LEOPOLD CENTER
FOR SUSTAINABLE AGRICULTURE

Linking soil and water quality with crop performance across a continuum of tillage and management strategies: Enhancing sustainability through soil health-promoting practices

(Part I of a three-year program)

Abstract:

Comparisons across the three Iowa research sites, with histories ranging from three to 17 years, allowed the research team to examine of the effects of crop rotation history (short vs. longer) and system (organic vs. conventional) on weed management, crop productivity, soil quality and soil microbial communities.

Investigators:

Kathleen Delate
Agronomy and Horticulture
Iowa State University

Cynthia Cambardella
Matt Bakker
USDA-ARS National Laboratory for Agriculture and the Environment
Ames

Ann Johanns
ISU Extension and Outreach
Osage

CROSS-CUTTING

By studying and collecting over 25 sets of biological data, researchers are beginning to determine equivalent yields where crops are grown on land with a history of longer rotations with oats and alfalfa, and non-synthetic inputs are used. Soil microbial community analysis showed the presence of more than 11,000 distinct bacterial taxa at the Neely-Kinyon Long-Term Agroecological Research (LTAR) site, with bacterial communities within the organic soils different from the bacterial communities in the conventional soil. This suggests that organic management provides a rich resource of food for the soil microbes, which fuels microbial growth, and subsequently increases microbial biomass.

What was done and why?

The project hypothesis is that farming systems will accrue long-term economic and environmental benefits through the use of integrated methods of tillage, crop rotation, and cover crops. These practices will promote soil health, suppress competitors, and minimize the negative impacts on beneficial organisms while improving overall productivity of the system. The research team will evaluate performances at several Iowa experimental sites with different cropping histories and management practices.

The project objectives were to:

- Identify cropping systems that maximize yields, increase profitability, limit pests (especially weed populations), and promote soil health, while minimizing nutrient loss and fostering carbon sequestration;
- Determine the effects of cropping systems with different management histories on soil health, water quality and soil microbial community structure and function related to nutrient cycling and carbon sequestration;
- Enhance conservation, environmental, energy and economic outcomes on farms by developing systems-based IPM/BMP guidelines to suppress weeds, augment biological controls, and improve soil health; and
- Develop and demonstrate educational tools to promote soil conserving practices for producers, extension personnel, NRCS, and other agricultural professionals that include technology transfer techniques of workshops, field days and webinars, utilizing a farmer-centered approach.

What did we learn?

Work continues on this program through the efforts for Leopold Center grant XP2015-03. See: http://www.leopold.iastate.edu/grants/xp2015-03