

NEWS & VIEWS

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Evaluation of Site-Specific Soybean/Corn Management Systems

A MULTI-STATE, multi-disciplinary project was begun by the Foundation for Agronomic Research (FAR) in 1995, with an initial funding grant from the United Soybean Board (USB). USB has continued and expanded support for this project and numerous additional sponsors have contributed through FAR to the expansion of the project. This project has become a model for developing partnerships in on-farm research on site-specific management. As additional layers of information are collected on the fields in the study, other resource people are being brought into the project to help interpret the information and formulate the plans for the management system.

The underlying plan is to develop a comprehensive database for the comparison of site-specific management systems in a soybean-corn rotation. FAR is coordinating the development of an evaluation...comparing a site-specific, integrated crop management system with conventional (field-scale) management. The focus is on the Midwestern states, with cooperation and data sharing with related projects in other parts of the U.S. The statistical design for the study created small plots, which vary in treatment from variable rates and field average.

The overall objective of the project is to compare site-specific systems to field average management systems. To do this, fields and farmers were selected based on their experience with site-specific management practices and records on available fields. A system for statistical analysis was designed and developed during the first years of the project. Data management systems and procedures for data collection are now established and are being used to process information for all fields.

In the first two years of the project, study sites were established on 10 farms in Illinois and Indiana, with a

corn field and a soybean field on each farm. The selected farmers were already using site-specific management, including grid sampling of soil, variable-rate fertilizer application, and yield monitors. They had 2 to 4 years of yield monitor data available, giving the project a head start on data collection and analysis. From these farms a data management system was developed to handle future fields. It served as a testing ground of the procedure to be used as the project expanded to additional locations in succeeding years.

Matching, in-kind, and cooperating projects expand the scope of research in this project. Several of the sites have additional research plots being conducted to address specific questions about individual management practices or technologies for that farm.

The project has been a cooperative effort, with various participants helping design the experiment, collect good data, and evaluate the results. This diverse group of participants includes farmers, researchers, state and federal agencies, retail and wholesale agribusiness, software companies, machinery, and high-tech equipment manufacturers. Several of the co-sponsors have contributed additional resources or technical support to further enhance the project beyond the basic objective. The result is a blend of people and technologies in a common vision for precision farming systems as the production management system of the future.

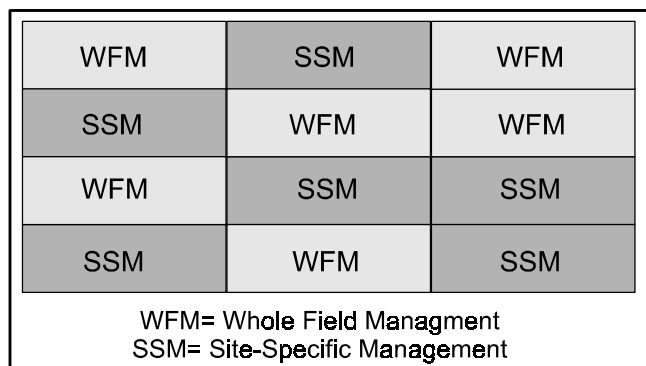
As the yield data from the project fields are collected over a series of years, impact of weather can be assessed, and the other yield limiting factors can be more clearly identified. The objective of a site-specific management plan is to identify the variability of various yield-limiting factors and to manage or systematically eliminate them from the system.



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The overall question to be answered in the initial stages of the project has been, "Does site-specific management differ from field-average management, when analyzed from agronomic, economic, and environmental perspectives." The experimental design is a paired-plot comparison, with plots of approximately 60 ft. x 240 ft. in size. Depending on field layout, this usually allows for about 60 pairs of plots in an 80-acre field. **Figure 1** shows a sample layout for 12 plots, illustrating the randomization pattern in blocks of 4 plots. The statistical analysis of this design can detect significant differences as small as one



bushel per acre.

Figure 1. Field plot layout for on-farm comparison of site-specific management and field-average management.

Table 1 outlines some preliminary results from the 1997 yields for selected fields. While yield differences were small, several showed statistical significance. Perhaps more important, there were substantial differences in phosphorus (P) and potassium (K) fertilizer recommendations between the SSM and WFM treatments. The WFM system failed to identify a need for both P and K fertilizer on four of the eight fields, but not necessarily the same fields. The SSM system called for substantial reductions in P fertilizer on two fields, and a slight

Table 1. Preliminary analysis of USB 1997 corn yield.

Field	Yield, bu/A		P	P applied lb/A		K applied lb/A	
	SSM	WFM		SSM	WFM	SSM	WFM
1	145	143	0.06	84	80	115	114
2	180	180	NS	79	121	96	105
3	162	162	NS	19	0	92	73
4	140	140	NS	52	98	87	115
5	167	166	0.10	0	0	51	0
6	158	157	NS	36	0	110	115
7	173	171	0.02	100	0	58	0
8	103	100	0.05	35	0	36	0

SSM = Site-Specific Nutrient Management (Variable Rate Application)
WFM = Whole Field Nutrient Management (Uniform Broadcast)
P = Probability that yield difference is due to chance alone
NS = Not significant at 0.10 probability level

reduction in K recommendations on two of the fields.

Soil test and yield data layers will be studied for these fields, along with other data sets, to identify relationships between measured factors and yield variability. These analyses will help define the management system plans for the 1998 growing season and help identify specific practices requiring more detailed research.

Some of the farms are participating in evaluation of on-site electronic weather stations to collect detailed data for use in crop and pest simulation models. Data are transmitted by radio at 15 minute intervals to a central point. Farmers can then access the information by modem to run selected models and decision aids. On one farm, a highly-sophisticated monitoring system continuously measures atmospheric conditions, including CO₂ and H₂O levels in and above the crop, providing a year-round data set. (This is one of only two such installations in the U.S.) Researchers at the National Oceanic and Atmospheric Administration (NOAA) center in Oak Ridge, TN, monitor the data as they are transmitted via cellular phone from an in-field computer to their data center in Tennessee. A second NOAA system is being installed on another of our project sites for the 1998 season.

Digitized Order 1 soil surveys of the fields have been prepared by the Natural Resource Conservation Service (NRCS). Details associated with the soil surveys help identify limitations or capabilities of the soil types within the fields. These factors help explain the spatial variability of measured components of yield and guide spatial variation in recommendations.

This project is beginning to answer the question of whether site-specific management is better than field average management. It also helps demonstrate overall cooperation among farmers, input suppliers, researchers, and government agencies to develop a team approach to crop and soil management. It has also spawned several

cooperative efforts in software compatibility and technology development and adaptation. This project has generated some of the most complete detailed data bases available anywhere for evaluating site-specific management.

Details and regular updates on this project and related information may be found on the internet web site: <http://www.agcentral.com/usb>. Some of the actual data sets are available for downloading. Farmers, agribusinesses, researchers and educators throughout the world have used these data to gain a better understanding of site-specific management. There are also links to sponsors' web sites where you can get more information on related topics. When you check them out, be sure to send a note expressing appreciation for their support of this important project. ■