Illinois SOIL Quality Initiative

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What Is ISQI?

The Illinois Soil Quality Initiative is a project that involves a group of University of Illinois researchers, farmers, personnel from the USDA and the Natural Resources Conservation Service (NRCS), and representatives of many public and private organizations striving to identify a definition and means of monitoring soil quality that will help to protect Illinois's soils.

ISQI History, Accomplishments, and Goals

Fall 1994

The ISQI Board was formed after the Agricultural Experiment Station Special Research Initiative retreat and the Soil and Water Conservation District workshop in Decatur. That board provided direction and helped form the objectives developed for the project (see back page for listing of past and present members).

January 1995

ISQI Phase I was first funded by the U of I Agricultural Experiment Station. The objectives of that proposal were to conduct (1) a dialog initiative to increase idea exchange among concerned parties, (2) a planning/pilot study to develop a strategy to monitor Illinois's soil quality, and (3) a farmer participatory soil quality index screening trial. The outcomes sought by ISQI were to promote the protection of the state's soil resource by improving our understanding of the soil quality issue and to identify soil quality indices that farmers can use to make decisions about their own specific management practices.

June 1996

ISQI and the NRCS National Soil Quality Institute formed a cooperative agreement working on soil quality assessment. State NRCS personnel collected and characterized soil profile descriptions from Phase I farm fields. During winter 1997–1998, Georgine Paris entered this information into the NRCS's database under the guidance of Mac Hodges. Both cooperating farmers and NRCS offices will receive copies of that information during fall 1998. Work integrating that information and data produced by ISQI Phases I and II is ongoing.

December 1996

Management Impacts on Soil Quality: ISQI Phase II was funded by the Illinois Department of Agriculture's Conservation 2000 program. The objectives of ISQI Phase II are to strengthen the baseline data set by adding sites for which diverse crop rotations have been used and to tie measures of soil quality to soil performance (biological productivity, water partitioning, and environmental buffering). During the final year of Phase II, ISQI staff will work with cooperating farmers, the National Resources Conservation Service, and other soil quality information end-users to develop strategies for information delivery (see related article on page 2 of this newsletter).

January 1997

ISQI Phase I was completed. A summary of outreach and research efforts is below.

Summary of ISQI Outreach

A board of farmers, farm managers, state and conservation agency personnel and soil scientists, agronomists, and social scientists met to establish project goals and monitor project progress. The technical staff worked with farmer cooperators at regional winter meetings and then reported to the board at two annual meetings. Definitions and beliefs about soil quality were found to vary widely, and it was suggested not to think of soil quality as a single inclusive concept. Farmers and board members expressed great interest in obtaining soils information. Many participants were concerned about long-term maintenance of soil quality.

Funds from the Illinois Department of Agriculture Conservation 2000 supported publication of the newsletters and provided resources for meetings and cooperator compensation. For more information, see previous ISQI newsletters or read the article by Walters et al. (1997) that was published in the *American Journal of Alternative Agriculture* Vol. 12, pp. 64–72.

A survey of farmers conducted to identify soil information needs was headed by Gerry Walter and funde<None>d by the University Research Board. The results of that survey appeared in the August 1997 ISQI newsletter.

Summary of ISQI Research

In 1995 and 1996, ISQI studied soil quality in 36 farm fields under conventional tillage (CT) or no-till (NT) practices. In addition, relatively nondisturbed (ND) areas were sampled and used as a sort of benchmark. Soils included in the study were Mollisols or Alfisols. During the study, 23 physical, chemical, and biological properties were characterized. ISQI Phase I results suggest NT practices improved the biological and physical condition of the soil in the top two inches or so, despite increased soil consolidation. The study also found that the biological and physical aspects of soils influenced by organic matter were the properties most altered by agronomic practices. Particulate organic matter, aggregate measures, and several other properties were identified as promising measurements of soil quality. For more information, refer to the August 1997 ISQI newsletter or contact us to request an article by Michelle Wander and Germán Bollero. A report on the organic matter characteristics of fields characterized by ISQI Phase I is on page 3 of this newsletter.

The USDA-SARE-ACE program funded research addressing microbial measures and herbicide biodegradation. The research was headed by Gerry Sims and carried out by Jason Tor (see article in August 1997 ISQI newsletter).

July 1997

Microbial and Organic Matter Contributions to the "Rotation Effect" was funded by the C-FAR external grants program. Soil samples were collected from the Morrow Plots in 1997 and from farm fields that are part of ISQI Phase II. A variety of direct and indirect measures of the total and active microbial community and soil organic matter are being used to assess the validity of proposed microbial indices of soil quality. The objective of this work is to contribute to the identification and development of soil quality assessment tools adapted for individual and/or commercial use (see related article on page 3).

Soil Management Workshops Held

by Ellen Phillips, Extension Crops Educator

Syringes, six-inch pipes, and miniature sieves are not items that you would ordinarily think about taking into the field, but they are new tools for assessing soil quality. More than 90 farmers, consultants, Extension staff, and Natural Resources Conservation Service (NRCS) staff gathered at soil management workshops on July 22 at the Orr Center near Perry and on July 23 at the Crops Training Center near DeKalb. The workshops were organized by Ellen Phillips and Mike Roegge.

Each one-day workshop gave participants an in-depth view of different kits and cards used to evaluate soil quality. By comparing soils that have been in long-term tillage to those under grass cover, participants were able to see differences in soil infiltration, structure, and biological and chemical properties resulting from different management techniques.

Standing in a soil pit, soil scientists from NRCS led discussions of traditional soil properties used to describe soils. Michelle Wander, University of Illinois Assistant Professor of Soil Fertility, discussed a new way to think about soil quality assessment.

Accompanied by Mike Hubbs from the Soil Quality Institute, Wander demonstrated different in-field tests to evaluate indicators of soil quality. Water infiltration can easily be measured using six-inch rings. Respiration of soil microbes and other biota can be measured with syringes attached to thin hoses, which suck air from a chamber on top of the soil. Finally, structural stability can be assessed by placing soil clods on miniature sieves and continuously dunking them in a water chamber. With this demonstration, Wander and Hubbs showed how simple yet effective tests can provide a better understanding of management practices and their effects on soil properties.

In the afternoon, the workshop shifted focus to management practices to maintain or improve soil quality. John Siemens, Professor of Agricultural Engineering, led a thought-provoking discussion, "Soil Compaction: Does It Matter?" Next, Michelle Wander explained how tillage can influence soil quality. The workshops ended with a pair of farmers (Jeff Rueschel and Terry Davis in Perry, and Joel Rissman and Nick Moore in DeKalb) sharing their perspectives on why soil quality is important and how they incorporate this philosophy into their conventional and organic production systems, respectively.

Photo: Bob Frazee, UI Extension Educator

Mike Hubbs, from the Soil Quality Institute, demonstrating in-field soil quality measures at the Soil Manage-ment Workshop held in DeKalb.

Funds from the Illinois Department of Agriculture awarded to ISQI Phase II were used to purchase written materials for these workshops.

Illinois Earthworms: Indicators of Soil Health?

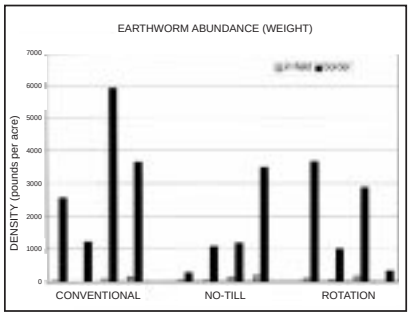
by Ed Zaborski, Illinois Natural History Survey

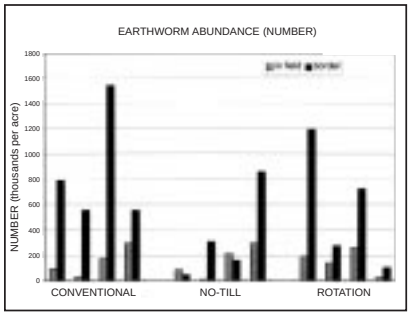
Soil is one of Illinois's most valuable natural resources. It supports biomass production (including food, fiber, and energy); it filters, buffers, and transforms environmental pollutants; and it provides a biological habitat and genetic reserve for a vast number of organisms. The ability of soil to perform these functions is called *soil quality* or *soil health*.

In recent years, concerns about the sustainability of food production and the off-site impacts of soil degradation have given impetus to develop objective criteria for assessing and monitoring soil quality. Although the initial focus in developing soil quality criteria has been on chemical and physical properties, scientists recognize that many important functions of soil, such as decomposition and nutrient cycling, are mediated by the organisms living in soil, and that an objective, comprehensive assessment of soil quality should include biological parameters. The soil is home to a complex community of organisms that includes bacteria, fungi, protozoa, nematodes, potworms, earthworms, mites, springtails, millipedes, centipedes, and other arthropods, so there are many potential candidates for biological indicators of soil quality.

Earthworms are the largest and most familiar soil invertebrates in Illinois soils. They are important members of the soil community because they can be the most abundant invertebrates by weight, reaching up to 1,000 pounds per acre in some agricultural soils, and even more in unmanaged soils. Furthermore, because of their ability to redistribute large amounts of soil and organic matter (roughly as much as their own body weight each day), earthworms may shape the rest of the soil community and important ecosystem processes such as water infiltration, nutrient cycling, and decomposition. In Illinois, about 35 species of earthworms have been reported. Of these, roughly half are native species about which we know very little. The remainder are mostly European species that probably came to North America in soil used for ship ballast or on the roots of nursery stock.

During May and June 1997, as part of the Illinois Soil Quality Initiative, Illinois Natural History Survey scientists sampled earthworm populations on 12 Illinois farms in conjunction with sampling of physical, chemical, and microbiological properties by University of Illinois soil scientists. Farms were clustered in groups of three that had similar





hydrology and soil type but with different management systems: (1) no-till corn-soybean rotation, (2) conventional tillage corn-soybean rotation, and (3) conventional tillage with a longer rotation, including a perennial hay.

We collected samples from cornfields on each farm (nine samples per field), as well as from uncultivated grassy border areas of each field (three samples per field). For each sample, we dug soil from a pit 12 x 16 x 8 inches deep. We hand-sorted the earthworms from each sample, then counted, weighed, and (in the case of adults) preserved them for identification. We kept juvenile worms in lab culture for identification when they mature.

Because of our method of sampling, we collected mostly endogenic earthworms—earthworms that tunnel back and forth through the topsoil and feed on buried decaying organic matter and on soil rich in organic matter. We did not collect anecic earthworms—earthworms, such as the nightcrawler *Lumbricus terrestris*, that form permanent vertical burrows three to nine feet down into the soil and pull plant residues from the soil surface into their burrows to feed.

The most striking observation was the difference in abundance of earthworms between cultivated fields and their uncultivated grassy borders. Across all farming systems, we estimated an average of 148,000 worms per acre within the fields (up to 292,000 worms per acre in one field) and almost four times as many—an average of 589,000 worms per acre, in the grassy border areas. In one of the grassy border areas, we estimated an abundance of 1.54 million worms per acre. The difference between in-field and grassy border populations was even greater when we considered the living weight of the earthworms: an average of 78 pounds per acre within fields, with a maximum of 179 pounds per acre, and almost 30 times that weight (an average of 2,263 pounds per acre and a maximum of 5,909 pounds per acre) in the grassy borders. Thus, topsoil-dwelling earthworms were not only less abundant within fields than in borders, but they were also smaller. In contrast to the difference between fields and grassy borders, we were unable to detect a difference in the number or weight of topsoil-dwelling earthworms among the fields with different management practices.

What caused the difference in earthworm populations between grassy borders and cropped fields? Several possible explanations exist, but keep in mind that we sampled only topsoil-dwelling earthworm populations. During winter, the thick layer of grass on the soil surface in the grassy borders may afford some protection to the soil; researchers have shown that bare soil freezes more deeply, resulting in higher earthworm mortality. The grassy borders may also provide a more abundant, stable, and nutritious food supply to support larger populations of earthworms. Agricultural practices and chemicals may result in higher mortality of earthworms within the field than occurs in uncultivated border areas. Finally, native earthworm species may not tolerate soil disturbance; we found them in the grassy border areas, but not within the fields.

We hope to relate our observations on earthworm populations to information about soil physical and chemical characteristics and soil management practices. By identifying factors that affect the abundance and structure of earthworm populations in agricultural soils, we hope to develop biological criteria for assessing and monitoring the health and quality of agricultural soils in Illinois.

(Reprinted from *Illinois Natural History Survey Reports No. 351.)*

Summary of the Illinois Soil Quality Initiative Phase II

During 1997 and 1998, ISQI staff sampled fields in corn only. Staff sampled 28 farm fields that had a history of conventional or no-tillage practices and that used either two-year or multi-year crop rotations.

In Christian County, the farmer cooperators are Jack Erisman, John Hebert, Len Corzine, and Dale Brix. Their groups of fields have soils in the Virden and Herrick soil series under the following management: tilled and in long rotation (LR), no-till (NT), and conventional till (CT). In Piatt and Champaign counties, we are sampling Drummer/Flanagan soils with farmer cooperators Allen Williams (LR and NT), Steve Jurgens (CT), and Don Parkhurst (CT). In Vermilion County, we sampled Drummer/Flanagan/Raub soils on farms managed by Jim and Eleanor Smith (CT), Barbara Buchanan (NT), and Terry Brewer (LR). In Warren County, we are working with Terry Davis (NT and LR) and Robert Grant (CT), who farm Tama/Muscataine/Sable soils. Our last sets of farms are in DeKalb and Lee counties. Cooperators there are Jerry Hipple (NT), Dean Winterton (CT), Joel Gerlt (CT), and Aaron and Paul Butler (LR); soils include the Saybrook/Drummer/Flanagan/Batavia and Elburn series.

Both traditional markers and global positioning were used to record sampling locations within the fields. This was also done in ISQI Phase I to allow researchers to return to sampling locations in the future. The physical measures being collected in Phase II are percentage of residue at the surface, soil crusting, bulk density, penetration resistance, aggregate strength and dry-aggregate size, and macro-porosity. The chemical measures being collected include routine and a few novel soil fertility measures: pH, phosphorus, potassium, calcium, and magnesium, soil organic carbon and nitrogen, and particulate organic matter. The following biological measures are being explored: bacterial/fungal ratios, soil enzyme activity (fluorescein diacetate hydrolysis and beta-glucosidase), microbial substrate utilization patterns, and assays of corn yields.

The last year of ISQI Phase II (1999) will include such measures of soil performance as biological productivity, water relations, and possibly disease suppression. Implementation strategies will be developed with cooperating farmers, the National Resources Conservation Service, and others interested in soil quality.

Research Priorities Identified

The Illinois Agricultural Statistics Service conducted a Farming Research and Education Study for the Illinois Department of Agriculture in 1997. The Illinois Sustainable Agriculture Committee sponsored the survey to gather information about current farm management practices and to obtain recommendations of future research and educational priorities for Illinois agriculture. The 2,200 Illinois farmers surveyed were asked, among other questions, to rate 22 topics for which additional research is needed—research that would help make their farming operations more sustainable. The #1 response was soil health/soil quality. It is worth noting that soil health/soil quality ranked in the top five topics for both education and research.

Mark Your Calendars

Farming Profitably in a Changing Environment

Thursday, December 10, 1998
8:00 a.m. to 7:00 p.m.
Holiday Inn
1001 Killarney Street, Urbana

Directed at farmers, landowners, and farm managers, along with agency and educational personnel, this conference will include an opportunity to participate in six concurrent sessions.

Topics include
- **environmental issues affecting farmers and landowners**
- **livestock and crop enterprises**
- **marketing**
- **organic agriculture**
- **soil health and soil quality**
- **resource protection and conservation**

The conference will offer practical, "take-home" information, and will feature three keynote speakers.
- Writer **Alan Guebert,** whose syndicated column appears weekly in *Illinois Agri-News*
- **Mike Duffy,** Iowa State University agricultural economist, associate director of the Leopold Center for Sustainable Agriculture, and professor-in-charge of the Iowa State Beginning Farming Center
- **Michele Gale-Sinex**, communications manager, Center for Integrated Agricultural Systems, University of Wisconsin—Madison.

For more information about this event, call Deborah Cavanaugh-Grant at (217)968-5512 or e-mail her at cavanaughd@mail.aces.uiuc.edu.

Managing Soil Productivity: Understanding Soil Health and Quality

April 21 and 22, 1999
Contact Pam Swingle, NRES,
at (217)626-1545 or swingle@uiuc.edu.

Photo: Bob Fraree, UI Extension Educator

Field demonstration at Northern Illinois Agronomy Center: Aggregates obtained by dry sieving reveal a lot about soil condition. Granular structure (lower left) is more desirable.

Soil Organic Matter Influences Soil Habitat Quality and Microbial Ecology

Many people recognize that soil microbial ecology contributes significantly to soil quality. Still, producers need a basis to evaluate claims that certain measures indicate "good" or "bad" microbial status in soil. For example, it has been asserted by Dr. Elaine Ingham that bacterial-to-fungal ratios (typically assessed by staining and counting methods) can be used in this way. Given the limited amount of information available, it may be difficult to determine whether a particular bacterial-to fungal ratio is indicative of good or poor soil conditions in Illinois. Collection of such data will improve our general understanding of this subject and help establish relevance for our cropping systems.

Similarly, we are evaluating the utility of microbial activity as measured by soil enzymes. We are assessing fluorescein diacetate (FDA) hydrolysis because FDA is broken down by a number of soil enzymes and is associated with a wide array of fungal and bacterial decomposers. FDA is also of interest because it has been tied to disease suppression in soils. In addition, we are measuring beta-glucosidase because this enzyme is associated with organic matter turnover in soils. Both Dr. Richard Dick of Oregon State University and Dr. Dianne Stott of the Erosion Productivity Lab in Indiana have worked extensively with soil enzymes; both researchers have found FDA and beta-glucosidase to be good general measures of soil biological activity.

Also, by assessing metabolic diversity using substrate utilization patterns, we are exploring the claim that soil productivity is tied to microbial diversity. Alternative methods to characterize the microbial community composition are being explored.

We are working to characterize soil organic matter fractions that determine habitat quality. Young organic matter fractions, which typically make up a small percentage of total organic matter in soils, have a disproportionately large impact on nutrient supply, nutrient storage, and soil physical condition. Farming practices have their greatest impact on the younger organic matter in soils. Particulate organic matter (POM) is an example of young organic matter that can be isolated using size or density as a basis for separation. We are investigating POM in association with measures of aggregation in an attempt to understand how habitat quality controls the microbial community.

Tillage, Texture, and Organic Matter in Illinois Soils

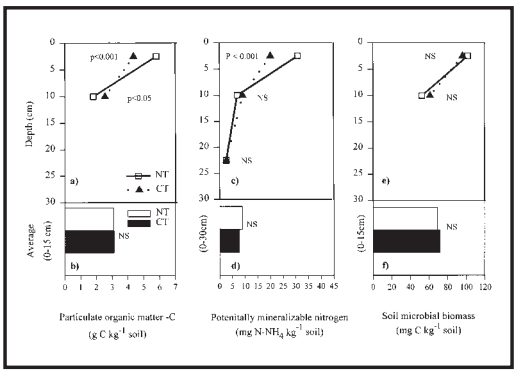
by Brian Needelman, Ph.D. Student, Penn State University

Soil organic matter (SOM) is a critical component of agroecosystems and has beneficial impacts on agronomic productivity and environmental quality. In the ISQI study, I focused on three measures of biologically active SOM: particulate organic matter, potentially mineralizable nitrogen, and soil microbial biomass. The portion of SOM that is biologically active releases such nutrients as nitrogen. Particulate organic matter is composed of sand-sized, incompletely decomposed organic materials. Potentially mineralizable nitrogen is a measure of readily degradable organic nitrogen. Soil microbial biomass is mostly bacteria and fungi.

Tillage practices strongly influence SOM dynamics by altering biomass production, surface cover, and soil properties. The dramatic increase of no-till in Illinois over the past decade may profoundly influence SOM characteristics of Illinois soils. In general, researchers have found that no-till practices have a more positive impact on SOM contents than do conventional tillage practices. However, research results are highly variable. There may be some unique site-specific conditions, such as poor drainage or finely textured soils, that should be taken into account.

We first assessed the impacts of tillage practices on the biologically active and total SOM measures. Next, we quantified the influence of soil texture on the impacts of tillage practices on these measures. We sampled 36 fields in four regions of Illinois during the early part of the growing seasons of 1995 and 1996. Each field had been under either conventional tillage (disc, moldboard plow, and/or chisel plow) or no-till management for at least five years. Fields were sampled in the corn or soybean phase of their rotation.

From zero to two inches in depth, no-till fields contained slightly more soil organic carbon and total nitrogen than conventional tillage fields. No statistically significant impacts of tillage practices on soil organic carbon or total soil nitrogen were observed in the two- to six-inch or the six- to twelve-inch depths, or overall (zero to twelve inches depth). From zero to two inches in depth, no-till soils contained more particulate organic matter. Less particulate organic matter was found at the two- to six-inch depth. There was no statistically significant impact of tillage practices on particulate organic matter contents overall (zero to six inches depth). Greater amounts of potentially mineralizable nitrogen were found at the zero- to two-inch depth in no-till soils. No statistically significant differences in potentially mineralizable nitrogen contents between tillage systems were observed in the two- to six-inch or six- to twelve-inch depths, or overall (zero to twelve inches depth). Soil microbial biomass contents were not statistically different between tillage systems in any soil depth. These results suggest that tillage practices impact the vertical distribution but not the total accumulation of biologically active SOM and total SOM.



We also assessed the influence of soil texture on the relationship between tillage practices and biologically active and total SOM. In other words, we tested whether the impacts of tillage on the SOM measures were the same at different soil textures. Soil textures ranged from silt loam to clay. Sand contents ranged from 0.1 to 21.2 percent. When we looked at the entire sampling profile (zero to twelve inches depth), we observed no influence of texture on the relationship between tillage and SOM measures. However, we noted an influence of texture on the effect of tillage on the vertical distribution of SOM. In soils with low sand content, tillage influenced the vertical distribution of particulate organic matter, potentially mineralizable nitrogen, soil organic carbon, and total nitrogen. But in soils with high sand content, there was no influence of tillage on the vertical distribution of any of the SOM fractions. Therefore, tillage was influencing these SOM measures only in the soils with low sand content.

Overall, tillage practices do not seem to affect the total accumulation of biologically active and total SOM in Illinois soils. This observation was constant across soils of differing texture. Tillage practices do, however, affect the vertical distribution of SOM fractions. Greater quantities of SOM fractions were observed in no-till soils than in conventional tillage soils in the upper two inches. Evidence also existed of greater SOM fraction contents in conventional tillage soils than in no-till soils in the lower plow layer (two to six inches). However, these effects were statistically significant only for particulate organic matter contents. The effect of tillage practices on the vertical distribution of SOM fractions was primarily observed in soils with low sand content. *(Brian Needleman conducted this study as part of his master's degree from UIUC.)*

Soil Management Resources

Guide to Management of Soil Organic Matter

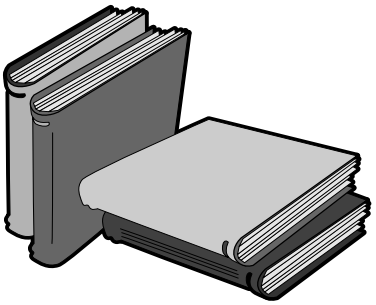
A practical, low-cost guide for building and maintaining soil organic matter is now available through the Northeast Region Sustainable Agriculture Research and Education (SARE) Program. *Building Soils for Better Crops,* by University of Vermont soil science professor Fred Magdoff, was written for farmers, gardeners, Extension specialists, and others interested in integrated approaches to enhancing soil quality.

"The book's underlying theme is that managing soils and crops from the point of view of maintaining and increasing organic-matter content is the foundation for sustainable agriculture," Magdoff says.

"We're not only interested in the total amount of organic matter, but also in the various types of organic materials in the soil, including the diversity of soil organisms which provide many essential processes such as releasing nutrients and improving soil tilth, as well as helping keep potentially harmful bacteria, nematodes, and other pests in check," he says.

The book was published in 1993 by the University of Nebraska Press but has since gone out of print. Magdoff hopes to have a second edition available within a year. However, in response to increasing requests for farmer-oriented information about organic-matter management, the Northeast Region SARE Program recently printed a limited number of bound photocopies of the book. SARE is a USDA program that works to increase knowledge about agricultural practices that are profitable, environmentally sound, and beneficial to local communities and society as a whole.

One to four copies of the photocopied book cost $10 each (shipping and handling included). Five to 24 copies



are $9 each, and 25 or more copies sell for $8 each. Orders will be filled on a first-come, first-served basis while supplies last. To order, send a check or purchase order payable to Northeast Region SARE Program, Hills Building, University of Vermont, Burlington, VT 05405-0082. Be sure to include a daytime telephone number and your shipping address.

New Publication Explores Multiple Nutrient Management Issues

A new bulletin offers a thorough, fresh discussion of agricultural nutrient management and examines issues ranging from soil–root interactions to watershed, regional, and global concerns. *Nutrient Management: More Than an On-Farm Priority* was produced by the USDA's Northeast Region Sustainable Agriculture Research and Education (SARE) Program. Up to 10 copies are available at no charge.

The eight-page publication is packed with information and analysis. It reviews characteristics of nutrient flows in agriculture and explores opportunities for enhanced nutrient cycling through sustainable farming methods. It also examines how social policies and economic factors influence the nutrient management agenda. Finally, the bulletin offers suggestions for improvement—not just for the agricultural community but for society as a whole.

"It was written for people who have an interest in nutrient management and whose focus has generally been on the area that's easiest to see—what the farmer does," says co-author Fred Magdoff, a soil science professor at the University of Vermont and coordinator of the Northeast Region SARE Program.

"But what the bulletin shows is that if we look at nutrient management as just the farmer's problem, we are missing a big part of the story. A good part of the problem doesn't have to do with the question of whether particular farmers are putting too much fertilizer on their fields. Some of the issues are a result of the structure of agriculture as it has developed in the 20th century."

The bulletin is based on a longer, more complete discussion of these issues that appeared in *Advances in Agronomy* (Volume 60). Both the bulletin and the original article were co-authored by Magdoff, Pennsylvania State University soil fertility researcher Les Lanyon, and University of California—Davis agronomy professor Bill Leibhardt.

Bulk orders (more than 10 copies) of *Nutrient Management* are available for $0.50 per copy, plus $2 shipping and handling. To order, send your request along with a check or purchase order payable to Northeast SARE (purchase orders cannot be accepted for orders of less than 10 copies) to John Nelson, Northeast SARE, Hills Building, University of Vermont, Burlington, VT 05405-0082. Be sure to include your name, shipping address, daytime phone number, and the quantity desired.

For information about rush and international orders, contact Nelson at (802)656-0484 or at jonelson@zoo.uvm.edu.

Farewell

by Georgine Paris,
Former ISQI Project Coordinator

Although I helped with the soil sampling this past spring and summer, by the time you read this, I will no longer be involved with ISQI. My husband finally graduated from the University of Illinois and accepted a job in St. Louis. We'll be living in Waterloo, on the Illinois side of the Mississippi River. I'm not sure what I'll be doing except possibly looking for a job in agriculture.

I'd like to say thanks to everyone who was involved with ISQI. I've enjoyed meeting the cooperators, traveling the many back roads of Illinois, and eating in local cafes. During the two years that I was involved with ISQI, I heard many interesting discussions on farming and soil quality. Every year brings new questions and challenges. I encourage each of you to continue to love the land and your work and to remain diligent stewards of the land.

Thanks for the memories.

Champaign County Drainwater Nitrate-N Survey

by Ted R. Peck, Professor of Soil Chemistry

A nitrate-nitrogen survey of Champaign County open-ditch and tile drainage was undertaken. The survey was prompted by recent reports of high nitrate-nitrogen levels in nearby Lake Decatur, which is used by Decatur residents as a source of drinking water.

Between mid-April 1995 and mid-June 1998, 30 samplings of the Sangamon River at Allerton Park showed a nitrate-N level ranging from 1 to 14 ppm, with a median level of 8 ppm. The higher concentrations of nitrate occured during higher levels of water flow. Two field tile outlets were sampled during periods of flow, with tile A showing a range of 4 to 15 ppm nitrate-N (with a median level of 10 ppm) and tile B showing a range of 8 to 27 ppm N (with a median level of 16 ppm). An acceptable level of nitrate-N in drinking water is 10 ppm or less.

The fertilizer and cropping history of field A is not known, but in field B, lower-than-expected harvest yields in recent years are believed to have resulted in soil nitrate-N buildup, resulting in the high drainwater nitrate-N levels.

A 1942 study reported in the *Journal of the American Society of Agronomy,* "Runoff, Percolate and Leaching Losses from Some Illinois Soils," showed that "much larger amounts of plant nutrients are lost from the more productive soils than from the less productive ones. The results also show that the loss of plant nutrients depends largely on the amount of water passing through the soil. This may be worth considering when so much effort is being made to reduce the amount of runoff from soils. This may be particularly true if mechanical means rather than vegetative cover is depended upon to control the runoff. If a cover crop is kept on the soil, both leaching losses and loss of water by percolation will be held to a minimum."

Corn growing and a safe supply of groundwater is considered a balanced program: The corn plant takes up dissolved nutrients from the soil water. Although crop growth depends on the water solubility of nutrients, the forms are vulnerable to leaching when rainfall in excess of soil storage and crop usage occurs. More than 10 pounds of nitrate-N in 1,000,000 pounds of water (or 4.4 acre-inches of water) is an unacceptable level for drinking water. Illinois receives an average of 30 inches of rainfall annually, and we might expect one-fourth to one-third of that to percolate through soil, for about 8.8 acre-inches or 2,000,000 pounds of water—which at 10 ppm nitrate-N is 20 pounds per acre of nitrogen. Hence, the importance of applying nitrogen at levels commensurate with corn yield requirements.

Farmer-Developed Soil Quality Cards

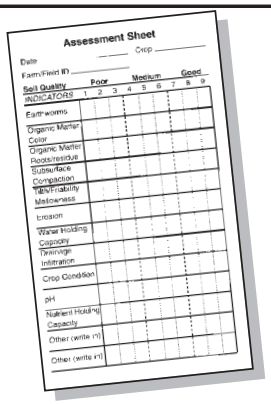
by Ellen Phillips, Extension Crops Educator

When two fields with different tillage methods exist side by side, differences in soil conditions between the two are often apparent. How can a farmer keep a record of these differences and begin to get a feel for whether those differences might be changing over time? The Natural Resources Conservation Service, the University of Illinois Extension, NCR SARE, and other agencies are teaming up with farmers to create an in-field assessment tool to answer this question. That tool is a soil quality card.

The goal of the soil quality card will be to integrate scientific and local knowledge, enabling farmers and scientists to work together to improve our understanding of soil quality. Farmers and collaborating scientists will work closely together to design the card. The illustration, right, is an example of an assessment sheet developed by the University of Maryland in collaboration with the USDA-NRCS Soil Quality Institute and 17 Maryland Farmers.

Because farmers will be the primary users of the card, they will select the terminology to be used and the assessment criteria for the soil quality indicators. Farmers will also determine the card's format and layout. The soil quality indicators will be based on farmers' practical experience and intimate knowledge of local soils, natural resources, and farming systems.

The card will include five to seven qualitative soil quality indicators that can be assessed without the use of technical or laboratory equipment. Examples of such indicators include compacted soil layers, abundance of earthworms, and amount of organic matter. Descriptive terms might include "Soil crumbles well. Can slice through, like cutting butter. Spongy when you walk on it" to describe good soil tilth. A management guidebook will accompany the soil quality card so that producers can evaluate alternative management practices to achieve the soil quality they desire.



The soil quality card will be a simple tool for individual farmers to use in the field. To assess soil quality with the card, a farmer will select representative locations in a field and then rate the indicators, guided by the descriptive terms. The first assessment for each field or location within a field will serve as the baseline or as a personal reference point. Over time, the same area will be reassessed using the same indicators to determine if management practices have an effect on soil condition.

Local ecological and environmental conditions vary throughout Illinois, as do the types of farming systems; these differences must be considered when designing a qualitative soil assessment tool. A single card covers a limited eco-region with similar soils, natural resources, and farming conditions. Eventually there may be different soil quality cards for use in the various regions of Illinois. The first card being developed is for northeastern Illinois. (Development began in September 1998). Once developed, the card must be tested. If you are in northeastern Illinois and would be willing to provide feedback on this card, or if you would like further information on this project, call Ellen Phillips at (630)833-2171 or e-mail her at Phillipse@mail.aces.uiuc.edu.

Who's Involved in ISQI

Illinois Soil Quality Initiative Contacts

Michelle Wander, Research Leader
Department of Natural Resources and Environmental Sciences
University of Illinois, W-503 Turner Hall,1102 S. Goodwin, Urbana, IL 61801
(217)333-9471, FAX (217)333-9817, mwander@uiuc.edu
ISQI Research Leader

Gerry Walter, Communications Research Leader
Department of Human and Community Development
University of Illinois, 149 Bevier Hall, 905 S. Goodwin, Urbana, IL 61801
(217)333-9429, FAX (217)244-7877, gwalter@uiuc.edu
Information Research Leader

Deborah Cavanaugh-Grant, Outreach Coordinator
Department of Natural Resources and Environmental Sciences
University of Illinois, W-503 Turner Hall, 1102 S. Goodwin, Urbana, IL 61801
Mailing address: P.O. Box 410, Greenview, IL 62642
(217)968-5512, FAX (217)968-5512, cavanaughd@mail.aces.uiuc.edu
Dialogue Project Leader

Illinois Soil Quality Initiative Research Team

Susanne Aref, UIUC Biometrics
Charlie Boast, UIUC Professor of Soil Physics
Germán Bollero, UIUC Assistant Professor, Biometry and Cropping Systems
Don Bullock, UIUC Associate Professor of Crop Production
Bob Darmody, UIUC Associate Professor of Pedology
Bob McLeese, State Soil Scientist, NRCS
Jerry Sims, Microbiologist, USDA
Ed Zaborski, Assistant Professional Scientist, Center for Economic Entomology, Illinois Natural History Survey

Illinois Soil Quality Initiative Board Members

Dan Anderson, UIUC Research/Extension Specialist in Agriculture
Kevin Barber, UIUC Brownstown Agronomy Research Center
Dennis Bowman, UIUC Crop Systems Extension
Ray Brownfield, Capital Agricultural Properties Services
Mark David, UIUC Forest Soils
Steve Elmer, Natural Resources Conservation Service
Jack Erisman, Goldmine Farms
Gayle Goold, Illinois farmer
Doug Gucker, Piatt County Cooperative Extension Service
Eldon Hesterberg, Illinois Farm Bureau
Morris Huck, USDA Soil Science
Renee Hunt, Illinois Stewardship Alliance
Don Johnson, UIUC Geography
Gary Johnson, Hutcheson Farm Management
Jim Kinsella, Illinois No-Till Farmers Association
Leon Kohlmeier, Association of Professional Residue Managers
Roy Mahnesmith, Sheffield, Illinois
Greg McIsaac, UIUC Natural Resources and Environmental Sciences
Ernie Moody, Bank One Farm Management
Jack Norman, Sierra Club, C-FAR, MSAWG
Lyle Paul, UIUC DeKalb Research Center
Ted Peck, UIUC Soil Testing
Terry Schneider, Schneider Farm
Michael Scully, Scully Farms
Robert Tegeler, Natural Resources Conservation Service
Keith Waterman, Heren Fertilizers and Illinois Society for Farm Managers and Rural Appraisers
David White, UIUC Farm and Resources Management (FaRM) Lab
Allen Williams, Stewardship Farm, Ridgeline Farm

Illinois Soil Quality Initiative Farmer Cooperators, Phases I and II

Terry Brewer*
Dale Brix*
Barbara Buchanan*
Aaron Butler*
Paul Butler*
John Cender
Mark Cender
Len Corzine*
Terry Davis*
Mark Dreska
Jim Dobbels
Dale Edge
Jack Erisman*
Larry Fogerson*
Joel Gerlt*
John Gesell
Darrel Gilomen
Robert Grant*
Jay Hageman
John Hebert*
Jerry Hipple*
Tom Hortin
Gary Johnson
Steve Jurgens*
Paul Kahle
Leon Kohlmeier
Rick Larimore
Everett McCoppin
Ben Meister
Ken Osterbur
Don Parkhurst*
Ken Reinhardt
Jeff Reuschel
Roger Rinderer
Joel Rissman
Terry Schneider
James Smith*
Jerry Snodgrass
David Steiner
Joe Strullmyer
Denny Sy
Bob Van Hoveln
Richard Wiegand
Roger Wiegand
Allen Williams*
Dean Winterton*

*Cooperators whose fields were sampled in 1997 or 1998 as part of ISQI Phase II; other cooperators either had fields sampled or participated in the Dialogue Project.

Final Newsletter

This is the final ISQI newsletter. We wish to acknowledge and thank the cooperating farmers, the board members, and the Natural Resources Conservation Service personnel who have contributed their time. A soil quality bulletin will be produced and distributed by the close of ISQI Phase II.

If you have suggestions for information to be included in the bulletin, or for further information, please contact Deborah Cavanaugh-Grant at (217)968-5512 or cavanaughd@mail. aces.uiuc.edu.

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