



Precision Agriculture: Not the Same as Big Data But...

Steve Sonka and Yu-Tien Cheng

University of Illinois

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With today's media and marketing hype, it's easy to get confused about the two terms, precision agriculture and Big Data. In addition to briefly reviewing the impact of precision agriculture, this article stresses that Big Data is much more than precision agriculture. However, precision agriculture operations often will generate key elements of the data needed for Big Data applications. This is the second of a six part series on [Big Data and Agriculture](#).

This article provides a sense of the evolution of precision agriculture, identifies the more popular technologies employed, and reviews the admittedly scanty evidence as to the on-farm effectiveness of these innovations. The article concludes by discussing key linkages with Big Data.

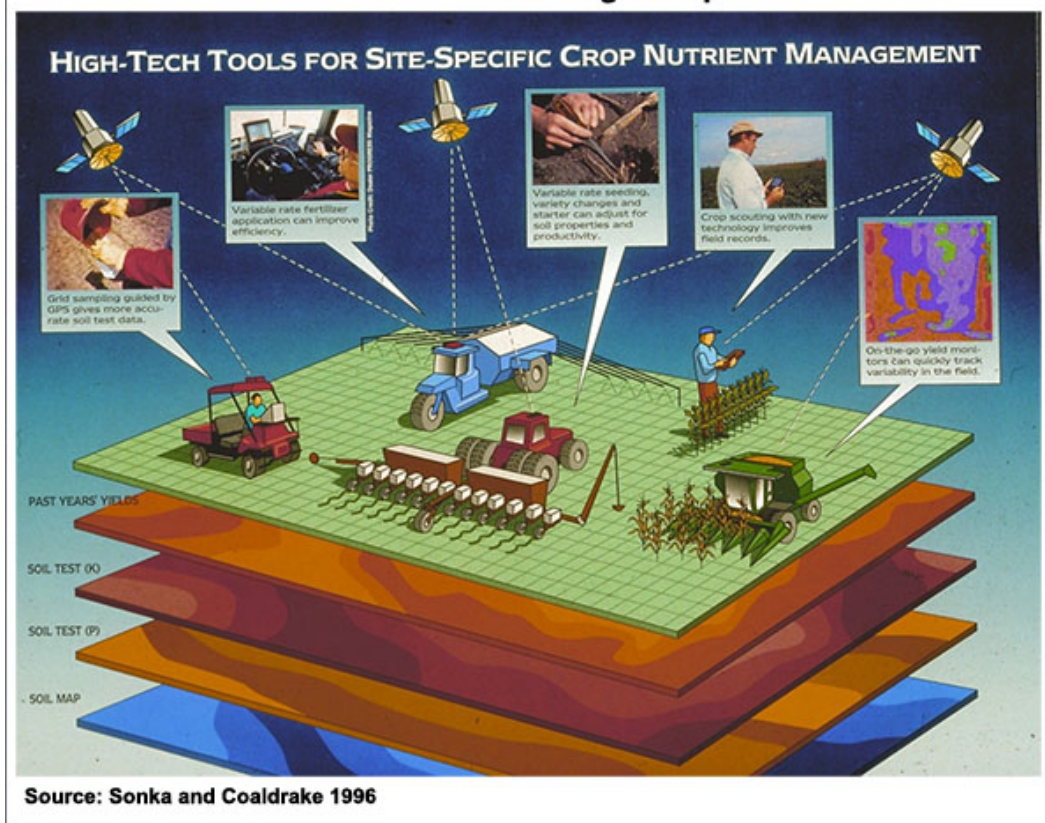
20 Years (or so) of Precision Agriculture.

Precision agriculture has several dimensions; indeed the concept itself is not precisely defined. A [1997 report](#) of the National Research Council refers to precision agriculture, "... as a management strategy that uses information technologies to bring data from multiple sources to bear on decisions associated with crop production". For some reason, the term, precision agriculture, has been primarily linked to crop production. However, precision practices, and Big Data techniques, are equally applicable in animal agriculture.

Farmers and agribusiness managers played a significant role in the development of precision agriculture. For example, in the mid-1990s, a group of agribusiness professionals in Champaign County, Illinois, came together to explore the opportunities associated with two emerging technologies — site-specific agriculture and that strange thing called the Internet. This group, called CCNetAg, was part of an initiative co-sponsored by the local Chamber of Commerce and the National Center for Supercomputing Applications at the University of Illinois. A voluntary enterprise, CCNetAg provided a vehicle for farmers, agribusiness managers, and university researchers to jointly explore adoption of these tools. Figure 1 depicts their expectations of a then future precision agriculture.

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Figure 1. A Mid-1990s View of Precision Farming from the CCNetAg Group



Although created some time ago, the graphic continues to depict key elements of precision farming:

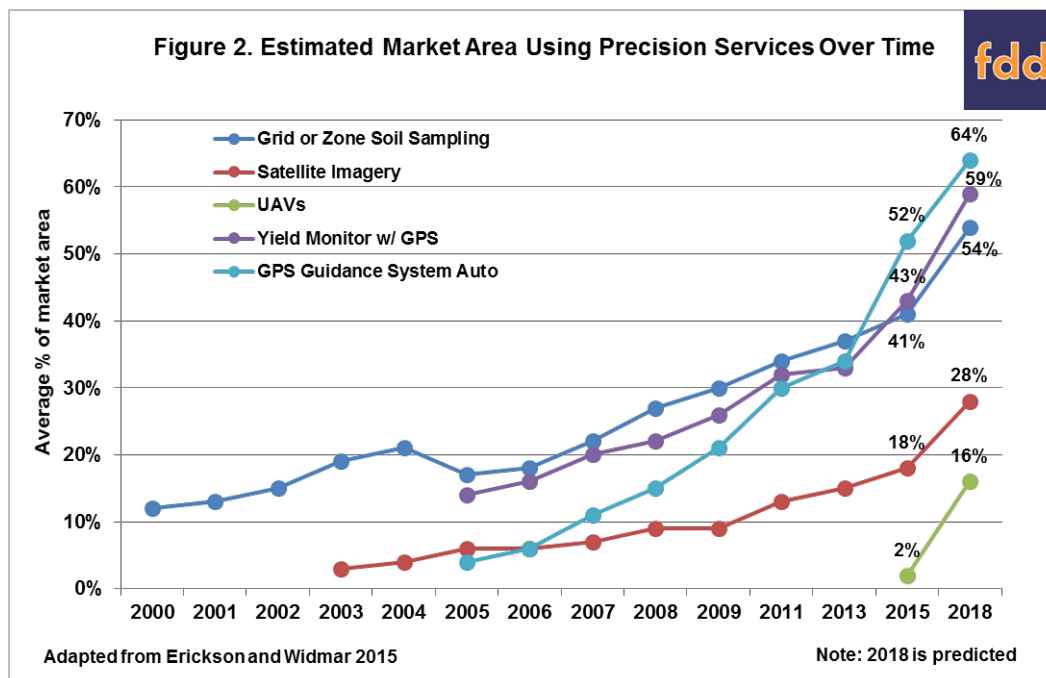
- The role of georeferencing is indicated by satellites linking to the farm field.
- On the field itself, key farming operations are being directed by and are capturing digital information on:
 - Soil characteristics,
 - Nutrient application,
 - Planting,
 - Crop scouting, and
 - Harvesting.
- The layers that underlie the farm field represent the notion that visual mapping would allow the farmer, and the farmer's advisors, to see meaningful correlations to inform future decisions.

Since 1997, technologies have advanced, although the general categories remain relevant. For example, auto-steer capabilities on farm machinery have become much more prevalent. And active, detailed measurement of the planting process (recording where “skips” occur) is now feasible. Further, the ability to monitor the status of farm machinery as it operates is now paired with electronic communications to signal when machine operations are out of acceptable bounds.

While there have been many publications describing precision agriculture, reports with independent evaluation of the economics of adoption are much less numerous. One means to assess whether there are net benefits of a technology is to monitor its marketplace adoption. For several years the Center for Food

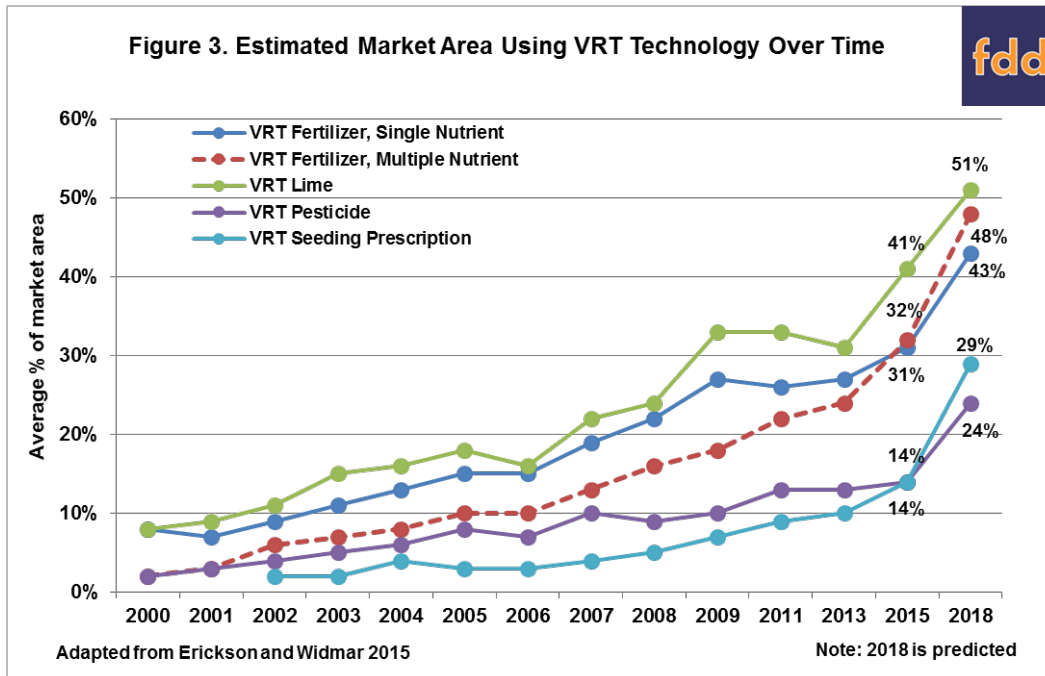
and Agricultural Business at Purdue University and CropLife magazine have surveyed agricultural input suppliers regarding the adoption of precision agriculture. Focused primarily on the Midwest and Southern regions, this work is a particularly useful assessment of the technology's application. From the [2015 report](#), Figures 2 and 3 provide evidence of adoption for key precision agriculture practices (Erickson and Widmar 2015).

The crop input dealers who provided input for this study are uniquely well positioned to understand and report on adoption of these technologies. Their firms provide inputs (fertilizer, pesticides, and seeds) and services to producers evaluating and adopting precision agriculture.



Early interest in precision agriculture focused on site-specific application of inputs and on use of yield monitors. As shown in Figure 2, grid sampling, a practice associated with site-specific lime and fertilizer application, is currently employed on about 2 out of 5 crop acres. Increased coverage to a majority of acres is expected by 2018. Similar adoption rates (43% and 59%) are noted for GPS-assisted yield monitors. Over the last decade, use of GPS guidance systems has increased rapidly, to a current use estimated to exceed 50%. Continued strong growth to 2018 is expected. The use of satellite imagery and UAVs as tools to support crop production is more recent. Current use affects 18% and 2% of acreages, respectively. Interesting, acreage covered by UAVs is expected to increase eightfold, to 16%, in just three years.

Figure 3 describes a relatively consistent adoption pattern for VRT (variable rate technology) practices. In the early 2000s, adoption was at single digital levels. Since then, steady increases in the extent of acreage covered have occurred. However, the most utilized practice, application of lime, is only now achieving coverage on 41% of the total acreage. These patterns also are interesting because of the very different price regimes that existed for corn and soybeans over these 15 years. When output prices were low prior to 2008, the driver for adoption likely was cost reduction. Possibly, increasing yields was a more significant factor in recent years when prices were higher.



Linkages to Big Data

Media and marketing attention sometimes blur distinctions between precision agriculture and Big Data. Some communications seem to suggest that Big Data is just an updated buzzword for precision agriculture practices.

That is not the case. Figure 1 can be used to identify key differences:

- While a useful picture, that graphic does focus our attention on the individual field. The Volume characteristic of Big Data requires observations from many, many farm fields to be effective. Discerning the interrelated effects of soil type, several nutrients, and seed variety requires data dispersed over time and space.
- While the farmer has several types of precision data from each field, additional sources of data naturally reside and originate beyond the fencerow. Achieving the Big Data's Variety characteristic requires access to that broader set of information.
- Precision agriculture employs comparisons across field map layers as its dominant method of analysis. The effect of a single factor, such as a blocked tile line or a buried fencerow, often is observable from a map. However, identifying complex interactions across several production factors and multiple years requires much more sophisticated tools. Analytics is a major differentiating feature of Big Data.
- As noted earlier, we've had 20+ years of precision agriculture experience. If we could count up all the digital information collected from yield monitors and site-specific input operations, the total undoubtedly would qualify as BIG Data. However, we could then think about the legion of thumb drives, disk drives, and desktop computers where all that data resides today. Analytics can't happen unless/until that data can be accessed and aggregated. This organizational challenge will be discussed in the sixth article of this series.

Both precision agriculture and Big Data arise from the advent and application of information and communication technologies. They, however, are not synonymous. That said, it is hard to foresee that Big Data approaches will have significant impact without employing the data generated by precision agriculture practices with which we've now become familiar.

References

Erickson, B. and D.A. Widmar. *2015 Precision Agricultural Services Dealership Survey Results*. Purdue University. West Lafayette, Indiana, August 2015. Accessed October 30, 2015, <http://agribusiness.purdue.edu/resources/2015-precision-dealership-survey-results>

National Research Council. *Precision Agriculture in the 21st Century: Geospatial and Information Technologies in Crop Management*. National Academies Press. Washington, D.C., 1997. Accessed October 30, 2015. <http://www.nap.edu/catalog/5491/precision-agriculture-in-the-21st-century-geospatial-and-information-technologies>

Sonka, S.T. and K. F. Coaldrake. "Cyberfarm: What does it look like? What does it mean?" *American Journal of Agricultural Economics* 78, no. 5 (1996): 1263-1268.

Sonka, S., and Y.-T., Cheng. "[Big Data: More Than a Lot of Numbers!](#)" *farmdoc daily* (5):201, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, October 29, 2015.