Future Farming: Tech-Enabled Solutions Are Farmers' Best Friends

WITH AN EYE ON SUSTAINABILITY, FARMS INCREASINGLY RESEMBLE TECHNOLOGY COMPANIES AS THEY INCORPORATE BIG DATA, TECH, AND INNOVATION TO PRODUCE MORE WITH LESS.

With the world's population on track to reach 9.1 billion people by 2050, farmers need to raise overall food production to meet demand, growing 70% more between 2007 and 2050, according to the Food and Agriculture Organization. Already challenged by factors ranging from weather to environmental conditions to crop prices, farmers face enormous new difficulties as they increase crop yields, improve livestock practices, and scale up in sustainable ways.

Growers are increasingly relying on technology solutions to increase that yield. Sensors help identify areas that need water or chemicals, while tracking crop qualities during harvest. Drones monitor crop development and water needs, creating maps that pinpoint different growing conditions in the field. Apps help diagnose and manage livestock. Smart tractors and vehicles apply just the right amount of seed and fertilizer, minimizing inputs while maximizing outputs.

But technology has a host of other advantages, like decreasing the manual labor required to test crops and soil in the field. It even eliminates the need to manually adjust inputs during the planting or fertilizing process. Yet the results are higher quality and more uniform products. Farms investing in these technologies often attract new customers and maximize profits on what are typically thin margins.

Vendors that once just manufactured farm equipment or supplied nutrients are increasing their scope of business, becoming technology innovation companies. They harness technology to allow a new generation of precision agriculture, improving on traditional techniques. Technological breakthroughs and adoptions are changing the way farmers grow and produce just about everything. The farms of the future are increasingly looking like technology companies themselves.

BIG DATA: TYING ALL FARMING COMPONENTS TOGETHER

At the heart of the technology is data. "What we're doing now is collecting more data and using more data to make our decisions," says Andre Daccache, an assistant professor in biological and agricultural engineering at University of California, Davis.

That data is part of AGI's holistic approach to the crop cycle, says Tim Close, AGI's CEO. AGI manufactures equipment and technologies covering the full crop cycle connecting field activity with grain marketing: equipment for seed, fertilizer, and solutions for post-harvest crop storage and handling from the field to global markets. Sensor use across the farm, including soil probes, weather stations, and automated bin conditioning, combined with in-field data captured from their partnership with Farmobile, allows growers

▲ Sensors in AGCO's IDEALTM combine help determine what is grain vs. not, and direct the system to self-adjust on the go.

▶ AGI clinics equip farmers with the data they need to succeed.in their farming operations.

to manage crop production and marketing to maximize profitability.

AGI's lab services and grain analyzers provide crop characteristics, allowing growers to sell their crops on the AGI SureTrack platform based on actual crop content. "Every processor has a preferred characteristic of a crop they're using," Close says. Farmers can segregate products based on qualities like high levels of starch, oil, or protein, for example.

"If they use the complete AGI SureTrack system, farmers can market their crop with real traceability," he says, with details about what happened with the crop at every stage. Farmers using this system can earn a premium for traceability and for grain content, providing new sources of revenue and meaningful gains in profitability for farmers and efficiency gains for processors.

"IF A FARMER APPLIES SOMETHING IN THE FIELD AND IT DOESN'T LEAD TO YIELD, THEY'RE LOSING MONEY."

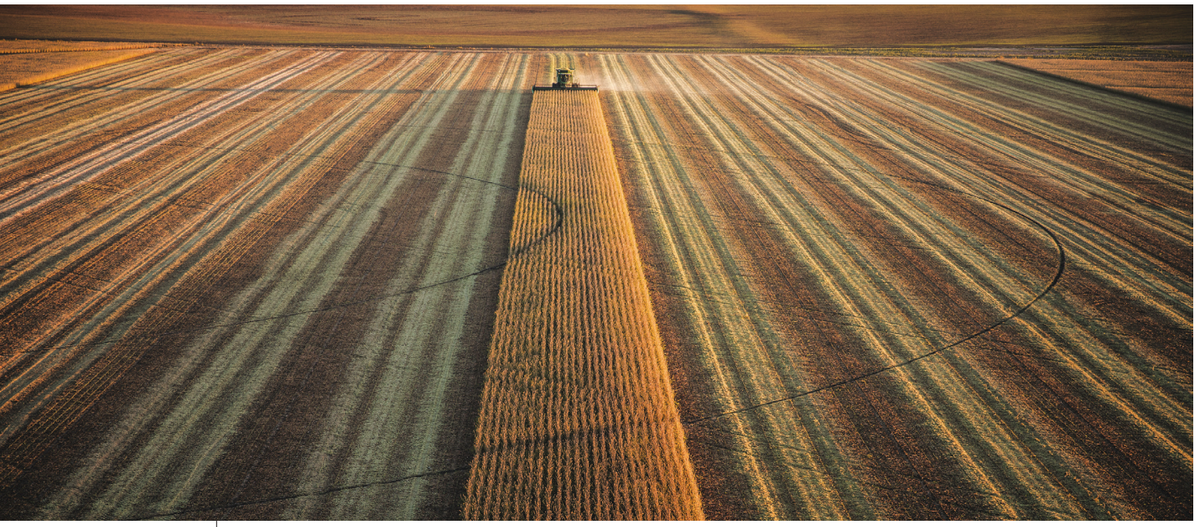
WESLEY GWALTNEY, PROFESSOR, AGRICULTURAL TECHNOLOGY, VIRGINIA TECH

SMART FARMING CONSERVES INPUT, INCREASES OUTPUT

While self-driving cars and trucks are making headlines, "we've been automating machines for many years," says Seth Crawford, AGCO's vice president of Fuse® connected services and technology, the Duluth, Georgia–based agricultural company's smart farming group. About 50% of planted acres with row crops use guidance systems, according to the U.S. Department of Agriculture (USDA). Responding to GPS signals, AGCO's tractors not only drive themselves through the field, but optimize the seed placement and rate. "Our smart farming products can sense the ground we're putting seed into and precisely adjust the seed population and fertilizer rate on each acre," Crawford says. Data is streamed from the equipment to the cloud and back, so customers can optimize their fleet and agronomic settings. "They can adjust those settings over the air, something they couldn't do five to 10 years ago," he says.

AGCO designed their IDEAL combine around these available technologies. "Others stuffed sensors in, but we designed it with the sensors in mind," Crawford says. As a result, while the machines harvest crops, they simultaneously measure moisture and grain quality. That information is fed into customers' respective farm management information systems enabled by AGCO's open platform approach, thus providing useable data for crop advisers.

While sensors are widely available,



▲ Nutrien Ag Solutions provides growers with resources to be as efficient as possible with every acre.

they're not yet uniformly adopted, says Wesley Gwaltney, professor at Virginia Tech's agricultural technology program. "It doesn't just apply to combines and moisture," he says. "I'm trying to think of an aspect (of farming) where sensors aren't used." Farmers are getting smarter and more efficient in all aspects of how they manage farms.

SUSTAINABILITY IMPACTS THE BOTTOM LINE

Advancements and innovations in agriculture production are crucial to reducing greenhouse gas emissions worldwide. "Because we touch so many growers, we can move the needle on greenhouse gases in a way no one else can, so we have the obligation to do so," says Brent Smith, vice president of marketing and innovation at Nutrien Ag Solutions in Loveland, Colorado.

Nutrien Ag Solutions does this by reinvesting one-third of their annual profits back into the business. During the last eight years, they spent $1 billion developing innovative technologies to benefit not just the half-million growers they serve globally in fertilizer sales, but anyone affected along the supply chain. "Getting the most out of the land we farm is an important part of what we do, but we want to lessen the impact on the ground, taking into account soil health, water quality and efficiency, crop quality, and nutrient use," Smith says.

Nutrien Ag Solutions launches more than 15 new products annually, partly as a result of this innovation research. "We have a long-term view on where agriculture is going, which is why we're invested across the value chain. We're not afraid to invest in technologies that potentially disrupt one piece of that value chain," Smith says.

Optimizing fertilizer on the field is important. "We want fertilizer placed spatially and in time, where and when the plant can use it," Gwaltney says. It may be applied before the seed is planted, alongside the seed, and then two or three times throughout the growing season when it most needs the nutrients. "If a farmer applies something in the field and it doesn't lead to yield, they're losing money," Gwaltney says. "There's no incentive to overapply. Inputs are expensive, and margins are tight. These decisions are made with as much thought as possible."

STEP BY STEP: ADOPTING TECHNOLOGIES OVER TIME

Technology allows farmers to use variable-rate applications, mapping a field for yield data to give an historical idea about where the highest yields are, pointing to where they'll likely be in the future. "We can use those maps in the equipment to apply fertilizer where it can be best used," Gwaltney says.

The rise in these kinds of technologies is coming at an important time, as the global need for food is growing exponentially. Tractors powered by steam engines, go back to the 1800s, while adoption of electricity, the internal combustion engine, and motorized vehicles started increasing farm productivity around 1915. We're now in the next technology growth phase, with the internet and information technology affecting efficiency, yield, and crop quality. The USDA estimates that row crop growers are in the early majority of adopting these new technologies, ahead of livestock and specialty crop growers, and ahead of the agricultural industry as a whole.

By maximizing digital technologies with the help of broadband internet access, U.S. farms can add $47 to $65 billion annually to the domestic gross economy, according to the USDA.

As farmers think about adopting technologies, it's important that they know their farm and their equipment, Daccache says. "Most growers know that some fields are more productive than others—but they may not know why," he says. Technology can help with the why, and it can help the grower with decision support based on the data, he adds. Technology costs continue to decrease, and adopting technology can ultimately help the farmer save money while improving the all-important output quantity and quality. ■