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Digital innovations for sustainable crop production

Bjoern Kiepe
Global Head of Agronomy
The right balance for better yield

Yield that is valued by society

More biodiversity protection

Higher yield with lower environmental impact

Less CO₂ per ton of protein produced

Help farmers make a living
Digitalization is a must for agriculture, meeting challenges and transforming food and crop production

At BASF, we aim to bring digital technologies to 400+ million hectares of farmland by 2030\textsuperscript{1}

\begin{itemize}
\item Natural resource management
  \begin{itemize}
  \item Water & CO\textsubscript{2} footprint reduction
  \end{itemize}
\item Climate resilience
  \begin{itemize}
  \item Manage risk & volatility for farmers
  \end{itemize}
\item Required productivity increase
  \begin{itemize}
  \item Demand for combining existing & novel technologies
  \end{itemize}
\item Resistance management
  \begin{itemize}
  \item Call for innovations in seeds & crop protection
  \end{itemize}
\item Farm professionalization
  \begin{itemize}
  \item Digitalization & farm management systems
  \end{itemize}
\end{itemize}

\textsuperscript{1}cumulative 2020-2030
Digital farming enables improved and automated crop production

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

Yield Potential / Quality

Return on Investment (ROI)

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

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

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

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1Source: BASF Digital Farming trials results 2017-2020
2Source: 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

Variable precision application is now scalable and fully automated

- 1.5% yield increase\(^1\)
- 13% volume reduction\(^1\)
- +30 €/ha\(^1\)
- Reduced CO\(_2\) footprint
- 0.22 CEPP Points/ha\(^2\)

\(^1\)Source: BASF Digital Farming trials results 2017-2020
\(^2\)Source: Certificat d’Economie des Produits Phytopharmaceutiques
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

1Thresholds 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

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

- Stable yield
- Up to 70% herbicide volume savings\(^1\)
- Reduced impact on biodiversity

\(^1\)Depending on field conditions
Digitalization is vital to achieve the right balance for better yield

- 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

- Seeds
- Traits
- Seed Treatment
- Digital
- Crop Protection
- Biologica
- Productive Land Use
- Resource Efficiency
- Yield Protection
- Promote Biodiversity
- Targeted Inputs
- Quality & Nutrition
We create chemistry