Biological Breakthroughs
Crop Science Innovation Summit
June 20, 2023

Jessica Christiansen // Head of Sustainability and Business Stewardship, Bayer Crop Science
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Biological Solutions Key to Advancing Benefits of Regenerative Agriculture

Active ingredients derived or developed from naturally-occurring sources
Pathway for growers to protect their crops and land, increase their nitrogen use efficiency and limit their environmental impact

01 BIOCONTROLS
Biocontrol products aim to protect plants from pests and diseases

02 BIOSTIMULANTS
Biostimulant products aim to improve nutrient use efficiency and tolerance to e.g. drought or heat

regenerative agriculture
“producing more and restoring more”

Improved soil health
Mitigation of climate change
Conservation of water
Yield increase and improved productivity, social and economic well-being of farmers and communities
Preservation, restoration of biodiversity

Deliver Sustainably-sourced food, Renewable fuels
Building on the Leading Portfolio of Biological Solutions to Meet Growing Market Needs

**Biocontrols**

- **Insecticides**
  - Integral Pro³
  - Poncho Votivo³
- **Fungicides**
  - In-licensed from Total Energies
- **SeedGrowth/Soil**
  - 3rd party product from BASF

**Biostimulants**

- **SeedGrowth**
  - B-360²
  - TagTeam⁴
  - Nitragin Gold⁴
- **Crop Performance Enhancers**
  - Optimize⁴

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**In-licensed / Commercial Products**

Table shows selected examples only

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**Leading Position**

- Bayer is the #1 Trusted Brand in Biologicals by Growers⁵
- Delivering ~€200m in annual sales in 2022
- Offering >20 commercial products

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**Select Key Product Offerings**

- **Acceleron portfolio** offers advanced seed treatment solution in the industry (for corn, soybean and cotton)
  - Designed to complement, protect, and enhance seeds including Bayer’s DEKALB corn commercial hybrids from the outset (exclusive combinations of seed treatments merging chemical and biological products)
- **Biological Insecticide**
  - Natural product containing fatty acids derived from a by-product of extra virgin olive oil
  - Consistent broad-spectrum activity across multiple fruit and vegetable crops and pests
  - In-licensed from AlphaBio Control

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1. In-licensed from Total Energies
2. Also sold under BioRise® and Torque® brand names
3. 3rd party product from BASF
4. In-licensed from Novozymes
5. 75-100 growers polled in each of seven countries (Europe, Brazil, US) for potato, tomato and grapes, Bayer Market Research 2020
Serenade Soil Activ Tailored for Soil and Crop Health

Accelerate Growth in Emerging Global Soil Application Market Across Fruits & Vegetables

NEW Serenade Soil Activ propelling Serenade brands to €170m peak net sales in next 10 years

Serenade brand family: the biological active *bacillus amyloliquefaciens* strain QST 713 delivers solutions in emerging soil treatment and expanding bacterial disease markets:

- **Serenade ASO** offers QST 713’s combination of several modes of action to help control foliar bacterial and fungal diseases while reducing residues.

- **NEW Serenade Soil Activ** with its higher concentration of QST 713 spores provides farmers handling efficiency with low use rates and less water consumption.
  - The concentrated QST 713 spores, applied in furrow or via drip, can speed up root formation and uptake of nutrients, raising marketable qualities (skin, shelf life, nutrient content).
  - Launched in U.S., Canada & Australia, sales in all global regions expected with coming registrations.

- **Higher proportion of big potatoes**
- **~10% more premium class potatoes**
- **Better skin finish, improved uniformity**
- **Lower use of water/ac**

Sustainably increases marketable yield with spores optimized for improved root colonization.
We aim to Outgrow the Market with a 17% CAGR

Global Biologicals Market

- CAGR: 7%
- Biocontrol: €12bn
- Biostimulants: €20bn

Bayer Biologicals Opportunity

- CAGR: 17%
- Sales 2022: €200m
- Sales 2035: >€1.5bn

Increasingly stringent regulatory approvals processes, consumers’ demand for low- and no-residue food products and retailer food sourcing standards drive growers to look for new innovations in crop protection.

Source: Global Agricultural Biologicals Market, Forecast to 2030, Frost & Sullivan, 2022 and internal estimates
Expanding a World Class Biological Platform with Open-Innovation
Partner of Choice with Industry Leading Capabilities in Development, Regulatory and Commercialization

**Open Innovation Ecosystem**

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<th>January 2023</th>
<th>Commercialized</th>
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<td>• Scouting to meet short to mid-term portfolio needs</td>
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<td>• M2i: partner to supply fruit and vegetable growers around the world with pheromone-based crop protection products</td>
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<td>• Ecología y Protección Agrícola: commercialized Vynyty Citrus</td>
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<td>• Driving next-generation biological concepts</td>
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<td>• Ginkgo: 3-year collaboration on nitrogen optimization, carbon sequestration, and next generation crop protection</td>
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<td>• Kimitec: strategic partnership to accelerate the development and commercialization of biological crop protection solutions and biostimulants</td>
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**SeedGrowth Corn Yield**

- Phase 3

**SeedGrowth Bird Repellent**

- Phase 3

**Pipeline advancements** through development of internal assets and co-development with selected partners

**Multi-year strategic research partnerships** with technology leaders to develop proprietary portfolio of next generation biologicals

**Complementing efforts with academic partnerships and Leaps by Bayer investments**, such as:

- *andes*
- *Sound*
- *PIVOT BIO*
Biologics Most Effective in Integrated Crop Management System; Complementary to Other Technologies

Example: Integrated Citrus Pest Management

- **Sustainable and effective pheromone-based product** that controls three of the most common invasive pests in citrus cultivation, using pyrethrin, an organic compound that does not encourage residues.

- Replicates the sexual pheromone of the **South African cotonet** (Delottococcus aberiae) to attract the males of the species, inhibiting their reproduction in a specific and targeted manner.

- Depending on pest pressure, the use of Vynty Citrus1 can be complemented by the precise use of products like Movento and Citrole using CroppingView.

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1 In-licensed from EPA Ecologia
Two Biological Seed Treatments Advanced in our Pipeline

Pipeline advancement focused on differentiated products

**Bird Repellent**

- Bird repellent for corn seeds in Europe with Black Pepper Oleoresin (BPO) as active ingredient
- BPO is a food grade natural extract which is applied onto seeds to protect them from bird attacks in freshly sown fields, which cause 9-15% of corn acreage in Europe to be replanted\(^1\)
- BPO is a unique biological alternative to substitute chemical bird repellents with poor toxicological and environmental profiles

**Biological Seed Treatment**

- Expected to unlock yield potential in corn
- Significant and consistent yield increases demonstrated in trials over several years in the core regions
- Will associate with corn roots and increase nutrient availability by solubilizing insoluble nutrients
- Potential for improved and increased root systems can enable higher yields

\(^1\) according to internal survey in Germany, France and Italy
\(^2\) shows two week old corn plants grown in containers in greenhouse; Pipeline phases as of Feb’23
Comprehensive Open-Innovation Strategy for Nitrogen Fixation

The Need

- Synthetic nitrogen fertilizer has helped feed >3.5bn people\(^1\)
- But accounts for \(~3\%\) of global greenhouse gas emissions

Our Approach

- Regulatory requirements are increasing around the globe
- In-licensing or distribution
- Pipeline advancements
- Strategic research partnerships

Transformational Partnership with Ginkgo Bioworks

- Enhance nitrogen fixing bacteria through synthetic biology
- Leverage Ginkgo's expertise in microbial discovery, our expertise in agronomics, product development and commercialization
- Exclusive commercialization rights to programs already started at Bayer and/or Joyn Bio
- Aiming to reduce use of added synthetic fertilizers while maintaining the yield potential of the crops

\(1\) Source: Our World in Data
Key Takeaways – Biological Breakthroughs

01. Leading portfolio with ~€200m in annual sales from >20 commercial offerings in 2022

02. Expect to outgrow the market and reach €1.5bn sales ambition by 2035

03. Aim to explore additional value pools like nitrogen fixation technologies via our open-innovation strategy

04. Most optimal use case for biological solutions such as Vynyty, Flipper or Serenade is integrated with other solutions

05. Pathway for growers to protect their crops and land, increase nitrogen use efficiency and limit their environmental impact
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Jessica Christiansen // Head of Sustainability and Business Stewardship, Bayer Crop Science
Crop Science: Crop Protection R&D Pipeline
(Annual Update Feb 2023)

1 Shown here is a subset of Bayer’s total life cycle management activities; focused on new formulation developments which have the potential to bring significant innovation to customers compared to currently marketed product; Products shown may not yet be fully registered in all jurisdictions; includes all advancements made in FY’22, updated Feb’23; 2 SeedGrowth is currently reported within other SBEs; 3 3rd party collaboration

PSP = Peak Sales Potential, 50% incremental; Expected to reach 30% of PSP by 2032, 80% of PSP by 2037 and remainder in 2038+; Note that products are excluded from the pipeline PSP typically the year following launch.

Selection of projects listed here and included in the peak sales potential by segment do not include projects in early research or discovery
Industry-Leading Technology for the Next Generation of Biologicals

4-6 Year Product Development Timeline

Partner of Choice to Bring the Next Generation of Biologicals to Growers

**Discovery**
- Access to a variety of diverse technologies through our Open Innovation Network

**Research Optimization**
- Accelerate competencies in fermentation and formulation optimization of microbial products for agriculture

**Field Development**
- Worldwide network of field-testing capabilities for early screening and development of application programs

**Grower Support**
- Dedicated resources to understand compatibility, rainfastness and stability of biologicals in jug and on seed

**Industry leading portfolio**
- Sustaining today’s leading lineup and pioneering next generation of biologicals

**Competitive Advantage**
- Strategic research partners with in-depth understanding of innovative modes of action resulting in novel products

**Competitive Advantage**
- Market leading end use products with ease of handling for customer and good shelf life for distribution

**Competitive Advantage**
- Understanding of geographic product range with precise guidance on practical use

**Competitive Advantage**
- Exceptional customer support with market leading biological products

**Competitive Advantage**
- Ability to address untapped markets and work within challenging regulatory constraints worldwide