

SITE-SPECIFIC CROP MANAGEMENT: FILLING CRITICAL GAPS

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Background

For the past eight years I have conducted a basic and applied research program focused on helping farmers and consultants with pest management decision making. Much of this work was conducted on-farm. Having been trained as a research scientist in a research station environment I was surprised to learn that questions that hadn't been apparent to me on the research station often were critically important to farmers in their production fields. It was through this on-farm research that I came to appreciate the importance of soil, landscape position and pest infestation level variation on crop fitness. Our work and the work of other on-farm researchers revealed that weed management outcomes are density dependent. In addition, under the right suite of conditions, chemical weed control and crop tolerance to this practice can be highly dependent on variation in soil physical and chemical properties. Beyond our work in weed management, it was also clear that discipline oriented scientists like myself need to think broader than their own discipline as farmers are working with complex integrated cropping systems. The economic benefits associated with geospatial and information technologies must therefore be sought through integrated systems. It is also important to ask who realizes these economic benefits. Over the past 80 years farmers have received a declining share of the ag sector dollar (Smith, 1992). It is important that a significant proportion of the economic benefits realized by site-specific crop management remain on-farm.

Use the data we have

Develop a broad platform with existing data. The Federal Government has a rich resource in the Soil Survey Geographic Database (SSURGO) and other data resources. At times this resource has been dismissed because it has been stated by some to lack the necessary spatial resolution for precision agriculture. It is my view that this database is a rich resource for site-specific crop management and efforts should be made to enhance this existing data resource rather than dismiss it. It is also obvious that this data resource is largely under utilized and is unknown to many growers. Efforts to make such data more accessible is the necessary first step in providing an existing landscape database for growers. The database can be enhanced by adding newly collected data to the SSURGO database.

Couple explicit data with the farmers' implicit knowledge of the land. I have co-taught a Site-specific Crop Management course in which most of the students in the course intend to return to their family farm. This teaching experience coupled with interactions with growers across the midwest has convinced me that a user-friendly SSURGO derived data visualization tool (with limited analytical capability) is needed for growers and consultants. Farmers and students intending to return to the farm have asked for a geographic information system that would enable them to manage yield map and soil sample data (explicit data/knowledge) but of equal or greater importance would enable farmers to capture their impressions of how fields perform with a particular interest in temporal variation. For example several students in my course pointed out that many families have two and three generations of experience working the land. Through this experience knowledge about land-leveling flooding frequency and pattern,

yield performance etc. has been observed for 40-60 or more years. The spatial resolution of this implicit knowledge about the land may not be as fine as the recently collected yield map however the temporal resolution would be far greater. Knowledge about crop management outcomes over a broad range of weather events (temporal resolution) coupled with historic management practices could greatly enhance our ability to derive meaning from currently collected soil and crop performance data.

The need for robust on-farm treatment designs

The farm as laboratory. A question commonly asked by site-specific farmers is “I’ve collected data for several years now and want to know what management changes are possible to improve my bottom line?” It is my opinion that we’re not as far along toward answering this question as we should be. I believe the lack of clarity toward answering this question is the result of two things. First, that temporal variation has a greater influence on crop management outcomes than was previously thought. Second, we have not been very good about designing on-farm experiments in order to derive meaningful local recommendations. Design of these trials must be robust enough to derive locally relevant treatment response functions. In addition, more must be done to define the local inference space or zone of similarity around a farmstead then conduct on-farm trials to derive integrated cropping systems recommendations.

Facilitating data sharing. Following on the *farm as laboratory* theme discussed above, farmers sharing data with neighboring farmers could lead to new ways of deriving locally relevant recommendations for crop production practices. While it is obvious that no two farms are alike Peter Hildebrand points out “farming systems or portions of the system are similar in important characteristics. These systems or subsystems can be grouped into homogeneous systems or recommendation domains which provide a convenient means for developing location specific technologies”. The National Research Council panel study evaluating *Precision Agriculture in the 21st Century* concluded that subfield and field level data could have additional value beyond the individual farm but that policies, methods, and practices to facilitate data sharing are needed. It is my view that there is great potential in seeing farmers working collaboratively with trained facilitators cooperatively conducting on-farm experiments to define inference space and recommendation domains for crop and natural resource management practices.

Education Opportunities

Land Grant universities are struggling to meet the educational needs of agricultural practitioners; this is particularly true in rapidly developing agricultural fields like site-specific management and transgenic crop technologies. For the first time companies like John Deere and Monsanto are offering their own courses or are co-teaching courses with the Extension Service in these rapidly developing fields of science. The concern is whether the courses are truly objective. More support is needed to help the Extension Service be more responsive to new developments in agricultural practices.

Selected Publications

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