An Overview: Digital Farming

Digital farming tools help farmers work smarter by combining their expertise and knowledge of their land with modern, digitally enabled tools that collect and organize more data, providing them with actionable insights that allow for better decision-making.

The Basics

// **What:** Digital farming combines a farmer's knowledge with cutting-edge technologies, such as: remote sensing through satellites, drone imagery, variable rate application/planting algorithms and artificial intelligence technologies, that work with precision equipment to help make more informed and real-time decisions.

// **Why:** The more digital farming is adopted, the more precise farming can be and the fewer resources farming uses. More efficient use of raw material and other inputs are positive for the planet overall.

// **How:** Using software tools that integrate data from satellites, field sensors, irrigation systems, drones and other input sources, billions of data points combine to help farmers prevent problems before they start so they can grow enough using less land, energy and water.

> Smartphones, software and other connected tools are changing everything from the way we do work, to hailing a ride or staying connected with relatives. These same solutions are also bringing more management options to the farm, allowing farmers to grow more while using only what they need, even in an increasingly unpredictable climate.

The Background

As the world's population grows and factors such as climate change, urbanization and soil degradation limit the amount of arable farmland, agricultural productivity will need to increase to safeguard our food supply in the long term. Digital tools and data are not only helping Bayer deploy our resources efficiently and sustainably, but they are also enabling farmers to get the most out of their fields while using less land and fewer inputs.

Everything produces data, and digital technology's ability to connect and leverage that data with incredible speed is evident every time we conveniently bank online, seamlessly schedule and pay for a ride, or easily track the delivery of a product we purchased from a hyper-personalized website. At Bayer, we're using these same technologies to connect and leverage data about our products and across our operations to bring significant advancements to agriculture for the benefit of farmers, consumers and the planet.

As part of Bayer's commitment to shape a more sustainable future for agriculture – one of the world's most important industries – we're aiming to reduce the environmental impact of crop protection by 30 percent by 2030. Our strategy includes using software tools that integrate farmers' expertise with data from satellites, field sensors, irrigation systems, drones and other input sources, to provide detailed, real-time assessments of growing conditions and crop health to help farmers sustainably grow enough while using fewer resources and inputs such as pesticides and fertilizers.

The Highlights

Digital farming is farmer-focused.

// The rise of digital farming technologies has opened a wealth of new data for farmers. Remote sensors, satellites and drones can monitor plant health, soil conditions, temperature, nitrogen utilization and much more - 24/7.

// Artificial intelligence-based tools can analyze this overwhelming amount of data at high speeds and funnel it back to farmers in the form of useful insights, helping them make critical, timely and in-field decisions, even on the smallest footprint of land.

// Digital tools like drones and smart sprayers are maximizing efficiency for farmers, allowing for less wasted time and higher yield, all while using fewer resources.

An Overview: Digital Farming

The HIghlights

Digital farming uses a smarter toolbox.

⫽ Whether it's selecting the right crop variety for each individual field or determining the ideal time and amount of crop protection, our tools allow this information to be geospatially tagged and transmitted to a farmer's smartphone or tablet before the plan is executed by precision farming equipment guided by GPS technology.

⫽ Our Climate FieldView™ platform helps farmers gain a deeper understanding of their operations by allowing them to collect and store billions of data points to monitor field variability, optimize inputs and stop problems before they start.

⫽ Our FarmRise™ mobile application combines agronomic knowledge and mobile technology to bring free, relevant information and advice directly to farmers' fingertips.

No two farms – or fields – are alike.

⫽ Since farmland varies in different areas, a "one-size-fits-all" management approach won't work for every farmer.

⫽ The digital transformation of agriculture has the potential to benefit all farmers independent of size. Not all digital tools benefit all farmers equally. However, they open the door for a more diverse offering of tailored solutions to bring the most possible benefit to each famer and, in turn, each field.

⫽ Even within a single farm, differences in soil, water, nutrients, vegetation and terrain create unique microclimates. Using data science, farmers have better insight into exactly where and at what rate a seed product or active ingredient should be applied. Combined with precision agriculture, these digital solutions help limit the waste of resources, help improve farmers' bottom lines and minimize agriculture's impact on the environment.

We are transforming ourselves, too.

⫽ By investing in new automated and data-driven technology, we know more now than ever before about our products, how they are used and how they perform.

⫽ Digitally connected and accessible data allows us to be more efficient at breeding the next generation of genetics and requires less testing in the field, enabling us to use fewer hectares and few natural resources to develop a product.

⫽ We are using decision science to breed seeds that are custom-designed for specific regions, climates and soil types through initiatives such as the Precision Genomics Project – a data warehouse gathering genetic insights from around the globe.

Key Things to Remember

⫽ When farmers can make data-driven decisions in real-time, they end up using more precise amounts of resources, including water, energy, fertilizer and pesticides.

⫽ Using the right varieties and the right amount of fertilizers or crop protection products, applied at the right time, farmers can produce the maximum amount of food from every crop on every field, reducing the need to use more land.

⫽ Tools like drones, satellite imagery and sensors empower farmers to collect more detailed information on factors such as weather conditions, soil moisture, soil nutrient levels and crop health – contributing to an overall improvement in decision making.

⫽ At Bayer, we're committed to reducing the environmental impact of crop production by 30 percent by 2030. We aim to achieve this by developing new technologies that enable farmers to scale down crop protection product volumes and enable more precise application.