Seeds of revolution **down on the farm**

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Efficiencies from the use of drones, GPS technology and 'magic eyes' are transforming agriculture

A young man drives a four-wheeler across a field of corn stubble, pushing down a probe, dumping the contents into a sack, labelling the sack with coordinates and dispatching it to a lab for analysis.

Since the late 1800s, farmers have taken multiple samples and mixed them for analysis. New techniques are much more precise, zeroing in on a zone rather than a whole field to get detailed information.

"The genesis arose when the US military released GPS satellite data for commercial use," says James Blome, president and chief executive officer of Bayer CropScience. For about 15 years, new processes that help to create an exact formula of which nutrients will deliver an optimal yield have led to cost savings and higher returns on investment.

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First, drones with infrared cameras can fly over fields before planting. The farmer can turn the flow of fertiliser or herbicide up or down for particular spots, varying the application rate. An electronic eye counts each seed as it drops.

In growing months, sensors in fields detect how the environment is changing. At the season's end, a yield marker weighs the crop as it is harvested and links the amounts to the GPS information, giving an immediate response on how well the inputs did.

Customising big data

"Although farmers are slow adopters, at some point every field in the US and Europe will be mapped," predicts Justin Gardner, professor of agribusiness at MTSU School of Agribusiness and Agriscience. Already, companies such as Monsanto, Dupont, Sygenta and Dow have created vast databases, which they are using with different permutations of inputs to construct algorithms for predictive modelling.

The history, trials, weather and commingled data are crunched into a format for decision-making.

Before these advances, a typical farmer had about 40 chances in his lifetime – representing 40 years of crops – to make the best guesses about inputs or irrigation activity, or for hedging based on futures contracts.

"Now we're taking the risk out," says Blome.

He explains: "The farmer owns his own data and must give somebody contractual rights to use it, with a hire service agreement that spells out the ownership." The farmer can do so anonymously, and thereby participate in a big pool in the cloud.

The next major development will be faster data analysis and real-time answers. Suppose a grower has an aphid infestation of 3 per cent per plant. Should he spray?

In the past, he applied fungicide to corn side-by-side with untreated plants to discover results at harvest time.

Now, the model allows a real-time decision. The farmer can know months ahead how many bushels of corn he can expect, relevant to his profile and rainfall.

Looking ahead

More technology means less fuel, less ploughing, less soil erosion and a smaller carbon footprint. "Whenever you can do more with less, fewer inputs are wasted and everyone wins," says Gardner.

For example, smaller farms see pay-offs faster from equipment that can automatically turn off sprayers, reducing planting overlap. They turn more corners than larger operations, which benefit more from self-guiding GPS that steers tractors in straight lines on wider fields.

It may take another decade for the industry to experience the full advantage. The reason is that farmers hesitate to replace equipment until it is completely worn out or obsolete and they are dealing with five- to 10-year depreciation schedules.

Early adopters are less likely to see such huge savings in input costs since "they are already doing the best job in the first place", Gardner points out. Ultimately, it is the price of corn and other grains that will drive conversion to the new technology. "If the price plummets, they won't adopt," he says.

Digital agriculture opens new directions in trading, monitoring and marketing. Right now, commodity traders must wait for government reports to know how good the harvest is and apply the results against inventory, stocks and forecasts for next year's demand. If, however, they were using real-time information, that data could change the entire structure for grain trading and pricing, affecting insurers, plant makers and hedge traders.

The technology holds promise for safety identification, too. A lettuce grower whose crop carries, say, listeria or salmonella, will be able to pinpoint exactly where in the fields it came from.

And consider the applications for personalised marketing. Suppose a shopper chooses an apple, with a bar code attached. Up pops a video of a farmer to tell the shopper how he grew that fruit. The same bar code can also identify produce that may need to be removed from sale for expiry or even a massive recall.

Most importantly, precision farming will dramatically enhance output. We must increase yields by 70 per cent by 2050 to feed populations as further arable farmland supply is exhausted.

"If we don't boost production," says Blome, "at best, prices will skyrocket – and at worst, we'll fight wars."

KEY TAKEAWAY

New technologies provide detailed data on crops, soil and growing conditions. These advances will affect entire industries, from agriculture and equipment to commodity trading and food distribution.