Agronomic, ecological and economic comparisons of conventional and low-external-input cropping systems

Abstract: Low-external-input cropping systems were compared to conventional practices over several years with contrasting weather conditions. The results offer several potential options for farmers in times of rising fossil fuel costs. Diversified low-external input systems consistently outperform conventional systems on a number of important measures.

This project was successful in documenting and extending information about the impacts of conventional and diversified LEI crop rotation systems on crop yields, weed dynamics, soil quality, energy use efficiency and profitability.

What was done and why?
Synthetic fertilizers and pesticides are major expenses in Iowa farming systems and often are linked to environmental damage. If farmers can learn how to reduce reliance on these materials without compromising farm productivity and profitability, agricultural sustainability could be enhanced in Iowa and the U.S. Corn Belt. Fossil energy costs associated with farming have increased over the last decade and reducing reliance on non-renewable energy sources also is critical to improving agricultural sustainability.

Results of previous research at Iowa State University’s Marsden Farm, in Boone County, indicated that small grains and perennial forage legumes added to conventional row-crop systems help to maintain crop yields, minimize requirements for synthetic fertilizers and herbicides, reduce production costs, and maintain or increase net returns. The Marsden Farm experiment was used to generate and extend additional information about the agronomic, ecological and economic characteristics of conventional and low-external-input (LEI) cropping systems.

This project compared the agronomic, ecological and economic performance characteristics of three cropping systems: a conventionally managed corn-soybean rotation and two more diverse rotations (corn-soybean-oat/red clover and corn-soybean-oat/alfalfa-alfalfa) receiving much smaller quantities of nitrogen fertilizer and herbicides. Measurements included crop yields, weed dry matter production, weed seed densities in soil, economic costs and returns, fossil energy use, and soil organic matter concentrations.

What did we learn?
Results indicate that diversified crop rotation systems can produce high yields of corn and soybean, suppress weeds effectively, and improve soil quality, while substantially reducing requirements for synthetic N fertilizer, herbicides, and fossil energy inputs. Despite historically high market incentives for corn and soybean throughout the period of study (2007-2010), the LEI 3-year rotation system was 6 percent more profitable than the conventionally managed 2-year system. The LEI 4-year system was slightly (3 percent) less profitable than the conventional 2-year system.

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