

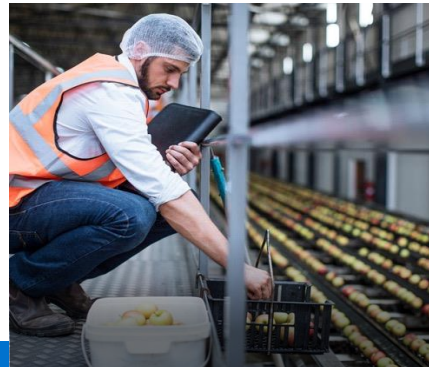


The Role of the Global Food Security Index and Innovation in Agriculture

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The Role of the Global Food Security Index and Innovation in Agriculture in a changing world





It's a pivotal time for agriculture

Global food demand continues to grow

The need for food will expand and change, driving pressures to convert more land and habitats to farmland to meet growing demand.

Farmers have more threats to their crops

more than half of the world's countries has been negatively impacted by changing rainfall patterns and excessive temperature swings.

And society expects more from agriculture

The future of food production hinges on getting new, sustainable and productive tools and technologies into the hands of farmers

Farmers have more threats to their crops



Changes in our climate have **shifted weed, insect and disease pressures and increased extreme weather events**. In 2021 Global Food Security Index, by Economist Impact, reported that agricultural productivity in more than half of the world's countries has been negatively impacted by **changing rainfall patterns and excessive temperature swings**.

More than half of the world



has been negatively
impacted by changing
rainfall and excessive
temperature swings

The Global Food Security Index

Since 2012, the annual Global Food Security Index (GFSI) has set a common framework to identify and address the drivers of food insecurity.

Developed by **Economist Impact** and supported by Corteva Agriscience, the GFSI measures the state of food security across **113 countries**, providing a **global perspective** on which countries are most and least food secure, and how resource risks increase vulnerability.

With extensive input from experts, policymakers, academics and other key stakeholders, the GFSI has established:

- A set of best practices
- A **tool to measure progress**
- An **actionable roadmap for policymakers**

The GFSI model and the global executive summary report will be available online at:

<https://economistimpact.com/food-security-index>



Supported by  **CORTEVA**
agriscience

What does the GFSI measure?

Four core pillars of food security:

1	Affordability
2	Availability
3	Quality and Safety
4	Sustainability and Adaptation

The Global Food Security Index is a dynamic quantitative and qualitative benchmarking model, constructed from 68 unique indicators, that measures the **enabling environment to achieve food security** in developing and developed countries.

While most global food measures track outcomes and examine hunger, the **GFSI looks beyond measuring hunger itself, and focuses on measuring its underlying drivers.**

The index takes into account how effectively a **country is able to meet its population's caloric and nutritional needs while also examining the impact of external factors such as agricultural infrastructure, political stability and climate risks**, among others.

The GFSI Framework Underlying indicators

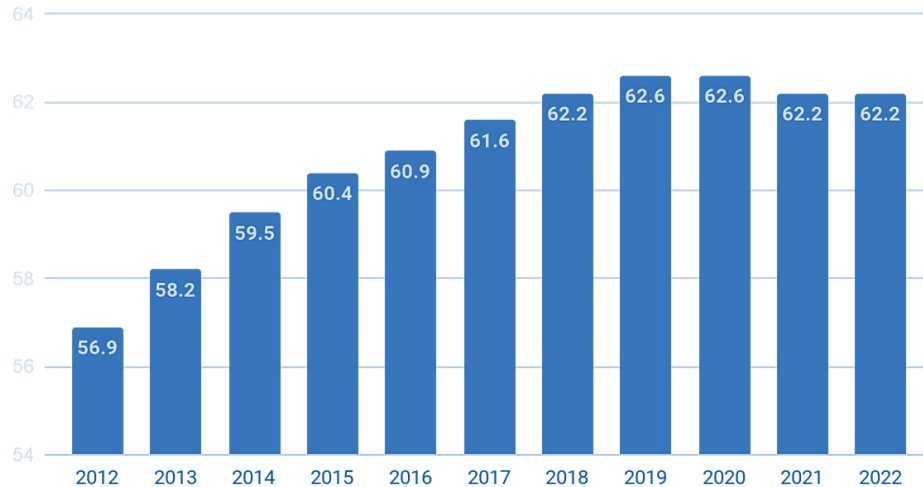
Affordability	Availability	Quality and Safety	Sustainability and Adaptation
<ul style="list-style-type: none"> + Agricultural trade + Trade freedom - Market access and agricultural financial services ↔ Access to finance and financial products ↔ Access to diversified financial products ↔ Access to market data and mobile banking 	<ul style="list-style-type: none"> + Access to agricultural inputs + Producer prices + Access to extension services + Community organisations + Empowering women farmers + Agricultural R&D + Commitment to innovative technologies + Farm infrastructure ↔ Crop storage facilities ↔ Irrigation infrastructure + Supply chain infrastructure + Planning and logistics ↔ Road infrastructure ↔ Air, port and rail infrastructure 	<ul style="list-style-type: none"> + Dietary diversity + Sugar consumption + Food safety + Relevant food safety legislation 	<ul style="list-style-type: none"> + Land + Soil organic content + Political commitment to adaptation + Climate finance flows + Environmental accounting implementation + Sustainable agriculture + Disaster risk management + Pest infestation & disease mitigation - Sensitivity - Food import dependence - Dependence on natural capital - Demographic stress - Projected population growth - Urban absorption capacity

Composite indicators are in **bold**

Key Findings

Driven by structural issues, GFSI scores deteriorated after peaking in 2019. The recent socio-economic shocks and disruptions have only weakened an already-fragile food system.

Average overall food security scores, global (2012-2022)



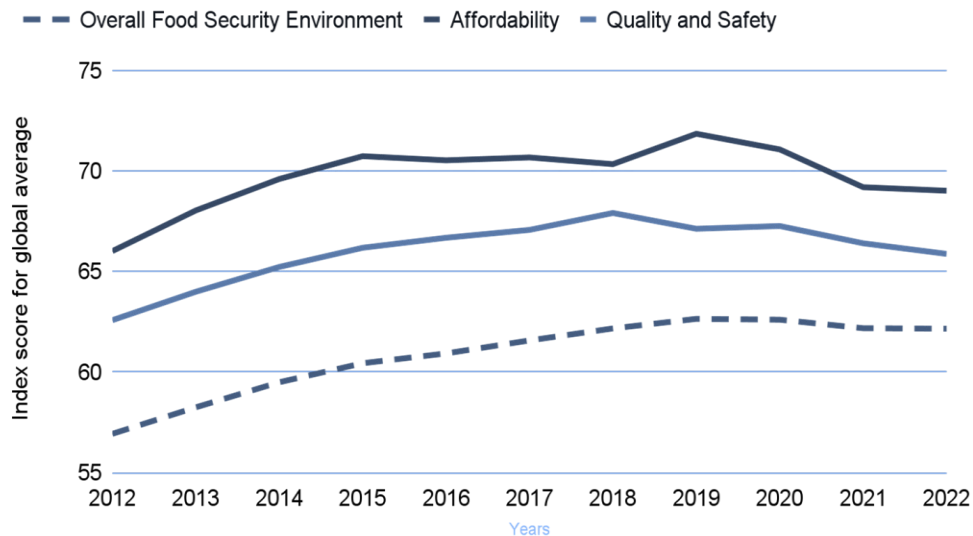
- **In the GFSI, overall food security scores deteriorated after hitting its peak in 2019**
 - GFSI scores declined from 62.6 to 62.2 between 2019 and 2022 highlighting that the global food security environment is deteriorating
 - **Higher food prices**, the inability of governments to fund food safety programmes and sociopolitical instability, among others, contributed to the index deterioration
- **GFSI growth rates have been declining since 2015**
 - Overall food security saw biggest gains in the early days of the GFSI with 6% growth during 2012-15
 - **Long-term structural issues** such as volatility in agricultural production, scarcity of natural resources, increasing economic inequality and trade volatility continue to weaken the global food system

Drivers of GFSI

Affordability and Quality and Safety—the two strongest components of the GFSI—have been deteriorating in recent years.

- **Affordability scores have dropped between 2019 and 2022 after increasing in the previous years**
 - **Rising food costs** and the fiscal strain on the governments to fund food safety net programmes have contributed to deteriorating affordability scores
 - **Trade freedom** has also shown weakness, especially in the last two years.
- **Quality and safety scores have deteriorated since 2019**
 - Countries have significant room for improvement on nutritional standards, specifically, having a **national nutrition strategy and nutrition monitoring** and surveillance. Almost one third (35) countries do not have a national nutritional strategy as of 2022
 - **Lack of food safety legislation** also contributed to the deterioration of the quality and safety measure

Drivers: Affordability, Quality and Safety (2012-2022)

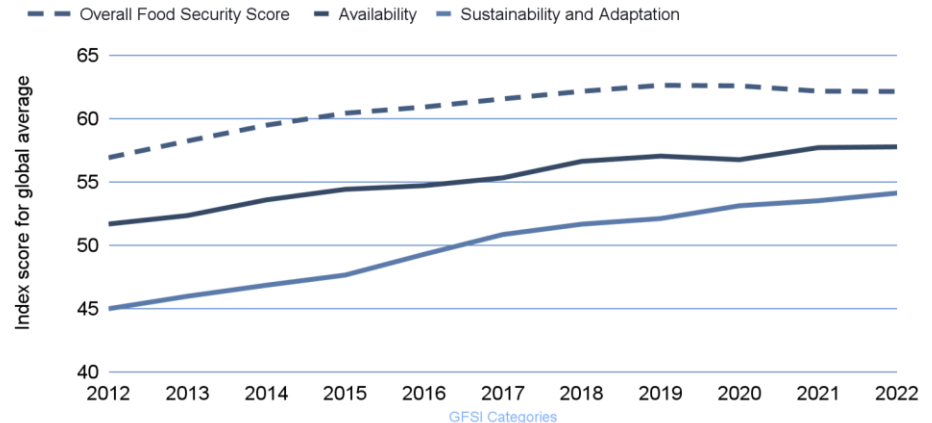


Drivers of GFSI, cont.

The other two pillars—Availability and Sustainability and Adaptation—continued to remain weak with the lowest scores, although they increased slightly over the years.

- **Availability, one of the weaker pillars, has seen scores improve, albeit from a low base**
 - **Social and political barriers** and dependency on chronic food aid continued to dampen the food availability in 2022.
 - Moreover, recently-added measures on agricultural inputs, while improving, increased from a low base, limiting the availability and access to food.
- **Sustainability and Adaptation scores, the weakest pillar, have seen improvement between 2012 and 2022**
 - As governments adopt national agricultural policies, **improve risk management coordination** and increase climate finance flows, scores have improved.
 - However, there is significant scope for improvement especially through investments in **soil organic content**, protecting marine **biodiversity** and **prioritising agricultural water risk**

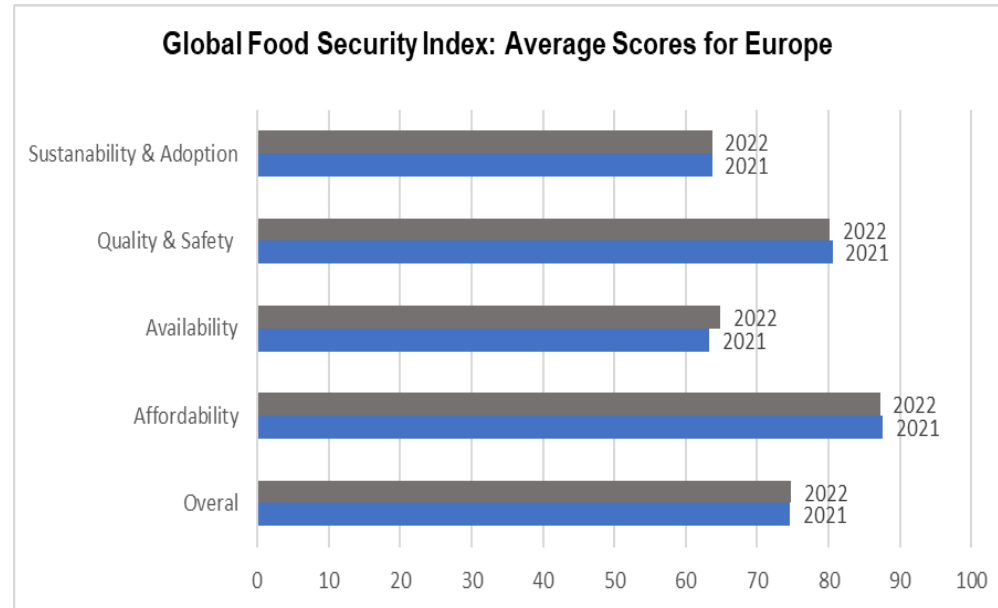
Drivers: Availability, Sustainability and Adaptation



GFSI: Europe Regional Findings



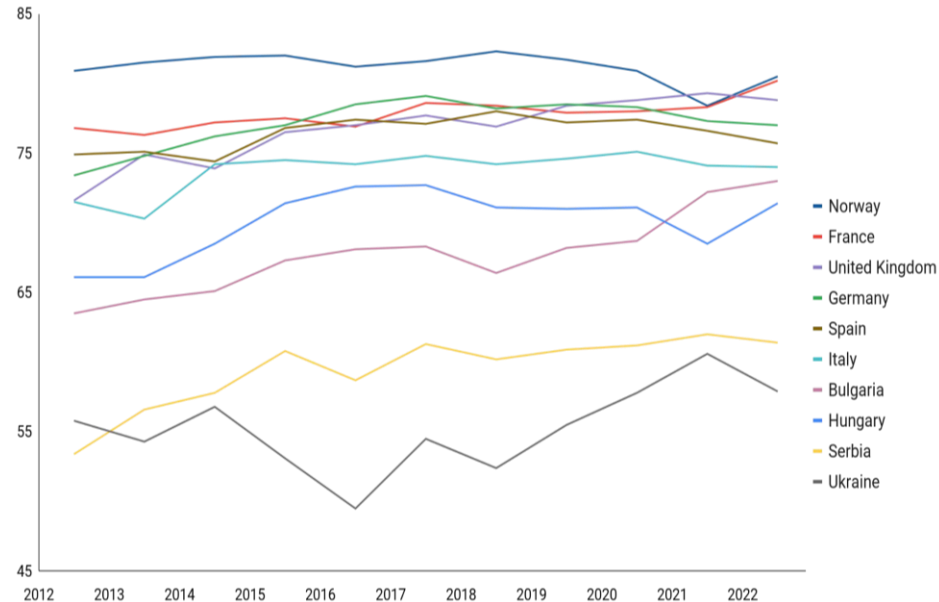
- Europe scored an average of 74.8 on **overall food security environment** in 2022 - an increase of 6.9% since 2012.
- Europe performs strongest in **Affordability** with a score of 87.2, followed by **Quality and Safety** scoring 80.2.
 - Between 2012 and 2022, improvements in Affordability were driven by relative stability of average food costs. Quality and Safety was improved through robust Nutritional standards.
- **Availability** and **Sustainability and Adaptation** have grown considerably since 2012, however the region scores lower in both
 - Lower scores on Availability were driven increased volatility in agricultural production and declining public expenditure on agricultural R&D
 - Low scores on Sustainability and Adaptation were driven by limited improvements in maintaining the health of Land and Oceans, rivers, and lakes.



11-year trends in European countries

- Sixteen of the 26 countries in the region score above the regional average in 2022 indicating significant variation in the region.
 - The biggest 11-year improvements were seen in **Bulgaria**, **Serbia**, and the **United Kingdom** driven by gains in commitment to empowering women farmers, investment in crop storage facilities, and political commitment to adaptation.
 - **Ukraine** and **Spain** experienced the least improvement in the region, owing to increased risk of armed conflict negatively influencing global food security and decline in agricultural R&D.
 - Although **Norway** is as one of the top-ranking countries of Europe, it experienced a slight decline driven by volatility of agricultural producer prices.
- **Finland** stands at the **first place in the region** (and globally) with a score of 83.7.
 - It scores high on Affordability and Quality and Safety driven by **stable food prices and robust nutritional standards**.
 - It has made biggest improvements in Sustainability and Adaptation through an increased commitment to adaptation and improved risk management coordination.

GFSI Overall Food Security Score: Europe



European countries included in GFSI

Global Rank/ 113	Country	Score/ 100
1	Finland	83.7
2	Ireland	81.7
3	Norway	80.5
4	France	80.2
5	Netherlands	80.1
7	Sweden	79.1
9	United Kingdom	78.8
10	Portugal	78.7
11	Switzerland	78.2
12	Austria	78.1
14	Denmark	77.8
16	Czech Republic	77.7
17	Belgium	77.5

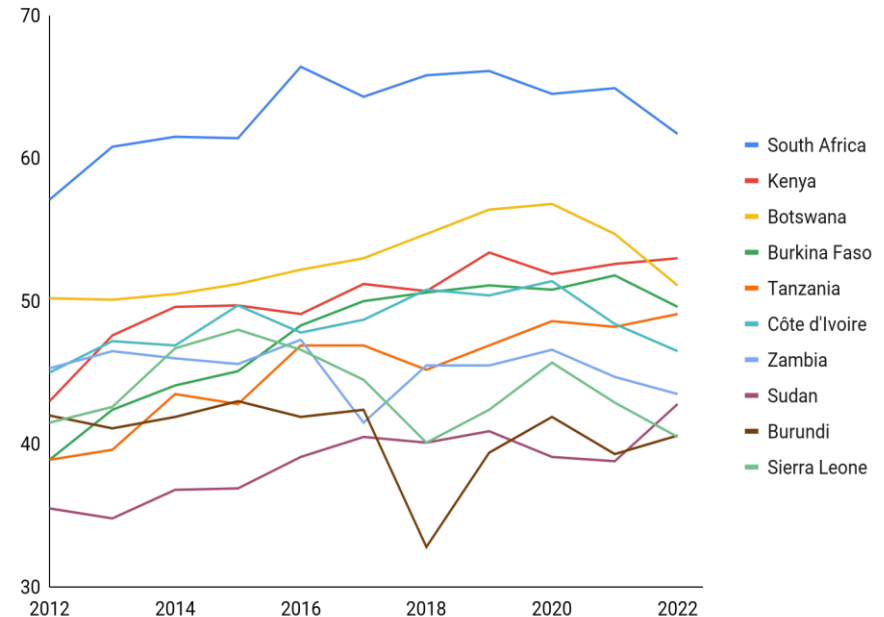
Global Rank/ 113	Country	Score/ 100
19	Germany	77
20	Spain	75.7
21	Poland	75.5
27	Italy	74
29	Bulgaria	73
31	Greece	72.2
34	Hungary	71.4
36	Slovakia	71.1
43	Russia	69.1
45	Romania	68.8
55	Belarus	64.5
61	Serbia	61.4
71	Ukraine	57.9

11-year trends in Sub-Saharan Africa



- Only 13 of the 28 countries in the region score above the regional average in 2022.
 - The **biggest 11-year improvements** were seen in **Burkina Faso, Tanzania, and Kenya** driven by score gains in disaster risk management, change in average food costs and protein quality.
 - **Zambia, Burundi, and Sierra Leone saw an 11-year decline, owing to rising average food costs, deteriorating disaster risk management, and lower food security** and access policy commitments.
- **South Africa** stands at the first place in the region with a score of 61.7.
 - **High scores in micronutrient availability and food safety** has contributed to South Africa scoring the highest in Quality and Safety.
 - It has made biggest improvement in **Sustainability and Adaptation**, owing to notable gains in disaster risk management and political commitment to adaptation.

GFSI Overall Food Security Score 2012-22: Sub-Saharan Africa (SSA)



Sustainable Innovation is Core to Corteva

Sustainable Innovation Criteria tied to UN Sustainable Development Goals

Goal

Goal criteria in each stage of R&D

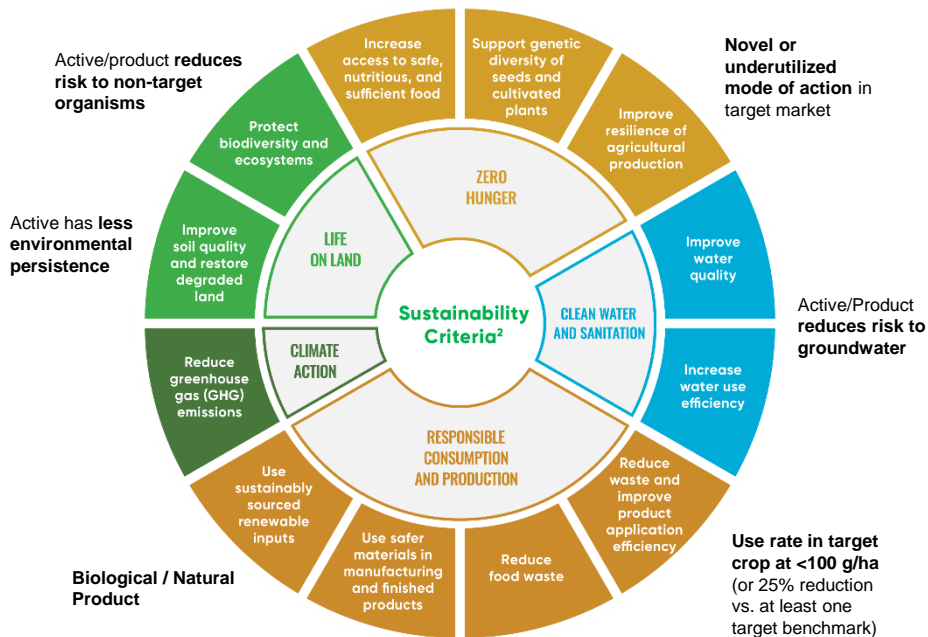
New products with sustainable attributes

Example: Crop Protection active ingredient threshold

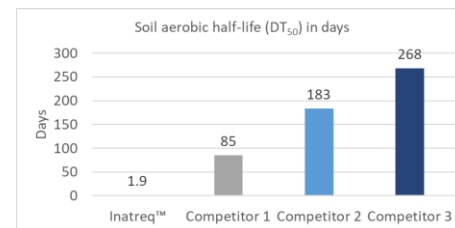
100% of newly-developed Corteva solutions in our pipeline will meet our sustainability criteria by 2025.

100% of current¹ CP Pipeline meets sustainability criteria

100% of current¹ Seeds Pipeline meets sustainability criteria



Inatreq™
active



- Naturally-derived fungicide that controls plant diseases
- Low use rate
- Degrades faster³ than competitor products
- Very low acute toxicity to terrestrial species

Innovation: Science and collaborations to develop research-driven solutions for the most complex ag and food problems

The curious minds on our teams help solve food industry challenges by using:



AGRONOMY



BACTERIOLOGY



BIOCHEMISTRY



BIOLOGY



BOTANY



CHEMISTRY



ECOLOGY



ENTOMOLOGY



STATISTICS



SOIL SCIENCE



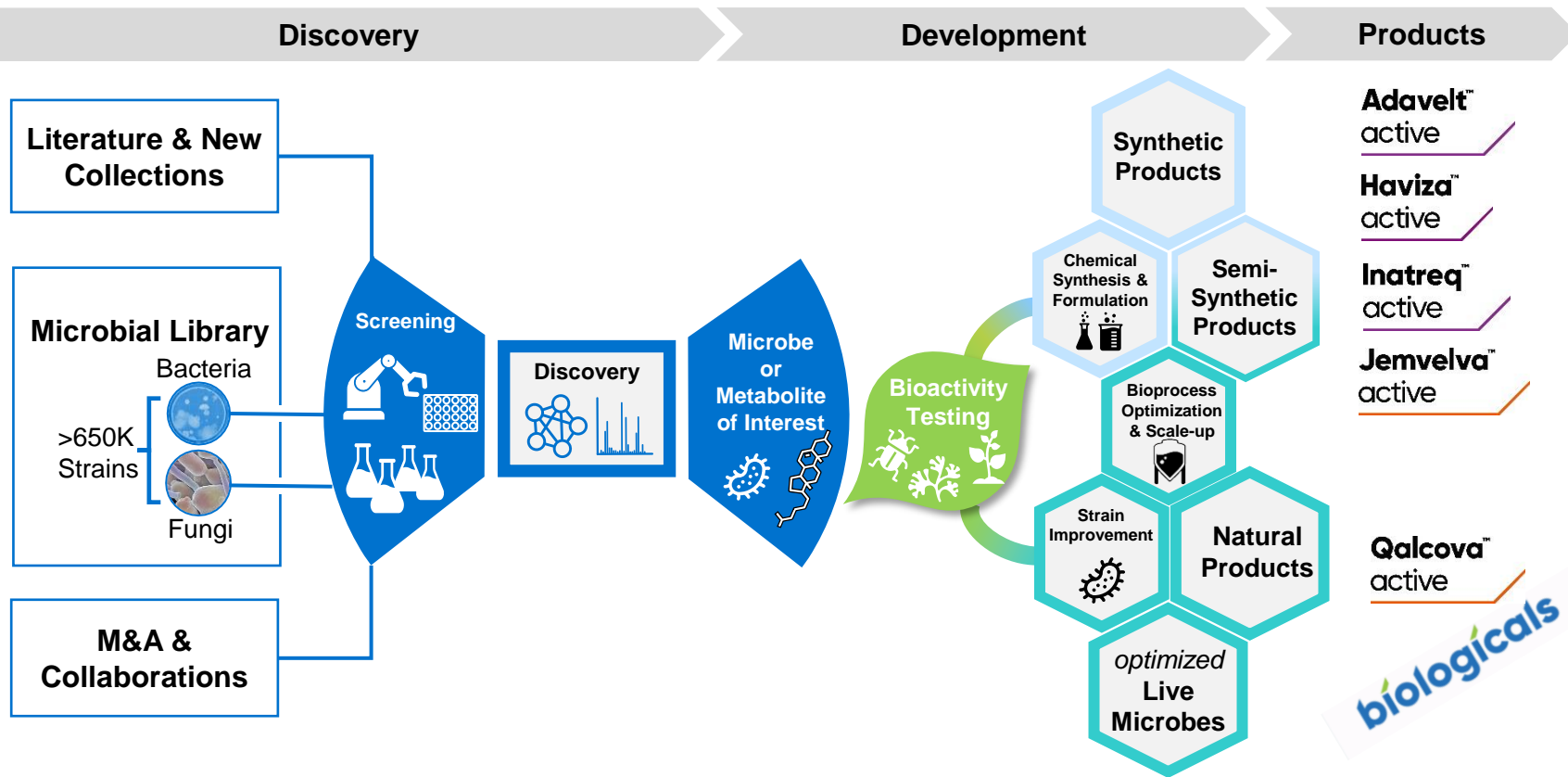
GENETICS



Soil Health

openinnovation.corteva.com

Biological Strains Create Diversified Crop Protection Products



Biologicals: A Rapidly Growing Market



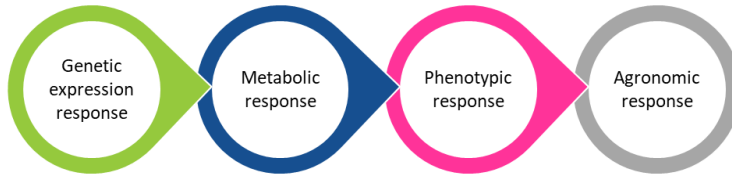
By 2035: Biologicals will make up ~25% of the overall crop protection market. It is anticipated to grow by more than 3x to \$30 billion. Today, the global biologicals market totals about \$9 billion.

Key Factors Contributing to Biologicals Growth

- ✓ Sustainable Production
- ✓ Regulations and Legislation
- ✓ Enhanced Efficacy
- ✓ New Modes of Action
- ✓ Market Reach

Biologicals will not replace synthetic chemistry, which remain important tools for farmers to produce crops. However, biologicals have growing adoption in the market as complementary, sustainably advantaged solutions for farmers.

Example: Nitrogen availability and uptake improvement

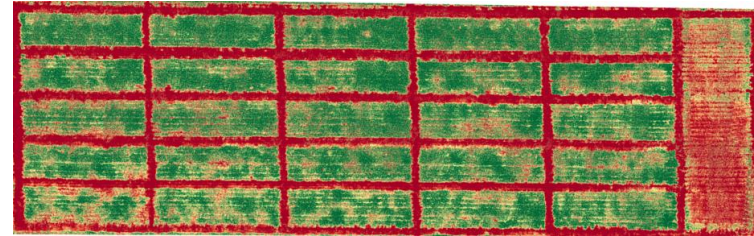
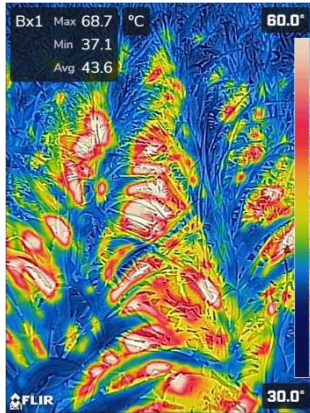


Example Utrisha N : *Methylobacterium symbioticum* positively influences their host plants once they are colonized.

- **Reduces cellular stress by consuming Methanol produced during active tissue growth.**
- **Enables a better photosynthetic efficiency due to the Methylobamine UV protection and chromophores.**
- **Nitrogenase Complex : changing N₂ available in the air into NH₄⁺ directly available for the plant, when it needs it.**
- Increased vegetative growth, yield and quality.



Wrapping up





THANK YOU

