: What is the role of decision support in precision farming?

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In approximately 8000 B.C. when farming and agrarian communities were established, the population of planet Earth was around 5 million people. On May 10, 2015, the World population was approximately 7,300,000,000, **7.3 billion people**, cf., www.worldometers.info/world-population/. To feed the growing population, more efficient and more effective farming was developed to provide an expanded food supply. To meet the food needs of a global population expected to reach 10.85 billion people on July 4, 2100, more efficient and better technology-supported farming is needed. Computerized decision support is a central capability in the technologies of precision farming that will feed our growing population.

According to Covey (1999), "Precision farming is an integrated agricultural management system incorporating several technologies. The technological tools often include the global positioning system, geographical information system, yield monitor, variable rate technology, and remote sensing." He notes that "just having information about variability within the field doesn't solve any problems unless there is some kind of decision support system ("DSS") in order to make VRT recommendations." VRT is an acronym for Variable Rate Technology.

Farms.com explains "precision agriculture, also known as precision farming, is a broad term commonly used to describe particular farm management concepts, sometimes referred to as satellite farming or site specific crop management (SSCM). The term first came into popular use with the introduction of GPS (global positioning satellites) and GNSS (global navigation satellite systems) as well as other methods of remote sensing which allowed farm operators to create precision maps of their fields that provide detailed information on their exact location while in-field. ... The use of decision support systems (DSS) is often incorporated into precision agriculture as it pertains to managing the information collected through spatial and temporal practices."

The HGCA Glossary (2009) defines precision farming as "
management of farming practices
that uses computers, satellite
positioning systems, and remote
sensing devices to provide
information on which enhanced
decisions can be made. Sensors can
determine whether crops are growing
at maximum efficiency, highly specific
local environmental conditions can
be identified, and the nature and
location of problems pinpointed.

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Information collected can be used to produce maps showing variation in factors such as crop yield or soil nutrient status, and provides a basis for decisions on, for example, seed rates and application of fertilisers and agrochemicals, as well for the automatic guidance of equipment."

Russo and Dantinne (1997) suggested five steps for creating precision farming decision support:

1. Identify environmental and biological states and processes in the field that can be monitored and manipulated to improve crop production.

2. Choose sensors and supporting equipment to record data on these states and processes.

3. Collect, store and communicate the field-recorded data.

4. Process and manipulate the data into useful information and knowledge.

5. Present the information and knowledge in a form that can be interpreted to make decisions.

The goal is to help a decision maker choose an action associated with a decision situation that will "change the identified state or process in a way that makes it more favorable to profitable crop production."

Lowenberg-DeBoer (1996) argued the "Long run profitability of precision farming technology depends on the development of management systems that link inputs applied with yields harvested on specific sites. These management systems will be some combination of computerized decision support systems and the accumulated wisdom of experienced managers. Decision support systems require databases. Wisdom comes with long experience. These management systems will be site specific. Generic decision support systems will be developed, but their performance on your farm will be enhanced by data from your farm." Precision agriculture is no longer the "infant technology"

discussed by Lowenberg-DeBoer, but the need to improve decision support and collect and share data remains.

Davis, Casady and Massey (1998) explained "As important as the devices are, it only takes a little reflection to realize that information is the key ingredient for precise farming. Managers who effectively use information earn higher returns than those who don't." GPS (Global Positioning System) and sensor technologies make precision farming possible, but databases of historical information, analytics, and decision support enable farmers to effectively use the data gathered from using the technology tools.

So the role of decision support is to help farmers manage their farms better. The precision farming decision support applications include advising about 1) what to plant where, 2) when and where to apply chemicals and in what amounts, and 3) when to harvest. There is also a role for decision automation in precision farming. Real-time decision automation can control the application of chemicals in the field based on GPS data, soil data, crop and decision rules. Software creates an integrated, precision farming system from disparate hardware components and historical and real-time data.

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