

PRECISION TECHNOLOGY FOR CITRUS

By Reza Ehsani

Data, technology and management are three key elements for having a successful production and harvesting system. Technology is rapidly evolving and growers must keep up with the changes that may benefit their operations.

Precision agriculture or site-specific crop management is an information-based management concept that was initially developed during the late 1980s in the Midwest. Precision agriculture can be defined as a comprehensive scientific and technological system designed to optimize agricultural production and management choices.

It is important to mention that precision technology does not replace the conventional knowledge and wisdom, but complements it by providing better and more accurate information, which leads to an informed decision. A comprehensive approach to precision agriculture for citrus utilizes all facets of citrus management practices such as planting, fertilization, irrigation, insects, diseases, harvesting and post-harvest operation.

Figure 1 shows different components of a precision technology system. The first steps involve collecting geo-referenced data. Data can be converted to useful information by conducting a visualization process. For example, raw yield data is just several pages of numbers and can provide very little information. By converting the raw data to a map, it becomes a one-page figure that can easily show the high- or low-yield area. The same can be said for data collected for pests and weeds.

A large amount of data is needed to be collected in this type of system. Some data may be beneficial where other data may not apply directly to the production operation. The conversion of data to information is the process of refining the data into a form where it actually makes sense and the grower may ask the “how” and “why” questions.

Canopy size and density, pest and weed, rootstock and tree age, remote sensing images, soil fertility, soil type, soil electrical conductivity and yield are examples of data that can be used for a citrus precision production system.

The second process is converting the information to knowledge. Knowledge is the important step of asking the correct “how” and “why” questions before management decisions are made. In this process different layers of information are integrated to add more value. For example, a yield map can only show the low- or high-yield spot in the grove, but it does not state why the yield is low on that spot or what the causes of yield variability are. To answer these questions, more information is needed. For example, having a tree canopy size and density distribution map can be very useful in explaining the cause of yield variability.

The process of converting information to knowledge involves integrating different layers of information using technologies such as Geographic In-

formation Systems (GIS) in combination with mathematical or statistical models. The information resulting from this step can be used by the grove manager to make sound and informed management decisions.

TECHNOLOGY MAKES IT WORK

What makes the above system work successfully is technology. Figure 1 also shows the technologies that are needed at each step. The level of technology accepted is the determining factor for bringing the largest percentage of success to the grove production. The hand-held computer is one example of such technology. It can help the grower to collect site specific information such as weed and pest distribution data and also organize and effectively

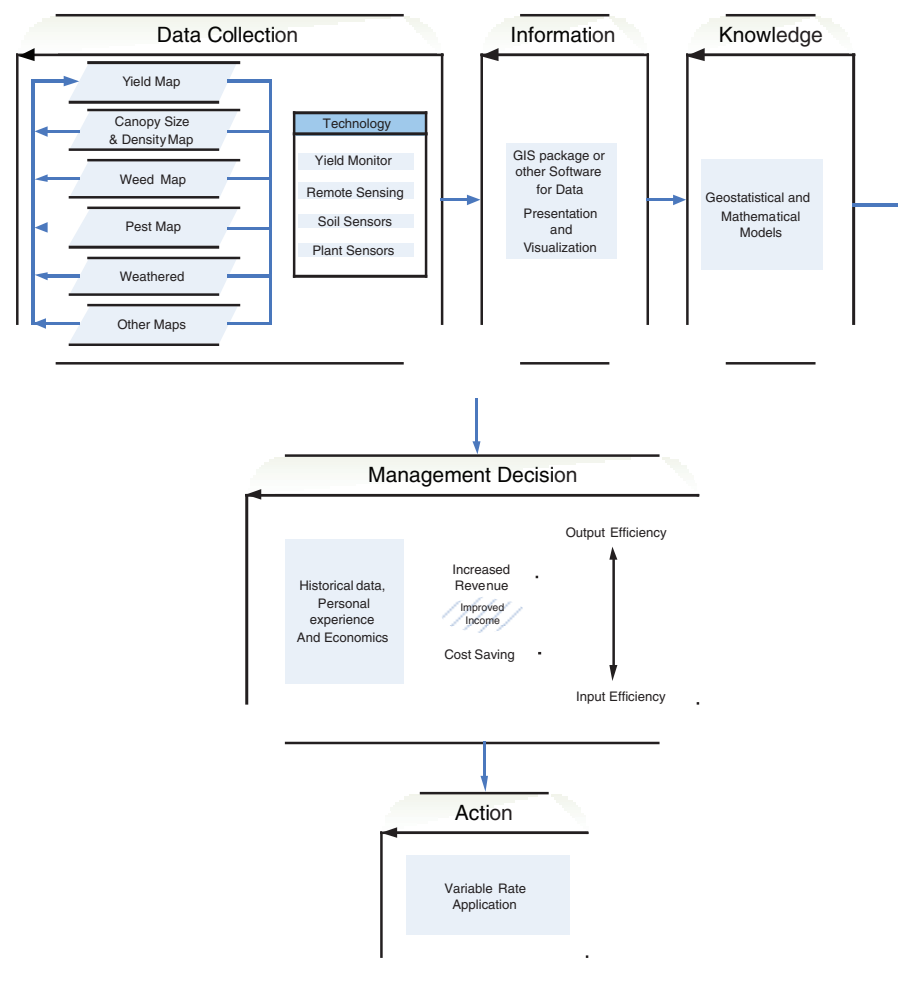


Figure 1. Conversion of data to decision-making in a precision technology system.

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manage data. Computer software, including spreadsheets, databases, GIS and other types of application software, are also needed to make the hardware efficient.

New low cost Global Positioning Systems (GPS) have given the farmer the ability to locate position information within a few feet. By combining position data with other field data, the grower can use the GIS capability to create different maps.

Precision agriculture is not a single technology, but rather a set of many components from which growers can select to form a system that meets their unique needs and management style. Not all technologies that were developed for precision agriculture are directly useful for citrus production. Overall precision technology for citrus makes more sense because the

grower has more control over different variables that affect yield compared to crops such as soybeans and corn in the Midwest. In citrus production, a small change in increasing the efficiency of the input materials or yield could significantly affect the bottom line.

One unique feature about a precision agriculture system is that there are smaller systems within the larger one. A system can be as simple as a variable rate fertilizer spreader with a couple of canopy sensors that can apply the fertilizer based on the tree size. Such a system can easily improve profitability, increase efficiency, and improve environmental performance, plus the growers can recoup the investment costs of the equipment very rapidly.

There are other technologies that are currently under development at the Cit-

rus Research and Education Center that can be very useful. These developments include yield monitoring systems for mechanical harvesters, sensors that detect disease and tree stress at early stages of development, or techniques that can count the number of trees from freely available aerial images which could probably lead to a better estimate of the yield early in the season.

Using data to evaluate the past and look toward the future may help in determining what is needed for current operations. With new technologies coupled with sound management decisions, changes can be made quicker than in the past and provide us with the edge we need to compete in today's global market.

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