Agriculture and global warming

Industrial agriculture and its transportation requirements contribute vast quantities of greenhouse gases such as carbon dioxide to our steadily heating planet. Carbon is released into the atmosphere every time we burn gasoline or diesel fuel, produce chemical fertilizers or even disturb the soil through tillage. Research at The Rodale Institute comparing conventional and organic agriculture side by side over nearly three decades shows how the way we grow our food can either alleviate or compound our global warming challenges.

Climate change

Under the direction of Fulbright Scholar Paul Reed Hepperly, PhD, our Farming Systems Trial (FST)—the longest-running comparison of organic and conventional agriculture in the U.S.—has demonstrated that organically managed soils actually trap, or sequester, carbon. Specifically, our organic system has captured more than 1,000 pounds of atmospheric carbon—or about 3,670 pounds of carbon dioxide—per acre-foot of soil per year over nearly three decades of our ongoing experiment. (An acre-foot is the volume of a square acre of soil measured to a depth of 1 foot.) The conventional system in our research captured no carbon. This indicates to us that synthetic nitrogen fertilizers speed up the decay process of organic matter so that it is released into the atmosphere as carbon dioxide, rather than remaining in soil.

Energy, water and more

Organic systems require up to 75 percent fewer energy inputs to produce crops, largely because they do not rely on synthetic nitrogen fertilizers—which require vast amounts of natural gas to produce— or chemical pesticides or herbicides. Our FST has also demonstrated over time that carbon-rich soils conserve water and support healthier plants that are more resistant to drought stress, pests and diseases, and are higher in antioxidant compounds and other nutrients. Organically managed soils also significantly reduce the erosive capabilities of wind and water to carry valuable topsoil, and excess nutrients into our waterways.

With consumer demand for organic food and concern for the environment at an all-time high, public Land Grant universities are opening their doors to organic research like never before. Here at The Rodale Institute, we've been forging collaborative partnership with these institutions for more than 35 years. That's why we're on the cutting edge of understanding why organic systems work the way they do and how properly managed organic farming can address so many critical challenges of our day, including but not limited to energy management, greenhouse gas reduction, natural resource conserva-

tion and the economic vitality of our rural communities. The next big challenge is helping government and industry connect the dots and translate these findings into meaningful changes in energy, agriculture, climate change and food policy.

Other highlights of our research

- **Our limited-tillage organic system** combines the advantages of conventional no-till and organic farming to increase the benefits of both approaches. While conventional no-till agriculture has long been considered the Holy Grail of carbon sequestration, organic agriculture can improve soil's ability to trap carbon up to three times more than conventional no-till agriculture. Here at The Rodale Institute, yields from our organic limited-tillage and standard organic plots have equaled or surpassed our conventional plots as they have built up resiliency over time, busting the myth that organic agriculture cannot feed our growing population. Innovative tools such as our cover-crop roller/planter also reduce a farmer's trips over the field, saving both time and energy.

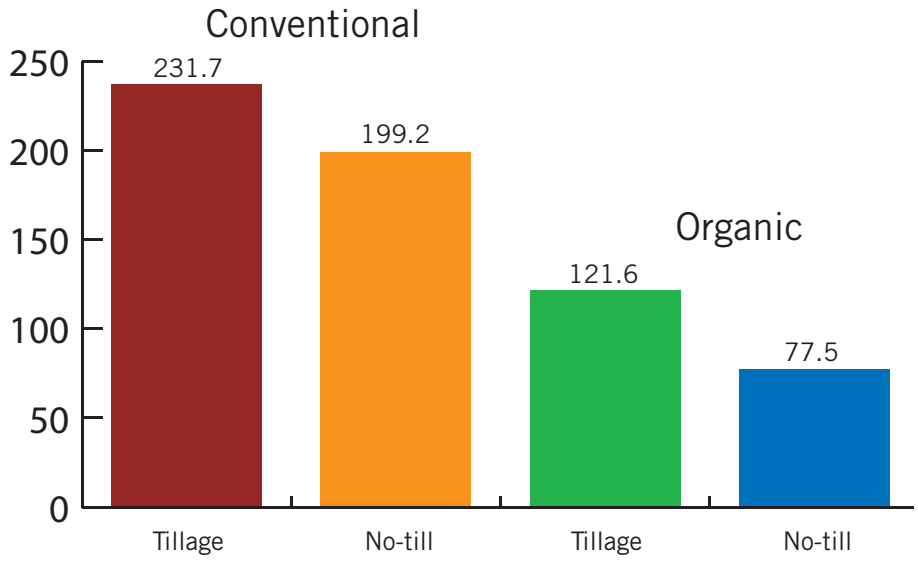
- **Our Compost Utilization Trial** has shown that modern compost technology is capable of increasing carbon sequestration annually by more than 2,600 pounds per acre and that properly managed on-farm composting is an effective way to manage manure, build fertility and protect adjacent waterways from nutrient runoff.

- **Our FST**, in collaboration with Cornell University, has shown that diversified organic agriculture with cover crops can reduce fossil fuel use up to 50 percent compared to conventional agriculture systems. The Institute's innovative organic no-till system reduces fossil fuel use by 75 percent over conventional tillage farming. Our organically managed soils have shown an increase of more than 30 percent in soil organic matter and 15 percent in soil nitrogen over 27 years. In drought years, our organic field crops' yields have outpaced those under conventional management by 28 to 75 percent.

- **Our work with USDA scientists** has led to a deeper understanding of the biological processes at work in the soil. We now know how certain fungi (mycorrhizae) work in symbiosis with plant roots, increasing both the plant's ability to uptake nutrients and the soil's ability to store carbon. We're currently exploring ways to deliver these beneficial fungi to impoverished soils.

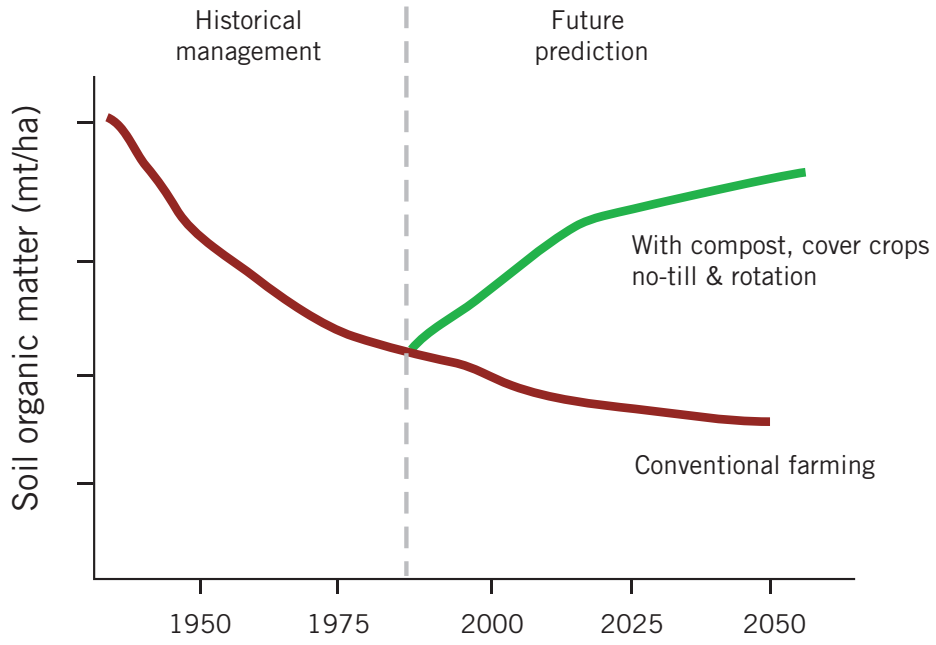
- **Our economic analyses** in collaboration with the University of Maryland have shown comparable returns in organic systems, even without factoring in organic price premiums or conventional farm subsidies. In recent years, premiums for organic grains have varied from 35 percent to 240 percent, offering great opportunities to wean farmers off government assistance.

Energy Used in Different Corn Production Systems
(gallons of diesel per acre)



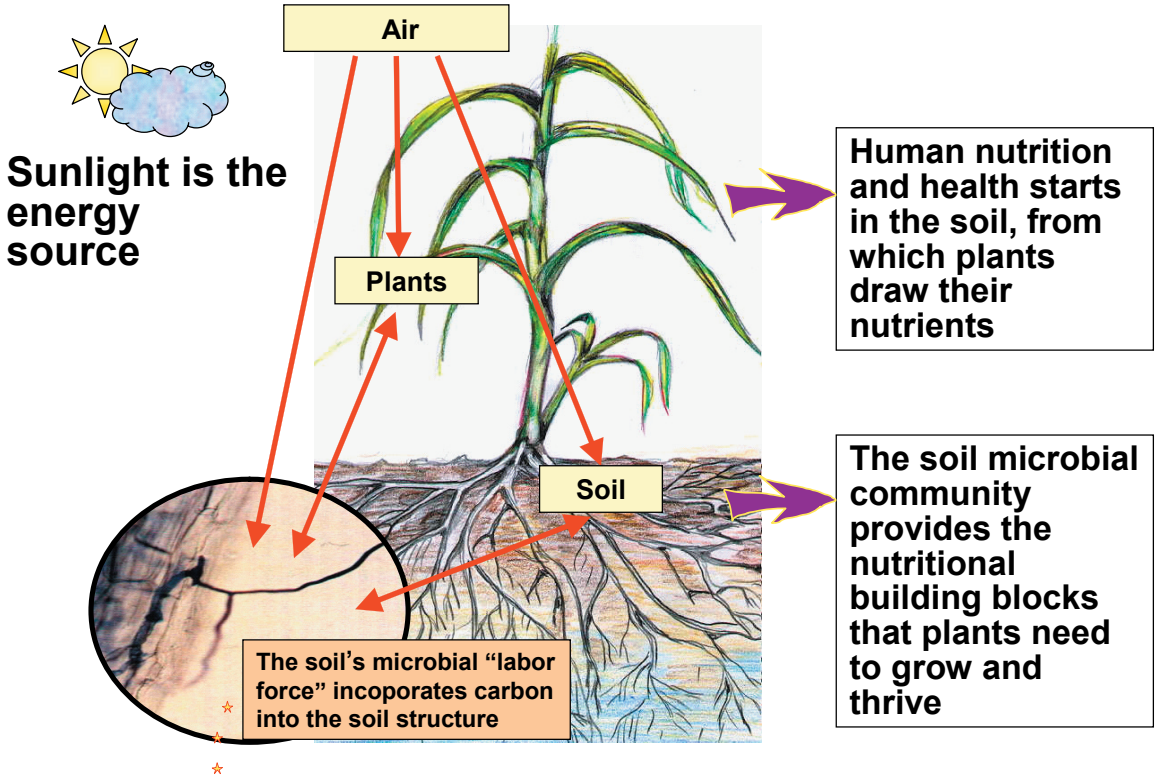
In collaboration with David Pimentel, Ph.D. of Cornell University, calculations from the FST show no-till and organic farming practices work together to greatly reduce the energy or fossil fuel needed to farm corn.

Organic Agriculture can Increase Soil Organic Matter



Until the 1950's, agriculture was considered the biggest contributor to the increase in atmospheric greenhouse gas. Current scientific consensus shows that by changing the way we farm, agriculture can become a powerful positive source in reducing the excess greenhouse gases.

Plants Equal Proven Carbon Sequestration



Plants and soil are a well-proven mechanism for capturing greenhouse gas from the atmosphere and returning it to soil, where it will improve our production system of food and feed and also conserve and enhance our natural resources. Other mechanisms being proposed, such as sequestration in geologic structures or water resources, are not proven and are likely to have large negative consequences. The Rodale Institute and its partners are uniquely positioned to help provide agricultural solutions that will mitigate runaway greenhouse gas and not endanger the environment.