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# Digital innovations for sustainable crop production

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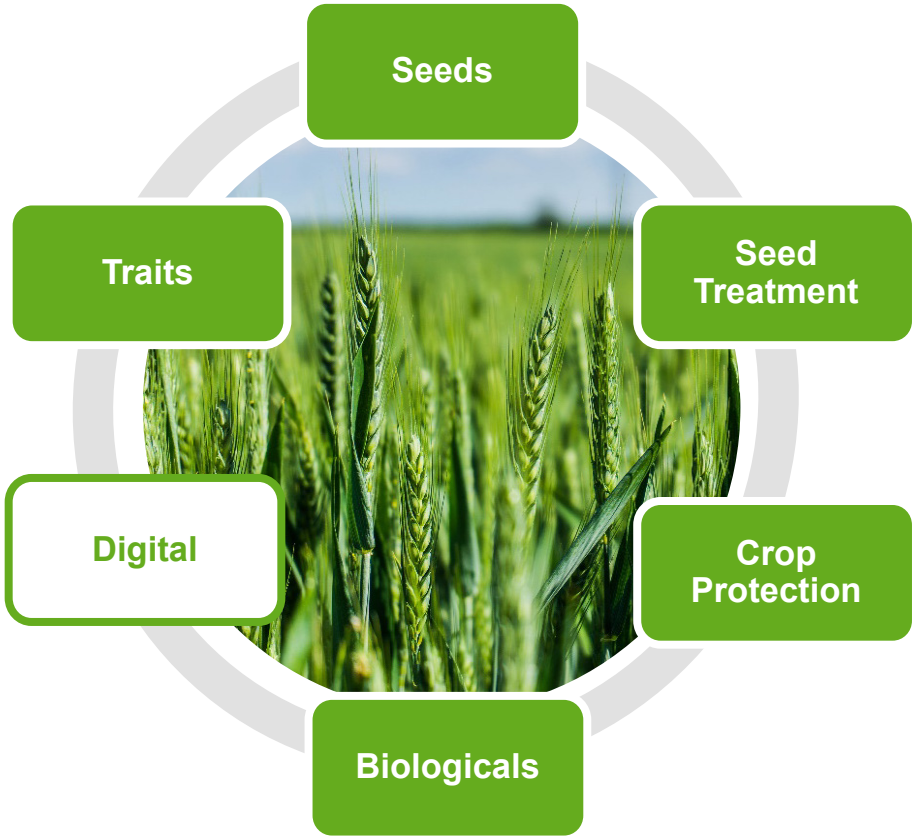
xarvio® Digital Farming Solutions
powered by BASF

# The right balance for better yield




Yield that is valued by society

More biodiversity protection

**Higher yield with lower environmental impact**

Less $CO_2$ per ton of protein produced

Help farmers make a living

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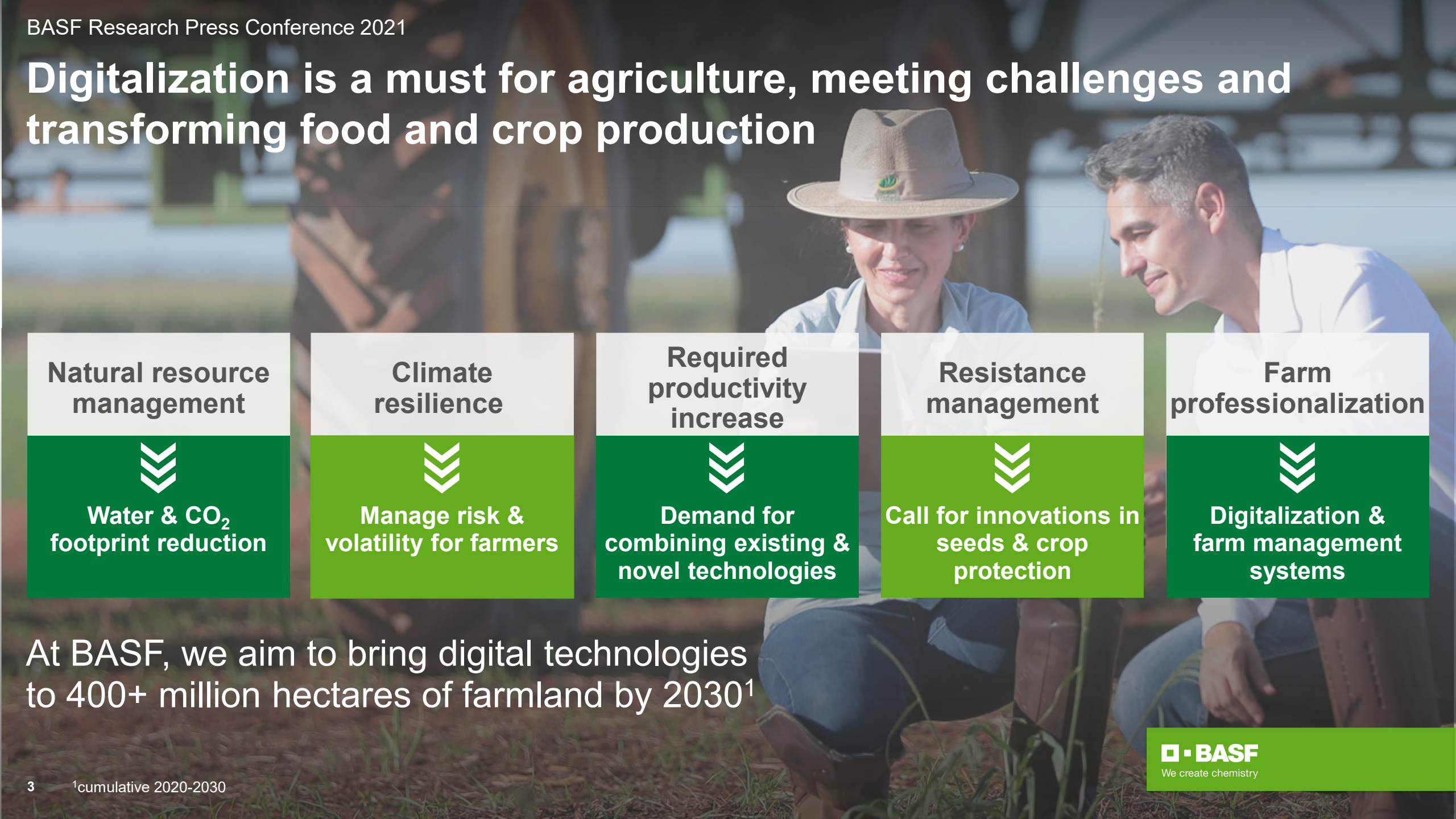
# Digitalization is a must for agriculture, meeting challenges and transforming food and crop production



| Natural resource management | Climate resilience | Required productivity increase | Resistance management | Farm professionalization |
|---|---|---|---|---|
| Water & $CO_2$ footprint reduction | Manage risk & volatility for farmers | Demand for combining existing & novel technologies | Call for innovations in seeds & crop protection | Digitalization & farm management systems |

At BASF, we aim to bring digital technologies to 400+ million hectares of farmland by 2030[1]



[1]cumulative 2020-2030

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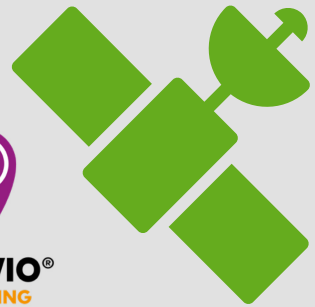
# Digital farming enables improved and automated crop production

## Capture field-specific data



xarvio® SCOUTING powered by BASF

**Understanding**

## Agronomic Decision Engine (ADE)

xarvio ADE

**Decision making**

## Recommendation

xarvio® FIELD MANAGER powered by BASF

**Actionable advice**

## Crop health guarantee

xarvio® HEALTHY FIELDS powered by BASF

**Outcome assurance**

xarvio® Digital Farming Solutions provide farmers with the right product, the right rate, for the right place at the right time



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# Three digital R&D pillars support the Agronomic Decision Engine for more sustainable farming practices

## Digital Agronomy

- Crop phenology
- Pest and disease models
- Crop yield modeling
- Optimized intensity
- Product recommendation

## Data

- AI for data-driven innovation
- Data infrastructure and data engines for automation
- Data enrichment and synthetic data creation
- Data integration

## Technology

- Weather & remote sensing with high temporal and spatial resolution
- Drone-assisted assessments
- Connectivity to IoT solution
- Buffer Zone Automation

## Agronomic Decision Engine (ADE)

**Smart digital products**

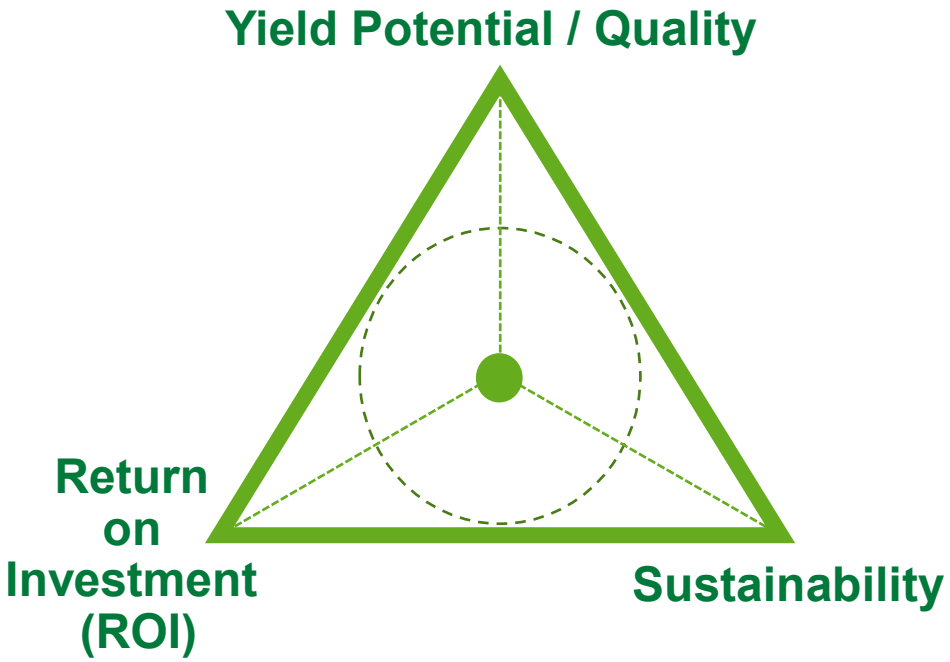
xarvio® SCOUTING, FIELD MANAGER, HEALTHY FIELDS

**Smart machinery for optimal execution**

e.g. Bosch BASF Smart Spraying

The Agronomic Decision Engine is the foundation and centerpiece

# The Agronomic Decision Engine balances yield, profitability and sustainability




Continuous learning and dynamic adaption with additional and new information

# Smart digital products enable better land use and precision application: Spray Timer

## Spray Timer
(feature of xarvio® FIELD MANAGER)

- Optimal timing for crop protection application
- Proprietary disease and pest modeling algorithms
- Prediction of infection moment and disease spreading
- Frequent model calibration by country, target pest and crop improves accuracy

- >230,000 improvement cycles
- Same yield level
- 30% volume reduction[1]
- 29 €/ha gross margin gain[1]
- 0.35 CEPP Points/ha[2]


Use of xarvio® FIELD MANAGER enables yield optimization as well as reduction of crop protection inputs and costs



[1]Source: BASF Digital Farming trials results 2017-2020
[2]Source: Certificat d'Economie des Produits Phytopharmaceutiques

# Smart digital products enable better land use and precision application: Zone Spray

## Zone Spray
(feature of xarvio® FIELD MANAGER)

- At the field level, remote sensing information is used for mapping zones of plant density and health insights
- Zone-specific algorithm for Variable Rate Application Seeding, Crop Protection and Crop Nutrition
- Smart application maps optimize rates per field zone
- Definition of product and sprayer-specific automated buffer zones

- 1.5% yield increase[1]
- 13% volume reduction[1]
- +30 €/ha[1]
- Reduced $CO_2$ footprint
- 0.22 CEPP Points/ha[2]

xarvio® FIELD MANAGER
powered by BASF

Variable precision application
is now scalable and fully automated



[1]Source: BASF Digital Farming trials results 2017-2020
[2]Source: Certificat d'Economie des Produits Phytopharmaceutiques

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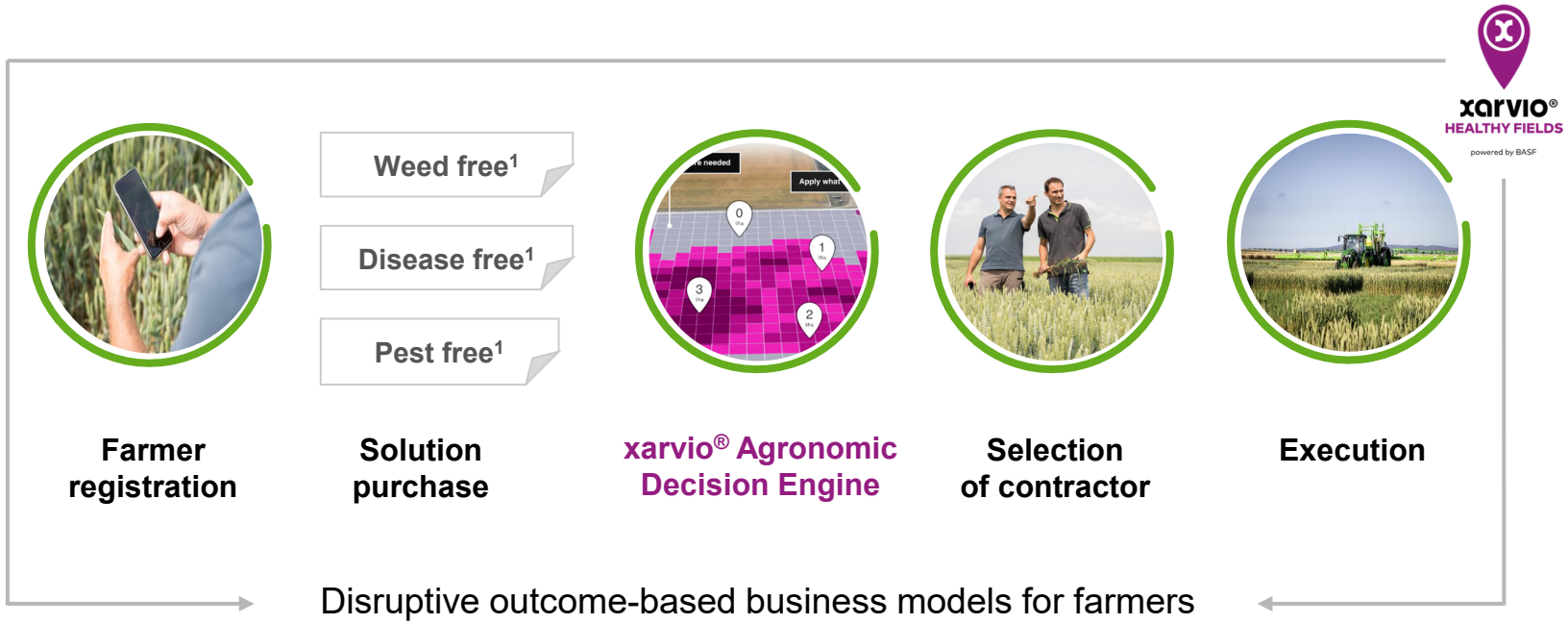
# Smart digital products allow for new, outcome-based business models: xarvio® HEALTHY FIELDS




- Guarantees plant health and enables achievement of agreed yield forecast
- Tailored field- and season-specific crop protection strategy
- Agrow Crop Science Award 2020 for “Best Innovation in Digital Farming Technology”

## xarvio® HEALTHY FIELDS incentivizes sustainable farming practices



[1]Thresholds to be defined, e.g., for biodiversity

# Smart machinery combining hardware, software and agronomic expertise for more sustainable weed management

## Smart Spraying

Complete solution for targeted weed control

- Bosch hardware & software:
  - High-resolution camera technology developed for usage in agriculture
  - Software: High-speed image-based weed identification
- xarvio® agronomic intelligence: for targeted and timely use of crop applications

- Stable yield
- Up to 70% herbicide volume savings[1]
- Reduced impact on biodiversity


First products to be launched in Brazil, followed by Europe and North America



[1]Depending on field conditions

# Digitalization is vital to achieve the right balance for better yield

**Productive land use despite uncertainties**

**Promotion of biodiversity**

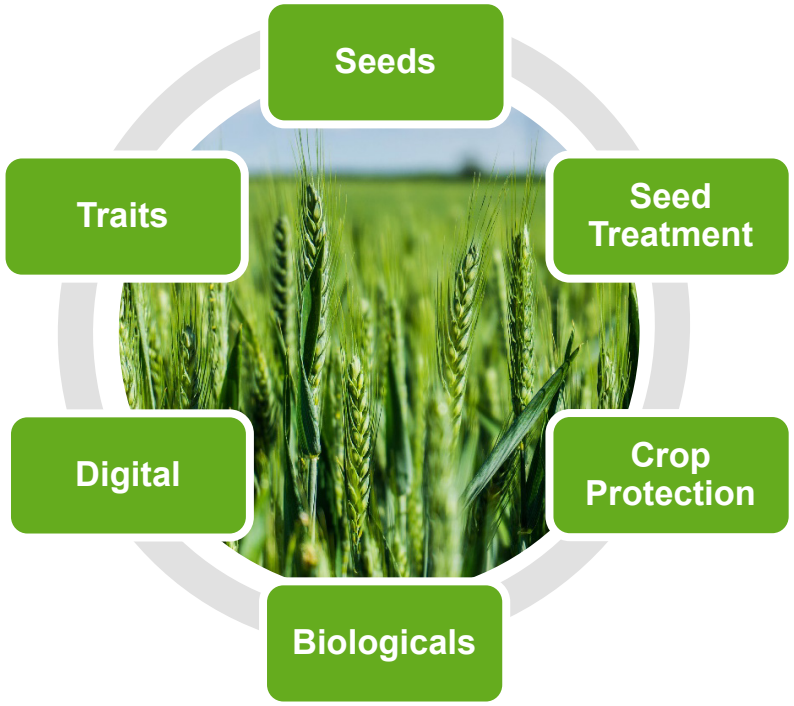
**Improved & automated crop production**

**Precision application**

**Partnering**

- Digital Farming has the power to transform crop production in a **resource-efficient way**
- xarvio® Agronomic Decision Engine enables
  - **Smart digital products** and **smart machinery**
  - Balanced decision making
  - Field-zone specific optimization and precision application
- **Partnering across the value chain**, delivering data-driven, farmer-focused technologies
- Our target is to **bring digital technologies to 400+ million hectares of farmland by 2030** (cumulative 2020-2030)

# The right balance for better yield





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