# PRECISION FARMING IN POTATOES: A CASE STUDY

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All fields have variation that impacts the crop outcome. This can be due to topography, soil type, or barriers (rock outcroppings etc). Variation can also be caused by management techniques like solid set irrigation in the corners, or type and method of preparing a field. How a field is managed will determine the extent of the impact a field's variability will have on the crop potential.

Most fields are managed in one of two methods. Agronomic decisions are made to optimize the poor, or most deficient, areas of the field. The second method is to base decisions on the predominant, or majority of the field. This results in either applying more inputs than necessary to accommodate poor areas, or neglecting the poor areas of the nutrients needed to grow an optimum crop. One method increases costs and has environmental impacts while the other reduces revenue potential.

Precision agriculture technology, now available, allows the grower to reduce a field into smaller management zones economically. Precision Farming is the concept of applying inputs into a farming system at different rates based on variation in need due to location (spatial variability) or time (temporal variability). Technological advances in tools like the Global Positioning System (GPS), Geographic Information Systems (GIS) and Variable Rate Application Technology (VRT) are key to turning the concept of variable management into a reality. The question is what are the ways to variably manage a field for maximum economic crop yield and quality while attaining environmental benefits. A grower needs to review the costs associated with advanced application methods to determine the benefits on his or her individual fields.

At the present time, the technology for variable management exceeds our knowledge of how to use such technologies to achieve production and quality goals. To Develop Site-Specific Crop Management (SSCM) strategies for irrigated potato rotation systems in the Pacific Northwest, a team was started at the Irrigated Research and Extension Center in Prosser, WA. This team is made up of a consortium of people from the farm, from both agricultural production and processing industries, the local conservation district, and both state and federal scientists. All team members play important roles in making the project happen.

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**Initial Work:**

We have been working on SSCM concepts for center pivot irrigated potatoes in central Washington since 1993, starting by evaluating three commercial fields on sand and fine sandy loam soils. Topographic surveys, grid soil samples, and sprinkler uniformity tests were conducted. An extensive GIS database was created for the three fields using a combination of the field-collected data, output from a computerized irrigation model, and various plant growth models. This study showed that increases in yield could be obtained and at the same time losses of nutrients from below the root zone could be achieved when irrigation and nutrient applications were optimized in discrete areas of the field.

In 1995, we began the development of procedures and software to generate irrigation management maps and applied these depending on the position of the center pivot in the field. Using radio modems, a computer in the farm office communicated with 30 addressable controllers along a pivot distribution pipe, an on-site weather station, and soil water monitoring stations. The data were entered into the GIS and linked to existing computer simulation models for two more center pivot irrigated fields on sandy soils to generate optimum water and nutrient application rate maps. Communications and hardware to control sprinklers and implement management maps were field validated and shown to be practical.

**Current Efforts:**

We have been monitoring yields of potatoes and wheat since 1995 on several sites, several of which have had variable rate (VRT) preplant fertilizer applications. Repeatedly, the one factor that seems to be most related to yield and crop quality is elevation. We have found the highest yields to be related to the highest elevations. It is likely that the relationship between elevation and crop productivity indicates a water management problem at lower elevations.

**Summary:**

SSCM technologies offer tremendous systems benefits because spatial data can be collected and analyzed then used to make site-specific applications on a scale, which has never been previously available. Consequently, current potato cropping systems research by this team has focused on precision irrigation, VRT nutrient management, yield monitoring, weed science and plant pathology. We believe that the multiple range of disciplines and sectors involved in this program will help to move understanding of SSCM forward in a way that is comprehensive and applicable.

Precision agriculture will continue to advance in both technology and usefulness. Costs will continue to decrease as more equipment becomes available and more people make use of the equipment. The ability to reduce the field size for which agronomic decisions are made will enable a grower to produce a uniform crop across an entire field.