Soil Health Important to Farmers, the Environment and Society

By Paul Salon

More than 250 people came together to see firsthand the importance of soil health at three events in Cayuga County, NY, on August 21–22. The events were a collaboration between the Natural Resources Conservation Service (NRCS) the New York Soil and Water Conservation Committee, the Cayuga Co. Soil and Water Conservation District (SWCD) and Cornell Cooperative Extension of Cayuga Co. The meetings came about as part of a national soil health campaign initiated by conservation farmers, NRCS and SWCD's. Farmers from North Dakota to North Carolina and beyond -- who after years of no-till farming followed by cover cropping -- are recognizing lower production costs and improved soil function. After the meeting, NRCS-NY State Conservationist, Don Pettit said, "Soil Health is the ability of the soil to perform at its full potential to grow crops. NRCS is proud to partner with farmers and organizations dedicated to sharing the technologies, management and programs available to improve soil health to all those involved in agriculture."

Speakers included Keynote David Brandt a farmer from Carroll, OH. David Brandt's farm was visited by former NRCS Chief Dave White when announcing NRCS's national Soil Health Campaign in 2012. David Brandt has been no-till farming since 1971 and cover cropping since 1978. He is a featured speaker at many national no-till conferences.

David Lamm, an NRCS agronomist from the East Region National Technology Center and leader of the national soil health team, led off the meetings with an overview of the importance of soil health emphasizing how the soil is not just sand, silt and clay but a living, biologically diverse ecosystem. He explained that climax communities only form after years of limited disturbance, diverse plant covers and buildup of residues and organic matter. He went on to explain that agriculture can follow and apply similar principles and build organic matter and increase the quantity and diversity of the soil biota, all while harvesting crops on an annual basis. For good soil health we need to work with the complex interactions of the biological, nitrogen, carbon and hydrologic cycles. The principles of good soil health management for agriculture are: 1) disturb the soil as little as possible, preferably using long term continuous no-till, 2) diversity in crop rotations including perennials where possible, 3) maintain a living plant throughout as much of the year as possible, especially through the use of cover crops and cover crop mixes and, 4) maintain surface residues.

One of the most powerful aspects of David Lamm's program was a series of demonstrations using soils from similar soil types that were managed differently. His demonstration allowed attendees to see the difference between how these soils behaved when exposed to simulated rainfall. One soil, farmed by Ralph and Rodman Lott Jr., whose farm is the site for Empire Farm Days, has been in a no-till system of corn and soybeans for 30 years. It was compared to a neighboring farm with a similar soil and rotation but conventionally tilled. When an equal amount of simulated rainfall hit each of these soils, the difference was dramatic. The water passing through a cut section of the no-till soil infiltrated and was absorbed and the runoff was clear. In contrast, the "rain" on the conventionally tilled soil quickly sealed over and most of the water ran off taking sediment with it. In addition, the amount of water that

ran off was significantly more from the conventionally tilled soil. This demonstration showed that with reduced runoff comes the benefit of reduced flooding and erosion as well as decreased sediment and fertilizer entering lakes and streams. Rodman Lott Jr. exclaimed that all farmers need to see this demonstration and plans to have this demonstration repeated at the 2014 Empire Farm Days.

Dr. Moebius -Clune research associate from Cornell's Soil and Crop Science Department and the Cornell Soil Health Lab explained the soil science behind the demonstrations. By following the principles of soil health management farmers see increased: infiltration, water holding capacity, organic matter, soil biological activity and higher aggregate stability. Dr. Moebius-Clune explained that increased aggregate stability comes from increased soil biological activity and the glues excreted by the various soil organisms. She also gave an overview of the complex soil food web. Increasing soil aggregation, increases pore space which can hold more water but also through better drainage allows for more oxygen to enter into the soil profile. These conditions benefit root growth and the soil biota. Eliminating tillage prevents the destruction of aggregates and the channels formed by roots, earthworms and other soil organisms. The improvement in soil function through the principles of soil health management is improving and buffering yields, especially in years of dry weather, such as 2012. It also provides benefits in years with overabundance of rain as in the 2013 growing season.

Dr. Moebius-Clune also gave an overview of the Cornell Soil Health test, mentioning that conventional soil tests only measure the chemical soil factors such as, pH, macro nutrients (N, P, and K) and some of the micro nutrients for plant growth but does not measure the physical or biological soil properties. The physical and biological properties can be just as important in limiting plant growth and assessing them is just as important as chemical testing. The Cornell soil health test measures many indicators in all three areas, going well beyond conventional soil tests. The test includes compaction, available water capacity, aggregate stability, active carbon and potentially mineralizable nitrogen. She is working with NRCS through a Conservation Innovation Grant (CIG) in New Hampshire to utilize this test to promote specific NRCS conservation practices that will improve soil health.

David Brandt concluded the discussion with how he uses no-till and diverse cover crops on his farm to reduce inputs while maintaining or exceeding yields of other farms in his area. David Brandt is working with Dr. Rick Haney of USDA-ARS in Temple Texas, who uses innovative biological nitrogen testing to analyze soils to provide nitrogen recommendations and Dr. Rafiq Islam from Ohio State University to develop economic analyses, both of which were explained to the attendees. David Brandt grows enough biomass and nitrogen fixing cover crops following wheat to significantly reduce his fertilizer and herbicide bills for his following corn crop. When developing mixes he keeps the cost under $30/ac by precision seeding. David Brandt uses as many plant types as possible: warm season, cool season, grass, broadleaves, and legumes keeping an eye on his carbon to nitrogen ratio for the following crop. The use of diverse cover crop mixes allows for better soil plant interactions with diversity in above and below ground plant architectures. This diversity takes advantage of the sunlight longer in the growing season and to place, root exudates, carbon and nitrogen throughout the soil profile where it is needed for the following crop.

These meetings were a partnership effort of the interagency soil health working group. It was felt that while we had these national soil health educators in New York that it would be beneficial to have a farmer meeting and a train-the-trainer program, both will help spread the word about soil health. Lauren Prezorski of the New York State Soil and Water Conservation Committee was instrumental in organizing the train-the-trainer meeting which was held at Cornell University's Musgrave Research Farm. The purpose was to train NRCS, SWCD, Extension and consultants to conduct demonstrations and field walks for on farm field days. Paul Stachowski, the farm manager, did an excellent job of hosting the event and lining up an impressive array of equipment.

The event held at Steve Cuddeback's farm in Cayuga County was the highlight of the meetings with a large turnout – more than 100 attendees. Jason Cuddeback from Cayuga Co. SWCD and son of Steve Cuddeback contributed greatly to the organization of the event. This event was sponsored by Farm Bureau, the Empire Chapter of the Soil and Water Conservation Society, Monroe Tractor, Cazenovia Equipment and Aerway. In addition to some of the sponsors Poettinger US, Steve Cuddeback and neighboring farmer Mike Sheppard provided additional equipment which was demonstrated at the event.

There was a panel of New York farmers which included Steve Cuddeback, from Cayuga County, Donn Branton from Genesee County and Steve Nemec from Cayuga County all with more than 30 years of experience with zone-till and no-till and more recent experience with several cover crops. These farmers gave a more local perspective on what it was like to move from conventional tillage toward a reduced tillage approach. The moderator, Keith Severson from Cornell Cooperative Extension of Cayuga County, asked what their motivating factors were in utilizing reduced tillage and what they learned along the way. While all agreed their initial motivation was reduced time, labor and fuel, everyone agreed that along with reducing tillage the addition of cover crops is key for improved soil health. Their advice to other farmers was to have patience as it takes time for the soil to improve, ask questions, keep learning and continue to try new things.

NRCS and its partners in conservation often speak about sustainability but it becomes more meaningful when you see the father and son teams of Steve and Jason Cuddeback -- one year from becoming a century farm --Donn and Chad Branton, and Rodman Lott Jr. of Rodman Lott Farms and Sons. These young farmers already understand they need to maintain their soil health to continue farming into the future and pass productive and profitable farms on to the next generation.

If you are a farmer already practicing soil health practices or want to learn more and become part of a farmer network please contact Paul Salon paul.salon@ny.usda.gov (607) 562-8404.