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Profile from the Field

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Soil Scientist Makes Case for "Active C" Soil Test

Project Title: Linking Soil Testing with Farmer Decision Making – An Interdisciplinary Approach

Coordinator: Christne Sprunger

Location: Michigan State University
SARE Grant: $6,853
Duration: 2014-2015

To read the full project report, go to http://mysare.sare.org and search for project number GNC14-192.

Researcher Christine Sprunger studies how farmers view soil carbon and the barriers they face when working to improve soil fertility. Photo courtesy of Christine Sprunger.

It can be somewhat surprising to learn that the largest amount of carbon present on the land is not in the living plants, but in soil organic matter; the carbon stored in all the world's soils is more than three times the amount in the atmosphere. Some farmers are adopting carbon-building management practices in order to reduce carbon loss from soil to the atmosphere as carbon dioxide.

Christine Sprunger, a National Science Foundation post-doctoral fellow at Columbia University, researches soil carbon from both a biophysical and social science perspective, and says that soil carbon (C) is the most important variable in sustaining annual and perennial cropping systems both in terms of increasing crop productivity and enhancing soil health. Sprunger believes the most effective way to simultaneously increase crop productivity while mitigating climate change is through increasing soil carbon cycling.

In 2014, when Sprunger was a graduate student at Michigan State University (MSU), she was curious about the role crop biodiversity could play in increasing soil C in both annual and perennial cropping systems. She received a $6,382 NCR-SARE Graduate Student Grant to examine the role that plant diversity has on root production and soil C dynamics in annual and perennial crops; she also aimed to measure the labile soil C pool on farms and discuss the results with farmers to see if results reflected perceived soil conditions on-farm.

Sprunger wanted to determine the effect that biodiversity has on root production because fine roots significantly contribute to soil C accumulation. Through her research, Sprunger found that increased biodiversity led to increases in root production. In addition, she found substantial differences in active C between annual monoculture and perennial polyculture crops, but not between the annual and perennial monoculture crops. She hopes this work can be used to show that diverse cropping systems can be used as a means to sequester soil C.

After examining the impact of biodiversity on root production and C accumulation, Sprunger collaborated with a fellow NCR-SARE Graduate Student Grant recipient at MSU, Brendan

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O'Neill, who was working on a grant project to look at farmers' use of soil testing strategies. Together, they looked at how traditional soil tests for C would perform against new soil health tests on farm fields.

Both of the grant recipients wanted to know if soil health testing strongly supported what farmers were experiencing and witnessing in their fields. Working together, they sampled 52 farm fields in Michigan, and compared MSU's total soil organic matter (SOM) test which measures soil weight loss on ignition and correlates it to oxidizable organic carbon, to the active C test, which assesses active carbon using permanganate oxidation and a portable spectrophotometer. They wanted to determine which test better corroborated farmer perceptions of productivity.

As they worked with farmers and extension workers across the state of Michigan to examine how traditional soil testing would perform against the active C test on actual farmer fields, they found that the SOM test was insufficient at detecting differences between farmer described 'Best' and 'Worst' fields, while the active C test found significant differences. They found that the active C test across the different fields supported farmer descriptions and overall experiences that the farmers had with specific fields. For example, farmers often observed lower yields and poorer soil quality in the Worst field, while yields and soil quality were much better in their Best fields. They reported that the active C test was much more effective at picking up these differences, and in Sprunger's opinion, the active C test should be more widely available and offered at university and commercial soil testing laboratories.

"Farmers invest a lot of time and energy into improving the health of their soils," said Sprunger. "Currently, the soil carbon test that is most available to them (SOM) is insufficient at detecting differences between high yielding and poor yielding fields. We found that farmers often stopped short of adopting sustainable management practices because of soil carbon test results. Since the active C test is more sensitive, farmers can utilize the test to make more informed management decisions regarding soil fertility and nutrient application."

Sprunger said the farmers in the study valued the information gained from the soil health testing, and argues that farmers will be more likely to meet target soil C sequestration goals if active C or other tests that are sensitive to changes in management are more widely available.

"Over 90% of the farmers that we met with wanted to continue soil testing using the soil health metrics that were introduced to them during the study," reported Sprunger. "Our study found that if these soil health tests are made commercially available, then farmers will incorporate the tests as part of their soil testing regimen."

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