

Indiana NCR180 Report—2004

Site-Specific Management Center (SSMC)

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Daniel Ess, Ag. & Biological Engineering	Mack Strickland, Ag. & Biological Engineering
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Kevin Gibson, Botany & Plant Pathology	

Abstract: In 2004 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), the monthly site-specific management seminar on campus, articles in the trade press and conference presentations.

Publications (all available at www.purdue.edu/ssmc):

Lambert, D., J. Lowenberg-DeBoer, and G. Malzer. Variable Rate Fertilizer Increases Value of Manure. SSMC Newsletter, January, 2004.

Peone, J., and J. Lowenberg-DeBoer. Managing Fields with Isolated Low Fertility Areas. SSMC Newsletter, February, 2004.

Tenkorang, F., and J. Lowenberg-DeBoer. Observations on the Economics of Remote Sensing in Agriculture. SSMC Newsletter, March, 2004.

Gumz, M.S., and S.C. Weller. Potential for Site Specific Management in Midwest Mint Production. SSMC Newsletter, April, 2004.

Lowenberg-DeBoer, J. The Management Time Economics of On-The-Go Sensing for Nitrogen Application. SSMC Newsletter, May, 2004.

Griffin, T. How GPS Auto-Guidance Affects Existing Farms. SSMC Newsletter, June, 2004.

Lowenberg-DeBoer, J. Uninhabited Aerial Vehicles (UAVs) at the 2004 Top Farmer Crop Workshop. SSMC Newsletter, July, 2004.

Lambert, D., and T. Griffin. Measuring the Pulse of Technology at the 7th International Precision Agriculture Conference. SSMC Newsletter, August, 2004.

Lambert, D., and T. Griffin. Suggestions for Producers Considering Yield Monitor Data Analysis. SSMC Newsletter, September, 2004.

Griffin, T., D. Lambert, J. Lowenberg-DeBoer, and B. Erickson. Using Cotton Yield Monitor Data for Farm-Level Decision Making. SSMC Newsletter, October, 2004.

Frankenberger, J., and B. Erickson. Using Geospatial Information to Design and Install Drainage at the Davis-Purdue Agricultural Center. SSMC Newsletter, November, 2004.

Erickson, B. Field Experience Validates On-the-Go Soil pH Sensor. SSMC Newsletter, December, 2004.

Precision Agricultural Services Survey

Principal Investigator: Jay Akridge

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Abstract: The annual survey of agricultural retailers showed that three-quarters of respondents used precision technologies in some way in their dealership. Dealers continue to adopt precision technologies for internal uses but at a fairly slow rate; grower adoption has continued to expand. Another survey is planned for early 2005.

Publications:

Whipker, Linda, and Jay Akridge, "Precision Agricultural Services: Dealership Survey Results." Staff Paper No. 04-07, Center for Food and Agricultural Business, Purdue University, West Lafayette, IN, USA, June, 2004.

Site-Specific Fertilizer Recommendations and Sampling Guidelines

Principal Investigator: Sylvie Brouder

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Abstract: Major concentration involved site-specific data integration, evaluation, and development related to fertilizer recommendations and use efficiency in Indiana cropping systems. Research activities in 2004 emphasized protocols for delineating management zones. Plans for 2005 include evaluation of environmental benefits of N management zones and continued evaluation of soil fertility interactions related to grain quality.

Publications:

Adamchuk, V.I., M.T. Morgan, and S.M. Brouder. 200X. Analysis of Variability in Automated Soil pH Measurements. Trans. ASAE. Submitted.

Brock, A., S.M. Brouder, G. Blumhoff, and B.S. Hofmann. 200X. Yield-based management zones for corn-soybean rotations. Agron. J. In Press.

Brouder, S.M., B.S. Hofmann, and D.K. Morris. 2005. Accuracy of common soil collection strategies and estimation techniques for mapping soil pH and lime requirement. Soil Sci. Soc. Am. J. In Press.

Morris, D.K., C.J. Johannsen, S.M. Brouder, and G.C. Steinhardt. 2004. Remote Sensing / Organic Matter. In Daniel Hillel, Editor, Encyclopedia of Soils in the Environment. 4pp. Elsevier Ltd. Vol. 3:335-392.

Decision Making in Precision Agriculture

Principal Investigator: Daniel R. Ess

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Publications:

Ess, D.R. and M.T. Morgan. 2003. The Precision Farming Guide for Agriculturists, 2nd Edition. John Deere Publishing, Moline, IL. 138 p. (+ accompanying study guide).

O'Neal, M.R., J.R. Frankenberger, D.R. Ess, and J.M. Lowenberg-DeBoer. 2004. Profitability of on-farm precipitation data for nitrogen management based on crop simulation. *Precision Agriculture* 5:153-178.

Evaluation of Weed Species Spatial Distribution

Principal Investigators: Kevin Gibson, Richard Dirks

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Abstract: A tractor-mounted mechanical vision system for weed detection is being developed to provide highly accurate, detailed maps of weed populations in agronomic crop fields. The system utilizes a Patchen weed-seeker, digital imagery and GPS equipment, with the ultimate goal to combine weed maps with other precision technologies to evaluate the relationship between environmental variables and weed species spatial distribution.

Remote Sensing Applications in Agriculture

Principal Investigator: Chris J. Johannsen

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Abstract: Annual focus of remote sensing applications included soil landscape dynamics relating to soil variability and soil management zones, yield-influencing factors, automated correction of sensor errors, vegetation damage by insects, flooding impacts on corn and soybeans, and weed anomaly monitoring. For 2005, research related to weed detection, crop residue detection and soil & crop anomaly classification is planned.

Publications:

Erickson, B. J., C. J. Johannsen, J. J. Vorst and L.L. Biehl. 2004. Using Remote Sensing to Assess Stand Loss and Defoliation in Maize, *Photogram. Eng. & Remote Sensing*, Vol. 70, No. 6: 717-722.

Getman, D, J. Harbor, B. Engel, C. Johannsen, G. Shao. 2004. Improving the Accuracy of Historic Satellite Image Classification by Combining Low-Resolution Multispectral Data and High-Resolution Panchromatic Data. *Remote Sensing of the Environment*. Submitted November 2004.

Johannsen, C.J. and P.G. Carter. 2004. Site Specific Soil Management: Concepts and Prospects. *In* Daniel Hillel, Editor, *Encyclopedia of Soils in the Environment*. Elsevier Ltd. Vol 3: 497-503.

Morris, D.K., C.J. Johannsen, S.M. Brouder, and G.C. Steinhardt. 2004. Remote Sensing/Organic Matter. *In* Daniel Hillel, Editor, *Encyclopedia of Soils in the Environment*. Elsevier Ltd. Vol 3: 385-392.

Rochon, G.L., C.J. Johannsen, D.A. Landgrebe, B.A. Engel, J. M. Harbor, S. Majumder and L. L. Biehl. 2004. Remote sensing as a tool for achieving and monitoring progress toward sustainability, Chapter 39 *In Technology Choices for Sustainability*, S.K. Sikdar, P. Glavic and R. Jain, Editors, Springer-Verlag Berlin. pp 415-428.

Using Remote Sensing to Determine Weed Densities and N Stress in Corn

Principal Investigators: William Johnson, Kevin Gibson

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Abstract: Remote sensing imagery is being used to determine weed densities and to assess N stress in corn. Goal is to determine the effect of weed removal and N application timing on weed growth and herbicide-resistant corn yields. Environmental concerns associated with N fertilizer and soil-applied herbicides are likely to limit their use in the future and growers will increasingly adopt post-emergence management strategies. However, weed-corn competition for N can occur early in the season and weed accumulation of N may suppress corn yields. If successful, this information could be used to provide farmers with data necessary to make more informed decisions regarding fertilizer and herbicide applications.

Publications:

Donald, W. W., D. Archer, W. G. Johnson, and K. A. Nelson. 2004. Zone herbicide application controls weeds and reduces residual herbicide use in corn. *Weed Sci.* 52: in press.

Economics of Knowledge Intensive Agriculture for Crop Farms

Principal Investigator: Jess Lowenberg-DeBoer

Department of Agricultural Economics, Purdue University, West Lafayette, IN 47906, phone: (765) 494-4230; fax: (765) 494-9176; email: lowenbej@purdue.edu

Abstract: Research in 2004 focused on developing better ways for growers and those who advise them to use information from combine yield monitors and other site-specific sources. Studies showed that in corn-soybean systems phosphorous response may be quite stable from year-to-year in large parts of the field, but that nitrogen response varied widely from year-to-year, as well as over space. A study using data from Minnesota indicated that variable rate fertilizer in combination with a uniform rate of manure application may be more profitable than variable rate manure alone. Monte carlo studies demonstrated that it is possible to draw reliable information to guide farm input use and agronomic decisions from the large plot, low replication trials many farmers find logistically attractive. Work is underway with funding from the USDA/CSREES Sustainable Agriculture Research and Extension (SARE) program to test the reliability of large block, low replication trials with farmers in Indiana, Illinois, Kentucky, Arkansas and Arizona.

Publications:

Anselin, L., R. Bongiovanni and J. Lowenberg-DeBoer, "A Spatial Econometric Approach to the Economics of Site-Specific Nitrogen Management in Corn Production," *American Journal of Agricultural Economics*. 86, 3 (2004), p. 675-687.

Bongiovanni, Rodolfo, and J. Lowenberg-DeBoer, "Precision Agriculture and Sustainability," *Precision Agriculture*, 5: 359-388.

Griffin, T.D., D.M. Lambert, and J. Lowenberg-DeBoer. Improved Decision Making With GIS Tracking Crop Inputs and Outputs. Presented at the Indiana GIS Conference, February, 2004, Indianapolis, IN.

Griffin, T., D. Lambert, and J Lowenberg-DeBoer. Testing appropriate on-farm trial designs and statistical methods for precision farming: a simulation approach. Seventh International Conference on Precision Agriculture, July 25-28, 2004, Minneapolis, MN.

Griffin, T.D., J. Lowenberg-DeBoer, D.M. Lambert, J. Peone, T. Payne, and S.G. Daberkow. 2004. Adoption, Profitability, and Making Better Use of Precision Farming Data. Staff Paper #04-06. Department of Agricultural Economics, Purdue University (www.purdue.edu/ssmc, click on publications).

Lambert, D., J. Lowenberg-DeBoer., and G. Malzer. Incorporating soil test information into variable rate manure management recommendations: a systems approach. Seventh International Conference on Precision Agriculture, July 25-28, 2004, Minneapolis, MN.

Lambert, D., G. Malzer, and J. Lowenberg-DeBoer. Using GIS Crop Information to Determine Site-Specific Manure Management Recommendations. Presented at the Indiana GIS Conference, February, 2004, Indianapolis, IN.

Lambert, D., J. Lowenberg-DeBoer and R. Bongiovanni, "A Comparison of Four Spatial Regression Models for Yield Monitor Data: A Case Study from Argentina," *Precision Agriculture* (in Press).

Urcola, H.A., and J. Lowenberg-DeBoer. The role of combine yield monitors in the choice of crop genetics. Purdue Agricultural Economics Report, February, 2004, p. 6-7 (<http://www.agecon.purdue.edu/extension/pubs/paer/2004/paer0204.pdf>).

Watson, M., and J. Lowenberg-DeBoer. Who will benefit from GPS auto guidance in the Corn Belt? Purdue Agricultural Economics Report, February, 2004, p. 13-16, (<http://www.agecon.purdue.edu/extension/pubs/paer/2004/paer0204.pdf>)

Automated Measurement and Mapping of Soil Properties

Principal Investigator: Mark Morgan

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Abstract: Rapid measurement and mapping of soil properties has shown potential for improving site-specific management. A model combining geo-statistics, agronomics and economics is being used to demonstrate the potential benefit of high resolution soil pH maps when combined with variable-rate lime application. Similar modeling and data analysis is under development for nutrients potassium and nitrogen. In addition, sensing systems are being investigated for mapping other soil properties including: potassium, nitrogen, and soil mechanical impedance at various depths in the profile. These sensors will ultimately provide the basis for accurate control of variable rate tillage and chemical application.

Publications:

Adamchuk, V.I., J.W. Hummel, M.T. Morgan, and S.K. Upadhyaya. 2004. On-the-go soil sensors for precision agriculture. *Computers and Electronics in Agriculture* 44(1):71-91.

Adamchuk, V.I., M.T. Morgan, and J.M. Lowenberg-DeBoer. 2004. A model for agro-economic analysis of soil pH mapping. *Precision Agriculture* 5:109-127.

On-Farm Harvest Timing, Yield Monitor Calibration, and GPS Crop Management Technologies

Principal Investigator: Robert Nielsen

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Abstract: Trials were continued at four outlying Purdue research centers to determine the consequences of not regularly calibrating yield monitors. Two differing hybrids were harvested at three times, beginning at grain moistures in the high 20's and finishing in the mid-teens. Yield monitors were calibrated for both weight and moisture estimation based on plot loads and grain moisture estimates at each harvest. Additional calibrations and corresponding yield data sets were generated for earlier harvest data at the time of the second and third harvests at each location. Failure to calibrate or recalibrate yield monitors for weight and moisture estimations results in erroneous wet weight estimates as well as dry grain yield estimates.

Using Soil Electrical Conductivity to Delineate Soil Management Zones

Principal Investigator: Gary Steinhardt

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Abstract: The use of soil electrical conductivity (EC) as a means of delineating soil management zones is being investigated. Bare soil areas have been established at the Purdue Agronomy Center for Research and Education in an area with a good Order II soil map, and EC and soil moisture information is being collected weekly (weather permitting). At the Davis-Purdue Agricultural Center in East-Central Indiana, work is in progress to investigate how site-specific long-term yield monitor data correlates with Order I soil survey information. 120 acres of an Order 1 survey have been completed at the Davis Farm.

Site-Specific Applications for Grain Quality Traits, Tillage Systems, and Crop Residue

Principal Investigator: Tony Vyn

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Abstract: Primary emphasis is on oil quality and seed nutrient composition of soybean as affected by tillage, soil fertility, fertility management (banding vs. broadcast), and inherent soil variability caused by stratification of soil phosphorus and potassium. Research was initiated in 2004 on automated guidance systems and their role in nutrient banding in corn.

Publications:

Omonode, R., I. Conti, and T. Vyn. Spatial and temporal variability in electrical conductivity and its relationships to soil characteristics in Indiana. In Proc. Thirty-Fourth North Central Extension-Industry Soil Fertility Conf., Nov. 17-18, 2004. Potash & Phosphate Inst., Brookings, SD.

Omonode, R., R. Nielsen, and T. Vyn. Spatial variability in electrical conductivity and its relationship to soil chemical properties in East-Central Indiana. American Society of Agronomy Annual Meetings abstracts, October 31-November 4, 2004, Seattle, WA.

Omonode, R., and T. Vyn. 200X. Spatial variability in electrical conductivity and its relationship with soil chemical properties in Indiana. Agron J. Submitted.

Omonode, R., and T. Vyn. Spatial and temporal variability in electrical conductivity and its relationships to soil characteristics in Indiana. Seventh International Conference on Precision Agriculture abstracts, July 25-28, 2004, Minneapolis, MN.

Vyn, T., and I. Conti. 2004. No-till soybean responses to residual fertilizer K and site-specific exchangeable K on variable soils. American Society of Agronomy Annual Meetings abstracts, October 31-November 4, 2004, Seattle, WA.