Nations' Economic Commission for Europe (UNECE) awarded the 2021 Building Back Better infrastructure award to Better Life Farming. Watch the video.

“Better Life Farming is an effective example of how clearing roadblocks to enable success for individual smallholders ultimately contributes to the ecosystem success.

Smallholders equipped with the seeds, tools and knowledge to unleash their potential are in turn empowering their neighbors and neighboring smallholder communities to do the same.”

Inci Dannenberg
President of Global Vegetable Seeds

Partnering with the food chain and smallholders for food security

Improving food security with potatoes

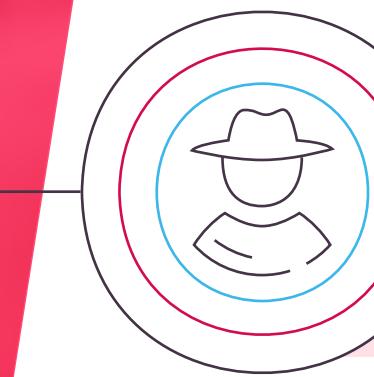
Second only to maize, potatoes are one of Kenya's staple foods. However, due to a lack of access to knowledge, high-quality seeds and the food value chain, **the majority of smallholder farmers in Kenya are unable to grow and harvest anywhere close to the yield potential for their fields.** This has led to income instability for the smallholders of Kenya as well as food insecurity for the people of Kenya.

Partnering with a consortium of public and private organizations, **we worked to train more than 2,000 smallholder potato farmers on agricultural best practices so that they could grow their yields.** And we specifically designed the training program so that we would gain a clear understanding around the amount of impact proper access could have on their livelihoods.

We've also developed a new geodata system called GeoPotato. Powered by satellite data and powerful analysis models, it is designed to enable preventative spraying, easier crop protection decisions and improved farmer income. GeoPotato has entered a full commercial launch in Bangladesh and could reach as many as 1 million smallholder farmers in the coming years.



[Learn more about the GeoPotato system on our website.](#)



// 1 //

The basic farmer
who received no support.

// 2 //

The advanced farmer
who planted his farm-saved seed and received coaching, agronomic training and some fertilizer and crop protection innovations.

// 3 //

The connected farmer
who received coaching, training and the full innovative input of certified seed, fertilizer and crop protection products, as well as a secured selling connection.

Increase in yields
compared to
the basic farmer

-----**X3**-----**X6**

What we learned was livelihood-changing. While the basic farmer struggled to generate income, both the advanced and connected farmers saw their yields and incomes rise significantly. **The advanced farmer's yield was three times higher than that of the basic farmer. The connected farmer's yield was six times higher than that of the basic farmer.** What's more, the advanced and connected farmers' incomes were at least 9 times the income of the basic farmer.

By giving Kenyan smallholders access to the knowledge, products and opportunities needed to successfully farm potatoes, we help them significantly grow their incomes, and we're able to help grow the nutrition for all people in Kenya. This project, while groundbreaking in itself, can serve as a roadmap for feeding a growing population around the world.



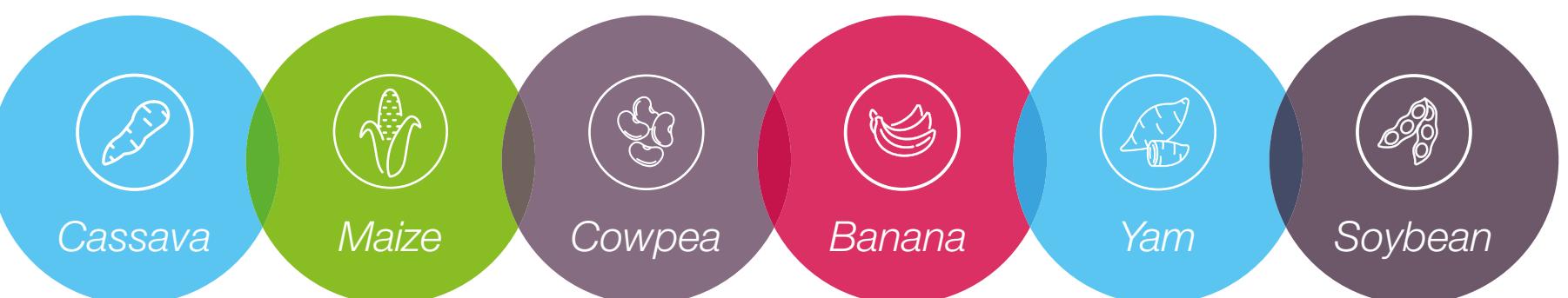
[BayG.A.P. certification opens the doors to food chain partners and buyers. Learn more about BayG.A.P. certification here.](#)



Supplying tools to improve smallholders' operations

Breeding higher-yield versions of key smallholder crops

To efficiently feed a growing population, we must adapt our food to ensure it can grow. With this in mind, we've partnered with the International Institute of Tropical Agriculture (IITA) to create the Modern Breeding Project. Through this unique partnership between a private company and a public organization, **we're sharing the knowledge, tools and manpower to breed hardier versions of Africa's most critical crops:** cassava, maize, cowpea, banana, yam and soybean.



With improved breeding, millions of smallholder farmers throughout sub-Saharan Africa will be able to improve their harvests, their incomes and their communities' access to nutritious food. The end result: a more food-secure Africa.



[Read more about how modern breeding methods are being used to improve smallholder harvests.](#)

Growing the reach of our digital products

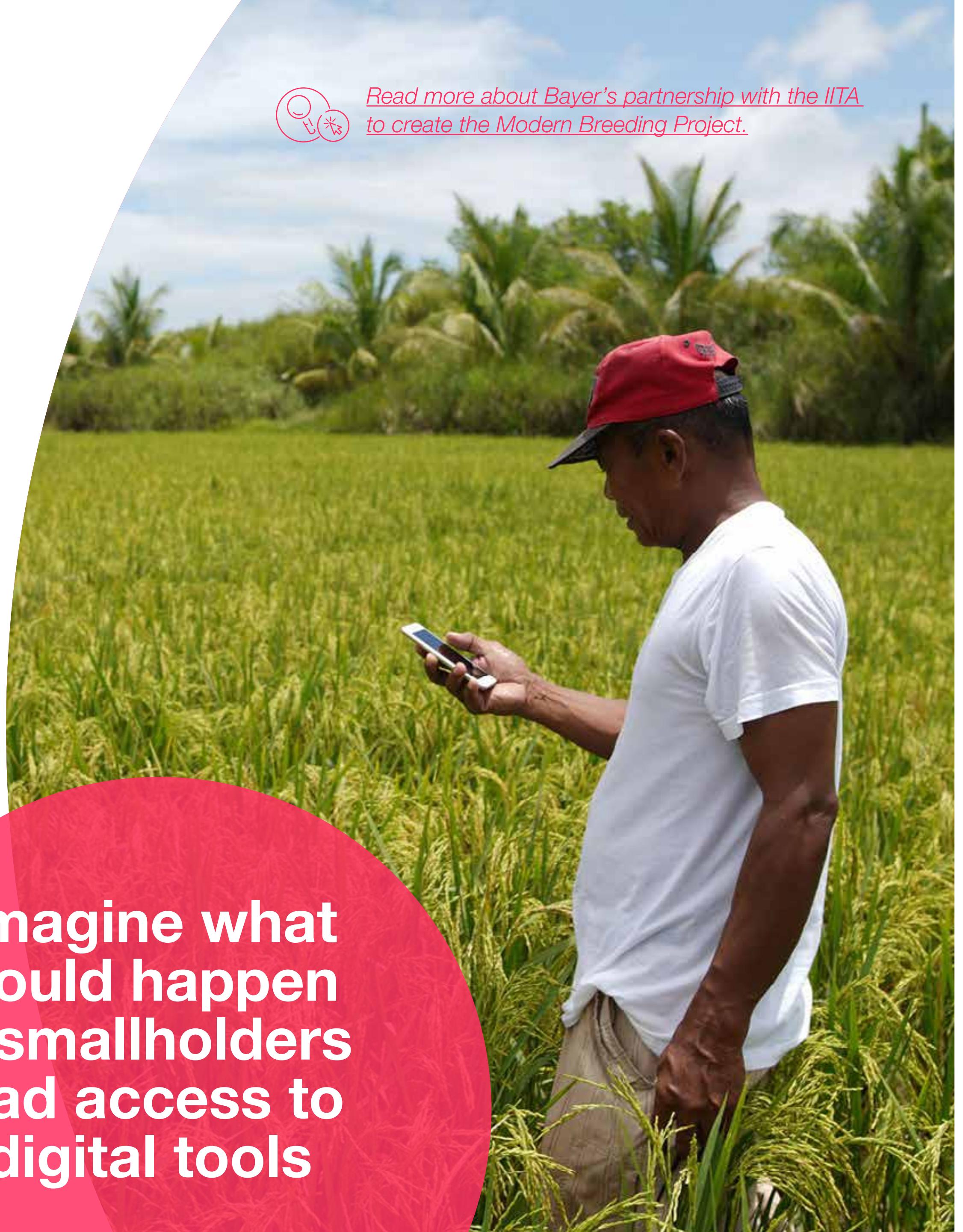
For decades, we've been developing advanced technology to aid commercial farmers. Tools like our Climate LLC's FieldView™ make large-scale growing more efficient, profitable and sustainable.

Imagine what could happen if smallholders had access to these same tools. Our FarmRise™ App, for example, provides detailed weather, pest and disease management insights so that smallholders can act quickly to protect their crops, as well as gain market insights to get a fair price for their harvests.



[Read more about Bayer's partnership with the IITA to create the Modern Breeding Project.](#)

Imagine what could happen if smallholders had access to digital tools



Unleashing the potential of smallholders with vegetables

Helping smallholders become more resilient to climate change

Smallholder farmers usually produce a wider range of crops to diversify their own diets and to mitigate the risk of possible disease or pests affecting crops. Diverse seed types and varieties or hybrid seeds can further minimize the risks farmers are facing today and the challenges imposed by climate change in the future.

Bayer's commitment to smallholders is reflected in our vegetables seeds organization. We are strongly committed to providing solutions that mitigate the risks for vegetable smallholder farmers and increase their productivity and income while helping them to become more resilient to climate change.

The Huntington Sweet Pepper variety is an example that performs well in both low temperatures (5 °C) and high temperatures (40°C) — making it a perfect tool to support smallholders in India.

Breeding vegetable seeds to support nutritional needs

We are also working to give smallholder farmers access to innovative vegetable seeds that are tailored for their specific needs, support diverse food systems and provide essential nutrients. This includes new breeding programs in crops that play a critical role in smallholder communities such as okra and bitter gourd.



Read more about how Vegetables by Bayer is working to improving the lives of millions of Smallholder vegetable growers.



"The Vegetables by Bayer portfolio enables smallholders to become more productive and resilient, boosting food security and economic development."

VK Kishore

Vice President of Vegetable Seeds,
Smallholders & Sustainability

Better outcomes lead to better lives for smallholders

By transforming our business to take action in service of smallholder farmers, we're making measurable progress toward a world in which all growers have the resources they need to run a thriving, sustainable business – and toward a world in which all people have access to the nutrition they need.

In this world, smallholders like Afiya will no longer toil and strain, only to come up short. Afiya's two-hectare operation will have all the resources needed to produce the nutrition her family depends on while also producing a profit through supplying her community. And it will do so in ways that help to sustain our Earth's natural resources rather than deplete them.

This world – it's not so far away. Together, we can get there by 2030.



Bayer ranked #1 in 2021 Access to Seeds Index Rankings

Overall and in Western & Central Africa and Eastern & Southern Africa and #3 in South and South-East Asia
[– View rankings](#)



Learn more about our work with smallholder farmers

// [Smallholder Farming section of 2021 Annual Bayer AG Sustainability Report](#)

// [Better Life Farming Alliance Homepage / LinkedIn](#)

// [Crop Science Smallholder Farming Commitment](#)

Have questions or would like to discuss our work with smallholder farmers? Please reach out!



[Engage on LinkedIn](#)
Lino Dias, Vice President, Smallholder Farming
Lino.dias@bayer.com

REDUCING AGRICULTURE'S GREENHOUSE GAS EMISSIONS



June on Tim Haskin's 2500-acre farm near Gardner, Illinois is a time of vibrancy. He and his employees have usually finished planting the entirety of the maize and soybean crops for the season and the work of fertilizing, protecting, maintaining and growing begins. But June of 2019 was anything but vibrant for Tim and thousands of other farmers throughout the midwestern United States.

70% of Tim's 2500 acres sat completely under water. A sustained deluge of rain throughout May left his land, and his hope for a prosperous season, drowned. Unable to plant in time for the growing season, by fall, Tim filed an insurance claim and only yielded 30% of his typical output at harvest. Tim is just one of the millions of farmers across the world feeling the devastating impacts of climate change.

Our work reducing Agriculture's greenhouse gas emissions contributes to the following U.N. Sustainable Development Goals



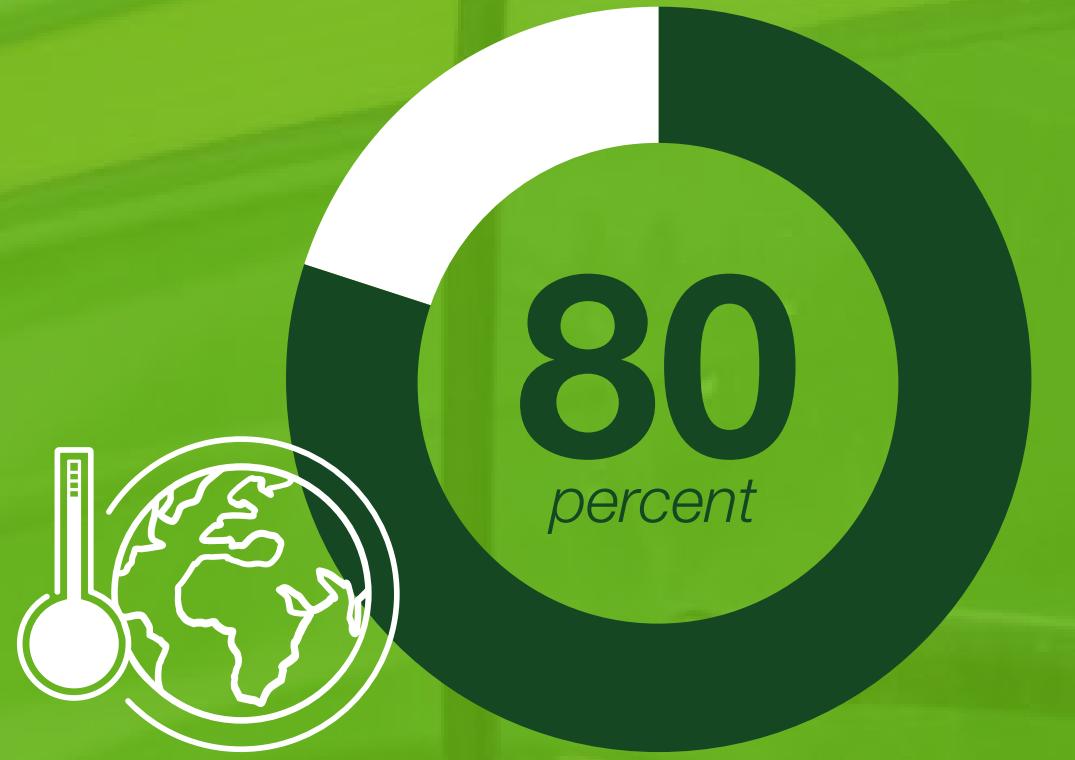
- / 32 On the front lines of the problem and the solution
- / 36 Putting emissions reduction at the center of our business
- / 39 Partnering for more reach & impact across the value chain
- / 41 Looking internally to reduce our own footprint
- / 42 Accelerating the world's progress toward reducing emissions

On the front lines of the problem and the solution

Farmers are feeling the impact of climate change, and we're helping them do something about it

More frequent extreme weather conditions, including floods, drought, high winds and wildfires, are the consequences of a rapidly warming atmosphere. The last decade has delivered an unprecedented amount of these types of events. Not only has it been the hottest decade ever recorded, six category-5¹ hurricanes have torn through the Atlantic, numerous intense wildfires have burned through hundreds of millions of acres of farmland and forests across the Amazon, Australia, California and Greece, and warmer temperatures have brought on more intense episodes of flooding and droughts.

These extremes in weather mean crop loss for farmers, and can threaten the food system. According to research published in the journal *Environmental Research Letters*, throughout Europe, crop losses due to extreme weather events have tripled over the last 50 years. But, while farmers have suffered grave consequences from this problem, we're focused on helping them adapt to climate change and be part of the greater solution.



of farmers globally say their farm is getting impacted by climate change.

In Europe, crop losses due to extreme weather events have increased by

3X / 50 years



Wildfire



Floods



Droughts

¹Source: *Environmental Research Letters*, 2021

Leading an industry-wide resolution

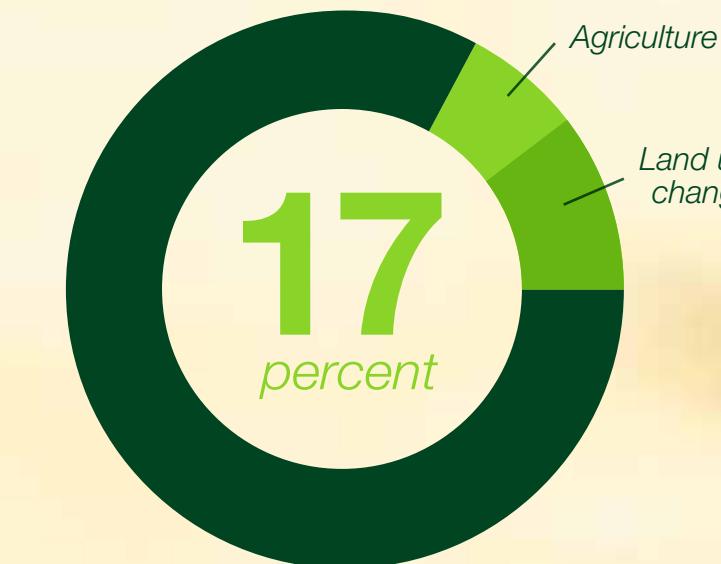
Greenhouse gas emissions, like carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), are a leading cause of climate change. Land use and land use changes including those occurring within the agriculture industry, coupled with crop and livestock activities, account for a large percentage of these global emissions. According to a report from the Food and Agriculture Organization of the United Nations, **in 2018, agriculture and related land use changes accounted for 17% of global greenhouse gas emissions from all sectors.**

If we, as the agriculture sector, continue to practice as we always have, we'll contribute to further climate change. However, if we can adopt ways to lessen our impact and even offset emissions from other industries, we'll strengthen the world's fight against this looming problem. As a leading agriculture company, we strive to discover ways to achieve this. And, as we've found, at least one solution is in our own customers' backyards. Or, rather, their fields.

Like all plants, the crops farmers grow absorb carbon from the atmosphere through photosynthesis. When the plant matter breaks down, it leaves the carbon in the soil. **This makes soil one of the earth's best natural carbon sinks, second only to oceans.** Carbon can then be retained in the soil with sustainable farming methods like no-till farming and planting cover crops in the off season. **By helping farmers to implement practices that help keep the carbon in the soil, we can lessen the amount of carbon in the atmosphere – taking us one step closer to a carbon-neutral future.**

What's more, carbon-rich soil is also healthy soil. It requires less fertilizer and yields more bountiful healthy harvests. What's good for the atmosphere is also very good for growing food. And that means it's good for farmers' businesses.

Agriculture and related land use changes account for

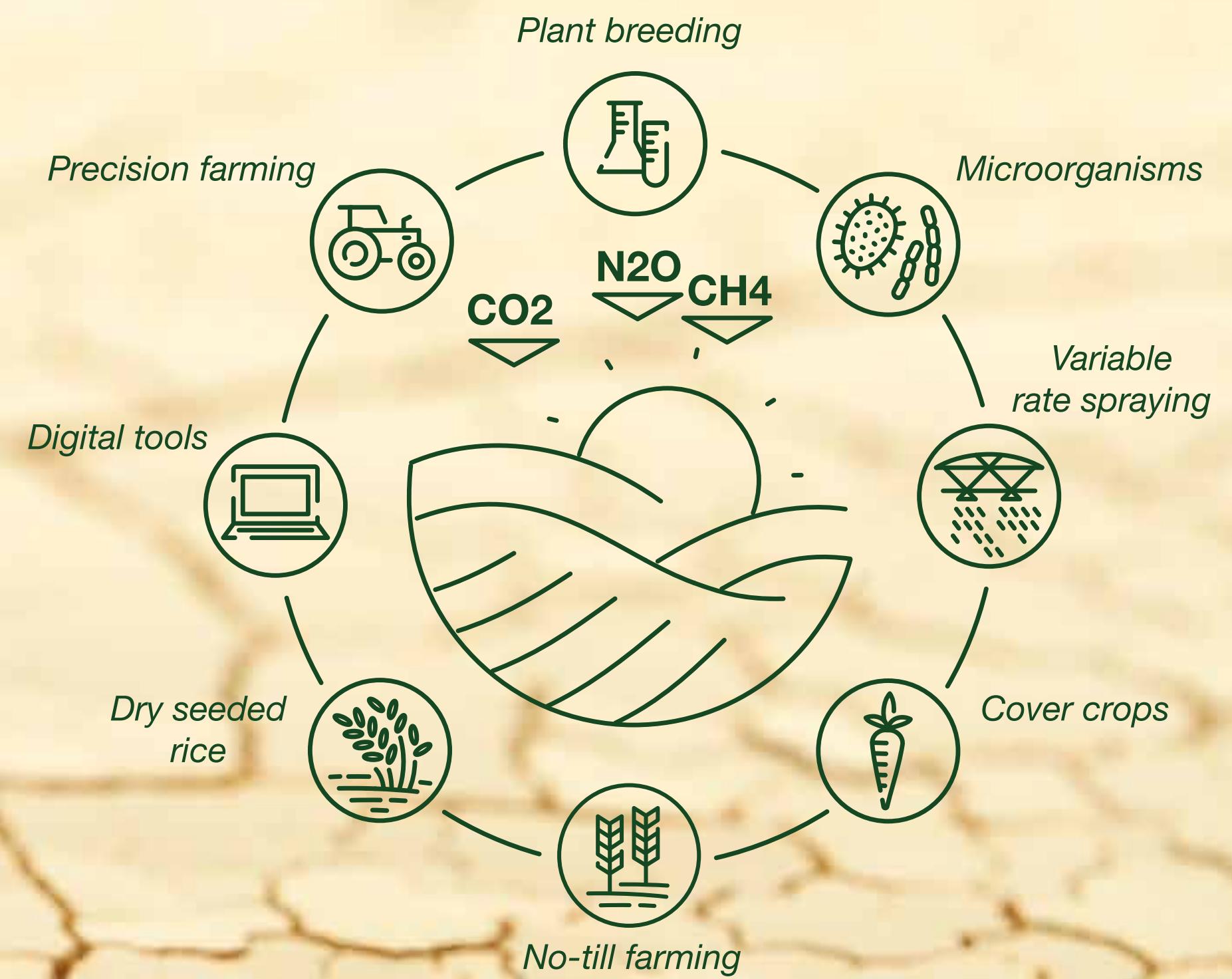


of global greenhouse gas emissions

Source: FAO, 2021

Collaborating with farmers and partners across the value chain to innovate and drive adoption of tools, practices and business models to reduce agriculture's greenhouse gas emissions by:

- // Keeping Carbon in the Soil
- // Sequestering Carbon from the Atmosphere
- // Reducing Farmer Operational Emissions of CO_2 , N_2O , and CH_4



Reducing the greenhouse gas footprint of crop production where our products are used by 30% by 2030

In 2019, we set an ambitious commitment. By 2030, we will equip farmers to reduce the greenhouse emissions per kilogram of crop produced by 30% where our products are used. This target is measured against a 2020/2021 baseline, based on data on our customers' footprint that year. Accurate definition of our scope and measurement is essential so we know what's working and what isn't, as well as to maintain focus on our goal.

The scope of our commitment is centered on where we can make the biggest difference—and that is with the most carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) emitting crop systems in the regions that we serve. That's soy and maize in the U.S., Brazil and Argentina, paddy rice in India, as well as wheat, cotton and rapeseed in other geographies. More specifically, we're focused on the sources of these emissions, primarily cultivation, decomposition of applied fertilizers and organic matter, as well as irrigation. We define our customers as farmers whose share-of-wallet for our products at least equals our market share in a particular market, farmers using our seed varieties, our digital platform Climate FieldView™ or farmers participating in our Bayer Carbon Initiative. To measure progress against our target, we'll use representative samples of field-level data from a third-party market research data provider obtained in interviews with randomly selected farmers.

 [Read more about our detailed methodology to track our progress against our commitment](#)

Centering our approach around farmers and society

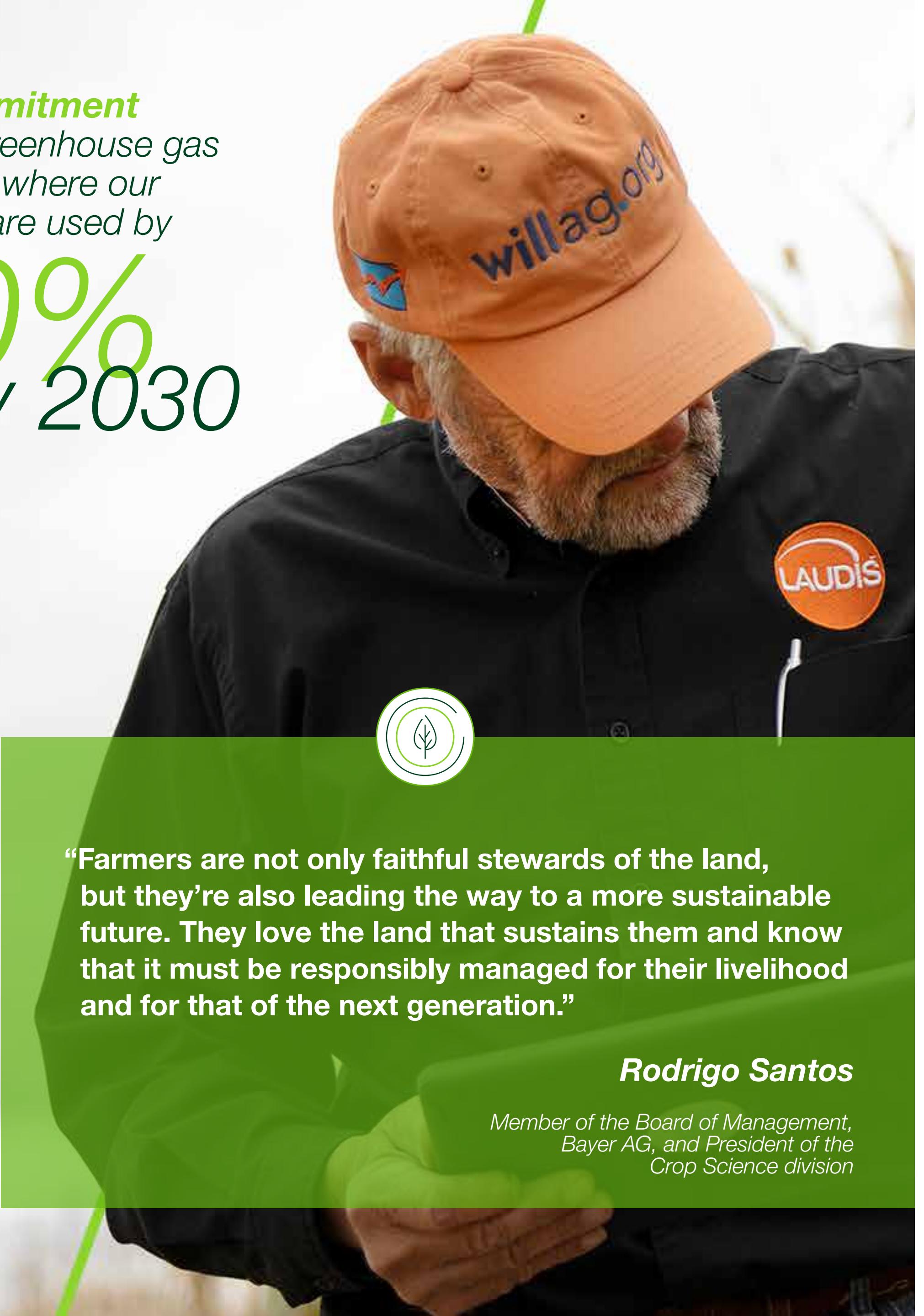
Farmers are the earth's original conservationists. After all, when the land is your livelihood, any changes to it can be devastating. However, our ambitious goal of significantly reducing atmospheric carbon won't work if it doesn't work for farmers' businesses. So, farmers are at the center of every initiative we have to reduce agricultural emissions and sequester carbon in soil. **In everything we do, we first work to fully understand the impacts it will have on farmers' day-to-day practices and their livelihoods.**

If it impacts their businesses positively and is practical for their day-to-day work, we move forward. If it doesn't work for farmers' businesses, it shouldn't have a place in ours. With that in mind, we asked ourselves, beyond improving the health of their harvests, is there a way we could make soil carbon something farmers want to farm? The answer is rather simple.

Our Commitment

Reduce greenhouse gas emissions where our products are used by

**30%
by 2030**



"Farmers are not only faithful stewards of the land, but they're also leading the way to a more sustainable future. They love the land that sustains them and know that it must be responsibly managed for their livelihood and for that of the next generation."

Rodrigo Santos

*Member of the Board of Management,
Bayer AG, and President of the
Crop Science division*

Carbon: Farmers' newest crop.

Farmers are in the business of growing, harvesting and selling crops based on the price dictated by commodity markets. **To make sequestering carbon a vital part of their work, we must treat carbon as a potential revenue stream. That means giving farmers a way to generate income from it at a price equal to their efforts.** By giving farmers the tools and methods to increase the carbon retained in the soil and ensure it remains there, they're able to measure it and earn from it, just as they would bushels of tomatoes, maize or soybeans.

Prices for carbon offsets could be as high as

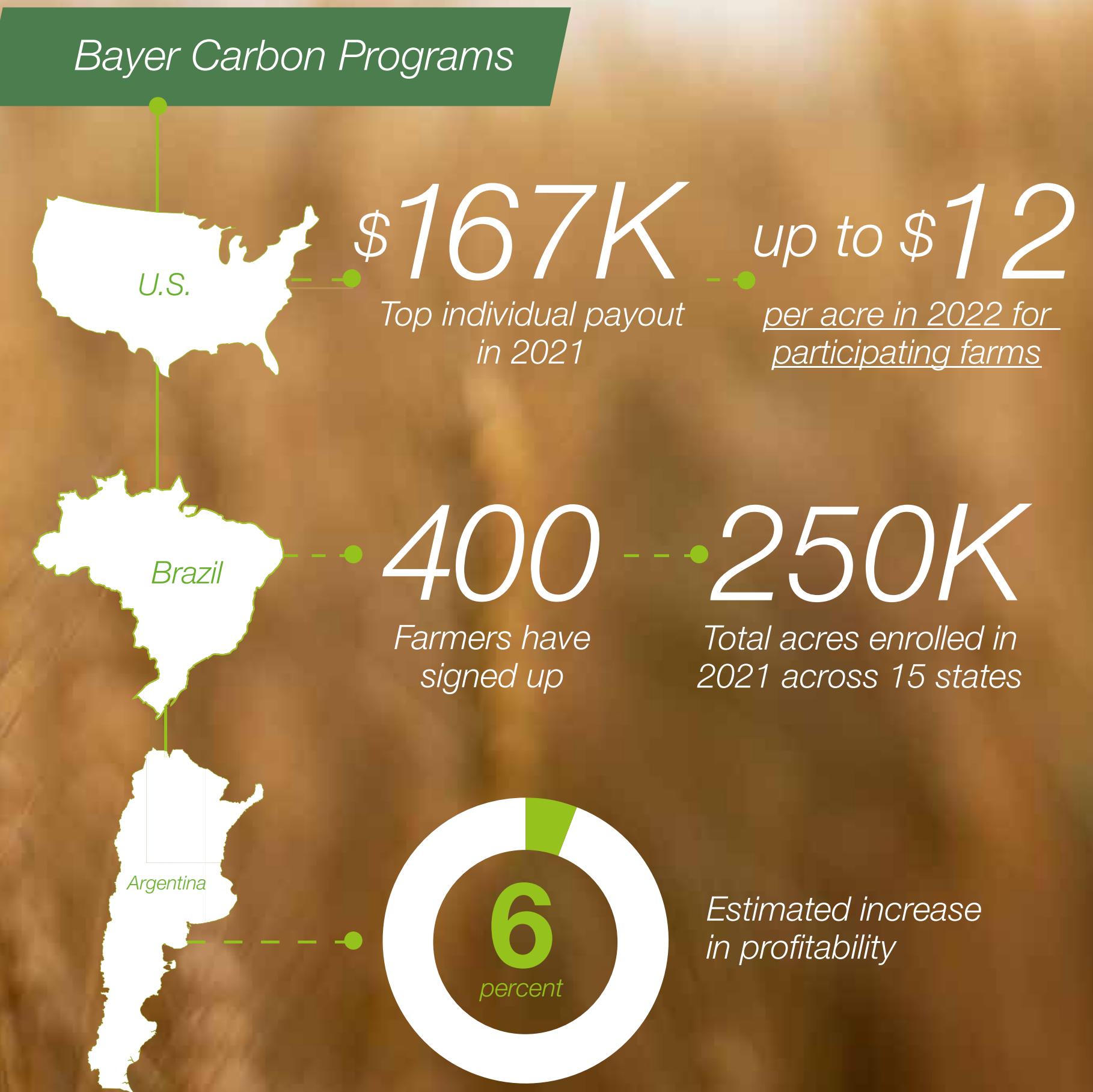
\$120/ton by 2050

At Bayer, we feel that using soil to reduce carbon in the atmosphere is not just our responsibility, it could unlock our own promising business opportunities. **Our work on the ground with farmers puts us in exactly the right position to help them improve their practices and, in turn, their businesses.**

And, when we improve farmers' businesses, we improve ours. By creating new ways of working, we'll create new value opportunities for all of us. **It's good for business, good for farmers and good for the world.**



Putting emissions reduction at the center of our business



Recognizing that farmers are our single best asset for growing soil carbon, we're creating brand new business models that will help to ensure their participation, far and wide. **Our global approach is designed to reach farms of all sizes.** After all, we know that no matter how many hectares they manage, all farmers should reap the benefits of farming carbon.

Empowering farmers to create big impact

Launched in the United States in 2020, the premise of the Bayer Carbon Program is simple: supply farmers with the motivation to adopt climate-smart practices.

In the U.S., participating farmers who adopt methods like no-till or strip-till farming and planting cover crops receive payment from Bayer relative to the number of acres they're implementing them on. This provides us a way to generate high-quality, certified carbon assets. **Guaranteed payment based on the number of acres enrolled makes participation straightforward for farmers and easy to verify by Bayer.** It also offers flexibility around which methods work best for farmers' individual businesses while also giving them certainty about the income they can expect to generate. In the first year and a half of the program, hundreds of farmers have signed on and been paid for their efforts, making as much as \$167,000 individually. Based on the successful foundation of the existing Bayer Carbon Program, the recently launched farmer-first digital platform ForGround will expand and evolve to go beyond carbon offsets to explore other ways that farmers can make a positive impact in their operations, through the adoption of regenerative agriculture practices and technologies, and the potential to connect with companies to help them meet their sustainability goals from foot printing to value chain interventions all the way to carbon offsets.



[Learn more about ForGround here.](#)

In Brazil, farmers who fulfill certain requirements like social and environmental compliance while adopting climate-smart practices are eligible for soil collection and analyses with our partner, Embrapa. Since its launch in 2020, 400 farmers have signed up and begun participating from 15 different states in Brazil – totaling over 250,000 acres.

In Argentina, we've launched the PRO Carbon program where farmers agree to apply management practices that increase carbon sequestration in the soil. In addition to reaping the direct benefits of greater soil fertility, participating farmers have access to carbon analysis, technical consultants and professional agronomists. Current estimates suggest that the resulting carbon capture improvements to soil health could result in more than 10% yield and 6% profitability increases.

Decarbonizing the food system

In Europe, we launched the [Carbon Farming Initiative](#) in 2021. With a goal of decarbonizing the entire food value chain, this program brings together farmers from seven different countries along with value chain players and our own experts in order to test new carbon farming methods and generate learnings. Methods deemed to be most effective will then be used to explore future reward structures for farmers who implement them. **In line with the objectives of the new EU Green Deal, we are confident this initiative will set the standard for carbon farming throughout all of Europe.**

Connecting
farmers &
value chain
players from

7

European
countries

Enabling verification

Central to our new business models is our proprietary platform, Climate FieldView™.

FieldView™ provides farmers with real-time updates about their fields, down to the soil health level. **Through the platform, we can verify farmers' carbon farming, acre by acre.** And farmers can access monitoring tools to use nitrogen efficiently – reducing their emissions. It's just **one more way we're empowering farmers to adopt sustainable practices.**



Reducing the emissions from rice cultivation

Paddy rice farming is a significant contributor to methane gas emissions. Because rice paddies are flooded with water, the water blocks oxygen from the soil, increasing the amount of bacteria that emit methane. As part of the India Sustainable Rice project that started in 2021, we are evaluating GHG emissions reduction as well as water saving potential in the cultivation of rice. We have also launched an initiative to train farmers in sustainable practices related to GHG emissions reduction, water efficiency and integrated weed management to improve environmental footprint and productivity.

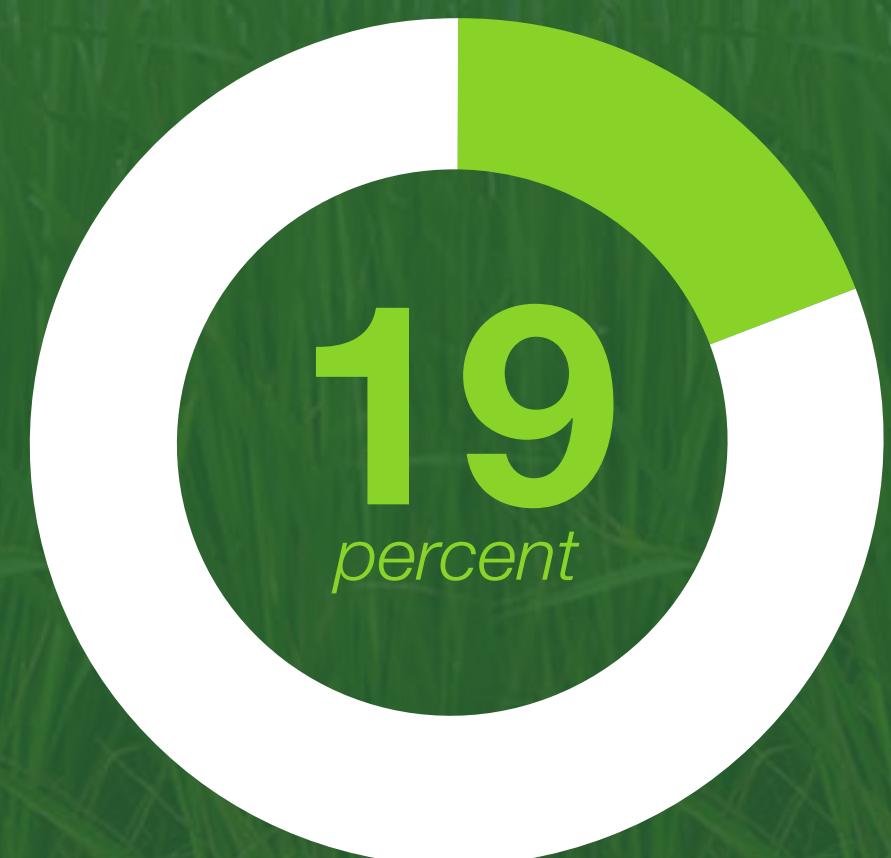
Innovations in rice products are also paving the way for more sustainable cultivation. Our new Arize® hybrid rice is meant to be dry seeded – improving production and reducing GHG emissions by 19% compared to other traditional open-pollinated varieties of rice.



Putting more weight behind our efforts

Seeing the benefit as well as the business opportunity in galvanizing farmers to sequester carbon, we're putting more and more resources toward it. We're increasing our percentage of full-time employees dedicated to carbon farming business models, and we plan to add more resources as we expand into new regions and explore more programs. We're also significantly increasing the amount we're investing in developing our carbon farming business models.

When dry-seeded, our Arize® hybrid rice varieties can deliver



*reduction of greenhouse gas emissions
compared to other traditional open-pollinated varieties*



*Read the Impact Study on 25 years
of Arize® hybrid rice*

Partnering for more reach & impact across the value chain



Aiming to launch business model pilots with value chain partners in 2022 focused on regenerative ag with the following emissions reduction levers

When it comes to reaching carbon neutrality, we recognize that our new business models will only get the earth so far. So, **we're collaborating with other entities to create new pathways for reducing agriculture's emissions.** When we combine our expertise with the knowledge, technologies and power of governments, organizations, farmers, consumers and food chain members, together we can achieve profound impact.

Partnering to decarbonize European agriculture

As part of the Carbon+ Farming Coalition, we're partnering with organizations representing every step along the food value chain with a goal of decarbonizing the European food system. Starting with a lighthouse project we're calling the Carbon+ Farming Journey, the coalition is taking a farmer-centric approach to increasing the adoption of regenerative and climate-smart practices. **The coalition will ultimately deliver a set of recommendations to the European Commission to help frame EU policies that will accelerate climate-smart solutions on a size and scale suitable to encourage adoption across the entire continent.** By identifying the roadblocks to adoption, designing solutions with practical benefits to farmers and creating public and private financial tools like subsidies, tax incentives and carbon markets to help farmers transition to more sustainable practices, we can ensure that farmers around the world are able to do their part in reaching carbon neutrality.

Increasing transparency along the supply chain

Working with Amazon Web Services and Bushel, we developed a first-of-its-kind digital platform to provide farmers in the United States with real-time data around the carbon released – from planting through production of end products. **Project Carbonview will enable U.S. farmers who grow maize within a specific distance of ethanol facilities to limit their carbon footprint along the supply chain.** While this is being rolled out for production of ethanol, we'll be able to implement it along other food value chains as well. We believe this technology will set the standard for transparent and sustainable supply chains everywhere.

Understanding emissions through three scopes

Like all corporations, our emissions are classified into three different scopes. Our scope 1 emissions are our direct emissions from our corporate-owned facilities and vehicles. Our scope 2 emissions are our indirect emissions as a result of procuring electricity, steam and cooling energy. Scope 3 emissions represent all indirect emissions along our value chain, both upstream and downstream.

We are committed to transparently communicating our climate targets and progress, as well as the impact that climate change has on Bayer. Through continued participation in CDP we disclose a high level of details on our climate related activities and progress. In 2021, CDP once again gave the highest rating (A) to our company's climate strategy for leading in environmental performance and transparency.

Advancing our digital capabilities

We're also [partnering with Microsoft](#) to develop a digital, cloud-based infrastructure that will provide all those along the value chain with a variety of tools to adopt more sustainable practices. **These strategic offerings will ensure that agriculture companies of all types and sizes are able to confidently move forward in improving their impact on the world's atmosphere with the help of data-based insights.** This new source of valuable information will transform our entire digital landscape inside Bayer. But, even more importantly, we expect this innovative partnership to transform the impact of the entire industry.



Scopes of emissions

1

Direct emissions from our corporate-owned facilities and vehicles

2

Indirect emissions as a result of procuring electricity, steam and cooling energy

3

Indirect emissions along our value chain

Looking internally to reduce our own footprint



We've set ourselves a target of reducing scope 1 and scope 2 emissions by

42 percent

by the end of 2029

We've set ambitious targets for our own emissions reductions

We've joined the world's leading Science Based Targets Initiative, founded by the CDP, the UN Global Compact, the World Resources Institute (WRI) and the World Wide Fund For Nature (WWF). **The initiative, aimed at assisting organizations in setting transparent targets for reducing emissions, has approved our ambitious targets in the reduction of our scope 1, scope 2 and scope 3 emissions.** With these targets, we have committed ourselves to actively playing our part in limiting global warming to 1.5°C for scopes 1 and 2, and 2°C for scope 3.

As a leading life sciences company, we realize there's a lot we can do within our own organization to lessen our footprint for greenhouse gas emissions. While our work with farmers and along the value chain is helping to limit emissions upstream and downstream, we're also making huge commitments to adjust our internal ways of working. **We're reducing our own emissions from power plants, vehicles and production facilities (scope 1) and indirect emissions from the procurement of electricity, steam and cooling energy (scope 2).**

We've set ourselves a target of reducing our scope 1 and scope 2 emissions by 42% by the end of 2029.



[See the specific internal actions we are taking to reduce our own emissions and move toward a more carbon-neutral future.](#)

Accelerating the world's progress toward reducing emissions



Our efforts to reduce greenhouse gas emissions are helping to shape a future one step closer to climate neutrality. While our efforts to reduce the emissions from our own operations are but a tiny contribution to the greater whole, by providing the tools, programs and partnerships to reduce emissions throughout the entire food system, we can help lead a step change in the reduction of emissions in agriculture.

Proud to be harvesting the way forward

Tim Haskin's extremely diminished 2019 maize and soybean harvest was devastating to his business. But, by the 2020 growing season, Tim had added an entirely new source of income to his operations that didn't require him to purchase any more land, nor did it require a reduction in his maize and soybean planting. If anything, it actually helped to ensure an increased yield for future seasons, while also providing another source of income for his business. **This revenue stream: carbon sequestration. And it's one that we hope to provide every farmer around the world with the tools to generate.**

Although there is still much work to do, we can begin to see a future in which all farmers like Tim are no longer simply feeling the harsh effects of a warming world, they are actively working to address it – so that all those along the value chain can feel the benefits.



Learn more about our efforts to reduce agriculture's greenhouse gases

// [Climate Smart Agriculture section of the 2021 Bayer Sustainability Report](#)

// [Crop Science Greenhouse Gas reduction commitment](#)

// [Learn more about how we protect the climate](#)

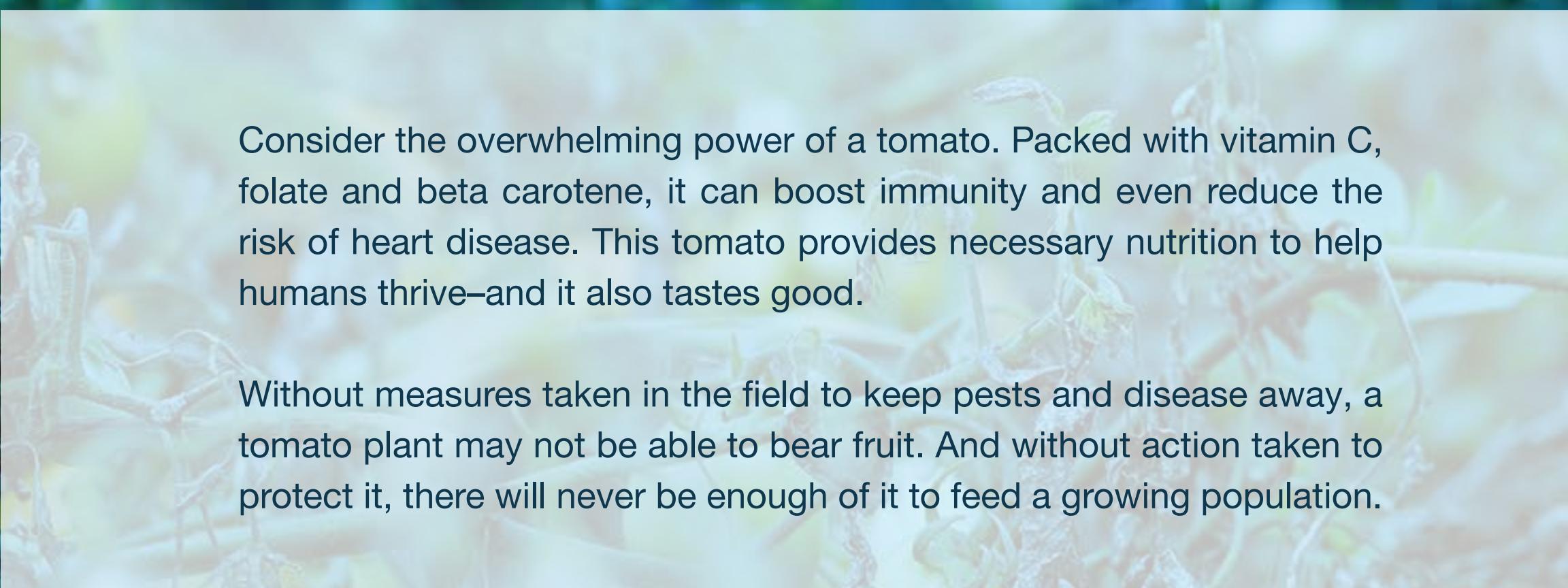
// [Our investment in the sustainable lower carbon oilseed producer CoverCress™ Inc.](#)

Have questions or would like to discuss directly with us our efforts to reduce agriculture's greenhouse gas emissions? Please reach out!



[Alexey Kuzmenkin](#)
Director Global Climate Change

CROP PROTECTION ENVIRONMENTAL IMPACT REDUCTION

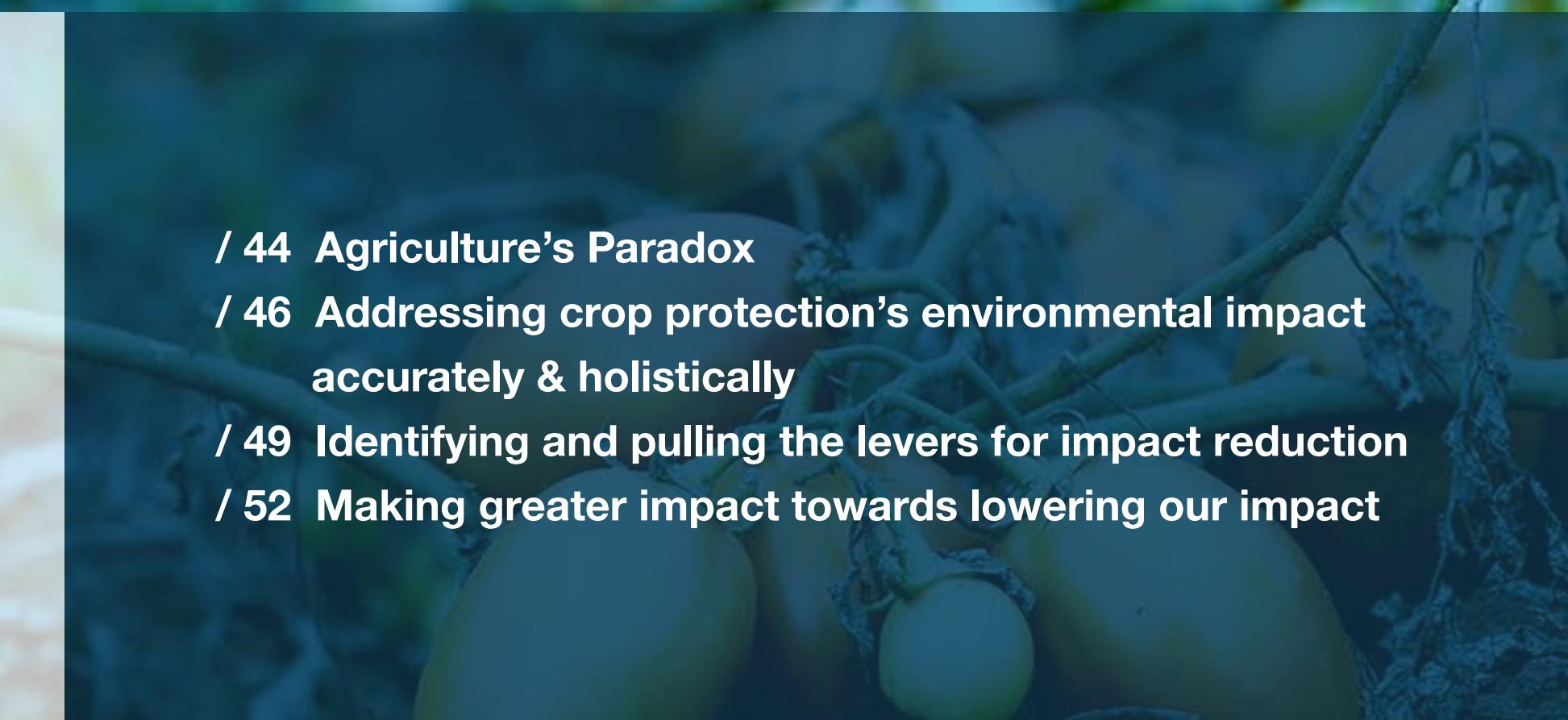


Consider the overwhelming power of a tomato. Packed with vitamin C, folate and beta carotene, it can boost immunity and even reduce the risk of heart disease. This tomato provides necessary nutrition to help humans thrive—and it also tastes good.

Without measures taken in the field to keep pests and disease away, a tomato plant may not be able to bear fruit. And without action taken to protect it, there will never be enough of it to feed a growing population.

Our work reducing the environmental impact of crop protection contributes to the following U.N. Sustainable Development Goals



- 
- / 44 Agriculture's Paradox
 - / 46 Addressing crop protection's environmental impact accurately & holistically
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Agriculture's paradox

By definition, farming alters the natural environment in order to supply the food we eat across the globe. Farmers need to tend to their land to protect their crops from harmful insects and disease as well as guard them from weeds competing for the same land, nutrients and water.

Crop protection isn't just critical for farmers' businesses, it's imperative for our food system. Historically, crop decimation from blight and pests resulted in starvation and conflict in the developing world, and it is still a significant threat in many countries. Crop protection gives us the security of knowing our food supply is protected from this type of destruction.

Crop protection also increases yields, allowing farmers to grow more food on less land, which is a necessity now more than ever. Today, farmers use less than one third of the land they would have needed in 1961 to produce the same amount of food. This ability to do more with less reduces the need to expand agricultural production into natural habitats.



**By definition,
farming alters
the natural
environment in
order to supply
the food we eat
across the globe.**

*Because of increased demand for food and challenges caused by pests, disease, extreme weather and other factors, the use of crop protection results in a net-benefit yield gain. Without using crop protection, **sustaining production would lead to:***

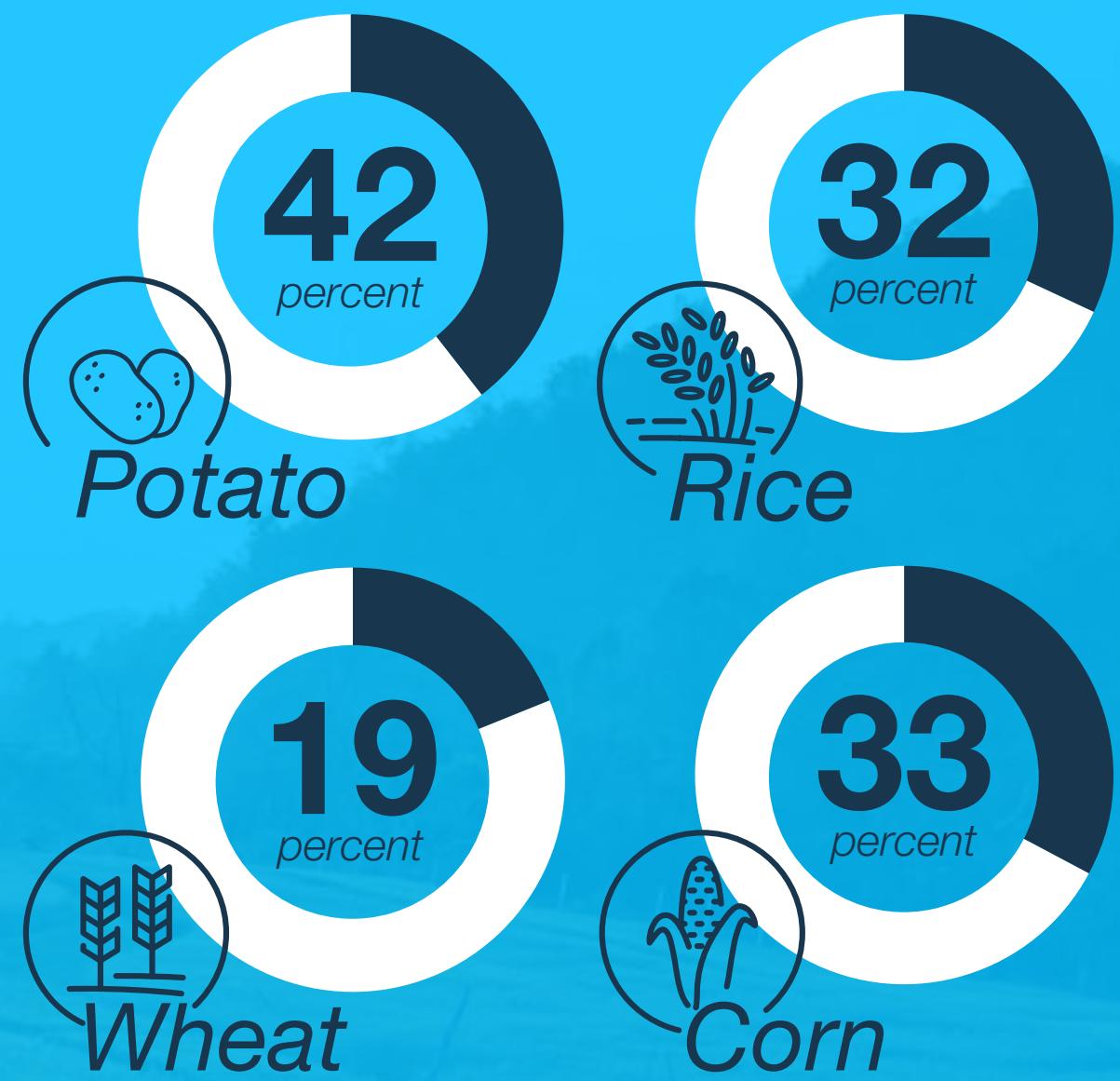


**Significant food
price increases
expected**



**Non-agricultural
land will be
converted**

Net-Benefit^{**} yield gain using Crop Protection



*Scientific Foresight Unit, European Parliamentary Service. March 2019 **The Benefit which cannot be mitigated by alternative actions related to agronomy, rotation or cultural measures



Our Commitment
Reduce the environmental impact of our crop protection portfolio by
30% by 2030

While crop protection has obvious benefits for our food supply, we also know that crop protection products have an impact on the environment beyond the field. When used incorrectly, this impact can be increased.

The typical requirement for placing a pesticide on the market is to demonstrate clear proof of efficacy while ensuring there are no effects on human health and acceptable risks for the environment. Our safety standards reflect the guidelines and standards of international organizations such as the FAO, WHO and OECD, as well as those of local regulatory authorities around the world.

Through extensive testing and risk assessments, we ensure products have no effects on human health and only acceptable environmental effects.

As the global population grows along with society's concerns about the usage of chemical crop protection, so does our need to produce more products—which means we must ensure that the environmental impact of our crop protection does the opposite. That's why, as the world's leading provider of crop protection products, we are committed to reducing the environmental impact of our crop protection portfolio by 30% by 2030. We are proud to be the only company within our industry to make such a measurable commitment across the entire crop protection portfolio with publicly available models.

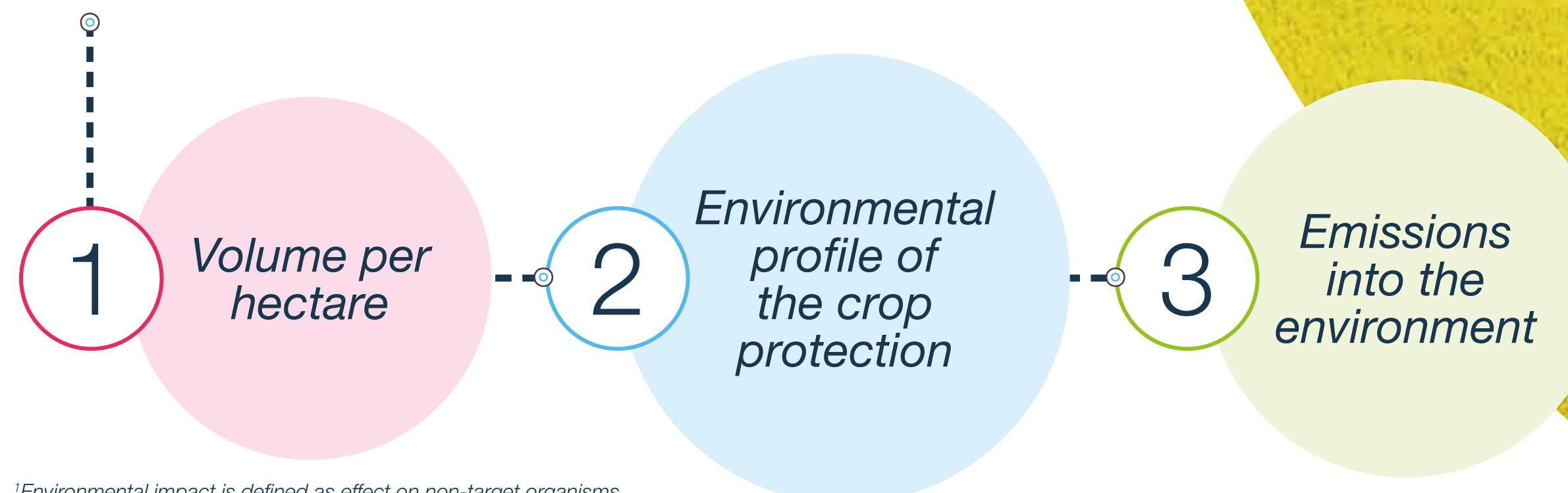
Through extensive testing and risk assessments, we demonstrate that the label-compliant use of our products have no risks for human health and only acceptable risks for undesired environmental effects. This is what we consider safe use, and only products that are considered safe can be registered and brought to the market. We continuously seek to develop and offer products that have the same or better benefits for farmers, while having less impact on the environment.

Addressing crop protection's environmental impact accurately & holistically

Going beyond volume— a more comprehensive way to evaluate impact

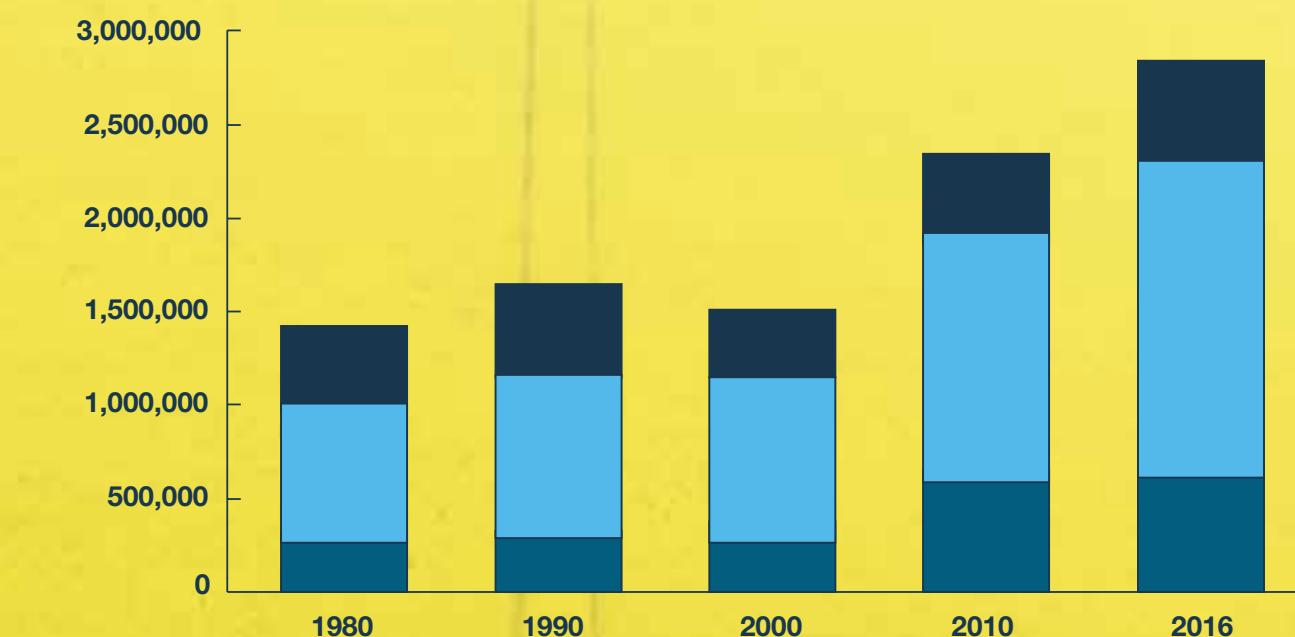
As part of our commitment to significantly reduce the environmental impact of our crop protection portfolio, we set out to adopt a more accurate way of measuring it. Oftentimes, environmental impact is correlated with the volume of product used. While volume certainly plays a role, there are more important factors in determining a product's efficacy and environmental impact. One indication of this is that while the total global volume of crop protection sold has steadily increased, the average amount of active ingredients applied per hectare has decreased. This overall volume increase is due to greater food demand, stemming from a growing world population, whereas **the decreased volume applied per hectare is the result of innovations to improve the efficacy and reliability of crop protection products.** These innovations have resulted in less product needed for the same level of control, and in many cases, active ingredients with better environmental profiles.

Bayer therefore strives for the ability to go beyond looking at volumes per hectare. Broadly speaking, **the environmental impact of crop protection is determined by three main variables:**

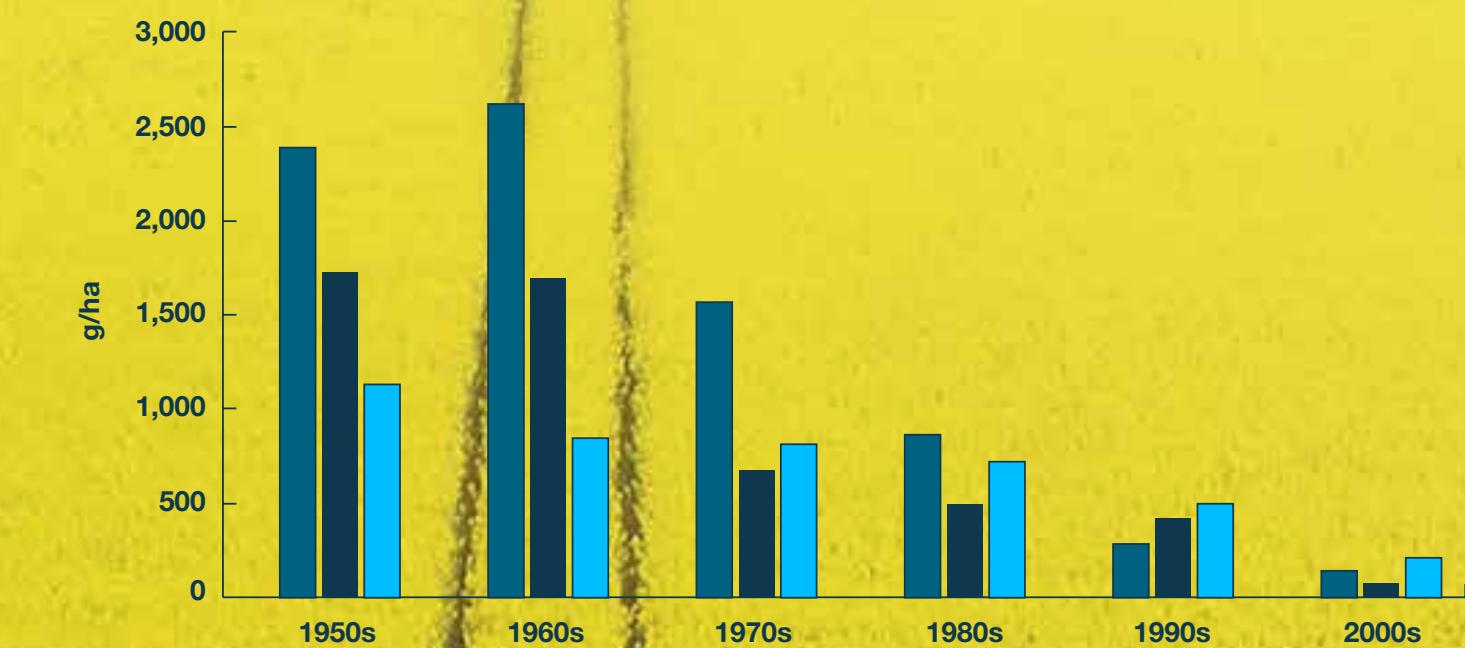


¹Environmental impact is defined as effect on non-target organisms

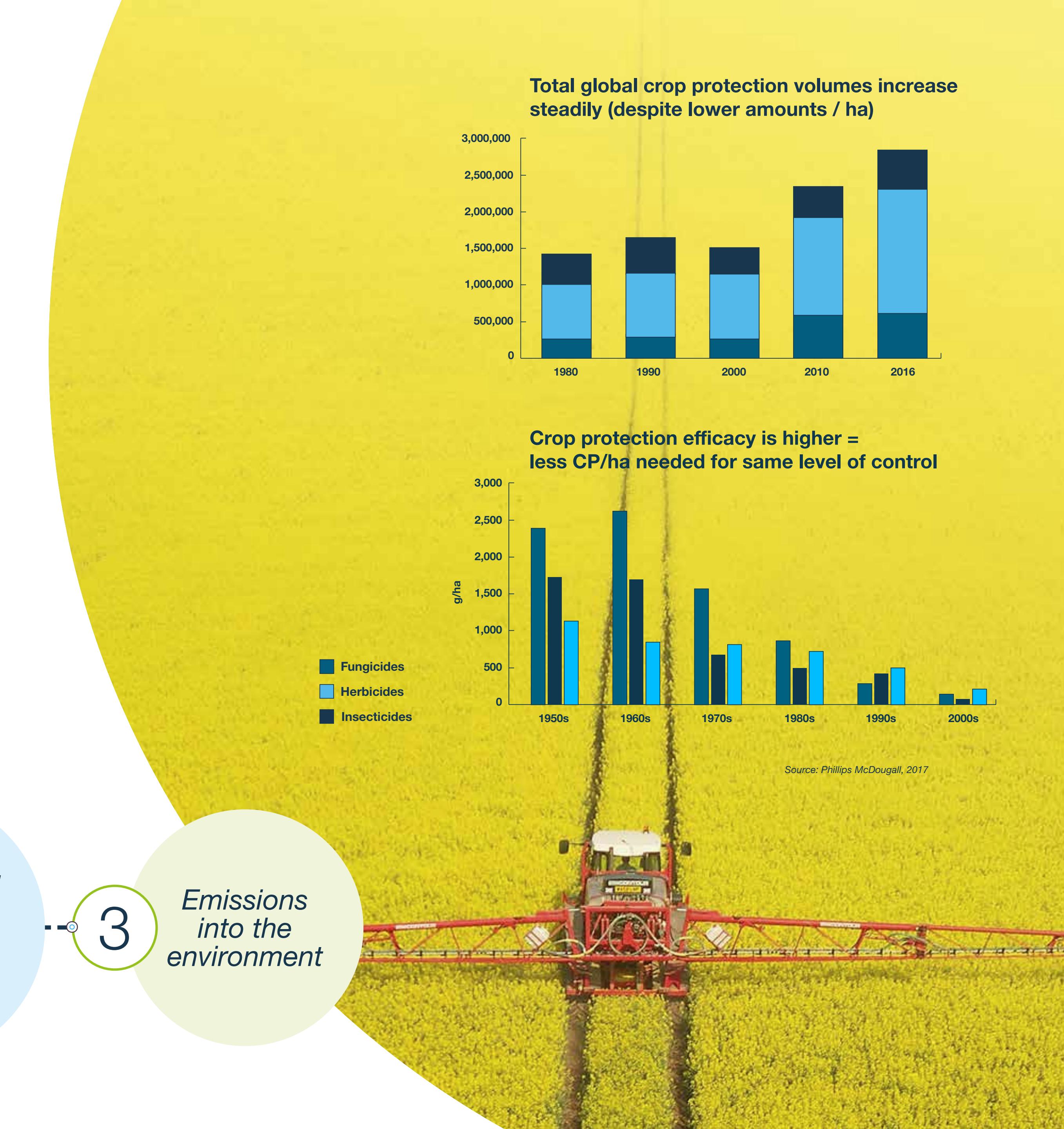
Total global crop protection volumes increase steadily (despite lower amounts / ha)



Crop protection efficacy is higher = less CP/ha needed for same level of control

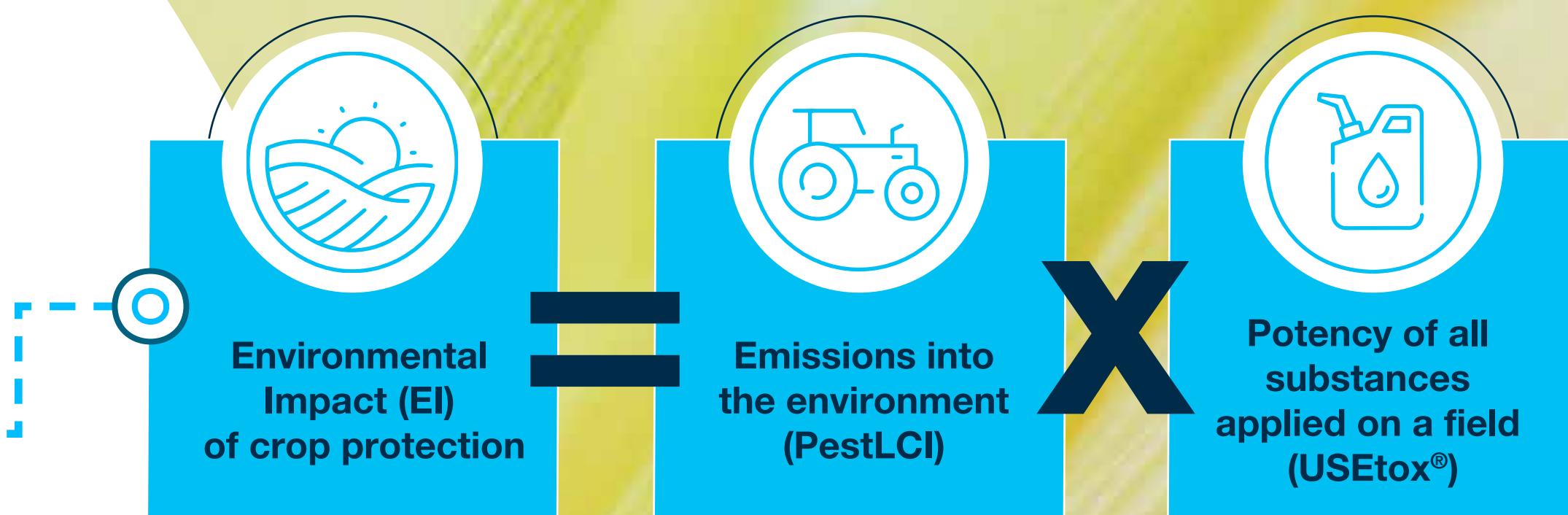


Source: Phillips McDougall, 2017



Developing and adopting a better model

Since 2019, we've collaborated with the Technical University of Denmark (DTU) to create a state-of-the-art methodology for measuring the environmental impact of crop protection. The new approach combines two renowned models—PestLCI and USEtox®—with a global data set of crop protection applications for a more precise measurement.



These two models, developed externally in academia, have been peer-reviewed and adopted by leading public authorities. In fact, they have been trusted by leading organizations such as the United Nations Environment Programme (UNEP), the Society of Environmental Toxicology and Chemistry (SETAC) and the European Union.

We are actively collaborating with DTU to apply these models to a global data set of crop protection applications—which we will rely on to assess our progress against our 30% Crop Protection environmental impact reduction commitment. The application of the models and the global impact assessment to this commitment is vetted by an unbiased external panel of experts to guarantee that we are applying the models adequately across our entire global crop protection portfolio.

While we have financially supported the research project at DTU and provided sector-specific information upon request, we would like to emphasize that the independence of the university's scientific research work and model development have been respected and safeguarded at all times. It is important that the models remain unbiased and based solely on sound science—which is why we insist on working to ensure that the models remain an independently developed tool. The DTU is working to publish the global impact assessment in peer-reviewed journals, which we fully support.

Input data processed by the models

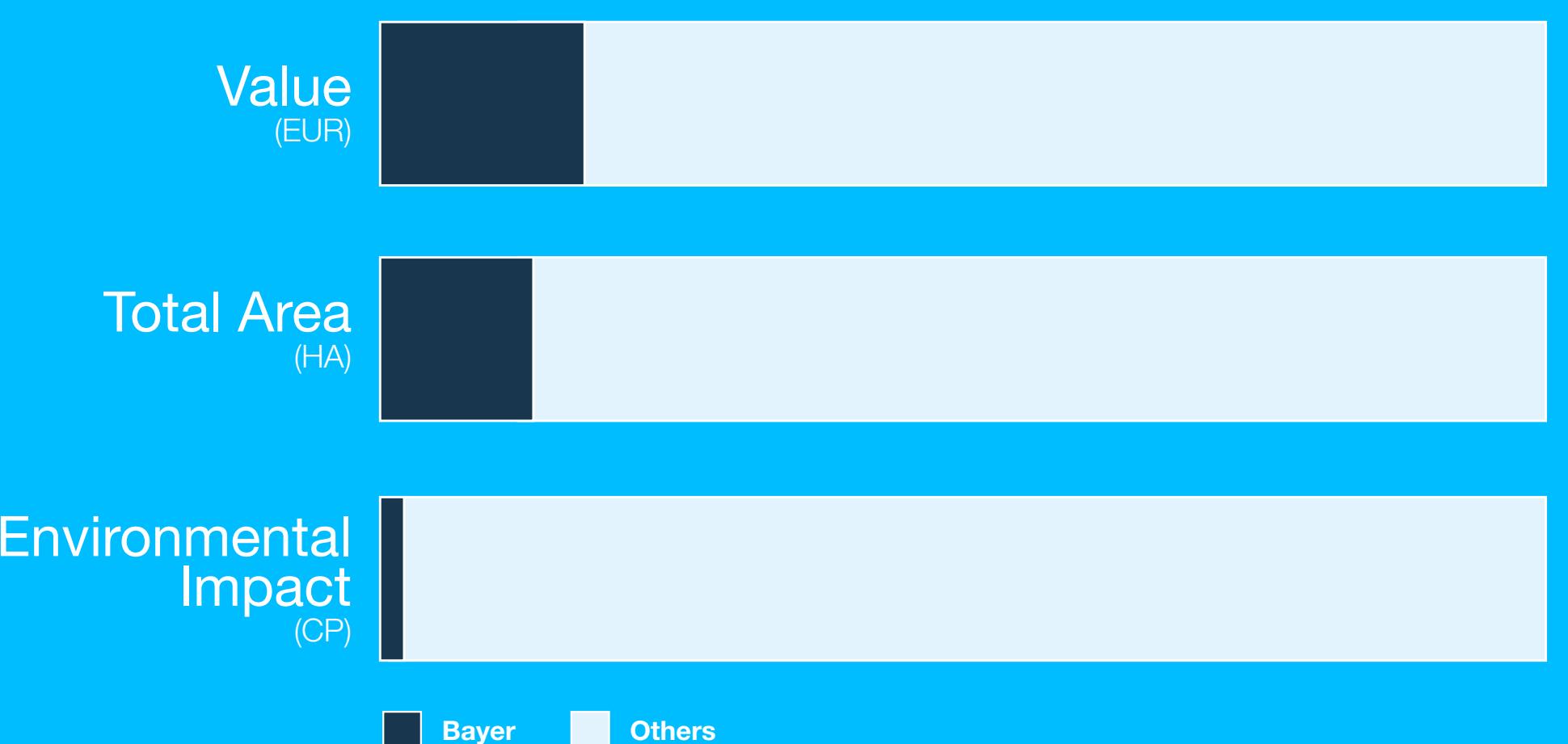
- Crop protection application data
- Substance data
- Crop & Soil
- Weather Patterns

Taking responsibility for our share of impact

While we already scrutinize the impact that our new and existing products have on the environment, with this new methodology, we'll be able to assess the complete global crop protection portfolio. And we'll be even better positioned to help growers increase their output with less impact on surrounding environments.

Using the methodology, assessments show that despite our strong global market position, **Bayer products only account for 2% of the environmental impact from crop protection in 2018**. While this new measurement is encouraging for our business, it only makes us more determined to further reduce our portfolio's impact and lead the charge in transforming the level of impact for the entire industry.

2018 Crop Protection Environmental Impact



Preliminary impact assessment has been conducted by Technical University of Denmark (DTU) based on the PestLCI/USEtox® models. PestLCI secondary distributions currently out of scope. Impact assessment limited to current scientific consensus of USEtox®: aquatic organisms and the substances which can be characterized in USEtox®. Terrestrial and pollinator impact assessment is currently not included in USEtox®. CP application data mostly from third parties such as Kynetec/Kleffmann in some countries based on Bayer estimates. Only CP applications in 2018 covered.



Bayer products only account for



of the environmental impact from crop protection in 2018

Identifying and pulling the levers for impact reduction

We have identified a number of different technologies that can be deployed to help progress towards our commitment of a

30% reduction in our crop protection portfolio's environmental impact. These technologies fall into four main categories:



Improving the chemistry of crop protection products



Reducing the amount of crop protection products needed per hectare



Reducing Crop Protection Emissions to the surrounding environment



Ensuring safe, responsible use of crop protection products

(see chapter on Sustainable Use)



1

Improving the chemistry of crop protection products

One very clear way we can reduce the environmental impact of our crop protection products is by adjusting their chemistry. So, we're working to ensure all formulas have reduced effects on non-targeted plants and species. And we're evolving them to keep the active ingredients where they are supposed to be.

We have integrated our holistic methodology into the governance of our research and development decisions. And all future crop protection research and development projects will incorporate our commitment to impact reduction as an additional decision-making criteria. To ensure delivery of our commitment, we plan to initiate mitigation measures in geographic areas and with specific crops where our CP environmental impact is currently higher compared to Bayer's baseline.

We have integrated our holistic methodology into the governance of our research and development decisions.

Reducing the amount of crop protection products needed per hectare

2

As a business that supports farmers, we know that the crop protection we offer is just one part of a holistic, tailored approach. So, we also explore ways to reduce the need for chemical products by optimizing their application and complementing them with other tools.

Precision application tools:

We're putting our focus on tools that can help farmers ensure the right amount of crop protection is applied in exactly the right place at the right time.

Through our innovative **Climate FieldView™ Technology**, farmers have the ability to work smarter and with greater nuance. Armed with real-time data, they can better plan the position, timing and application of the right amount of crop protection products only when and where they are needed.

Partnering with Netafim™, we developed a new mode of targeted crop protection application that allows farmers to apply with this kind of precision. **DripByDrip** Automated Irrigation leads to less runoff, less drift and less product needed.

*The Environmental Impact Quotient (EIQ) was developed by Cornell University scientists in 1992 as a method to provide growers with data regarding the environmental and health impacts of their pesticide options. It is acknowledged that the EIQ has methodological limitations and its assessment capabilities are limited. Collaborations are ongoing to convert to a more holistic assessment approach in the near future; in the meantime, EIQ will be used as an indicator to estimate changes of pesticide environmental impact.

New seeds and traits:

By breeding new crops specially designed to withstand and fight against pests and diseases, we can ensure less chemical crop protection will be required throughout the crop lifecycle.

Our **Intacta RR2 PRO™ soybean seeds** contain insect-resistant traits that help plants protect themselves. They also contain herbicide tolerant traits. This eliminates the need for some insecticide use and leads to plants that are more easily protected through integrated weed management strategies.

Their benefits are also verified. A 5-year, peer-reviewed study of Intacta soybeans planted in South America revealed a 10.4-million-kilogram reduction in insecticide and herbicide usage. This resulted in a **30.6% reduction in environmental impact**. Because of that reduction, more than 200 million liters of water were conserved.*

And the benefits continue: second-generation insect-protected soybeans will provide protection against an expanded spectrum of insects including armyworm and podworm, which in turn will allow for more efficient use of herbicides and insecticides.



Biologics

Within every spoonful of soil are millions of microorganisms. They can help nurture crop development and deter pests and diseases, in combination with, but independent from, chemical crop protection. We're finding new ways to enhance beneficial microbials that naturally occur in a farmer's soil and can, in certain cases, reduce or eliminate the need for other crop protection products with elevated environmental impacts.

Our biological crop protection portfolio is one of the industry leaders with more than 20 commercial and in-licensed products, reaching 60 million acres in row crops and high value vegetables. Recent launches, like Flipper™ and Serenade™, provide excellent control options in all organic production systems and are complementary to our conventional crop protection.

To address the need for further reducing the environmental impact of agriculture, we introduced BIOLOGICALS by Bayer®, a new signet for all biological crop protection products. Bayer's science-based biological products provide growers with a broader choice for pest and disease management, while contributing to Bayer's goal of reducing the environmental impact of crop protection by 30% by 2030.*

Cover Crops planted in the off season can help suppress weeds while also creating a habitat for beneficial insects. These "good bugs" can naturally feed on invasive species, reducing the farmer's need for insecticides.

Crop Rotation is the practice of planting different crops on a field in each growing season. This benefits soil health and disrupts breeding patterns of pests and diseases who only feed and/or live on a specific type of crop.

*An external panel of experts is *independently* performing an assessment of how Bayer, along with the Technical University of Denmark (DTU), applies the PestLCI and USEtox® models to assess crop protection environmental impact. This assessment will also review how Bayer measures performance against the environmental impact reduction commitment along with additional methodological considerations.

3

Helping farmers reduce crop protection emissions to the environment

No-spray buffer zones are areas around the edge of a farmer's field where pesticides aren't applied, keeping any potential spray drift on the farm—rather than the surrounding areas.

Buffer strips are lush areas of native plants and grasses that act as a cushion, or filter, between a field and the environment around the farm. They prevent any pesticide run-off from reaching waterways and the wildlife that depend on them.

DriftRadar, Bayer's integrated drift management concept, was awarded the "DLG-Agrifuture Concept Winner 2022" for pioneering agricultural technology work and visions for the future by the DLG (German Agricultural Society) at this year's Agritechnica (digital), a leading global trade fair for agricultural machinery and equipment. The prize was awarded for the first time in 2022.

The integrated drift management concept is based on the reading of information on the spray drift tendency and buffer zones as well as distance control shown on the labels of pesticides. When the pesticide is poured into the sprayer, the saved information is translated into an application map. At the same time, wind direction and speed are recorded in the field in real time. If required, drift-reducing spray nozzles are activated and buffer zones and distance control are maintained, all automatically. The system records and saves all activities including weather information.



Winners 2022 - AGRITECHNICA

4

Ensuring safe, responsible use of crop protection products

Along with the need for crop protection products in agriculture comes the need to use them responsibly. We are teaching farmers how to conscientiously apply our products while using them solely for their intended purposes. We are also taking action to remove all counterfeit products from the market that may pose a threat to the environment. And we're taking extra care to train landowners on prudent use and the utilization of personal protective equipment to ensure their own safety.



See more details around the efforts to be responsible product stewards in the "Sustainable Use" chapter of this report.

Making greater impact towards lowering our impact

Every farm is different, and so is every habitat. What works for one grower may not work for another—and what's effective in reducing environmental impact in one region may be less effective elsewhere. So, we seek to better understand farmers' specific challenges to tailor a combination of solutions that will work best for them and help them protect their crops, all while helping them to reduce their impact on the surrounding environment.

Agriculture will always have an impact on the environment, and there will likely continue to be a tradeoff between farming and sustainability—but it's a give-and-take that we can improve upon.

With a focus toward our bold 30% commitment, we can tip the scales to allow for far more give and much less take.



Learn more about our efforts to reduce the environmental impact of crop protection

// [Protecting Crops: Reducing Crop Protection's Environmental Impact](#)

// [Crop Protection Environmental Impact Reduction: methodological report reviewed by independent panel of experts](#)

// [Sustainability Report](#)

// [Climate FieldView](#)

// [Bayer Crop Science Pipeline](#)

Have questions or would like to discuss directly with us our efforts toward environmental impact reduction? Please reach out!



[Engage on LinkedIn](#)

Daniel Glas

Sustainable Agriculture Lead
Cereals, Oilseed, Cotton, Rice
at Bayer Crop Science

ENHANCING BIODIVERSITY

"Agriculture accounts for 40% of the world's land surface, and is therefore in a prime position to play a role in restoring much of the biodiversity we have lost. To do so, we scientists need to work closely with farmers, policymakers, and the agriculture industry to develop new farming approaches that deliver environmental benefits while maintaining quality food production and viable incomes to farming communities."

- Jaboury Ghazoul, Professor of Ecosystem Management at the ETH Zurich (Swiss university for science and technology). Read on to learn about how Bayer is collaborating with ETH Zurich and the International Food Policy Research Institution to take on some of the greatest challenges agriculture faces in restoring biodiversity.

- / 54 Feeding more, disturbing less
- / 56 Helping agriculture reach a biodiversity-positive future
- / 59 Supporting farmers & landowners
- / 61 Advancing the science in balancing food production while enhancing biodiversity
- / 64 Helping to protect forests & promoting sustainable vegetation management
- / 65 Helping to mitigate climate change

Our work protecting biodiversity contributes to the following U.N. Sustainable Development Goals



Feeding more, disturbing less

In the Mediterranean climate of Santa Inés in Central Chile, the fertile soil is ideal for growing fruits. For Christián Ellendes, a farmer in Santa Inés, the challenge is not growing more, but doing so without further disrupting the soil or the surrounding ecosystem. **By incorporating modern farming techniques like digital weather and irrigation monitoring, Christián can grow 250% to 400% more per hectare than traditional orchards, all while maintaining healthy soil and waterways and even restoring surrounding ecosystems by utilizing 1000m² as a garden for pollinators.** His farm is a clear example of the ways in which innovation and sustainable agricultural techniques can help feed a growing population without disturbing the delicate balance of surrounding ecosystems.

Incorporating modern farming techniques like digital monitoring and drip irrigation =
250% to 400%
more growth per hectare than traditional orchards

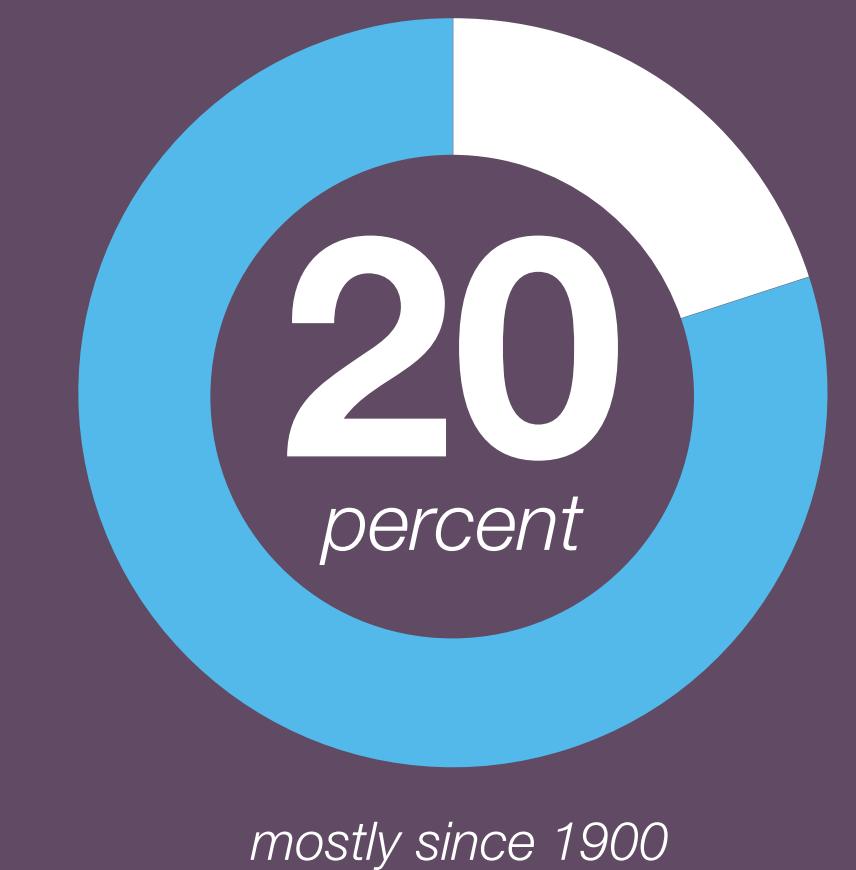
Helping farmers feed a growing population without harming natural habitats

According to the latest report of the IPBES on biodiversity and ecosystem services, **more than one million species of animals and plants face extinction, driven by human activity.** The number one threat to biodiversity is the loss, deterioration and fragmentation of habitats—this is why attention is centered on raw material production in the primary sector, and particularly agriculture. Furthermore, the IPBES report names land use change as the number one root cause of biodiversity decline.



You can read the full report here.

The average abundance of native species in most major land-based habitats has fallen by at least



More than
1M

species of animals and plants face extinction, driven by human activity.

! Species threatened

More than  40% of amphibian species

Nearly  33% reef-forming corals

 1/3 of all marine mammals

 10% of insect species

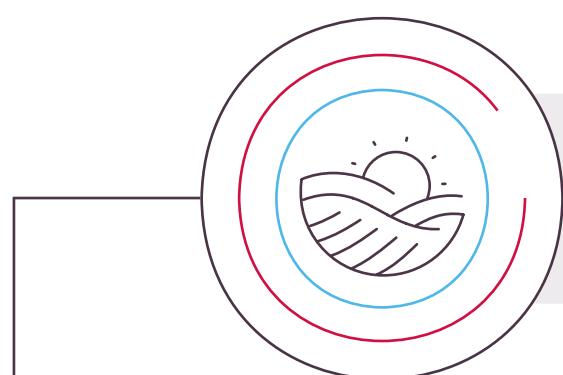
9% *all domesticated breeds of mammals used for food and agriculture had become extinct by 2016*

At Bayer, we believe enhancing biodiversity means enabling farmers to grow more with fewer, better inputs through innovation in seeds and traits, crop protection, digital farming technology, and new business models. We agree that relevant and scientifically sound metrics and indicators need to be developed to mitigate the impact while enhancing biodiversity. We believe such innovation requires strong partnerships with scientific organizations to collaborate on new solutions, provide 3rd-party validation and advocate for biodiversity policy. One example which we explore further in this chapter is our partnership with The International Food Policy Research Institute. In parallel, through Bayer ForwardFarming, we collaborate with farmers by demonstrating on real farms, like Christián's, how sustainable farming can both protect biodiversity and benefit their businesses.

The need for modern agriculture to reduce further decline of biodiversity is critical for our planet. **Without pollinators like bees, without a healthy soil biome, without natural pest control from the habitat, crops won't have what they need to produce healthy yields.**



Helping agriculture reach a biodiversity-positive future



There are three pillars to this strategy:

// 1 //

Developing innovative, sustainable solutions for farmers

// 2 //

Advancing the science of the food production and biodiversity enhancement balance

// 3 //

Helping mitigate climate change and preserving soil health

Developing innovative, sustainable solutions

The best way to enable food production with minimal negative effects to the natural ecosystem is to empower farmers to do more with less: less land, less impactful inputs and less waste. Which is why we have taken on a responsibility of developing products, partnerships and methods that make doing more with less possible.

We've committed to cutting the environmental impact of our crop protection products by nearly a third by 2030. We're working towards this goal by focusing on the formula and application of products, improving their environmental profiles, and reducing the amounts needed.

Recognizing both the responsibility and the opportunity we have in protecting biodiversity, we're expanding our investment and range of partnerships focused on developing biodiversity-protecting business models and collaborations.

Our overarching strategy to foster a biodiversity-positive future for agriculture is centered around supporting farmers in maintaining their productivity while adopting sustainable intensification principles.



Shortening maize to reduce impact and deliver tall yields

One example of our commitment to developing innovative, sustainable solutions for growers is the Smart Corn System. Combining new maize technologies with digital solutions, data-driven decision making and efficient management practices allows us to provide a modern solution for farmers that enables them to consistently achieve higher yields with fewer inputs.

Central to this innovation is a shorter type of maize which improves resistance to common causes of yield loss like root lodging, stalk lodging and green snap.

It allows for more precise application of crop protection products and provides more stability, meaning less crops wasted in the field. It also allows farmers to potentially grow more crops on less land because it can be planted more densely than traditional maize varieties. **The Smart Corn System is expected to be launched worldwide over this decade starting in 2024 with North American growers.**

We're developing digital tools to drive conservation.

The natural variability that exists between fields – or even within a single field – means that one-size-fits-all management is not the best approach. This can lead to an overuse of crop inputs in some areas, which results in added costs and a higher impact on the environment, all with minimal gains, if any. **Bayer's Climate FieldView™ platform not only enables farm management to be more economically sustainable by providing a higher return on investment, but it can also help increase ecological and environmental conservation.** Such digital farming tools support the United Nations Sustainable Development Goals (SDGs), especially relating to SDG #12: Sustainable Production and Consumption.

Enhancing biodiversity and farmer value with Alternative Management Practices (AMPs)

Knowing the optimal management practices for the highest-yielding and lowest-yielding areas of a field can directly impact a farmer's bottom line. With the use of advanced digital tools, the decision to farm (or not to farm) on different parts of their land becomes less risky. **These tools allow farmers to gather years of data to evaluate and visualize performance at a sub-field level based on productivity and return on investment (ROI) and provide farmers the opportunity to think differently about how they manage their land.** Consistently underproductive or marginal farmland can be an economic loss for farmers as input costs can exceed profits. Alternative Management Practices (AMPs) which incorporate the creation of biodiverse habitats can be considered for these areas and may reduce economic loss while providing additional revenue and benefits. In the U.S., several government-sponsored conservation programs exist that provide financial incentives to farmers to establish conservation habitats on their operations. Negative ROI acres can be turned into positive economic outcomes through enrollment in these programs. In addition to the financial benefits, biodiverse native habitats can provide on-farm benefits such as increases in beneficial insects, reductions in erosion and water/nutrient runoff as well as provide aesthetic and recreational value. It's a win-win for farmers and the environment. This product concept is in development to be included in Bayer's Climate FieldView™.



U.S. Conservation Reserve Program payments typically exceed

\$129

per acre in the Midwest

*This calculation is based on the county average for general dryland of the 2022 CRP payments for the US Midwest (12 states in total). The official numbers can be found in ["CRP 2022 County Average SRRs"](#)

Can intensive agriculture be sustainable?

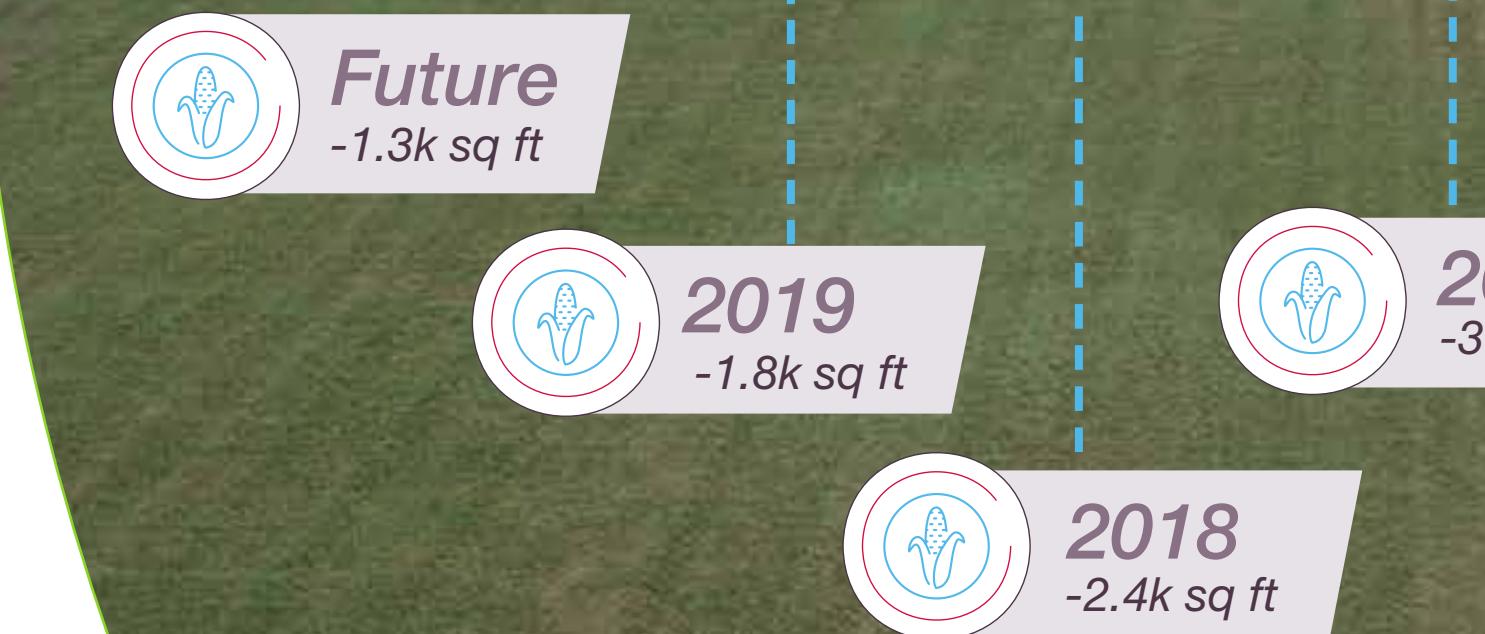
The world's population is expected to grow to around 10 billion people by 2050 – an increase of around two billion people relative to 2020. In addition, both the Food and Agriculture Organization (FAO) of the United Nations and the World Resources Institute (WRI) expect a 50% increase in the demand for food and animal feed by 2050. Intensive agriculture, made possible by advances in breeding technologies, along with fertilization, irrigation and crop protection, is the only time-tested way to grow food without turning more natural habitats into farmland. Over the past 40 years, agricultural yields have grown by 60% while the amount of agricultural land has increased by only 5%.¹ **While subsistence agriculture and organic farming are viable production options, they cannot scale up to meet existing demand and maintain the resilience of the modern food systems.** For example, biotechnology has made it possible to increase global production levels of soybeans by 278 million tons and of maize by 498 million tons since the introduction of the technology in the mid-1990s.²

When objections to modern agriculture technologies are raised, we need to ask ourselves if it is possible to produce enough food to meet the needs of the entire global population with zero impact on the environment. Without using any technology, including GMOs, natural habitats would continuously be sacrificed for crop cultivation. Technology makes it possible to limit the amount of agricultural land, but it does have impacts on biodiversity, including pollinators. Tradeoffs are inevitable to ensure food systems are resilient and food supplies are ample and affordable. **It is important to note that Bayer is committed to conserving and restoring biodiversity within and beyond agricultural fields through our technologies and services and through good stewardship and best management practices.**

50
percent

increase in the demand
for food and animal feed
by 2050

Each Plot
10
Bushel Yield



¹ Time and cost of bringing a biotech crop to market

² GM crop technology use 1996-2018: farm income and production impacts

Without using any technology, including GMOs, natural habitats would continuously be sacrificed for crop cultivation.

[Enhancing transparency: Bayer's UN Global Compact adherence webinar on June 29, 2022](#)

[Read about the biodiversity benefits of glyphosate](#)

Supporting farmers & landowners

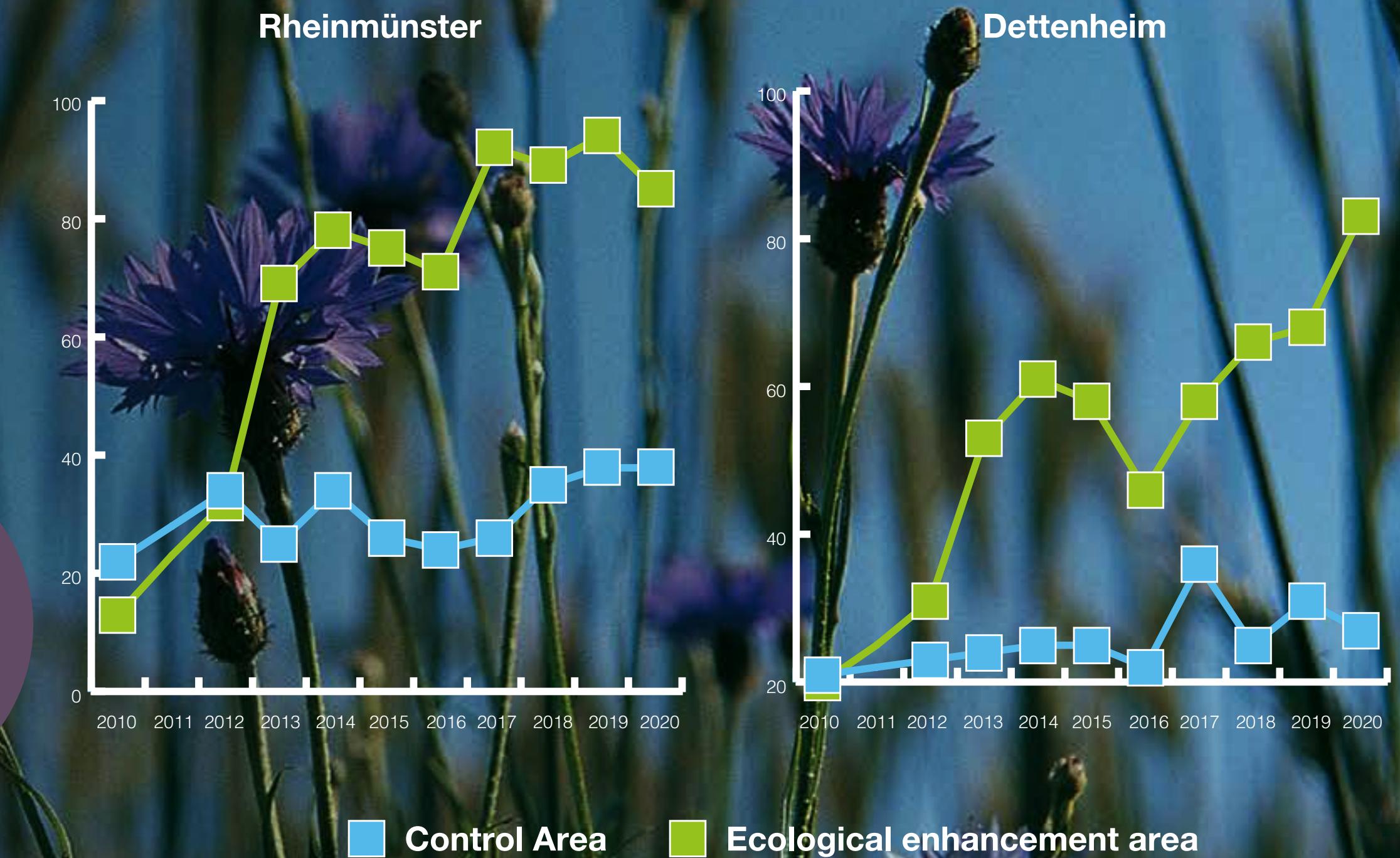
Giving farmers the tools and knowledge to adopt and track sustainable practices allows them to take advantage of incentives such as government subsidies and premium pricing. It also ensures they are able to maintain vibrant ecosystems where plants and animals can flourish. One such initiative supporting farmers is the long-term ecological enhancement project in the Upper Rhine Valley (Germany) which, starting in 2010, began studying the effect of wildflower strips. At one of the study sites, the number of wild bee species in the ecological enhancement area increased from 20 in 2010 to a peak of 83 in 2020. In the control area, the number of species (21 in 2010) remained largely constant over the years (peak in 2017: 36 species; in 2020: 27 species). At the second project site, the number of wild bee species in the ecological enhancement area increased even more (peak in 2019: 94 species). At both sites, the number of wild bee species in the ecological enhancement areas is about three times higher than in the control areas.

Collaborating to uncover new answers

In May 2021, we launched a new research collaboration with **The International Food Policy Research Institute (IFPRI)** and **ETH Zurich** to address how agriculture can develop and implement new solutions to reduce its impact on biodiversity. Recognizing that developing the right solutions must ensure they will work for farmers' businesses, the partnership centers around the problems, needs and successes of farmers. Concentrating our research around farmers will ensure that we develop worthwhile solutions that will allow both ecosystems and businesses to thrive. **The first partnership with a global scale and a special focus on broadacre crops, this collaborative group is setting out to put biodiversity and resilience at the center of focus in intensive soy, maize, and wheat production systems around the globe.**



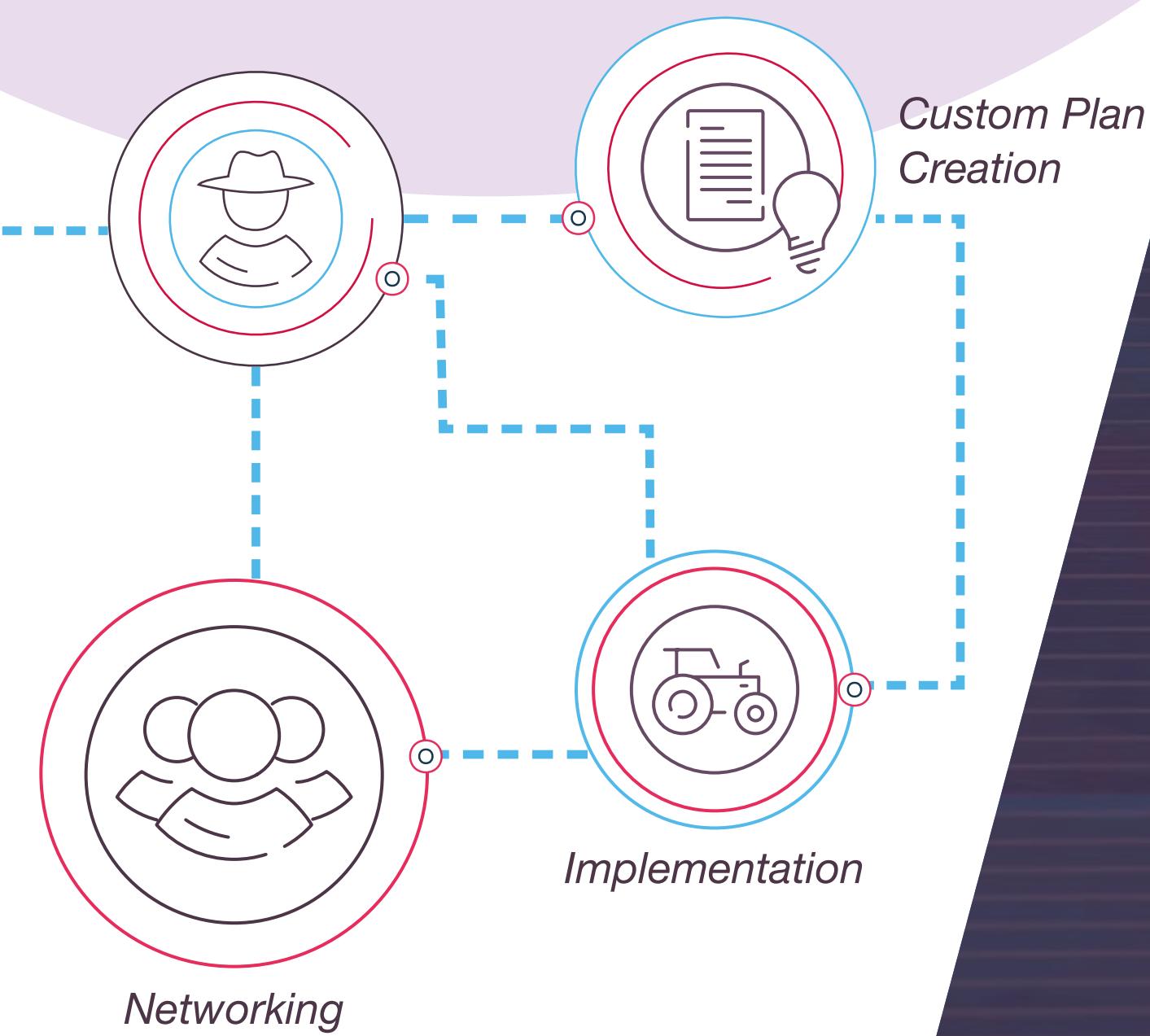
Development of wild bee species numbers between 2010 and 2020 in the ecological enhancement area and the control area in:



The creation of wildflower areas on 5-10% of the arable land in the ecological enhancement areas resulted in a considerable and sustained increase in the number of species and of individual wild bees and butterflies.

Tailoring biodiversity-positive solutions to farmers' unique needs

Every farm, and every ecosystem, is a little different. **We engage with farmers at the individual farm level**, collaborating with nature conservation experts and landowners to create custom plans for their farms. We help them implement the proposed practices and then provide farmers with a network of other farmers in the region implementing similar practices, allowing them to further their knowledge and their successes.



App to help farmers protect Monarch butterflies

Pollinators, like the monarch butterfly, play a crucial role in ensuring both the success of crop production and the vitality of an ecosystem. However, many pollinator populations, including monarch butterflies, have significantly declined in recent years.

Our easy-to-use iOS mobile app, HabiTally, enables farmers, ranchers and landowners to record their monarch butterfly habitat data and securely share the information with U.S. Fish and Wildlife Services to help with conservation efforts.

Realizing its value to the community at large, we have donated the app to Iowa State University. Through the university's stewardship, HabiTally will remain a transparent and public entity.



Download on the
App Store

GET IT ON
Google Play

Advancing the science in balancing food production while enhancing biodiversity

Always in search of a balanced outcome, we're working to better understand the root causes of species decline while ensuring farmers can grow healthy, abundant harvests.

A science-based approach to understanding insect decline

In May 2021, we co-organized a scientific session titled **Insect Decline - The Contribution of Multiple Stressors on Landscape Level** with over 150 stakeholders at a congress of the Society of Environmental Toxicology and Chemistry (SETAC). **Bayer and other organizations presented new research on the topic** – providing new data for the stakeholders in attendance that will ultimately contribute to a growing knowledge base for this broader community to continue developing solutions to mitigate risk and counteract insect decline.

Delivering on our commitment to protect pollinators

In the 1990's, neonicotinoids were introduced to the market as a critical step in reducing the environmental impact of insecticides. **Neonicotinoids replaced older, more toxic insecticides and they accelerated the idea of seed treatment.** We were on the leading edge of this introduction. And for some time, we were the market leader in neonicotinoid products.

Years after this introduction, there were reports of incidents where the use of neonicotinoid products was associated with negative effects on non-target insects, like bees. In a 2008 incident, dust from treated seeds was accidentally released during planting in Germany, resulting in significant intoxication of bees nearby. Adverse incidents like this prompted us to take immediate action. The incidents triggered a period of internal review and research into suitable risk mitigation measures or product replacements. It also changed the risk assessment and profiling of existing and new products in the R&D pipeline, e.g., taking toxicity to pollinators systematically into account already at the early stages of research. We've been taking multiple measures to ensure the safe application of neonicotinoid products and address areas of concern.

We've been taking multiple measures to ensure the safe application of neonicotinoid products and address areas of concern.

First, **we're working to mitigate risks associated with seed treatment of neonicotinoid products, launching innovative efforts to reduce the risk to pollinators from dust including improved seed coating, deflector technology and thorough quality assurance.** We've encouraged the adoption of extensive certification schemes worldwide and also introduced a series of training courses designed to result in "zero dust" in the field. We're also partnering with other seed companies to ensure proper implementation, certification and education around the world.

Bayer works in favor of contributing to reduced pollinator decline

Training programs in compliance with FAO
2.7M external farmers, field workers, distributors, retailers and stakeholders reached
in 2021

Partner with leading
Research institutes & universities

Portfolio innovation

Second, we're working to mitigate risks associated with spray application of neonicotinoid products, ensuring thorough and proper labeling of all spray products and communicating restrictions in line with the FAO Guidelines on Good Labelling Practice for Pesticides.

 [More examples of progress made in mitigating risk can be found in the full report here.](#)

We're also fostering comprehensive training programs. In compliance with FAO, Bayer reached more than 2.7 million external farmers, field workers, distributors, retailers and other stakeholders in the global agricultural industry in 2021, focusing on training activities in countries where there are no statutory protection requirements or certification for users regarding the safe handling of crop protection products.

Beyond ensuring the pollinator safety of our products with cutting-edge research, **Bayer has partnered with leading research institutes and universities to foster bee health and pollinator safety in agriculture.** In Kenya, for instance, we were partnering with experts to understand more about cucumber pollination by African stingless bees. **Similar studies around the world will be critical to learning more about how diverse local bee populations can be alternate pollinators for specific crops instead of fully depending on managed honey bees.**

Finally, to ensure protection of pollinator species, we are focusing on portfolio innovation – developing products that successfully balance the need to protect crops with the need to protect pollinators. As part of our research and development stage, we rigorously test new chemical and biological crop protection products to understand the toxicity's impact on bees. That way, if unsafe, they can be identified and removed very early on in development.



Demonstrating biodiversity-friendly agriculture in practice

Through our [ForwardFarming](#) initiative, we're putting the idea of doing more with less into practice – in real, replicable applications that farmers can experience firsthand. **On more than 26 independent farms across the globe, farmers are implementing methods that balance food production with biodiversity preservation and other sustainability practices**, so that those around the world can see the results.

On these farms, practices like crop rotation, cover cropping, creating flower strips, and providing refuges, bird nesting aids and insect hotels help to build an agro-environment rich in biodiversity. **These independent farmers serve as stewards for a better, more sustainable way of running a successful farm.**

Discovering a new bee species in the middle of a modern farm

Discovering a new animal species is a rare event. However, to make history, **one scientist and a Bayer consultant had to look no further than a Brazilian farm within our ForwardFarming network. Alongside 72 identified species of native bees on the farm, they discovered a new bee species—*Ceratina (Ceratinula) fioreseana*.** This discovery demonstrates how sustainable agriculture is changing the relationship between food production and the natural world – and what it means for our future. While the discovery of a new species is important, the presence of many pollinators in an agricultural setting is even more significant.

Sustainable farming upends a popular misconception that agriculture is solely about increasing productivity at the expense of wildlife and the environment. Each Bayer ForwardFarm may be unique in the crops it grows, the land it farms and the community it serves, but all participating farmers share a common passion for advancing sustainable agricultural practices.



“Just as our farm has seen growth thanks to the variety of crops we harvest, the diverse practices we implement on the farm ensure we are respecting the environment and our community. From digital tools to natural wastewater purification, to partnerships with local beekeepers, we are able to demonstrate how these elements can work together.”

Stephane Peillet

*Earl des Bruyeres,
part of the Bayer
ForwardFarming network*

Helping to protect forests & promoting sustainable vegetation management

Our Objective: net-zero deforestation

Deforestation poses a serious threat to the world's biodiversity. While many sectors contribute to deforestation, one very large driver is the agricultural industry's need to expand farmland to produce more food. But modern farming practices can eliminate much of this need for deforestation and forest degradation. Our objective is for the industry to achieve net zero deforestation. **In addition to this commitment, Bayer also joined the LEAF coalition, which, in its first year, mobilized \$1b dollars to protect tropical forests by ending deforestation, while also supporting countries to complete their Nationally Determined Contributions (NDCs) to the Paris Agreement.**

Bayer joined the LEAF coalition

\$1b to protect
tropical forest
from deforestation

Innovating to end deforestation

We can make significant progress toward this objective with innovations in seed varieties, crop protection products and digital farming solutions. These advances help farmers be more precise, more efficient and more productive, reducing their need to expand into natural habitats. We believe that our work improving *the livelihoods of smallholder farmers* around the world will reduce their need to expand farmland.

**Modern farming
practices can eliminate
much of this need for
deforestation and forest
degradation.**



Helping to mitigate climate change

Improving the atmosphere to foster biodiversity

By helping to slow the warming of the Earth's atmosphere, we can reduce the negative impacts severe weather can have on Earth's ecosystems. And, **by empowering farmers to decrease greenhouse gases and sequester them in the soil, we're giving soil organisms an even healthier place to inhabit, increasing the overall health of the ecosystem.** With this in mind, our programs and partnerships dedicated to eliminating greenhouse gases are likewise beneficial to biodiversity.

 [Learn more about our specific programs and partnerships designed to mitigate climate change in our chapter on reducing greenhouse gas emissions](#)

Farmer, food system and biodiversity prospering together

With advancements in seed varieties and crop protection paired with digitally-guided, sustainable agriculture practices, we're proud to make progress toward a future where all villages, communities and cities have the food they need to survive—all while ecosystems around the world retain the balance they need to flourish.

When we support nature in this way, the results will breed more and more benefits. Growers will experience improved health of their land, resulting in better, healthier harvests. Improved harvests lessen the need to expand farmland, and natural habitats remain. The benefits are inextricably tied together, cycling toward a more sustainable world.

When we support nature in this way, the results will breed more and more benefits.

 Learn more about our efforts to enhance biodiversity

// [Biodiversity section of 2021 Annual Bayer AG Sustainability Report \(page 45\)](#)

// [Benefiting Biodiversity & Soil Health - Sustainable Solutions to Nurture Nature](#)

// [Conservation and Restoration of Biodiversity in Agriculture and Forestry](#)

// [Enhancing Biodiversity & Resilience in Agriculture](#)

// [Bending the curve of biodiversity loss – How can agriculture become part of the solution?](#)

// [Pollinator Health](#)

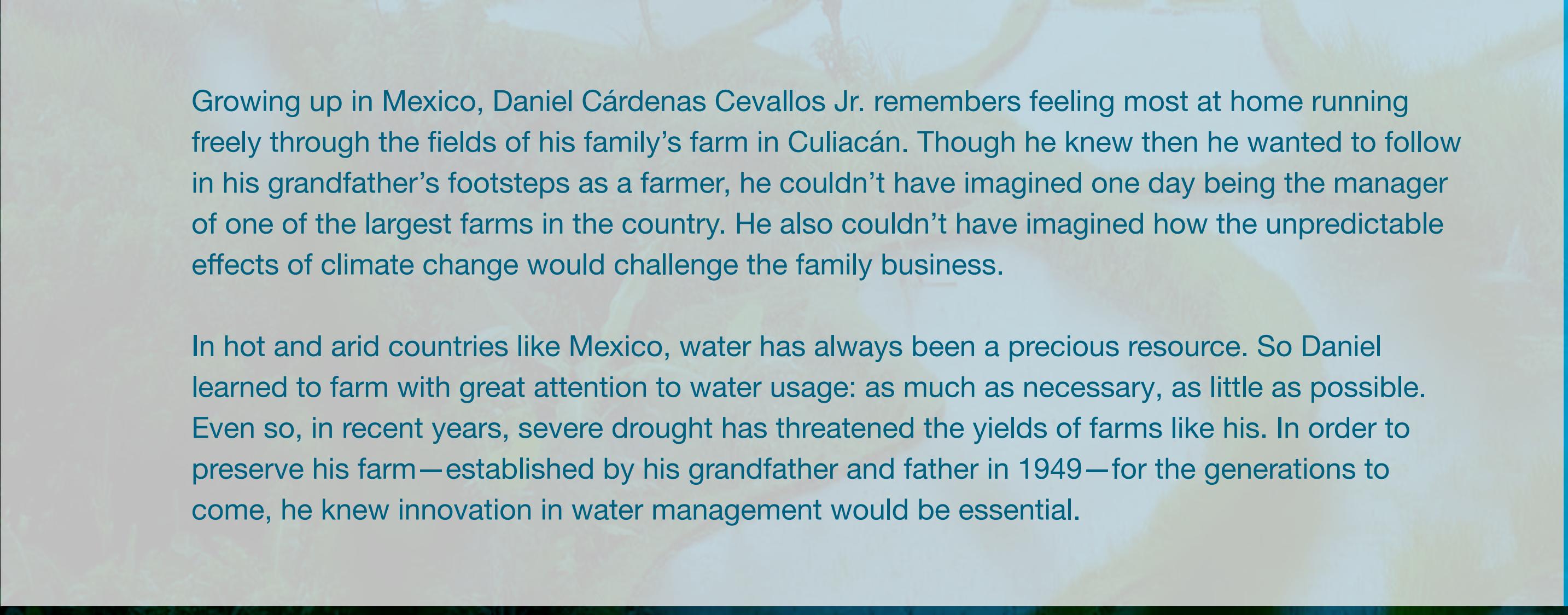
Have questions or would like to discuss our work on Biodiversity directly? Please reach out!



[Engage on LinkedIn](#)

Laurent Dini, Strategy Lead, Biodiversity
Laurent.dini@bayer.com

CONSERVING WATER: AGRICULTURE'S MOST ESSENTIAL INPUT



Growing up in Mexico, Daniel Cárdenas Cevallos Jr. remembers feeling most at home running freely through the fields of his family's farm in Culiacán. Though he knew then he wanted to follow in his grandfather's footsteps as a farmer, he couldn't have imagined one day being the manager of one of the largest farms in the country. He also couldn't have imagined how the unpredictable effects of climate change would challenge the family business.

In hot and arid countries like Mexico, water has always been a precious resource. So Daniel learned to farm with great attention to water usage: as much as necessary, as little as possible. Even so, in recent years, severe drought has threatened the yields of farms like his. In order to preserve his farm—established by his grandfather and father in 1949—for the generations to come, he knew innovation in water management would be essential.

Our work towards conserving water contributes to the following U.N. Sustainable Development Goal



- / 67 **Growing enough in the age of water scarcity**
- / 69 **Sowing the seeds of water-efficient agriculture**
- / 71 **Getting to the root to make the most of water resources**
- / 73 **Collaborating to address agriculture's water problem**
- / 75 **Responsibly watering the world's food supply**

Growing enough water scarcity

Agriculture takes the biggest drink of all

Perhaps it's a little ironic that the beautiful blue planet that sustains so much life is nearly 71% covered in water—most of it unusable for the bulk of its inhabitants.

Even more astonishing, the agriculture sector is the main consumer of water resources, accounting for 70% of global freshwater consumption, primarily for irrigation. Adding to the complexity of water scarcity are the escalating effects of climate change.

Increasingly, communities around the world are impacted by drought or water inaccessibility, directly affecting food production.

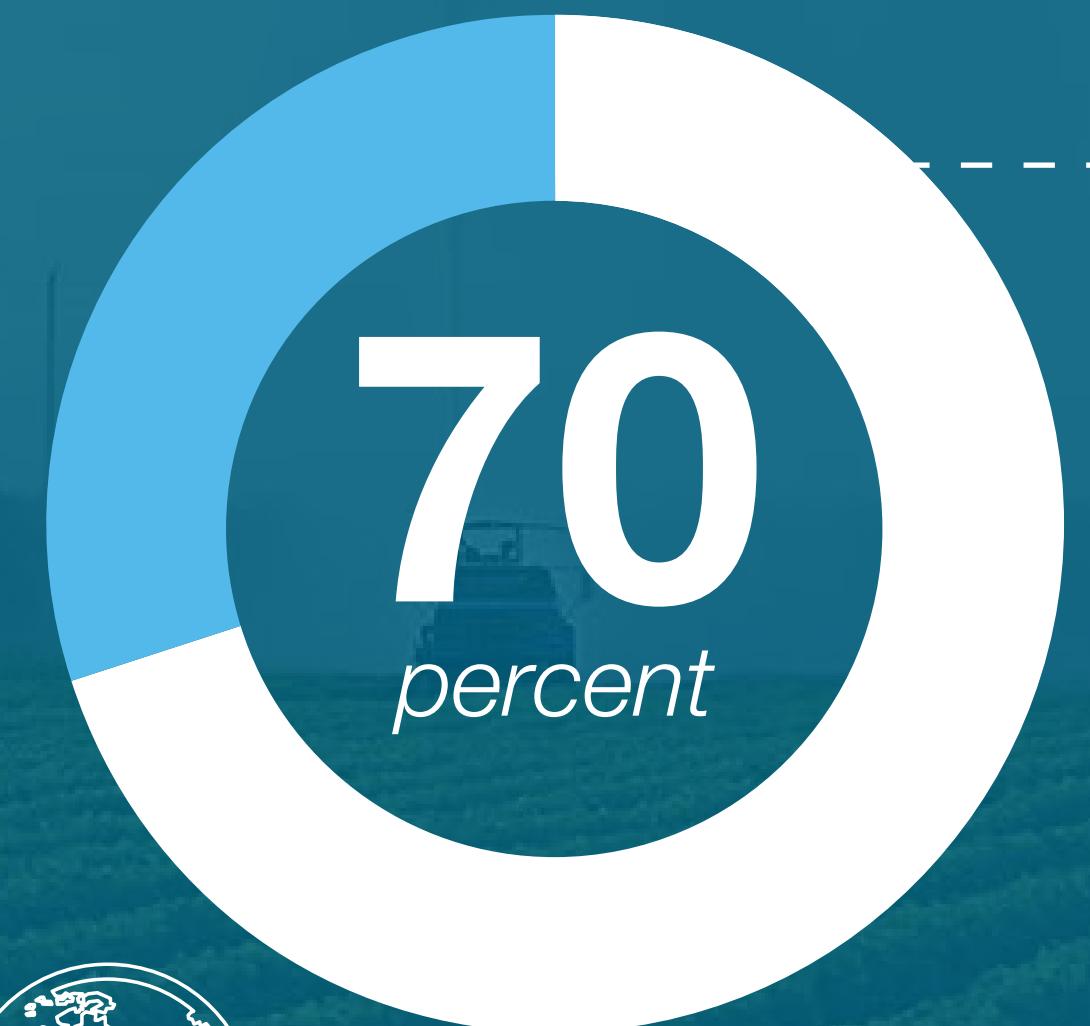
Though many people, especially in much of the developed world, are fortunate enough to not yet have felt the impact of water scarcity directly, it's a global problem. At the same time, a growing population means more demands made on already scarce water resources, not just for agricultural, but industrial and municipal use as well. **Water scarcity is truly an existential threat, and agriculture must be prepared to adapt.**



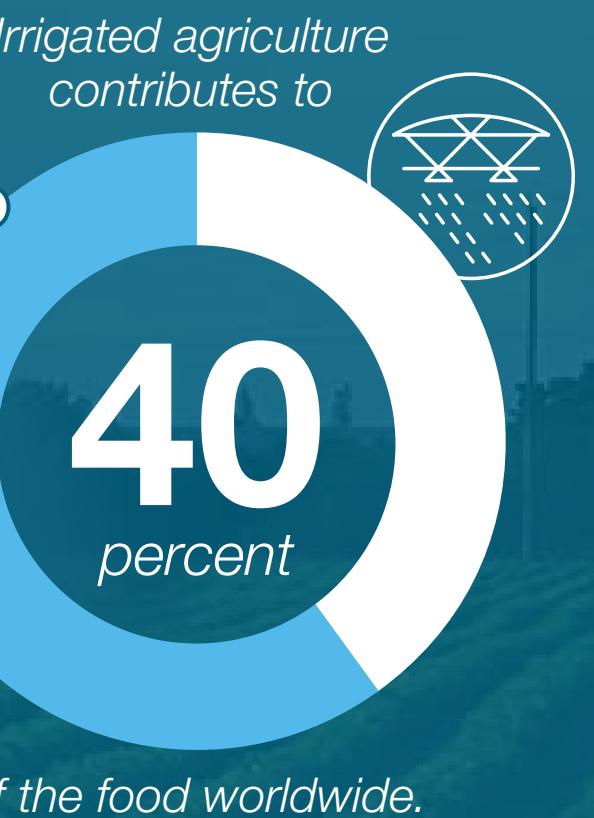
Less than
1% of Earth's water
is available for
humans

Source: The World Bank

Agriculture
accounts for nearly



of global freshwater
consumption, primarily
for irrigation.



Source: UN World Water
Development Report 2022

Curbing agriculture's outsized thirst

Without evolving agriculture's tools and practices and without a concerted effort to make more efficient use of scarce water resources, the global food system is at risk. Though the statistics may seem daunting, we believe we can help correct course.

Today's farmers are producing significantly more and higher-quality food per hectare than just four decades ago, thanks to an evolution of practices and technology. We're optimistic that agricultural ingenuity can overcome water scarcity issues and reverse the potential impact of climate change, a growing population, urbanization, etc.

We believe we have an opportunity to lead the transformation of water conservation in agriculture.

1.8B people by 2025

living in regions with absolute water scarcity

Source: Worldbank

In 2020, the World Economic Forum declared the water crisis a

Top 5 global risk

in terms of social, economic and environmental impact.

"The agricultural sector is by far the biggest consumer of water. As a leading crop science company, Bayer has an almost 25% market share in the agriculture input value chain. With that comes a huge responsibility. We will not be able to bring the company vision 'Health for all, Hunger for none' to life without focusing on the water problem."

Matthias Berninger, 2020

Global Head of Public Affairs, Science, Sustainability & HSE



Sowing the seeds of water-efficient agriculture

Helping rice farmers yield more with less

Rice is a staple crop for [more than half the world's population](#). What seems like a simple bowl of grains is essential daily nutrition for billions. To meet this need, 11% of cultivated land worldwide (159 million hectares) and up to a whopping 43% of the total water used for irrigation goes to irrigated rice¹.

Traditionally, rice fields are flooded because rice thrives when submerged, and water helps control weeds. But this conventional production is not only water-intensive, it's also labor-, capital- and energy-intensive—and less profitable as resources become increasingly scarce.

Our plant scientists continue to pursue modern breeding methods to develop locally adapted hybrids that have higher flooding and stress tolerance. For example, our Arize® hybrid rice seed AZ 7006 is specially designed to survive even in extreme flood conditions, producing consistent yields even under unfavorable weather conditions. This helps safeguard the nutrition and livelihoods of people in countries struck by weather-related calamities like the Philippines, India and Bangladesh.

We are also developing high-yield breeds of rice that can be directly seeded. Our Bayer Arize® 6444 Gold and our Arize® 6585 ST require less water, energy, labor and seeds than conventional transplanted rice and can help reduce GHG emissions. Direct seeded rice also promotes convenience for an aging farmer population.

This is vital for smallholder farmers' livelihoods and those that depend on the rice they grow, as smallholders produce an important share of the world's supply of rice. In addition to breeding for innovative seeds, we're also working to help make direct seeded rice more accessible and widely available to them. To do this, we're teaming up with the International Rice Research Institute (IRRI) to deliver direct seeded rice seeds to smallholder farmers in Asia.

Via our partnership with IRRI, we have participated in the Direct Seeded Rice Consortium (DSRC) since 2018, developing a comprehensive, science-based agronomic package adapted for direct seeded rice production in Asia to make it more widely accessible to rice farmers. By providing an alternative to puddled transplant rice, the predominant method of rice production, it saves scarce and expensive resources such as labor and water while also reducing GHG emissions.



IRRI has developed the DSRC technology platform to improve crop management practices and maximize the advantages of direct seeded rice. Through this platform, we provide access to our proprietary genetic materials (hybrids), seed and drone technologies, as well as in-kind activities for DSRC research and testing. Overall, this platform aims to improve crop management practices to maximize the advantages of direct seeded rice—enhancing both the economic and ecological sustainability of rice production in Asia.

¹Sources: Chakraborty et al. (2017); Rice Knowledge Bank (revised 2020)

Fighting water scarcity in Africa with maize that thrives on less

In another part of the world, **we are helping address the twin issues of water scarcity and destructive pest infestations through research and development of water-efficient technologies and products.** In Africa, maize is the most widely grown food crop—more than 300 million people depend on it as their main food source. But drought and insects routinely threaten its production, impacting yields and leading to crop failure.

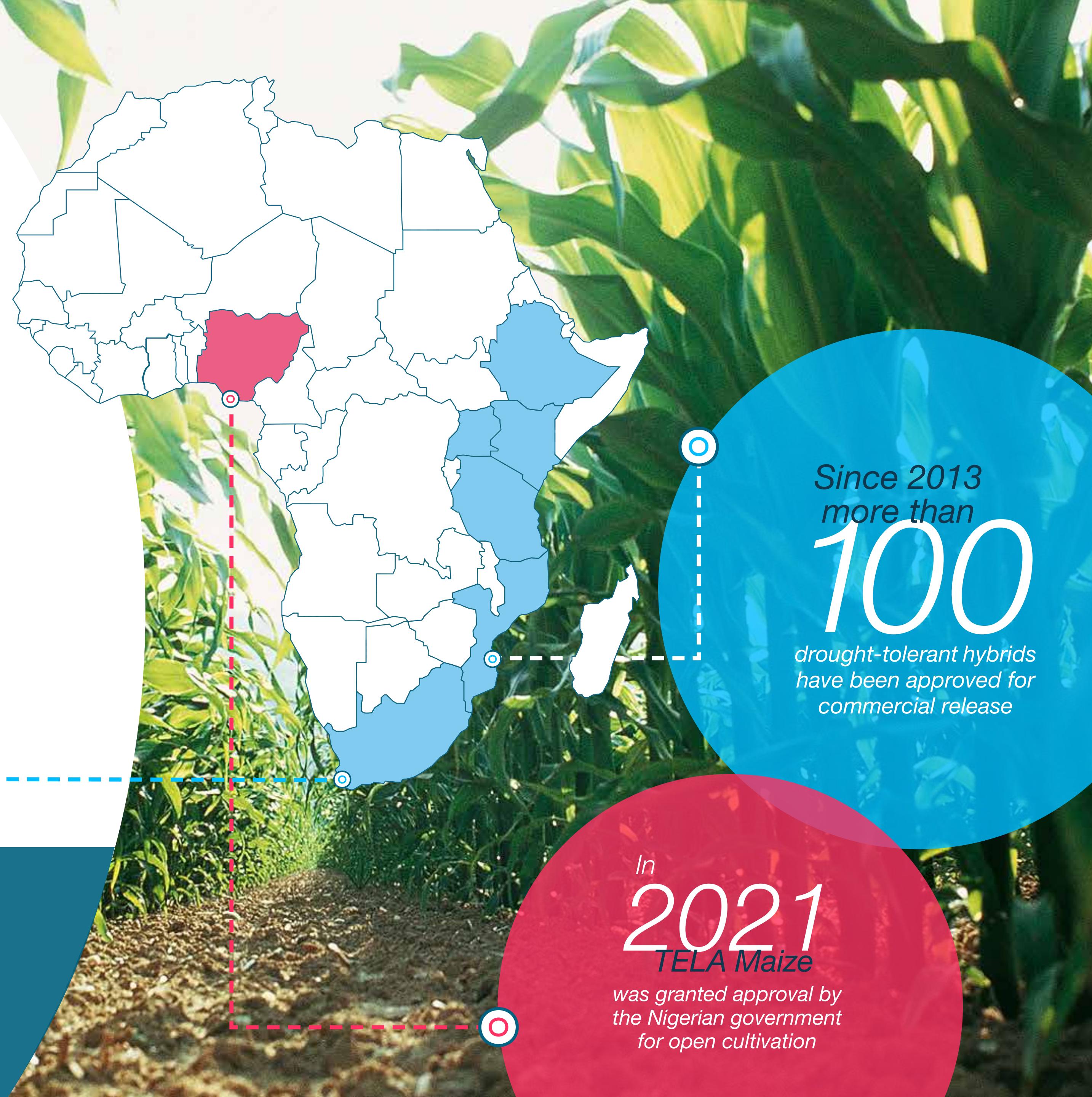
Through Water Efficient Maize for Africa (WEMA, now operating as TELA Maize project), a public-private partnership supported by the Bill and Melinda Gates Foundation and the United States Agency for International Development (USAID), we're helping protect harvests in water-limited conditions. The project uses both conventional advanced plant breeding and biotechnology in the development of maize varieties designed to tolerate drought and resist pests. The program helps these smallholders acquire these locally adapted maize hybrids without paying a trait royalty fee, allowing them to feed their families and communities and thus improving food security as well as their livelihoods, even in the presence of drought conditions.

Since 2013, more than 100 drought-tolerant hybrids have been approved for commercial release in Kenya, Mozambique, South Africa, Tanzania, Ethiopia, and Uganda; and in 2021, TELA Maize was granted approval by the Nigerian government for open cultivation with the likelihood of a commercial introduction in the 2023 season and the goal of making it accessible to Nigeria's smallholder farmers.

 [Read more about TELA maize and the partnership](#)

As the key enabler of the Smart Corn System, Short Stature Corn is the latest innovation to help farmers meet the needs of a growing population with potential sustainability benefits in a changing climate.

 [Read more about how Short Stature Corn has the potential to provide better yields, better soil use and better water use in our Biodiversity Section.](#)



Getting to the root to make the most of water resources

Watering more precisely to save water and farmer spend

Precise application of water through modern irrigation techniques contributes to significant water savings as well as optimization of energy, labor and use of inputs such as crop protection and fertilizers.

As part of a [collaboration between Bayer, Netafim and BGN Technologies of Israel's Ben-Gurion University](#), DripByDrip smart irrigation technology delivers water where it does the most good—directly at the roots, where it lessens evaporation and runoff, and reduces water usage by 60% compared to traditional irrigation. Based on our findings from 2019, **precision irrigation contributes to significant water savings as well as optimization of energy, labor and use of inputs such as crop protection and fertilizers. What's more, because it enables more efficient delivery, it produces better yields—and that means better business.** We are working toward publishing our 2021 data in a report later this year.

Bayer's vegetable seeds product supply organization facilitates access to infrastructure, such as irrigation systems, to enable successful crops. Bayer enables and promotes sustainable irrigation practices, such as changing from gravity to drip, contributing significantly to the technification of local growers in the Bayer supply chain and enabling higher yields and preservation of soil and water resources.



DripByDrip smart irrigation uses up to

60 percent

less water than traditional irrigation methods as well as reducing the amount of fertilizer needed

Saving water with integrated weed management and conservation tillage

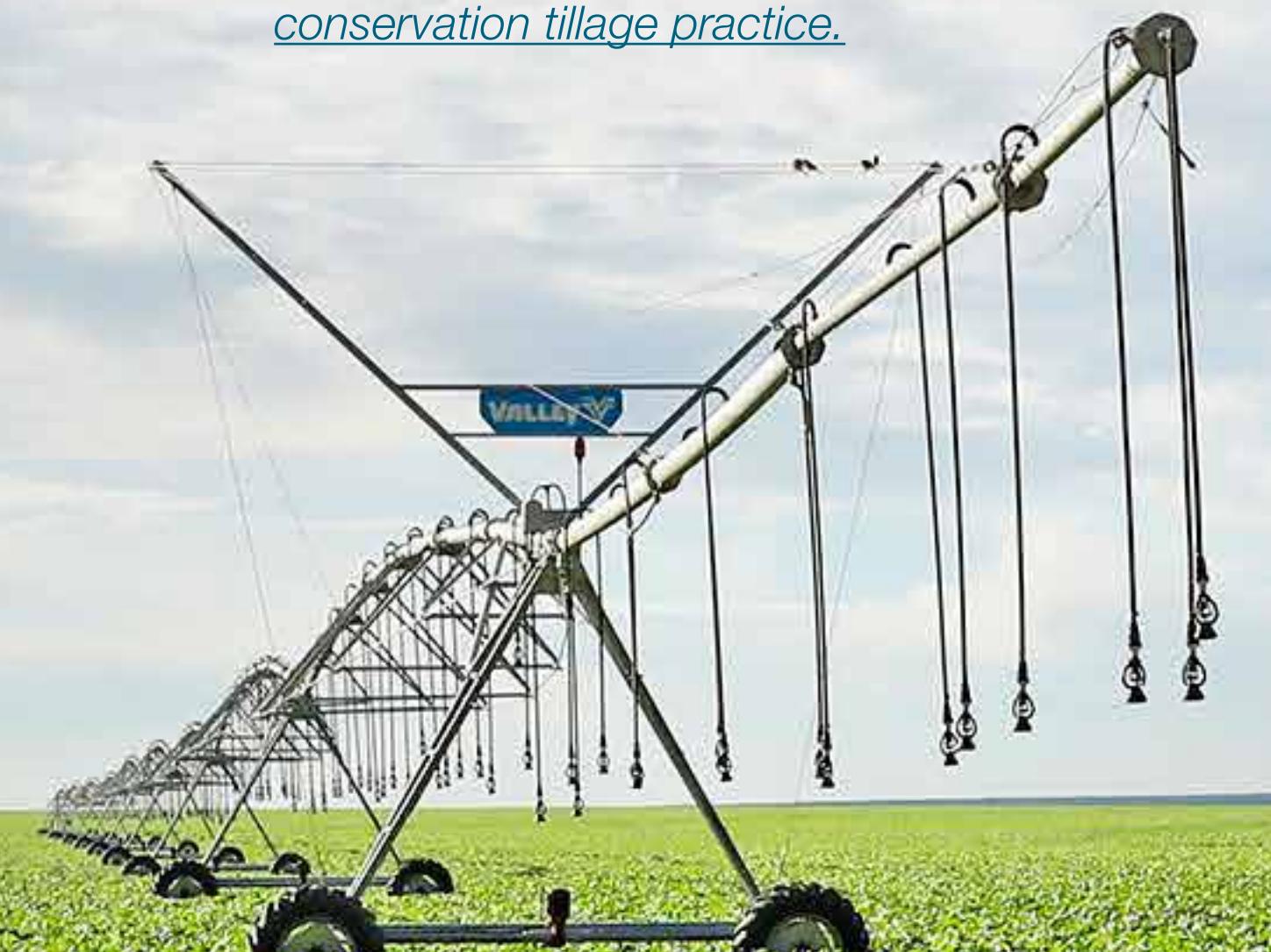
Because weeds compete with crops for water, light and nutrients, managing weeds helps farmers optimize consumption of inputs. **Our integrated weed management (IWM) program aims to help farmers save water and reduce reliance on a single weed control method by promoting a combination of strategies that include cover crop planting, seeds and traits, digital enablement and diverse chemical and biological herbicides.**

Conservation tillage (strip-till and no-till) systems are yet another agronomic practice that have important environmental benefits—and these benefits extend to water conservation.

The adoption of adapted tillage techniques reduces run-off, increases infiltration rates and decreases the evaporation of water in the soil, contributing to improved soil moisture and better soil quality, and ultimately, less water needed for irrigation¹. A seven-year study by the Irrigation Research Foundation (IRF) showed that compared to conventional tillage, strip-tillage increased water infiltration rates, resulting in a richer soil biome, less inputs like fertilizer and crop protection, and ultimately better yields with less water. And less water means operational savings for farmers; and better soil means healthier crops with better yields.



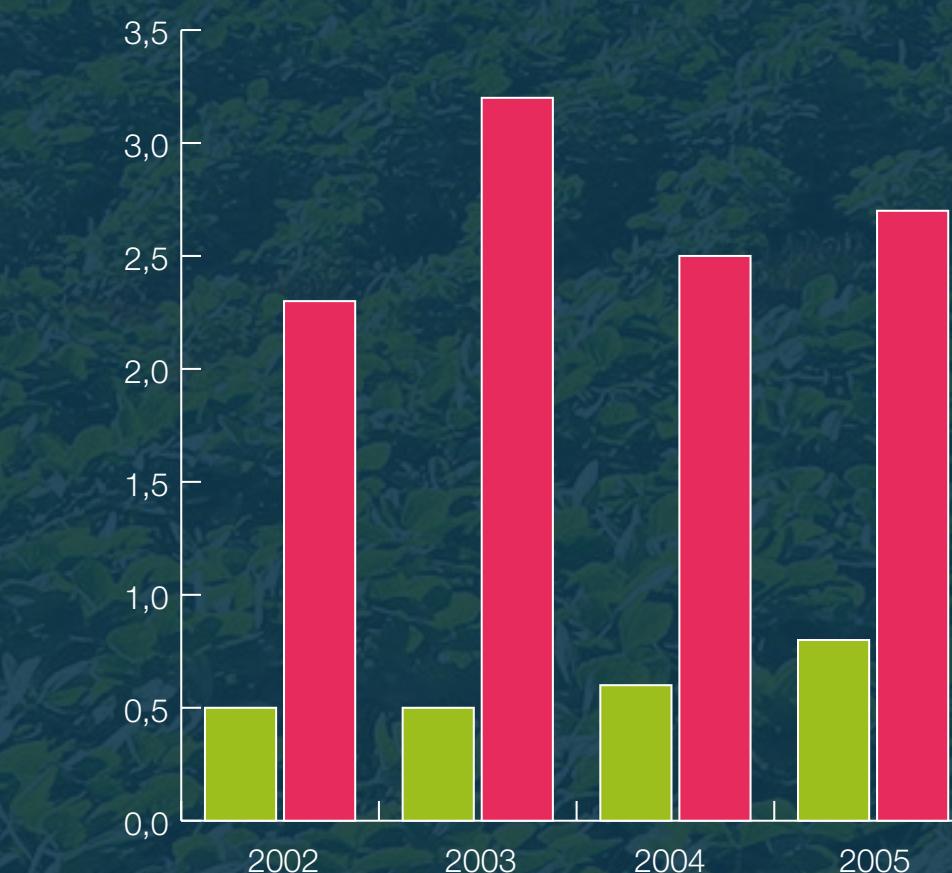
Our Bayer Carbon programs further encourage these efforts by incentivizing farmers all around the world to adopt cover crops and conservation tillage practice.



IRF Irrigation Rates inches of water/hour - Moist soil

(Measurements with Cornell Sprinkle Infilometer on moist soil)

■ Strip Tillage
■ Conventional Tillage



Strip tillage had a greater percentage of organic matter, water intake and worms per square feet than conventional tillage methods.

	Strip Tillage	Conventional Tillage
Organic Matter	2.4%	1.5%
Water intake (in/hr)	0.81 to 4.95	0.06 to 1.8 inches/hour
Worms per sq.foot	15 to 32	1 to 10
Soil pores (4 sq inches)		
Small pores (<1mm)	320 to 688	65 to 314
Medium pores	25 to 81	10 to 21
Large pores	6 to 18	1 to 6

¹Source: National Summary Corn Production and Strip Tillage in the Western Plains

Collaborating to address agriculture's water problem

We believe addressing the global water crisis requires strong collaboration between a diversity of stakeholders. That's why we're engaged with a wide range of partners from the public and private sectors in numerous projects and initiatives focused on conserving water in agriculture.

Research and knowledge sharing is another aspect that we strongly invest in. We are in constant dialogue with farmers and other partners. The insight from practices in the field helps us gather the data and knowledge we need to innovate and develop easy-to-implement solutions and practical guidance for farmers on how to make water – or limited water – work best for them.

The **Gothenburg Center** is a perfect example of this knowledge transfer. Located on one of the most important water resources for agriculture in the United States—the Ogallala Aquifer—our Gothenburg Water Utilization Learning Center in Nebraska monitors the impact that water, or lack of it, has on maize and soybean crops. Scientists at the Learning Center conduct research and demonstrations year-round to provide farmers with information about how to increase their annual crop yields through better, more efficient water management. A similar effort is being carried out in Argentina, where farmers who grow our seeds are provided learning opportunities around water conservation and efficient irrigation management.

Partnering to incentivize water efficiency

In Australia, cotton farmers are suffering from recurring drought, which is severely impacting their farms. To help combat this problem, **Bayer has partnered with Goanna Ag to provide myBMP certified sustainable cotton growers access to the Water Use Efficiency Grant program, which aims to increase efficiency and sustainability.**

Through this grant, Bayer provides a 12-month subscription to 2 Goanna Ag GoField Plus units, for each farm unit, which includes a soil moisture probe and a canopy temperature sensor, both with in-field connected sensors. Whilst soil moisture probes are widely implemented, it is the introduction of the canopy temperature sensor that is the differentiator. The GoField technology enables plant stress measurements to be analyzed to determine levels at which crop performance will be impacted. Algorithms are used to predict when the stress threshold will be exceeded, enabling optimization of irrigation timing. The result is a more profitable, sustainable cotton production system.

At the conclusion of the program, Bayer and Goanna Ag will generate a report that shows the impact of optimized grower irrigation scheduling on water use efficiency. This report will include aggregated, anonymous data from participants. Currently halfway through its first season, the program has already received plenty of feedback, suggesting that growers are stretching their crop irrigations further than they ever have before based on the insights from the technology.



Learn more about this project at the Goanna Ag website.

Water savings expected of up to

Water Efficiency Grant
68,000 ha
covered by the program
in its 2021 season

Value per ha
AU\$152 /



Future-proofing sustainable food production

Back on the farm in Culiacán, Mexico, Daniel Cárdenas Cevallos, Jr. is optimistic. A prescient stroke of innovation kept his crops growing and protected his operation from the severe drought that hit Mexico. Daniel had already transitioned his farm from the traditional water channels between fields and instead installed a drip irrigation system that makes much more efficient use of what little water is on hand.

Without drip irrigation, Daniel stood to lose 60-70% of his crop during the drought. Instead, he was able to save most of his crop and protected his operation from catastrophic losses, keeping him competitive in a tough industry. Having come through such an uncertain period, Daniel is a believer in the continual need for innovation.

Across our global Bayer ForwardFarming network of independent, sustainable modern farms, we partner with independent entrepreneurial farmers to demonstrate how the implementation of modern, sustainable agriculture tools and practices can benefit the farmer, environment and society on fully operational farms.

On the Agrícola La Hornilla ForwardFarm outside of Santiago, Chile, Cristián Allendes works with his sons on his bountiful fruit farm to meet the expectations of a demanding market—a task made increasingly difficult by water scarcity. According to the University of Chile, almost 80% of the national territory is affected by drought, meaning successful, sustainable farmers must take efforts to ensure water efficiency and conservation.

Part of the success of the Agrícola La Hornilla farm is due to its high-density planting and the use of a drip irrigation system, which precisely controls and distributes the necessary amount of water and fertilizers while also reducing run-off and erosion.

Guided by satellite monitoring, the use of low-water-volume crop protection application equipment such as electrostatic machines also contribute to the Allendes family's water-saving efforts. These technologies allow the application of crop protection products in a sustainable and efficient way using significantly less water—on average 500 liters per hectare compared to 1,000 liters in conventional applications—and provide better coverage and adherence of the products.

Because of these water conservation efforts, more hectares are covered with less water each day, resulting in less labor and greater economic benefit for the Allendes' farm and reducing their consumption of the scarce Chilean water resources.



[Learn more about the water-saving efforts at Agrícola La Hornilla and across other ForwardFarms](#)



By implementing drip irrigation systems, we've empowered farms in Chile, Spain, China and the Netherlands to use

**Bayer
Forward ►
Farming**

60
percent less
water

The world's food supply Responsibly watering

It's clear we need to curb the thirst of agriculture—for our food supply and for our planet. **Agriculture's vulnerability to water scarcity is already a reality; and the projections of food demand coupled with climate change will only exacerbate the crisis we are facing.**

But we're optimistic as innovations in agriculture have already shown benefits to water conservation. Through partnerships and focusing research and innovation on improving water efficiency and productivity with more resilient crops, advanced crop protection products and bio-stimulants, as well as promoting modern irrigation and good agronomic practices—a water-secure future for agriculture is within reach.

By 2050, more than 9 billion people are projected to be inhabiting the planet—requiring



more water to sustain the population with current production practices.



 Learn more about our efforts on Conserving Water

// [Drip Irrigation Systems](#)

// [Bayer Partnership with IRRI](#)

// [Bayer Forward Farming](#)

// [Goanna Ag Partnership](#)

// [Sustainable Rice Initiative](#)

Have questions or would like to discuss directly with us our water conservation efforts? Please reach out!

 [Mehdia Mounir](#)
Sustainable Agriculture Manager
Water Conservation Lead

PROMOTING SUSTAINABLE USE

Thirty minutes outside of Dusseldorf on a farm in Rommerskirchen, Germany, Bernd Olligs sprays his crops with just the right amount of crop protection. He is the sixth generation of his family to own and operate the Damianshof farm, and tending to the roughly 115 hectares of sugar beets, winter wheat and potatoes for the next generation is a labor of love.



Our work on promoting sustainable use contributes to the following U.N. Sustainable Development Goals

- / 77 From people to planet, we're working to protect the full cycle
- / 78 Sustainable use is at the core of our business
- / 79 Sustainable innovations in R&D
- / 80 Digital farming for the future
- / 81 Monitoring and guidance of product use
- / 82 Responsible application of crop protection products
- / 83 Empty container management
- / 84 Product resistance management
- / 84 Taking action against counterfeiting
- / 85 Transparency in marketing, sales and distribution
- / 86 Fostering sustainable partnerships
- / 86 Product safety standards
- / 87 Sustainable use is essential to success

From people to planet, we're working to protect the full cycle

For Bernd, crop protection doesn't end in the field. Among his chief concerns is not just protecting his crop from harmful pests but also protecting the water and the environment.

"Water pollution control is resource protection," Bernd emphasizes. He uses **Phytobac®**, **an innovative biological system, to keep crop protection residue from entering the water when meticulously cleaning his spraying system.** In use on his farm since 2012, the Phytobac system collects the water and employs microorganisms to break down any residual crop pesticides found in the water so they don't end up where they don't belong.



[Read more about how Bernd practices sustainable use at Damianshof, part of the Bayer ForwardFarming network.](#)

Treating the water used to clean spraying equipment is just one part of a sustainable farm operation. Bernd knows he also needs to dispose of product containers properly so they can be recycled and don't pose safety or environmental risks. He also uses only seeds and crop protection products that have undergone comprehensive safety testing and registration. **In order to hand the farm down to the next generation, Bernd knows all of these sustainable use measures add value.** Sustainable means successful.

Sustainable means successful



Sustainable use is at the core of our business

Promoting Product Stewardship

Safety is paramount in any industry. And it's absolutely imperative when it comes to our food supply. Because of the scale and reach of the agriculture industry, safe and sustainable use of our products is of utmost importance for Bayer. Together with [CropLife International](#), we work to promote effective stewardship around the world, which brings about changes at a farm level. These programs are having an impact in their communities and on the environment through stewardship in action.



You can learn more about how these programs are having an impact in their communities and on the environment on the Crop Life International Stewardship in Action webpage.

It's not enough to just innovate effective products; we have a responsibility to ensure safety throughout the product life cycle.

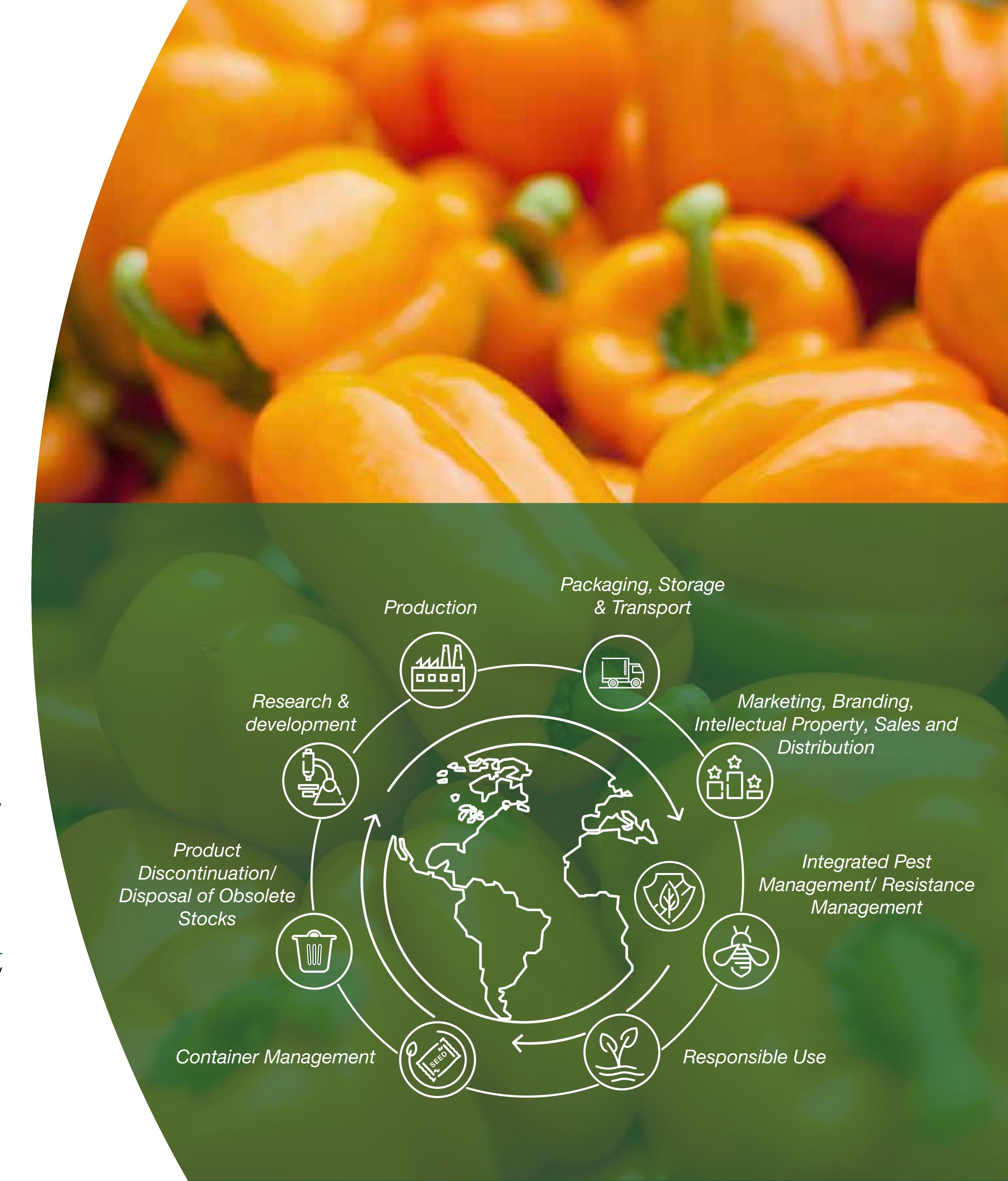
From their development and manufacture to their application and disposal, we do our utmost to ensure our products do not harm people or the environment. This responsible and ethical management of a product throughout its life cycle is known as Product Stewardship. We're pioneering sustainable product use within the industry for the protection of people and planet.

Proper Product Stewardship practices are central to supporting the availability of high-quality products, services and best practices by promoting compliance with legal and regulatory requirements, good agricultural practices, helping maximize product potential and sustainability and minimizing risk.

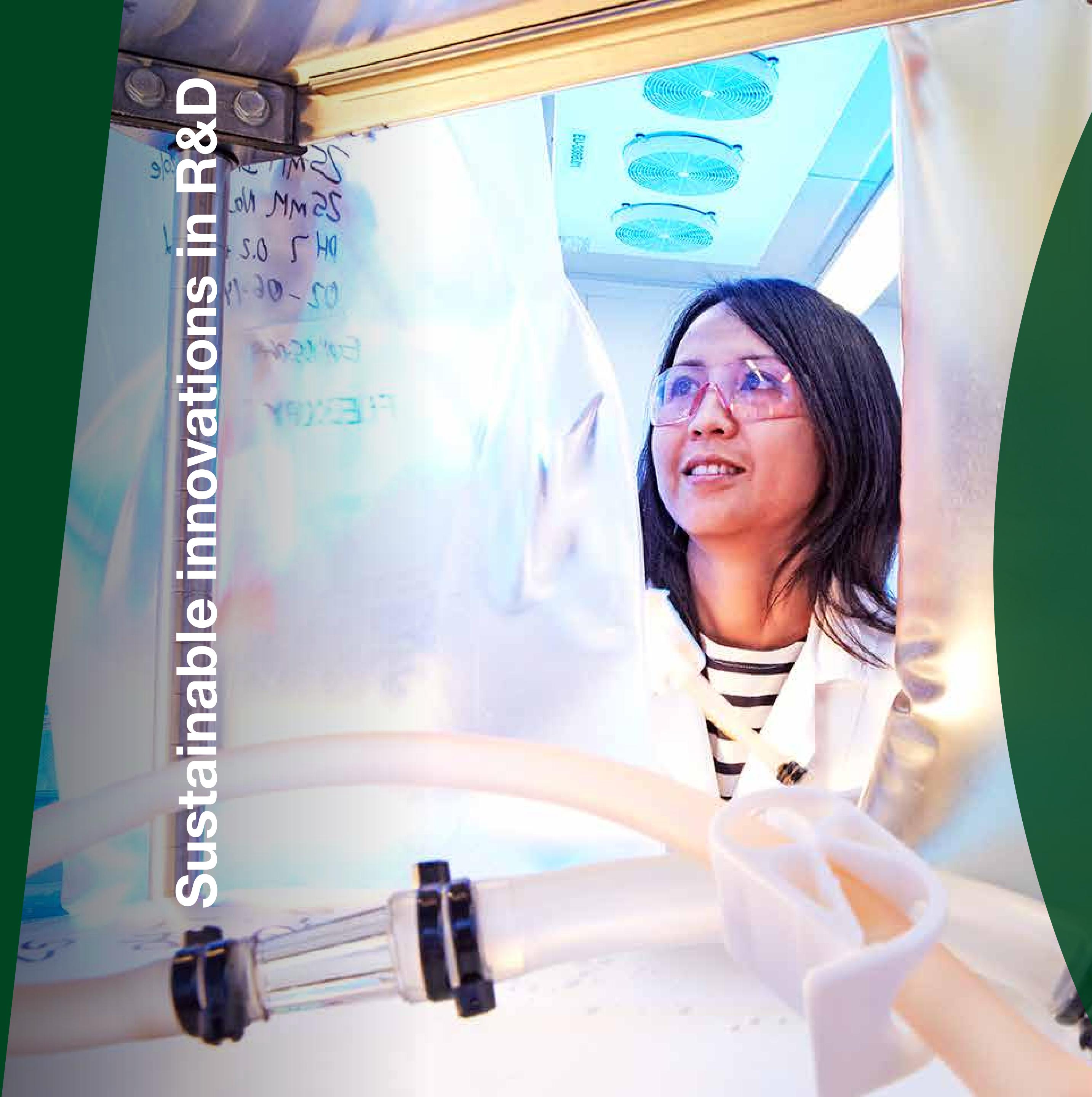
Our Product Stewardship Commitment is based on the Food and Agriculture Organization of the United Nations (FAO) [Code of Conduct on Pesticide Management](#), the [CropLife International Plant Biotechnology Code of Conduct](#), and the Universal [Declaration of Human Rights](#). We also actively contribute to industry initiatives, like [Excellence Through Stewardship](#) (ETS).



Read more about our commitment to product stewardship.



Sustainable innovations in R&D



Advancing sustainable agriculture with the latest technology

In developing our products, we use the latest technologies so that we can optimize their efficacy, productivity and safety for people and planet. As part of the testing process, chemical and biological crop protection products are examined early in the development phase with regard to their mode of action, their human and environmental toxicological properties and the extent of potential residues in plants and the environment to ensure that only those products with the best safety profiles are developed further.

Sustainable use is not just about crop protection products, it's also about the seeds themselves. Feeding a growing population means our business is dependent on developing ways to produce high-quality, high-yield plants, even in unprecedented extreme conditions. Innovations in the areas of plant breeding and biotechnology allow us to strengthen plants' resistance to insects, weeds and other environmental stresses, like drought, in a precise manner.

The development of genetically modified seeds is also subject to stringent international and national laws and regulations. We test products in compliance with the applicable official regulations and perform extensive risk assessments, while also observing import regulations for the importing countries.

These solutions enable farmers to meet demand while simultaneously reducing the environmental impact of our products. To provide one example, more productive farming increases sustainability by facilitating minimum tillage practices, which preserve topsoil and reduce CO₂ emissions.

Digital farming for the future



Ushering in a new era of sustainable farming with a toolbox of smart technology

Smart tools are evolving every aspect of our daily lives, enabling greater connection, information sharing and real-time decision-making. Farmers are no exception. Digital technology and data help us deploy our resources efficiently and sustainably, but perhaps more importantly, they enable farmers to get the most out of their fields—while using less land and fewer inputs, all amid changing climate conditions.

All of the data and connectivity mean we're empowering farmers to produce more with less and meet the challenges of feeding the population, all while protecting the environment.

produce
more / *using less*

To achieve this, we partner with major drone-producing companies, and through our [Leaps by Bayer](#) unit, we also invest in two companies with their own drone application development: [Rantizo](#) and [Guardian Agriculture](#). In [Brazil](#) for example, drones are replacing direct application by farmers, which not only reduces the amount of time and energy farmers spend maintaining their fields, but drastically reduces the use of water and crop protection by allowing for precision applications that minimize excess use.



Monitoring and guidance of product use

Ensuring safety and sustainability throughout the product life cycle

Controlling water contamination

As an already limited natural resource, protecting water from contamination from agricultural products is a central part of our responsible use engagement. **That means helping growers manage crop protection products so they don't end up where they don't belong.**

We place particular importance on the disposal of residual liquids following the application of crop protection products to prevent surface or groundwater contamination. Our biological remediation system Phytobac™ is designed to prevent water contamination with residue from crop protection chemicals generated during the filling and cleaning of spraying devices or the disposal of residual liquids. Phytobac™ uses microorganisms to biologically break down any residual pesticides. Since its inception, Phytobac™ has been installed on thousands of farms, in 20 countries across the globe.

New technologies not only enable crop production to be increased, but also promote the safe and responsible use of crop protection products. This includes the targeted application of crop protection products using data from satellites and drones.

Additionally, the application of crop protection products is subject to national water protection regulations, including in Europe the requirements of the [Water Framework Directive](#).



Safe Use Trainings

Our product responsibility extends up and down the value chain, including the safe application and disposal of our products. We take great care in educating our farmers, operators and consumers, in accordance with the [International Code of Conduct for Pesticide Management](#), and we leverage new technologies to do so.

To ensure safe use, we provide knowledge platforms to foster best practice exchange on the proper use of pesticides, focusing particularly on low- and middle-income countries.

Through targeted training courses, we show farmers, seed treatment professionals and distributors how to use our products both effectively and safely to maintain healthy plants and increase the yield and quality of their harvested goods. Training can be adapted depending on the target audience, a particular product or crop plant, and can cover such varied topics as safe product handling during use, transport, storage and disposal, proper protective clothing, and emergency first aid measures.

We've made it our goal to increase the outreach of our training activities, in part through more widespread use of digital media in the future. **In 2021, we reached more than 2.7 million external contacts** (i.e. farmers, field workers, distributors, retailers and other stakeholders in the agriculture industry) with information on the safe use of pesticides by increasingly using digital training opportunities, when in-person trainings were not possible due to the COVID-19 pandemic. **Additionally, with CropLife International, we helped train nearly 4 million farmers worldwide in 82 countries.**

Responsible application of crop protection products

Protecting pollinators and other beneficial insects

Many of the fruits, vegetables and nuts we enjoy as part of our diverse daily diet rely, at least in part, on insects to pollinate them and enable seed and fruit production. That is why protecting bees and other pollinators is a critical part of the challenge of feeding a growing population sustainably.

Yet, currently declining insect populations are of great concern to us and, as the cause is not fully known, we believe further studies and countermeasures are urgently needed. We are involved in researching the factors leading to this decline and in developing measures to counter the trend. It is very likely that there are multiple, interacting factors, which may vary between different regions. However, among scientists, there is agreement that key drivers are resulting from human activity, such as landscape management, habitat loss and increasing agricultural intensity.

Key drivers to the decline of insects
are resulting from human activities such as



Landscape
management



Habitat
loss



Increasing
agricultural
intensity



Neonicotinoids are the subject of much debate with regard to bee safety. These highly effective insecticides protect plants from a broad array of pests and are therefore widespread. The effects observed under laboratory conditions did not harm bee colonies under realistic field conditions when the products were used properly.

Several measures have been taken to address areas of concern. For example, from seeds treated with certain coating techniques (e.g., film coating in maize), small quantities of insecticidal dust from the coating may be abraded and emitted to the environment during drilling. Mitigation measures include innovation in seed coating adhesion that allows for up to 95% decrease in dust emissions, as well as deflectors that when attached to sowing equipment ensure that at least 90% of dust particles are directed onto the soil, not the air. More can be found about our research and innovation regarding neonicotinoids [here](#).

For more on our pollinator research activities, [continue reading in the Biodiversity chapter of this report](#).

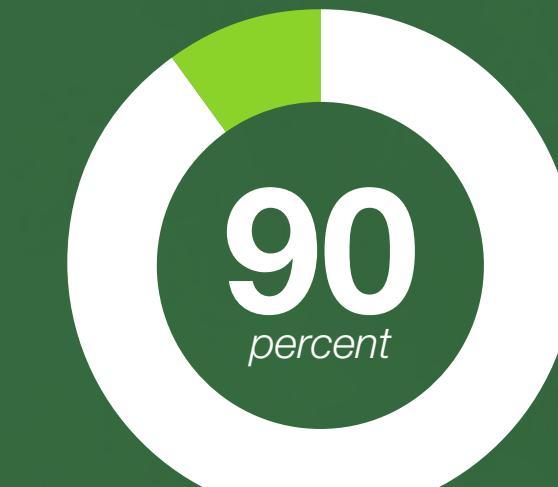
Several measures have been taken to address areas of concern.

Innovations in seed coating adhesion that allow for up to



decrease in dust emissions

Deflectors attached to sowing equipment ensure that at least



of dust particles are directed onto the soil, not the air

Empty container management

We're working to help contain empty containers

We know that once our crop protection product is applied and the container is emptied of its contents, our responsibility for it doesn't end. For us, product stewardship includes facilitating safe disposal of empty containers.

As part of our Responsible Use training, we not only instruct on the proper handling and application of our products, but also the safe disposal of empty containers. We actively support programs to safely recycle and, if not feasible, encourage the safe disposal of empty packages and containers in accordance with local regulations. We also promote responsible empty container management systems, especially in countries with less regulated waste management systems. **Our goal is that anyone who uses our products has the information and access needed to safely dispose of product containers when finished.**

Together with the CropLife International industry association, we support the safe disposal of empty crop protection product containers in many countries, contributing to the collection of 800,000 metric tons of plastic since 2005. This partnership has also facilitated the development of environmentally friendly packaging design programs, the implementation of training courses for distributors and farmers in the proper handling of crop protection product containers, and the testing of plastic recycling options. Particularly successful disposal programs have been established in Brazil, Canada, France, Germany and Australia.

Bayer is a member of [InpEV](#) (National Institute for Processing Empty Packages), which began in Campo Limpo, Brazil and has grown to become one of the most successful container management programs globally. With a 94% recycling rate, more than 650,000 metric tons of empty crop protection product containers have been disposed of since 2002 through the program, an example of the adoption of the circular economy model. With more than 140 members, InpEV is a non-profit that represents the industry.

One of the most successful container management programs globally



recycling rate

More than

650,000

metric tons of empty crop protection product containers disposed of since 2002

+ 140
companies

Product resistance management

Championing an integrated approach to pest management and weed resistance

Resistance is the naturally occurring, inheritable adjustment in the ability of individuals in a pest population to survive a treatment with or exposure to a plant protection product that would normally give effective control.

This means without proper controls, our crop protection products could lose effectiveness over time. We support the implementation of Integrated Pest Management (IPM) measures, including resistance management tools, for all Bayer products and services. As a part of these measures, we develop and promote IPM solutions, we develop and implement IPM guidance based on the CropLife and Resistance Action Committees, and we train farmers and others on proper resistance management, research issues related to resistance, and collaboration with stakeholders.

Weed resistance is of equal importance to our customers as pest management. Driving research and innovation in this critical field is our dedicated Weed Resistance Competence Center (WRCC). WRCC specialists are dedicated to advancing our expertise as a business both in the lab and in the field to stay ahead the ever-changing new challenges that farmers face in weed control. However, we understand that these challenges cannot be solved alone. The WRCC cooperates globally with leading institutions and weed scientists to expand its capabilities and collaborate to solve many different weed management issues.

Taking action against counterfeiting

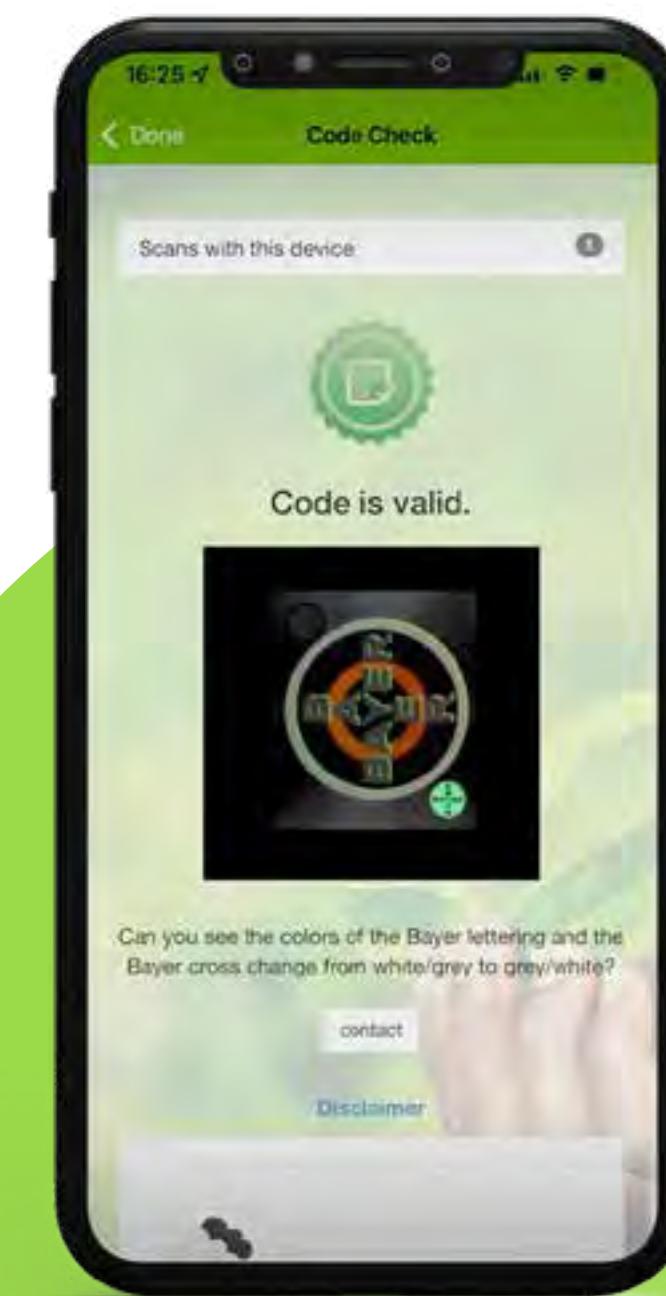
Successful anti-counterfeit work helps protect people and the planet

It's a fact of modern commerce that when something of value enters the marketplace, fakes are sure to follow. The agriculture industry is not immune. Counterfeit products have infiltrated nearly every aspect of the agriculture industry worldwide, in part due to e-commerce. Such illegally produced goods aren't just of questionable provenance and efficacy, they pose a real risk to the environment, farmers and consumers. Counterfeit crop protection products are unsafe as their content is unknown, they are not tested, and hence they do not meet the regulatory standards. Counterfeit seeds can't be counted on to possess the traits they claim, and illegal seeds treated with unknown chemicals can be dangerous to farmers, the environment and consumers.

Product counterfeiting can only be addressed through joint cooperation by industry, associations, governmental agencies and nongovernmental organizations. We support association initiatives and work closely with crop protection and law enforcement authorities to prevent counterfeits from making their way to the marketplace.

We also back these efforts with extensive measures of our own and are committed to shutting down attempts to exploit our brand. With an innovation we call Bayer Safety Seal, we're the first producer of crop protection products and seeds to enable farmers to clearly authenticate our original products.

The Bayer Safety Seal technology employs optical security features and a QR code on a seal that a user can scan with the Bayer Seal Scan App and access important information about the product's authenticity. The Bayer Safety Seal is found on all Bayer crop protection products that are filled in bottles and sold in Europe/Middle East/Africa and Latin America regions, as well as parts of Asia Pacific. In 2021, we expanded the Bayer Safety Seal technology to include selected solid crop protection products and in 2022 we will expand the technology to row crop seed bags in Europe.



Transparency in marketing, sales and distribution

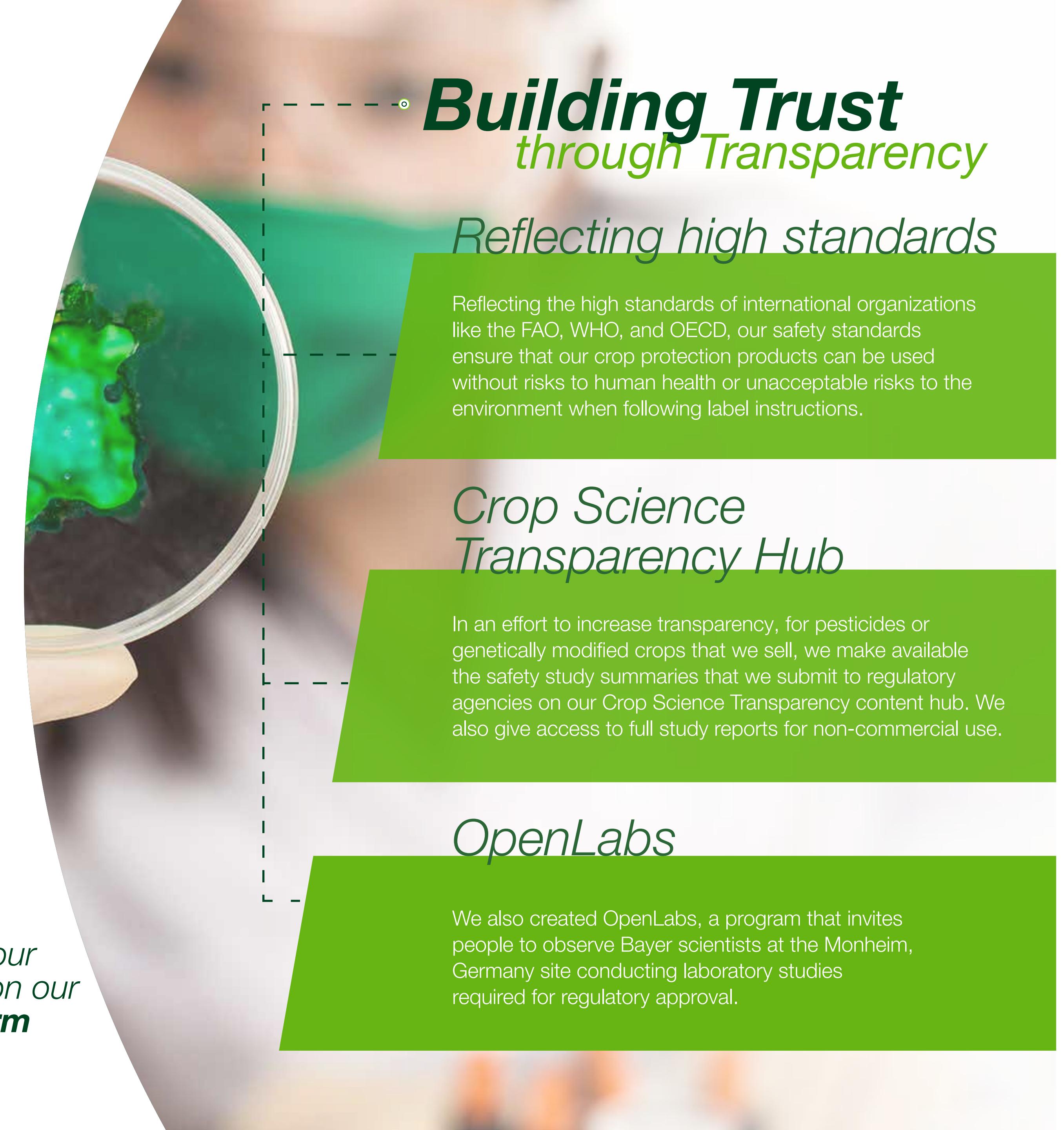
Setting and transparently adhering to high safety and sustainability standards everywhere

We adhere to ethical sales and marketing practices that meet all applicable regulations, as well as our own high internal standards. In this context, Bayer committed itself to only selling crop protection products that are registered in at least one OECD (Organisation for Economic Cooperation and Development) country. **Responsible marketing and sales also involve monitoring the implementation of procedures, systems and processes by all relevant Bayer legal entities and distributors of our products and services.**

We have made safety-related data on our crop protection products and genetically modified crops accessible for interested non-commercial parties. Summaries of scientific studies submitted to the European Food Safety Authority in connection with the registration procedures for 32 of our crop protection active ingredients in the European Union are already available on our online transparency platform. We have also published summaries of scientific studies for 16 biotechnology traits within our seeds business that were previously evaluated by the responsible regulatory authorities in the United States.

32 safety study summaries
on crop protection **active
ingredients** available

16 **biotechnology traits** within our
seeds business are available on our
online transparency platform



Building Trust through Transparency

Reflecting high standards

Reflecting the high standards of international organizations like the FAO, WHO, and OECD, our safety standards ensure that our crop protection products can be used without risks to human health or unacceptable risks to the environment when following label instructions.

Crop Science Transparency Hub

In an effort to increase transparency, for pesticides or genetically modified crops that we sell, we make available the safety study summaries that we submit to regulatory agencies on our Crop Science Transparency content hub. We also give access to full study reports for non-commercial use.

OpenLabs

We also created OpenLabs, a program that invites people to observe Bayer scientists at the Monheim, Germany site conducting laboratory studies required for regulatory approval.

Fostering sustainable partnerships

Collaborative partnerships for sustainable use

For farmers today, certifications are a critical part of making a farm a viable business operation. But many farmers lack the knowledge and skill required to successfully take their produce to market. We help fill an essential role in this process with BayG.A.P., a service program dedicated to helping farmers acquire the information and skills needed to grow their businesses. It comprises topics like Integrated Pest Management, Safe Use, Crop Protection Products, Application Technology, and Food Safety.

We've also made great efforts to reach those just entering the agriculture industry. Since 2017, we partner with universities on the Safe Use Ambassador Program in the APAC region, which fosters the exchange of know-how on best practices in the use of crop protection products by bringing students and farmers together. Now, Crop Protection (CP) Stewardship extends its network to the health sector and poison control centers, offering webinars and trainings for medical students and health care workers on the prevention and treatment of pesticide poisonings.

So far, this program has reached 53 universities in 13 countries, with more than 11,200 students trained as certified Bayer Safe Use Ambassadors to date. These Ambassadors have in turn trained thousands of growers during their farm visits and internships. Program partners (ever-increasing) now also include agriculture scientists, government extension workers, national agriculture authorities and smart growers. We are well connected with these important stakeholder groups and use digital platforms to share new innovations, tools and other sustainability related topics. In 2021, the program won the HIS Markit Crop Science Forum & Awards (Agrow awards 2021) as best stewardship/stakeholders engagement initiative in the agriculture industry. We also demonstrate safe use and proper empty container disposal via external platforms such as the [Bayer ForwardFarming](#) network, [Bayer DressCode](#) and the [BayG.A.P. Service Program](#).



Certified Bayer Safe Use Ambassadors
11,200 Students



Product safety standards

Raising standards for health and safety beyond our walls

We continually work to ensure our production facilities and sites are of an appropriate standard in all countries in which our products are manufactured or seeds are produced. Our goal is always to minimize risks to health, safety and the environment, as well as to use resources efficiently and in compliance with applicable regulations or industry standards. Where third parties produce on behalf of Bayer, contractual agreements will include stewardship requirements consistent with Bayer internal requirements.

Sustainable use is essential to success

Pioneering product stewardship for the future

Bernd Olligs, of the Damianshof ForwardFarm in Germany, has at his fingertips access to more data, technology and essential crop protection products than any of his previous generations of family farmers. He puts it to good use. Not to would mean putting his farm at risk.

He knows that while his day-to-day work is essential, it means so much more to be able to pass down a successful operation to another generation.

The Damianshof Farm is just one of 26 independent farms that are part of our global Bayer ForwardFarming network, showcasing how sustainability measures are a critical part of successful farming, just one part of our multi-tiered approach to sustainable use to ensure the future of our food supply.

26 Independent farms
are part of our ForwardFarming network



Learn more about our
efforts on Sustainability

// [Product responsibility in practice on the Damianshof ForwardFarm \(bottom of page\)](#)

// [Product Stewardship Brochure](#)

// [Growing Matters – BeSure! Product Stewardship Coalition](#)

// [Determining Safe Use of Pesticides](#)

// [Bayer Position on Product Stewardship in the Agricultural Business](#)

// [Stewardship in Action | CropLife International](#)

// [Counterfeits in Agriculture](#)

Have questions or would like to discuss directly with us our efforts to a more sustainable use? Please reach out!

 [Engage on LinkedIn](#)
Kyra Constanze Pauly,
Head of Crop Protection Stewardship

Annex:

THE ZERO HUNGER PLEDGE



Aligning Investments

Bayer commits USD 160 million for the following portfolio of Ceres2030-aligned core business investments and in-kind contributions to achieve Zero Hunger in developing countries between 2022 and 2030, with multiple partners:

	Vegetable Seeds	Arize Hybrid Rice Seeds	Better Life Farming Expansion Studies	BayG.A.P.	Modern Breeding Project	Total Commitment
Investment in education, training and vocational programs for rural youth			x	x	x	
Investment in extension services and R&D, especially for women	x					
Agricultural interventions and innovation to support sustainable practices		x	x		x	
Support adoption of climate resilient crops		x				
Scale up farm-level interventions in water-scarce regions		x				
Reduce post-harvest loss by focusing beyond cereals to fruits & vegetables, and other parts of the value chain	x					
Invest in infrastructure, regulations, technical assistance (TA) and services to support SMEs in the value chain			x			
Regions	Africa, Asia	Asia	Asia	Asia, Africa, Latin America	Africa	
Years	2022-2030		2022	2022-2025	2022	
Financial commitment (Million USD)	101	52.2	3	2.5	1.2	160

Vegetable Seeds

With more than 20 different crops and thousands of innovative seed varieties, our vegetable seeds business with its two brands, Seminis and De Ruiter, have long provided cutting-edge solutions for customers in diverse open-field and protected environments.

At Vegetable Seeds, we are strongly committed to providing solutions that mitigate the risks for smallholder farmers, placing their needs for access to seeds and resources at the center of smallholder business operations. Our commitment to this customer-centric approach is reflected in our Vegetable Seed organization strategy, which focuses on smallholders as one of four key customer segments. The shift from a product focus to a customer focus shines a spotlight on delivering value through access to seeds for its smallholder customers. Customer-centric governance guiding the way to reach more smallholders means identifying and addressing smallholder needs via expertise and partnerships that support these farmers with the resources to develop and apply their farming knowledge, mitigate risk, and optimize yield quality and quantity. Bayer's dedicated global and regional teams work on delivering solutions that meet the unique needs of smallholder farmers to, on, and beyond the farm. As part of this pledge, our Vegetable seeds business will:

- // Invest around US\$101M in research and development by 2030 to support smallholder farmers to have access to quality vegetable seeds that are tailored for their specific needs, supporting diverse food systems and the nutrition needs of their local communities' diets. This includes new breeding programs in crops that play a critical role in the diets of smallholder communities and markets, such as okra and bitter gourd.
- // Enable smallholder farmers to have access to vegetable seeds, agronomic knowledge and sustainable practices that are adaptive to the local environment through our market channels and partnerships.
- // Donate seeds to non-profit organizations, as part of our Corporate Charitable Giving, support the common good by combating hunger and increasing the consumption of fruits and vegetables.
- // Collaborate with partners to drive efficient production and increase consumption of fruits and vegetables to improve nutrition and address zero hunger.

Regions	Asia, Africa									
Alignment with CERES2030 investment areas	<ul style="list-style-type: none"> // Investing in extension services and R&D, especially for women // Reducing post-harvest losses by focusing beyond cereals to fruits and vegetables, and other parts of the value chain 									
Financial commitment (USD)										
R&D	2022	2023	2024	2025	2026	2027	2028	2029	2030	
	11.2M	11.2M	11.2M	11.2M	11.2M	11.2M	11.2M	11.2M	11.2M	
Contact person	VK Kishore, Cristiane Lourenco									
Web	Vegetables United States Unleashing the potential of millions of smallholders vegetables									

Arize Hybrid Rice Seeds

Bayer's Arize hybrid rice seeds combine cutting-edge science in seed traits with a climate-customized approach to create seeds that both improve yields in the face of specific agro-climatic conditions while optimizing water and nitrogen efficiency. One new variety of Arize—a first-of-its-kind hybrid rice seed which we launched in 2018 in India —has been bred with resistance against Brown Plant Hopper and Bacterial Leaf Blight, which both cause huge crop losses. Another Arize rice variety that can survive more than 15 days under a sustained flood was introduced in Bangladesh, where frequent flooding has a serious impact on farmers' rice harvests. Today, Bayer is looking for a solution to grow hybrid rice with high-salinity water and focusing on other abiotic/biotic stresses. So far, around 3.5 million smallholder farmers are benefitting from our pioneering work on hybrid rice. This is helping farmers in improving their income levels, livelihoods, sustainability, and also their contribution to food security in the region.

Countries	India, Philippines								
Partners	International Rice Research Institute (IRRI), GIZ, Sustainable Rice Platform (SRP)								
Alignment with CERES2030 investment areas	<ul style="list-style-type: none"> // Implementing agricultural interventions and innovation to support sustainable practices // Supporting the adoption of climate-resilient crops // Scaling up farm-level interventions in water-scarce regions 								
Financial commitment (USD)									
	2022	2023	2024	2025	2026	2027	2028	2029	2030
R&D	4.7M	4.7M	4.7M	4.7M	4.7M	4.7M	4.7M	4.7M	4.7M
Capex	1.1M	1.1M	1.1M	1.1M	1.1M	1.1M	1.1M	1.1M	1.1M
Total	5.8M	5.8M	5.8M	5.8M	5.8M	5.8M	5.8M	5.8M	5.8M
Contact person	Amit Trikha								
Web	New Traits. Unique solutions Benefits of Arize Hybrid Rice Seed								

BayG.A.P.

BayG.A.P. is a service program that aims to train, advise and support farmers on implementing good agricultural practices to ensure Food Safety and enable the verification of their produce. Through a comprehensible training content based on good agricultural practices, BayG.A.P works to advance equitable livelihoods worldwide. The program empowers and connects smallholder farmers to new market access points and therefore new income-generating opportunities, helping them become competitive in local and international markets. While BayG.A.P. has helped hundreds of farmers, there are still many more in need of their localg.a.p. or equivalent certificates, and smallholder farmers continue to have difficulty completing the certification process due to the cost and the resources required. In response to these issues, BayG.A.P. provides sponsorships to fully cover the cost of trainings and has extended its reach by making the service program available through further channels like radio, WhatsApp and online trainings. We believe agricultural transformation is not only technological, it's mainly cultural and BayG.A.P. aims to support agricultural culture.

Countries / Regions	Brazil, China, India, Indonesia, Thailand, Colombia, Ecuador, Mexico, Egypt, West-Central Africa, East Africa								
Partners	Instituto Interamericano de Cooperación para la Agricultura (IICA)								
Alignment with CERES2030 investment areas	Offering integrated training in multiple skills through vocational programs for rural youth								
Financial commitment (USD)									
In-kind	2022	2023	2024	2025	2026	2027	2028	2029	2030
	2.5M	-	-	-	-	-	-	-	-
Contact person	Ronald Guendel, Gerhard Adam								
Web	Shaping the Future of Agriculture Bayer's training program for an easier achievement of localg.a.p.								

Better Life Farming Expansion Studies

Bayer is currently leading the Better Life Farming Alliance (BLFA), a global, multi-stakeholder partnership between Bayer, Netafim, and the International Finance Corporation (IFC), created to ensure the easy availability of farming solutions from the partner network to rural farmers through a “last mile delivery model” in their villages to improve initially limited access to essential agricultural services – with the roll-out potential to other areas such as healthcare and nutrition.

BLF Centers provide to local farmers agronomic advice and good agricultural practices trainings (BayG.A.P.), customized agronomic solutions, financing (including financial literacy training), access to model farms, as well as partnerships along the value chain to facilitate market access and ensure fair prices. BLF Centers are owned and run by agri-entrepreneurs, farmers, or agri-graduates from the rural communities, who are trained to provide access to inputs and services. Moreover, the introduction of irrigation systems through BLF also ensures a more effective use of water, which proved effective in reducing methane emissions in rice production (BLF plans to incorporate GHG reduction assessments at smallholder farm levels in lighthouse projects). As of June 2021, more than 900 BLF Centers in India (630 centers), Bangladesh (100) and Indonesia (200+) reached ~440k farmers. An increasing number of BLF Centers are run by

women (currently 10%). By onboarding women agronomists and agri-entrepreneurs, more female farmers can be more easily reached and trained, with positive effects on women's empowerment in rural communities.

Each BLF owner in India is generating on average 2,000 EUR annual revenue, which is double the country's average rural farmer's income. Green chili farmers relying on BLF centers in Uttar Pradesh, India, had their yields doubled and incomes almost tripled. As part of the India projects, around 3,000 trainings on GAP and user safety have been conducted. BLF also enlisted Axis Bank, India's third largest private sector bank, as a partner to further strengthen BLF offerings. The BLF Axis Bank partnership created access to affordable credit and digital finance solutions, which were a high priority for rural farming communities. More than 1,000 farmers currently use BLF banking services in India. In 2021, we tripled the number of Better Life Farming centers in India, Indonesia and Bangladesh to more than 1,600. In addition, the partnership plans to expand the Better Life Farming concept to Africa and Latin America.

Countries	India, Bangladesh, Indonesia								
Partners	Netafim								
Alignment with CERES2030 investment areas	<ul style="list-style-type: none"> // Offering integrated training in multiple skills through vocational programs for rural youth // Implementing agricultural interventions and innovation to support sustainable practices // Investing in infrastructure, regulations, technical assistance and services to support SMEs in the value chain 								
Financial commitment (USD)									
In kind	2022	2023	2024	2025	2026	2027	2028	2029	2030
	3M	-	-	-	-	-	-	-	-
Contact person	Lino Dias								
Web	Better Life Farming								

Modern Breeding Project (MBP)

The Modern Breeding Project (MBP) is a 30-month project launched in 2020 by Bayer, IITA, and CGIAR, funded by the Bill & Melinda Gates Foundation, aimed to build a more effective plant breeding system that develops superior cultivars for critical African crops, namely cassava, maize, cowpea, banana, yam, and soybean. The project is expected to improve both technical and organizational elements patterned after protocols and best practices from Bayer. Bayer is assisting IITA with research workflow management, product development, implementation of shared services, and general organizational insights. Bayer is contributing up to \$1.2 M of in-kind support, mostly in the form of the time of skills-based volunteers. The project's beneficiaries are the over 100 million smallholder farmers who grow IITA's mandate crops on about 60 million hectares in the humid to semiarid zones of sub-Saharan Africa.

Countries	Burkina Faso, DR Congo, Ghana, Kenya, Mali, Nigeria, Rwanda, Tanzania, Uganda, Zambia								
Partners	International Institute of Tropical Agriculture (IITA)								
Alignment with CERES2030 investment areas	<ul style="list-style-type: none"> // Offering integrated training in multiple skills through vocational programs for rural youth // Implementing agricultural interventions and innovation to support sustainable practices 								
Financial commitment (USD)									
In Kind	2022	2023	2024	2025	2026	2027	2028	2029	2030
	1.2M	-	-	-	-	-	-	-	-
Contact person	Stella Salvo								
Web	IITA and Bayer launch modern breeding project								

Disclaimer

The signing and acceptance of the pledge does not constitute a blanket endorsement by the project partners of any company or its activities. The partners of this pledge are not directly affiliated with the companies through the signing of this pledge. The partners of this pledge reserve the right to revoke or suspend the pledge if the company fails to comply with the overarching principles.

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The current version of this report contains the following changes compared to its previous version:

Page 15, paragraph 2. Adjustments in key figures.