

PRECISION FARMING OVERVIEW

Wayne F. Smith

John Deere Precision Farming

Precision Farming is an improved management system for production agriculture.

This statement comes as a surprise to many people who think of precision farming as synonymous with satellites, microprocessors, and intelligent sensors. Technology is important to precision farming but that is not what precision farming is really about. Precision Farming is about improving the productivity and efficiency of the farming enterprise through better information management.

Precision farming has been known in the past by a variety of other names--prescription farming, farming by the foot, site-specific crop management, satellite farming, and many others. But in the end, all these names refer to the same management concept. So what makes this new system called Precision Farming different from what most producers still do today?

For the past thirty to forty years or more, producers have managed their fields on an average basis. They have applied inputs at a constant rate determined by the average requirement for the entire field. And they have harvested their crop so that they end up with an average yield for the whole yield. This is no longer the case with precision farming--fields are managed on a site-specific basis. Inputs are applied at variable rates at each site in a field depending on the specific agronomic needs of that location. And yields are measured continuously through the field so that the end result is a yield map showing yield variations on a point by point basis.

Precision farming is beginning to have a major impact on production agriculture for four major reasons:

- 1) Technologically...it is practical
- 2) Economically....it makes sense
- 3) Environmentally...it is friendly
- 4) Agronomically...it increases knowledge

Precision farming is technically practical. Generally speaking, that is a poor reason to do anything but recognition of this fact is important. Producers and agronomists have long known that variability exists in most fields, and this variability should be managed on a localized basis. Unfortunately, technology did not provide the tools to efficiently manage this variability until recently. Now we have some of the sensors and controls needed, and more are being developed every day. Personal computers and microprocessors are becoming more powerful and less expensive. And most importantly, the Global Positioning

System (GPS) is fully operational. It is providing producers with accurate positioning anywhere in North America and in many other places around the world. Accurate positioning information is crucial to virtually every aspect of precision farming.

Economically, precision farming techniques allow producers to optimize inputs for maximize monetary return. The data generated by precision farming becomes knowledge for better decision making. Will the cost of precision farming always pay for itself? No, there will not always be a positive cash flow; it will vary from field to field. Producers will have to be selective in how and where they apply precision farming practices. But there are already enough successful stories to show that the trend is good if practices are applied intelligently.

Environmentally, precision farming allows producers to apply inputs on a site-specific basis only where they needed, only when they are needed, and only at the rate needed. And that is what being an environmental steward of the land is all about. Precision farming also provides an additional environmental benefit. Producers have the option of receiving an automatically generated document of exactly what was done whenever any field operation is complete. Depending upon what happens with regulatory legislation in the future, this capability to document field operations may prove not only beneficial but almost required for environmental compliance.

Agronomically, precision farming enables the producer to quantify the impact of his farming practices and decisions. Armed with the tools of precision farming, producers will better understand all of the underlying factors that impact the agronomy of their fields and crops. This increased knowledge will help them manage their fields for maximum productivity and efficiency.

Precision farming will impact all aspects of the crop production cycle. As shown in Figure 1, producers can begin using precision farming practices by entering this cycle at virtually any point--one the input side, on the output side, or somewhere in-between. Some producers have chosen to begin at the top of the circle by intensively soil sampling their fields. They use this fertility information, often coupled with soil classification maps and other information, to vary fertilizer and other field inputs. In fact, commercial application of fertilizer on a variable rate basis is the way precision farming got its start five to ten years ago. Other producers have chosen to monitor the health of their crop during the growing season using remote sensing, scouting, and tissue sampling techniques, and then use this information to custom apply maintenance levels of crop inputs at mid season. But virtually every producer who is involved in precision farming recognizes the potential of yield mapping.

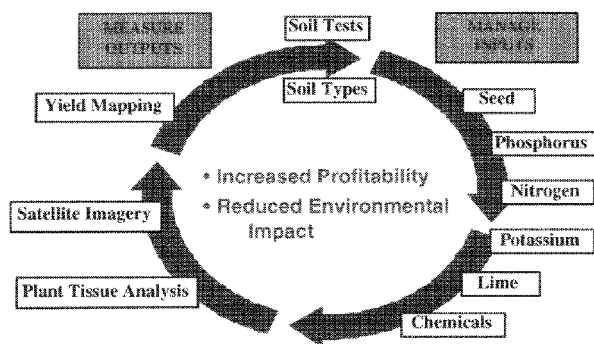


Figure 1. Precision farming will impact the entire crop production cycle.

Yield mapping enables producers to document variability in their fields, and quantify its impact. Analysis of field variability often drives producers to implement other precision farming practices in the crop production cycle. Systems to map yields for grain combines are already available, and over 1000 producers are using such systems today. Work is underway to develop similar yield mapping systems for cotton, peanuts, potatoes, sugar beets, and many other crops.

Many people and organizations will be involved in providing producers with integrated solutions to precision farming. Many alliances and partnerships will be established to provide the range of equipment and services required. Figure 2 shows the major segments of this growing precision farming industry. Companies like John Deere will be leaders in providing the on-farm harvest equipment, variable rate application equipment, positioning systems, and map display software shown on the left half of the diagram. But studies suggest that only 25 cents of every dollar will be spent on hardware/software of this kind. The larger part of each dollar will be spent by producers on support services such as soil testing, data management and analysis, and cropping recommendations. A wealth of opportunity exists for a variety of companies to play important roles in the precision farming support and services area.

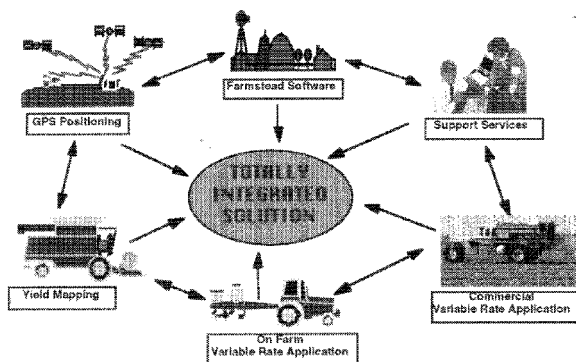


Figure 2. Many people and organizations will be required to provide producers a total, integrated precision farming system.

Effective information management is a key to the success of precision farming. In fact, to reap maximum benefit, a producer will be linking his cropping data to environment compliance, tax reporting, and financial record keeping. This framework will integrate virtually all aspects of the farming enterprise, providing producers with a valuable tool for maximizing profits while protecting the environment.

Producers have several distinct expectations from the precision farming marketplace. They want integrated systems, not components. They expect systems which take full advantage all component capabilities, and which capture and manage information consistent with their overall operational strategies. They demand industry standards in data structure, communications, and hardware interfacing to ensure seamless compatibility of competitive products. They are looking for systems with flexibility to adapt to their unique needs and cropping practices. They are looking for world class support not only for hardware and software but for information analysis and recommendations as well. And, finally, producers expect high-tech tools that leave them in control of their data. Most producers will want to share their data because data reaps its greatest benefit only through compilation within a larger base of information. But in doing so, producers clearly want to control access to their information so that they maintain a competitive advantage in the marketplace.

A limited number of precision farming products are already available at the farm level from after-market suppliers. These include DGPS positioning products, yield monitor and/or mapping components for grain combines, variable seed rate equipment for planters, and variable chemical rate systems for sprayers. In the next several years, John Deere and other major equipment suppliers will provide integrated OEM *systems* to accomplish these and other precision farming tasks. New products at the farm level could include yield systems for cotton, peanuts, potatoes, sugar beets, and maybe even hay or forage, and VRT equipment for fertilizer, lime, and nitrogen. Also, commercial equipment to vary the rate and mix of fertilizer inputs has been available for many years, and its use seems to be on the rise. Other commercial VRT products will certainly be introduced in the future.

Data management software is a major missing link in meeting producer needs for a total integrated solution to precision farming. A few software packages are available that provide agronomic and crops record keeping capabilities with spatial and temporal referencing, and others can perform economic analyses. But few if any software packages can interpret multiple layers of field input/output information and recommend an optimum cropping plan. Research opportunities abound for software tools to address this latter need.

No one can predict the future of agriculture with any degree of certainty, but I am sure that virtually everyone would agree that producers that take agriculture into the next century will do so facing economic, environmental, and regulatory pressures that no previous generation ever had to deal with. However, with the advent of precision farming, many of these same producers will be armed with information and technology that no previous generation could ever have imagined.

By the turn of the century, the successful farmer will be the one who can:

- manage his operation for optimum productivity and efficiency,
- deliver a quality product that meets market demands,
- reduce the environmental impact he places on soil, air, and water,
- and still make a profit doing it.

The successful supplier will be the one who helps the producer make all this happen.

Precision farming is still in its infancy; it is not yet a perfected science. It will continue to evolve, and it will experience growing pains in the process. But acceptance of precision farming practices is spreading as more and more producers convince themselves that precision farming is not a passing fad. **Precision farming is the future of production agriculture.**