

## Indiana NCERA-180 Report—2007

### Site-Specific Management Center (SSMC)

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Jane Frankenberger, Ag. & Biological Engineering	Luc Valentin, Agricultural Economics
Raymond Florax, Agricultural Economics	Tony Vyn, Agronomy
	Stephen Weller, Horticulture & Landscape Architecture

**Abstract:** In 2006 the work of the SSMC focused on disseminating results of site-specific management research at Purdue to the agricultural community, via the website ([www.purdue.edu/ssmc](http://www.purdue.edu/ssmc)), the monthly site-specific management seminar on campus, articles in the trade press and conference presentations.

#### **Publications** (all available at [www.purdue.edu/ssmc](http://www.purdue.edu/ssmc)):

Erickson, Bruce. Advancing the Science and Application of Site-Specific Crop Management. *SSMC Newsletter*, January 2007.

Nistor, Adela, and Raymond J.G.M. Florax. Farmers and Consultants Receive Training in Spatial Analysis of Yield Monitor Data. *SSMC Newsletter*, April 2007.

Vyn, Tony J., and Terry D. West. Optimum Pre-Plant Nitrogen Placement for Corn Producers with RTK Automatic Guidance Systems. *SSMC Newsletter*, July 2007.

Griffin, Terry W., Jess Lowenberg-DeBoer, and Bruce Erickson. A Primer for On-Farm Experiments Using Yield Monitor Data. *SSMC Newsletter*, October 2007.

## **Precision Agricultural Services Survey**

**Principal Investigator:** Jay Akridge

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**Abstract:** The annual survey of crop input retailers showed that 76 percent of respondents used precision technologies in some way in their dealership in 2007, down from 81 percent in 2006, and similar to the 75 percent reported in 2005. Precision activity is highest among outlets of cooperatives and national/regional chains. Dealers are still expanding adoption of precision technologies for internal uses. The growth in the number of dealerships offering precision services has slowed, but grower adoption continues to expand at a modest pace. Retailers were also asked how they felt the rapid expansion of biofuel processing capacity would affect demand for precision services. About 30 percent said the increase in biofuel processing capacity would boost demand for precision services. Another survey is planned for early 2008.

### **Publications:**

Whipker, Linda, and Jay Akridge, "2007 Precision Agricultural Services: Dealership Survey Results." Working Paper No. 07-13, Center for Food and Agricultural Business, Department of Agricultural Economics, Purdue University, West Lafayette, IN, USA. September 2007.

Whipker, Linda and Jay Akridge. "A Midwestern Precision Update." *CropLife*. June 2007, pp 10-14.

Whipker, Linda and Jay Akridge. "Biofuels: Future Challenges and Opportunities." *CropLife*. June 2007, pp 16-18.

## **Site Specific Agricultural Research at Regional Agriculture Centers**

**Principal Investigators:** Jeff Boyer, Stephen Hawkins, P.C. Walker, Jane Frankenberger, and R.L. Nielsen.

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**Abstract:** Work is continuing using GPS technology for large-scale research at the Davis-Purdue Agricultural Center. Large-scale research challenges research station personnel to develop efficient systems that best balance researchers' needs for statistical design and experimental precision with the research farm's logistical needs associated with operating commercial-scale field equipment for field research purposes. Additionally, a drainage workshop was held with the Indiana Land Improvement Contractors Association with about 250 attending the two-day event including drainage contractors, agency personnel, and landowners. Many tile installers are not using GPS, or do not provide as-built maps of their work. Recent drainage management work at Purdue Agricultural Centers has utilized topographical and planning tools for layout, and some of the tiling machines are using on-the-go GPS recording depth.

## **Site-Specific Fertilizer Recommendations and Sampling Guidelines**

**Principal Investigator:** Sylvie Brouder

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**Abstract:** Research involves site-specific data integration, evaluation, and development related to fertilizer recommendations and use efficiency in Indiana cropping systems. Research activities have emphasized protocols for delineating management zones and evaluation of soil fertility interactions related to grain quality.

## **Remote Sensing Applications in Agriculture**

**Principal Investigators:** Melba Crawford, Departments of Agronomy/Civil Engineering, Purdue University, West Lafayette, IN 47907-2054, phone: (765) 496-9355; fax: (765) 496-2926; email: [mrcrawford@purdue.edu](mailto:mrcrawford@purdue.edu) and Chris J. Johannsen, Department of Agronomy, Purdue University, West Lafayette, IN 47907-2054, phone: (765) 494-6248; fax: (765) 496-2926; email: [johan@purdue.edu](mailto:johan@purdue.edu)

**Abstract:** Focus on remote sensing applications including soil landscape dynamics relating to soil variability and soil management zones, estimation and analysis of crop residues using hyperspectral data, yield-influencing factors, automated correction of sensor errors, and flooding impacts on corn and soybeans. Research related to crop residue detection, apparent electrical conductivity (EC<sub>a</sub>), and spatial/temporal variability pattern analysis of soil properties on different landscape scales is planned for 2008.

### **Publications:**

Hager, B.R., S. Brantley, J. Bloxham, R. Eisner, A. Goetz, C.J. **Johannsen**, J. Kirchner, W. Rose, H. Shah, D. Smit, H. Zebker and M. Zuber. 2007. Solid-Earth Hazards, Natural Resources, and Dynamics, Earth Science Systems, Chapter 8, *In* Andres, R.A., B. Moore III, et al. (Editors), Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond, pp 217-255, National Research Council, National Academy Press, Washington, DC.

Pantaleoni, E., B.A. Engel and C.J. **Johannsen**. 2007. Identifying Agricultural Flood Damage Using Landsat Imagery. *Journal of Precision Agriculture*, Vol. 8:27-36.

## **Theory and Practice of Spatial Econometrics**

**Principal Investigators:** Raymond Florax

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**Abstract:** Research deals with spatial data analysis, spatial econometrics, spatial and environmental modeling, and meta-analysis.

## **Economics of Knowledge Intensive Agriculture for Crop Farms**

**Principal Investigator:** Jess Lowenberg-DeBoer

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**Abstract:** Research in 2007 focused on 1) combining yield monitor and other yield data in hybrid and variety choices, 2) testing the importance of site specific nutrient carryover information in the profitability of variable rate fertilizer, 3) analyzing the economic incentives for controlled drainage in the Corn Belt. Stochastic dominance techniques were developed to combine yield monitor data and information from traditional hybrid and variety trials in guiding farm level seed decisions. The proposed method selects cultivars that have smaller probabilities of low yields, thus are more risk efficient than the ones selected by traditional methods. This methodology was test for the US Corn Belt and Argentina. Site-specific corn response to N and P and soybean response to P was simultaneously estimated with a P carryover equation using data from a corn-soybean, variable rate nitrogen (N) and phosphorous (P) experiment conducted over five years in Minnesota, USA. These estimates are used in a dynamic programming model to determine site-specific optimal N and P fertilizer policies, soil P evolution, and profitability. The results indicate that when P carryover is accounted for in determining optimal P fertilizer rates, returns to the variable rate strategies are higher than returns to a uniform or whole-field management strategy. A representative farm linear programming model was used to estimate the whole farm financial incentives for farmers to adopt controlled drainage technology that improves downstream drainage water quality. The results show that controlled drainage can be more profitable than free flowing whole farm field drainage as long as the minimum yield advantage with controlled drainage is 2% with subsidy and 4% without subsidy respectively. However, even with a 10% yield advantage due to controlled drainage, the lack of labor during key periods may limit adoption of controlled drainage technology. To improve estimates of the yield advantage with controlled drainage, split field trials were implemented in 2005, 2006 and 2007 on four farms in Indiana. Spatial statistical analysis showed that yield gains due to controlled drainage varied widely from year to year. For three of the farms the decision to invest in controlled drainage technology is supported with and without subsidy respectively, and the additional returns range from \$7,856 to \$33,591 over the lifetime of the control structures. The remaining farm would be better off with its existing drainage system and not investing in controlled drainage technology, as it would incur a loss in the range of \$1,764 to \$2,880 over the lifetime of the drainage system with and without subsidy respectively. A review of crop responses estimated from site-specific yield monitor data shows that longer-term, multi-location agronomic experiments are needed for the estimation of site-specific ex-ante optimal variable input rates, and for the estimation of expected profitability of variable rate technology and information gathering.

### **Publications and Presentations:**

Bullock, David, and J. Lowenberg-DeBoer, "Using Spatial Analysis to Study the Values of Variable Rate Technology and Information," *Journal of Agricultural Economics*, 58:3 (2007), p. 517-535.

Lambert, D.M., J. Lowenberg-DeBoer, and G. Malzer, "Managing Phosphorous Soil Dynamics over Space and Time," *Agricultural Economics* 37 (2007), p. 43-53.

Urcola, Hernan, J. Lowenberg-DeBoer, "A Stochastic Dominance Method for Incorporating Yield Monitor Data into the Hybrid and Variety Decisions of Argentinean Farmers," *Computers and Electronics in Agriculture*, 58:1 (Aug., 2007), p. 4-12.

Nistor, Adela and J. Lowenberg-DeBoer, "Drainage Water Management Impact on Farm Profitability," *Journal of Soil and Water Conservation*, Nov./Dec. 2007, 62:6, p. 443-446.

Nistor, Adela, "The Impact of Controlled Drainage on Agricultural Yields: A Spatial Panel Model Using Yield Monitor Data," PhD Dissertation, Department of Agricultural Economics, Purdue University, West Lafayette, IN, USA, 2007.

Griffin, Terry, Jess Lowenberg-DeBoer and Bruce Erickson, "Using Yield Monitor Data for On-Farm Experiments," Top Farmer Crop Workshop Monthly Update, Oct., 2007, ([www.agecon.purdue.edu/topfarmer/update.asp](http://www.agecon.purdue.edu/topfarmer/update.asp)).

Griffin, T.W., C.L. Dobbins, and J. Lowenberg-DeBoer, "Case study of on-farm trials, spatial analysis and farm management decision making," 6th European Conference on Precision Agriculture, Skiathos, Greece, June 4-7, 2007.

Griffin, T.W., C.L. Dobbins, and J. Lowenberg-DeBoer, "Case Study Evidence of New Opportunities for Farm Management Specialists in Spatial Analysis of On-farm Trial Data" National Farm Management Conference, Rochester, Minnesota June 12-14, 2007.

Griffin, T.W., Craig Dobbins and J. Lowenberg-DeBoer, "Spatial analysis of On-farm Experiments and Subsequent Farm Management Decision Making: A Case Study," Selected Paper, American Agricultural Economics Association Annual Meeting, Portland, OR., USA, July, 2007 ([http://agecon.lib.umn.edu/cgi-bin/pdf\\_view.pl?paperid=26241&ftype=.pdf](http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=26241&ftype=.pdf)).

## **Soil Spatial Variability/Remote Sensing/Crop Simulation Modeling/ Hydrological Modeling in GIS**

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**Abstract:** Research involves spatial variability analysis (variogram, autocorrelation, Moran's I, kriging/co-kriging etc.) of soil physical and chemical properties, remote sensing of crop biophysical condition (water and nutrient stress) and mapping of soil properties on a field-scale, crop simulation modeling (GOSSYM and DSSAT), hydrological modeling in GIS at landscape level in agriculture, and soil moisture sensors calibration (Diviner 2000 and Troxler 200AP) and soil moisture monitoring.

### **Journal Publications:**

Smith, D.R., P.R. Owens, A.B. Leytem and E.A. Warnemuende. 2007. Nutrient losses from manure and fertilizer applications as impacted by time to first runoff event. *Environmental Pollution*.147:131-137.

Hart, K.S., B. D. Lee, P. S. Schoeneberger, D. P. Franzmeier, P. R. Owens and D.R. Smith. 2007. Comparison of field saturated hydraulic conductivity measurements to estimated morphological loading rates in Northeastern Indiana. *Journal of Hydrologic Engineering*. *Accepted*

Winzeler, H.E., P.R. Owens, B.C. Joern, J.J. Camberato, B.D. Lee, D.E. Anderson and D.R. Smith. 2007. Potassium fertility and terrain attributes in a Fragiudalf drainage catena. *Soil Sci. Soc. Am. J.* *Submitted*

## **New Data Collection and Analysis Techniques for Field Crops**

**Principal Investigators:** Luc Valentin, Bruce Erickson

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**Abstract:** Research will begin in 2008 to analyze data with a spatial component such as yield monitor information, soil mapping unit and soil test results, crop management inputs, and other factors. The goal will be to judge the capability of various spatial analyses to predict future responses, the bottom line for the profitable utilization of these tools.

## **Automatic Guidance and Site-Specific Applications for Tillage Systems, Fertility Placement and Crop Response**

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### **Publications:**

Boomsma, C.R., and T.J. Vyn. 2007. Plant-to-Plant Uniformity is Essential for Optimum Yield in No-Till Continuous Corn. Purdue Extension AY-329-W.