



# Technology in the Field

A recent report by global consulting firm, McKinsey & Company, revealed that a staggering one-third of all agricultural production is lost every year due to:

- Planting, irrigating, harvesting inefficiencies
- Unexpected, adverse weather conditions
- Inadequate pest control

Who takes the hit? Producers. Is there a common thread in these risk factors? One common thread is information. What's the solution? The solution is getting information to growers. Farmers need information they can depend on and use in the field; in a word, they need data to manage their operations for more efficiency. The specialized tools that deliver the data are called, collectively, precision agriculture.

*"Functionality increases as a technology provides more information that operators can apply across a wide-range of production practices. Guidance systems have high ease-of-use, while yield and soil maps have high functionality."*

*David Schimmelpfennig, USDA ERS*

**Big Data and Big Money**  
Developers expect the market for the tools of precision agriculture to grow 15 percent over the next three years. That may be too modest a figure because much of the adoption of ag tech is tied to mobile devices, which already number seven billion are poised to double by 2020. Analysts expect that when the number of farmers using precision agriculture hits critical mass, it will unleash a level of productivity not seen since the age of mechanization. The money is on precision ag, too. Investors are putting big dollars into big data, with private investment surging 80 percent since 2013.

## A No-Brainer

Agriculture is competitive because it is crucial. No one knows that better than producers and no one knows the land better than they do. Farmers are using more technology because it gives them more control and leverage; their operations are

more efficient, their soils are more fertile, their crops are more robust, they spend less time in the field, they get advance notice of potential problems and at the end of the day, they're less stressed.

The data that does all this comes from technologies that provide key information in real time about soil, crops, air, pests, chemicals, water, sunlight, equipment, workers and more. Big data shows growers at a granular level exactly what is happening in their fields. (An evolving offshoot of this, that will also involve growers, is big data that lets consumers track the sourcing of their food from field to table.)

## The Foundation of Big Data

There are three technologies that undergird precision agriculture:

- Wireless is the transmission of data via radio and microwaves without the need for cables or wires. It is the most explosively adopted technology ever and covers vast swaths of the country.

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- Global positioning (GPS) is geo-referenced locating data. It is built into much agricultural equipment to allow pinpoint accuracy in plowing, seeding, harvesting and more.

- Geographic information (GIS) is a system for capturing topographic data for spatial and geographic imaging, analysis and planning.

Think of big data as another kind of farmer's almanac for the information age.

*"Accuracy is addictive."*  
-Matt Darr, Iowa State University

## Precision Agriculture

Information-based tools are growing in use because they put valuable data into farmers' hands. So, what can these tools really do? According to the Economic Research Service of the USDA, the national average for corn yield is about 168 bushels per acre. They speculate that with precision technologies, a yield of 530 bushels per acre should be possible.

Last year, Forbes reported that three-quarters of producers now use one or more data tool in their operation. These technologies require varying investments of time and money, but they can pay for themselves through more precise input management, resource allocation, cost savings and higher yields.

## Automation Technologies

Drones, or unmanned aerial vehicles (UAVs) give growers a bird's eye view of their operation. Some can be equipped with specialized cameras that show plant chemistry and species distribution.

Variable Rate Technologies (VRT) allow growers to adjust the rate of application of inputs (fertilizer, pesticide, irrigation, etc.) to reduce waste and improve efficiency. For growers with significant soil

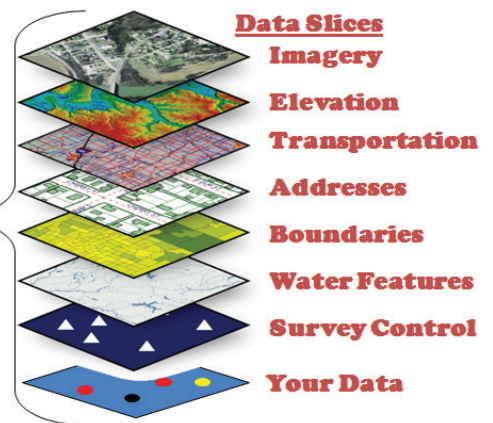
chemistry and contour disparity in their fields, the savings can be dramatic. VRT devices are among the least expensive way to get started with precision ag. Autosteering is in wide use, and even though a few operators have run into things while reading the paper on their tractors, most new farm equipment comes equipped with it these days. Autosteering helps reduce overlap planting and it makes possible things like precise strip tilling and banding.

Agricultural robots (agbots) automate tasks like plowing, weeding, harvesting and irrigating and are already at work in large-scale agronomic crop operations.

The Real World



GIS World Model



Robotic swarms, the combination of agbots with complementary functions, is on the horizon. About eight years out in development, agbot armies are being designed to perform start-to-finish tasks with little to no human supervision.

Telematics relay data over distance which can include remote control and integrated informatics that can be used for vehicle tracking and fleet management; it also sends notification when equipment failure is possible. Most machinery manufactured after 2013 is equipped with telematics.

## Sensors

Air sensors report moisture, temperature, barometric pressure and chemistry. Among other things, they're critical for determining when it's safe for workers to re-enter a field after chemical application.

Soil sensors provide deep data about what's happening on and below the surface. The complexity of the nitrogen cycle, for example, has always made its management difficult, but soil sensors provide data that eliminates the guesswork that can reduce yield. Crop sensors provide additional data on crop health through chemical analysis and infrared scanning. This simplifies part of the quest to produce better crops—matching crops to better growing conditions.

*"It [precision agriculture] unlocks a lot of new potential—things that really add value back to the farm."* David Hest, Reporter

## Digital Tools

Today, farmers use hardware and software for an astonishing array of data and analysis that goes beyond what they can see with their own eyes. Like what? Like multi-spectral analysis that shows how crops are absorbing or reflecting different wavelengths of sunlight. Farmers have been faster to adopt some tools than others, GPS mapping is second only to auto-steering in terms of early and wide use. Other tools in increasing use are

those that help with crop scouting, weather modeling, land mapping and data collecting. Two popular combinations of these sought-after technologies are found in FieldView and MapItFast.

## Climate FieldView

There is no more critical and unpredictable factor in agriculture than weather—it is every grower’s best opportunity or greatest risk. Over the past 25 years, weather modeling has been refined into a tool that farmers can count on, turning their inexact prognosticating into accurate predicting. Crop scouting shows pest pressure and crop health,

Designed to reduce weather and pest threats, it lowers the margin of error by identifying adverse conditions in real time so growers can take appropriate action.

*“We’re using data science to de-convolute what’s going on... Information on the farm is now being collected the same way we collect information on our cellphones...”*

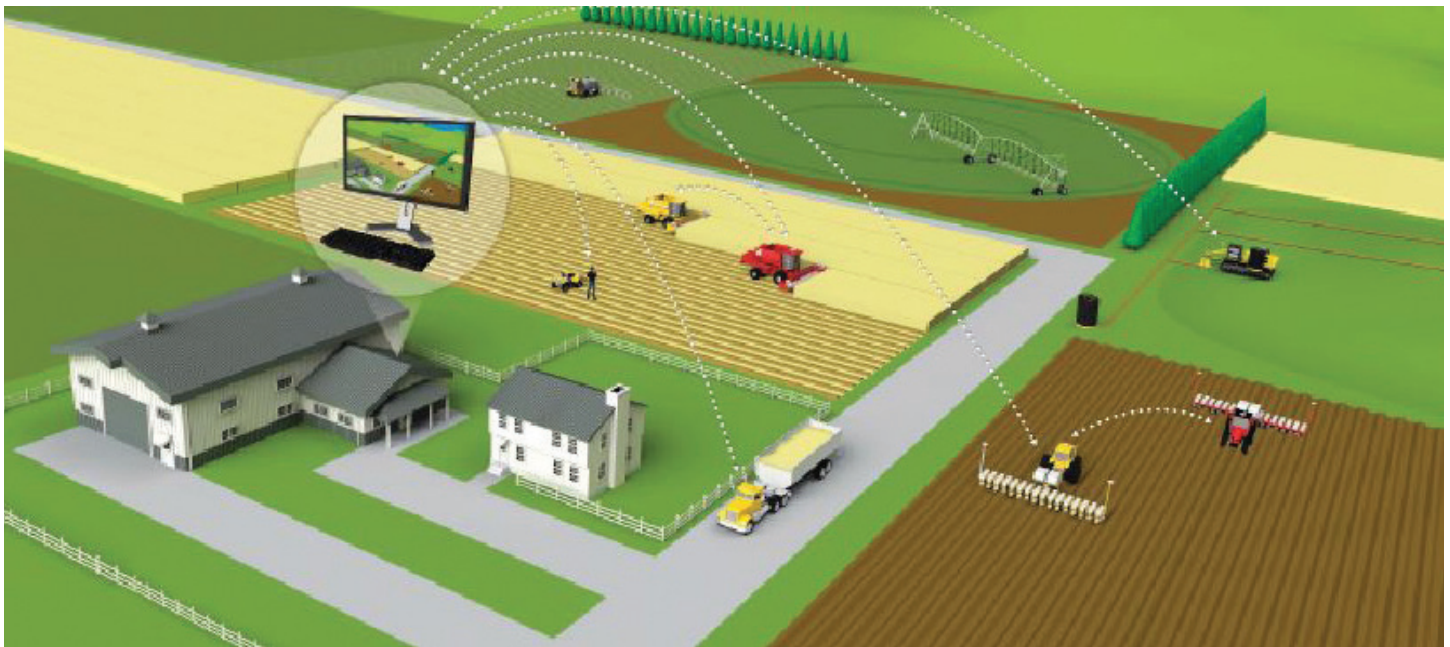
Mike Stern, CEO

## AgTerra MapItFast

Precision GPS mapping on the mobile platform has already become indispensable. Of all precision technologies, GPS mapping shows the most pronounced impact—boosting

- Integrate photographs into the record
  - Relay data in real time to any location(s)
  - Layer graphical and textual data
- In addition, MapItFast works with or without an internet connection.

*“To compete in the agriculture market today, it’s crucial to have tools that are easy to use and don’t break the bank. Producers want to make better decisions and react faster without getting bogged down by technology. At AgTerra, we design our products to help farmers easily create maps, records and reports while working from anywhere with devices they already own.”* Alan Telck, President



enabling growers to evaluate risks to their crops as well as the efficacy of their management of those risks. Weather-modeling paired with crop scouting, gives farmers big data with which to manage operations with greater assurance of bountiful harvests. Climate Corporation, founded in 2006 as a weather insurance business, was acquired by Monsanto and expanded to take the guesswork out of weather modeling and crop scouting. Their FieldView app suite creates digital maps that show planting prescriptions, seed performance and nitrogen content.

average operating profits by nearly three percent and net returns by two. In 2003, AgTerra Technologies released the first version of MapItFast, which turns a mobile device into a flexible, scalable data system. Easy to use, it works with powerful tools (database, form, GIS, GPS, imaging, spreadsheet) to help growers:

- Establish a baseline of conditions
- Build a history (insects, reclamation, trees, weeds)
- Itemize inputs (chemicals, fuel, labor)
- Track movement and use (equipment, vehicles)

Precision agriculture is becoming more robust and more precise, ushering in an era of hyper precision that’s finding its place on more and more American farms.

 - J.E. Holloway

### Sources

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