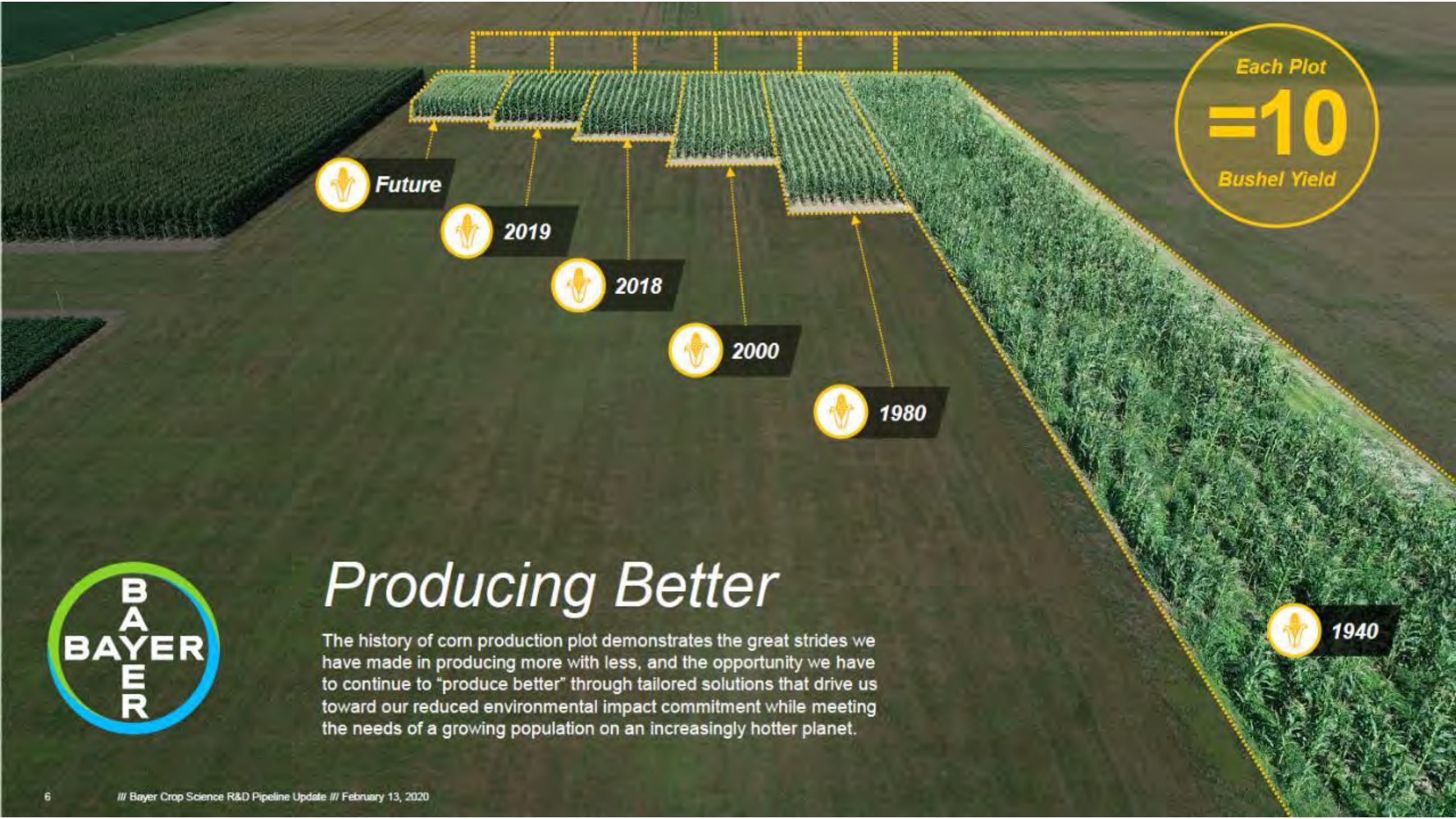
Big Challenges Require Bolder Approaches

Richard Dickmann
Bayer Crop Science



Producing Better

The history of corn production plot demonstrates the great strides we have made in producing more with less, and the opportunity we have to continue to "produce better" through tailored solutions that drive us toward our reduced environmental impact commitment while meeting the needs of a growing population on an increasingly hotter planet.

Leveraging Open Model for Incremental and Disruptive Innovation

Enabling Innovation and Effective Delivery on Industry-Leading Pipeline

Incremental Innovation

- Annual germplasm upgrades
- New modes of action in weed, insect and disease control through biotech and crop protection
- New formulations and uses in crop protection to expand spectrum and crops

Disruptive Innovation

- Genome-editing
- Next generation biological science
- Precision breeding
- Drone application technology
- New modalities for crop protection

Open Innovation Model

Technology Collaborations

Gerthbio, Atomwise, PAIRWISE, elemental enzymes, SECOND GENOME, 2BLADES FOUNDATION, targenomix, MeiogeniX

Venture Capital

leaps by Bayer, FARMLEAD, APOLLO, UNDERSTORY, AgBiome, CoverCress Inc., PAIRWISE, PIVOT BIO, JOYN BIO

Customer-sponsored Research

GRDC, CRDF Citrus Research and Development Foundation, Inc.

Universities & Research Institutes

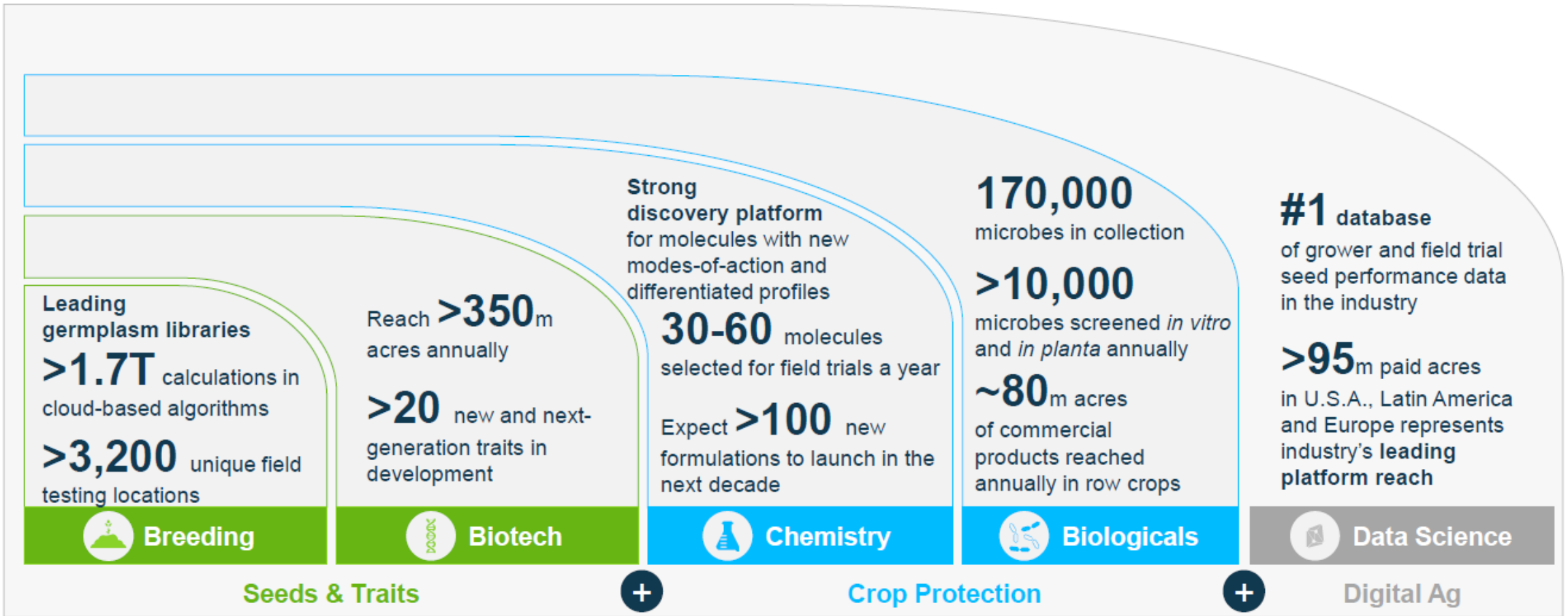
JÜLICH, Embrapa

Crowdsourcing

Grants4Targets™ Grants4Traits™ Grants4Biologicals™

Next Growth Opportunity: Convergence of Leading R&D Platforms

Continued Investment in Data Science and New Technologies are Driving Future Opportunity



Best positioned to discover, combine and tailor solutions for growers

Two Approaches to Short Stature Corn Advance

Genome Editing Reveals Promising Third Option

Three Development Approaches to Short Stature Corn Provide Options to Access Multiple Markets

// Breeding: ADVANCED TO PHASE 3

Advanced breeding used to introgress naturally occurring short stature characteristic into elite germplasm.

VITALA commercial beta in Mexico in 2020

// Biotech: ADVANCED TO PHASE 3

In collaboration with BASF, uses transgene to shorten internodes; enables applicability across wide-array of germplasm.

NEW! // Genome Editing: DISCOVERY

Multiple, elegant approaches to generate short-stature corn, creating potential for opportunities in multiple markets.

XtendFlex Soybeans Advancing to Launch Phase Spring 2020[1]

Built on the Proven Performance Roundup Ready 2 Xtend Soybeans

ROUNDUP READY® XTEND CROP SYSTEM

#1 *Soybean system planted by farmers*

ROUNDUP READY 2 XTEND® SOYBEANS

Roundup PowerMAX® HERBICIDE

Glyphosate

XTENDIMAX® with VaporGrip® Technology

Low-Volatility Dicamba

XTENDFLEX® SOYBEANS

- Provides exceptional weed control and yield with a triple-stack herbicide-tolerance trait providing growers with the flexibility of three over-the-top herbicide options:

Glyphosate	*Low-Volatility Dicamba*	*Glufosinate*

- Increases spectrum of control from 350 to 375 weed species; Enlist E3™ system only controls 260[2]
- Average 2019 yield and agronomic performance consistent with Roundup Ready 2 Xtend soybeans[3]
- Acres in the U.S. expected to be limited in first year

Enables continued use of conservation tillage and no-till systems which improve carbon sequestration and soil health

[1] Commercial availability pending regulatory approval
[2] Based on EPA labels for the chemistries.
[3] Derived from 26 site locations in SC, NE, IN, IL, WI, MO, IN, AR, IA, NC, KS, SD, OH & GA

Xtendimax with VaporGrip Technology is a Restricted Use Pesticide. Always read and follow label instructions. Products not registered in all jurisdictions.
Enlist E3™ is trademark of Corteva

Intacta 2 Xtend to Broaden Insect and Weed Control Spectrum

Intacta RR2 PRO on >65m Acres in South America in 2018/2019; Intacta 2 Xtend in Phase 4

- Intacta 2 Xtend trait technology to provide an additional mode of action for insect control and both glyphosate and dicamba tolerance for weed control
- Stewarded trials expected in 2019/2020 and launch in 2021[1]

Reduces insecticide use and the environmental impact of the crop protection program

[1] Pending regulatory approvals
[2] 2019 soybean screenhouse trials, various Bayer Crop Science Research Centers in the U.S. and Argentina
Always read and follow label instructions. Products not registered in all jurisdictions.

First-Ever Biotech Trait for Piercing and Sucking Insect Control

Lygus and Thrips Control Trait in Cotton in Phase Four with Expected U.S. Launch in 2021[1]

- Protein design and optimization resulted in a protein that **controls targeted piercing/sucking insect pests** through expression in the plant tissues they attack
- Protects the plant from thrips and tarnished plant bugs, while **allowing beneficial insect population to survive**
- Season-long protection from trait technology **expected to reduce foliar insecticide applications,** particularly in high pressure environments
- **Expect to launch in 2021** in the U.S. in a stack with the proven Bollgard 3 XtendFlex Technology

Control

2019 University of TN Trials; West TN Research and Education Center

Lygus & Thrips Control Trait

ThryvON™ TECHNOLOGY

Reduces insecticide use and the environmental impact of the crop protection program

[1] Pending regulatory approvals
Always read and follow label instructions. Products not registered in all jurisdictions.

Vayego Launched; New Broad-Spectrum Insecticide

Asia Pacific Focus with Initial Launch in Korea in 2019; >€300m Peak Sales Potential

vayego Reatis

Builds on #1 position in insecticides in horticulture and #3 in both corn and soybeans[1]

- Fast-acting and long-lasting control of all important **caterpillars** and selected **beetles** and **sucking pests** with this tetraniliprole diamide insecticide
- Regulatory submissions planned or submitted across key markets of **India, China, Indonesia, Australia, Chile, Argentina**; up to **17** launches expected in 2020 and 2021
- Expect use in a number of key crops; **corn, rice, potatoes, fruits & nuts and vegetables** via multiple application methods, including **foliar, drone, drip & drench and seed treatment**

Increases productivity per acre through improved insect control

[1] Internal estimates

Always read and follow label instructions. Products not registered in all jurisdictions.

New Herbicide Molecule Unlocks Greater Flexibility

First New Post-Emergence Mode of Action for Broad Acre Weed Control in 30 Years

Potential to build on #1 position in global herbicides[1]

- Entirely new mode of action **advanced to Phase 2 early development**
- Demonstrates effective control of key resistant grasses, including **Goosegrass and Sourgrass**
- **Discovery** program launched in biotechnology to discover a matching **herbicide tolerant trait**; initial approaches under evaluation

Enables continued use of conservation tillage and no-till systems which improve carbon sequestration and soil health

[1] Internal estimates

FieldView Seed Advisor Advancing to Commercial Launch

Planning to Expand Corn Seed Advisor with Increased Acres in 2020

FieldView Corn Seed Advisor Optimizes Key Grower Decisions

Products & Portfolio

Which products should I purchase and how much of each?

Assignment

Which fields do I optimally place each product?

Density

What's the right density? Should I redistribute seeds in this field?

Powered by Millions of Data Points

- Algorithm powered by >6m data points from >7,700 hybrids and 60K+ fields from Bayer R&D and seed genetic library to develop and validate algorithm
- Performance testing from 2017-2019 demonstrates consistent **6-9** bu/ac yield advantage
- Product enhancements focused on improving field assignment accuracy using extensive FieldView data

> 2019 Beta Launch for Corn Seed Advisor across seven states (IA, IL, IN, MN, MO, SD, WI)

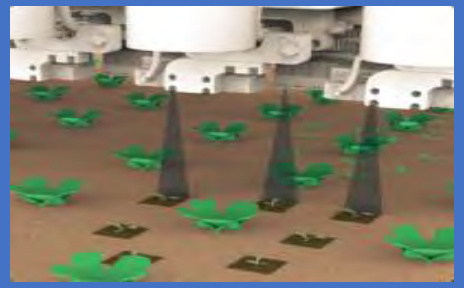
Improves productivity per acre through optimized seed placement

~$25B herbicide market in the face of resistance, provide opportunity and value

First market entrance into high value crops with growth opportunities into row crops as scale improves

1 **Patch Spraying**

2 **Spot Spraying (Individual Weeds)**



3 **Robots**

4 **Drones**

5 **Non-chemical Weed Control Technologies**

6 **Digitally improved Weed Management**

Enter the Digital business
for Drones in APAC

// **BCS Japan** agreed on a collaboration with **XAG** to digitally **transform agriculture**

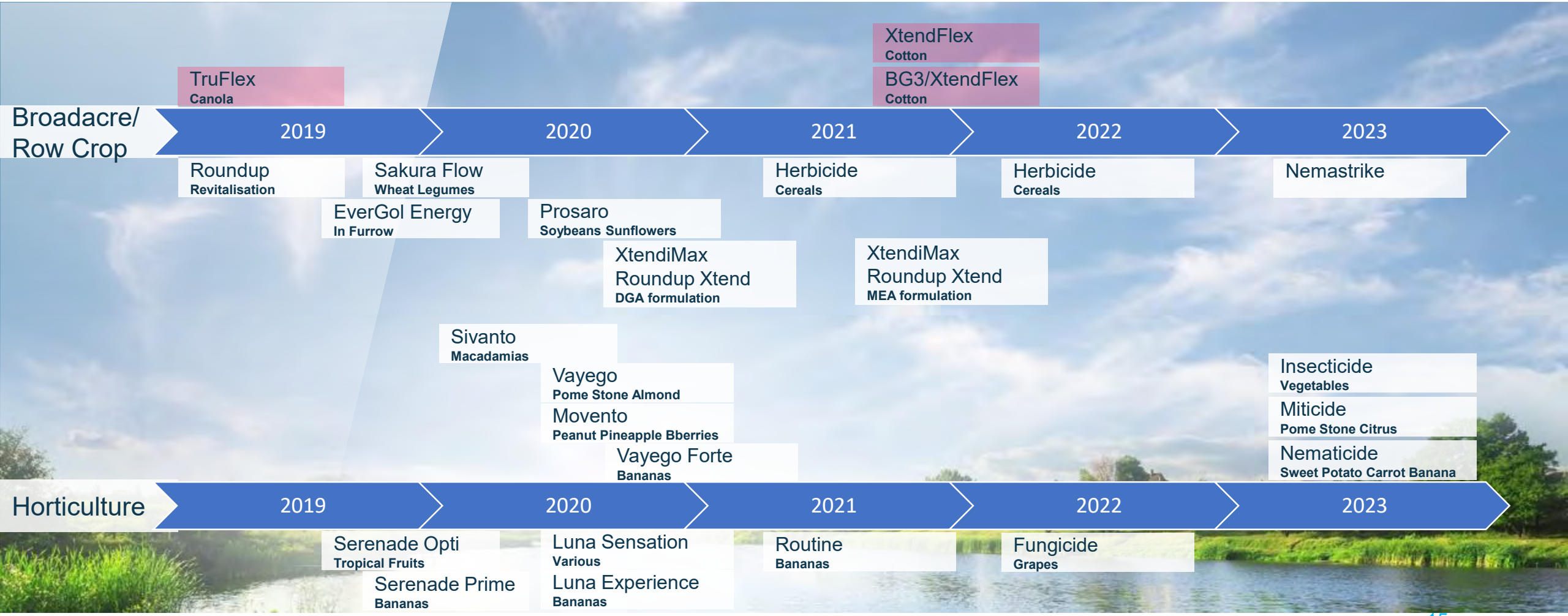
// **The Impact:**

- // Successfully introduce **drone technology** to Japanese farmers to overcome challenges of an **aging farmer society**
- // Develop innovative drone **application technologies** and **formulations**
- // Develop data-driven **digital farming solutions**

And.. Biological frontiers

We are perfectly positioned to deliver innovation across ANZ

Our pipeline



Committed to Innovation and Research in Australia

- **Bayer – Grains Research and Development Corporation Partnership**
  - Six-year $54 million Herbicide Innovation Partnership to provide grain growers with **new ways to break herbicide resistance**.
- **Bayer – CSIRO Research Partnership**
  - Research to **increase integrated pest control**, **wheat crop yield**, **cotton quality**, **pest resistance and yield.**
  - Partnered for the world-first launch of **the Bollgard 3 cotton variety in Australia.**
- **Bayer's committed to new technologies for Australian farmers**
  - **> 40 R&D employees**
  - **350+ field trials** per year
  - **3 research facilities**