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Precision Agriculture: AI That Sees the Difference

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European agriculture is facing a complex challenge: farmers must produce more food and feedstock while using fewer resources. Rising input costs, climate change, increasing environmental expectations, and the need to maintain profitable businesses require new approaches that combine productivity with sustainability. Rather than relying on additional regulation alone, Europe should accelerate the adoption of technologies that enable farmers to make better, data-driven decisions.

Artificial intelligence (AI) is becoming one of the most powerful tools to achieve this. At John Deere, we believe AI is not about replacing farmer's expertise, it is about enhancing it. By combining advanced sensors, computer vision and agronomic knowledge, AI enables farmers to apply exactly the right treatment, at the right place, at the right time. This is where technologies such as See & Spray™ are transforming crop protection.

1.1. Seeing every plant – treating only what is needed

For decades, crop protection has largely been based on uniform field applications. While effective, this approach treats entire fields regardless of whether every square metre requires intervention. Today's technology allows agriculture to move beyond this "one-size-fits-all" model.

The challenge is enormous: in Europe's small grain and oilseed production alone, an estimated 23 trillion individual weeds must be identified and managed every year. Yet weeds typically occupy only one to five percent of the total arable land. Farmers therefore face the task of finding and treating a vast number of weeds while avoiding herbicide application on the remaining 95 to 99 percent of the field. Achieving this level of precision exceeds human capabilities and requires advanced artificial intelligence capable of making millions of decisions in real time.

John Deere's See & Spray™ technology represents a major step forward in precision agriculture. Using high-speed cameras and artificial intelligence, the system analyses plants in real time while the sprayer moves through the field. Within fractions of a second, the AI distinguishes between crops and weeds and activates individual spray nozzles only where treatment is required.

The benefits are significant. Depending on the application, farmers can reduce herbicide use by up to 70 percent, lowering both input costs and environmental impact without compromising agronomic performance. Instead of applying products across an entire field, every droplet is used where it is needed to protect valuable crops.

The technology continues to evolve. The first stage, known as "Green on Brown", identifies green plants against bare soil and enables highly targeted spraying before crops emerge. The next generation, "Green on Green", goes a step further by distinguishing weeds from growing crops, allowing selective treatment even within established crop stands. Already deployed successfully in crops such as maize and soybeans in North America, this technology also offers significant potential for European agriculture, including crops such as sugar beet.

1.2. Digital intelligence enables more sustainable farming

Artificial intelligence only delivers value when supported by reliable data. Every field is different, and every season presents unique challenges. By integrating field data, satellite imagery, machine information and agronomic insights, digital farming platforms such as the John Deere Operations Center™ help farmers make informed and timely decisions throughout the growing season.

These platforms allow farmers to manage field operations, application maps, machine performance and agronomic data in one integrated environment. Information collected during spraying is automatically documented, creating transparency while supporting operational efficiency and simplifying record keeping.

Precision technologies also complement other sustainable farming practices. GPS-guided implements allow highly accurate mechanical weed control between crop rows, reducing chemical inputs even further. Together, these technologies demonstrate that sustainability is not driven by a single innovation, but by intelligent combinations of digital and mechanical solutions tailored to each field.

1.3. Turning innovation into sustainable productivity

Europe's agricultural sector has always embraced innovation. Today, artificial intelligence offers an opportunity to improve productivity while reducing resource use, helping farmers remain competitive and resilient in an increasingly demanding global environment. Rather than viewing digitalization as an additional burden, policymakers should recognize it as an essential enabler of

sustainable food production. Technologies such as See & Spray™ show that precision agriculture can help farmers produce more with less – benefiting both their businesses and the environment.

About the author



Justin Rose is President, Worldwide Agriculture & Turf Division, Small Ag & Turf at John Deere, and is responsible for the European, African, and Asian markets. He leads a team dedicated to developing equipment and technology solutions for small ag and turf care customers globally. His work focuses on accelerating the adoption of precision agriculture and digital farming technologies that enable data-driven decision-making and more efficient use of agricultural inputs.

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