

// November 2024



BAYER

# Crop Science Sustainability Progress Report

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

**SUSTAINABLE DEVELOPMENT GOALS**

*Please see [page 7](#)*

**Introduction**



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# Foreword

Farming forms the bedrock of our food system. It demands resilience and passion. However, farmers face increasing challenges from external factors such as a growing world population, geopolitical shifts, economic uncertainty, and notably, climate change.

Over the past decade, severe weather events have intensified, affecting growers worldwide with droughts, prolonged periods of high temperatures, extreme weather fluctuations, strong winds and natural disasters.

These trends are placing additional strains on the resilience of global food systems, jeopardizing food security for millions of people already today – and for the 2.2 billion more people who are estimated to inhabit the Earth by 2050. According to the UN’s Food and Agriculture Organization, **we need to produce 50% more food to meet rising demand.**

While increasing food production is crucial, the future of farming and food security will require smarter approaches. Our intention is to **create a world where agriculture is part of the solution rather than part of the problem. That’s why our vision for the future of farming is clear:**

## Produce 50% More. Restore Nature. Scale Regenerative Agriculture.

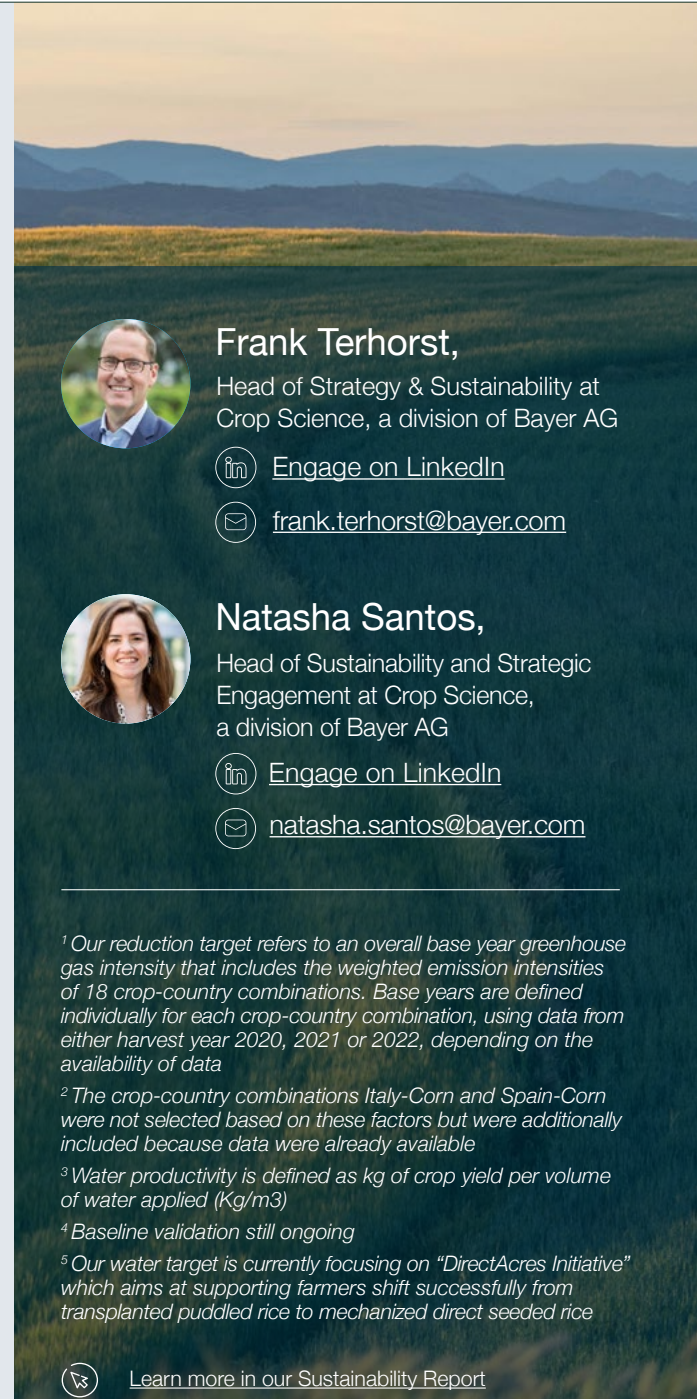
We promote a concept of regenerative agriculture that is defined as an outcome-based production model based on two key building blocks: productivity, which focuses on helping farmers maintain or increase yield with fewer inputs leading to improved social and economic wellbeing outcomes; and regeneration, which focuses on delivering a positive impact on nature. Positive impacts on nature include striving to improve soil health, reduce field-level greenhouse gas emissions and increase carbon sequestration to mitigate climate change, preserve and restore on-farm biodiversity, enhance plant genetic diversity, and conserve water resources.

We are working together with our customers and partners to scale up regenerative agriculture and advance progress towards our 2030 sustainability targets:

- Enable our farming customers to **reduce their on-field greenhouse gas emissions per mass unit of crop produced by 30% by 2030** compared to the overall base year emission intensity.<sup>1</sup> This applies to the highest greenhouse gas-emitting crop systems in the regions Bayer serves with its products.<sup>2</sup>
- **Reduce the treated-area-weighted environmental impact per hectare of Bayer’s global crop protection portfolio by 30% by 2030** against a 2014 – 2018 average baseline.
- **Support a total of 100 million smallholder farmers in low- and middle-income countries (LMICs) by 2030** by improving their access to agricultural products and services, including in collaboration with our partners.
- **Support our smallholder customers to increase water productivity<sup>3</sup> by 25% by 2030** against a 2019-2021 average baseline<sup>4</sup> by transforming rice cropping in the relevant geographies where Bayer operates, starting in India.<sup>5</sup>

In this progress report, we want to demonstrate not only how we are working towards this vision, but also how sustainability is already a driving force behind our entire business. While our targets may be ambitious, we recognize that they are only one step in our long-term sustainability journey. That’s why we want to be transparent about how we’re tracking progress and what metrics we’re using to hold ourselves accountable against our targets.

We are making important progress, both in terms of driving new solutions forward and enabling growers and food chain partners to embrace long-term sustainability. We cannot do it alone, but we are ready to tackle the challenges that lie ahead and transform the agricultural landscape towards a more sustainable and regenerative future for generations to come.



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<sup>1</sup> Our reduction target refers to an overall base year greenhouse gas intensity that includes the weighted emission intensities of 18 crop-country combinations. Base years are defined individually for each crop-country combination, using data from either harvest year 2020, 2021 or 2022, depending on the availability of data

<sup>2</sup> The crop-country combinations Italy-Corn and Spain-Corn were not selected based on these factors but were additionally included because data were already available

<sup>3</sup> Water productivity is defined as kg of crop yield per volume of water applied (Kg/m<sup>3</sup>)

<sup>4</sup> Baseline validation still ongoing

<sup>5</sup> Our water target is currently focusing on “DirectAcres Initiative” which aims at supporting farmers shift successfully from transplanted puddled rice to mechanized direct seeded rice

[Learn more in our Sustainability Report](#)

## 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 and society**. As part of a broader reporting landscape at Bayer, we publish different reports that vary in their focus and depth. Our main corporate reports and publications are supplemented by special ad-hoc reports. You can find an overview of our reporting landscape [here](#).

The information in this Crop Science Sustainability Progress 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 targets 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 towards our 2030 targets and, more importantly, our **“Health for all, Hunger for none”** mission.

### End to End Value Chain Coverage

Chapter	Upstream	Own Operations	Downstream
Governance	✓	✓	✓
Innovation		✓	
Food System		✓	✓
Product Supply	✓	✓	
Smallholder Farmers		✓	✓
GHG			✓
CP EIR			✓
Biodiversity			✓
Water			✓
Sustainable Use		✓	✓



**Tomas Zaborowski,**

Sustainability & Strategic Engagement  
at Crop Science, a division of Bayer AG

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# Progress Highlights

In 2023, we have enrolled

**3 new**  
Bayer ForwardFarms



2018-2022: we have **reduced the treated-area-weighted environmental impact per hectare of our global crop protection portfolio**

**by 12%**

against the 2014 - 2018 baseline



In 2023, together with our partners, we have supported

**53M** smallholder farmers

in LMICs<sup>6</sup> with our products and services

<sup>6</sup>Low- and middle-income countries



In 2023, we successfully brought Direct Seeded Rice to

**4,500** hectares

in India through the DirectAcres program, achieving a

**90%** farmer satisfaction rate



In 2023, we have reached almost

**5.3M** external contacts

including around 4M farmers, through training on the safe use of our products



We have more than

**40** certified sites

by the **Wildlife Habitat Council** globally





# Elevating Sustainability in Agriculture through Good Governance & Strategy

Can companies truly be trusted to hold themselves accountable for the steps they promise to take towards 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, a sustainable strategy, clear leadership and transparency are the keys to holding ourselves accountable in every step along the way.

**UN Sustainable Development Goals on which we have the greatest impact through our businesses:**



# Sustainability - embedded in our Corporate Strategy

The Bayer mission 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 Sustainability Strategy. Bayer has sustainable development objectives and targets embedded in its strategy and business model.

Through our Sustainability Report and additional ad hoc reporting, we disclose how we have identified and prioritized relevant sustainability topics on which Bayer has a clear impact.

These fundamentals for the whole Bayer organization carry through within the Crop Science division. In this report, we will highlight the most impactful stories regarding sustainable agriculture that complement and link to other reporting across the organization.

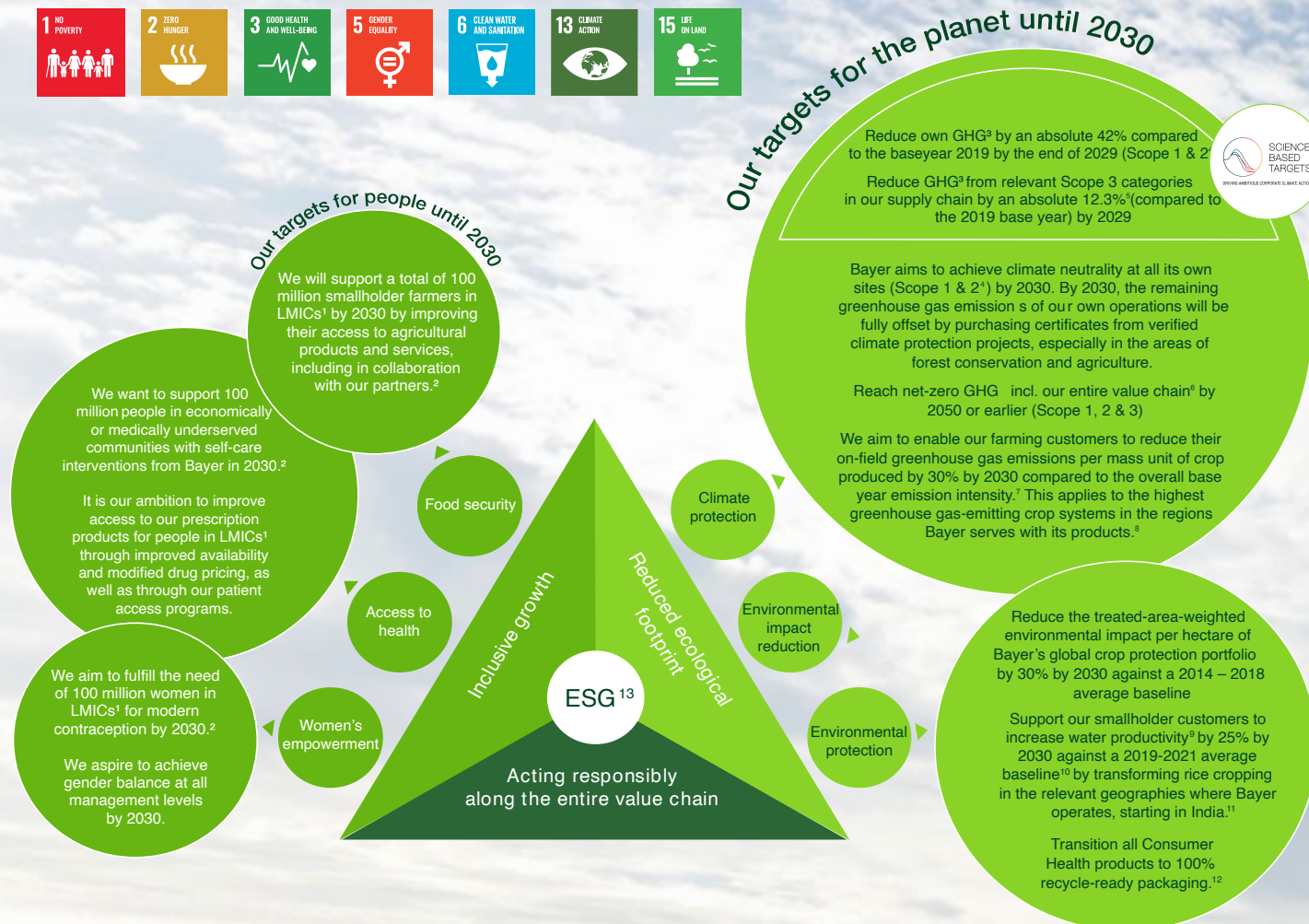


[Learn more about our corporate sustainability strategy in the Bayer Sustainability Report](#)



## Our mission: “Health for all, Hunger for none”

### SDGs on which we have the greatest impact through our businesses



<sup>1</sup> LMICs: low- and middle-income countries

<sup>2</sup> These targets are accounted for in the long-term variable compensation (LTI) of our Board of Management and our LTI-entitled managerial employees.

<sup>3</sup> GHG: Greenhouse Gas emissions

<sup>4</sup> Comprises direct emissions (Scope 1) and indirect emissions (Scope 2, market-based) from Bayer sites whose annual energy consumption exceeds 1.5 terajoules

<sup>5</sup> In accordance with the criteria set out by the Science-Based Targets initiative (SBTi), the following Scope 3 categories of the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting & Reporting Standard are relevant for Bayer: (3.1) purchased goods and services, (3.2) capital goods, (3.3) fuel- and energy-related activities, (3.4) (upstream) transportation and distribution and (3.6) business travel

<sup>6</sup> Entire Scope 1-3 emissions. Scope 3 includes all categories defined in the GHG protocol.

<sup>7</sup> Our reduction target refers to an overall base year greenhouse gas intensity that includes the weighted emission intensities of 18 crop-country combinations. Base years are defined individually for each crop-country combination, using data from either harvest year 2020, 2021 or 2022 depending on the availability of data.

<sup>8</sup> The crop-country combinations Italy-Corn and Spain-Corn were not selected based on these factors but were additionally included because data was already available.

<sup>9</sup> Water productivity is defined as kg of crop yield per volume of water applied (Kg/m<sup>3</sup>)

<sup>10</sup> Baseline validation still ongoing

<sup>11</sup> Our water target is currently focusing on “DirectAcres Initiative” which aims at supporting farmers shift successfully from transplanted puddled rice to mechanized direct seeded rice

<sup>12</sup> Where safety permits and regulations allow

<sup>13</sup> ESG: environmental, social, governance

# Becoming an impact generator in agriculture

No one can see into the future, but we can all work together to shape it.

At Bayer, we're striving for **building a world where hunger and climate change are taken care of for years to come**. We are working to make that a reality – and innovations on the farm can help get us there. That's why we're pursuing new possibilities in agriculture that are helping address some of humanity's greatest challenges for a more sustainable future.

Farming has always thrived on innovation. From the very beginning, farmers have sought better ways to nourish themselves, their families and their communities. This engagement continues today as we continually strive to find more sustainable solutions that can help farmers grow enough for a growing world.

Our Crop Science division's sustainability strategy focuses on the following sustainability areas and transformational targets.

## • Areas of impact

Our sustainability focus areas and transformational targets

### Biodiversity & Soil Health

Balance the need for **crop production and nature conservation** to ensure a healthy environment

### Promoting Sustainable Use

Promotion of **effective, safe and responsible use of our products**; protection against product counterfeiting

### Crop Protection Environmental Impact

Reduce the **treated-area-weighted environmental impact per hectare** of Bayer's global crop protection portfolio **by 30% by 2030** against a 2014 – 2018 average baseline

### Water

Support our **smallholder customers to increase water productivity<sup>14</sup> by 25% by 2030** against a 2019-2021 average baseline<sup>15</sup> by transforming rice cropping in the relevant geographies where Bayer operates, starting in India.<sup>16</sup>

### Smallholder Farmers

Support a total of **100 million smallholder farmers in LMICs<sup>17</sup> by 2030** by improving their access to agricultural products and services, including in collaboration with our partners

### On-field GHG Emissions

Enable our farming customers to **reduce their on-field greenhouse gas emissions per mass unit of crop produced by 30% by 2030** compared to the overall base year emission intensity.<sup>18</sup> This applies to the highest greenhouse gas-emitting crop systems in the regions Bayer serves with its products<sup>19</sup>

<sup>14</sup> Water productivity is defined as kg of crop yield per volume of water applied (Kg/m<sup>3</sup>)

<sup>15</sup> Baseline validation still ongoing

<sup>16</sup> Our water target is currently focusing on "DirectAcres Initiative" which aims at supporting farmers shift successfully from transplanted puddled rice to mechanized direct seeded rice

<sup>17</sup> Low- and middle-income countries ("LMICs")

<sup>18</sup> Our reduction target refers to an overall base year greenhouse gas intensity that includes the weighted emission intensities of 18 crop-country combinations. Base years are defined individually for each crop-country combination, using data from either harvest year 2020, 2021 or 2022 depending on the availability of data

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**Produce 50% more.  
Restore nature.  
Scale regenerative agriculture.**



# ESG performance summary

For decades, Bayer, like most of the listed companies, has been rated by **ESG rating agencies to demonstrate and reinforce its performance in terms of Environmental, Social, and Governance (ESG) topics**. The results of this assessment are a foundation for most investors when they make decisions on investments.

We have engaged in regular and constructive **discussions with ESG rating agencies in order to increase transparency** in the evaluation process and identify opportunities and focus on those areas where our ESG management and reporting can be improved. Along the years, we have made significant progress, which has been reflected in Bayer's sustainability strategy.

The **Crop Science division** actively participates in ESG benchmarks by **CDP** and the **World Benchmarking Alliance (WBA)**, where a significant improvement can be seen in recent years:

## 1 CDP Climate

In the latest assessment, Bayer's score experienced a modest decline to an **A-**, primarily due to **the pending publication of our detailed climate transition plan, which has now been published**. Despite this temporary setback, it's important to emphasize that a **robust and comprehensive climate strategy is already in place**. Moreover, **Bayer continues to be recognized within the leadership band**, consistently performing above the sector's average. We remain dedicated to enhancing our transparency in the coming year.

## 2 CDP Water

In relation to the **water security questionnaire**, we have received the same scoring as the previous years, which maintains us in the **leadership band** and higher than the sector's average.

## 3 WBA

Bayer has ranked **top 5** in both, the **"2023 Food and Agriculture Benchmark" (FAB)** and the **"2023 Nature Benchmark" (NBB)**, significantly **enhancing the results from previous editions**. This is mainly due to remarkable improvements in our performance in the social and nutrition measurement areas, resulting in **first position in "NBB" and second position in "FAB" for the agricultural inputs segment**. Additionally, we claim the top spot in the Nutrition measurement area among all value chain segments (FAB).



### Scores and ratings from key ESG benchmarks,<sup>20</sup> showcasing our targets to sustainability (2021-2023<sup>21</sup>)



<sup>20</sup> Bayer also participates on CDP Forests (palm oil & soy) since 2020. The results can be found in the CDP website.

<sup>21</sup> Data included when available; 1) No benchmarks were published by NBB in 2021; 2) No benchmarks were published by FAB in 2022

# Governance – our path to becoming an impact generator

## Clear leadership

Our governance system at Bayer starts with the [Board of Management](#) and its highest-level members **acting with responsibility and accountability for our Sustainability Strategy**. Our sustainability targets are not only integrated into the company’s decision-making processes, but **Bayer has also incorporated measurable sustainability targets that carry weight into the long-term compensation of its management staff, including the Board of Management**. Operational implementation takes place in the divisions and along the value chain.

Additionally, Bayer has a dedicated **Environmental, Social & Governance (ESG) Committee** in its [Supervisory Board](#) to deal with ecological and social responsibility matters and sustainable corporate governance. Moreover, to further develop the sustainability elements of our business strategy, provide guidance and evaluate progress in the implementation of our sustainability targets previously mentioned, Bayer trusts in its [Sustainability Council](#) composed of independent international experts. 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

Our compliance principles apply throughout the Bayer Group and are established in our [Corporate Compliance Policy](#). We commit to upholding ten principles, particularly in antitrust and anticorruption matters.

Our [Code of Conduct](#) guides **our interactions with everyone** – our employees, patients, customers, consumers, business partners, public policy stakeholders, scientists, critics and our shareholders worldwide.

**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.



**Bill Anderson,**  
Chairman of the Board of Management and Chief Executive Officer of Bayer

Responsible for sustainability implementation across the company

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**Rodrigo Santos,**  
Member of the Board of Management of Bayer AG and Head of Crop Science, a division of Bayer AG

Committed to shaping a more sustainable and digital future of agriculture using science, innovation and technology to help farmers, society and the planet

[Engage on LinkedIn](#)



Transparency is a top priority for Bayer, and we demonstrate these efforts by making information accessible from a whole range of areas, including:

### Bayer transparency platform

Bayer has made safety-relevant data on crop protection products and genetically modified crops accessible. [Learn more](#)

### Bayer science collaboration explorer

We publish information related to our scientific [collaborations with external partners](#).

### “OpenLabs”

On our OpenLabs 360° platform you can observe our scientists as they carry out a safety registration study. [Learn more](#)



[For more information, please refer to our 2023 Sustainability Report](#)



[Learn more about our Code of Conduct for Responsible Lobbying](#)

# Building strong relationships to foster agricultural transformation towards our vision of regenerative agriculture

At Bayer, we believe **purposeful and strategic stakeholder engagement is fundamental to drive agricultural transformation**. At the Crop Science division, our dedicated team within the Strategy and Sustainability group manages long-term relationships and partnerships, streamlining the inclusion of external input into our strategy.

## Identifying & prioritizing key stakeholders

The process we use for **identifying stakeholders is grounded in our mission**, “Health for all, Hunger for none”, and **guided by our Code of Conduct**. Through our mission, we are working to meet challenges like climate change, food security, environmental impact reduction, as well as biodiversity and nature conservation. It is through these lenses that we prioritize and identify stakeholders across our value chain, and our passion and determination to address these challenges fuel our Code of Conduct. Overall, we **identify stakeholders** with whom to engage **based on their alignment with our sustainability and strategic priorities and the impact they can have on Bayer’s business**.

In identifying key stakeholders, **we first look within our value chain**: from growers (customers and non-customers), grower organizations and associations, retail partners, off-takers and traders, food manufacturers and processors, to retailers. Additionally, we identify stakeholders across international organizations, financial institutions, entrepreneurs, think tanks, non-governmental organizations, researchers and academia, and multistakeholder platforms such as the World Economic Forum (WEF) and the World Business Council for Sustainable Development (WBCSD).

In order to address the challenges and assess the impacts on the identified ESG material topics, **Bayer engages with their stakeholders at a local, national and international level**. Moreover, we regularly consult our **Sustainability Council**, which reports directly to the Board of Management, helps Bayer further develop the sustainability elements of its business strategy and independently examines the progress made by Bayer in the implementation of its sustainability targets.



## Who we engage with and how

At Crop Science, a division of Bayer AG, our stakeholder activities range from local dialogues to international initiatives, addressing topics such as regenerative agriculture, food systems, nutrition, climate change, biodiversity and water, as well as poverty alleviation and farmers’ wellbeing. On the next page, **we highlight the most relevant groups of stakeholders for the Crop Science division and how we engage with them**. You can find more information in our Sustainability Report.



**Partnering with stakeholders in the value chain will scale regenerative agriculture and help promote food security**

## Relevant topics

## How do we engage

## Stakeholders & initiatives

Farmers,  
Farmers' Associations,  
Local Communities

- **Engage on regenerative agriculture topics, food system, carbon, water, and biodiversity**
- **Provide availability of resources, financial tools and solutions** to enable sustainable practices, enhance capacity building, increase profitability and strengthen resilience to challenges driven by climate change
- **Foster the adoption of innovative agricultural techniques and best practices**, promote health and safety and share relevant market information

- **Support and engage** through farmers fostering open dialogues and sharing insights
- **Implement programs and pilot projects** that create tangible impacts improving farmer's quality of life
- **Forge robust relationships** by collaborating and working towards sustainable outcomes in agriculture

- **Farmer associations:** [World Farmers Organization](#), [Global Farmer Network](#), [Next Generation Ag Impact Network](#), [Farm to Market Alliance](#)
- **Partnerships and initiatives:** [DK Silos](#), [Better Life Farming Centers](#), [Bayer ForwardFarming](#), [Farmer Voice survey](#), [Food Chain Partnerships](#), [Bay.G.A.P](#)

International  
Organizations

- **Promote global regenerative agriculture standards**
- **Support food security**, and identify best practices to enhance better policies for better lives
- **Promote technology transfer** between developed countries and LMICs
- **Raise sustainability management** to reduce environmental impacts
- **Identify best practices** to promote better policies for better lives

- **Actively communicate & share experiences** with International Organizations to find solutions to common challenges & advance on SDGs
- **Participate in International Events, Conferences and Committees**
- **Engage by means of industry associations** such as the [CLI](#), [ISF](#), [USCIB](#), [ICC](#), [BIAC](#), etc.

- **International Organizations:** [FAO](#), [United Nations](#), [OECD](#), [GSI](#), [IICA](#)
- **Events & platforms:** [Field of the Future](#), [Peace for food](#), [African Farmers Roundtable](#), [Africa Food System Forum: AGRF](#), [IICA: Sustainable agricultural practices: decarbonization of agriculture in the Americas](#)

NGOs

- **Engage on dialogues** about regenerative agriculture, food systems and new technologies
- **Partnering for sustainability initiatives**
- **Actively communicate and showcase solutions** on regenerative agriculture
- **Promote open dialogues** to enhance each other's capabilities
- **Promote community engagement**

- **Participate in global platforms & global summits**
- **Promote partnerships on sustainability topics**
- **Knowledge sharing**

- **Collaboration with NGOs through** [COP](#) or [Midwest Row Crop Collaboration](#)
- [Solidaridad, Bayer & Grupo Pantaleon winners of the 2023 Sedex Sustainability Awards! - Solidaridad Network](#)

Governments

- **Operate in a transparent environment** with the highest standards of compliance with local and global regulations
- **Promote knowledge and data transparency** to support decision-making based on scientific evidence and sustainability goals
- **Keep License to Operate (LTO)**
- **Achieve reliable product authentication systems**
- **Safeguard responsible business conducts**

- **Engage with all levels of government/direct engagement**
- **Engage in conferences and committees** through transparent communications and thoughtful dialogue
- **Participate in global platforms & global summits**
- **Apply compliance standards, transparency principles and robust governance**

- **Collaboration with governments through** [Davos/WEF](#), [COP](#) or [WBCSD](#)
- [Transparency at Bayer | Bayer Global](#)
- [Government of Saskatchewan and Bayer partner on Ag-Tech Innovations](#)
- [Bayer partners with the Government of India's Common Service Center \(CSC-SPV\) and Gram Unnati](#)
- [USAID and Bayer expand partnership with additional \\$15.5M USD from Bayer to support Ukrainian farmers](#)

Academia

- **Provide science-based and innovative solutions** supporting regenerative agriculture, digital solutions and sustainability targets supported by reliable sources and data
- **Transform the food system** with science and innovation for a more sustainable agriculture
- **Promote knowledge and data transparency** to support decision-making based on scientific evidence

- **Collaborate & partner** with universities, start-ups and research centers
- Submission of R&D studies, science publications, etc.
- **Perform field tests** and share results
- **Network of Life-Hubs & research centers**
- **Create & update** Science Data Bases

- [Dialog4Ag program](#)
- [Bayer Science Collaboration Explorer](#)
- [Halo Science](#)
- [The Bayer Water Utilization Learning Center](#)

ESG Rating  
Agencies &  
Benchmarks

- **Harmonization on global criteria** on regenerative agriculture metrics and measurements
- **Discussion around transparency**, reporting and efficacy of innovative solutions

- **Provide support to TNFD criteria**, applying methodologies from the top reputable monitoring agencies (SASB, CDP, WBA)
- **Participate in multiple benchmarks** (CDP, WBA)

- [TNFD](#)
- [CDP climate](#), [CDP water](#)
- [Food and Agriculture Benchmark \(WBA\)](#), [Nature Benchmark \(WBA\)](#)

# Respecting human rights along our value chain

**At Bayer, we are constantly working towards creating a world where everyone has access to essential services, encompassing health and nutrition.** In this report, we present projects that contribute to achieving this aim. While much of the downstream impact we have generated is through our global work with [Smallholder Farmers](#) and [Sustainable Use](#), respecting human rights is also a critical component of our governance that ripples across the value chain.

**Our Human Rights Policy defines and obligates us to respect and foster human rights within our company and in our business relations. This applies to all Bayer employees worldwide and the entire value chain, i.e., vis-à-vis suppliers, business partners, customers, consumers and local communities alike.** 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. In 2022, we introduced the position of **Human Rights Officer** at Bayer, who oversees human rights risk management and reports to the Board of Management. Moreover, **a group-wide human rights risk assessment was completed in 2022, and in 2023, the results of the analysis were incorporated into the Bayer Risk Portfolio of our Group-wide, integrated risk management process.** In 2023, Matthias Berninger was named as Human Rights Officer and briefed the Board of Management three times on the officer's work and developments in this regard.

**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 the pillars of Ethics; Labor & Human Rights; Health & Safety; Environment; Quality; Governance & Management Systems.

One factor of our Human Rights Policy that we hold to a particularly high standard is **our stance against modern slavery and child labor** — contemporary realities, especially in the agricultural business, that require unilateral cooperation from businesses, governments and stakeholders up and down the value chain in order to be stopped.

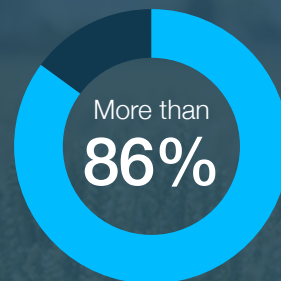
We also offer training on human rights, which includes the topics of modern slavery and child labor, in the form of an e-learning program. **In 2023, more than 86% of our employees (vs. 85% of our employees in 2022) received training on aspects of our Human Rights Policy in sessions totaling more than 224,000 hours (vs. 165,000 hours in 2022).**

**With this training, employees learn how to identify, analyze and address cases of human rights violations.** The topic of human rights is also an integral element of training measures for the management of our country's organizations.

Moreover, **as a leader in agriculture, we aim to overseeing the entire life cycle of our products** to promote responsible production, distribution, and use, so we offer safe & responsible use trainings for our products (both chemicals and seeds). Since 2021, we have shared our [crop protection safety standards on our website](#). Our voluntary standards reflect the guidelines and standards of international organizations such as the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO) and the Organization of Economic Cooperation and Development (OECD), as well as those of reference regulatory authorities around the world.



[See more details about our product stewardship efforts](#)



of our employees received a training on aspects of human rights



# Diversity, equity and inclusion

## Cultivating an inclusive workplace

The [Bayer Group's goals of furthering diversity, equity and inclusion](#) carry through within the Crop Science division. Various [Business Resource Groups \(BRGs\)](#), such as [BayAfro](#), [BLEND](#), [ENABLE](#), [Grow](#), and [MERGE](#), assist Bayer with cultivating an inclusive workplace and help shape how we engage with customers, the community, and our culture.

## Supporting women and youth in agriculture

**Inclusion is an important factor for all our operations, as demonstrated in the [Smallholder Farmers chapter of this report](#)**

Globally, [43% of global farmers are female](#). In smallholder realities, up to 75% of women report agriculture as their primary source of livelihood, yet they produce [24% less than their male counterparts](#), facing significant challenges resulting in a productivity gap. For instance, **if gender employment equality and training were achieved, productivity would boost by 131%**, [lifting 45 million people out of hunger](#), and long-term GDP per capita would increase by 20%. Moreover, [more than 1B women in developing countries lack access to basic banking services](#), and 40% of countries impose gender-based property restrictions.

Achieving food and nutrition security for a steeply growing world population and addressing global sustainability challenges requires innovation and technological advances in agriculture and the food value chain. [Young people make up 50% of the world's population](#) and are keen to explore and implement new solutions that align with the Sustainable Development Goals. However, they lack ways to participate in agriculture effectively. Therefore, **empowering the next generation of agricultural leaders is crucial** for creating employment, developing solutions, and promoting regenerative agriculture. Bayer contributes to this by working with diverse stakeholders through partnerships, co-creation, and exchanging knowledge directly with young leaders in the sector.



## Here are some concrete examples on how we are working to support women and youth in agriculture

### Better Life Farming Centers (BLFC)

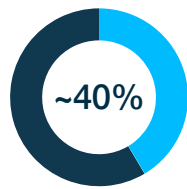
Through Better Life Farming, a long-term partnership between Bayer and several external partners, a growing number of women have opened Better Life Farming Centers in their communities. This means increased women's enablement and female farmer community-building in rural areas. Read more about how we support women farmers holistically in [our chapter on Smallholder Farmers](#).



Global Female BLFC Owners



Female BLFC Owners in Indonesia



Female BLFC Owners in Latin America (Mexico & Honduras)

### Farm to Market Alliance (FtMA)

Together with the UN World Food Programme (WFP) and other organizations, **Bayer is a founding member of the Farm to Market Alliance, which supports smallholder farmers in Kenya, Rwanda, Tanzania and Zambia.** Since 2016, FtMA has reached around 615,000 farmers through engagement, 49% of them being women. In Kenya, for example, FtMA has benefited more than 296,400 smallholder farmers building a network of 1,520 Farmer Service Centers (FSCs), of them 53% women and 25% youth. **FtMA strives for the inclusion of women and youth** by steadily increasing representation from these groups since 2021. In Kenya, youth training and job creation were key initiatives in 2023, with the primary goal of mentoring and empowering young individuals.

FtMA globally reached

**615,000** & **2,740**

farmers at the end of 2023

Farming Service Centers

49%

Female

In Kenya

**296,400** & **1,520 FSCs**

smallholder farmers are currently being served

a total of

have been onboarded to the FtMA network

53%

Female

## Women connection: supporting female farmers in Brazil

In Brazil, **19% of the farmers are women, managing around 75 million acres.**<sup>22</sup> Despite their experience and ownership status, 64%<sup>23</sup> feel unequal to their male counterparts. However, these women leaders are eager for knowledge and growth, investing in sustainable practices. Bayer supports them with tailored trainings and programs like Jornada do Conhecimento, the [Mulheres do Agro Award](#) and Congress, drawing thousands of women to foster business, networking, and gender awareness.

<sup>22</sup> 2017 Agricultural Census by the Brazilian Institute of Geography and Statistics (IBGE)

<sup>23</sup> Survey by Agroligadas supported by Brazilian Agribusiness Association (Abag) in 2021



## Empowering the next generation of agricultural leaders

**1 Next Generation Ag Impact Network (NGIN):** Bayer is a founding Board member of the **Next Generation Ag Impact Network (NGIN)** established in 2022 as a multistakeholder, intergenerational platform co-creating growth and participation opportunities for young leaders in agriculture. Involving associations, youth platforms, academia, the private sector, NGOs, and international organizations, NGIN generates open dialogue and first-hand experience in agriculture. In 2023, the Network grew to include new partners and amplified its network of cautiously selected NGIN Ambassadors representing 28 countries and all continents.

**2 International Association of Students in Agricultural and Related Sciences (IAAS):** Since 2021, Bayer partners with the **world's largest student association in agricultural sciences** with presence in over 50 countries and over 10,000 members. Every year, Bayer brings agricultural experiences to IAAS's International Conferences for Youth in Agriculture (ICYA) and engages in open dialogue. Field trips around the globe provide insights that no webinar can replace.

**3 Bayer NextGen Deep Dives:** In 2023, Bayer launched Bayer **NextGen Deep Dives**, enhancing transparency and dialogue with youth leaders. These online sessions allow young people to openly ask questions, provide feedback, and reflect. They offer Bayer a valuable opportunity to listen and learn from the next generation of stakeholders, ensuring a reciprocal flow of information and knowledge sharing to gauge the viability of ideas and developments.



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



**Natasha Santos,**

Head of Sustainability and Strategic Engagement at Crop Science, a division of Bayer AG

[Engage on LinkedIn](#)

[natasha.santos@bayer.com](mailto:natasha.santos@bayer.com)

Want to know more about our impact on woman and youth farmers in Latin America? **Scan the QR code!**



Learn more about our efforts demonstrating good governance

[Food Chain Partnership](#)

[Our Collaborations with External Partners](#)

[Stakeholder Dialogue](#)

[Sustainability Management](#)





# Powering Regenerative Agriculture through Our Innovation Engines

How can we grow enough to feed and fuel the world around us? Can we create a more sustainable, healthy, and resilient food system, while helping farmers produce more with less? We believe it's possible, even as climate change, declining natural resources, and supply chain challenges make the job even more complex.

At this pivotal moment, **breakthrough technologies are essential for a smarter approach.** We need science and smart systems to optimize our inputs and outcomes, and we need to do it all in a way that sustainably benefits both the environment and growers. In short, **we need to rethink our methods – and this is where regenerative agriculture comes into play.**

Our efforts in R&D and innovation contribute to the following UN Sustainable Development Goals:



# Bayer's vision for regenerative agriculture

Three of the most globally recognized **challenges** the planet will face **by 2050** are **food security, biodiversity loss and climate change**. As the world's population continues to grow, the need for sustainable food production has never been more critical. At Bayer, we are aligned with the United Nations objective of **producing 50% more by 2050 to meet the demands of a growing population while restoring nature**.

At **Bayer**, we are committed to **addressing global challenges** through our vision of **regenerative agriculture**, which is based on two building blocks: **productivity**, which focuses on helping farmers to produce more using less resources, and **and restoring nature, which focuses on our sustainability targets and enabling the adoption of regenerative agriculture**. Moreover, with farmers at the center of our efforts, it is critical that these initiatives create new value for them, driving faster adoption and implementation of regenerative farming practices.



For Bayer, regenerative agriculture is an outcome-based production model based on two key building blocks: productivity, which focuses on helping farmers maintain or increase yield with fewer inputs leading to improved social and economic well-being outcomes; and regeneration, which focuses on delivering a positive impact on nature. Positive impacts on nature include striving to improve soil health, reduce field-level greenhouse gas emissions and increase carbon sequestration to mitigate climate change, preserve and restore on-farm biodiversity, enhance plant genetic diversity, and conserve water resources

## Our vision aspires to address global challenges at scale

**Produce 50% more**

by 2050 to feed a growing population<sup>1</sup>

**Restore nature**

through delivering on our 2030 sustainability targets

**Scale regenerative agriculture**

introduction of systems and solutions that are intended to contribute to delivering regenerative agriculture outcomes

## Sustainability targets<sup>2</sup>

**30%**

Reduction in GHG emissions per kg of crops produced<sup>3</sup>

**30%**

Reduction in Crop Protection impact on the environment

**25%**

Increase of water productivity<sup>4</sup>

**100M**

Empower 100M smallholder farmers<sup>5</sup>

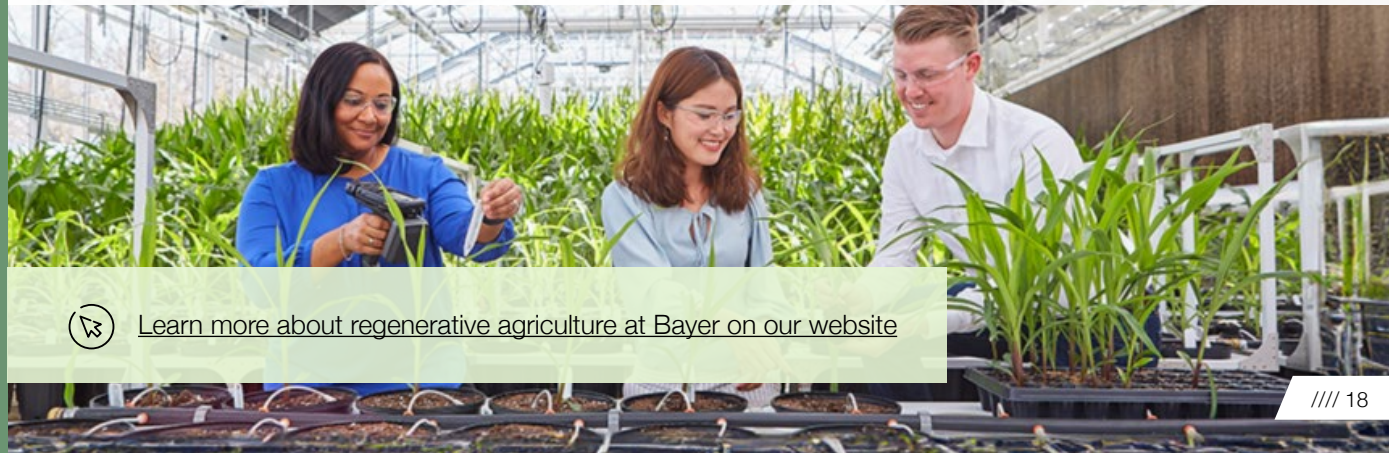
<sup>1</sup> FAO estimates that the world will need 50 percent more food by 2050 to feed the increasing global population in the context of natural resource constraints, environmental pollution, ecological degradation and climate change

<sup>2</sup> For detailed targets see our [Sustainability Report](#), page 7

<sup>3</sup> We aim to enable our farming customers to reduce their on-field greenhouse gas emissions per mass unit of crop produced by 30% by 2030 compared to the overall base year emission intensity. The overall base year greenhouse gas intensity that includes the weighted emission intensities of 18 crop-country combinations. Base years are defined individually for each crop-country combination, using data from either harvest year 2020, 2021 or 2022 depending on the availability of data

<sup>4</sup> Support our smallholder customers to increase water productivity by 25% by 2030 against a 2019-2021 average baseline by transforming rice cropping in the relevant geographies where Bayer operates, starting in India. Water productivity is defined as kg of crop yield per volume of water applied (Kg/m<sup>3</sup>). Baseline validation still ongoing. Our water target is currently focusing on "DirectAcres Initiative" which aims at supporting farmers shift successfully from transplanted puddled rice to mechanized direct seeded rice

<sup>5</sup> We will support a total of 100 million smallholder farmers in LMICs (Low- and Middle-Income Countries) by 2030 by improving their access to agricultural products and services, including in collaboration with our partners

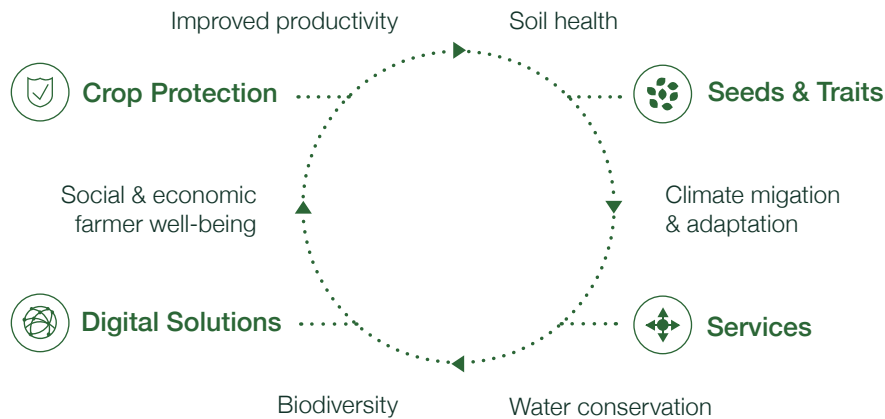


[Learn more about regenerative agriculture at Bayer on our website](#)

# Our portfolio supports a System Solution Approach to deliver regenerative agriculture outcomes

For us, regenerative agriculture is about outcomes, and the only way to achieve these outcomes is through a “systems approach” that integrates existing and new solutions in Bayer’s portfolio, in partnership with our farmer customers.

At Bayer, this means combining our innovations in crop protection, seeds & traits, services, and digital solutions to deliver a holistic set of multi-season solutions tailored to each individual farm and its specific soil conditions. Recognizing that each farm’s realities differ, we treat each one as a unique ecosystem and consider the optimal mix of solutions adapted to its conditions.



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The way to deliver regenerative outcomes is through a multi-season, multi-crop system approach

## Innovation at Bayer: driving sustainable growth in agriculture through investments in Adjacent Spaces

As a leader in the agriculture sector, particularly in the crop protection and seeds & traits markets, **innovation is essential to maintaining our competitive edge**. In 2023, the global agricultural market was valued at over 100 billion euros. Throughout the year, the Crop Science division of Bayer delivered robust growth from our core business, outpacing both our peers and the broader market. **We are dedicated to continuing this trajectory, leveraging our pipeline of sustainable products as a competitive advantage to scale regenerative agriculture.**

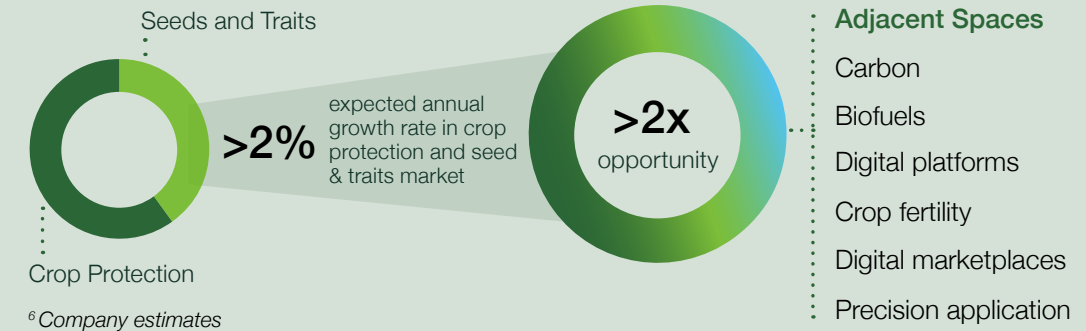
In the near term, **we anticipate the traditional crop input market to grow by over 2%** to meet increasing demand. Furthermore, we believe **our investments in innovation within adjacent spaces could potentially double our accessible market, reaching over 200 billion euros by 2030**. These adjacent spaces offer new value pools driven by advancements in digital technology, agricultural transformation, and scientific breakthroughs. **This 200 billion euros market will allow us to grow our core portfolio faster and generate value in adjacent spaces from the outcomes of a systems driven approach.**

>100B<sup>6</sup> EUR

2023 Global Ag Input Market

>200B<sup>6</sup> EUR

2030 Global Ag Input Market & Related Adjacencies



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We foresee the opportunity for our accessible market to more than double by 2030, increasing from over 100B EUR today to over 200B EUR

## Main advancements in adjacent spaces – a year of growth

Facing intensifying environmental challenges and a growing population, **Bayer is working towards developing sustainability initiatives and capitalizing on new market opportunities.** Progress has been made over the past 12 months in diverse areas, including carbon sequestration and biofuel development, innovative plant protection methods and water-efficient farming practices.

### Global Ecosystem Services

In the last year, **Bayer has expanded its Global Ecosystem Services in 6 countries.** The positive results coming from pilot projects and initiatives have proven attractive to downstream players in the value chain, showing a strong interest in forming partnerships and focusing on the programs' goals.

**Cutting-edge tools and farming practices are helping farmers significantly reduce the amount of greenhouse gas emissions in their operations, while also removing carbon from the atmosphere.**

- **ProCarbono in Brazil – confirming the benefits of regenerative agriculture:** over the past two years, ProCarbono has undergone extensive testing, confirming key assumptions about the benefits of regenerative agriculture. **The program has demonstrated that productivity and sustainability are not only compatible but also mutually reinforcing.**

Farms implementing regenerative agricultural practices have achieved a 10% increase in yield and a boost in carbon sequestration compared to farms using non-regenerative methods. These results underscore the significant potential of regenerative agriculture to enhance both productivity and environmental health, simultaneously driving additional value and revenue for farmers.



[Learn more about our Global Ecosystem Services in the GHG chapter of this report](#)



## Biofuels: decarbonizing the transportation sector

As farmers adopt regenerative systems, we also aspire to unlock new value in the biofuel market and secure a leading oilseed feedstock position as the decarbonization of the transportation sector drives new opportunities in renewable fuels. We see significant potential for intermediate oilseed crops to meet the growing demand for lower-carbon-intensity feedstocks.


One example is **CoverCress™**, a **climate-smart seed technology that acts as a low-input winter oilseed cash crop**. It has the potential to not only help store carbon in the soil but also improve soil health by increasing organic matter content and contributing to healthy field microbiomes. Furthermore, **we believe it can provide a low-carbon renewable fuel solution to the energy industry, presenting a significant opportunity for both Bayer and farmers globally to capture additional value.**

 [Learn more about our partnership with CoverCress Inc.](#)

## Improving water use and enabling smallholder farmers

Rice is a critical staple food globally, serving as the primary source of daily nutrition for half of the world's population. However, **rice cultivation accounts for up to 43% of the total water used for global crop irrigation.**

Bayer is addressing this issue with an approach called **Direct-Seeded Rice (DSR)**. This method enables farmers to plant seeds directly into the soil, eliminating the need for traditional flooded paddies. As a result, **this can reduce water usage by up to 40% and decrease GHG emissions by up to 45%.**

 [Learn more about DSR in the water chapter of this report](#)

## Reducing the environmental impact of Crop Protection

**Crop protection is essential for sustainably feeding the Earth's growing population.** According to the Food and Agriculture Organization (FAO), pests and diseases cause the loss of 20-40% of global crop production annually.<sup>7</sup>

**Farmers consistently face challenges in protecting their crops from persistent threats such as insects, diseases, and weeds,** and our ambition for crop protection chemistry is to pioneer new ways to safeguard crops, support food security, and protect the environment, setting a new industry benchmark.

- Through our **CropKey approach**, we leverage the latest scientific advancements and data-driven technologies to design innovative crop protection solutions that achieve unprecedented levels of precision, safety, sustainability, and efficacy. This approach allows us to **integrate safety and sustainability criteria from the outset, continuously reducing the environmental impact of our crop protection portfolio.**
- An example of our advancements in the development of biological crop protection solutions is our recent **licensing partnership with U.K. - based AlphaBio Control** to introduce the first-ever biological insecticide designed to help farmers control pests in arable crops.

**Bayer holds a 15% market share in the crop protection market, yet we are accountable for only 2% of the overall environmental impact associated with all crop protection products**

<sup>7</sup> *FAO - Pest and Pesticide Management*

Our innovations and digital solutions are key enablers in realizing our vision of scaling regenerative agriculture.

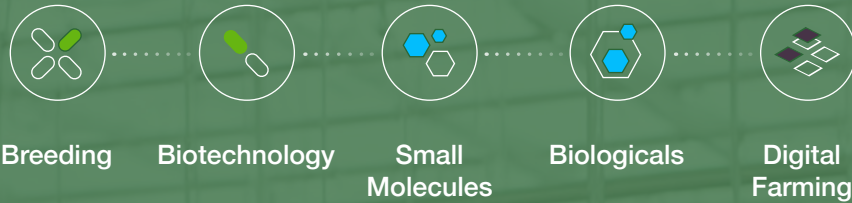
**We anticipate launching ten blockbusters over the next decade, each with a peak sales potential exceeding 500 million euros.**

This unparalleled lineup will help us stand out in both the current market and emerging adjacent spaces.



# Innovation Engines for powering the future

With our global presence, leading market position and comprehensive farming solutions, we're driving towards regenerative agriculture in order to restore nature, increase crop yields and productivity, and enhance the social and economic well-being of farmers and communities. **Our vision of scaling regenerative agriculture is powered by five Innovation Engines:**



## Breeding

For more than 3 decades, we have been committed to modernizing plant breeding processes for row crops and vegetable seeds. Our Precision Breeding approach aims to **create a design-driven methodology for crop improvement, resulting in more resilient crops and sustainable product concepts**. This process generates terabytes of data, which we optimize by using advanced AI tools for decision-making. Our approach utilizes this vast output with two key goals:

- **Designing better germplasm:** Leveraging advanced seed chipping, DNA testing, and sequencing capabilities, we conduct comprehensive analyses of our germplasm and its outputs. This process enables us to accurately predict the future value of seeds for farmers. **We are transitioning from selecting among existing seed options to actively designing the desired seeds.** This progress is driven by our extensive knowledge of plant genetics and environmental data. This integrated approach allows us to tailor the genetic characteristics of seeds to **meet the future needs of farmers**.
- **Accelerating the breeding process:** Traditionally, assessing potential parent plants in the field took 5 to 6 years. Today, we can make predictions using genomic information, reducing this timeframe to just 3 or 4 months. Yield improvements that once took years can now be achieved in a matter of months. In 2025, we will trial the first outputs of precision breeding to **evaluate how well genomic predictions align with empirical field data**.

## Plant Biotechnology

Over the last 28 years, we have launched more than 65 biotechnology traits across at least 140 unique trait combinations in corn, cotton, canola, and soybean breeding programs. Our biotechnology traits contribute to sustainable agriculture by **protecting plants from insects and plant-specific diseases, thereby helping farmers increase their yields and productivity while using natural resources more efficiently**.

The **Preceon™ Smart Corn System** represents a fundamentally **innovative approach to corn cultivation**. With its improved standability in high winds and challenging weather conditions due to its shorter height, farmers benefit from better protection of their crops, better access during the season, and higher yields.

**Bayer's corn pipeline** will also focus on delivering the next-generation insect control traits including the fourth and fifth generation of Lepidoptera control as well as the new fourth-generation trait against corn rootworm.

Bayer's leading soybean systems for Latin America and North America are delivering **excellent productivity and quality combined with various pest control traits and herbicide tolerance options**. With these systems, farmers are not only able to reduce insecticide application, but also perform no-till farming at a large scale, which is beneficial for soil health, helps sequester carbon and prevents soil erosion.

### Benefits of Preceon Smart Corn System



#### Protection

Improved standability in high winds and challenging weather conditions



#### Access

Extended in-season crop access with standard ground equipment



#### Yield potential

Optimizing crop inputs, planting densities and field placement



#### Silage

Value expected to be seen from improved silage quality & increased tonnage



#### Sustainability

Potential for reduced GHG emissions & opportunities for carbon sequestration



### Small molecules

To address climate change and sustainability, we focus on **better environmental profiles in our crop protection products**. Our scientists are pioneering the future of sustainable protection through an approach we call **CropKey**, which aims to **bring new types of Crop Protection products to farmers**. Using data-driven technologies, we narrow down those molecules with promise of efficacy and eliminate those that do not reach our high safety and sustainability standards far faster than in the past.

We are advancing beyond traditional methods. **The shift from a selection-based approach to a design-based approach underpins many of our capabilities at CropKey**. This means we start by understanding the biology of the pest we aim to control and work backwards to develop chemical solutions that effectively address the problem.

Over **30 potential new targets are currently under investigation**, including a unique broad-spectrum fungicide for fruit and vegetables and a new herbicide molecule for broad-acre post-emergent weed control, all expected to reach the market in the next decade.

We have partnered with the agricultural biotech company **Oerth Bio™** to develop crop protection solutions designed to target and dismantle pest mechanisms by inducing the degradation of specific pest proteins. OerthBio™ is a joint venture founded by Bayer's impact investment arm, Leaps by Bayer, and Arvina, a renowned healthcare company with expertise in targeted protein degradation for human therapeutics. Initially developed to fight human diseases like cancer and other difficult-to-treat diseases, Oerth's patented **PROTAC® (PROteolysis TArgeting Chimera)** protein degradation technology provides an innovative pathway to entirely novel crop protection and climate-resilient farm solutions.

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**> 80% of growers in 2023 Groundbreaker trials in U.S. and Europe would plant Preceon™ Smart Corn again**



## Biologicals

The biologicals industry is rapidly expanding in several areas, including nature-derived biocontrol and biostimulant solutions such as pheromones, botanicals, plant extracts, and synthetic biology applications. **Bayer is at the forefront of shaping and growing this segment, positioning itself as the preferred R&D and commercial partner.** By leveraging our trusted brand, regulatory expertise, and global capabilities, Bayer can efficiently bring new products to the market. Integrating biologicals into holistic tool sets represent a shift towards more sustainable agriculture, addressing both environmental concerns and the need for effective pest and disease management.

We employ three distinct approaches to efficiently bring new products to the market:

- **Licensing products from external sources:** we offer farmers new biological solutions, such as **MustGrow**, by utilizing Bayer's capabilities to effectively deliver in-licensed products.



- **Development of internal assets:** in Europe, where birds often consume corn seeds, Bayer has created a bird repellent for corn seeds using Black Pepper Oleoresin (BPO). This technology makes the seeds unpalatable to birds, effectively protecting the crops.



- **Multi-year strategic research partnerships:** we are working with **Kimitec**, a Spanish company specializing in identifying plant extracts with potential biological properties. Together, we work on developing new fungicides or herbicides from these extracts.

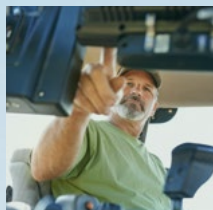


## Digital farming

Digital tools and data have been transforming agriculture for years, enabling growers to make more informed decisions that extend beyond visual observations. Our **Climate FieldView™** platform, along with partnerships with companies like Microsoft, delivers downstream value by equipping farmers with comprehensive data. These technologies empower growers to make data-driven decisions, enhancing farm sustainability and productivity. **By extending digital transformation throughout the value chain, we aim to create new value pools to foster the adoption of regenerative agricultural practices.** As consumers increasingly demand sustainably grown products, digital farming plays a crucial role in meeting these expectations.

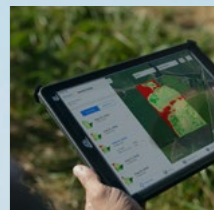
**We are impacting +250M acres in 23 countries through our digital farming solutions and global ecosystem services, powered by an open ecosystem that drives continuous innovation towards more sustainable food systems**

### Data collection



Understand what farmers are doing

### Data analysis



Obtain deeper insights into each acre

### Data-based recommendation



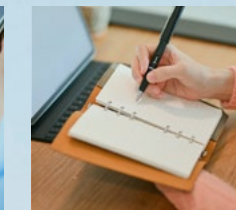
Support farmers in decision-making

### Creation of new value streams



Quantify outcomes & co-benefits

### Validation of Regen Ag outcomes



Certify outcomes & co-benefits





## Our digital farming solutions framework

At Bayer, **our digital solutions are part of holistic systems that meet the needs of growers, the value chain and the entire agri-food business.** A digital farming solutions' framework has been defined, which focuses on three areas:

### 1 Tailored solutions for growers

We are uniquely positioned to meet farmers' specific needs and objectives through our **tailored solutions** and integrated digital tools.

- **Climate FieldView™:** this global platform for digital insights and analysis is widely adopted around the world and top-rated for ease of use and equipment compatibility.<sup>8</sup> As the largest database of grower and field trial seed performance data in the industry, **the platform operates in 23 countries with over 80 partners on the platform<sup>9</sup> and more than 250 million subscribed acres.**



#### Climate FieldView's features:

- In-cab visualization<sup>10</sup>
- Performance visualization
- Performance evaluation
- Field health images
- Prescription delivery

<sup>8</sup> Stratus Market Research, 2023 Dynamics of Data in Agriculture

<sup>9</sup> Signed agreements, various stages of platform integration

<sup>10</sup> Refers to in-cabin monitoring: technology and systems used within the operator's cabin of agricultural machinery (such as tractors, harvesters, and sprayers) to display real-time data, maps, and other relevant information in order to make informed decisions & optimize operations

### 2 Value chain solutions

Our efforts to **create climate-smart business models extend far beyond the farm.** We aim to provide farmers with accessible methods to adopt scalable, cost-effective, and impactful sustainable practices. Our Global Ecosystem Services offer growers tools and resources for adopting sustainable practices while enabling new revenue streams.

Additionally, we have recently launched **ResiYou, a smart residue management platform that predicts the dissipation of phytosanitary active substance residues in fruits and vegetables in real-time.** Utilizing AI-based models that incorporate climate data and crop biomass evolution, ResiYou offers an intuitive web interface where predictions are compared with legal and private requirements. This provides detailed information on the compliance level of each plot, ensuring adherence to regulatory standards.

### 3 Digital platforms

While developing digital counterparts for our physical products is essential, our technology has the potential to significantly impact the food and agriculture sectors beyond the scope of our physical products, fostering a healthy, productive, and increasingly interconnected food system. Bayer has partnered with **Microsoft** to leverage our expertise in data ingestion from diverse sources, transforming it into a usable format for generating actionable insights.

**This collaboration aims to streamline the process for Bayer and other companies to analyze the vast amounts of data being generated.** We believe this partnership will play a crucial role in the industry, simplifying the generation of valuable insights from agricultural data.

## Partnerships are crucial to drive innovation and achieve scalability

**In the future, we expect that both data from the field and carbon stored in the soil will be as important as yield.** Today, our accessible market has an estimated value of more than 100B EUR globally. By 2030, we expect our systems to unlock new opportunities – from regenerative agriculture to digital platforms – with an estimated value of over 200B EUR. We want to co-lead innovation within the agricultural sector, and together with our partners, we're actively building the future we envision, where our technologies are well positioned to contribute to sustainable farming worldwide.

## Access to innovation and path to market

As communities fight poverty, hunger and malnutrition, it's our responsibility to **expand the reach and impact of our 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, technology and information contributions, working to improve the availability of high-performing seeds to farmers.

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

Our extensive global field-testing footprint, broad germplasm library and corresponding genetic characterization information are unmatched in the industry. **As a company that's passionate about the advancement of agricultural science and – most importantly – determined to make a positive impact for farmers as quickly as possible, the opportunity to enable this kind of benefit sharing is motivating for our team.** We are involved in many projects and programs dedicated to the advancement of agriculture around the world.

For example, **Bayer collaborates with The World Vegetable Center**, an international non-profit research and development institute. The institute's mission is to reduce hunger through 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 our **collaboration on addressing the diseases of bitter melon with the Asia and Pacific Seed Association (APSA)** which strives to enable smallholder farmers access to quality seeds. **These collaborations are aimed at boosting smallholder farm operations, while improving access to the resources essential for achieving food security.**

We apply market segmentation to encourage input affordability by adapting package size, pricing, and distribution, augmented by technical advice and training. We conduct local trials to understand the value that our products bring to smallholder farmers, and prices reflect market realities and smallholder farmers' affordability, in line with 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 helps ensure that seeds and traits technology transfer requests from third parties in the Developing World, or those 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 aimed at reviewing requests for the transfer of seeds and traits technologies and the associated intellectual property (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 diverse challenges facing smallholder farmers is the establishment of successful public-private partnerships. **Like other companies in the agricultural industry, we are committed to driving innovation for the benefit of new seed markets and partnering with other organizations to improve product quality.** An example is our **TELA Maize Project in Africa**: by providing research, technical expertise and both drought-tolerant and insect-resistant traits on a royalty-free basis, we aim to enhance food security for farmers and their families.



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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 that enables farmers to have the solutions they need for sustainable agricultural production. Therefore, we advocate for high standards of intellectual property (IP) protection that should be internationally aligned.

As a major contributor to agricultural research and development globally, **we invest significantly, among other things, in plant breeding innovations, including biotechnology, and we are therefore an active participant in discussions and arrangements concerning plant-based IP rights.** We are also mindful of possible concerns patents may create in the seed sector, and we take initiatives aimed at mitigating them.

## Promoting transparency and facilitating access to patented traits in seeds

Bayer actively contributes to the [Euroseeds PINTO database](#),<sup>11</sup> which lists all commercial varieties containing a patented trait, enabling other breeders to make informed decisions when using commercial varieties in their breeding programs.

**Since 2023, Bayer has been a founding member of the [Agricultural Crop Licensing Platform \(ACLP\)](#),** an industry initiative aimed at enabling and expediting access to seed innovation for European-based seed companies. European companies becoming members of the ACLP are able to breed new varieties containing patented traits and commercialize them at a guaranteed, reasonable price. Bayer is exploring with other member companies how to expand the ACLP initiative to more crops.

Bayer also offers [small vegetable breeding companies in the European Union](#)<sup>12</sup> access, free of cost, to our European patents on traits in vegetables, which are in the Euroseeds PINTO database and licensable by Bayer. With this initiative, we intend to **address concerns that small breeding companies especially may have regarding access to patented innovation.** The initiative has now been translated into several EU languages and communicated to many small breeding companies and relevant stakeholders. Bayer openly welcomes other owners of IP rights to provide similar initiatives.

IP 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 IP rights on our [Principles and Positions page](#).



<sup>11</sup> 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

<sup>12</sup> 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)



# Enabling Sustainable Food Systems

As the global population continues to expand and the effects of climate change become increasingly evident, it is essential that we **develop and maintain food systems that are not only capable of meeting the nutritional needs of present and future generations, but also reduce their impact on the environment.** The importance of sustainable food systems lies in their ability to support the availability, accessibility, and affordability of diverse and nutritious food at all times, within planetary boundaries.

**UN Sustainable Development Goals on which we have the greatest impact through our businesses:**



# The state of global food & nutrition security

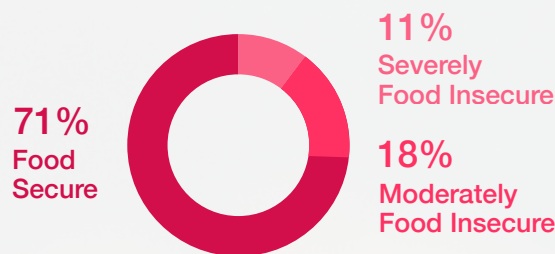
According to the Food and Agriculture Organization (FAO), **food and nutrition security is achieved “when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”**. Yet, in today’s world, **over 700 million people face hunger**, and 2.4 billion people – nearly 30% of the global population and especially those living in rural areas – are moderately or severely food insecure.<sup>1</sup>

The major drivers of food insecurity and malnutrition – such as conflicts, extreme weather, economic slowdowns, and growing inequality – are intensifying. At the same time, urbanization is changing food consumption patterns, with diets increasingly including dairy, fish, meat, vegetables, and fruits instead of traditional grains. Additionally, **we still lose or waste one third of the food produced globally between farm and fork**, and despite scientific progress and available knowledge significant yield gaps persist across and within regions and countries.<sup>1</sup>

In this context, **we need a response that encompasses agrifood systems as a whole** – from food production, processing, and distribution to consumption. This response must address the most-pressing challenges of our food systems, which include **securing food availability, accessibility and affordability**. Yet we also need to drive long-lasting transformation that uplifts the livelihoods of farmers – especially those who are excluded from formal value chains – and regenerates nature.

To ensure all people on this planet today – and 10 billion people by 2050 – have access to affordable and nutritious food, **we need all farms of all sizes to produce more, and in an increasingly regenerative way**.

Out of 8.1 billion people in the world...



Examples of food & nutrition security areas and why they remain a challenge:

## Food availability & accessibility

The availability of vegetables and fruits is insufficient to meet the daily dietary requirements in almost every region of the world

## Food affordability

Almost 3.1 billion people worldwide (42%) could not afford a healthy diet in 2021

<sup>1</sup> *FAO - The State of Food Security and Nutrition in the World 2023*

## Farmers are the backbone of food & nutrition security

Farmers worldwide face the monumental challenge of feeding an ever-growing population under increasingly difficult weather conditions, on less arable land and with fewer resources. This task is especially arduous for the **hundreds of millions of smallholder farmers who produce one-third of the world's food supply, including more than 50% of all food consumed in low- and middle-income countries (LMICs).**

Despite their pivotal role, many of these farmers and particularly those in LMICs, operate in isolation, cut off from the latest technology, knowledge and means that could dramatically increase their crop yields and improve their livelihoods. **The disparities in access to agricultural innovation perpetuate a cycle of unequal opportunities and threaten global food and nutrition security.**

Food production, farm incomes, nature restoration, and climate adaptation must increase to make our food systems more resilient. Without farmers, there is no food sufficiency – at neither local, national, nor global levels.

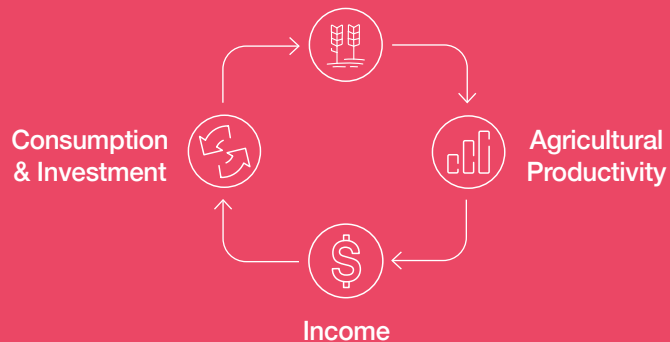


## Our stake in the food system

**Food sufficiency & balanced nutrition is, and should be, of concern for all of us.** As a leader in agriculture, and in line with our mission “Health for all, Hunger for none” we are mobilizing our expertise, portfolio and footprint to address the food and nutrition security crisis. Why are we doing it? Because we believe that access to sufficient and healthy food is a human right, because we believe science and innovation will enable farmers to feed our growing population and because we understand how climate change and food system resilience are interconnected.

To this end, **we work side by side with farmers to help them sustainably grow more abundant, diverse, and nutritious food.** In developed countries, we will continue to foster innovation to meet global food demands, and in LMICs, we will focus on reducing yield gaps. Giving access to innovation and regenerative agricultural practices will be key, contributing not only to sustainability but also thriving ecosystems and communities for generations to come.

### Resource Allocation



### Our impact transcends the value chain



#### Agricultural Productivity

About **one-sixth** of all fruits and vegetables in India are treated with Bayer CPPs



#### Livestock, Processing and Trade

Bayer contributes to **26%** and **19%** of global corn and soy intended for animal feed



#### Market Access, Retail and Consumption

Bayer contributes to **12%** of available corn intended for human consumption in Africa



# Living up to our role and responsibility as an impact generator

As a market leader in health and agriculture, **we are committed to leading the way.**

**We believe that good nutrition stems from a diverse and balanced diet.** Our business supports the production of a wide range of food crops, from staple grains like corn, rice and wheat to fruits, vegetables, pulses, and nuts. We also support the production of grain products for feeding livestock which provide quality proteins like meat, milk and eggs. **Our portfolio of innovative products and solutions, including seeds, crop protection products and digital tools, empowers farmers to produce abundant, high quality, nutritious foods for people and animals.**

We also know that **nutrient-adequate diets are two to three times more expensive than calorie-sufficient diets.** As we all strive towards affordable and available healthy food for all, it is crucial to guarantee a safety net of supplementation. We are leveraging R&D across the nutrition spectrum, from food to supplementation, to ensure everyone has access to the essential nutrients they need to preserve their health and thrive.

In our day to day, we focus on what we do best:

## 1 Beyond growing more

We help farmers **produce more in a sustainable and increasingly regenerative way** that protects natural resources and reduces agriculture's environmental impact. From promoting the adoption of cutting-edge solutions in developed countries, to building capacity and enabling market infrastructure, to reducing yield gaps in developing countries.

## 2 Food system resilience

We develop solutions to **make food systems more resilient to climate and support agriculture's transformation towards a sustainable future.**

## 3 Human health & nutrition

We support millions of people around the world through a **more abundant, diverse, nutritious, and sustainable food supply** as well as supplements for essential vitamins and minerals. We offer high-quality seeds for more than 20 fruit and vegetable crops.

**We support the production of grain products for feeding livestock which provide quality proteins like eggs, milk and meat**



Bayer contributes to feeding poultry accountable for **17% of the world's egg production**



Bayer contributes to feeding animals accountable for **23% of the world's milk production**



Bayer contributes to satisfying the meat consumption needs of **2 billion people**







## 1 Beyond growing more

Although advances in plant science and chemistry have enabled a decoupling between land use and agricultural productivity, **farmers still experience inequalities in terms of access to innovation, knowledge, tools, and solutions.** These differences explain why today we still observe significant differences in productivity levels for many crops across and within geographies. For example, Africa is the only continent where the population growth has been higher than the agricultural productivity increase.<sup>2</sup> Our approach reflects the need to best serve farmers in their environment. **We differentiate between developed countries, where we focus on sustainably increasing productivity, and low-and-middle-income countries (LMICs), where we help reduce the yield gap in a sustainable way to unlock the full potential of farmers:**

**In developed countries,** we offer **system-based solutions that include high-quality seeds, biological and chemical crop protection as well as digital tools and technologies** for grains, oilseeds, and fruits and vegetables.

- We offer system-based solutions like the **Preceon™ Smart Corn System** with a shorter stature hybrid corn designed to maintain yield stability in the face of adverse weather events. Alongside the short stature corn hybrids, our **FieldView™ platform** delivers data-driven recommendations to optimize production. The corn produced with this system helps secure animal feed globally, and, consequently, the availability of protein sources such as meat, milk and eggs.

<sup>2</sup> *FAO - Food and Agriculture Organization*

**In low- and middle-income countries,** the challenges are often related to lack of knowledge, and access to modern and innovative inputs, tools, technologies, and financing options. **We pursue localized approaches developed with stakeholders along the local value chain to holistically support farmers.**

- Today, together with our partners, **we support 53 million smallholder farmers with our products and services.** Our Smallholder Knowledge Transfer Program is a capacity-building initiative for fruits and vegetable growers in India, China, Kenya, The Philippines, Central America with an impressive reach of almost 10.5 million farmers to date. By helping farmers optimize their yields, we are helping them provide nutrient-rich foods to their communities and increase awareness about the importance of food and nutrition for human health and productivity.



We enable farmers who grow more than 1/4 of all corn globally



Indian farmers protect 16.8 billion tomatoes with our crop protection solutions. If brought together in one place, they would fill 110,000 semi-trucks

## 2 Food system resilience

A changing climate has likely already **reduced global agricultural productivity growth<sup>3</sup> by about 21% since 1961**, which equals losing seven years of productivity growth. The effect is substantially more severe - up to 34% - in warmer regions such as Africa and Latin America and the Caribbean.<sup>4</sup>

In response to changing weather patterns and more extreme weather events, our scientists are delivering **seed varieties with improved genetics like drought or heat tolerance, crop protection and biological crop nutrition solutions that will make food production more resilient to changing weather patterns**. We are also supporting farmers as pest infestations shift to new geographic regions due to changing weather and the emergence of novel pests and diseases. A good example is TR4, which is threatening the entire global production of bananas, an important staple crop.

**To strengthen local food production in Sub-Saharan Africa, we are building a new site in Zambia that will deliver high-quality corn seeds to farmers in several countries in the region.**

While our primary aims are to enhance crop efficiency, yields and resilience, **we also innovate in the quality of harvests, including factors such as taste, transportability and shelf life**. All of these contribute in a very direct way to a more abundant, diverse, and nutritious food supply.

We also enable and advocate for regenerative practices that help restore natural resources and advance agriculture's transition towards a sustainable future.

<sup>3</sup> Total Factor Productivity, TFP

<sup>4</sup> *Nature Climate Change - Anthropogenic climate change has slowed global agricultural productivity growth*



In a global “Farmer Voice” survey conducted on behalf of Bayer in 2023, 71% of the farmers said that climate change already has a large impact on their farm

### Did you know?

Up to 400 million people worldwide depend on bananas for their food security

### 3 Human health & nutrition

We aspire to a future in which the macro and micronutrient needs of individuals of all ages across the globe are fulfilled. To this end, we leverage our expertise, portfolio, footprint and networks across both food and essential supplementation.

On the one hand, **our business supports the production of a wide variety of nutrient-dense crops** such as spinach, cauliflower, tomato and broccoli and other fruits, vegetables, pulses and nuts. On the other hand, **our portfolio includes science-based, high-quality supplements for essential vitamins and minerals** to bring the necessary micronutrients within physical and financial reach of millions of people who are not able to achieve a nutritious diet through food alone.

Our **Nutrient Gap Initiative** aims to impact 50 million people in underserved communities annually by 2030 by expanding access to essential vitamins and minerals, including diverse nutritious food (such as vegetables, fruits, grains) and a safety net of nutritional supplements.



“We offer high-quality seeds of more than 20 fruit and vegetable crops”



“We support smallholder farmers through 500 Better Life Farming Centers to grow fruits, vegetables and nuts”

# The Nutrient Gap Initiative: reversing the cycle of malnutrition

Guided by our mission of “Health for all, Hunger for none”, we launched **The Nutrient Gap Initiative in 2021** with the goal to impact 50 million people in underserved communities annually by 2030.

**Our efforts are focused on expanding people’s access to essential vitamins and minerals through nutritious and affordable food and safety-net supplementation.** This includes access to diverse, nutritious food (such as vegetables, fruits, and grains) and nutritional supplements through direct interventions and partnerships. **This is a key step in improving access to nutrition and ensuring food and nutrition security and health equity.**

## Hidden hunger

Often called “hidden hunger”, vitamin and mineral deficiencies are highly prevalent in underserved communities, with women and children being most vulnerable. **This type of malnutrition develops gradually over time, with the impact not seen until irreversible damage** – such as birth defects or a weakened immune system – is inflicted, often exacerbating the cycle of poverty.

As a global leader in both agriculture and nutritional supplements, **Bayer is uniquely positioned to help vulnerable groups get access to proper nutrition.** Through the Nutrient Gap Initiative, we aim to address global food and nutrition security by ensuring access to sufficient, nutritious food, including essential vitamins and minerals, to combat hunger and malnutrition. The silent assumption of our food systems is that farmers are healthy enough to be able to grow the food to feed their communities.

Yet many rural communities live in both health and food deserts. Bayer is bringing access to nutritious food, essential supplementation, everyday health and family planning to rural communities. Building on the existing strong infrastructure of the Better Life Farming centers, **smallholder farmers and their families are a key audience for the Nutrient Gap Initiative.** Bayer pilots the expansion of services offered at these centers, providing access to nutritional solutions and education, given that food security cannot be achieved without health equity. Projects have already been initiated in Indonesia, India, Mexico, and Kenya. Through 2030, Bayer Indonesia’s goal is to improve the welfare and health of 4 million smallholder farmers, 1 million economically-vulnerable people, and 1 million women in urban and rural areas.



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**1 in 3 people in our world suffer from diets lacking the essential vitamins and minerals needed to grow properly, live healthy lives and raise a healthy family<sup>5</sup>**

<sup>5</sup> UN - One in three people suffers malnutrition at global cost of \$3.5 trillion a year



## Initiative focus areas

### 1 Intervention

We support the production of nutritious food, such as fresh produce and grains, and put supplementation (e.g., essential vitamins and minerals from the [WHO Essential Medicines List](#)) within physical and financial reach of underserved communities.

### 2 Education

Through both direct education and work with healthcare providers and farmers, we support vulnerable populations with information on self-care, family planning, nutrition, the importance of vitamins and minerals and how to integrate them into diets.

### 3 Advocacy

We join forces with partners who can initiate large-scale impact, such as governments and policymakers, to advocate for access to affordable and nutritious food, health literacy and essential supplementation.

Bayer signed a [collaboration agreement with HarvestPlus Solutions](#) to deliver innovations prompting agriculture sustainability and ensuring food and nutritional security, especially to the most vulnerable populations. The collaboration aims at scaling impactful agricultural innovations to address nutritional challenges in Africa and Asia communities. **This global collaboration will seek to accomplish three distinct goals: advance dietary diversity and nutrition** by increasing availability of vitamin C-rich vegetables among participating farming families; **contribute to improving nutrition and overall well-being of school children** and **provide training to women farmers on Nutrition Smart Agriculture and sustainable agricultural practices**, ultimately improving nutrition outcomes, and fostering community resilience and long-term health benefits.

In 2023, the Nutrient Gap Initiative impacted more than 30 million people in underserved communities

4M

women and their babies with essential prenats (Multiple Micronutrient Supplementation)

10M

people with affordable supplementation

16M

smallholder farmers with sustainable solutions to grow fruits & vegetables

We donated

~2K

kilograms of seeds across 10 vegetable crops

With reach52, we trained community health workers to engage

150K

community members, driving

46%

to visit a health center for care



Learn more about the [Nutrient Gap Initiative](#) and our [partnership on our website](#) or in our [Sustainability Report](#)

## Our approach to combat hunger

As a leader in agriculture, **we feel a great responsibility that we want to live up to.** The private sector, the market economy, not least our leading investments in research and development play a crucial role in combating hunger.

**As part of our efforts in making food systems more sustainable, we have been strategically collaborating with multi-stakeholder platforms.**

By fostering collaboration with diverse partners, we aim to enhance food and nutrition security, reduce food loss and waste, enabling regenerative agriculture. A key example of this engagement is our active participation in the World Business Council for Sustainable Development (WBCSD) since its foundation. Through partnerships with farmers, governments, civil society, and other stakeholders, **Bayer is dedicated to creating resilient and innovative food supply chains.** Our approach to these collaborations underscores our mission to provide safe, nutritious, and sustainable food for all, while ensuring a just transition that safeguards the economic, social, and environmental foundation of all communities.

## The Zero Hunger Private Sector Pledge

**The Zero Hunger Pledge is a demonstration of our approach to help combat 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 multi-stakeholder coalitions from the UN Food Systems Summit process. We committed to contribute \$160 million USD to achieve Zero Hunger in LMICs 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.

## Achievements and advancements in 2023

### 1 Vegetable seeds

We invested **15M EUR** to develop seeds varieties across 30 different vegetables crops to **help smallholder farmers grow quality and nutritious fruits and vegetables in Africa and Asia.** We are also actively advancing our efforts to increase the access of innovative seeds by donating high-quality seeds around the world. In 2023, our impact reached over 150,000 people in Brazil, India, Kenya, and Ukraine.

In Ukraine, **Bayer provided support to thousands of households ahead of the sowing season, particularly during wartime.** This initiative was made possible through the well-organized, and dedicated partnership with local organizations and USAID.<sup>6</sup> In 2024, we are scaling our collaboration with USAID to Africa.

<sup>6</sup>USAID: United States Agency for International Development



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**In Africa and Asia, we've invested 15M EUR to develop Vegetable Seed varieties that help smallholder farmers grow high-quality and nutritious fruits and vegetables**

## 2 Modern Breeding Project

Through the **Modern Breeding Project**, we supported the development of climate resilient cultivars for some of Africa's most important traditional and underutilized crops alongside our partners at the **International Institute of Tropical Agriculture (IITA)**. Experts from Bayer's Global Breeding organization contributed technical expertise in plant breeding to help IITA accelerate delivering improved genetics in seed systems across six crops (maize, soybean, cowpea, cassava, yam, banana & plantain). IITA manages 31 product pipelines focused on research for development, with national programs in 11 African countries. By supporting IITA's breeding ambitions towards more modern methods, smallholder farmers will have access to better crop varieties developed and tested in local conditions, supporting food security needs and resiliency for Sub-Saharan Africa and beyond. In 2022, the project received a high commendation for the "Best Public Outreach Program" by S&P Global Commodity Insights. IITA and Bayer continue to work together towards the next phase of the project.

## 3 Arize hybrid rice seeds program

Through our **Arize hybrid rice seeds program**, we are empowering smallholder rice farmers to have better and stable yields from their small farms. This enables them to not only feed their family but also improve their livelihood. **The hybrid seeds are also enabling us to demonstrate and scale up rice crop system transformation through Direct Seeded Rice.** In 2024, Bayer DirectAcres program for direct seeded rice enablement is expected to cover more than 35,000 acres in India. We are focusing on capacity build up through farmer trainings, field demonstrations and handholding on agronomic intervention along with the Indian Council of Agriculture Research, the Government of India network of research stations as well as enabling massive outreach through digital interventions (Chatbot - Ask Deena). DirectAcres offers a comprehensive system of technological and agronomic advisory as well as inputs to make the direct seeded rice transformation successful in the first attempt for the farmers.



**947K** farmers trained on BayG.A.P. Sustainable Farming Standards

**5** new rice hybrids developed

**50K** households supplied with seed donations

**11** African countries supported in breeding technology

**>2.7K** Better Life Farming Centers across 3 continents



[Read more about the Zero Hunger Pledge](#)

In 2024, rice smallholder farmers across India and the Philippines will gain access to **five new hybrid seed varieties across different duration and grain type segments.**

## 4 Better Life Farming

In 2023, we increased the number of **Better Life Farming** centers in India, Indonesia, Bangladesh, and Honduras to more than 2,700 and launched in Tanzania and Côte d'Ivoire. We are planning to further grow in these regions.

## 5 BayG.A.P. Program

Through the **BayG.A.P. Program**, we trained small and medium-scale farmers in 21 countries to implement sustainable farming standards and principles of good agricultural practices. We also added two new digital solutions that are being piloted in Ecuador, Peru and India, with the aim of improving market access for farmers with local supermarkets and giving them the recognition via a consumer label reaching more than 300 farmers. Additionally, **we have expanded our training portfolio with a new training** on Food Loss and Waste and expanded the training content to 14 languages, ensuring a broader access to knowledge for farmers worldwide.

# Addressing food loss and waste

A key metric for holding true to our Zero Hunger Pledge and the **Bayer group mission of “Health for all, Hunger for none” is to support 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 portfolio and solutions, Bayer is uniquely positioned to drive value chain collaboration and education in reducing FLW. Complementing our corporate values and enabling the world to achieve its shared sustainability goals, makes it a key strategic priority for Bayer and our stakeholders.

Creating awareness is the first crucial step to reduce food loss and waste along the value chain. **We have therefore expanded our BAYG.A.P. training portfolio with a new FLW training to support farmers around the world** in preventing losses at the farm and beyond the farm to improve the availability and affordability of healthy and nutritious food.

**By strategically building our portfolio of solutions to help farmers on and beyond the farm, we align our business growth with the principles of 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 farm to fork.



Learn more about the sustainability benefits of our vegetable seeds varieties in our [SHF chapter](#) and the [Annex](#) of this report

## Enabling reduction of FLW by:

- Co-creating with stakeholders along the value chain
- Promoting sustainable agriculture<sup>7</sup>
- Training farmers

<sup>7</sup>For our definition of sustainable agriculture, please see [the Annex](#)

**28%** of global agricultural land is used to produce food that is either lost or wasted

This is equivalent to the land area of China and corresponds to **8-10% of total anthropogenic greenhouse gas emissions<sup>8</sup>** (which equals more than 90% of global road transport emissions).

<sup>8</sup>[United Nations](#)

## Our impact



### To and on the farm

- Genetics
- Climate adaptation
- Pest & Disease management
- Harvesting
- Farm management



### Beyond the farm

- Transport & storage
- Processing & packaging
- Retail
- Consumer

## Integrating FLW within our workforce nutrition

As part of a holistic approach to promoting health and well-being, **our internal company platform “MyHealth” regularly provides information and explanations about health and nutrition and advises all employees** on specific health checks relating to nutritional aspects. Regarding nutrition, **the platform educates on responsible food handling**, with specific tips and recipes that encourage the use of regional products to be used in ways that limit food waste.

Our **Global Facility Management Service Specification for Catering** sets out general requirements and specific service standards for food and canteen services operated by external service providers, where employee nutrition and FLW are considered. **The knowledge and data available from the external service providers or subject-matter-experts can be used to measure effectiveness and progress** with regard to nutrition and FLW accordingly.

Our Bayer Gastronomie, serving our canteens in Germany (7 different locations), is implementing different actions, e.g. AI supported menu planning, food saver buffet<sup>9</sup>, cooperation with [TooGoodToGo](#) etc. to reduce food waste in the Bayer Canteens. And **with the help of the organization delicious data we can visualize our food waste per person in our canteens (<50g/person/day in our canteens).** In addition, we save food from overproduction in the value chain with the support of [SPRK Global](#). To date our Bayer Gastronomie organization is applying for the certification of, [United Against Waste](#) and we are very confident to receive this certification in the course of this year.

<sup>9</sup>Too little left over for a menu is too good for the garbage can. The individual components are offered at a fixed price at the Food saver Buffet





# Sustainability starts with Product Supply

At Product Supply, we have instilled the **goal of exceeding expectations across every interaction, product and service we deliver** – even when facing great challenges such as global supply chain disruptions. Our tailored solutions are essential to sustainably managing resources and improving productivity for our customers, while also driving sustainability within our own operations. We are also constantly working to increase efficiency for suppliers and growers, reducing our Green House Gas emissions (GHG) and improving water use and quality across the entire value chain.

Our work at Product Supply contributes to the following UN Sustainable Development Goals:



## 1 Sustainability Challenges

Supply chains in the agricultural inputs segment face significant sustainability challenges, including **escalating energy costs, disruptions in the flow of raw materials, and minimizing environmental impact while meeting customer demands.**

To tackle these issues, companies are transitioning towards sustainable raw material sourcing, clean energy, waste and pollution reduction, and the conservation of natural resources. **By adopting a multifaceted approach, companies can overcome these challenges.**

## 2 Our Approach

At Product Supply, our goal is **to build a world-class, end-to-end supply chain that is efficient and sustainable.** By investing in efficiency measures and renewable energies contributing to our global climate and water targets, we are reducing our greenhouse gas emissions and addressing water risks. Additionally, we drive a positive impact in the communities surrounding our production and breeding sites worldwide through our **Product Supply Community Outreach** program.

We also have an impact on society and the environment through our procurement activities and supplier relationships. We have high expectations for our suppliers to practice sustainability principles, and we support them in doing so. In order to improve sustainability within our supply chain, we apply not just economic standards, but also **Environmental, Social, and Governance (ESG) standards** when selecting new suppliers or continuing relationships with existing ones.

## 3 Progress

Between 2019 and 2023, we reduced our Crop Science division operations' CO2e emissions by **0.61 million tons (scope 1&2)**. Moreover, we have been making great efforts to reduce our upstream and distribution greenhouse gas emissions (scope 3) across the regions where we operate. With our new [water strategy](#), we strengthen our targets and develop our operations towards reducing our environmental footprint.

More than

**2,000** actions and initiatives of our Product Supply Community Outreach program

**1,118** Bayer suppliers evaluated on their sustainability performance in 2023 by our service provider EcoVadis

Recognized as leader on climate protection by **CDP**

*CDP: Carbon Disclosure Project*

## 4 Case Studies

GHG-related

[Waste Heat Recovery](#)

[Steam Use Optimization](#)

[Process Optimization](#)

[Cargo Transportation Initiatives](#)

Water-related

[Water Resources Management](#)



# Navigating global challenges

## The importance of sustainable and resilient supply chains

The growing world population and the increasing burden on natural ecosystems are among the biggest challenges humanity is facing. This situation is further complicated by the effects of the COVID-19 pandemic, the war in Ukraine, and the conflict in Israel and Gaza, leading to logistical constraints and inflationary pressure. Furthermore, both **challenges have clearly shown the importance of protecting health and ensuring food security worldwide** – and how these goals are in jeopardy.

Product Supply teams work across Seeds and Crop Protection functions and **leverage Digital Solutions to offer innovative and effective services** to our customers worldwide, while navigating and performing through global challenges such as supply chain disruptions and high energy and market prices. We believe in delivering the right product, in the right place, at the right time. And simultaneously, we reduce the ecological footprint of our own sites by investing in efficiency measures and renewable energies.



## Our mission at Product Supply: shaping agricultural supply together

The need to produce enough for a growing world



while protecting natural resources

## Our Product Supply network consists of:

**+140** production facilities with more than

**15K** employees & **+60K** growers

**~2,000** crop protection formulations

**+2,000** vegetable seeds varieties &

**~100K** row crops SKU<sup>1</sup>

In 2023, Crop Science, a division of Bayer AG, achieved a reduction of

**0.61** million metric tons of GHG emissions (Scope 1 & 2) relative to 2019

<sup>1</sup> Stock Keeping Unit is a unique product identifier to track and manage inventory efficiency

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**The growing world population and the increasing burden on natural ecosystems are among the biggest challenges humanity is facing**

# Driving sustainable transformation

## Advancing towards our climate targets and responsible practices for a sustainable future

We support the Paris Agreement and the objective of limiting global warming to 1.5 °C relative to the preindustrial level. Therefore, **within the strategic core element of “Reduction of our ecological footprint”, we have set decarbonization targets.** The Science-Based Targets initiative (SBTi) is a collaboration between different international organizations targeting the translation of global warming limits to emission reduction goals. SBTi has validated our targets and confirmed our contribution to fulfilling the Paris Agreement:

- Achieving **climate neutrality in all our own sites (Scope 1 & 2) by 2030:**<sup>2</sup> our target is to reduce our own greenhouse gas emissions by an absolute 42% compared to the base year 2019 by the end of 2029 (Scope 1 & 2).<sup>3</sup> This is supported by our target to achieve **100% renewable electricity by the end of 2029** and achieve climate neutrality by offsetting our remaining GHG emissions.
- Reducing **greenhouse gas emissions** from relevant Scope 3 categories<sup>4</sup> in our supply chain by an absolute 12.3% (compared to the 2019 base year) by 2029.
- We aim to reach **net zero greenhouse gas emissions incl. our entire value chain**<sup>5</sup> by 2050 or earlier (Scope 1, 2 & 3). Additionally, in 2024 we have handed in a target validation including a long term target to SBTi for achieving Net Zero GHG emissions by 2050 or sooner.

<sup>2</sup> By 2030, the remaining greenhouse gas emissions of our own operations will be fully offset by purchasing certificates from verified climate protection projects, especially in the areas of forest conservation and agriculture

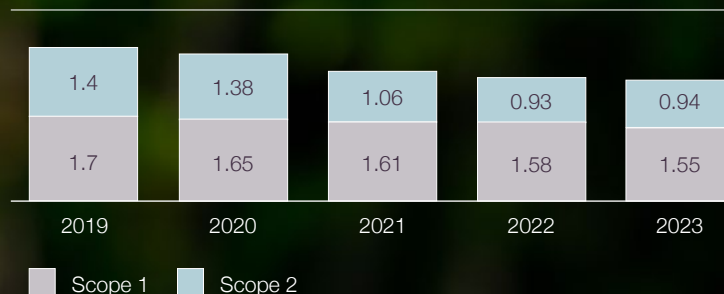
<sup>3</sup> Comprises direct emissions (Scope 1) and indirect emissions (Scope 2, market-based) from Bayer sites whose annual energy consumption exceeds 1.5 terajoules

<sup>4</sup> In accordance with the criteria set out by the Science-Based Targets initiative (SBTi), the following Scope 3 categories of the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting & Reporting Standard are relevant for Bayer: (3.1) purchased goods and services, (3.2) capital goods, (3.3) fuel- and energy-related activities, (3.4) (upstream) transportation and distribution and (3.6) business travel

<sup>5</sup> Entire Scope 1-3 emissions. Scope 3 includes all categories defined in the GHG protocol

## Crop Science division's GHG emissions

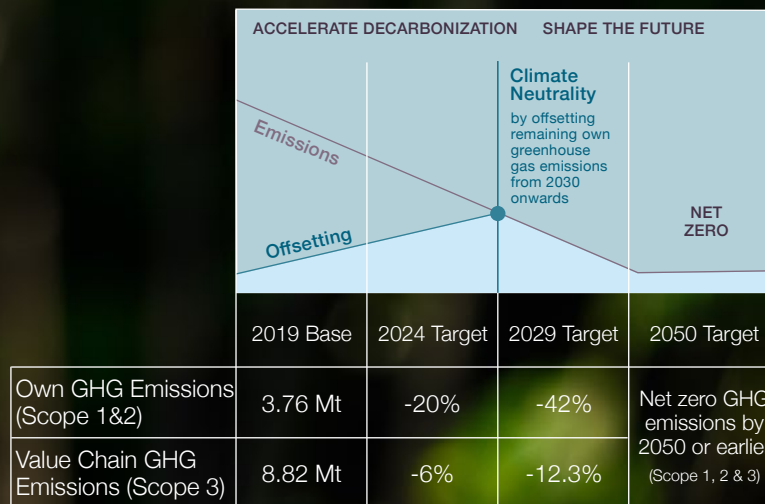
(Million metric tons of CO<sub>2</sub> equivalents)



### GHG

For our value chain-related emissions, or Scope 3 emissions, Product Supply and Procurement work together to engage with our suppliers and growers. We renewed our Supplier Code of Conduct in 2022, which sets forth key social, environmental, and ethical standards that we expect our suppliers and subcontractors to share. We also participate in various initiatives to reduce our Scope 3 emissions including Together for Sustainability (TfS), an initiative of the chemical industry, the Supply Chain Initiatives of CDP and the Pharmaceutical Supply Chain Initiative (PSCI).

## Bayer's Net Zero Pathway



We define Net Zero greenhouse gas emissions as a **90% reduction in our overall greenhouse gas emissions** (Scope 1 and 2) and those in our value chain (Scope 3) **compared with the base year 2019.**



Learn more about our roadmap to Net Zero on our 2023 Sustainability Report



Discover more of our Climate Strategy on our Transition and Transformation Plan



# Our holistic water strategy across the value chain

## Addressing risks and creating opportunities for agriculture

Our mission, “Health for all, Hunger for none”, cannot be fulfilled without water – and as a global leader in health and agriculture, we have an intrinsic motivation to address the water crisis. **Bayer’s primary use of fresh water is in production processes, irrigation, and seed production, and is also required by our suppliers and customers.**

Some of our sites, suppliers and customers are located in water-scarce regions, which poses a greater risk to our business. Clean water is essential; therefore, it is crucial that industrial water usage doesn’t lead to local issues.

At Product Supply, we take responsibility for our water consumption, collaborating upstream with growers across the seed production footprint. We continue to drive improvements in water use efficiency and look to identify improvement opportunities in our own facilities to reduce water risks, especially at relevant sites located in water-scarce areas.

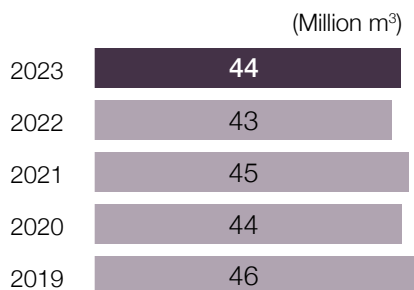
To this end, we have established water management systems at all relevant sites<sup>6</sup> in water-scarce areas or in areas identified as being threatened by water scarcity by the end of 2030.

<sup>6</sup> Sites with annual energy consumption of at least 1.5 terajoules that also account for at least 0.1% of our global water withdrawal & purchased

## Engagement and collaboration with our contracted seed growers

Across the globe, we engage and collaborate with our seed growers to implement new practices such as irrigation methods and irrigation management systems. This is key not only to contribute to the conservation of water resources, but also to improve yield and quality of crops, which translates to higher profits for the grower while sustaining water resources. These activities are especially relevant to smallholder growers in low- and middle-income countries (LMICs).

### In our own operations: Crop Science division’s water use



In 2023, we launched our holistic water strategy, which addresses potential water-related risks and levers our innovation skills to build business opportunities while adding value to the community



# Technology and innovation to reduce our GHG emissions across the supply chain

## Waste heat recovery

Use of “waste” heat led to CO<sub>2</sub> and water savings

### 📍 Muttenz, Switzerland

At Muttenz, in 2022 a project was launched to optimize the distillation process by using steam condensate “waste heat” (at 90°C), a byproduct of another process, instead of factory water (around 15°C). This innovative approach eliminates the typically high energy and water requirements needed to produce steam for the distillation column, which operates at 100°C. Implementing this change **significantly reduces greenhouse gas emissions and water usage**. The annual savings from this initiative are ~450 tons CO<sub>2</sub>e emissions from purchased steam and 35,000 m<sup>3</sup> of water usage. This not only enhances operational efficiency but also aligns with our sustainability goals.

Annual savings of

**~450 tons** CO<sub>2</sub>e

from purchased steam and

**~35,000 m<sup>3</sup>** of water

## Steam use optimization

CO<sub>2</sub> and Water reduction by steam use optimization

### 📍 São José dos Campos, Brasil

At our São José dos Campos site in Brazil, we have processes that involve the use of active ingredients, steam, oxygen, and catalysts. Looking for the optimum point on the use of these materials and utilities, a financial evaluation revealed that reducing steam usage would benefit the overall process result. Steam is generated using natural gas, resulting in GHG emissions. However, the technical team identified some actions, such as reducing the amount of process reactor water, using air instead of steam to clean some equipment, and increasing evaporator cleaning time. **In comparison to 2019, the year 2023 showed a 7% reduction in steam usage.**

Reduction of

**~1,500 tons** CO<sub>2</sub>e

and water savings of

**~12,000 m<sup>3</sup>** in one year

## Process optimization

Improvements in Lubbock and Illiopolis

### United States

Cotton seed goes through a period of dormancy that leads to challenges in determining quality early in the production season when ambient temperatures are lower. To address these challenges, in 2023 the Lubbock Lab adopted a process to retest batches of seed with low quality scores later in the manufacturing season, when the cotton seed has had the ability to break its dormancy period.

**This new testing strategy prevented discarding 50,000 units, reduced incineration costs, enabled additional sales, and facilitated emission reductions across all GHG emission scopes, enhancing sustainability and economic impacts.**

In Illiopolis, in 2023 a change in the treatment process and equipment set up for corn seeds has increased the treatment capacity, allowing the site to operate in a 24/5 shift setting (vs. 24/7). **This reduces energy consumption by two days per week during the treating season.** Other conditioning tower upgrades are expected to yield additional reductions in energy consumption by 2025.

Annual avoidance of

**~2,000 tons** CO<sub>2e</sub>

## Cargo transportation initiatives

Reduction of GHG emissions from cargo transportation

We aim to reduce our Scope 3 GHG emissions by 12.3% by 2029 (relative to 2019). Five GHG categories are relevant to Bayer towards this target, one of them being category 3.4 Upstream Transportation and Distribution. **The Crop Science division has achieved a remarkable 15% reduction of CO<sub>2</sub> emissions in 2023 compared to 2022 in this category.** This success can be attributed to various initiatives, such as the reduction of air shipments, adjustments in master data to optimize shipping locations, enhancement of our Transport Management Solutions for vehicle use optimization, a significant increase in rail usage in Europe, and an eco-route program in Latin America, among many other impactful measures.

**~69,000 tons**

CO<sub>2e</sub> Reduction in

**2023**





## Managing water resources

### Using water efficiently in our agricultural operations

Implementing drip irrigation across our APAC production areas

#### Khon Kaen, Thailand

In Khon Kaen, in 2023 the production has shifted entirely to drip irrigation, replacing furrow irrigation across all sweet corn production areas. This change has **significantly reduced water consumption for irrigation, saving up to 261,000 m<sup>3</sup> across Thailand's total sweet corn production area** compared to furrow irrigation methods. This environmentally conscious approach extends beyond Thailand, as India's vegetable sites have also adopted a similar transformation. Traditionally reliant on furrow irrigation, the shift to drip irrigation has gained traction, initially within hybrid crops and gradually expanding to include open pollination crops. This transition reflects our efforts to **leveraging advanced technology to optimize water usage and enhance sustainability** across diverse agricultural practices.

**100%** drip irrigation in sweet corn production areas in Khon Kean

Irrigation automation in Hawaii

#### Kihei, Hawaii

At our Kihei facility, we have been leveraging advanced technology to improve our irrigation process for several years. Our irrigation automation system offers precise scheduling for tailored watering across different crop areas. Integrated weather monitoring enables us to adjust irrigation schedules based on current and forecasted weather, optimizing water usage. Additionally, our mobile-controlled dripline irrigation system allows remote adjustments, **ensuring crops receive ideal moisture with maximum water efficiency.** This comprehensive approach streamlines our irrigation, promoting sustainable and efficient farming practices.

**100%** of the production area with irrigation automation at Kihei site



## Recycling and reuse of wastewater

### Aurangabad, India

At our Vegetable Seeds ISPP site, in 2023 our efforts have focused on three key initiatives:

1. **Implementation of a pre-wash water recycling unit in our sanitation process**, enabling us to recycle wastewater from our washing procedures.
2. **Construction of a sewage wastewater pipeline** to our **Treatment Plant** for effective recycling of wastewater.
3. **Relocation of part of the washing wastewater** at our Hyderabad facility to the ISPP facility **and treatment** in our in-house Treatment Plant for recycling.

Over the past three years, **our ISPP site has treated and recycled ~2,900 m<sup>3</sup> of water, which has been utilized for gardening and other purposes.** These efforts show our efforts to sustainable water management and preserving this precious resource.

## Sustainable irrigation in our vegetables seed supply

Our Vegetable Seeds Product Supply organization facilitates access to infrastructure, such as irrigation systems, to enable successful crops. By promoting and activating sustainable irrigation practices like switching from gravity to drip irrigation, **we contribute significantly to the technification of local growers in the Bayer supply chain and enable higher yields and the preservation of soil and water resources.**

**~2,900 m<sup>3</sup>**  
of water recycled  
in the last  
**3 years**  
**(2021-2023)**



# Our Product Supply Community Outreach Program by Crop Science, a division of Bayer AG

## Making a positive impact in the communities where our employees live and work

Our **Community Outreach Program** is part of our corporate social responsibility for sustainability and is aimed at **addressing the needs of the communities surrounding our production and breeding sites worldwide**. We want to have a positive impact on the communities where we live and work, and we achieve this through volunteering, social investments, disaster relief and long-lasting partnerships that support education, promote health and nutrition, and enrich community life. **Through the personal interactions of our teams with society and key community members, we raise awareness about our work at Bayer and the value we bring to our local communities, our customers and sustainable agriculture.**

Stakeholders within this program include:

- Local community leaders and organizations
- Education leaders, organizations, and schools
- Our customers
- Food security organizations
- Government leaders and organizations



**Based on impact analyses, material needs at our sites are identified and then suitable measures are defined**

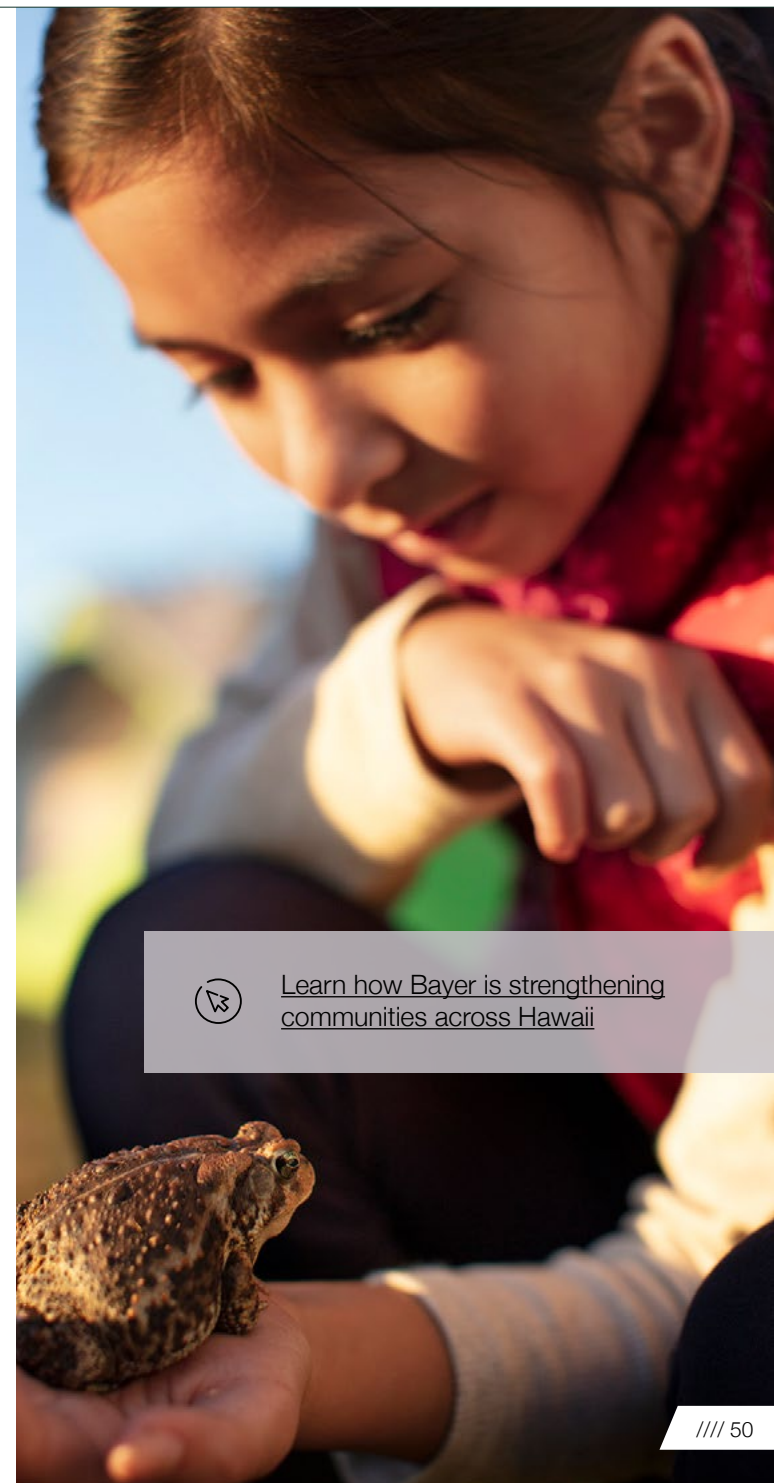
Aligned with our mission “**Health for all, Hunger for none**” and the SDGs on which we have the greatest impact through our business, our community engagement is structured into four pillars of activities that address local community needs:

- **Community Development** such as planting of community gardens, construction of school buildings and libraries, donations and event sponsorship, job trainings for women, and disaster response.
- **Health, Wellness and Safety:** safety trainings (e.g., for third-party workers or on-road) telemedicine, and awareness-raising on topics such as mental health.
- **Food and Nutrition:** food supply donations and working with local food banks.
- **Education:** career fairs, site visits for students, our Baylab education program, and teaching units in the STEM<sup>7</sup> disciplines at schools.

To achieve our objectives, we collaborate with both internal and external partners, also **utilizing company resources like the Bayer Fund or the Bayer Cares Foundation**. Additionally, we leverage our Health, Safety, and Environment (HSE) and sustainability site initiatives – like pollinator gardens or activities, as part of our work [supporting the Wildlife Habitat Council](#) and other country-specific communications efforts.

Our community outreach activities follow our [Code of Conduct](#), which comprise our values regarding innovation, our workplace, our business model and the way we interact with stakeholders.

<sup>7</sup> Science, technology, engineering, and mathematics



[Learn how Bayer is strengthening communities across Hawaii](#)

The target achievement for our implemented Community Outreach measures is closely monitored. In 2023, more than 2,000 actions and initiatives took place at around 130 sites in the world. We strive to create significant impact and difference in the community where we operate by building mutual understanding and trust



## Aprender+ at the Maria Eugenia site

The Aprender+ program was born in 2017 in Maria Eugenia, a seed production site in Latin America, with the aim of **achieving comprehensive training in trades with local demand, in addition to promoting local talent** through the joint work of Bayer, municipal authorities and Fundación Oficio (a local non-profit).

In 2023, we placed a **special focus on gender equality by offering exclusive courses to women**, including Truck Driver and Forklift Driving, with a graduation rate of 82%. We welcomed 50 women to participate in these courses and were honored to have the presence of municipal authorities, our logistics providers and our strategic ally in this initiative, Fundación Oficio.

Through this program, we collaborate from end to end, **eliminating barriers and responding to specific job training needs to be detected in the community**. There are **already more than 700 residents of the community who have been trained**, and today have in their hands the possibility of opening themselves to opportunities for growth and development.



**In 2023, we placed special focus on gender equality by offering exclusive courses to women**

## Fostering biodiversity at our sites: collaboration with the Wildlife Habitat Council

We've been partnering with the [Wildlife Habitat Council \(WHC\)](#) for 30 years, and have more than 40 certified sites in North and South America as well as Europe. In over 90 projects, the engagement of local biodiversity groups varies in scope, from protecting ecosystems and native plant management in Muscatine, Iowa to large scale habitat restoration of the Atlantic Forest in Camacari, Brazil.

In 2023, Monheim, Germany became our first EU site. By fostering biodiversity on our own sites, we complement our external sustainability targets and our activities aiming to create win-win situations for farmers and biodiversity, while benefiting ecosystems and communities. We aim to inspire more sites around the world to establish their own conservation programs and achieve certification.

*“At Bayer, we strive to achieve a balance between scientific progress and the protection of biodiversity. This goal is demonstrated through site conservation programs across the globe becoming certified through the Wildlife Habitat Council. At the Muscatine site, we provide the best technology for farmers while preserving habitat and providing conservation education opportunities for students of all ages”*

– Sarah Marston,

HSE Management Systems Lead,  
Muscatine, IA Site



## 41 Certified Sites

### Certified Gold - 3 sites:

- Chesterfield, Missouri
- Creve Coeur, Missouri
- Muscatine, Iowa



### Certified Silver - 5 sites:

- Centralia, Illinois
- Constantine, Michigan
- Grinnell, Iowa
- Illiopolis, Illinois
- Matthews, Missouri



### 📍 The Muscatine site, Iowa

Our Muscatine, Iowa, U.S. site has been certified by WHC since 2005 and has maintained a **Gold Certification**. During the last recertification, the site was nominated for three awards and won two, “**Formal Learning**” and “**Species of Concern (Yellow Mud Turtle)**.” Approximately 200 acres are set aside for conservation, including a portion of the 510-acre Big Sand Mound Nature Preserve, which is co-owned by Bayer and MidAmerican Energy. Nearly 100 employees contribute to education and management programs on the preserve and the site’s 2-acre butterfly garden and work alongside partners within the conservation community to achieve the greatest possible outcome to protect and preserve the diverse species that call this place home.

# Creating positive change: our Product Supply key role in more sustainable operations and supply chain collaboration







At Product Supply, we can have a positive impact on operations, suppliers, and communities. We continue to deliver quality products and services to meet the needs of our customers while reducing our ecological footprint.

**As an agricultural input provider, we are at the beginning of the production chain, which means we can contribute to shaping agricultural supply.** Therefore, we take responsibility and collaborate with others to continue to drive improvements.

In our own operations, **we work to continue reducing our GHG emissions and develop a baseline to set water targets in the coming years**, and in our upstream we engage and collaborate with our suppliers and growers in different initiatives, including best practice sharing.





## Learn more about our work around the product supply value chain

-  [2023 Sustainability Report](#)
-  [Supplier Code of Conduct](#)
-  [How we protect the climate](#)
-  [Our water strategy and targets](#)
-  [Preserving Biodiversity in the Community](#)
-  [Climate Strategy: Transition and Transformation Plan](#)

Have questions or would like to discuss our work around the product supply value chain? Please reach out!



**Dr. Sigurd Buchholz,**  
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Crop Science, a division of Bayer AG

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-  [sigurd.buchholz@bayer.com](mailto:sigurd.buchholz@bayer.com)



**At Product Supply, we can have a positive impact on operations, suppliers, and communities**



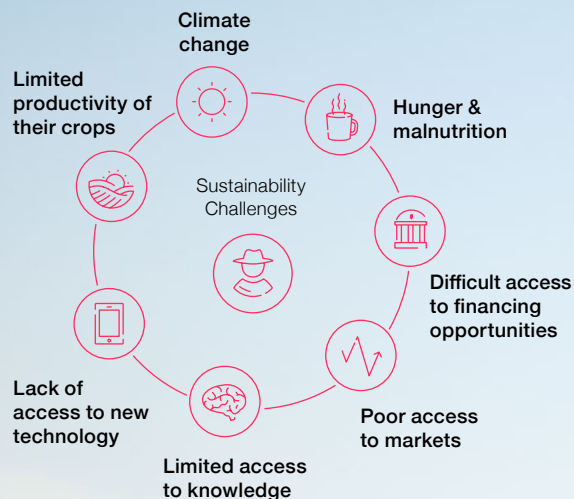
# Small Farms – Large Impact

The estimated **550 million smallholder farmers worldwide already produce more than 50% of the food consumed in low- and middle-income countries (LMICs)**. Our innovations and solutions can help them grow more to reduce the gap towards food security in many rural regions of the world. It is by supporting smallholder farmers that we can contribute to our mission of **“Health for all, Hunger for none”**.

**Our work supporting smallholder farmers contributes to the following UN Sustainable Development Goals:**



# 1 Sustainability Challenges



Smallholder farmers' yields are often lower due to a lack of access to high-quality crops and knowledge of more productive and sustainable cultivation methods. It's also a challenge for them to gain affordable financing or access markets to sell their products at appropriate prices. Furthermore, smallholder farmers are highly exposed to the impacts of climate change and increasingly to harvest losses. Therefore, **it's quite difficult for them to achieve a stable income through farming.**

[Bread for the World - What Are the Challenges of Smallholder Farmers Around the World?](#)

# 2 Our Approach

As a global leader in agriculture, **we will support a total of 100 million smallholder farmers in LMICs by 2030** by improving their access to agricultural products and services, jointly with our partners. **To achieve this ambitious goal, we are extending our range of commercial efforts and strategic initiatives tailored to the needs of smallholder farmers.** Today, roughly 11% of our divisional revenue is the result of our work with smallholder farmers, and we expect our business with them to double by 2030.<sup>1</sup>

<sup>1</sup> Compared to the initial baseline taken in 2019 at ~1.7B EUR

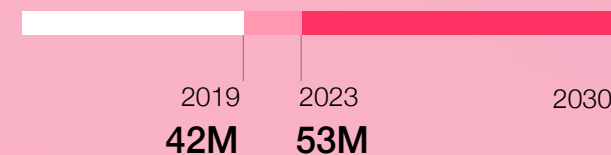
# 3 Main Actions

- // **[TELA Maize Project](#)**  
Breeding local drought- and pest-tolerant maize varieties
- // **[Partnering with the food chain](#)**  
Leveraging technology to safeguard potato harvests
- // **[Better Life Farming](#)**  
Helping smallholder farmers in remote regions access inputs, know-how and opportunities
- // **[Modern Breeding Project](#)**  
Co-developing higher-yield varieties of key smallholder farmer crops in Africa
- // **[DKsilos](#)**  
Collaborating across the supply chain to support small dairy farms in Central America
- // **[Vegetable Seeds](#)**  
Helping smallholder farmers become more resilient to climate change

# 4 Our Overarching Goal

Support

**100M** Smallholder Farmers by 2030



# 5 Progress

In 2023, together with our partners, **we supported 53 million smallholder farmers in LMICs** with our products and services – **four million more than in the previous year.**<sup>2</sup> We achieved this by significantly expanding business activities – particularly in the Asia-Pacific region. We further scaled key partnership models such as Better Life Farming and DKsilos.

<sup>2</sup> Due to the divestment of the Environmental Science Professional business in October 2022, the number of smallholder farmers no longer contains the respective vector control reach from 2023 onwards (2022: three million).

# The significant role of smallholder farmers

## Enormous impact of smallholder farmers on global food supply

Smallholder farmers are those **who farm on less than 10 hectares of land**. As independent farmers, smallholder farmers must each play the roles of manager, laborer and salesman. And **while their plots may be small, their impact on the world's food supply is huge**. They are responsible for feeding more than half of the population of LMICs, all while most of them living on incomes under \$2 USD per day.<sup>3</sup>

**Many smallholder farmers are food insecure themselves, as balanced diets may not be available and affordable**. And yet they are often responsible for the food security of their community. Which means threats like adverse weather, plant diseases and pests endanger not only their own income, health, and livelihoods, but also the food and nutrition security and prosperity of their communities.

By empowering smallholder farmers to build viable and resilient businesses, we can positively impact their communities and livelihoods, thereby contributing to our mission.



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

# 97 percent

of the world's farmers are smallholder farmers

Earn less than

# \$2 USD

 per day

(compared to the international extreme poverty line, defined as \$2.15 USD per day<sup>4</sup>)

<sup>3</sup> *A Year in the Lives of Smallholder Farmers by the World Bank*

<sup>4</sup> *Poverty Line defined by the World Bank*

Responsible for feeding over

# 50 percent

of low- and middle-income populations

They work on

# 10 hectares

of land or less





# Our targets and achievements to support smallholder farmers

## Investing in their future

We aim to provide smallholder farmers with more sustainable practices, improved incomes and better lives. We contribute to several United Nations Sustainable Development Goals (SDGs), specifically 1, 2 & 5. Recognizing urgent action is required, we will support a total of 100 million smallholder farmers in LMICs by 2030 by improving their access to agricultural products and services, in collaboration with our partners.



We are providing **agronomic education**, including safe use trainings



We are **creating innovative products and partnerships for smallholder farmers** along the value chain



We are actively **supporting initiatives across the food chain**, with a focus on helping smallholder farmers to sustainably improve their harvests and livelihoods



**Investing in smallholder farming** is inclusive business — the foundation of our actions

We plan to extend our smallholder farmers reach from **53M** in 2023 to **100M** in 2030

Around **4.0M**

**smallholder farmers trained on safe use**

We expect our **revenue with smallholder farmers to double**

**by 2030<sup>5</sup>**

**+ 4M**

**smallholder farmers reached effectively compared to last year<sup>6</sup>**

<sup>5</sup> Compared to the initial baseline taken in 2019 at ~1.7B EUR)

<sup>6</sup> Due to the divestment of the Environmental Science Professional business in October 2022, the number of smallholder farmers no longer contains the respective vector control reach from 2023 onwards (2022: three million)



## TELA Maize Project

### Providing livelihood-changing products

Our increased focus on smallholder farmers means an **increase in products tailored to their needs**. Just one example of how we are supporting innovation and scientific research locally is the TELA Maize partnership project, which is currently implemented in seven countries – Ethiopia, Kenya, Mozambique, Nigeria, South Africa, Tanzania and Uganda.

In Nigeria, **maize is a food staple** – making up a large portion of its population’s daily meals. However, severe drought paired with infestations by the fall armyworm and stem borer pests have made conditions for growing maize incredibly difficult. This has resulted in **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**.<sup>7</sup>

For years, our world-class scientists have been working hard with external partners on a solution to address this devastating problem through a game-changing technology: **TELA Maize. TELA Maize is genetically modified (GM) to tolerate drought and resist fall armyworm and stem borer insects**. It was recently approved by the Nigerian government for commercial release, and the first 50 tons of TELA Maize hybrids seeds were available to Nigeria’s smallholder farmers for planting in June 2024.

<sup>7</sup>World Food Programme - Achieve food security in Nigeria

### Data from official variety registration trials in Nigeria showed that:

The GM insect-resistant hybrid had an average yield of

**7.61t/ha**

compared to

**6.04t/ha**

for the non-GM hybrid,

signifying an extra

**1.6t/ha**

of yield protection provided by the technology.

Banyabetjeng Phinea Mohlala, or Mma Mohlala, is a smallholder farmer in the Matibidi community South Africa – currently the only country in Africa where farmers have access to plant GM hybrids. Many of the Matibidi community **farmers abandoned their farms due to the plight brought on by the fall armyworm**. But after planting TELA Maize, **Mma Mohlala was pleasantly surprised to harvest 54 bags of maize (10,000 kg) – a bountiful harvest she had never experienced before. Given the success, she opted to plant TELA Maize again the following season.**

### Making it easier for smallholder farmers to escape poverty

We believe it is key to helping smallholder farmers turn their farming activities into viable small businesses and become part of the world of commercial farming.

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



[Read more about the TELA Maize Project](#)



[The Food and Agriculture Organization of the United Nations \(FAO\) evaluated the TELA project as a part of a case study in 2023](#)



[Read more about the big impact smallholder farmers have on food security](#)



**Better Life Farming**

# Helping smallholder farmers access inputs, know-how and opportunities

## An alliance of public and private sector organizations

To help improve the livelihoods of smallholder farmers, **we must first help them improve their farming operations.** In partnership with the World Bank’s International Finance Corporation (IFC), Netafim, along with many local value chain partners and supported by government initiatives, we established the **Better Life Farming (BLF) Alliance.** In 2024, the Alliance grew further, with Yara joining as a new global partner. At its core, **the alliance aims to provide smallholder farmers with knowledge, best practices, modern agricultural technologies and resources aiming to enable smallholder farmers to grow their farms into commercially viable and resilient farming businesses.** It also helps improve profitability and promotes the **reduction of their ecological footprint.** Overall, the Better Life Farming Alliance leads to value generation for the partners involved and the development of rural ecosystems – which can ultimately contribute to food and nutrition security.

### The Better Life Farming Alliance Targets



Develop rural communities and help farmers improve their livelihood



Make rural farming more inclusive for women & youth



Promote environmental sustainability



[Read more about the global impact of the Better Life Farming Alliance here](#)

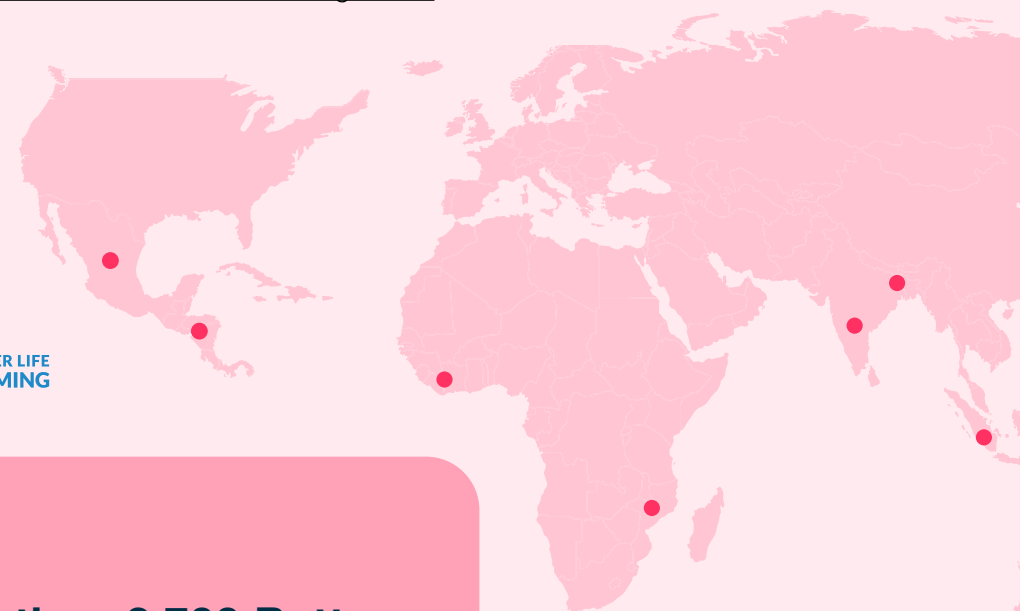
## Smallholder farmers coming together to support one another – Better Life Farming Centers

Smallholder farmers face several farming challenges and toil in relative isolation – despite the fact that dozens of other farmers may live and work nearby. As a key component of the alliance, **we created the Better Life Farming Center platform,** which consists of physical centers run by agri-entrepreneurs. These centers have become a convergence point for alliance partners to connect with smallholder farmers in surrounding villages. **Part supply store, part educational hub, each of the more than 2,700 Better Life Farming Centers are geographically positioned to connect hundreds of independent growers.** A short visit to the center can provide smallholder farmers with the products, knowledge, financing and other support they may need to help their farming businesses thrive.

The ingrained adaptability to local circumstances makes the Better Life Farming Center model scalable and adjustable. This platform encourages farmers to become BLF Center owners, catering directly to local needs and **bringing in relevant local partners to provide solutions tailored to smallholder farmers.**



[3D Model of a Better Life Farming Center](#)



**More than 2,700 Better Life Farming Centers**

## Creating stronger livelihoods

Reaching across India, Indonesia, Bangladesh, Mexico, Honduras, Tanzania and Ivory Coast, **the program has a potential coverage of more than one million smallholder farmers.**


The project was set up with a **dedicated focus on last-mile delivery to improve access to essential agricultural services.** Each Better Life Farming Center creates new rural employment with the agri-entrepreneur, who works closely with smallholder farmers. Over 2,700 agri-entrepreneurs generate income by providing inputs and services to farmers associated with them. In India, for instance, the agri-entrepreneur who earns, on average, above the annual country's rural household income after two years of operation, **earnings that are only projected to increase over time,** once the BLF Center is established and can expand its farmer reach and product and service portfolio.

Over time, a growing number of women have opted to open Better Life Farming Centers in their communities. As a result, it has **increased women's empowerment and female farmer community-building in rural areas.** Globally, more than 10% of the Better Life Farming Centers are owned and run by female agri-entrepreneurs, with the highest share being more than 20% of centers in Indonesia.

## Leveraging Better Life Farming to help close the nutrient gap in rural areas

Bayer is a global leader in health and nutrition. As part of **Bayer's Global Nutrient Gap Initiative, Better Life Farming brings access to nutritious food and nutritional supplements closer to communities based on its last-mile reach into remote rural areas in Indonesia.** The local Better Life Farming agri-entrepreneurs at 17 centers collaborate with healthcare professionals and NGO partners to offer general and prenatal nutrition education to enhance knowledge, especially for women in family planning, self-care and stunting prevention.

 [Read the article in the Harvard Business Review about the impact that Better Life Farming has on smallholder farmers](#)

 [BLF received recognition \(2nd Position\) for "Outstanding Sustainable Farmer Income Enhancement program" in FICCI's Sustainable Agriculture Awards 2022](#)

**Smallholder farmers in India who have worked with Better Life Farming report positive social benefits:<sup>8</sup>**



<sup>8</sup> *60 Decibels - December 2023, 276 farmer follow-up phone interviews in India in November 2023*

*"The paddy cultivation was good, and I am able to get a decent income from it. This has allowed us to sufficiently cover our expenses, do more farming, and secure our children's future so that they don't face any financial difficulties down the road"*

**- Female smallholder farmer, India**

**Through Better Life Farming in Indonesia, we reached around 400K smallholder farmers and their families**



## DKsilos

## Collaborating across the supply chain to support small dairy farmers

For low-income farming families in Central America and Southeast Mexico, **raising cattle and selling dairy to local milk processors help keep food on the table**. The typical small dairy rancher has about 25-30 head of cattle, grazing on a similar number of hectares.

During the five-month dry season, problems arise when grass growth is insufficient to feed the herd, a situation worsening with climate change. **During droughts, cows can lose up to 20-25% of their weight, produce 50% less milk**, become more susceptible to illness and are less likely to breed.

At Bayer, we saw an opportunity to help solve this challenge and share economic growth with more than 52,000 dairy ranchers and with dairy processors such as Lacthosa Sula in Honduras: **we train ranchers to plant maize on part of their grazing land and perform maize silage**, a technique that allows feed to be preserved through long periods of time. The DKsilos program complements this support with **access to a technology package, machinery, technical advice and milk recollection centers**.

Small-scale cattle ranchers quickly received economic benefits from this new business model. **The average farmer makes about \$5,000 USD more per year with DKsilos** thanks to lower feeding costs and higher milk productivity. The connected dairy processors, in turn, benefit from access to locally sourced milk year-round. In the future, the program will expand to more countries, and digital products will continue to be tested to help improve production and sustainability.



### Healthier Cows

- The higher nutrient content of silage makes for healthier cows
- This means less illness and higher birth rates for the herd



### Happy Farmers

- Instead of buying feed, farmers save by growing their own
- They can even sell extra feed to supplement their income



### Happy Dairy Processors

- Dairy processors can source locally, year-round
- They avoid imports of powdered milk

*"I have obtained a good feed for cattle that is preserved in difficult times. This gives me the peace of mind that I have things under control without having losses of both cattle and sales"*

**– Male cattle rancher, Mexico**



**Small-scale cattle ranchers in Mexico and Honduras who have worked with DKsilos report positive social benefits:<sup>9</sup>**

**86%**

say their income increased because of DKsilos.

**86%**

experienced a better way of farming.

**80%**

perceived an improved quality of life.

<sup>9</sup> 60 Decibels - April 2024, 152 cattle rancher follow-up phone interviews in Mexico/Honduras from January to March 2024



[Learn more on how maize silage improves the livelihood of cattle ranchers in Mexico & Central America](#)



[Read the article in the Harvard Business Review about why sharing economic growth with the community is good business](#)

## Partnering with the food chain

### Improving food security through trainings and innovations

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 potato farmers in Kenya are unable to grow, harvest and market their crops anywhere close to the yield potential of their fields.** This has led to income instability for smallholder farmers as well as food insecurity for the people.

Partnering with a consortium of public and private organizations, **we worked to train about 2,200 smallholder potato farmers on agricultural best practices to help grow their yields.** And we specifically designed the training program so that we would gain a clearer understanding of the impact proper access could have on their livelihoods.

**We created demonstration plots to serve as live classrooms for the farmers. Then we measured for three different farmer groups:**



1

**The basic farmer** who received no support.

2

**The advanced farmer** who planted his/her farm saved seeds and received training as well as fertilizer and crop protection innovations.

3

**The connected farmer** who received the full innovative inputs, trainings, and a secured selling connection.

**Increase in yields compared to the basic farmer**

x3

x6

By giving Kenyan smallholder farmers 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 improve the nutrition of the people in Kenya. This project can serve as a best practice for helping smallholder farmers close the yield gap and make a stronger contribution to food & nutrition security.



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

## Modern Breeding Project

# Breeding higher-yield varieties of key smallholder crops

## Supplying tools to improve operations of smallholder farmers

To efficiently feed a growing population, **we must adapt our food to ensure it can grow under changing and challenging weather conditions.** With this in mind, **we have 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 shared knowledge, tools and manpower to breed improved yields for some of Africa's most critical crops:** cassava, maize, cowpea, banana, yam and soybean.



Cassava



Maize



Cowpea



Banana



Yam



Soybean

The project's beneficiaries are millions of smallholder farmers who grow IITA's mandate crops on about **60 million hectares** in the humid to semiarid zones of sub-Saharan Africa. Through capacity building and knowledge transfer, the project was able to deliver several enhancements in IITA's breeding pipelines, with the ultimate goal of increasing genetic gains in farmers' fields. In order to achieve this, the project delivered:

- Annual measurements of genetic gain in each breeding pipeline at IITA
- The ability to track operational costs in line development and advanced yield trials
- Adopt best practices in phenotyping, trial design, and agronomic management, a necessary first step in establishing quality management systems and operation excellence
- Support the use of digital, including data management systems for decision support tools for crop development
- Formalized advancements and how decisions are made in breeding pipelines, along with key value chain stakeholders and experts

As Bayer and IITA plan for the next phase of the Modern Breeding Project, partners are keenly focused on improved breeding systems and networks, where millions of smallholder farmers throughout sub-Saharan Africa will be able to improve their harvests, their incomes and their communities' access to nutritious food. **Our vision: a more food-secure Africa.**

## Growing the reach of our digital products

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

**Imagine what could happen if smallholder farmers had access to the same tools.** Our FarmRise™ App, for example, provides detailed weather, pest and disease management insights so that smallholder farmers 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 IITA to create the Modern Breeding Project](#)



[Read outputs from the project on genetic progress from IITA's modernization efforts in cowpea](#)



[Read more about the economic impact of IITA and the CGIAR](#)



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

## Vegetable Seeds

### Enhancing resilience to climate change for smallholder farmers with innovative Vegetable Seed Solutions

Within our Vegetable Seeds business, we are working to deliver solutions that **mitigate risks for smallholder farmers**, addressing challenges such as extreme weather events, rising temperatures, unpredictable rainfall, and emerging pests. Our goal is to **enhance their productivity and income**, while also fostering **resilience to climate change**.

The **Seminis® Yoddha<sup>10</sup>** is an example of a tomato variety that can assist smallholder farmers in India in addressing these challenges. With Yoddha fruits remain firm even at sudden temperature spikes up to 40°C and perform well in both rainy and winter seasons. The variety also demonstrates high yield potential and minimizes post-harvest loss, offering the potential to enhance the economic well-being of smallholder farmers.

We are also working to increase smallholder farmers' access to solutions beyond our seeds' portfolio to help them **mitigate risks** related to climate change. **In the Philippines**, we are collaborating with partners to **offer weather-based seed insurance**, aiding farmers in their recovery from adverse weather. Since its launch in August 2023, the pilot program has enrolled around a thousand farmers, with plans to expand and enhance support for Filipino smallholder farmers' resilience.

Partnerships are crucial for improving smallholder productivity and facilitating access to innovation:

- In Nigeria, we have been collaborating with **AGRA** to expand the availability of innovative seeds to over a thousand growers, benefiting 40 villages since 2023.
- In India, our partnership with **Tata Trust** supports growers from Kamrup District, Assam State, enabling them to access innovative hybrid seeds to diversify their production, thereby promoting higher income while embracing crop diversification, a key practice in regenerative agriculture.

<sup>10</sup> Based on 50 Bayer trials in West Bengal, Assam, and Northeast India (2020-2022) in comparison with the main competitors, Trishul and TO 1458



Kaddus Ali and Motijan Nessa are smallholder tomato growers from Barpeta in Assam, India. Over the past few years, they have been facing challenges to the success of their tomato crops due to high disease pressure and fruit quality issues.

### Did you know?

Smallholder farmers growing **Seminis® Ansal tomatoes** in Kenya not only noted a positive impact on their livelihood but also on the environment. **52% of the farmers stated that working with Seminis® Ansal Tomatoes has environmental benefits, such as improved soil health and water conservation**




# Better outcomes lead to better lives for smallholder farmers

We are working directly with smallholder farmers around the world, aiming to make a big impact, together.


We will continue to deliver on our 2030 target by expanding our activities in numerous regions across the world – through the means of the TELA Maize project in Africa, the Better Life Farming Centers worldwide, BayG.A.P. certification in Kenya, DKsilos in Central America, and innovative vegetable seeds in Africa and Asia Pacific. We invite interested partners to join this journey.


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

# Learn more about our efforts on sustainability

 [2023 Sustainability Report](#)

 [Follow the Better Life Farming Alliance on LinkedIn](#)


 [Smallholder Farmers Bayer Global](#)


 [Impact on smallholder farmers' livelihoods](#)

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



**Ronald E. Guendel Gonzalez,**  
Vice President, Smallholder Farming

 [Engage on LinkedIn](#)

 [smallholder@bayer.com](mailto:smallholder@bayer.com)





# Reducing Agriculture's Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions pose a significant challenge for agriculture, impacting both the environment and food security. Agricultural activities, such as livestock production, use of synthetic fertilizers and land-use management, contribute to the release of GHGs like carbon dioxide, methane, and nitrous oxide into the atmosphere. These emissions exacerbate climate change and disrupt ecosystems, leading to adverse effects on crop yields and water resources.

**Through our innovative product portfolio and the promotion of climate-smart practices, we strive to play a pivotal role in enhancing soil health, increasing resilience to climate change, and reducing GHG emissions.**

**Our work reducing agriculture's greenhouse gas emissions contributes to the following UN Sustainable Development Goals:**



# 1 Sustainability Challenges

Climate change poses significant challenges for agriculture, primarily through increased frequency of extreme weather events such as floods, droughts, winds and wildfires. Over the past decade, these events have led to substantial crop losses and instability for farmers – which have tripled in the last 50 years – endangering global food security. At the same time, agri-food systems are responsible for nearly a quarter of global greenhouse gas emissions. By implementing sustainable farming and regenerative agricultural practices, farmers can make meaningful contributions by sequestering carbon in the soil, reducing the amount of carbon in the atmosphere and bringing us closer to a climate-neutral future.

# 2 Our Approach

At Crop Science, a division of Bayer AG, we are working towards tackling climate change and driving towards a climate-neutral future for agriculture. To achieve our GHG target, we foster the adoption of regenerative agricultural practices and technologies by our farming customers. These include the use of high-yielding crop genetics, crop protection products with lower environmental impact, precision irrigation systems, as well as soil management tactics such as conservation tillage and adoption of cover crops, crop rotations, and preservation and restoration of biodiversity. Combining different levers can help restore balance to the land and lead to profitable, tailored solutions for our farming customers.

## Our GHG target in agriculture

- Enable our farming customers to reduce their on-field greenhouse gas emissions per mass unit of crop produced by 30% by 2030 compared to the overall base year emission intensity.<sup>1</sup> This applies to the highest greenhouse gas emitting crop systems in the regions Bayer serves with its products.<sup>2</sup>

# 30% by 2030

<sup>1</sup> Our reduction target refers to an overall base year greenhouse gas intensity that includes the weighted emission intensities of 18 crop-country combinations. Base years are defined individually for each crop-country combination, using data from either harvest year 2020, 2021 or 2022 depending on the availability of data.

<sup>2</sup> The crop-country combinations Italy-Corn and Spain-Corn were not selected based on these factors but were additionally included because data were already available.

# 3 Main Actions

## North America

We provide farmers with incentives to adopt innovative, regenerative agricultural practices through programs such as the Bayer Carbon Program and the ForGround platform

## Latin America

PRO Carbono, PRO Carbono Commodities and their regional tools allow farmers to increase carbon sequestration in the soil and support value chain partners in measuring their footprint

## Europe

We support the decarbonization of the food value chain through our Bayer Carbon Program and collaborations with other organizations

## Asia/Pacific

We support GHG emissions reductions in rice cropping systems through initiatives with farmers in India through the Direct Acres Project and the Good Rice Alliance, which combines the use of sustainable cultivation techniques with our innovative hybrid seeds

# 4 Progress

**North America:** at the beginning of 2024, we announced our collaboration with **Mars Petcare** with the goal of changing practices on up to 200,000 acres. Additionally, in 2024 we expanded our Bayer ForGround program to growers in 28 states with enrollment possibilities extended to 12 cash crops

**Latin America:** in Argentina, we closed a PRO Carbono Commodities deal for the 2024 season with **Viterra**

**Europe:** in March 2024, Bayer announced a collaboration with **Trinity Agtech** to leverage Trinity Agtech's platform Sandy, an ag tech software for measurement and management of regenerative agricultural practices. In June 2024, Bayer and **ADM** announced an extension of their collaboration, working with farmers to drive the further adoption of regenerative agricultural practices in Europe

**Asia/Pacific:** in late 2023, Bayer announced the **Good Rice Alliance**

# On the front lines of the problem and the solution

Farmers are experiencing the impact of climate change, and we are striving to help them take action

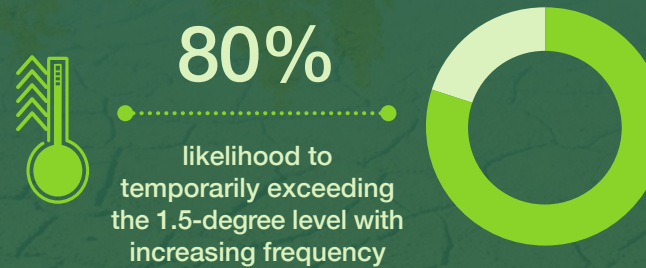
More frequent extreme weather conditions, including floods, drought, high winds and wildfires, are the consequences of a rapidly warming atmosphere. **The last decade has delivered an unprecedented amount of these type of events.** As reported in [February 2024](#), the world marked a full year of global warming surpassing the 1.5-degree Celsius threshold for the first time on record. [The World Meteorological Organization \(WMO\)](#) indicates there is an 80% likelihood that we will exceed the 1.5-degree level set by the Paris Agreement on a temporary basis with increasing frequency.

These extremes in weather mean **crop loss for farmers and can threaten the food system.** According to recent studies throughout Europe, crop losses due to extreme weather events have tripled over the last 50 years. Amidst the grave consequences faced by farmers, we're focused on helping them adapt to climate change and be part of the greater solution.

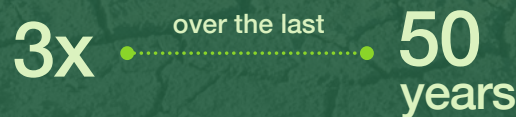
<sup>3</sup> *The Farmer Voice survey 2024 was conducted independently by Kynetec, a global leader in data, analytics and insights in agriculture, and the final report was produced in collaboration with Kekst CNC, a global strategic communications firm. Interviews took place between June and July 2024*

According to [The Farmer Voice survey](#) conducted in 2024 with 2,000 farmers across Australia, Brazil, China, Germany, India, Kenya, Ukraine and the United States:

- 75% of farmers agreed that climate change already has a large impact on their farm or are worried about impacts in the future.
- 61% of those surveyed indicated they had recently experienced significant revenue loss due to weather events out of the norm.<sup>3</sup>



In Europe, the impact of heatwaves and droughts on crop production has approximately increased by



## Leading an industry-wide response

Greenhouse gas emissions, including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), 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. The latest [IPCC report](#), released in March 2023 states: “In 2019, approximately 22% of net global GHG emissions came from Agriculture, Forestry, and Other Land Use (AFOLU).”

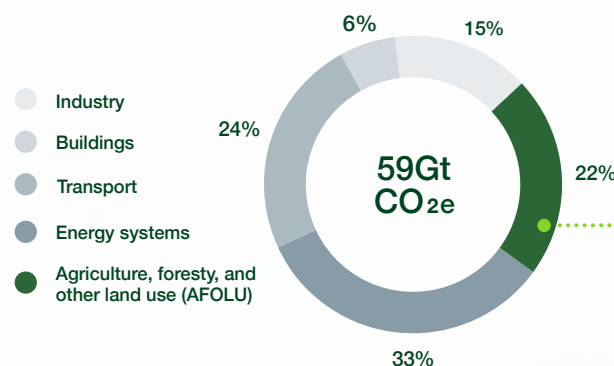
The agriculture sector has an opportunity to lessen the impact of climate change. As a leader in agriculture, we at Bayer strive to discover ways to achieve this. And, as we have found, at least one solution is in our farming customers' backyards. Or rather, their fields.

Crops actively absorb carbon dioxide from the atmosphere during the process of photosynthesis. Subsequently, as the plant biomass decomposes, it releases carbon into the soil. **This makes soil one of the earth's largest natural carbon sinks<sup>4</sup>, second only to oceans.** Carbon can then be retained in the soil through sustainable farming practices like no-till farming and planting cover crops in the off season. By helping farmers implement practices that help keep the carbon in the soil, we can lessen the amount of carbon in the atmosphere.

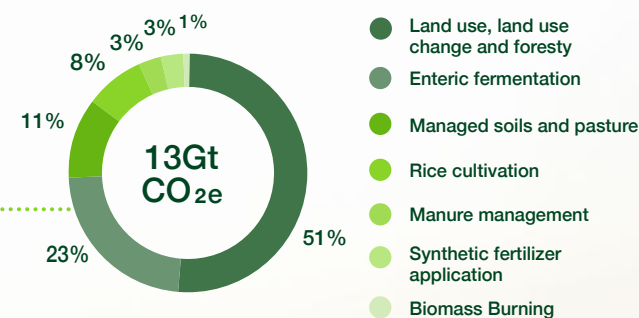
What's more, carbon-rich soil is also healthy soil. It requires less fertilizer and yields more bountiful healthy harvests. What's good for the atmosphere is also very good for growing food. And that means it's good for farmers' businesses.

<sup>4</sup> Carbon sinks: natural deposits that absorb and capture CO<sub>2</sub> from the atmosphere, reducing its concentration in the air

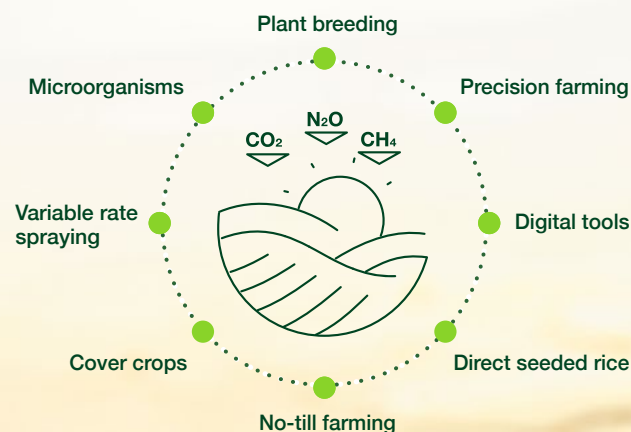
Direct global GHG Emissions by Sector<sup>5</sup>



Agriculture, Forestry, and Other Land Use - Global GHG Emissions by Subsector<sup>5</sup>



<sup>5</sup> From 59Gt global GHG emissions (reference year 2019; source: [IPCC AR6 WGIII Full Report 2022](#))



We collaborate 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<sub>2</sub>, N<sub>2</sub>O, and CH<sub>4</sub>



Source: IPCC Report



## Our approach to reduce on-field greenhouse emissions

In 2019, we set **an ambitious target**. We aim to enable our farming customers to reduce their on-field greenhouse gas emissions per mass unit of crop produced by 30% by 2030 compared to the overall base year emission intensity.<sup>6</sup> This applies to the highest greenhouse gas emitting crop systems in the regions Bayer serves with its products.<sup>7</sup> 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 approach is centered on where we can make a significant difference — and that is with the most greenhouse gas emitting cropping systems in the regions that we serve. That's **soybean 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 and land management practices, 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 Global Ecosystem Services. To measure progress against our target, we use representative samples of field-level data from a third-party market research data provider obtained in interviews with randomly selected farmers.

Our methodology is described in more detail in a report reviewed by an external panel of experts to ensure the baselining and performance tracking methodology is adequate.

<sup>6</sup> Our reduction target refers an overall base year greenhouse gas intensity that includes the weighted emission intensities of 18 crop-country combinations. Base years are defined individually for each crop-country combination, using data from either harvest year 2020, 2021 or 2022 depending on the availability of data.

<sup>7</sup> The crop-country combinations Italy-Corn and Spain-Corn were not selected based on these factors but were additionally included because data were already available.



[Read more about our methodology to track the progress against our target](#)

## Centering our approach around farmers and society

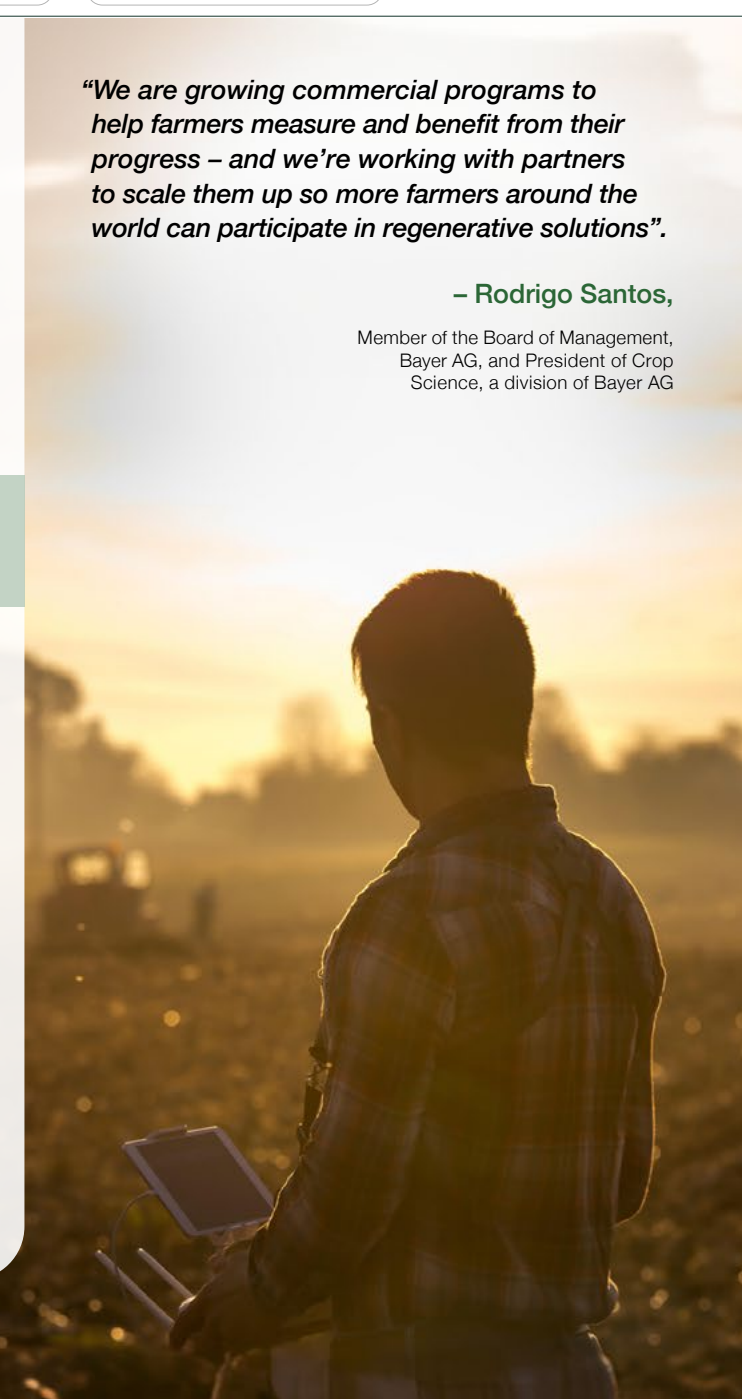
Farmers are the earth's original conservationists. After all, when the land is your livelihood, any changes to it can be devastating. However, our ambitious goal of significantly reducing atmospheric carbon won't be achieved if it doesn't work for farmers' businesses. Therefore, farmers are at the center of every program we support 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. With that in mind, we asked ourselves, beyond improving the health of their harvests, **is there a way we can make soil carbon something farmers want to farm? Our answer is yes.**

**"We are growing commercial programs to help farmers measure and benefit from their progress – and we're working with partners to scale them up so more farmers around the world can participate in regenerative solutions".**

**– Rodrigo Santos,**

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



## Bayer's climate objectives - understanding emissions through three scopes

Like other corporations, our GHG emissions are classified into three different scopes.

**Scope 1 emissions** are our direct emissions from our corporate-owned facilities and vehicles. **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 dedicated to transparently communicating our climate targets and progress, as well as the impact that climate change has on Bayer.** Through continued participation in the Carbon Disclosure Project (CDP) we disclose a high level of details on our climate related activities and progress. In 2023, CDP has awarded Bayer the rating of A- for its climate strategy for leading in environmental performance and transparency. In June 2024, we published the [Transition and Transformation Plan](#), a report that reflects Bayer's actions and potential with regard to climate change.

### Scope 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**



[Find out more information regarding our Scope 1, 2 & 3 progress within the Product Supply chapter](#)

## Looking internally to reduce our own footprint



### We have set ambitious targets for our own GHG emission reductions

We've joined the world's leading Science Based Targets Initiative (SBTi), founded by CDP, the United Nations 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 striving to limit global warming to 1.5°C for Scopes 1 and 2, and 2°C for Scope 3.

## Partnering for greater reach & impact across the value chain

When it comes to reaching climate neutrality, we recognize that our new business models will only get farmers 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 NGOs, governments, international organizations, farmers, consumers and food chain members, together we can achieve profound impact.



[A summary of our climate strategy can be found here](#)

# Enabling regenerative agriculture

We calculated our overall base-year greenhouse gas intensity based on our customers' greenhouse gas intensities for our major crop-country combinations with data from the 2020-2022 harvest years.

To calculate the overall base-year greenhouse gas intensity, individual greenhouse gas intensities per crop and country were weighted according to Bayer's footprint in these crops and regions, estimated using the total production volume of a particular crop in a particular market as stated in the database of the Food and Agriculture Organization (FAO), our market share in this market and carbon intensity of this crop within a particular country.

To achieve our target, we are fostering the adoption of regenerative agricultural practices and technologies by our farming customers in the different regions where we operate.

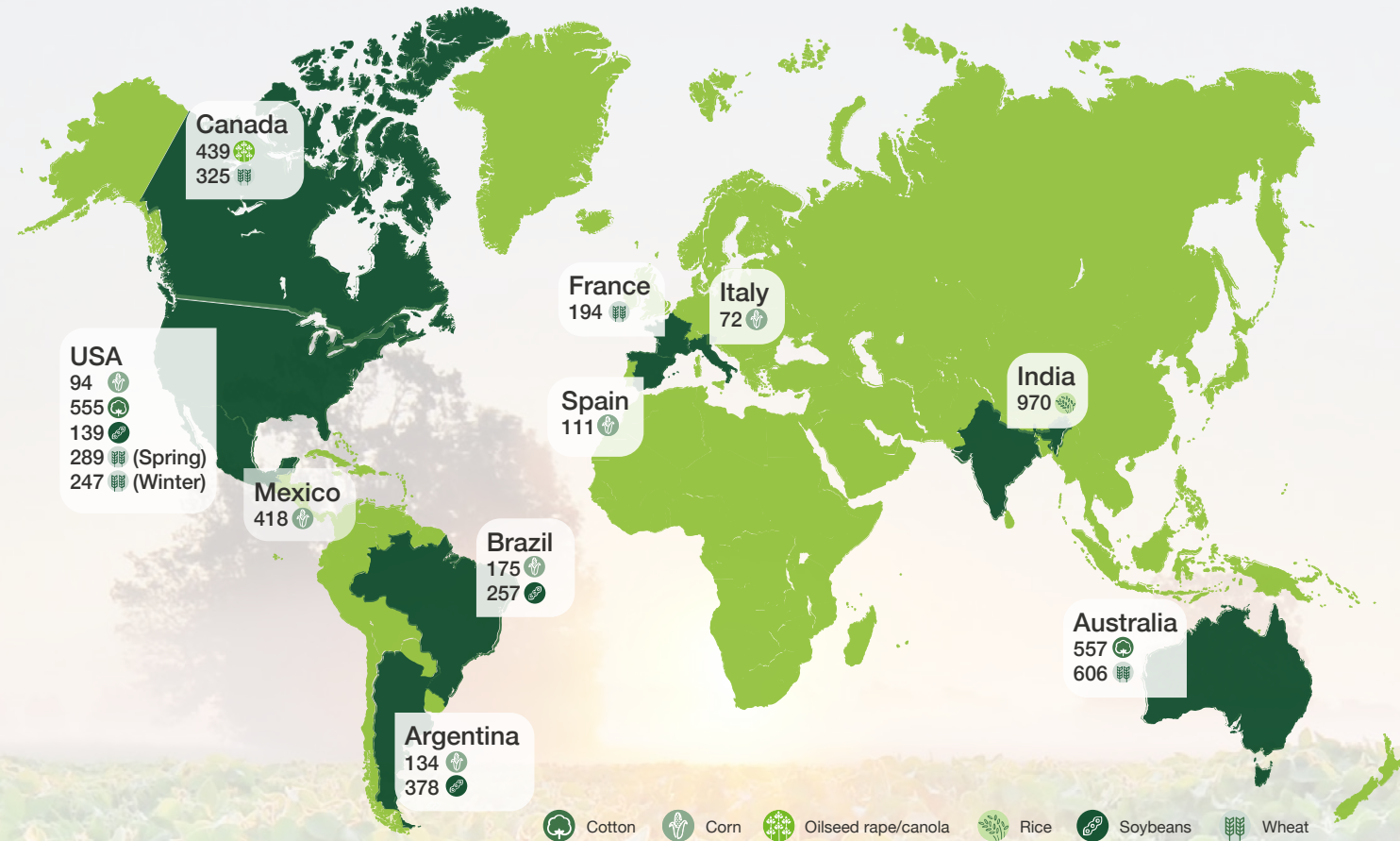


[Find more information on our baselining and performance tracking methodology](#)

## Greenhouse gas intensities for our most important crops (Crop-country combinations)

Greenhouse gas intensity (weighted)

**443** kg CO<sub>2</sub>e/t



Cotton
 Corn
 Oilseed rape/canola
 Rice
 Soybeans
 Wheat

Data in kg CO<sub>2</sub> equivalent per metric ton of crop produced (not weighted)



## 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 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 with hectares of tomatoes, maize or soybean harvests.



Prices for carbon offsets could be as high as

**\$238 USD/ton**  
**by 2050<sup>8</sup>**

At Bayer, we believe that using soil to reduce carbon from the atmosphere is not just our responsibility, but it could unlock our own promising business opportunities. **Our work on the ground with farmers puts us in the right position to help them improve their practices and, in turn, their businesses.** By creating new ways of working, we can create new value opportunities for all of us. **It's good for farmers, good for business and good for the world.**

<sup>8</sup> *BloombergNEF - Carbon Offset Prices Could Increase Fifty-Fold by 2050*



**Recognizing that farmers are our single greatest asset for generating soil carbon, we have created 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 removing carbon from the atmosphere**

Further expansion of business model projects with value chain partners in 2023 focused on regenerative agriculture with emissions reductions levers, including:



Cover crops



Digital tools



Precision farming



No-till farming

# Working with farmers and the ag value chain around the world to lower greenhouse gas emissions

We are working with farmers and companies across the value chain to **accelerate the adoption of more regenerative agricultural practices and digital technology**. We firmly believe that with the right tools and ideas we can help farmers protect their soil to produce food. We are also uniquely positioned to help companies across the agriculture value chain to reduce their carbon emissions, gain insights on the co-benefits of regenerative agriculture and together, cultivate a healthy planet for generations to come. **We currently have 22 programs with 17 different companies in 6 countries globally to help increase and scale the adoption of regenerative agricultural practices throughout the value chain.** ADM, Algar, Coplacana, Natter and Viterra are some of our customers committed to reducing GHG emissions from their operations and supported by Bayer Ecosystem Services' capabilities.

While our efforts to reduce emissions from our own operations are but a tiny contribution to the greater whole, by providing the tools, programs and partners to decarbonize the entire food system, we can help **lead a step change in the overall reduction of emissions in agriculture.**

- **For farmers: Bayer offers industry-leading and farmer-focused programs tailored for regional needs**, so farmers are incentivized for their verified implementation of regenerative practices that can capture, store more carbon and reduce emissions. These programs offer more than a long-term revenue stream — they can also help strengthen and protect their land for the future, through the many potential benefits of regenerative agriculture, such as healthier soil and greater weather resiliency.
- **For companies:** meeting carbon emissions reduction targets across the supply chain is critical to addressing the climate crisis, and **at Bayer we have the tools to help other companies multiply their impact.** With a science-based approach along with the right tools and expertise to scale up, our services include data-driven insights and recommendations, Scope 3 reductions, carbon credits, and low-carbon labels.

## Global Ecosystem Services

**6 Countries**

Argentina, Brazil, France, India, Poland, U.S.

**22 Programs/Projects<sup>9</sup>  
17 Companies**



**+21K Growers**

**3.6M Paid Acres<sup>10</sup>  
1.5M hectares**

**10M Acres in the Pipeline<sup>11</sup>  
4M hectares**

<sup>9</sup> The number of programs/projects include one internal project

<sup>10</sup> Paid acres: acres where Bayer is compensating farmers for regenerative farming practices and converting the sustainability benefits into new company revenue

<sup>11</sup> Acres in the pipeline: cropland acres enrolled in the most basic programs and not yet qualified to a revenue generating program, thus not converted yet to paid acres

All figures as of September 2024



[Learn more about our Ecosystem Services](#)

## Some of our Global Customers

**Algar**  
Telecom

**ADM**

**COPLACANA**  
GRUPPO CO-AGRO

**VITERRA**

**PERDUE**

**Natter**

## North America

# Empowering farmers to create big impact

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

In the U.S., participating farmers who adopt practices like no-till or strip-till farming and planting cover crops, receive payment from Bayer relative to the number of acres the practices are implemented.

This approach allows us to generate high-quality, certified carbon assets. The guaranteed payment based on the number of acres enrolled makes participation straightforward for farmers and easy to track 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. Since its inception in 2020, hundreds of farmers have signed on and received payment for their efforts.

## Collaborations

Perdue AgriBusiness was our first major partner onboard to work towards the large-scale reduction of carbon emissions under our ForGround platform. **This collaboration aims to create a model for a more sustainable food value chain spanning across Perdue's entire grain network.** The program is anticipated to help improve soil health and reduce Scope 3 GHG emissions at scale in the long term. Through this partnership, we are creating additional opportunities to support farmers on their regenerative agriculture journey, benefiting their land and helping them produce more environmentally friendly food and ingredients for businesses and consumers.

At the beginning of 2024, **we also announced our collaboration with Mars Petcare for a goal of changing practices on up to 200,000 acres.**

## ForGround

Based on the successful foundation of the existing Bayer Carbon Program, **we launched the farmer-first digital platform ForGround in 2022.** This platform has expanded and evolved to explore other ways farmers can make a positive impact in their operations through the adoption of regenerative agricultural practices and technologies. ForGround also offers Bayer the opportunity to connect farmers with other companies to help them meet their sustainability goals.

**In 2024, we expanded our ForGround program to growers in 28 states with enrollment possibilities extended to 12 cash crops.** In addition, the historical performance period for fields with eligible practice changes was extended, and a new Nitrogen Management Program was added to increase farmers' per-acre payment potential.



[Learn more about ForGround here](#)



## Latin America

## Creating value for the grower

### PRO Carbono

We launched the **PRO Carbono program** in Brazil in 2020. **Participating growers implement regenerative agricultural practices in their fields to increase carbon in the soil while also increasing their crop yield. In addition to reaping the direct benefits of greater soil fertility, participating farmers have access to carbon analysis, technical consultants and professional agronomists.** Participants have access to exclusive benefits from partner companies, such as access to differentiated credit from banks and discounts or early access on the purchase of inputs. In 2021, we also launched the PRO Carbono program in Argentina.

**In 2024, Bayer, Louis Dreyfus Company, and Global Clean Energy Holdings partnered to expand the cultivation of camelina as part of Bayer's PRO Carbono program in Argentina.** Camelina is an intermediate, over-wintering cover crop that can help improve soil health, water filtration, and nutrient cycling. It can also be used as an ultra-low-carbon feedstock for advanced biofuel production. An ideal candidate for an otherwise fallow season, and ready to use thanks to camelina's long history of cultivation in Argentina.

### PRO Carbono Commodities

**In addition to PRO Carbono, in May 2023, Bayer delivered the first load of Brazilian soybeans with a traceable, deforestation-free carbon footprint. Titled PRO Carbono Commodities, this initiative aims to protect forests and other natural vegetation.** The carbon footprint data was measured by a carbon calculator (PRO Carbono Footprint), which we are developing initially for soybean cultivation in the tropical zone in a joint effort between Bayer and Embrapa. **The program, in collaboration with ADM, recorded primary data from the areas relating to 240,000 tons of soybeans produced and calculated an average carbon footprint of 925 kg CO<sub>2</sub>e.** In Argentina, we closed a PRO Carbono Commodities contract for the 2024 season with Viterro in which more than 300 producers who plant over one million hectares of soybeans will have their carbon footprint calculated, and farmers will receive a financial incentive on grain value from Viterro.



[Learn more about the Embrapa Agricultural Research Corporation](#)



## Europe

# Decarbonizing the food system

In Europe, we launched the Bayer Carbon Program in 2021. With a goal of supporting the decarbonization of the food value chain, this program consists of four main pillars:

## 1 Agronomy

Identifying the best levers and types of interventions to reduce the carbon footprint of European farms is essential. With this objective, and to always support the best interests of our customers, **we have developed a network of pilot farms across different countries to test new carbon farming methods and generate learnings.** These farms are connected to value chain players and supported by our own experts for testing.

## 2 Science

In Europe, agricultural conditions vary considerably, resulting in different crop rotations, soil types and climatic conditions, among other aspects. That's why **we leverage all of our scientific expertise and our best soil engineers to assess and validate the most accurate farming models for the region.**

## 3 Digital

Data collection and precision farming are two critical tools to develop successful Carbon Farming projects. **With Climate FieldView™ and other data capture methods, Bayer can provide a powerful, daily connection with growers.** The tool also brings a unique benefit to the market: connecting carbon farming interventions with the farm productivity thanks to high-quality yield maps.

## 4 Carbon Project Management

**While the previous elements are essential to develop a low-carbon project in agriculture, the ability to aggregate these components in a project is equally important.** This represents the last pillar of development for our value proposition to the Food Value Chain. This complete portfolio of solutions starts with a feasibility study at the early stage of a project and finishes with a fully-certified project compliant with the most recognized registries.

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We're developing **Agriculture Value Chain Intervention Carbon Projects & Services** that leverage our unique digital capabilities. We strive to support companies in achieving their climate targets by fostering growers to increase adoption of smart carbon practices



## Europe

## European Carbon Program

**We are engaging in contracts with various Food Chain players to footprint their scope 3 emissions.**

This has been done across different value chains and four main crops (tomatoes, potatoes, corn and oilseed rape) in Spain, Portugal, Ireland/U.K., France and Poland.

Reliable Monitoring, Reporting and Verification (MRV) is an essential pillar of any Carbon project and key for all players of the food value chain to be compliant with third parties, global guidelines, certification bodies and regulatory requirements.

**In March 2024, Bayer announced a collaboration with Trinity Agtech to leverage their platform Sandy, a carbon calculator.** The platform will be instrumental for Bayer's Carbon Initiative in EMEA in measuring and monitoring carbon on a farm level.

**In June 2024, Bayer and ADM announced an extension of their collaboration,** working with farmers in a bid to drive the further adoption of regenerative agricultural practices in Europe. **In 2023, we embarked on a feasibility study to evaluate the impact of regenerative agricultural practices in curbing carbon emissions, increasing biodiversity and improving soil health with oilseed rape farmers in Poland.**

The program will expand into a broader range of crops such as corn, wheat and barley, and geographically across Eastern Europe. Additionally, farmers will be provided with financial and technical support to implement qualifying regenerative agricultural practices.

[Bayer and Trinity Agtech join forces to drive regenerative practices in agriculture](#)

[Farmers Achieve Lower Carbon Emissions with the Help of a New Regenerative Agriculture Collaboration in Europe | Business Wire](#)



## Asia/Pacific

## Reducing the emissions from rice cultivation

Today ~80% of the world's rice crop is produced using transplanted paddy rice (TPR) cultivation practices, which are land, water, energy and labor-intensive and contribute heavily to global greenhouse gas emissions.

The crop is among the largest contributors of GHG, producing 1.5% of total emissions globally, and is responsible for 12% of global methane emissions – a greenhouse gas 28 times more potent than carbon dioxide. In Southeast Asia, rice cultivation accounts for as much as 25-33% of the region's methane emissions.

In 2021, Bayer started the **India Sustainable Rice project**. As part of it, Bayer is evaluating GHG reduction and water-saving potential in the cultivation of rice under Alternate Wetting and Drying (AWD) and Direct Seeded Rice (DSR). This project evolved to the **Good Rice Alliance**:

[Learn more about how we are collaborating with GenZero and Shell to reduce methane emissions in rice cultivation](#)

In addition, Bayer is engaged in developing a holistic rice crop system powered by direct seeding and in 2021, Bayer started the **DirectAcres project**. Direct seeding will reduce labor requirements, optimize water use for growing rice and reduce GHG emissions – especially methane. This rice crop system package will consist of different solutions, including but not limited to: Arize hybrid rice seeds, weed management solutions such as Council® and Ronstar®, Reatis™ seed growth solution, pest and disease management solutions like Vayego® and Nativo®, and digitally-enabled advisory and application services.

### Direct Seeded Rice benefits against traditional rice cultivation<sup>12</sup>

	Conventional		Direct seeded rice <sup>13,14</sup>
	12.5-15.5 mio. L		Up to 40% reduction... ✓ 7.5 - 9 mio. L
	6.8t CO <sub>2</sub> e <sup>14</sup>		Up to 45% reduction... ✓ 3.8t CO <sub>2</sub> e
	300 labor h. <sup>15</sup>		Up to 50% reduction... ✓ 150 labor h.

References: TPR Water Use: Kynetec Panel Survey Data 2020, IRRI (2009). Bouman et al. (2002) | Water Savings from TPR to DSR: Bayer Sustainable Rice Initiative Pilot, Singh et al. | Carbon emission - IPCC (2008/2019) | Labor: Sidan et al (2020)

<sup>12</sup> Absolute numbers are per hectare

<sup>13</sup> The reduction numbers relate to paddy rice and could vary for different rice cultivation practices and geographies

<sup>14</sup> Considered yield of 5t/ha for the carbon footprint and labor calculations

<sup>15</sup> Savings on electricity and diesel to be evaluated

**Our AWD and DSR systems have the potential to lower GHG emissions by up to ~45%**, with GHG avoidance having an opportunity to be compensated through conversion into carbon credits, offering farmers an additional source of income.

## Advancing our digital capabilities

Thanks to Climate FieldView and many other regional-specific digital tools implemented by Bayer, farmers around the globe can generate more information about how and what they grow. Such data can provide critical insights that can, in turn, help feed a growing population more efficiently and sustainably. **Beyond the farm, businesses that support food production and farming are also generating and relying on data to make the best decisions possible to support a healthy, productive and increasingly interconnected food system.** Satellites, field sensors, drones, field equipment and soil sensors generate hundreds of variables and attributes, but until recently, it's been difficult and expensive to turn that information into insights because these systems aren't linked.

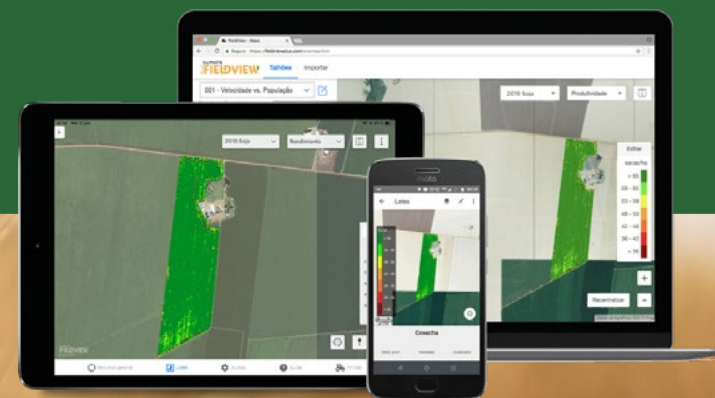
Until now, data from all aspects of agriculture – production patterns, weather data, insect and disease tracking – were not connected due to a lack of digital infrastructure. Without a common data format across the industry, interoperability and sharing has proven to be a challenge.

Bayer is proud to announce the evolution of its **collaboration with Microsoft** through the preview launch of the Azure Data Manager for Agriculture platform and the release of Bayer AgPowered Services. **Azure Data Manager for Agriculture extends the Microsoft Intelligent Data Platform with industry-specific capabilities to connect farm data from disparate sources, enabling organizations to leverage high-quality datasets and accelerate the development of digital agriculture solutions.** AgPowered Services are a set of capabilities and tools built on top of the platform that turn data into timely insights on crop health, weather forecasts, crop growth tracking and more. The platform will help promote sustainable farming practices by laying ground for sustainability applications built on rich and plentiful agronomic data. The two work interchangeably, enabling agri-food value chain companies to accelerate digital innovation and build new business value.

## Enabling verification

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

Climate FieldView™ provides farmers with real-time updates about their fields. **Through the platform, we can support farmers' carbon farming, acre by acre.** Additionally, farmers can access monitoring tools to manage their operations and use inputs more efficiently – reducing their emissions. **It's just one more way we're empowering farmers to adopt sustainable practices.**



[Scaling Sustainability Through Bayer & Microsoft Partnership](#)



[Bayer ForGround](#)



[Learn more about Climate Fieldview™](#)



## Reporting on our target achievement

We will assess and report every two years on our progress towards the target we have set. The first reporting of our progress against our base year greenhouse gas intensity will be published in our Bayer Sustainability Report 2024.

## Scaling regenerative agriculture for a greener future

We are driving forward the implementation of carbon farming initiatives in every region we serve. The goal is to learn **how to scale the adoption of regenerative agricultural practices and solutions to create new value streams** for our farming customers. This leads to **new business opportunities for us that benefit the environment at the same time.**

## Learn more about our efforts to reduce agriculture’s greenhouse gases



[2023 Sustainability Report](#)



[Crop Science division greenhouse gas reduction targets](#)



[Bayer Climate Strategy - Transition and Transformation Plan](#)



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



[Learn more about the “Preceon Smart Corn System” in our Innovation chapter](#)

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



Miya Howell,

Climate and Land Use Change Venture Lead



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# Crop Protection Environmental Impact Reduction

Crop protection, next to fertilizers and breeding advancements, has **helped humanity to feed an ever-growing population while limiting the increase of arable land**, which is a vital step in helping minimize land use change. Yet crop protection products do not just increase yield – they also have an environmental impact when applied on fields. At Bayer, we strive to develop crop protection products that offer the same or better benefits for the farmer while decreasing their environmental impact.

**Our work reducing the environmental impact of crop protection contributes to the following UN Sustainable Development Goals:**



## 1 Sustainability Challenges

While crop protection has benefits for our food supply, we must also consider its impact on the environment beyond the field. Crop protection products enable farmers to meet the world's growing food and feed demand while using less land and resources, which reduces the need to expand agricultural production into natural habitats.

**Agriculture must strike a balance between the need for tools like crop protection and potential trade-offs posed by increasing the use of such tools.** With new products and technologies, we aim to ensure that our solutions serve farmers' needs and wellbeing, while also reducing the impact of the products on the environment.

## 2 Our Approach

At Crop Science, a division of Bayer AG, we aim to reduce the treated-area-weighted environmental impact per hectare of Bayer's global crop protection portfolio by 30% by 2030 against a 2014 – 2018 average baseline.<sup>1</sup> To achieve this, **we take a holistic approach that starts with the way we develop crop protection solutions and finishes with product application.**

To this end, aligned with our regenerative agriculture vision, we are working on reducing the amount of crop protection products needed per hectare, our product emissions to the surrounding environment and improving the environmental profile of the active ingredients while ensuring their efficacy. In addition, we strive for the safe, responsible use of crop protection products with our Stewardship efforts. We collaborate with external experts to apply state-of-the-art methodology for measuring the environmental impact of our crop protection products. We strive to develop and offer products that have the same or better benefits for farmers while having less impact on the environment.

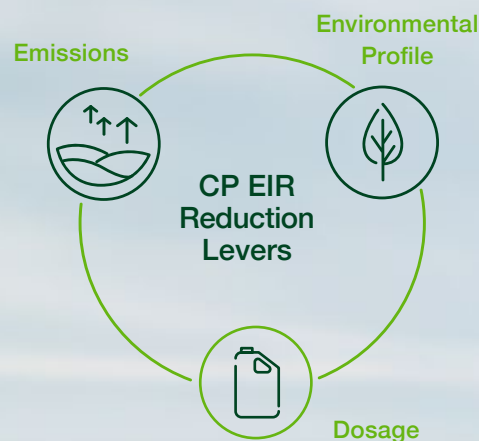
<sup>1</sup> Environmental impact is defined as the potential effect on non-target organisms

## 3 Main Actions

**Improve** the environmental profile of crop protection active ingredients while ensuring efficacy

**Optimize** the amount of crop protection products needed per hectare

**Reduce** crop protection emissions to the surrounding environment



### • Our Target

We aim to reduce the treated-area-weighted environmental impact per hectare of Bayer's global crop protection portfolio by 30% by 2030 against a 2014 – 2018 average baseline

# 30% by 2030

## 4 Progress

As a market leader in crop protection, **we have already achieved exceptionally low environmental impact levels in our crop protection portfolio**, but we must continue to improve. Based on the data collected between 2018 and 2022, **Bayer has reduced the treated-area-weighted environmental impact per hectare of our global crop protection portfolio by 12% against the 2014 – 2018 baseline.** This reduction was mainly the result of changes in our crop protection product portfolio in recent years. We also report quantitatively against our target in our [Bayer Sustainability Report \(2022, 2023\)](#).

Progress tracking period:

# 2018 - 2022

Reduced the environmental impact of our global crop protection portfolio per hectare

# 12% ↓

against the baseline 2014 - 2018



# The agricultural 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 diseases as well as guard them from weeds competing for the same land, nutrients and water.

Crop protection is not just critical for farmers' businesses, it is 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 better 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.

Because of increased demand for food and challenges caused by pests, diseases, extreme weather and other factors, the use of crop protection results in a net-benefit yield gain.<sup>2</sup> **Without using crop protection, sustaining production could lead to:**



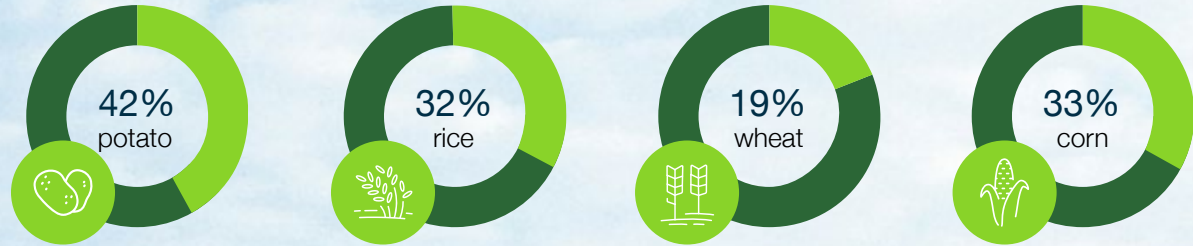
**Significant increase in food prices**



**Non-agriculture land use conversion**

<sup>2</sup> *European Parliament - Farming without plant protection products*

## Net-Benefit<sup>3</sup> yield gain using Crop Protection



<sup>3</sup> *The Benefit which cannot be mitigated by alternative actions related to agronomy, rotation or cultural measures*



**Today, farmers use less than one third of the land they would have needed in 1961 to produce the same amount of food**

# How to produce more with less and better preserve our environment

While crop protection has obvious benefits for our food supply, we also know that crop protection products impact the environment beyond the field.

We continuously seek to develop and offer products that have the same or **better benefits for farmers, while having less impact on the environment.** Our safety standards reflect the guidelines and standards of international organizations such as the Food and Agriculture Organization (FAO), World Health Organization (WHO) and Organization for Economic

Cooperation and Development (OECD), as well as those of local regulatory authorities around the world.

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 work towards ensuring that the environmental impact of our crop protection does the opposite. That is why, as the world's leading provider of crop protection products, **we aim to reduce the treated-area-weighted environmental impact per hectare of Bayer's global crop protection portfolio by 30% by 2030** against a 2014 – 2018 average baseline. We are proud to be currently the only company within our industry to make such a measurable target across the entire crop protection portfolio with publicly available scientific models.

## Our Target

We aim to reduce the treated-area-weighted **environmental impact per hectare of Bayer's global crop protection portfolio by 30% by 2030** against a 2014 – 2018 average baseline

# 30% by 2030

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**We are proud to be currently the only company within our industry to make such a measurable target across the entire crop protection portfolio with publicly available scientific models**



[Learn more about our approach for the development and use of crop protection products](#)

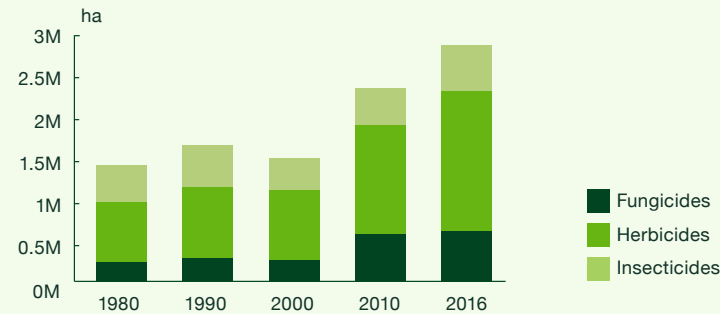
# Addressing crop protection environmental impact accurately & holistically

## Going beyond volume - a more comprehensive way to evaluate impact

As part of our target to significantly reduce the environmental impact of our global crop protection portfolio, we set out to adopt a more accurate way of measuring it. Oftentimes it is assumed that environmental impact is only 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.**<sup>4</sup> One indication 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.

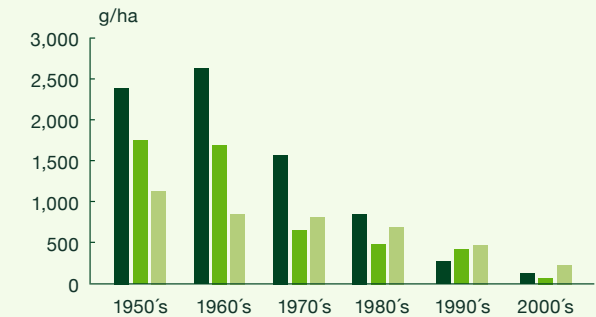
<sup>4</sup> Environmental impact is defined as the potential effect on non-target organisms

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



The Global Agrochemical Market Trends by Crop, Phillips McDougall, 2017

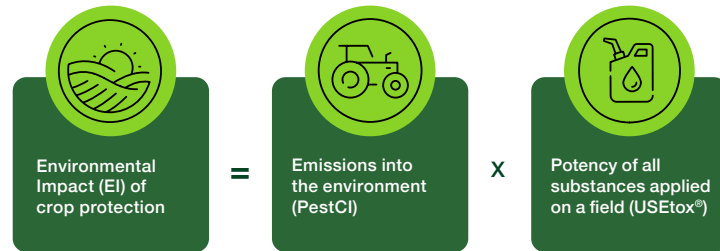
### Crop Protection (CP) efficacy is higher = less CP/ha needed for same level of control



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



## Developing and adopting a science-based model



### Input data processed by the models

- Crop protection application data
- Substance data
- Crop & soil
- Weather patterns

Since 2019, we have 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. USEtox® is being developed under the auspices of the United Nations Environment Programme (UNEP) and the Society of Environmental Toxicology and Chemistry (SETAC).

**We are actively collaborating with DTU to apply these models to a global data set of crop protection applications, and to assess progress against our 30% crop protection environmental impact reduction target.**



[Read the methodological report here](#)

The application of the models and the global impact assessment to this target 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, the independence of the university's scientific research work and model development has been respected and safeguarded at all times throughout the process. 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.



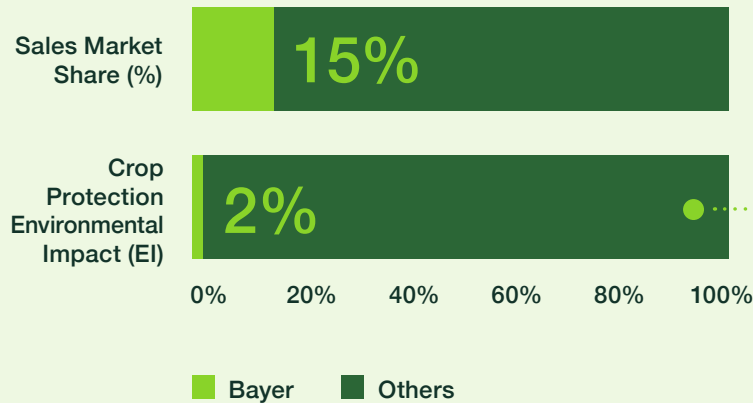
Additionally, in 2023, we initiated a collaboration with the **Technical University of Denmark (DTU)**, the **Ohio State University** and the **Technical University of Munich** to develop a pollinator module for Life Cycle Assessment (LCA) under the project acronym **PollLCA**. This initiative is grounded in the same rigorous and scientifically robust approach that has underpinned our successful work within the CP Environmental Impact Reduction (CP EIR) framework. The project is scheduled to run for three years, concluding in 2026. The integration of this pollinator module into the LCA framework will be facilitated by the USEtox consortium and undergo review by UNEP/GLAM to ensure accuracy and alignment with global standards

## Taking responsibility for our share of impact

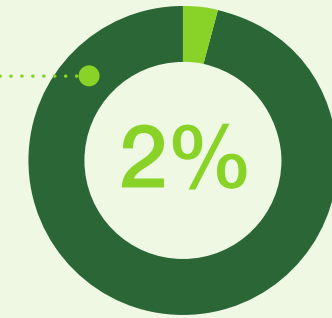
While we already scrutinize the impact that our new and existing products have on the environment, with this new methodology, we will be able to assess the complete global crop protection portfolio. And we will be even better positioned to help growers increase their output with less impact on surrounding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

Using the methodology, assessments show that despite our strong global market position, **Bayer products only account for about 2% of the environmental impact from crop protection in 2021**. While this new measurement is encouraging for our business, it 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.

### 2021 Crop Protection Industry Environmental Impact<sup>5</sup>



### Bayer products accounted for only



of the Environmental Impact from Crop Protection in 2021

<sup>5</sup> 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®*. Crop Protection application data mostly from third parties such as *Kynetec/Kleffmann* in some countries based on Bayer estimates



## Progress

Based on the data collected between 2018 to 2022, Bayer has reduced the treated-area-weighted environmental impact per hectare of our global crop protection portfolio by 12% against the 2014 – 2018 baseline. The reduction was mainly the result of changes in our crop protection product portfolio in recent years





## Identifying and pulling the levers for impact reduction

Aligned with our regenerative agriculture visions, we have identified a number of different technologies that can be deployed to help **progress towards our target of a 30% reduction in our treated-area-weighted environmental impact per hectare of Bayer's global crop protection portfolio** by 2030 against a 2014 – 2018 average baseline. 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



Striving for safe, responsible use of crop protection products

### 1 Improving the chemistry of crop protection products

One straightforward way we can reduce the environmental impact of our crop protection products is by adjusting their chemistry. We are striving for active ingredients with reduced effects on non-targeted plants and species. And we are 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 targets to impact reduction as an additional decision-making criteria.** To ensure delivery of our efforts, we plan to initiate mitigation measures in geographic areas and with specific crops where our crop protection environmental impact is currently higher compared to our baseline. Our scientists are using new approaches - such as CropKey - in the discovery of crop protection products, allowing us to reach safety and sustainability profiles that go above and beyond current standards.



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



[Learn more in our Sustainable Use chapter](#)

## 2 Reducing the amount of crop protection products needed per hectare

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 are putting our focus on tools that can help farmers apply the right amount of crop protection in exactly the right place at the right time.

Through our innovative **Climate FieldView™** Technology and offerings such as [MagicTrap](#), [MagicScout](#) or [MagicSprayer](#), 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. Precision application tools are key to advancing benefits of regenerative agriculture.

### New seeds and traits

By breeding new crops specially designed to withstand and fight against pests and diseases, we are aiming for less chemical crop protection to 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 7-year Bayer trial of Intacta soybeans planted in South America revealed a **30.7% reduction in environmental impact<sup>6</sup>** across herbicides and insecticides.

## 30.7% reduction in Environmental Impact

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.

<sup>6</sup>Calculated based on trial data with the PestLCI and USEtox® models

### Biologicals

**Our biological crop protection portfolio is one of the industry leaders with more than 20 commercial products, reaching 60 million acres in row crops and high value vegetables.** Recent launches, like Flipper™ and Serenade™, provide excellent control options in organic production systems and are complementary to our conventional crop protection. [Vynity Citrus®](#) is the first product on the market that is formulated with pheromones and natural pyrethrum to control pests in citrus fruits.

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 biological products provide growers with a broad choice for pest and disease management. Biological solutions are key to advancing benefits of regenerative agriculture.

**Accelerating development of biologicals through collaborations with:**



Driving the development of biologicals is promising as it addresses both environmental concerns and business potential. **Bayer recently entered a strategic partnership with Spanish biologicals company Kimitec**, focused on accelerating the development and commercialization of biological crop protection products, as well as biostimulants, to promote plant growth.

Another **partnership** was established **with French company M2i Group** to supply fruit and vegetable growers around the world with pheromone-based biological crop protection products. In 2022, **Ginkgo Bioworks became a multi-year strategic partner** with Bayer to develop biological solutions in areas such as nitrogen optimization, carbon sequestration, and next generation of crop protection.

Offering substantial reductions to environmental impact, the biologicals market is expected to more than double to around 30 billion euros by 2035.<sup>7</sup>

<sup>7</sup> *Global Agricultural Biologicals Market, Forecast to 2030, Frost & Sullivan, 2022 and internal estimates*



[Bayer's Crop Science Innovation Update 2024: Learn more about our journey towards regenerative agriculture](#)



[Winners 2022 - AGRITECHNICA](#)



[See more details around the efforts to be responsible product stewards in the Sustainable Use chapter of this report](#)

### 3 Helping farmers reduce crop protection emissions to the environment with innovative technologies

At Crop Science, a division of Bayer AG, we leverage a range of technologies from application technology to how the product is designed and formulated to reduce the crop protection emissions to the environment.

**DriftRadar**, our integrated drift management concept, simplifies pesticide application by using product label information and real time wind data to create an application map. If necessary, it activates drift-reducing nozzles and maintains buffer zones and distance control automatically. All activities, including weather data, are recorded for monitoring and analysis. **DriftRadar 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 the 2022 Agritechnica, a leading global trade fair for agricultural machinery and equipment.

In 2023, Bayer announced **two new precision application tools** “**MagicScout**” and “**MagicSprayer**”. “**MagicScout**” is an app that was designed to make field assessments easier and faster and allows images of weeds and pests to be individually analyzed by the system. In a matter of seconds, it can identify and document more than 140 weed types, diseases, and insect species in more than 20 countries around the world. “**MagicSprayer**” is a spot sprayer with precision down to the individual plant level, that automatically executes the spraying program only where it is needed, enabling reduced crop protection risk and volume.

### 4 Striving for 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 counterfeit products from the market that may pose a threat to the environment**. And we are taking extra care to train landowners on prudent use and the utilization of personal protective equipment to help ensure their own safety.



[Learn more about our safe use trainings in the Sustainable Use chapter of this report](#)

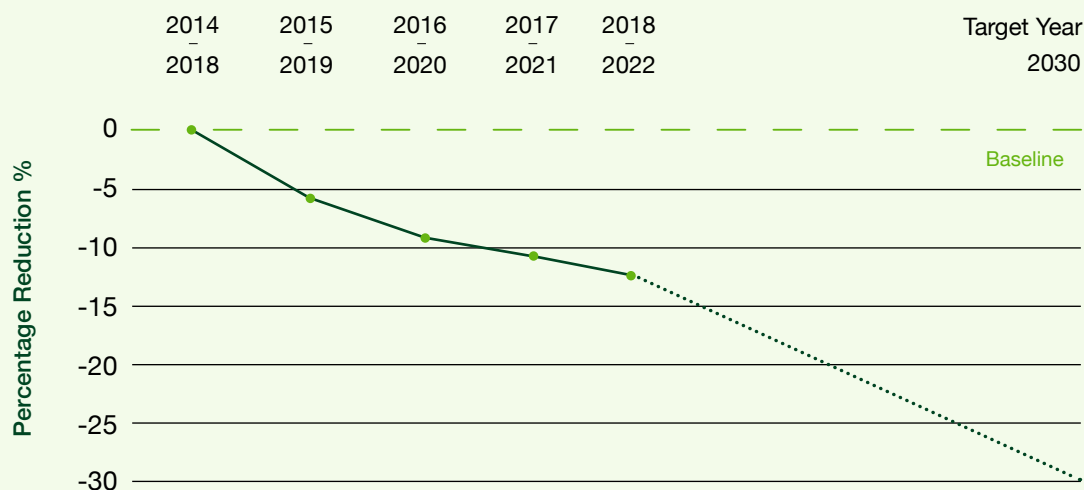
# Making greater progress towards lowering impact

## How we achieved a 12% Environmental Impact reduction, and how we will reduce further in the future

The strategic intent of our crop protection environmental impact reduction target is a continuous, relative improvement of our crop protection portfolio (chemical and biological) against the baseline.

### The main contributors to the 12% reduction so far are:

- 1 The criteria we use internally governing how **we develop new crop protection products**.
- 2 **Which crop protection compounds we in-license or acquire.**
- 3 **Which crop protection compounds we decide to phase-out or divest.**
- 4 **How the products are used** by the farmer (amount, application method, etc.) and how they are embedded in a crop system approach (e.g. complemented by crop rotations, cover crops, seed & trait technology, etc. which helps to reduce the amount of crop protection needed).



### We are on the path to achieve our 30% target

**Our industry leading pipeline** across Seeds and Traits, Crop Protection and Digital Solutions, which will help us deliver against our 30% target. Among the key contributors in our future portfolio are Xivana Fungicide, Plenexos Insecticide, Delaro Complete, Iblon Fungicide, Incelo Herbicide, Seeds & Traits ThryvOn™ and next generation insect control traits in maize and soybeans.

### 30% Reduction

of the treated-area-weighted environmental impact per hectare of Bayer's global crop protection portfolio

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



**Daniel Glas,**  
Sustainability Venture Lead

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[Climate FieldView](#)

[2023 Sustainability Report](#)

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

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



# Conserving Biodiversity

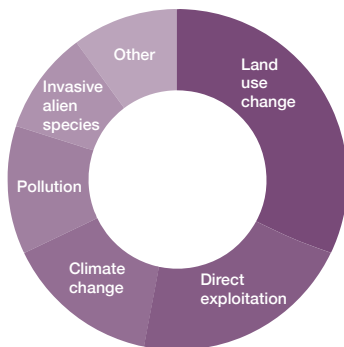
We believe farms and biodiversity can thrive together and contribute to each other's success. This is why **we seek to develop solutions and cropping systems that not only support the conservation of biodiversity but also provide tangible benefits to farmers. We address the Global Biodiversity Framework Targets 10, 13, 15 and 17.**

Our work around biodiversity conservation contributes to the following UN Sustainable Development Goals:



## 1 Sustainability Challenges

According to the [2019 IPBES Report](#), land use change and [intensification](#), as well as land degradation and habitat fragmentation, are part of the direct drivers of terrestrial biodiversity decline. **For agriculture, a balance between production, conservation, and restoration of biodiversity is needed. However, finding ways to mitigate trade-offs between agriculture and biodiversity that are timely, economical and at scale to achieve critical Sustainable Development Goals (SDGs) and targets remains a major challenge for all involved actors.**



### Biodiversity decline is a multidimensional problem

*According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report (2019), land use change, fragmentation, and degradation are the main drivers of terrestrial biodiversity decline.*

## 2 Our Approach

In line with our vision for regenerative agriculture, **we seek to develop solutions for cropping systems that not only produce more with less, but also become more regenerative in terms of soil health, more viable in terms of biodiversity conservation and more resilient towards climate change.** In this report, **we highlight promising approaches, actions, and partnerships** which underpin our engagements in the three areas of soil health, habitat and species and genetic diversity.

## 3 Main Actions

### *Protecting habitats and species*

#### Enabling forest protection in Brazil and beyond

- Updates from our Forest Protection Strategy

#### Understanding Drivers for Insect Decline

- The role of landscape management and land utilization – case study from Germany

### *Restoring soil health*

#### Our journey towards a better understanding of soil health

- Combining our solutions with regenerative agricultural practices

#### Advancing Regenerative Agriculture on our own sites

- Increasing resilience of our R&D operations

### *Sharing the benefits of genetic diversity*

#### Transforming underutilized crops for greater profitability and climate resilience

- Our collaboration with Plant Breeders without borders
- Our collaboration with Fair Planet

## 4 Progress

In the last year, the focus has been on soil health. **We received promising results from multi-year field trials, and we started to look deeper into soil biology in context of several scientific partnerships.** We also supported the alignment of metrics for regenerative agriculture outcomes in multi-stakeholder platforms, which is a prerequisite to advance monitoring and reporting. **The ProCarbono commodities program has been expanded and extended within the Forest Protection strategy, contributing to the protection of valuable habitats in Brazil and Argentina.** Our research on insect decline was deepened by conducting a correlation analysis to identify the driving factors behind this phenomenon in Germany. Through our collaboration with Fair Planet and Plant Breeders without Borders, **we promote access to high quality seeds and we contribute to crop diversification by supporting the breeding of underutilized crops.**





# Striving for balance between agriculture and nature’s contribution to people

Meeting the future demand for food, feed, fuel, and fiber while respecting the planetary boundaries, and protecting biodiversity remains a huge challenge. A recent study estimated that **at least 20% – 25% natural or seminatural habitat per km<sup>2</sup> is needed to sustain nature’s contributions to people (NCP) such as climate, water, and nutrient cycle regulation, pollination, or natural pest control.** We believe that **regenerative agriculture can contribute to many of those NCP’s by maintaining and improving soil health on agricultural fields.** Farmers will financially benefit from applying more regenerative agricultural practices in the midterm, but they need more financial and technical support in the transitioning phase ([WEF](#), [BCG](#)).

The study further mentioned that **only one-third of global human-modified lands meet the level of 20% – 25% natural or semi-natural habitat per km.<sup>2</sup>** We think it is not realistic to achieve the proposed share of habitats in intensively cropped regions. However, **when we just consider the aspect of species protection, our studies show that 3% – 10% of farmland dedicated to natural or semi-natural habitats significantly enhances species abundance and diversity.** These positive impacts are contingent upon the establishment and management of these habitats in a manner that effectively fosters and supports local biodiversity, creating interconnected habitat networks throughout the landscape. Additionally, it is essential to ensure that these habitats do not contribute to increased pest or disease pressure on adjacent crops (e.g. by cultivating host plants for pests and diseases).<sup>1</sup>

<sup>1</sup> *Pollinator diversity in Agriculture*

Landscape degradation and the associated loss of nature’s contributions to people (NCPs) are concerning, but it may not be necessary to have 20 - 25% natural or semi-natural habitat everywhere. Regenerative agriculture can help in preserving and restoring key NCPs

**Potential benefits** of regenerative agriculture according to a publication from the [World Economic Forum](#)

**80%** decrease in soil erosion, relative to conventional production

**~9-23%** of global annual GHG emissions could be sequestered in soils each year

**75K** more litres of water retained per acre for each 1% increase in soil organic matter content

**10x** more species richness in 40% of sites using regenerative practices

**2x** higher profitability for some U.S. farms, compared to farms using conventional practices



# Enabling more regenerative cropping systems

On our journey towards regenerative agriculture, we need to substantiate -step by step- how our solutions contribute to the desired regenerative outcomes and enable more regenerative farming practices. As a prerequisite, **we need to understand how outcomes like soil health and biodiversity can be measured in an affordable, scalable, and meaningful way.**

We are therefore engaged in various international multistakeholder platforms, such as the World Business Council for Sustainable Development (WBCSD) to contribute to greater alignment around regenerative agricultural metrics. In a second step, **we need to capture those metrics in relevant studies and experiments that we conduct, either internally or in collaboration with external partners.** Currently, **our focus is on soil health**, where we are experimenting with various types of soil health data and methodologies - including modern technologies such as e-DNA<sup>2</sup> analysis and metabarcoding.<sup>3</sup>

In addition, **we continue to engage in scientific partnerships to close knowledge gaps and gain insights on topics such as biodiversity monitoring, root causes of biodiversity decline and effectiveness of on-farm biodiversity measures.** The following pages provide various examples demonstrating our engagements in these areas.

<sup>2</sup> e-DNA corresponds to the DNA that has been left in the environment by organisms, which can be extracted and analyzed to monitor biodiversity or detect the presence of specific species

<sup>3</sup> Metabarcoding is a method for identifying multiple species from a complex environmental DNA sample by amplifying and sequencing standardized DNA regions and comparing them to a reference database

The current focus of our activities, categorized into three dimensions which are important for biodiversity and crop production because there is a potential to create win-win situations for farmers and biodiversity

## 1 Habitats & Species

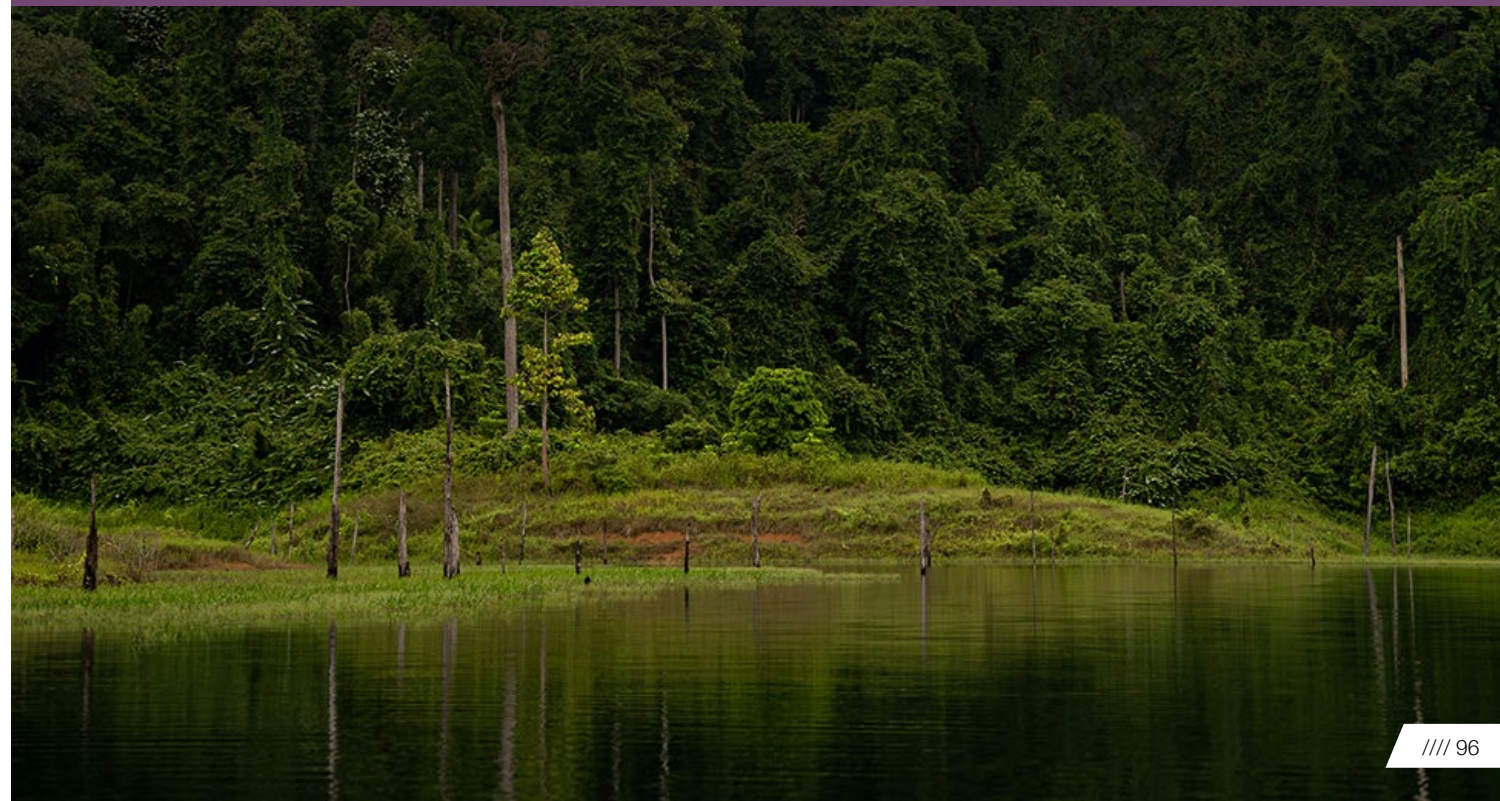
- Helping food chain companies to proof conversion-free and biodiversity-friendly supply chains
- Contributing to a better understanding of the root causes of insect decline

## 2 Soil Health

- Collecting data and insights to better understand soil health outcomes and Bayer's contributions
- Deep dive in soil health metrics and contributing to international alignment

## 3 Genetic Diversity

- Engagements in policy dialogues around creation of a workable system for access and benefit sharing
- Collaborating with partners to support breeding on underutilized crops





## 1 Habitats & Species

# Enabling forest protection by creating value for standing forests and native vegetation

In 2023, we launched our global “**Bayer Forest Protection Strategy**”, which aims to **increase our positive impact on the agricultural chain and take a leading role in the conservation of forests and biomes.**

## Enabling forest protection

Bayer is taking significant strides towards environmental sustainability by accelerating the implementation of net zero deforestation in its supply chain and enhancing traceability systems. To ensure the effectiveness of this initiative, **Bayer intends to apply and monitor 15 socio-environmental assessment parameters of its soybean and corn seed supply chain activities.** Those standards include assessment of non-overlapping with indigenous or quilombola<sup>4</sup> lands and conservation units, slave labor list, list of areas embargoed by environmental authorities (IBAMA, SEMA, and ICMBio), as well as environmental compliance with the Forest Code and assessments from the Rural Environmental Registry (CAR). This monitoring covers 100% of our Agroeste seed production area (Bayer direct brand) and 70% of our own corn seed production, compared to 50% in 2022.

## Creating value for standing forest

After the successful pilot of our **PRO Carbono Commodities program** within the Cerrado and Amazon biomes, **we were able to expand this program to the states of Minas Gerais and Mato Grosso do Sul.** The goal for the second year of this collaboration with ADM is to further reduce the carbon footprint of soybean production and monitor zero deforestation. **We also launched the PRO Carbono Commodities program in Argentina with agribusiness company Viterro to measure the carbon footprint of deforestation-free soybeans across one million hectares.** This initiative aims to engage over 300 producers, incorporating extensive data collection, quality control, and third-party audits, ultimately rewarding a more sustainable soy production.

## Understanding the value of tropical forests and regenerative agriculture

Over the next five years, the Amazon Research Institute (IPAM) and the Woodwell Climate Research Center will delve into the interrelationship between agriculture and natural vegetation conservation in the Amazon and Cerrado biomes. With a 1.7 million euros investment from Bayer, **the researchers will assess the value of the ecosystem services that forests and regenerative agricultural practices provide to agriculture.** This research will aid in improving landscape planning and help farmers support forest conservation.

<sup>4</sup>A quilombo is a Brazilian hinterland settlement founded by people of African origin, and others sometimes called Carabali. Most of the inhabitants of quilombos, called quilombolas, were maroons, a term for escaped slaves



[Learn more about the partnership with Amazon Research Institute \(IPAM\) and the Woodwell Climate Research Center](#)

## 1 Habitats & Species

# Understanding drivers for insect decline

Current reports indicate a global decline in insect abundance and biodiversity, with broad consensus that this decline is a key environmental issue.

**Recognizing land use intensification as a likely driver of insect decline, Bayer established a working group to analyze the causes and identify countermeasures for farmers and society. This effort is part of our holistic approach to understanding biodiversity in agriculture and balancing it with nature conservation.**

One of our research approaches has been evaluating long-term data regarding the development of insect populations and communities to better understand the drivers of changes and pressures on insect biodiversity. Our study analyzing insect population and biodiversity trends in Europe over the past 250 years found that **most pressures operate at a landscape level – influencing availability and condition of habitats.** This suggests long-term structural changes in the landscape as causes for insect decline.

Land use intensification and changes in landscape structures played a key role among the factors linked to decline processes. This highlights the importance of landscape management as a main driver behind the long-term development of insect populations.

Another ongoing, large-scale analysis looks at potential factors linked to insect decline and their correlations to measured decreases of insect abundance, in an exemplary region of Germany where the decline is well documented. Again, key correlations are with the development of landscape management features, such as urbanization and land use intensification, grassland management intensification, or intensification of livestock farming.

**The results underline the importance of the structure and the management of cultural landscapes.**

A detailed evaluation of the findings will be instrumental for conceiving measures in agricultural practice that can help counteract insect decline.



## 2 Soil Health

# Our journey towards a better understanding of soil health

2024 marks an exciting year for soil health, as **we observe promising outcomes and trends in our multi-season field trials**, which test the performance of our products and solutions over entire crop rotations. Additionally, **we are delving deeper into soil biology through the BioMonitor4CAP collaboration.**

Initial results from our Bayer ForwardFarm in Argentina, where we compare sustainably intensified fields (SIM) with average farm management (AFM) since 2014, show higher macro- and meso-fauna abundances in SIM fields. **These fields employ regenerative practices such as cover cropping, more diverse crop rotations, and input optimization.** Higher fauna abundances and biomasses indicate increased biological activity, which is crucial for maintaining and improving soil functionality.

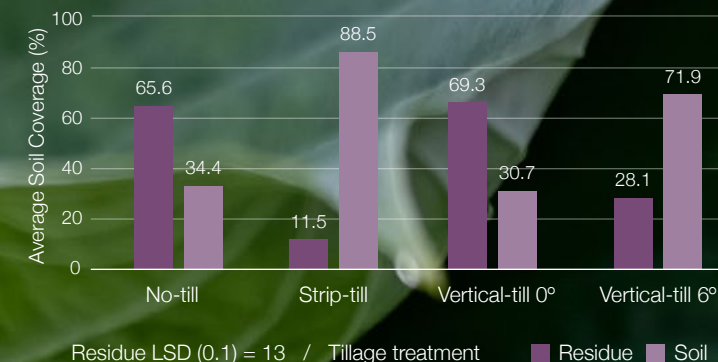
We also conduct long-term field trials (over 3 years) at five Bayer sites across different agroclimatic zones in the U.S. These trials investigate the effects of crop rotation, tillage practices, nitrogen management, and cover crops on yield, yield stability, water use efficiency, carbon balance, and soil health. Our goal is to develop agronomic advice tailored to various agroclimatic conditions.

So far, results indicate that no-till or reduced tillage and more diverse crop rotations, including corn, soy, and wheat, lead to higher yields under dry conditions, such as those in Gothenburg, Nebraska. No-till or reduced tillage practices also result in excellent soil residue coverage (up to 70%), compared to strip tillage (12%), helping to prevent erosion and retain soil moisture. Cover crops have shown mixed results on corn and soybean yields, depending on factors like species selection, biomass production, climatic conditions, and timing of termination. However, additional trials in Gothenburg demonstrate that cover crops are effective in suppressing herbicide-resistant weeds.

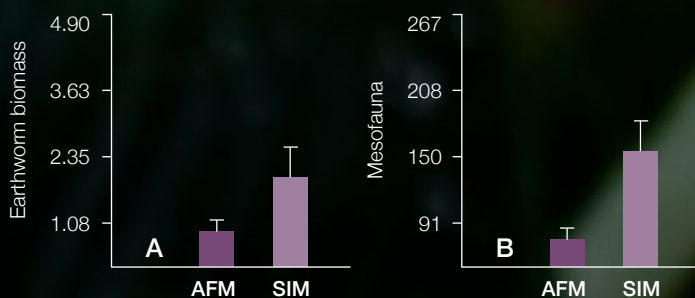


[Learn more about the Central Plains trials here](#)

### Average Percent Soil Coverage by Tillage Treatment Gothenburg, NE (2023)

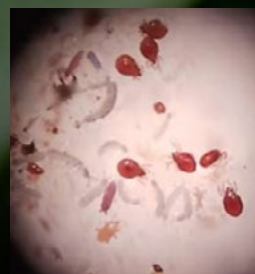


**Figure 1:** average soil coverage as affected by tillage at planting at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023)



**A:** earthworm biomass (grams) of earthworms in Actual Farmer Technology (AFM) and Sustainable Intensified Management (SIM)

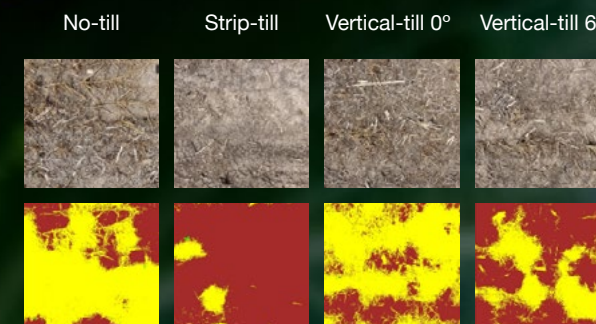
**B:** abundance (number of individuals) of total mesofauna in Actual Farmer Technology (AFM) and Sustainable Intensified Management (SIM) systems



Sample of mesofauna with predominance of Oribatids, in the microscope



Sample of mesofauna with predominance of Collembola, in the microscope



**Figure 2:** a sample of images taken at planting from the four tillage treatments classified using the Stover App. Yellow represents residue cover

## 2 Soil Health

# Advancing regenerative agriculture in Vegetables' Research & Development

Vegetables' Research & Development sites worldwide are embracing regenerative practices to enhance sustainability. Here, **we highlight efforts at global sites, including Woodland, California, Murcia, Spain, and Latina, Italy, aimed at promoting sustainable farming operations and reducing environmental impact.**

### 📍 Woodland, California, U.S.

At our Woodland, California, U.S. site, **we have initiated a holistic approach to land management, prioritizing soil health and quality trials.** Strategic farming practices, including cover crops, root crops, and pollinator habitats, have been implemented to minimize tillage, herbicide use, and soil compaction, **while promoting biodiversity and enhancing soil health.** Additionally, the site completed a solar project, generating renewable energy and reducing carbon emissions.

The collective efforts at these global sites reflect Bayer's approach to regenerative practices and environmental stewardship. **By integrating regenerative farming techniques, renewable energy solutions, and innovative soil management approaches,** Bayer's Vegetable Research & Development sites are making **significant strides towards more sustainable operations.**

### 📍 Murcia, Spain

In Murcia, Spain, **we have integrated cover crops into farming practices to improve soil health and reduce the need for nitrogen fertilizers.** The incorporation of peas into the soil has enriched it with nitrogen and organic matter, contributing to sustainable soil management. The site also observed an increase in earthworm presence due to the incorporation of biomass back into the fields.

### 📍 Latina, Italy

The Vegetable R&D site in Latina, Italy, **is pioneering a new methodology for soil solarization in greenhouses using Solin,** a vegetable black carbon product. This innovative technique **has successfully controlled soil-borne diseases** without resorting to chemical soil treatments.

### 3 Genetic Diversity

## Transforming underutilized crops for greater farmer profitability and climate resilience

Plant Breeders without Borders (PBWOB) shares knowledge and plant breeding skills in low- and middle-income countries (LMIC's) through the volunteer efforts of experienced plant breeders, agricultural students, and partners. They also empower smallholder farmers by encouraging the cultivation of underutilized crops with highly nutritional components and greater resilience to the effects of climate change. **Members of the Bayer team have been collaborating with PBWOB to host plant breeding workshops in Ecuador, Nepal, and Tanzania focused on improving important indigenous and traditional food crops.**

The workshops focused on Andean Lupino, locally known as 'chocho' in Ecuador; finger millet, foxtail millet, sweet buckwheat and Tartary buckwheat in Nepal; and Bambara groundnut and sesame in Tanzania. **Participants learned about theory, as well as practical field training on the principles of crop improvement.** These week-long sessions involved learning about the flower structure of the crop of interest and practicing how to perform pollination to transfer the desired plant characteristics to the next generation. During the workshops, farmers and researchers also discussed the basics of identifying crop market needs in their local areas and farm management tools to support their operations. **The aim was to assess how crop productivity, specifically increased yield, from plant breeding activities could improve on-farm profitability.**

Plant breeding is a long-term game. Crossing the best parents and then identifying the best offspring of those crosses after each growing season offers the potential to continuously improve crop quality and resilience. The application of plant breeding principles in the field proved to be a fruitful opportunity for workshop participants – local researchers and farmers alike.

Improving productivity, especially for underutilized crops, is essential for income and food security in the midst of shifting climate patterns and less rainfall overall in the region. When drought conditions do hit, crops can fail. This reflects just some of the real concerns participants shared during the workshops. **Farmers need broader access to innovation and practical knowledge to mitigate risks, and ultimately ensuring more reliable food sources and income stability in changing weather scenarios.** All germplasm developed through the program is made freely available through germplasm resource centers, allowing **knowledge to be transferred to support smallholder farmers in other regions as well.**



[Learn more about transforming underutilized crops here](#)



### 3 Genetic Diversity

## Fostering partnerships for sustainable agriculture and crop improvement

In 2023, **Bayer Corporate Giving** helped to kick-start a **five-year Seed Resilience Project** led by Fair Planet and the International Seed Federation (ISF) in Rwanda. Through this Seed Resilience Project, ISF seeks to strengthen **the contribution of the private sector in supporting farmers, particularly smallholder farmers, by establishing a robust seed supply chain and facilitating capacity building.**

Collaborating with the Horticulture Center of Excellence and the Rwanda Agricultural Board in Kigali, **the project embarked upon open field and greenhouse trials in September 2023.** These trials involved 61 varieties of vegetable crops such as carrots, cabbages, onions, tomatoes, and peppers provided by eight companies, including three local and five multinationals.

**The preliminary results have been promising, with most crops showing adaptability to smallholder farming conditions and, in some cases, yields surpassing existing local varieties significantly.** Notably, the carrot varieties tested yielded five to ten times more than the averages reported by the Food and Agriculture Organization (FAO).

**Training and development of farmers in Ethiopia remains a key focus for Fair Planet,** with Bayer and seed partners collaborating long-term.

*“Our partnership with Fair Planet and the generous support from Bayer Corporate Giving mark a pivotal moment in agricultural innovation and sustainability in Rwanda. By empowering smallholder farmers with superior seed varieties and comprehensive training, we are not just enhancing seed resilience, but also paving the way for a future where food security and farmer prosperity go hand in hand”*

– VK Kishore,

Bayer’s Global Head of Vegetable Seeds  
Smallholder & Sustainability



[Bringing ISF’s Seed Resilience Project to Life in Rwanda – Seed World](#)

## Collaborating for nature positive

Farmers have the potential to increase the resilience of their farming operations while preserving or restoring nature's contributions to people such as climate, water, and nutrient cycle regulation. However, they need financial and technical support to implement the necessary practices and solutions. We will do our part to support them by co-developing knowledge and solutions with our farming customers, academia and other stakeholders.

**We will continue our soil health related research activities, and we are looking forward to sharing more outcomes and insights which hopefully help to prove that investing in soil health pays off.**

The broad implementation of mechanisms to leverage benefits for farmers through the preservation or restoration of (semi-natural) habitats remains a challenge. While **the value of ecosystem services like pollination and natural pest control is well-recognized, understanding the complex mechanisms that limit their predictability and quantifiability remains incomplete. Habitat-related measures often involve trade-offs, such as pollinator habitats improving yields for some crops but potentially reducing available growing area. We will take a closer look at the current knowledge around natural pest control** to gain more insights into questions like whether and how respective habitat management practices could pay off for farmers. Our collaboration with IPAM and Woodwell in the Amazon/ Cerrado region might also increase our understanding of the value of habitats. Stay tuned!

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**Besides soil health, crop genetic diversity plays a vital role in helping farmers to adapt to climate change. We also continue to support relevant seed banks as well as selected breeding programs for underutilized crops**



[Learn more about our ambition for biodiversity](#)



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# Conserving Water: Agriculture's Most Essential Input

The scarcity of fresh water affects farmers worldwide. Water shortages are not only caused by the growing demand for this resource, coupled with climatic changes, but also by the deterioration of water quality, which reduces the quantity of water that can be used safely. The agricultural sector, consuming nearly 70% of global freshwater, plays a crucial role in addressing these challenges while ensuring food production and global food security. **At Bayer, we recognize the importance of water challenges and want to help alleviate the global water crisis.**

**Our work towards conserving water contributes to the following UN Sustainable Development Goals:**





## 1 Sustainability Challenges

Water scarcity is emerging more and more as a critical challenge driven by a range of demographic and economic pressures (e.g., population growth, rising wealth, increased meat and dairy consumption, and expanding biofuel production) that increase water demand and put high pressure on water resources. The deterioration of water quality also reduces the quantity of water that can be used safely.

**As the global population grows and the planet warms up, water resources are expected to dwindle even further, leading to a 40% gap between supply and demand in 2030.** The agricultural sector, which accounts for nearly 70% of global freshwater consumption, is central to addressing these challenges. To meet the growing demand for food, agriculture needs to use water resources more effectively and become more water-efficient and productive – especially in water-scarce regions.

## 2 Our Approach

**We aim to build water resilience through a holistic water strategy that anticipates potential water-related risks and leverages our innovation skills to build business opportunities while adding value to society.**

At the [UN Water Conference](#) held in New York in March 2023, we released [our new water strategy](#), which aims to have a transformational impact that goes beyond our own operations and reflects our willingness to contribute to climate resilience and more sustainable water usage. Our efforts will encompass all water dimensions along the entire value chain, from our own operations to the farmers we work with.

To this end, we will incorporate water into our investment processes, provide safe water, sanitation and hygiene (WASH) to our employees, set context-relevant water targets for our own operations, and make use of our external partnerships and participation in multi-stakeholder platforms to promote appropriate collective action and engagement on water.

## 3 Main Levers (in Agriculture)

- **Innovation** in seeds and crop protection portfolio
- **Leveraging partnerships** and **advancing water-efficient agriculture**
- **Digital enablement** and promotion of **Good Agronomic Practices**
- **Future-proofing** of sustainable food production

**Our target in agriculture:**

**Support our smallholder customers to increase water productivity<sup>1</sup> by 25% by 2030** against a 2019-2021 average baseline<sup>2</sup> by transforming rice cropping in the relevant geographies where Bayer operates, starting in India.<sup>3</sup>

# 25% by 2030

<sup>1</sup> Water productivity is defined as kg of crop yield per volume of water applied (Kg/m<sup>3</sup>)

<sup>2</sup> Baseline validation still ongoing

<sup>3</sup> Our water target is currently focusing on "DirectAcres Initiative" which aims at supporting farmers shift successfully from transplanted puddled rice to mechanized direct seeded rice

## 4 Progress

Our mission "Health for all, Hunger for none" cannot be achieved without building a water-resilient agriculture. Aiming to protect water resources and improve water use-efficiency, **Bayer has enshrined water at the core of its strategy and set an ambitious water target beyond our own operations.** Our innovative potential is used to develop scientific solutions that help build more water resilience in agriculture. In addition, we leverage our partnerships to encourage engagement & action on water and join efforts to build, test and promote solutions and agronomic practices that have the potential to drive a more water efficient agriculture.

# The water crisis: growing sufficient crops in the age of water scarcity

## Agriculture takes the biggest drink of all

Perhaps it's a little ironic that while the beautiful blue planet that sustains so much life is nearly 71% covered in water, most of it is unusable for the bulk of its inhabitants. This precious resource is getting even scarcer as demand increases and water supply is affected by a decrease in quantity or quality.

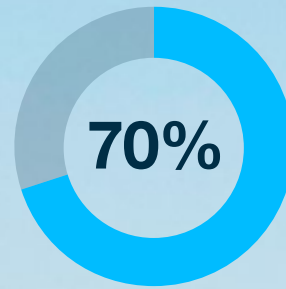
Climate change and variability have the potential to aggravate the water crisis and add additional pressures on water availability, accessibility, and demand.

As a major water consumer, accounting for 70% of global freshwater withdrawals, primarily for irrigation, **the agricultural sector is among the most vulnerable sectors**. Disturbances in the hydrological cycle can lead to dramatic impacts in terms of crop losses, shifts in cultivation land and growing conditions, pest incidence and volatility of prices, among others. While the severity of water losses may vary depending on the region, **the impact will be felt on a global scale in terms of food shortages, mass migration and increasing risk of conflicts and economic crises**. In addition to the implications on water-use efficiency and water availability, agricultural production systems are also known to be closely linked to water quality concerns. From this perspective, water scarcity is not only caused by the physical insufficiency of the resource, but also by the deterioration of water quality, reducing the quantity of water that can be used safely.

# Less than 1 %

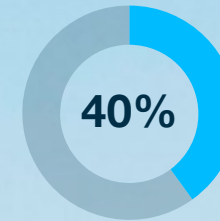
of Earth's water is available for humans

Agriculture accounts for nearly



of global freshwater withdrawals, primarily for irrigation<sup>4</sup>

Irrigated agriculture contributes to



of the food worldwide<sup>5</sup>

<sup>4</sup> World Bank Group

<sup>5</sup> The World Bank



# Curbing agriculture's oversized thirst

Without evolving agriculture's tools and practices or a concerted effort to protect and make more efficient use of water resources, the global food system is potentially at risk. Though the statistics may seem daunting, we believe that the situation can be overturned. **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.**

With our potential to develop innovative and scientific solutions that help build greater water resilience in agriculture, **Bayer is uniquely positioned to achieve significant impact at scale.** We see the opportunity to partner with farmers and other stakeholders to provide solutions that make agriculture more water-efficient and productive in water-scarce regions, allowing farmers to continue their livelihoods while staying within local water constraints. **This is clearly reflected in our target: Support our smallholder customers to increase water productivity<sup>6</sup> by 25% by 2030 against a 2019-2021 average baseline<sup>7</sup> by transforming rice cropping in the relevant geographies where Bayer operates, starting in India<sup>8</sup>.**

We will leverage our expertise and innovative seeds and crop protection portfolio, promote the use of efficient water management systems, and capitalize on our digital farming solutions. Together with our partners, we will strive to promote water-smart solutions and enhance best practices for better and more responsible water use.

<sup>6</sup> Water productivity is defined as kg of crop yield per volume of water applied (Kg/m<sup>3</sup>)

<sup>7</sup> Baseline validation still ongoing

<sup>8</sup> Our water target is currently focusing on "DirectAcres Initiative" which aims at supporting farmers shift successfully from transplanted puddled rice to mechanized direct seeded rice



Innovation in the seeds and crop protection portfolio



Leveraging partnerships and advancing water-efficient agriculture



Digital enablement and the promotion of Good Agronomic Practices



Future-proofing of sustainable food production

*"The agricultural sector is by far the biggest consumer of water. We will not be able to bring the company mission 'Health for all, Hunger for none' to life without focusing on the water problem"*

– Matthias Berninger,

Global Head of Public Affairs, Science, Sustainability & HSE



//

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

**Top 5 global risk**

in terms of social, economic and environmental impact<sup>9</sup>

**1.8B people by 2025**

will live in regions with absolute water scarcity<sup>10</sup>

<sup>9</sup> World Economic Forum

<sup>10</sup> UN Water

# Innovation in seeds and crop protection portfolio

## Breeding for water-smart solutions

Our plant scientists today routinely advance solutions that help farmers combat environmental challenges such as pests, diseases or drought. Plants bred to be adapted to certain climates or more resistant to changing environmental conditions have better chances of survival in the field, which leads to more productive harvests. Some examples of Bayer plant breeding with an impact on water include:

### Arize® hybrid rice

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 despite unfavorable weather conditions.** This helps safeguard the nutrition and livelihoods of people in countries struck by weather-related calamities, such as those occurred in the Philippines, India, and Bangladesh.

<sup>11</sup> Performance may vary, from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields

## Cotton

Cotton is another example where we continuously strive for further improvements through breeding and technology advancements. As shown in the figures to the right, with our focus on improving water efficiency, our cotton commercial varieties deliver improved water productivity compared to average market performance.

## Tomato varieties

At Vegetables by Bayer, we are working to improve growers' resilience to water and climate stress. **Over the last two years, we conducted trials with our Seminis® processing tomato varieties, comparing different irrigation schedules by mimicking growers' practices to adapt to water restrictions.**

The goal was to demonstrate the stability of the products under drought stress and recommend their optimal use in such conditions. Initial findings revealed that the yield was maintained and consistent performance was observed across the varieties, particularly SVTM9036 and SVTM9037, with a 20% potential reduction in water usage compared to a standard irrigation schedule.<sup>11</sup>

## High performance of our Deltapine cotton varieties in reduced and limited moisture conditions across three years of testing

Top 3 Deltapine products versus calculated market average under 60% ET<sup>12</sup> irrigation treatment

**↑ 10%** higher water productivity (amount of yield per unit of water used)

Profit difference of

**\$147 USD/ha**

Top 3 Deltapine products versus calculated market average under 0% ET<sup>12</sup> irrigation treatment

**↑ 16%** higher water productivity (amount of yield per unit of water used)

Profit difference of

**\$117 USD/ha**

Calculations based on A&M University crop budgets, USDA loan chart data with a \$0.52 base and Bayer cotton trial data from 2021, 2022, and 2023

<sup>12</sup> ET = evapotranspiration, representing the amount of water that is supplied to a plant. If a crop receives 0% ET, it means no irrigation water is provided after stand establishment and the plants rely solely on natural rainfall

## Helping smallholder farmers in India produce more with less

**10-15%**

increase in yield<sup>13</sup>

**8-9%**

less non-marketable fruits

**6.5%**

of water saved potentially<sup>14</sup>

100%-win rate. All comparisons are head-to-head comparisons of Seminis® Aryaman, Seminis® Garv and a leading competitor variety. Based on 62 trials in 2016-2019 by Bayer in the primary target market - central west India (Maharashtra region)

<sup>13</sup> Calculated average yield/ha - Aryaman: 45 tonnes/acre or 111.197 tonnes/ha (3,000 boxes of 15 kg); Garv: 39 tonnes/ acre or 96.371 tonnes/ha (2,600 boxes of 15 kg); Leading competitor variety: 42 tonnes/ acre or 103.784 (2,800 boxes of 15 kg)

<sup>14</sup> This is an approximate calculation on water efficiency compared to Seminis® Garv and a leading competitor variety. Approximate liter of water required per acre for Aryaman: 600,000 liters while for Seminis® Garv and a leading competitor variety: 642,000 liters. These tentative calculations depend on precipitation from that season and the average rainfall (RF) in Maharashtra is 600 mm. This water calculation is based on 6,000 plants per acre and 6,000 drippers per acre with 2 liters per hour discharge capacity and irrigation on alternate days for one hour

# Leveraging partnerships and advancing water-efficient cropping systems

## Transforming rice-cropping systems

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 (165 million hectares<sup>15</sup>) and up to a whopping 43% of the total water used for irrigation goes towards cultivating rice.

Transplanted puddled rice is the most common cultivation system. It is also a method that is land, water, labor, capital and energy intensive — and becoming less profitable as resources become increasingly scarce. Over the next two decades, **it will be necessary to move to a more economically viable and sustainable rice production method** if we are to ensure abundant grain availability, mitigate and adapt to climate change and improve the quality of life of smallholder rice farmers around the world.

One of the most promising solutions to these challenges is **Direct Seeded Rice (DSR)**. DSR is a technology-driven and less resource-intensive cultivation system. To help farmers transition to DSR, we launched the **DirectAcres program**, starting in India, with the vision of shaping the future of rice and transforming its cultivation. With our portfolio of high-yield rice hybrids that can be directly seeded, such as Arize® 6444 Gold and Arize® 6555, we are working to provide rice farmers with a crop that requires less water, energy and labor than conventional transplanted rice, while also reducing GHG emissions.

**Our ambition is to continue developing high-performing seeds bred specifically for the DSR system and tailored to different farm environments.** The crops are protected using safe, effective and targeted crop protection products, in particular weed control. Empowered by innovation, our tailored system will be digitally enabled, grounded in sustainability, and promoted by partnerships.

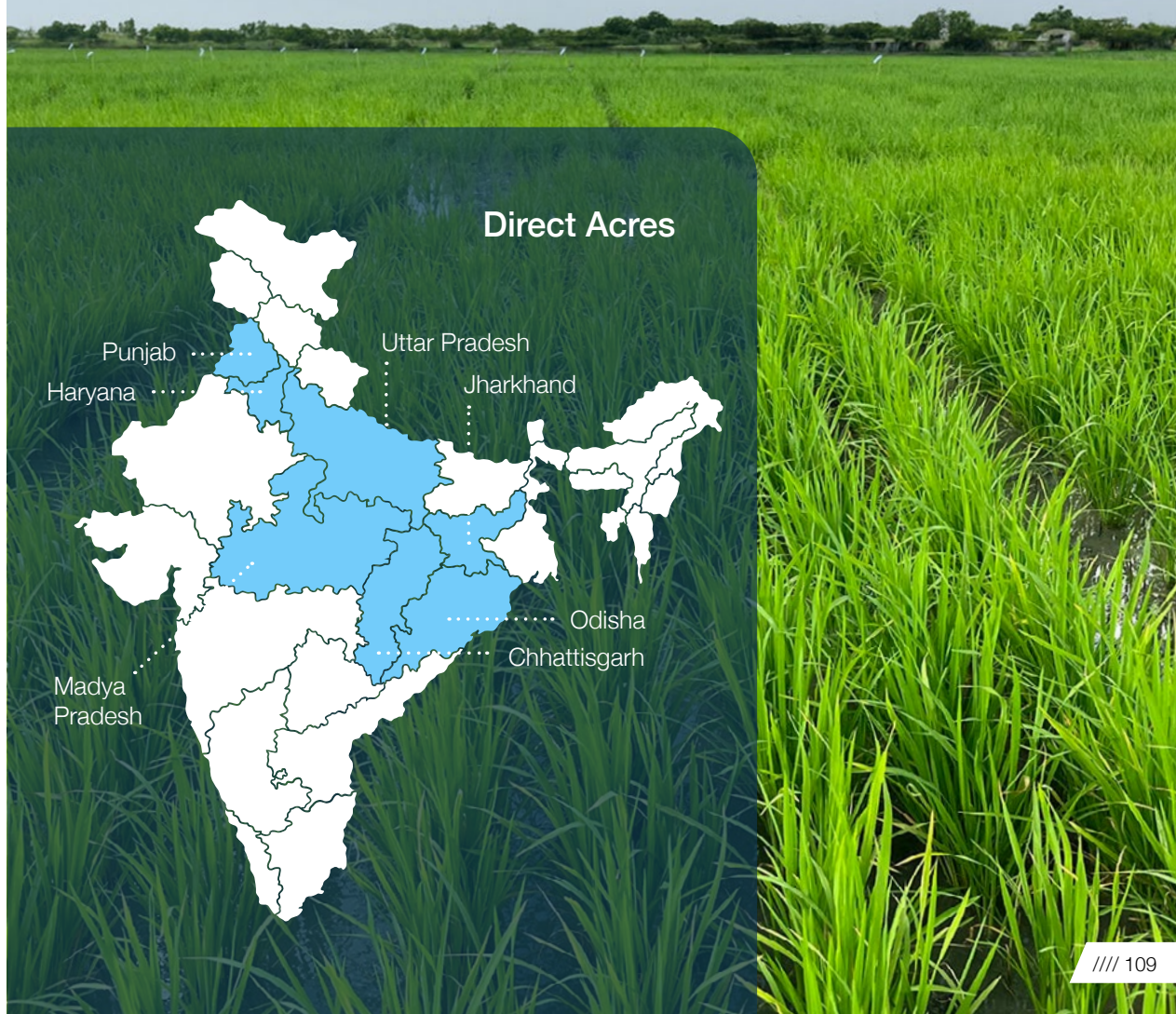
<sup>15</sup> [World Economic Forum - A global rice shortage is possible in 2023 - here's why](#)

**43%** of the world's irrigation water withdrawals go to rice

[Science Direct - Use of efficient water saving techniques for production of rice in India under climate change scenario](#)

**4B** people worldwide rely on rice as essential daily nutrition

[National Library of Medicine - Rice: Importance for Global Nutrition](#)





## Transforming rice-cropping systems

In 2023, we successfully brought DSR to 4,500 hectares in India through the DirectAcres program, achieving 90% farmer satisfaction with germination and weed management, when compared to using the traditional transplanted cultivation methods. In 2024, we have scaled up the project to around 18,700 hectares (as of end of September 2024), with the goal to reach 1,000,000 hectares in India by 2030.

In addition to our DirectAcres program, **we are also partners of the Good Rice Alliance:** learn more about how we are [collaborating with GenZero and Shell to reduce methane emissions in rice cultivation](#).

### Benefits of DSR



**Increases farm efficiency**



**Reduces water consumption** by up to 40% per ha



**Reduces drudgery** due to growing process of DSR



**Reduces GHG emissions** by up to 45% per ha



**Improves soil health** due to optimized water use & tillage



**Improves smallholders' livelihoods** through reduced cost of cultivation and improved ROI



**Shortens the duration of crop by 7 – 10 days** giving ample time for the growers to plant next crop in a timely manner

Numbers calculated for Paddy rice & could vary for different rice cultivation practices and geographies  
Considered yield of 5 ton / ha for the Carbon & labor calculations



[Learn more about why we need to rethink the way we grow rice here](#)

## Collaborative solutions for sustainable rice farming

At Bayer, we believe the transformation of rice farming requires a collaborative approach among experts across the industry and beyond to make the best solutions accessible to rice farmers and advance adoption.

**Through our partnership with the International Rice Research Institute (IRRI), we have participated in the Direct Seeded Rice Consortium (DSRC) since 2018.** IRRI has developed the DSRC technology platform to improve crop management practices and maximize the advantages of direct seeded rice, enhancing both the economic and ecological sustainability of rice production in Asia. Through this platform, we provide access to our proprietary genetic seed materials (hybrids), and weed management technologies, for DSRC research and testing.

Building on the successful work with IRRI, at the annual COP27 conference held in November 2022 in Egypt, **we announced together with the U.S. Agency for International Development (USAID) a partnership to improve the quality of life of smallholder rice farmers through the introduction, on-farm testing and scaling of improved, climate-smart rice varieties and agronomic practices.** This four-year project, also called **“ScaleDirect”**, is funded by USAID with up to \$8.5M USD, and Bayer committed up to \$4M USD of in-kind support through 2026. We will share knowledge as well as rice hybrids and digital capacity with the research network, receiving farmer feedback from the different geographic locations. 2023 was the first year of implementation in six countries: India, Bangladesh and Nepal in Asia; Kenya, Tanzania, and Mozambique in Africa. The project successfully demonstrated a range of technologies suitable for Direct Seeded Rice (DSR), emphasizing varieties, agronomy, and seed security of the farmers in the target region, leading to the advancement of seven new DSR technologies / products (including two Arize® Rice technologies), engaged with 58 NARES (National Agricultural Research System) partners and around 4,000 smallholder farmers.

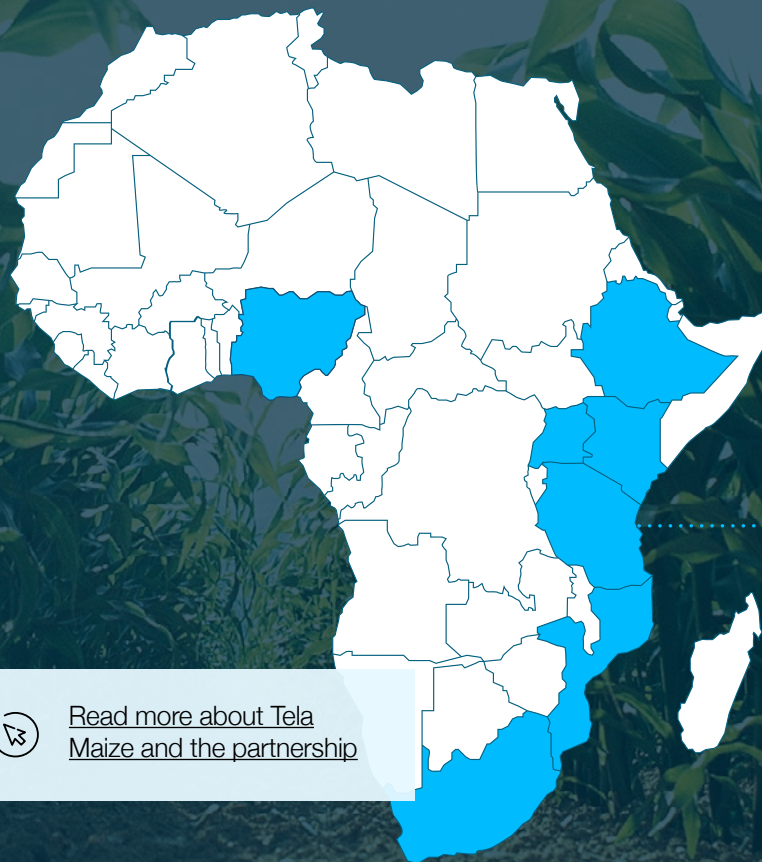
## Generating regenerative agriculture proof-points in a rice-based cropping system

Since 2023, we have **partnered with IRRI in India for a multiyear and multi-location study to generate data on regenerative agriculture outcomes.** The study assesses the impact of shifting from Transplanted Paddy Rice (TPR) to Direct Seeded Rice (DSR) on water productivity, soil health, as well as farmer’s productivity and profitability, etc. The assessment is carried out on rice as well as the following rotation crops (maize, wheat, rice) and takes into consideration the contribution of varieties and agronomic practices within the different cropping systems. Initial results indicate positive impacts of using hybrid seeds in a Direct Seeded Rice (DSR) cropping system with higher water productivity. **Results have shown between 22% - 30% improvement in water productivity in DSR with the Bayer package of practice (DirectAcres) when compared to conventionally transplanted rice.** It would take at least a couple of years to realize the impacts on soil health, the effects on rotation crop(s), and corroborate the impact on water productivity.



Since 2013,  
more than

**100** drought-tolerant hybrids have been approved for commercial release



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

Since

**2021** TELA Maize has been granted approval by the governments of Ethiopia, Kenya and Nigeria for open cultivation

## Fighting water scarcity in Africa with maize that thrives on less

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.

**We are helping address the twin issues of water scarcity and destructive pest infestations through the research and development of water-efficient technologies and products.**

Through **Water Efficient Maize for Africa** (WEMA, now operating as the 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 are helping protect harvests in water-limited conditions. The project uses conventional and advanced plant breeding together with biotechnology in the development of maize varieties designed to tolerate drought and resist pests. The program helps these smallholder farmers acquire locally adapted maize hybrids from local African seed companies without paying a trait royalty fee, allowing them to feed their families and communities, 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 Ethiopia, Kenya, Mozambique, Nigeria, South Africa, Tanzania and Uganda.** TELA Maize has been granted approvals by the regulatory authorities in Ethiopia, Kenya and Nigeria for open cultivation, with the likelihood of commercial introductions in 2024 and 2025 to provide greater accessibility to smallholder farmers in those countries.



## Partnering to incentivize water efficiency

During the previous few years, Australian cotton growers have experienced various weather challenges, ranging from prolonged periods of hot, dry weather, tropical cyclones, and above-average heavy rainfall, to late rainfall in the planting season.

Over the last few years, **Bayer has partnered with Goanna Ag to provide myBMP-certified<sup>16</sup> cotton growers access to the Water Use Efficiency Grant Program.** The 2023/24 cotton season was the final year of the three-year program, which provides eligible growers with a 12-month subscription for two Goanna Ag GoField Plus units for each cotton farming enterprise. The unit includes a soil moisture probe and a crop canopy temperature sensor, both with infield-connected sensors.

The GoField technology indicates when there are critical plant stress levels at which crop performance will be impacted. Algorithms are used to predict when the moisture stress threshold will be exceeded, enabling optimization of irrigation timing. The result is a more profitable, sustainable cotton production system. As we reflect on the program, these are the key takeaways that highlight its most valuable insights and lessons:

- **Water Use Efficiency has increased across the three years** despite differing rainfall volumes throughout the planting season period.
- **Irrigation timing is more important than frequency** – early irrigation decreases efficiency, increases waterlogging impact and adds expenses, while late irrigation reduces crop yield (~1% of crop revenue per day).
- **By getting the timing as ‘right’ as possible (optimal), yield is maintained at the same time as reducing the frequency of irrigation.**
- **Setting up a resilient crop starts early** (root development), which relies on soil moisture data.

<sup>16</sup> myBMP is a voluntary farm and environmental management system which provides self-assessment mechanisms, practical tools and auditing processes to ensure that Australian cotton is produced according to best practice

## Water Efficiency Program across three years:

### ~900 sensors

sensors deployed throughout Australian cotton growing regions

### ~700K bales

of cotton produced from fields involved in the program

Based on a 2023 survey involving a sample of local cotton growers who have been using the Goanna Ag technology, grower feedback shows promising results:

**87%** stated their irrigation scheduling approach changed because of using the technology

**69%** of respondents found it easy to interpret and use the data

For **68%** of respondents, the program met expectations

For a further **26%** the program exceeded expectations



*“The sensors gave us the right time to water the plant without stressing it. The primary goal is to grow a healthy plant. It allows us to stretch the irrigation scheduling out and adjust it earlier if needed...”*

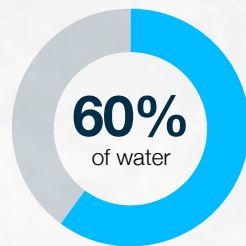
– Cotton grower, Australia

## Applying precision in irrigation to save water and farmer spend

Automation with smart irrigation technology enables the precise application of water and crop protection products: delivering them in the right quantity, at the right place, and at the right time. Moreover, it can offer various benefits, such as improved efficiency, reduced environmental impact, remote management and data-driven decision-making.

In collaboration with **Netafim**, we're developing innovative methods of targeted application. As part of the new, innovative system **DripByDrip**, growers use drip irrigation, which delivers water and crop protection where it is needed most, directly at the roots. **This precise application requires fewer chemical products and reduces evaporation and runoff while using 60% less water compared to traditional irrigation.** Based on our findings from 2019, precision irrigation does not only contribute to significant water savings, but also optimizes energy use, labor, and the application of inputs such as pesticides and fertilizers.

As part of the DripByDrip system, growers use drip irrigation, which saves up to



### Did you know?

Crop protection can be applied directly to different target areas, including the seed, the plant, the soil or even the roots

## Digital enablement and adoption of good agronomic practices

**With our digital farming platform Climate FieldView™ we are helping farmers to improve their yields through data support.** The sensor-based collection and storage of large volumes of machine-generated agronomic data now takes place directly at the farmers' accounts. The data collected from Climate FieldView™ is being used to develop tools that can help farmers fine-tune the operations and management of their farms in regard to precision use of crop protection products and seed placement.

In addition, Data Manager, a new feature in development for a U.S. release, will provide operational and field-level practice data in a single place, regardless of the source used for collection. These new layers for tillage and irrigation drive new opportunities for FieldView users to track sustainable practices and enhance the view of their farm with flexibility.

**Climate FieldView™ is currently available in North America, South America, Turkey, South Africa, Europe and Australia.**

Advancements on our digital research farms now allow the tracking of agronomic data, soil health data, while comparing regenerative practices alongside conventional to demonstrate the benefits of a regenerative system on GHG emissions, soil health, farmer ROI.

### Working with Hydrosat to optimize water use with Iriwatch technology

**Bayer is working with Hydrosat, a specialized company in irrigation scheduling, to optimize water management in our seed production and conduct commercial proof of concepts in vegetables and rice.**

Bayer is utilizing the product IriWatch and its data-driven field insights, which are generated through satellite imagery processed with an algorithm called SEBAL. This algorithm enables calculations of root zone soil moisture and crop productivity, providing valuable information for irrigation recommendations to help optimize crop growth, field uniformity, yield and quality. This spatially distributed data is the basis for calculating efficient and productive use of water along with sustainability indicators.



## Saving water through integrated weed management and conservation tillage

### Integrated weed management

Because weeds compete with crops for water, light and nutrients, **our Integrated Weed Management aims to help farmers optimize water use and reduce reliance on a single weed control method by promoting a combination of strategies that include the use of crop rotation, seeds and traits, digital enablement and diverse chemical and biological herbicides.** Through new modes of action, digital technologies and agronomic practices, we aim to provide growers around the world with innovative weed management services that support their short- and long- term needs and goals. **We plan to invest around 5 billion euros in the current decade to research additional weed control methods and thus provide farmers with more options in the future.** This includes the development of an entirely new herbicide mode of action for broad-acre weed control, the first in the industry for over three decades. This molecule has demonstrated effective control of key resistant grasses in research and is expected to be commercialized towards the end of this decade.

### Conservation tillage

**Conservation tillage systems, including strip-till and no-till, are agricultural practices that offer important environmental benefits, with water conservation being one of the positive outcomes.**

The adoption of adapted tillage techniques reduces run-off, increases infiltration rates and decreases the evaporation of water in the soil. This contributes to improved soil moisture and soil quality, as well as less water required for irrigation,<sup>17</sup> which ultimately means operational savings for farmers.

<sup>17</sup> *Monsanto - National Summary Corn Production and Strip Tillage in the Western Plains*



Our approach in fostering the adoption of regenerative agriculture practices and technologies by our farming customers across the globe further encourage these efforts

**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
Worms per sq foot	15 to 32	1 to 10
<b>Soil pores per 4 sq inches</b>		
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



# Future-proofing of sustainable food production

## Empowering sustainable agriculture through the farms of the future

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

**Yinhuang Farm in Baishan Village**, known for its high standards in agricultural production, is a leader in promoting sustainable agriculture in the Beijing metropolitan area. Founded in 2008 by Aiteng Qin, it was the first Bayer ForwardFarm in the Asia-Pacific region. The farm uses an entrepreneurial-cooperative model to produce high-quality vegetables and fruits, sharing knowledge with growers from smaller farms by demonstrating new varieties and technologies.

Covering 10 hectares, Yinhuang Farm primarily grows fresh market tomatoes as its main crop, along with strawberries, sweet peppers, lettuce, cucumbers, among others. A consistent growing environment is maintained by using high-quality seeds and carefully monitoring crop growth, while adhering to strict safety standards for crop protection.

In our Bayer ForwardFarms, we promote the adoption of innovative solutions and technologies to conserve water resources as well as preserve water quality. For instance, Yinhuang farm utilizes specialized equipment and an effective biodegradation process to eliminate product residues in wastewater, thus minimizing surface water contamination. Thanks to these technologies, **4,000 liters of wastewater containing spray residue were successfully treated in 2023**. Another example involving water conservation can be found in **Agrícola La Hornilla ForwardFarm in Chile**, where a weather station was installed, providing real-time weather information and irrigation probes by **using the digital technology EnviroSCAN**. As a result of these innovative measures, **high crop quality and yields are achieved in La Hornilla, while optimizing water use**.

Learn more about our [Bayer ForwardFarms network](#) to see what we do to protect water bodies and read in our [Sustainable Pesticide Management at Bayer Report](#) how we live the International Code of Conduct on Pesticide Management by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO).



**Forward**   
**Farming**

**60%**  
less water

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

## Collaborative research and knowledge sharing

**Research and knowledge sharing is another aspect that we strongly invest in. We are in constant dialogue with farmers and other partners.**

**The Bayer Water Utilization Learning Center's main mission is to provide water and sustainability outreach to farmers.** Located in Gothenburg, NE, near the center of 6 million hectares of irrigated cropland on the central and high plains, it makes it an ideal location to research water's impact on maize, soybean, and wheat cropping systems. Research trials and demonstration plots are managed with new irrigation technologies, and industry collaborators help evaluate irrigation management tools. The center's interaction with farmers enables better irrigation efficiency through improved crop yields and better management. In recent years, Gothenburg has added focus on regenerative agricultural practices to encourage cover crop integration and reduced tillage. **This has led to a 5-year collaborative efforts in Bayer across seven states with the following institutions: Kansas State University, the University of Kansas, Iowa State University, the Ohio State University, and Mississippi State University.**

**The Gothenburg Center is a great example of, and was designed for, our knowledge transfer efforts.** The Center in Gothenburg, Nebraska is an ideal location to monitor the impact that water, or lack thereof, has on maize, wheat and soybean cropping systems. Scientists conduct research and demonstrations year-round to provide information for farmers to help use water more efficiently through increased annual yields and better management of irrigation. Collaborative efforts with local universities, as well as adding more sustainable soil health practices to irrigated and dryland cropping systems, are also important initiatives at Gothenburg.



[Learn more about the initiative here](#)

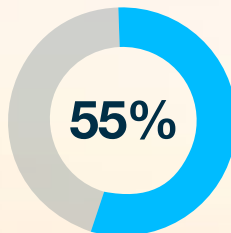
# Responsibly watering the world's food supply

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 projections of food demand coupled with climate change will only exacerbate the crisis we are facing.**

**However, we're optimistic, as innovations in agriculture have already shown benefits for water conservation.** Through partnerships, research and innovation focused on improving water efficiency and productivity with more resilient crops, advanced crop protection products, biostimulants, and promoting modern irrigation and good agronomic practices — we have the opportunity to address the water-related challenges in agriculture.

By 2050, more than 9 billion people are projected to be inhabiting the planet<sup>18</sup>, requiring

<sup>18</sup> [United Nations - Population](#)



more water to sustain the population with current production practices<sup>19</sup>

<sup>19</sup> [OECD - Water](#)

# Learn more about our efforts on conserving water

[Bayer Partnership with IRRI](#)

[Bayer ForwardFarming](#)

[Goanna Ag Partnership](#)

[Good Rice Alliance](#)

[Drip Irrigation Systems](#)

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



**Mehdia Mounir,**

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# Promoting Sustainable Use

**Crop protection products are essential for safeguarding crops**, improving yields and protecting farmers' livelihoods amidst climate change and limited arable land. However, **if these products are not used properly or if counterfeits are used, they can pose risks for farmers' yields**, human health and the environment. In a world of growing food demand, it is imperative that agricultural practices remain safe and sustainable.

At Crop Science, a division of Bayer AG, **we promote the effective, safe and responsible use of our products** to support agricultural productivity and to protect human and environmental health.

**Our work on promoting sustainable use contributes to the following UN Sustainable Development Goals:**



# 10



# 1 Sustainability Challenges

The sustainable use of crop protection products begins with the selection of authentic, legally registered products, ensuring compliance with regulatory standards. The improper use of products, or the use of counterfeit versions, presents significant risks.

Innovation enables the development of systems that track and verify product authenticity, ensuring that only legitimate, regulated products are used. Local education, training, and certification programs further support the sustainable and safe use of crop protection products.



# 2 Our Approach

We take a sensible approach to safeguard sustainable use that encompasses diligent product stewardship and anti-counterfeit measures – both important building blocks of sustainability in agriculture.

In stewardship, emphasis is placed on the use phase of our products, in alignment with **Food and Agriculture Organization of the United Nations (FAO) guidelines**. For example, **we provide training** on proper handling of our crop protection products to farmers, dealers, and applicators around the world. We also **foster innovation** in application technologies (e.g., through drone spraying and targeted, digitally enabled application technologies) which can have an additional positive effect on sustainable use. Resistance management and integrated pest management are further building blocks of our engagement, as well as the responsible management of empty containers. We record and follow up on any adverse incidents reported to us related to the use of our products.

In anti-counterfeit, **we focus on preventive measures to safeguard the integrity of our products against counterfeiting and to prevent the production, transport, trade and use of such products**. The focus lies on reliable product authentication, helping the farmer to select original products.

We actively engage with regulatory bodies and collaborate with a range of industry stakeholders to promote sustainable practices.

# 3 Progress

We have made progress across many areas. To name a few highlights: in 2023, we once again increased the number of people trained in safe use globally. We reached almost 5.3 million external contacts worldwide (e.g., farmers, field workers, distributors, retailers and other stakeholders in the agriculture industry), including around 4 million smallholder farmers. Further, we are **advancing on the adoption of innovative application technologies in agriculture** at a broader scale, including supporting the increased use of technology such as drones (e.g., with specific drone use-approved formulations of our products) or the training and certification of professional spray service providers – especially in smallholder countries. Further, as an industry leader, we have progressed with Sustainable Pesticide Management Framework developed by **CropLife International (CLI)**, which is geared to support LMICs<sup>1</sup> in capacity building and thus to spur innovation, responsible and sustainable use, and countries' reduced reliance on highly hazardous pesticides.

Since last year, the new **report on our approach to the development of crop protection products** is available. It illustrates how Bayer's R&D organization is reimagining the discovery and design of crop protection solutions, taking into consideration not only safety and efficacy criteria, but also our crop protection environmental impact reduction (CP EIR) target, product development costs and registrability. The report also covers the various internal and external processes and regulations that ensure that our products meet the highest standards for human and environmental safety. Additionally in 2023, we set a new milestone in transparency by publishing our first **report on Sustainable Pesticide Management at Bayer**, which details how we live the **FAO-WHO International Code of Conduct on Pesticide Management** as a company, including tangible examples of our stewardship activities along the full life cycle of our crop protection products.

<sup>1</sup> LMICs: low- and middle-income countries

## Safeguarding the complete lifecycle: an unwavering approach to product safety

Once a crop protection product reaches the market, **its label provides crucial information regarding its safe use and intended purpose.** This information includes product handling and application, as well as specific requirements such as the use of personal protective equipment. Potential human and environmental issues as well as the development of pest and weed resistance can arise if crop protection products are not applied in adherence to the label instructions.

Another challenge is the **prevention of counterfeit products in the market.** Various measures are implemented to address this issue, along the entire value chain. These measures include awareness campaigns, trainings, product authentication technology and collaboration with regulatory authorities, law enforcement agencies and other organizations such as OECD,<sup>2</sup> UNODC,<sup>3</sup> WCO,<sup>4</sup> Interpol and Europol. These steps aim to protect farmers from the potential risks caused by counterfeit products.

All these challenges are closely related to the degree of professionalization in agriculture: whereas professional large-scale farmers have the knowledge and technology to handle crop protection products correctly, millions of smallholder farmers around the world may face difficulties and hence require more intense stewardship.

At Bayer, **we are broadly addressing these challenges in collaboration with a variety of partners** within the agricultural industry.

<sup>2</sup> OECD: Organization for Economic Co-operation and Development

<sup>3</sup> UNODC: United Nations Office on Drugs and Crime

<sup>4</sup> WCO: World Customs Organization



*Insects, weeds and diseases have evolved resistance to many pesticide classes, leading to **increased control costs for farmers and a need for alternative control methods.** This challenge is worsened due to increasing costs of developing novel pesticides.*



*Illegal or counterfeit crop protection products are estimated to account for up to **15% of products sold,**<sup>5</sup> while illegal seeds make up as much as **10% of products sold.**<sup>6</sup>*

<sup>5</sup> OECD, *Joint Working Party on Trade and Environment: New digital technologies to tackle trade in illegal pesticides*, 2020, p.12

<sup>6</sup> Internal estimation



# Safety and sustainable use are imperatives for our business

## Promoting product stewardship


**Safety is an essential part of any industry, but it is of paramount concern when it comes to our food supply.** Due to the scale and reach of the agricultural industry, Bayer places the utmost importance on the effective, safe, and sustainable use of our products. Effective product stewardship practices directly support the availability of high-quality products, services and best practices by promoting compliance with legal and regulatory requirements, good agricultural practices, maximizing product potential and sustainability, and minimizing risk.

Our **Product Stewardship Approach** is based on the [FAO Code of Conduct on Pesticide Management](#), the [CropLife International Plant Biotechnology Code of Conduct](#) and the [Universal Declaration of Human Rights](#).


In collaboration with CropLife International, we promote effective stewardship worldwide, bringing impactful programs to local farming communities and actively supporting a healthy environment through firsthand stewardship actions.

## What is sustainable use?

Our definition of sustainable use in agriculture encompasses **the safe and responsible management of crop protection products in their use phase**. This includes handling and application, product disposal and counterfeit prevention.

 [Read more about our approach to product stewardship](#)

 [Counterfeits in Agriculture | Bayer Global](#)

 [Learn more about how these programs are having a positive impact in their communities and on the environment on the CropLife International Stewardship Website](#)

## Responsible and ethical management of a product throughout its life cycle





# Authentic inputs as key enablers for sustainable agriculture


Authentic crop protection products and seeds **undergo rigorous testing and strict regulatory evaluation before entering the market**, ensuring safe and high-quality standards.


The presence of counterfeit products in global agricultural markets is therefore a cause of concern. These fake items can contain harmful substances not disclosed on the label, posing risks to farmers, consumers and the environment. **Counterfeit seeds lead to reduced yields and inferior product quality**, negatively affecting food production and the livelihoods of farmers.

We take a strong stance against illegal activities and employ a comprehensive strategy to combat counterfeit products. We cooperate closely with government agencies, law enforcement, NGOs, intermediaries and other institutions to prevent production, transport, trade and use of counterfeit items. At the farmer level, we go beyond raising awareness by introducing innovative technologies that empower farmers to authenticate original products.

Preventing counterfeit products fosters sustainable agriculture, ensures a reliable food supply and, supports the pursuit of the UN Sustainable Development Goals.

 [BAYER and KURZ - Partnership of innovation leaders](#)

 [Bayer strives to combat counterfeit crop protection products and seeds](#)

 [CropLife Europe: stopping counterfeit and illegal pesticides](#)

# Digital farming for the future

## Increasing productivity and operator safety through innovative technologies

**Innovative application techniques combined with digital solutions help increase productivity and determine the right application volume of crop protection products at the right place and time.** Our advancements in precision application technology have a focus on ground and aerial autonomous machinery, as they minimize operator exposure during pesticide application.

Further improvement across these methods and the introduction of real-time farm data will steadily increase the precision and accuracy of product application. Some of the most promising technologies are **drones that hold the potential to significantly improve efficiency and replace handheld application in many regions**, especially in LMICs. Moreover, these developments are well-suited for smaller fields, but we also see interest from large-scale farmers in developed countries. We expect that labor shortages and costs will further push these new options. **All the data and connectivity mean we are empowering farmers to produce more with less.**

We partner with major drone-producing companies and professional drone spray service providers to **provide farmers with reliable and safe, high-quality spray applications in countries where regulatory systems allow such applications.** However, drone spray is a technology still under development. We work with regional CropLife organizations, such as CropLife Asia and CropLife America, to **establish guidance documents for the safe application of crop protection products** via unmanned aerial systems (UAS). We contribute to further defining operator safety via drone spray by taking into consideration exposure sources such as frequent refills, transport or battery exchanges. In May 2023, Bayer supported the OECD Cooperative Research Program-funded “Applying Pesticides Using Drones” conference held in York, United Kingdom, aimed at developing aligned best management practices for UAS applications of crop protection products.

Produce more ↑  
using less ↓



[Reduction of operators' exposure towards pesticides](#)



[Drift characterization of drones](#)



[Climate FieldView™ Technology](#)

# Supporting farmers through knowledge transfer and professionalization

## Safe use trainings

**We are educating farmers, operators and consumers**, in accordance with the [International Code of Conduct for Pesticide Management](#), also by leveraging new technologies. Through targeted training courses, we show how **to use our products both effectively and safely** to maintain the applicator's health, healthy plants and increase yield and quality of their harvested goods. Training can be adapted depending on the target audience, a particular product or plant, and can cover such varied topics as safe product handling during use, transport, storage and disposal, as well as proper protective clothing and emergency first aid measures.

[Safe use trainings](#) are an important lever to share knowledge with growers, field workers, seed treatment professionals, distributors, retailers and further stakeholders

who are in direct contact with our products. We are fostering best practice exchange and capacity-building on the safe use and disposal of crop protection products, with a focus on LMICs, especially those with no or little regulation on the use and application of crop protection products.

This includes holistic platforms like [Better Life Farming](#), as well as stewardship tools like Bayer [DressCode](#) – a web-based tool that gives farmers label-conform instructions about the personal protective equipment (PPE) to use in their individual situation. To maximize our impact and reach, **we collaborate with local universities to train agriculture students**, aiming to create a network of [Bayer Safe Use Ambassadors](#) who in return transfer their knowledge by training thousands of smallholder farmers in their communities.

The professionalization of agriculture is a major driver in behavioral shifts when using crop protection products and required PPE. Both the increased use of novel technology, such as drones or larger tractors, as well as a training and certification of professional spray service providers, **can increase the effective, safe and sustainable use of our products in the future.**

Through on-site and virtual trainings as well as digital tools **we reached almost 5.3 million external contacts worldwide (e.g. farmers, field workers, distributors, retailers and other stakeholders in the agriculture industry), including around 4 million smallholder farmers in 2023.**

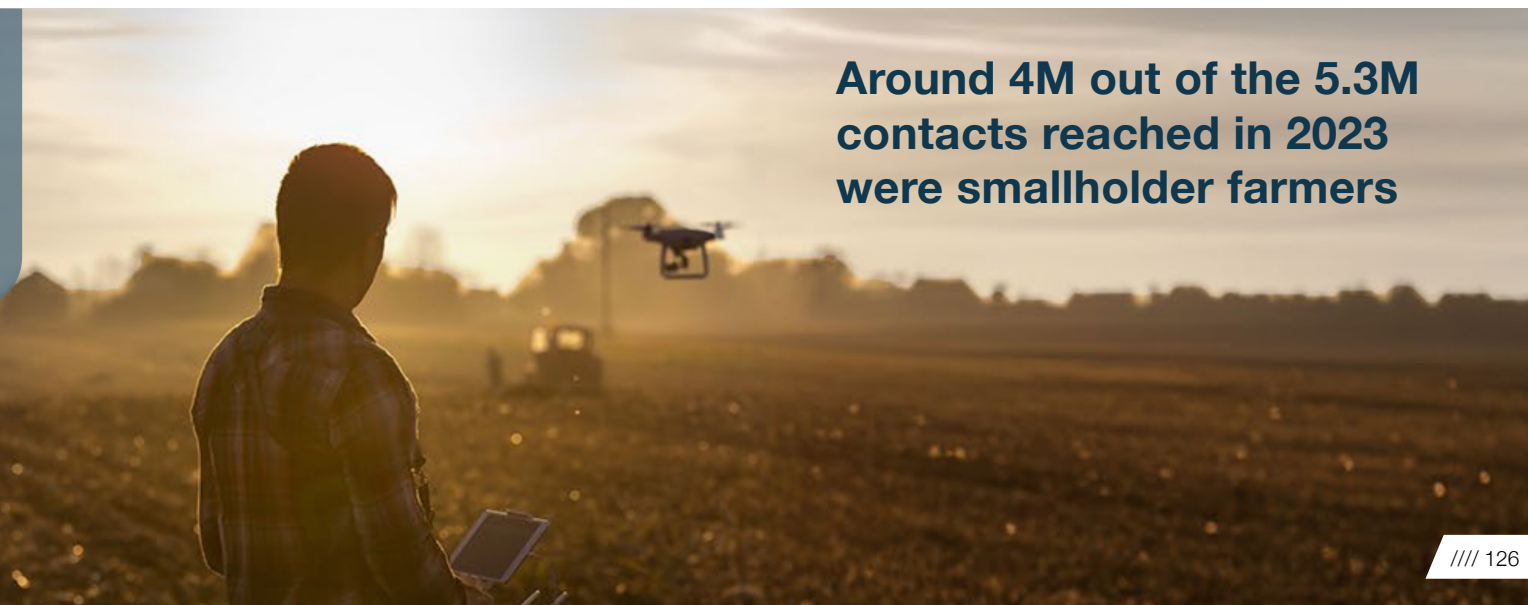
## Digitalization as a lever for knowledge transfer and reach

**We are always exploring and leveraging new ways of building capacity and raising awareness**, for example through WhatsApp trainings and messaging campaigns (SMS), as well as by adding webinars to our face-to-face trainings and outreach. Using only a smartphone or tablet, farmers in Africa, Asia, and South America can record pest and disease data, receive regional agronomic advice, and chat with knowledgeable experts. These insights will **help them grow their family farming businesses sustainably in the longer term and promote sustainable practices** among the next generation of growers in their local farming community.

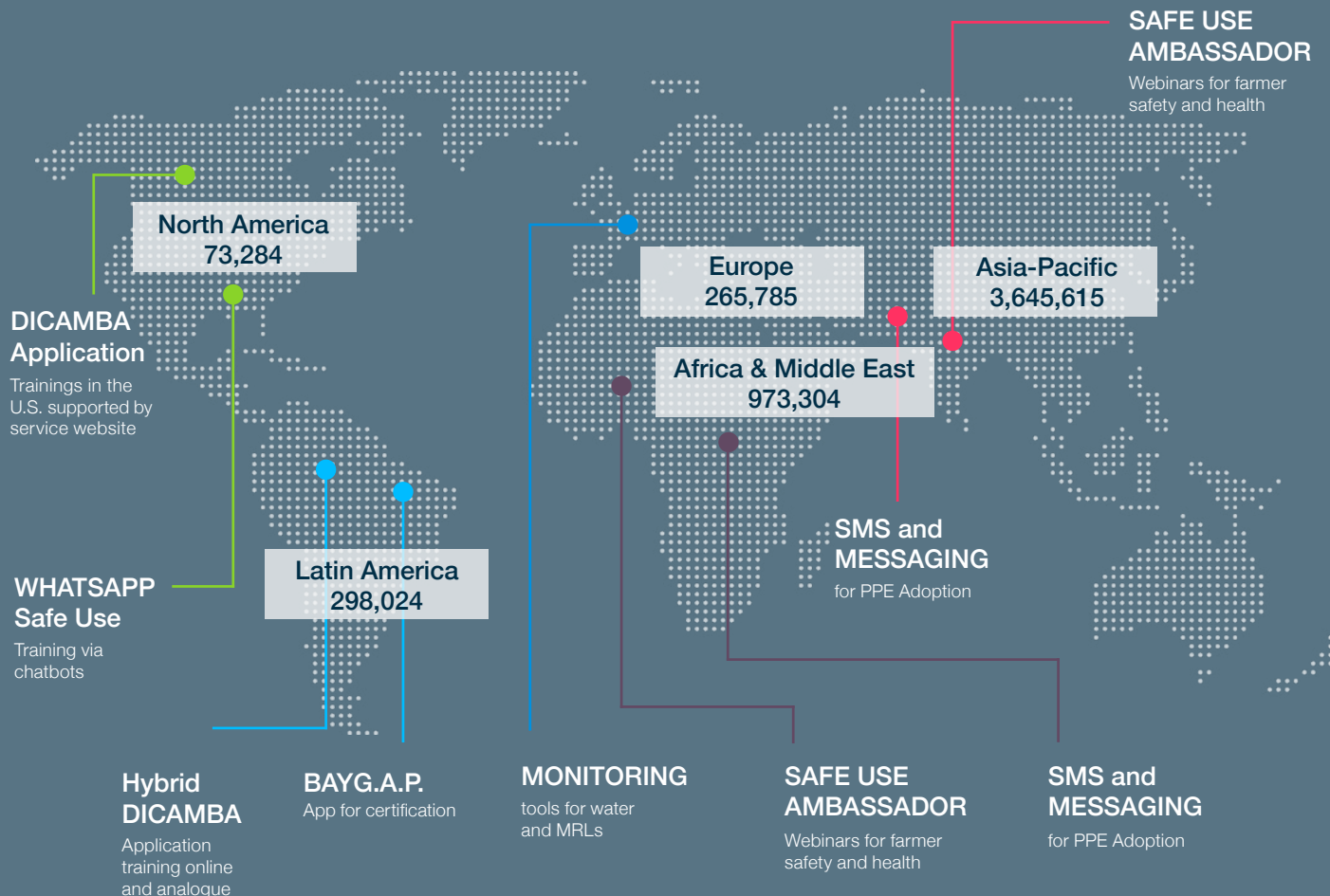
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Reached almost 5.3M external contacts in 2023

Around 4M out of the 5.3M contacts reached in 2023 were smallholder farmers



## Safe Use Trainings Global Outreach



## Incident monitoring and management

**We market only products that meet our high safety standards, but we also care about their real-world use by our customers.** We monitor and follow up on any report about adverse events or misuses. For that, we need reliable data that tells us how, when, where and how often incidents occur.

We collaborate with external partners like universities, as well as environmental and regulatory authorities, to **gather monitoring data on residues of our products in water and agricultural produce.** Expanding our database, we work with poison control centers and rural doctors, providing tools for reporting poisonings related to crop protection.

Incidents worldwide are tracked through our internal management system, encompassing data from poison control centers and reports from our network of colleagues and external partners. **We encourage incident reporting** through sales staff, hotlines, and source additional information from media reports, and medical professionals trained in our Safe Use Ambassador Program.

Our incident management system and product use review form the basis of our safety monitoring and improvements. **We analyze data to identify issues and hotspots, and we derive learnings to develop targeted stewardship measures.** These measures may include enhanced training, formulation changes, revised application recommendations, use limitations or even product withdrawal following the FAO-WHO Code guidelines.

# Empty container management

## Collecting empty containers

We know that once our crop protection product is applied and the container is emptied of its contents, we are still responsible for it. **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 on 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 more than 60 countries.** 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.

Establishing and activating local waste management systems was particularly successful in Brazil, Canada, China, France, Germany, and Australia. **A common success factor among these systems is the presence of national legislation,** which requires the establishment of nationwide empty pesticide container management systems.

**In Brazil, the non-profit InpEV (National Institute for Processing Empty Packages) program has reached a recycling rate of 94%, being the most successful program worldwide.** The example of China shows how container management systems can achieve remarkable progress in just a few years. Within two years of implementation, the country has already become one of the leading nations globally in terms of collecting packaging waste. In Asia, Bayer is working closely with CropLife Partners to advise governments on the implementation of Extended Producer Responsibility (EPR) initiatives that aim to overcome challenges in the agricultural sector.

### Canada

In 2021, the container management program CLEANFARMS INC. collected more than 3.3 million kilograms of packaging. 100% of plastic containers collected were recycled.

### France

In 2021 the French program ADIVALOR recovered 89,000 tons of agriculture plastic. Up to 90% of the plastic collected was recycled.

### Australia

Since 1999, the Australian program has collected and disposed of more than 40.6 million plastic containers.

### Brazil

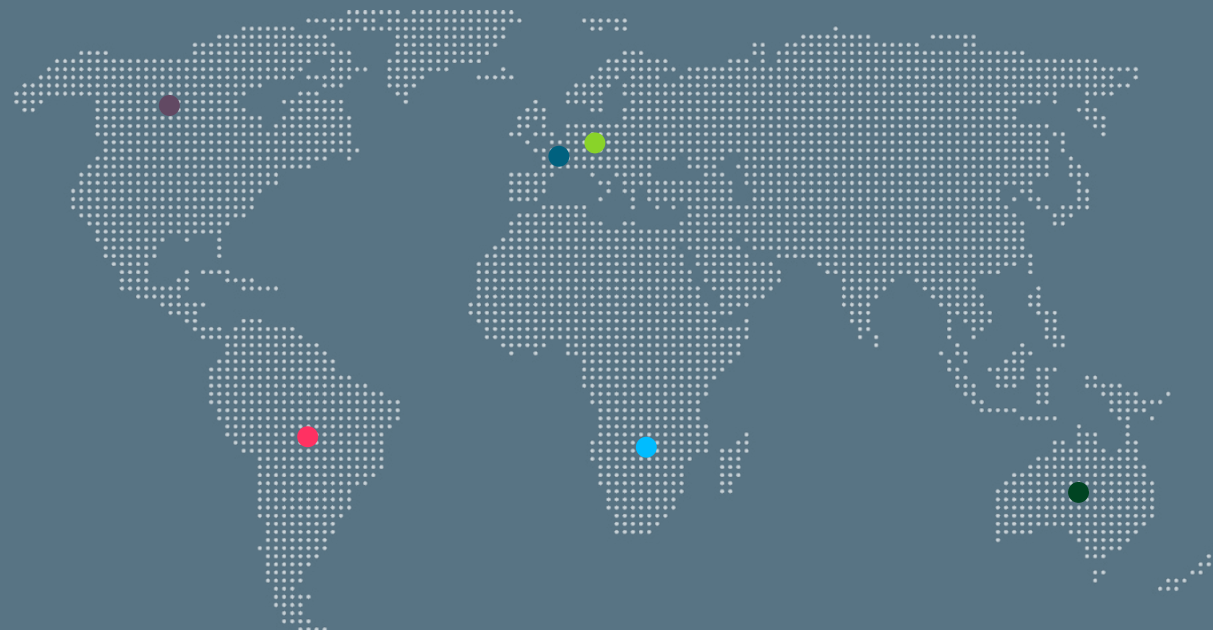
600,000 tons of empty containers correctly disposed with InpEV and Campo Limpo since 2002. 400 Collection sites across the country.

### South Africa

In 2021, the container management program spearheaded by CropLife South Africa collected 4,800 tons of plastic containers. 88% of the plastic collected was recycled.

### Germany

In 2022, through the PAMIRA system, around 3,000 tons of crop protection product and liquid fertilizer packaging were returned to the 400 collection points. More than 90% of the packaging was recycled in the European cable protection industry.





# Integrated 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 exposure to a plant protection product that would normally exert effective control.**

This means that without proper controls mechanisms, 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 part of these measures, we develop and implement IPM guidance, based on the [CropLife](#) and Resistance Action Committees. This includes training farmers and others on proper resistance management, as well as researching issues related to resistance and collaboration with stakeholders.

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



# Ethical marketing and sales as a foundation of trust

## Setting and adhering to high safety and sustainability standards everywhere

**We wouldn't be a leading global company without our customers' trust.** We adhere to ethical sales and marketing practices that meet the standards set by external regulations and codes of practice. In particular with the laws and regulations for advertising and marketing practices, the applicable global, regional and local industry codes relevant for our business, as well as data protection and privacy of customer or consumer information. We apply strict internal guidelines and regulations through our [Code of Conduct](#), the Group Regulation "Integrity & Responsibility in Communications and Marketing" and our published Group Regulation on [Product Stewardship Approach, Principles and Key Requirements](#).



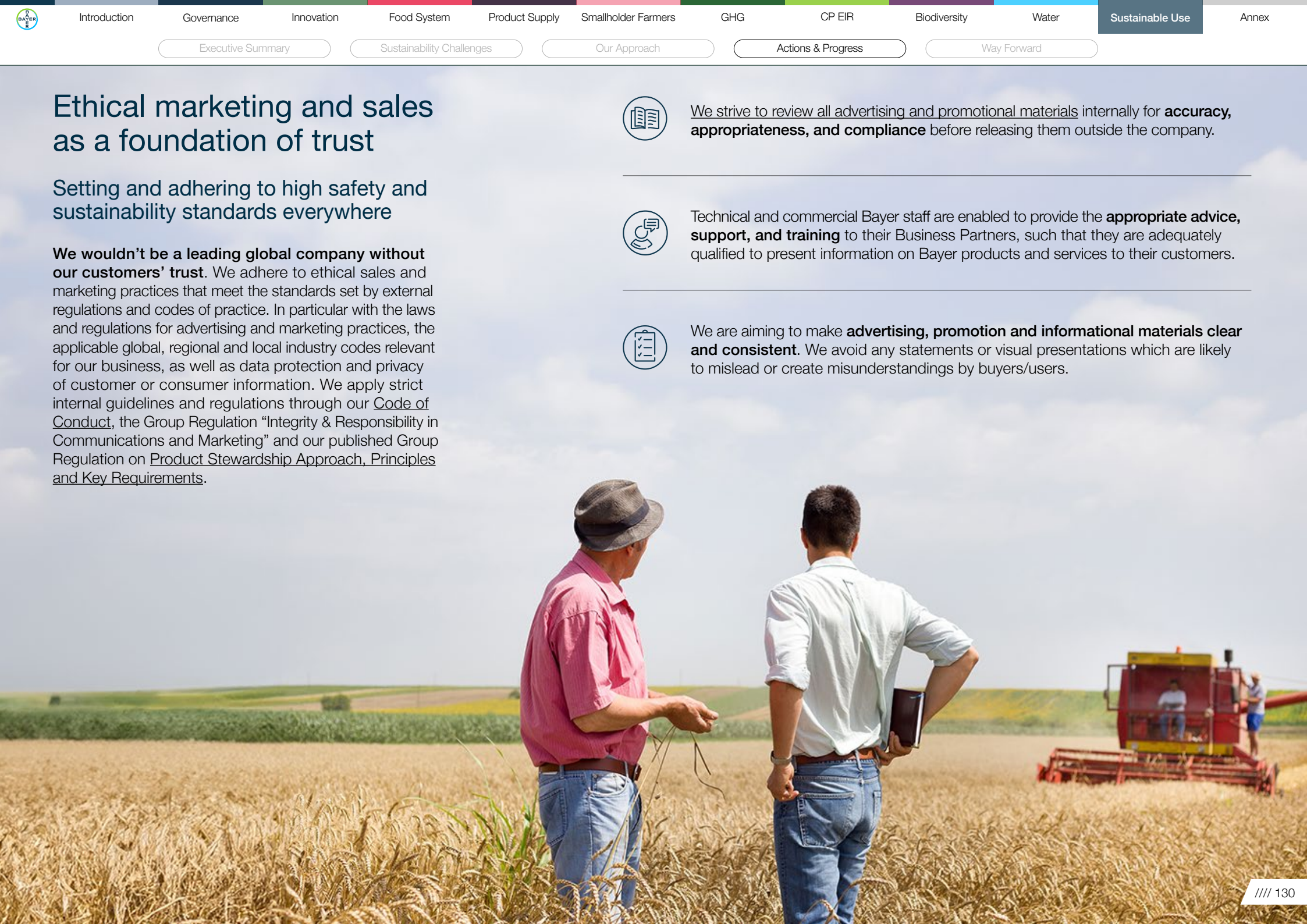
We strive to review all advertising and promotional materials internally for **accuracy, appropriateness, and compliance** before releasing them outside the company.



Technical and commercial Bayer staff are enabled to provide the **appropriate advice, support, and training** to their Business Partners, such that they are adequately qualified to present information on Bayer products and services to their customers.



We are aiming to make **advertising, promotion and informational materials clear and consistent**. We avoid any statements or visual presentations which are likely to mislead or create misunderstandings by buyers/users.



## Taking action against counterfeiting

### Preventing the use of counterfeits through reliable product authentication

The Bayer Safety Seal enables farmers and distributors to distinguish Bayer's original crop protection products and seeds from counterfeits. This technology employs optical security features and a QR code that can be scanned via the Bayer Seal Scan App. **The App provides reliable information about the product authenticity conveniently and in local language.**

In close collaboration with our technology partner KURZ, Crop Science, a division of Bayer AG, has developed the Safety Seal. A single scan with the Bayer Seal Scan App gives the farmer immediately and fully reliable information about the authenticity of the product. Introduced in 2016 and further developed ever since, the Safety Seal is in the meantime applied on all bottled crop protection products in EMEA and LATAM, as well as on selected solid products in high-risk countries like Egypt, Turkey, Vietnam, and Indonesia.

Since 2022, the Safety Seal also protects Bayer's row crop seeds (corn, canola, sunflower) in Europe and the implementation for Dekalb corn seeds in Brazil and NORLA<sup>7</sup> will be completed this year. Projects to introduce the Safety Seal on corn seed packaging in Africa as well as on vegetable seed packaging worldwide were also further advanced. While reliable product authentication remains the main purpose of the Safety Seal, the QR code on the Seal has been enhanced, and can now also serve a unique identifier and single-entry point for any kind of digital information.

<sup>7</sup> North of Latam



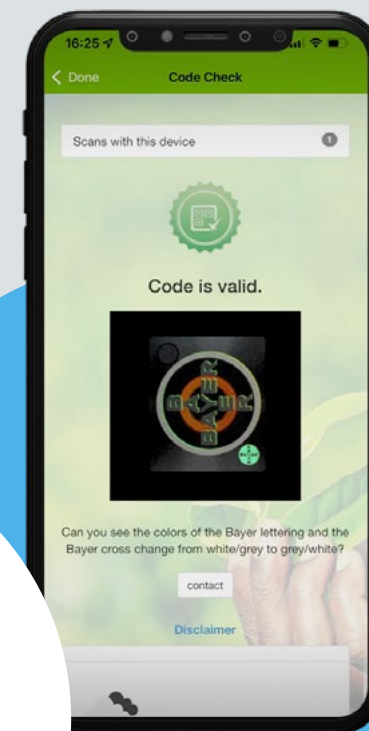
**Unique in our industry, the Bayer Safety Seal is our competitive advantage, helping us to capture value from our products and innovation**

## Safety Seal as an enabler for digital transformation in agriculture

**As a next step, the Safety Seal Technology is planned to provide farmers with location and product specific information**, such as weather and soil conditions, product name, batch number and production date, quality data, use instructions, stewardship recommendations and crop system information, amongst others.

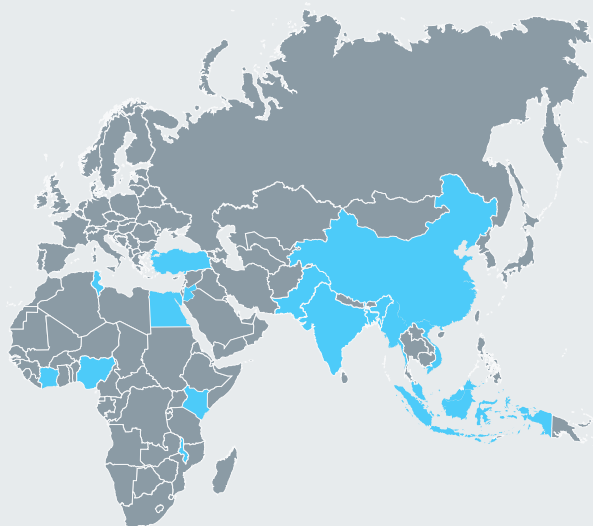
Combining the physical product with digital information will **increase customer confidence and customer experience significantly**. Moreover, broadening the data behind the QR code of the Bayer Safety Seal also avoids the need to scan multiple codes for different purposes and provides convenient digital access to use-instructions and other information, for example on safety or quality, and recommended retail prices.

The Safety Seal technology can also be integrated into other existing digital solutions and applications, such as Climate FieldView™. **By combining the physical product with digital information and expertise, we are enabling digital transformation in agriculture.**



# Collaborative partnerships for sustainable use

Fulfilling the FAO-WHO Code, and in line with our Stewardship Approach, **we collaborate and partner with various stakeholders to promote the responsible use of our products and services**, including governments, regulators, farmers' associations and industry players.



## Bayer Safe Use Ambassador Network as of 2023



### Bayer ForwardFarming Network

We partner with independent farmers to show how tailored solutions, modern tools and practices, proactive stewardship measures, and partnerships enable farmers to run successful businesses.



### Bayer Safe Use Ambassador

Launched in 2017, the program aims to advance farmer safety by training diverse stakeholders such as agriculture and medical students, agronomists, and rural medical practitioners as 'Safe Use Ambassadors'. Since the program's start in Asia, we've initiated collaborations with **55 universities in 15 countries** throughout Asia-Pacific, the Middle East and Africa. **Every year, 3,000-5,000 students and professionals participate in our program** and in 2023, over 1,000 people from across the world participated in our webinars (including side events).

**Bayer Safe Use Ambassador Program was recognized with the international Gold Standard Award for Corporate Citizenship 2023 across industries — its 6th award in five years.** This unique stewardship program brings us one step closer to realizing our mission of "Health for all, Hunger for none" by seamlessly bridging the agricultural and medical sectors and advocating for global farmers' health and safety.

Our most recent accolade, bestowed by the Public Relations and Communications Association (PRCA) Asia Pacific and Public Affairs Asia, further confirms our position as a global leader and underlines our approach to an effective community engagement. Find out more about the program on our website.



### CropLife International, Local Governments & Regulators

Through this industry association, we collaborate with national authorities and other stakeholders to build capacity in line with the FAO-WHO Code and **encourage authorities to take on their responsibility** to provide effective structures for the management of crop protection products. We support authorities in LMICs in implementing frameworks, exchanging best practices or collaborating with poison control centers.



### BayG.A.P. Service Program

For nine years, the BayG.A.P. Service Program has been instrumental in shaping the journey of farmers through training, agronomic advice, and market linkage. Today, our program places a significant emphasis on produce verification, leveraging innovative tools such as **BayG.A.P. Verify**. **This platform empowers farmers to enter competitive markets with confidence**, offering more sustainable and high-quality products while establishing direct connections with end consumers. The impact of our efforts is evident:

- **Wide Reach:** our messages on good agricultural practices reached over 2.4 million people through digital & social media, and face-to-face events.
- **Extensive Training:** close to a million individuals have benefited from our online courses and trainings.
- **Tailored Solutions:** we've directly supported over 20,000 farmers with verification, certification, and traceability.

Through these concerted efforts, the BayG.A.P. program continues to drive positive change within the agricultural sector, fostering sustainable practices and enabling farmers to succeed in an increasingly competitive landscape.

# Driving change together

## Pioneering product stewardship and counterfeit prevention for the future


In this chapter, we provided an overview of our programs, initiatives, digital tools and partnerships for the effective, safe and sustainable use of our products. While we already play an important role in promoting sustainable use, we are committed to improve even further. Guided by our Bayer mission “**Health for all, Hunger for none**”, we will continue to encourage, facilitate collaborations and raise awareness on the sustainable use of our products.

However, our industry cannot do it alone. **At Bayer, and together with our partners, we will continue to build local capacity where needed to ensure safety and improve the professionalization and productivity of agriculture.**

Effective stewardship and anti-counterfeit measures require a multistakeholder effort. National governments have a key role to play in providing effective legislation, regulatory systems and other structures to enable and drive sustainable pesticide management at scale. While many developed countries have effective structures in place, some LMICs are struggling. **We need engaged national authorities and strong local and global partners that build effective structures, legislation and regulation to foster innovation and professionalization in the agricultural sector.** This will, in turn, foster productivity gains for farmers.

**In times of a growing world population that is facing food security challenges through climate change and disrupted supply chains, the need has never been greater.**

## Learn more about our efforts on sustainability

 [Bayer’s approach for the development and use of crop protection products](#)

 [Determining Safe Use of Pesticides](#)

 [Bayer Crop Protection Safety Standards](#)

 [Promoting Stewardship – Crop Life International](#)

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

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



Jennifer Urnikis,

Head of Product Stewardship

 [jennifer.urnikis@bayer.com](mailto:jennifer.urnikis@bayer.com)




# Annex



# Demonstrating sustainable agriculture in practice

Our vision is to **lead the way in sustainable agriculture and demonstrate the importance of regenerative agriculture**. We believe the best way to achieve this is by pioneering new system solution approaches in the field. **We are growing a global network of independent farmers to demonstrate how modern, sustainable agricultural practices can benefit farmers, the environment, and society on fully operational farms.**

Through our global **network of Bayer ForwardFarms** we aim to inspire a greater number of farmers to adopt regenerative agricultural systems that produce more with less while restoring nature. Bayer ForwardFarming serves as a knowledge platform where farmers, value chain partners, academia, scientists and civil society can engage in dialogue and experience modern sustainable agriculture through first-hand experiences on independent farms around the world.

 [Learn more about Bayer ForwardFarms](#)

 [1st Bayer ForwardFarming Networking Event](#)

At these farms, we are demonstrating how sustainable farming practices can contribute towards:

**Climate-neutral agriculture:** in the last years, the Bayer ForwardFarming program **has played an integral part in the Bayer Global Carbon Initiative to reduce greenhouse gas emissions in agriculture**, through regenerative practices and the adoption of farmer-centric, climate-smart agricultural practices and technologies.

**Environmental impact reduction:** practices applied at **Bayer ForwardFarms reduce the environmental impact of crop protection by relying on modern sustainable solutions**. Additionally, through integrated crop management practices (such as crop rotation and cover crops), precision application and digital tools (e.g., [MagicScout](#) and [MagicTrap](#)) as well as by complementing chemical crop protection with biologicals, we aim for crop protection to be applied in the right amount and only when needed. We also strive to ensure safe and responsible use of crop protection products by demonstrating best practices in product stewardship.

**Water conservation:** no-till practices have been shown to increase water use efficiency in row crops such as wheat and maize. Additionally, **we aim to preserve water quality and quantity by implementing systems tailored to local conditions that reduce the amount of water used and protect the environment** from any unintentional exposure to crop protection products.

**Soil health:** crop rotation and cover crop management are regular regenerative agricultural practices at the Bayer ForwardFarms. **The latter also helps to reduce the negative impacts of wind and flood erosion**. In addition, soil analysis is conducted regularly for optimal fertilization to improve soil health and productivity on the farms.

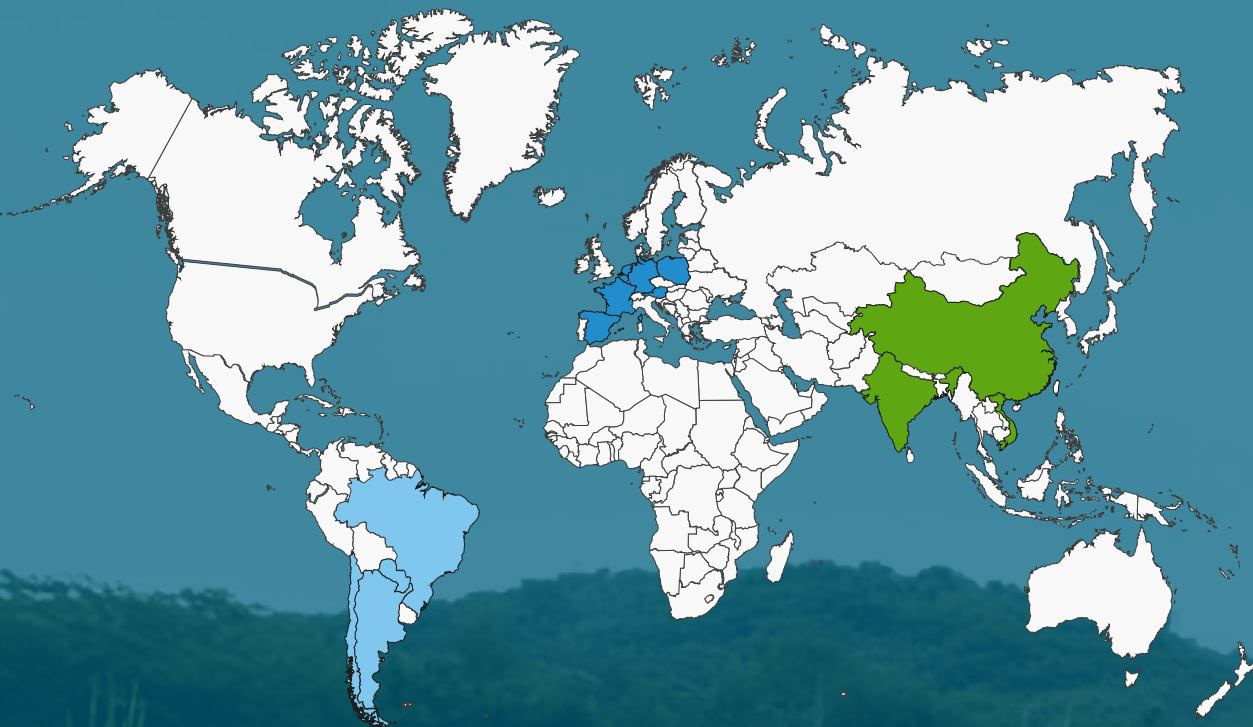
**Biodiversity conservation:** many activities implemented through Bayer ForwardFarming partnerships in Latin America and Europe **have contributed to obtaining deeper insights to improve nature conservation measures**, such as flowering strips, insect hotels, beetle banks, bird nesting aids and skylark plots.

While each Bayer ForwardFarm may be unique in the crops it grows, the land it farms and the community it serves, **all participating farmers share a common passion for advancing regenerative agricultural practices.**



# Our Growing Global Network

Activation of 3 new ForwardFarms in 2024



## Latin America (7)

- Argentina (2)
- Brazil (2)
- Chile (2)
- Paraguay (1)

## Europe (12)

- Austria (1)
- Belgium (1)
- France (1)
- Germany (4)
- Netherlands (3)
- Poland (1)
- Spain (1)

## Asia/Pacific (5)

- China (3)
- India (1)
- Vietnam (1)

Network: October 2024



**24** independent farms

in 14 countries are part of the BFF network



Main crops in almost **10K** hectares of independent farmland



**+56K** ForwardFarm visits

Additionally, a network of

**12** independent farms

in Argentina and Uruguay has been established under the ForwardFarming Scale-Up Model framework. These farmers are sharing their agricultural stories and advocate the adoption of regenerative agriculture within their communities. Together, they cultivate main crops across more than

**135K** hectares





## Prime examples of innovation

# Enhancing soil health & farmer wellbeing with Seminis® Moraleda beans

Beans, as a significant global crop, play a crucial role in both human health and soil health, with India being one of the top producers. The Vegetables by Bayer team in India has demonstrated the benefits of relay-cropping with leguminous crops, particularly promoting the use of the Seminis® Moraleda pole bean among smallholder farmers. **This approach contributes to regenerative agriculture by improving soil health, boosting yields, and elevating the livelihoods of approximately 5,000 growers.**

**A study conducted by 60 decibels**, involving interviews with farmers directly involved in this initiative, **has quantified the benefits of introducing Seminis® Moraleda beans and the relay-cropping practices, leading to a transformation in farming practices.**

Specifically, **90% of the growers reported a reduction in the use of fertilizers and crop protection products**, fostering a more sustainable way of farming. Additionally, **92% of farmers observed an improvement in the quality and production of tomatoes** when intercropped with beans. As a result, **over 94% of growers reported an increase in their crop income**, highlighting the positive financial impact this regenerative agriculture approach has on their livelihoods.<sup>1</sup>

**The above mentioned benefits have been translated into an increase of the growers' quality of life**, experiencing a reduction in their stress levels. This progress paves the way towards a regenerative future, where both the environment and farmers thrive.

<sup>1</sup> *60 Decibels - Lean data study, July 2024, 262 farmer phone interviews in India between May and June 2024*

90%

of the growers reported a reduction in the use of fertilizers and crop protection products

92%

of farmers observed an improvement in the quality and production of tomatoes

94%

of growers reported an increase in their crop income



## Prime examples of innovation

# Vegetables by Bayer offers innovative seed solutions that can help tackle food loss and waste

Vegetables by Bayer leads in developing varieties that align with Bayer's efforts to deliver innovative solutions for enabling regenerative agricultural practices and promoting sustainable food systems. By focusing on the creation of high-performing seed varieties, **Vegetables by Bayer is dedicated to advancing agriculture in a way that enhances productivity, minimizes environmental impact, and supports the long-term sustainability of food production.**

### 1 Seminis® Belcanto

**Seminis® Belcanto**, an orange melon variety adapted for open field production, demonstrates a high level of yield with the potential to reduce food loss. **Internal trials conducted in France from 2019 to 2021 indicated up to approximately 10% fewer field losses compared to Bayer's previous variety, Seminis® Funambul.**<sup>2</sup> This reduction is attributed to Seminis® Belcanto's exceptional field flexibility, contributing to regenerative agriculture outcomes by enhancing farm productivity, increasing potential income, and reducing greenhouse gas emissions.

<sup>2</sup> *Seminis® Belcanto: Based on 20 internal trials, from 2019 to 2021 in France. Calculation reference: Average Net yield/Food loss (t/ha): Belcanto Commercial Yield: 92% and 8% food loss | Funambul Commercial Yield: 82% and 18% food loss*

### 2 Seminis® Suertex

In Spain, **Seminis® Suertex Curdivex® type Cauliflower**, has shown **trial results indicating improved productivity with up to approximately 41% increased harvest uniformity and better harvest efficiency compared to a competitor variety.**<sup>3</sup> Seminis® Suertex offers the potential to reduce food loss and improve farmers' livelihoods, supporting Bayer's vision of regenerative agriculture systems.

### 3 Seminis® Ivex

In trials conducted in NorthWest Europe, **Seminis® Ivex**, a Curdivex cauliflower variety from Bayer, **demonstrated more than 18% increased curd visibility**<sup>4</sup> and **up to 7% more marketable heads.**<sup>5</sup> Additionally, Seminis® Ivex exhibits whiter color and up to 3.4% less curd pinkening than the Seminis® Freedom variety.<sup>6</sup> These features contribute to reducing food loss and waste, aligning with Bayer's approach to regenerative agriculture and sustainable food systems.

<sup>3</sup> *Based on 13 Bayer trials from 2022-2023 in Spain (Murcia, Ebro Valley, Levante regions), Calculation reference for % harvest uniformity: Seminis® Suertex: 66.9% | Naruto (competitor): 25% |  $66.9 - 25 = 41.9\%$ ; Harvest Efficiency (HARV) rating (1 best - 9 worst): Seminis® Suertex: 2,7 | Naruto: 5,4; Color rating (1 best - 9 worst): Seminis® Suertex: 3,3 | Naruto: 3,6*

<sup>4</sup> *Seminis® Ivex. Based on 56 trials in North West Europe from 2021-2023. Calculation reference for average curd visibility: Seminis® Ivex: 76% | Seminis® Freedom: 58% |  $76 - 58 = 18\%$*

<sup>5</sup> *Based on 43 trials in NorthWest Europe from 2020-2022. Calculation reference for average marketable heads: Ivex: 85.50% | Seminis® Freedom: 77.84% |  $85.50 - 77.84 = 7.66\%$*

<sup>6</sup> *Based on 147 trials in NorthWest Europe from 2020-2022 Curd color Rating (1 best - 9 worst): Seminis® Ivex rate 3.75 versus 5.62 Seminis® Freedom | % Curd Pinking: Seminis® Ivex 1.26 versus Seminis® Freedom 4.66% |  $4.66 - 1.26 = 3.4\%$*

*Performance may vary, from location to location and from year to year, as local growing, soil and environmental conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on their growing environment*





# Empowering smallholder farmers: the Impact of Seminis® Fortaleza Cauliflower on livelihoods in India

**Bayer Seminis® Fortaleza**, a hybrid cauliflower seed, **has transformed the farming landscape in India**. Its resilience and adaptability have not only minimized wastage and harvest losses during transportation but also introduced a more desirable cauliflower variety to buyers, **leading to substantial improvements in farmers' income and livelihoods**.

According to a study conducted by 60 Decibels<sup>7</sup>, Seminis® Fortaleza has shown significant positive outcomes for growers. Specifically, **57% of growers reported an increase in productivity** compared to the regular variety when using Seminis® Fortaleza on the same land. Additionally, **84% of growers reported improved farming practices**, leading to a 90% overall increase in crop earnings. Furthermore, **88% of farmers experienced an enhancement in their quality of life**, including reduced stress levels.

<sup>7</sup> 60 Decibels - Lean data study, July 2024, 262 farmer phone interviews in India between May and June 2024

 **93%** increased production

 **90%** increased their crop earnings

 **88%** improved quality their of life

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**In Rajasthan, the grower noted that the exceptional crop from Seminis® Fortaleza seeds commands a better price at the market, resulting in increased earnings**



# Seminis® Ansal Tomatoes: empowering Kenyan growers for sustainable growth

Vegetable Seeds is intensifying its efforts to expand the cultivation of **Seminis® Ansal Tomato** in Africa, providing technology and technical assistance to improve the lives of growers. **Seminis® Ansal Tomato is a disease-resistant and climate-resilient variety known for its exceptional firmness and extended shelf life, with profound and measurable effects.**

In 2023, **92% of Seminis® Ansal farmers surveyed reported increased production, and 94% experienced a significant improvement in their quality of life.** Nearly 80% of these farmers indicated positive changes in their farming practices due to the training received on how to grow Seminis® Ansal. Additionally, **61% of farmers improved their farming methods, and 61% saw increased production using the same land, indicating a significant boost in productivity.** Furthermore, 52% of farmers highlighted the environmental benefits of Seminis® Ansal, citing reduced usage of fertilizers and pesticides. **This positive impact serves as clear evidence of the sustainability and effectiveness of Seminis® Ansal Tomato.**

The impact of Seminis® Ansal Tomato is undeniable. **This product has not only transformed the lives of farmers in Kenya but has also promoted sustainable agricultural practices.** With a projected 40% increase in tomato sales for 2024, the potential for even greater impact is clear. **Bayer is dedicated to continuing its collaboration with local communities and partners to expand the reach of Seminis® Ansal Tomato, thereby promoting more sustainable agriculture and improving the lives of smallholder farmers worldwide.**

In the heart of Kirinyaga, Kenya, Purity Muthoni, a determined smallholder farmer, transformed her life with the Seminis® Ansal Tomato variety. Previously struggling with rice cultivation, she now manages ten acres of tomato fields, providing for her family and employing around 50 people. Empowered by an entrepreneurial spirit, Purity is thrilled by the positive changes Seminis® Ansal Tomatoes have brought to her life and her community.

*“I bought a truck, which allowed me to bypass middlemen and sell my produce directly in Nairobi’s markets, and I am paying rent. With increased earnings, my next step is to build my own house. I am very happy about this”*

– Cecily Waruguru, Kirinyaga, Kenya

With great fruit firmness and extended shelf life, the **Seminis® Ansal Tomato** variety is helping smallholder farmers in 16 countries across Africa and Asia Pacific achieve higher returns on investment from their fields. Smallholder farmers growing our Seminis® Ansal Tomato seed variety in Kenya report positive social benefits:<sup>8</sup>

92%

say their income increased because of Seminis® Ansal Tomatoes

81%

training adoption

94%

stated an improved quality of life

<sup>8</sup> 60 Decibels, Lean data study, November 2023, 211 farmer phone interviews in Kenya between September and October 2023

## Did you know?

Shaping new solutions that help smallholder farmers access knowledge and innovations beyond seeds is a key goal in our strategy. One solution is the Knowledge Transfer Initiative, an accessible virtual platform launched in China and India that helps vegetable growers obtain agronomic information to better manage their crops and optimize their production systems



# Empowering smallholder farmers in India: Agri-Impact Initiative driving sustainability and improving livelihoods

The Agri-Impact, a collaborative initiative between Bayer, the Israel Innovation Authority, the Fooksman Foundation, and Tel Aviv University, aims to provide smallholder growers in India with access to advanced agricultural technologies. These smallholder farmers face challenges in farm management, climate change, technology access, financial resources, and market opportunities.

Israeli companies and innovators are invited to submit applications to pilot affordable and innovative solutions tailored to meet the specific challenges faced by smallholder growers, especially those in vegetable cultivation. **The primary goal is to facilitate the large-scale commercialization of successful solutions in India**, focusing on improving productivity, environmental sustainability, climate resilience, post-harvest efficiency, market access, and gender inclusivity for smallholder growers. This open innovation approach aims to enhance the livelihoods of smallholder growers.

**In 2023, 30 startups applied for the Agri-Impact initiative, and 3 exceptional projects proceeded to the testing phase with growers in India.** Among the solutions are NOF's (Nature Offset Farming) revolutionary cooling deviance and Salicrop's cutting-edge seed enhancement technology.

**As we embark on the second year of Agri-Impact, we are expanding the testing of NOF and Salicrop solutions to additional regions in India.**



**In 2023, 30 startups applied for the Agri-Impact initiative, and 3 exceptional projects proceeded to the testing phase with growers in India**



[Learn more about the Agri-Impact Initiative](#)

# Glossary

## Regenerative agriculture

An outcome-based production model system, which holds improving soil health at its core and aims to increase resilience. Other key aspects include mitigation of climate change through greenhouse gas emissions reductions and increased carbon removals, maintaining, preserving or restoring on-farm biodiversity, conserving water resources through improved water retention and decreases in water run-off, and improving the social and economic well-being of farmers and communities.

## Nature positive

A measurable outcome where aspects of the natural world, including species and ecosystems, are being restored and where nature is regenerating rather than declining.

## Sustainable agriculture

For Bayer, sustainable agriculture refers to several farming practices that, while delivering on food security and nutrition for the present population, do not compromise the economic, social and environmental foundations that will allow future generations to meet their own needs. Sustainable agriculture needs to be profitable for farmers to ensure their livelihood and rural development, to guarantee food security and nutrition to a growing population and to safeguard the environment.

The broad nature of sustainable agriculture means other terms, such as regenerative agriculture, have started to emerge that focus on optimizing certain dimensions under sustainable agriculture. Regenerative agriculture has re-emerged as the new term of art for agriculture production systems that focus on improving soil health as a top priority.

## Intensification

Throughout the report, we use the word intensification in different contexts (e.g. agricultural intensification, land-use intensification, sustainable intensification, intensive farming systems, intensive agriculture).

IPBES defines agricultural & land-use intensification as follows:

- **Agricultural intensification**

The process of increasing the use of capital, labor, and inputs (e.g., fertilizers, pesticides, machinery) relative to land area, to increase agriculture productivity ([EUROSTAT, 2018](#)).

- **Land use intensification**

Activities undertaken with the intention of enhancing the productivity or profitability per unit area of land use, such as in agriculture, including intensification of particular land uses as well as changes between land uses. ([Martin et al., 2018](#)).

Increasing the agricultural productivity per area of land is not only achieved by increasing the use of capital, labor, and inputs, but also by introducing structural changes such as increasing field sizes, lowering crop diversity, removing hedges, field trees or field margins, which lead to an overall homogenization of landscapes. Recent research confirms that those structural changes have a strong contribution to the decline of insects ([Cardoso et al. \(2020\)](#); [Raven et al. \(2021\)](#)).

In the case of the sustainable intensified management systems mentioned in the report, we worked on both aspects: optimizing the use of capital, labor and inputs as well as increasing the structural diversity of the agricultural land by introducing wider rotations and cover crops which led to improved social, economic and environmental outcomes compared to the “business as usual” cropping system.

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