SOIL QUALITY COMPARISON OF ORGANIC AND CONVENTIONAL FARMING SYSTEMS IN NORTHWEST OHIO

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A Farming Systems Experiment has been managed by the Extension Educator.

Introduction:

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 is addressing ways to maintain production and economic viability while building soil quality. Farmers in this region 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.

Methods:

Baseline values at beginning of experiment: Total organic matter = 3.2%, Phosphorus = 43 lb/acre, Potassium = 164 lb/acre. Soil type = Hoytville clay loam.
Established spring 2001 in five replicate blocks, each system 30' x 900'

Compares the following five farming systems:

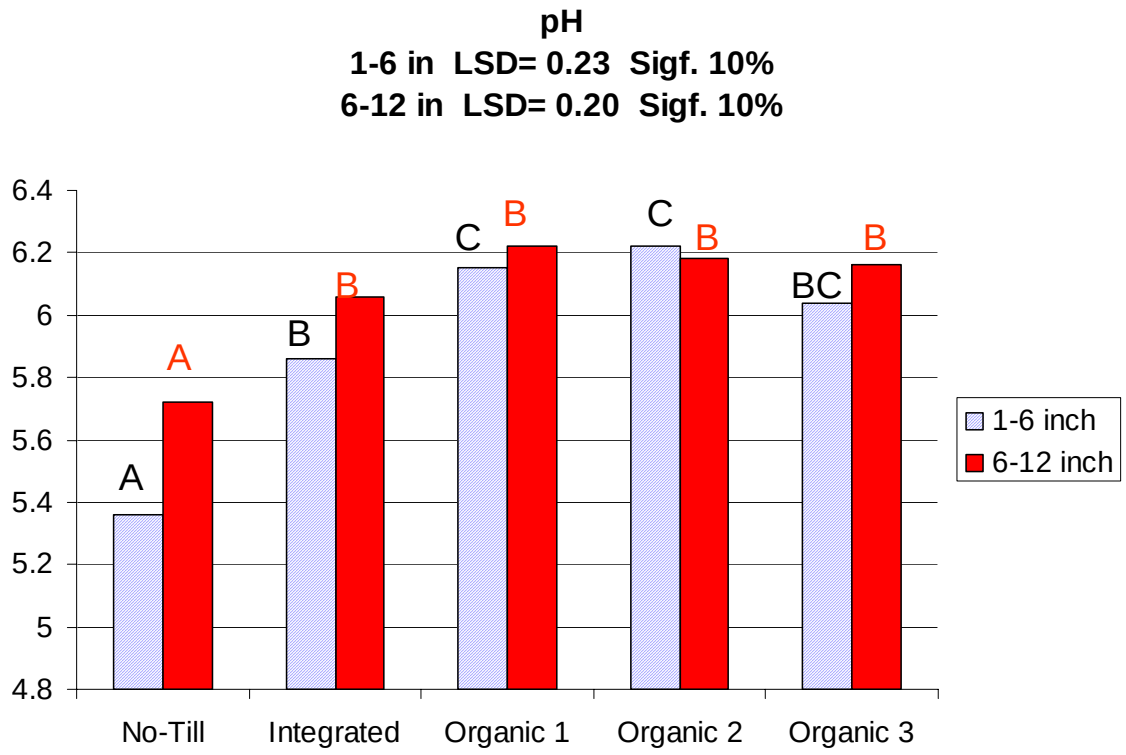
- ***Farming System 1*** **Conventional Corn – Soybeans – Wheat (No-till)**
  No-till, inorganic fertility, pesticides, conventional commodity marketing.
- ***Farming System 2*** **Integrated Corn – Soybeans – Wheat (Integrated)**
  No- and reduced-till, mixture of inorganic and organic fertility, manure,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

Results:

Soil pH

The no-till treatment was statistically different from all the other treatments at both the 1-6 and 6-12 inch levels. The integrated treatment at the 1-6 inch level was statistically different from the Organic 1 and Organic 2 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.

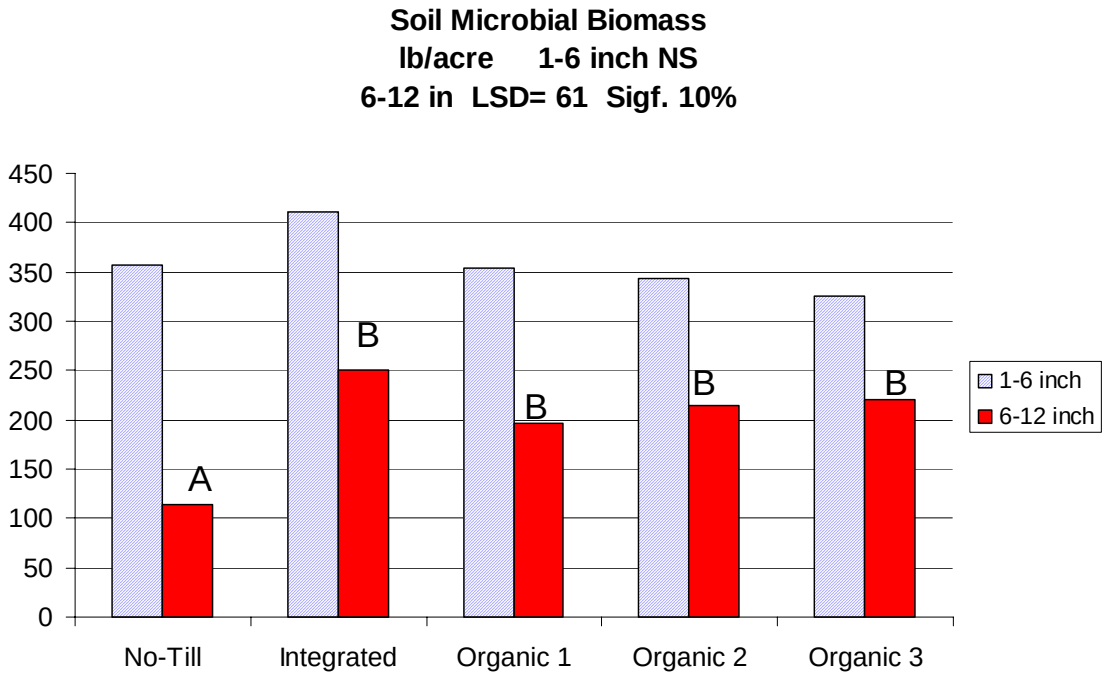


Values with the same colored letter in the graph above are not statistically different.

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 no-till 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 no-till, biological activity is significantly reduced due to absence of tillage which introduces oxygen and organic matter.



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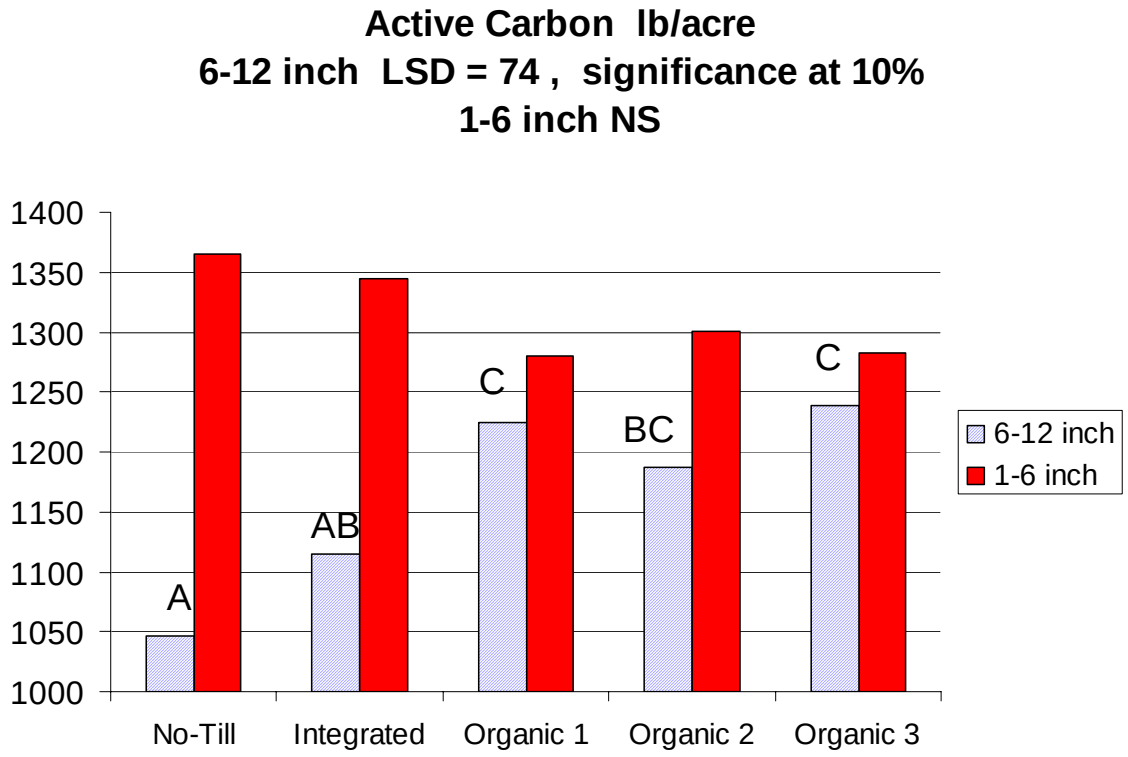
Active Carbon

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 no-till and integrated system were both statistically different from the Organic 1, Organic 2, and Organic 3 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.



Values with the same letter in the graph above are not statistically different.

Discussion:

- Soil data indicate that the organic systems, especially the Organic 2 and Organic 3 systems, are shifting to greater biological control of the nitrogen cycle.
- Of the organic systems, the Organic 2 system has very high initial economic costs, but showed a relatively rapid response in soil quality improvement. The Organic 3 system was the most profitable of all the systems on a variable cost basis and also showed marked improvements in some soil quality indicators, but a decrease in soil structure.
- The no-till 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 no-till system pH was 5.36 in the 1-6 inch deep zone. This compares to 5.8 in the integrated system and over 6.0 in the organic systems. The addition of lime would be recommended more often in the no-till system. Also the no-till system had lower levels of soil microbial biomass and active carbon due to the absence of cover crops, manure, or compost which the other systems received. These results indicate that tillage along with soil amendments can successfully maintain soil quality when compared to no-till without these amendments. Soil quality indicators in the no-till system might also improve if given more years of testing.