

The role of soil health practices on soil organic carbon in managed systems

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It is well known that soil organic carbon can be predicted at various spatial scales based on soil forming factors. In agricultural systems, though, historical land use complicates these predictions. It has been suggested that about half of the original soil carbon has been lost due to management such as tillage. However, the adoption of soil health promoting practices is thought to have the potential to increase soil carbon towards the pre-disturbance values. It can sometime be difficult to isolate the effects due to changes in practices, outside of controlled experiments, because of the spatial heterogeneity of soils and complications of collecting management data. The Soil Health Institute has been working to document the effects on soils of adopting these practices at both long-term research sites and in farmers' fields. At the research sites across a range of soil types and climates North America, we found that the adoption of practices such as reducing tillage, adoption of cover crops, retention of residue, and use of organic sources of nutrients was associated with a 10-25% increase in soil carbon in the top 15cm. The amount of change in soil carbon was in part due to the size of the change in practice. That is, there was a bigger change in soil carbon if the change in tillage intensity or proportion of the year with living roots was bigger. Because it is not feasible to do enough replicated experiments on farmers' fields, we are developing a "benchmarking" approach to determine the magnitude of the effects of management on soil carbon at the regional scale for a cropping system. We compare soil carbon on farms that have adopted soil health practices to those without soil health practices to reference sites with perennial vegetation. We are currently validating this approach in a variety of systems, such as cotton, dairy forage, corn/soy, potatoes, and vegetables in regions throughout the United States. We are also exploring whether it is feasible to collect the management data needed to use quantitative indicators of practice change instead of categorical differences. This approach will allow us to determine the potential for increasing soil carbon, and more broadly soil health, due to changes in practices while controlling for climate and soil texture.