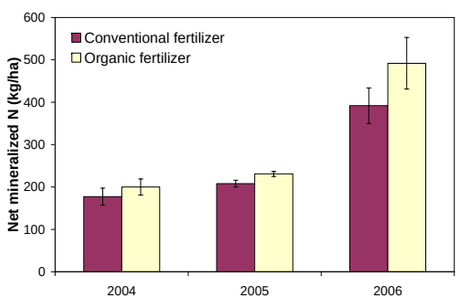
Nitrogen management impacts on nitrogen availability

Contact: Sharon Lachnicht-Weyers

Goal: To determine the availability of nitrogen in organic and conventional agricultural systems with different fertilization strategies (manure versus inorganic nitrogen) to aid in the development of guidelines for nutrient application.

Approach: A series of field plots have been established by the North Central Soil Conservation Research Laboratory to determine the impact of organic and conventional management regimes on agricultural economics. Experiments will be conducted in organic and conventional plots that are strip-tilled, fertilized, and maintained under a four-year rotation. Nitrogen mineralization and nitrogen availability will be evaluated in each plot in four successive years. The linkage of soil biological community dynamics to nitrogen mineralization will be assessed.

Availability of Nitrogen Under Different N Management



Net nitrogen mineralized during the growing season, averaged across four crops in rotation, shows no difference in nitrogen availability in crops fertilized with manure and conventional fertilizers.

Evaluation of soil movement for landscape restoration

Contact: Sharon Papiernik

Goal: Provide an evaluation of the impact of field-scale soil movement (conducted to decrease soil spatial variability) on soil characteristics, soil productivity, farm profitability, pesticide persistence and mobility, and subsequent soil erosion.

Approach: At two severely eroded sites, soil will be moved from areas of soil accumulation (concavities) to areas of topsoil depletion (upper slope positions). These studies will be conducted on-farm in cooperation with growers. A five-year study will assess changes that occur as a result of soil movement, including

1) Crop stand establishment, weed populations, crop growth, and crop yield
2) Soil profile characteristics and soil properties, including chemical (carbon, nutrient contents, pH), physical (bulk density, water availability), and biological (soil organism dynamics) properties of the soil
3) Herbicide fate and transport
4) Future predicted soil erosion
5) Short-term economic costs/benefits

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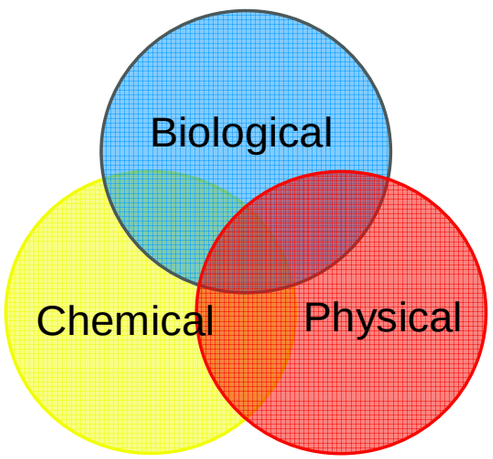
August 1, 2007

Need for Research

While the U.S. Corn Belt is a highly-productive agricultural region, production and profitability are currently limited by

- large input of resources
- a relatively short growing season
- cold and wet springs and autumns, and
- degraded soil quality

This project will provide an integrated assessment of the effects of management practices on sustained soil productivity and environmental impacts. This project is required to develop management practices for the northern Great Plains that optimize long-term productivity while protecting environmental quality.



The project will integrate physical, biological, and chemical aspects of soil as they affect soil productivity and environmental quality.

Impact of tillage and crop rotation on soil carbon

Contact: Don Reicosky

Goal: To provide information about the rate and duration of carbon storage under different management practices. This information is required to improve management recommendations that enhance soil carbon sequestration and reduce soil carbon losses.

Approach: Field studies including combinations of crop (corn and soybean) and tillage intensity (moldboard plow, strip tillage, no-till systems). These plots were established in 1997. The effects of these management factors will be assessed ten years after the experiments were started. Soil carbon concentrations and bulk density will be measured in depth increments, and the results compared with baseline samples collected in 1997.

Moldboard Plow Tillage

Strip Tillage

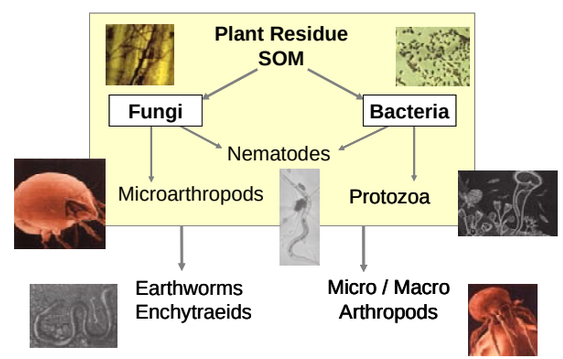
Effect of land management practices on the soil biological community

Contact: Sharon Lachnicht-Weyers

Goal: To improve understanding of the complexity in structure and function of soil biological communities in organic and conventional agricultural systems. This information is required to develop improved agricultural production systems that promote resource efficiency, improve soil quality, and enhance environmental services.

Approach: In 2002, the North Central Soil Conservation Research Laboratory established a large-scale field study to determine the impact of organic and conventional management strategies on agricultural economics. Experiments will be conducted in these plots, which include tillage, fertilizer, and crop rotation comparisons for each system (conventional and organic). Differences in microbial dynamics will be determined through microbial biomass, organic nitrogen content of the microbial biomass, fatty acid methyl ester (FAME) profiles, and enzymes associated with carbon, nitrogen, and phosphorus cycling.

Food Web Structure



Soil and economic impacts of harvesting corn stover for biofuel

Contact: Jane Johnson

Goal: To develop recommendations for the amount of biomass that must be returned to the soil to maintain soil carbon levels. This project is part of a nationwide research effort evaluating residue removal and the potential of crop residues to contribute to bioenergy systems that increase U.S. energy independence, reduce greenhouse gas emissions, and support rural communities without degrading soil resources.

Approach: Field studies will include no-till and conventional-tilled plots. Four rates of corn stover harvest (0%, 50%, 75%, and 100%) will be implemented. Soil carbon, nitrogen, and phosphorus contents, bulk density, pH, and electrical conductivity will be monitored over time to identify management effects on soil properties. Agronomic and economic crop yield will be determined annually.