



SAG-6-09

# Organic and Conventional Cropping Systems Comparison: 2008 Report for Northwest Ohio

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## Purpose

The purpose of this experiment is to promote (through research, demonstration, and education) vital agricultural systems in Northwest Ohio that are economically, ecologically, and socially sustainable.

## Plan

The plan is to establish a replicated farming systems experiment that demonstrates different options in sustainable agricultural crop production and marketing, and creates a foundation and framework for long-term agronomic, environmental (including soil quality and carbon sequestration), and socio-economic research.

## Farming Systems Experiment

The goal is to gain a better understanding of what occurs with crop production and soil changes when farmers transition from one management system to another. The treatments chosen for this experiment represent a range of conditions experienced by farmers transitioning either to organic or other more diversified crop management systems. Overall, the experiment addresses ways to maintain production and economic viability while building soil quality. Farmers (including the Hirzel family) in Northwest Ohio have been working with these types of management systems, in some cases, for many years. With this experiment, we are gaining a more detailed understanding of the changes occurring under controlled conditions, with the objective of using this information to help farmers with transition in their operations. Established in spring 2001 in five replicate blocks, each of the following farming systems measures 30' × 900':

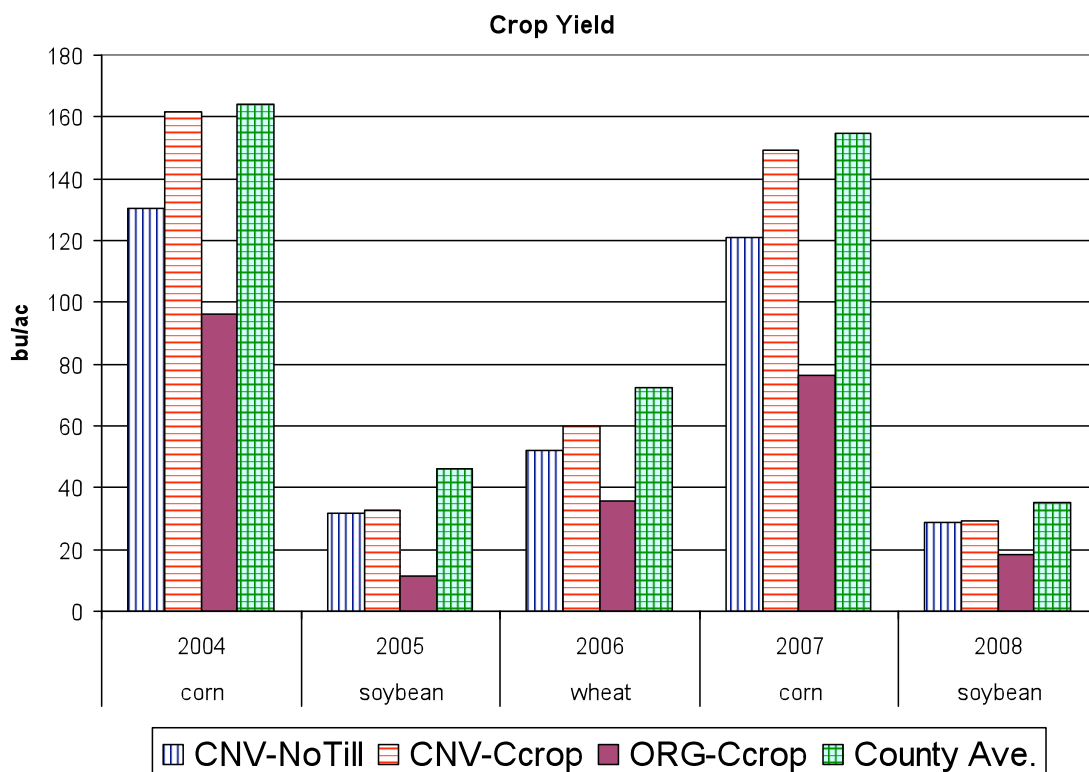
- **Farming System 1: Conventional Corn-Soybeans-Wheat (CNV-NoTill).** No-till, inorganic fertility, pesticides, conventional commodity marketing.
- **Farming System 2: Integrated Corn-Soybeans-Wheat (CNV-Ccrop).** No- and reduced-till, mixture of inorganic and organic fertility, cover crops, reduced rates on pesticides and fertilizers, conventional and some specialty marketing.
- **Farming System 3: Organic Corn-Soybeans-Wheat/Spelt (ORG-Ccrop).** Reduced-till, poultry compost fertility, cover crops, mechanical weed control, organic commodity marketing.
- **Farming System 4: Hirzel Organic Grains (ORG-compost).** Oats-Alfalfa-Alfalfa-Alfalfa-Corn-Soybeans-Wheat/Clover-Corn-Soybean-; reduced-till, duck manure/leaf refuse compost fertility plus other soil amendments, cover crops, mechanical weed control, organic niche marketing.
- **Farming System 5: Organic Multi-Crop Grains (ORG-Leg).** Oats/Clover-Sunflower-Soybeans-Spelt/Hay-Corn-Clover; reduced till, green manure fertility, mechanical weed control, local and international organic marketing.

### Research Results

An interdisciplinary team of researchers is collecting data on crop production and other important agronomic factors, as well as indicators of soil quality, nutrient cycling efficiency, carbon sequestration, and soil food webs.

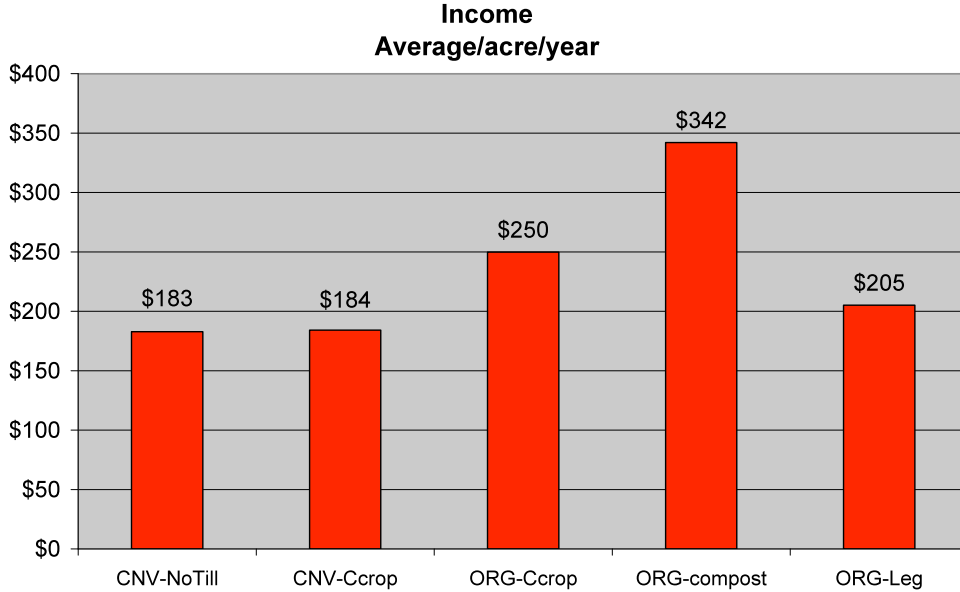
#### Crop Yield

The chart below compares two conventional grain cropping systems to the organic cover crop system. Also included is the Wood County average grain yield for that year. Yields were calculated by harvesting the center of each of five treatments and then averaging the result.



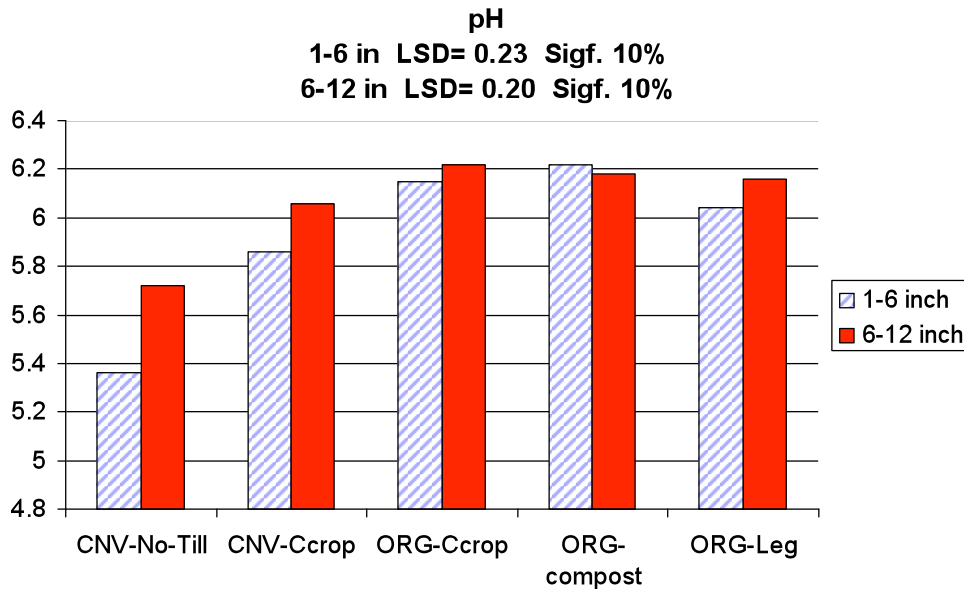
### Economic Analysis

The average income per acre per year was calculated as follows: Revenue was calculated by using the same grain market price per bushel each year, multiplied by the average grain yield. Input costs (including fertilizer, chemicals, seed, machinery, and land costs) were calculated by using the same unit cost each year, multiplied by the number of units or operations each year.



### Soil pH

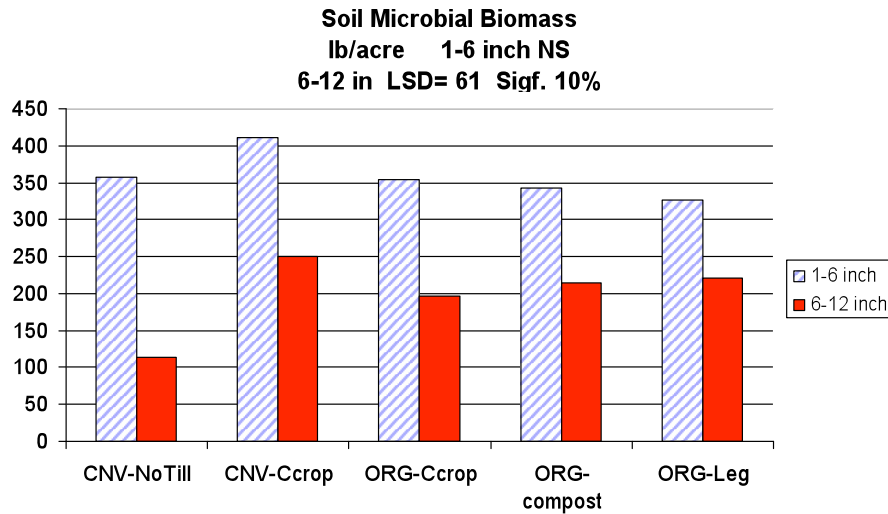
The CNV-NoTill treatment was statistically different from all the other treatments at both the 1–6 and 6–12 inch levels. The CNV-Ccrop treatment at the 1–6 inch level was statistically different from the ORG-Ccrop and ORG-compost treatments at the 1–6 inch level. Systems management affected pH significantly across all systems and soil sampling depths. Farmers should be aware of changes in pH as they transition to organic systems.



### Microbial Biomass

We measured the amount of nitrogen contained in the sum of soil bacteria and fungi. This evaluation gives an indication of what proportion of the nitrogen cycle is being controlled by biological activity and how management affects soil biology.

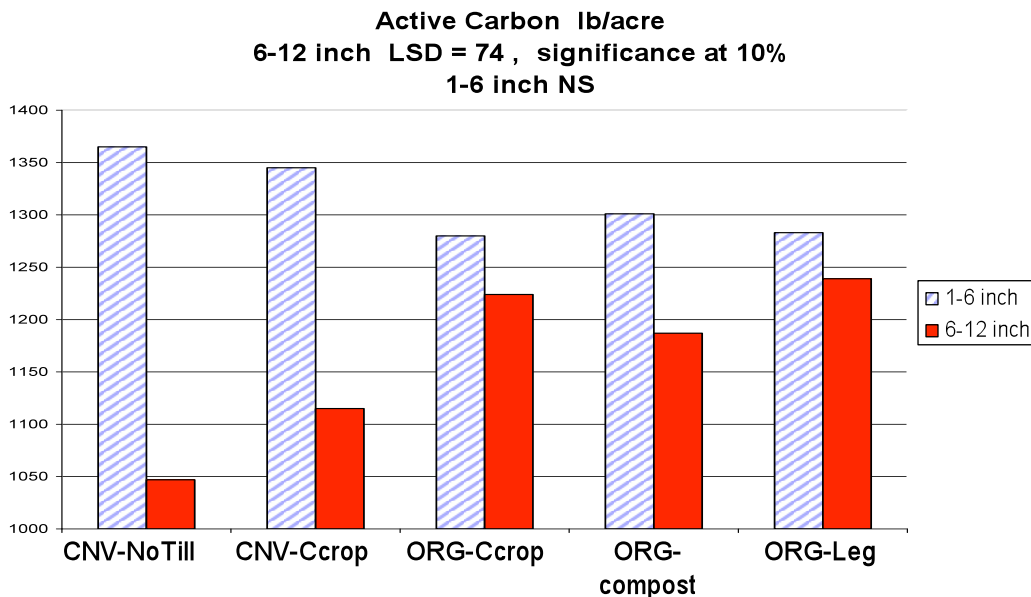
The CNV-NoTill 6–12 inch level was significantly different from all other soil biomass treatments at the 6–12 inch level. At the deeper soil sample depth in NoTill, biological activity is significantly reduced due to absence of tillage, which introduces oxygen and organic matter.



### Active Carbon

Active carbon is a measure of the fraction of soil organic matter that is readily available as a carbon and energy source for the soil microbial community. Active carbon is a leading indicator of soil health responses to changes in crop and soil management.

The active carbon sampling in the CNV-NoTill and CNV-Ccrop systems were both statistically different from the organic treatments at the 6–12 inch depth. Organic systems introduce soil amendments such as manure and compost, which significantly increase active carbon in the deeper soil profile.



## **Discussion**

Soil data indicate that the organic systems, especially the ORG-compost and ORG-Leg systems, are shifting to greater biological control of the nitrogen cycle.

Of the organic systems, the ORG-compost system has very high initial economic costs, but it showed a relatively rapid response in soil quality improvement. The ORG-Leg system was the most profitable of all the systems on a variable cost basis, and it also showed marked improvements in some soil quality indicators but a decrease in soil structure.

The CNV-NoTill system showed significant differences in pH, soil microbial biomass, and active carbon when compared to the integrated and organic systems. After five years of applying high amounts of commercial fertilizer and pesticides, the NoTill system pH was 5.36 in the 1–6 inch deep zone. This compares to 5.8 in the CNV-Ccrop system and over 6.0 in the organic systems. The addition of lime would be recommended more often in the NoTill system. Also, the NoTill system had lower levels of soil microbial biomass and active carbon due to the absence of cover crops, manure, and compost that the other systems received. These results indicate that tillage along with soil amendments can successfully maintain soil quality when compared to NoTill without these amendments. Soil quality indicators in the NoTill system might also improve if given more years of testing.

## **Contact**

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## **Acknowledgements**

This publication was produced in cooperation with Ohio State University's John E. Hirzel Sustainable Agriculture Research and Education Site, OARDC, OSUE, and The Agricultural Incubator Foundation at Bowling Green, Ohio. The authors dedicate this publication in memory of John Hirzel, long-time supporter of sustainable agriculture, state leader in organic grain and vegetable production, and friend.

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