



Cornell 2018 Agricultural Science Grad Sarah Hetrick Follows Her Passion for Soil Health

By Lisa Fields

In May 2018 Sarah Hetrick graduated from Cornell with her B.S. and Honors in Research as a double major in Plant and Agricultural Science. "Although I didn't have exposure to agriculture in my childhood, a writing seminar in my freshman year, Food Systems in Developing Countries, sparked my interest," she said. "Since then, I've taken every opportunity I could to learn about both the production and research aspects of plant and dairy science."

The Cornell Nutrient Management Spear Program (NMSP), led by Professor Quirine Ketterings, has been a major influence for Hetrick. She commented, "In 2016 I was a Sustainable Dairy Coordinated Agricultural Project (DAIRYCAP) intern with the NMSP. My project examined soil organic matter and phosphorus trends over time in the long-term corn-alfalfa rotation study at the Aurora Research Farm. I was hooked on soil health and it was exciting to have the continuity of working with the same site for my Senior Honors Thesis project, 'Soil Health Indicators in a Long-Term Manure-Based Corn/Alfalfa Rotation.'"

Ketterings explained, "In 2001, we initiated a corn and alfalfa rotation study that we maintained until 2016. In this study, we evaluated the impact of nutrient management decisions for corn, including use of manure or composted dairy solids versus fertilizer on yield and soil properties. This was the first experiment that we implemented after I joined Cornell University, and it was remarkable to be able to continue it through multiple funding cycles. Building soil health is the key in achieving more sustainable nutrient management over time, especially given the increased occurrence of weather extremes. It is important to know which management practices improve soil health and crop production while reducing the environmental footprint of farming. It was great to see Sarah's enthusiasm and provide guidance for her soil health research."

"A big topic right now in the soil science community is how to reach agreement throughout the industry to standardize methodologies," Hetrick noted. "My Honor's Thesis project focused on evaluating how well different methods of determining soil organic matter reflect the changes over time caused by nutrient management practices. Using samples from the long-term rotation study, we evaluated two direct measures of soil organic matter, loss-on-ignition or LOI and permanganate oxidizable carbon or POXC. We also examined other indicators including the Illinois Soil Nitrate Test (ISNT), soil aggregate distribution and stability, and in-field carbon emissions."



Sarah Hetrick presents her honors thesis research at the Farm Foundation Roundtable meeting in Charlottesville, VA.

The nutrient management treatments in the rotation study during corn years in 2001-2005 and 2011-2015 were low or high rates of composted dairy-solids, low or high rates of liquid dairy manure, and inorganic N only. During the alfalfa years, from 2006-2010, no manure, compost or fertilizer was applied. Soil sampling was done throughout the 15 years but Hetrick's project focused on soil health properties after 15 years of management. The soil health benefits of compost and manure treatments really began to be reflected in the

third year of the alfalfa crop, with yield increases most notable in both the high and low dairy solids compost and the high manure rate treatments.

In Hetrick's study results, both the LOI and POXC methods accurately reflected the effects changes in soil organic matter after 15 years. She described the differences between the two methods. "The LOI is a long established test for SOM done by commercial labs, but labs differ in the methodology they use and the assessment does not distinguish between active and more structural carbon and organic matter. The POXC test is a relatively new method. In my study, the POXC really showed the effect of the changes on SOM. It was gratifying that my POXC results concurred with four other studies in which POXC was found to have a strong correlation with field management and soil properties. Although the results were very promising, more research is needed to test POXC in varying field settings to see how and if other management affect its reliability as a soil health indicator. The hypothesis is that POXC shows soil differences earlier in time than SOM, given it is a more sensitive indicator of changes in soil health than LOI."

Hetrick also noted, "The ISNT, in-field carbon emissions, and soil aggregate distribution and stability assessments showed variability among the treatments, but LOI and POXC were the most consistent and practical measures for farmers. They're also the only measures we examined that can be done on composite soil samples which is a benefit."

Engaging in outreach and extension aspects of research was especially important to Hetrick. She was lead author of Agronomy Factsheet ['Improving Soil Aggregate Stability'](#) and co-authored two 2016 [What's Cropping Up? articles](#). "Communicating information that has practical use is really rewarding, because it's what research work is all about," Hetrick said. "Connecting our research to its purpose is part of the big picture view that Quirine keeps in front of us. The skills I've learned and

exposure to the whole process of research and extension through NMSP has been an amazing experience for me."

Hetrick's projects along with her drive for new experiences have helped set her direction. "In the summer of 2017 I gained on-farm field experience by working for Carovail as a crop scout. I loved the fieldwork, especially talking with the farmers about the information. I earned my provisional Certified Crop Advisor credential in 2017 and have a goal to gain permanent certification. On the academic side, I was humbled and thrilled to be invited to present a poster about my project at the Farm Foundation Roundtable meeting in Charlottesville, VA. I participated in discussions among top industry leaders there. I also attended the Soil Health Institute Annual Meeting in St Louis, MO, where Dr. Cristine Morgan recruited me into Texas A&M graduate school's Soil BioPhysics program." This month, Hetrick takes on a new challenge in the realm of technology with her Master's project, 'VisNIR-based sensing penetrometer for in situ high resolution depth sensing of soil.'

Reflecting on her senior year at Cornell, she said, "This spring was the most intense semester for me. It was exciting to have such a relevant topic for my Honor's Thesis project, and connect with leaders in soil health research. The topic is at the forefront of soil science across the globe because of the impacts of climate change. Our ability to feed the human population is linked to healthy soils. A major lesson I carry forward with me is that research work is a big responsibility. Your integrity is of great importance, as others are relying on the accuracy of your results. I've also learned that research is not just about the technical processes, but part of a bigger topic that involves the potential of industry-wide change."

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The **Nutrient Management Spear Program** (NMSP) is an applied research, teaching and extension program for field crop fertilizer and manure management on dairy and livestock farms. It is a collaboration among faculty, staff and students in the Department of Animal Science, Cornell Cooperative Extension, and PRO-DAIRY. Our vision is to assess current knowledge, identify research and educational needs, facilitate new research, technology and knowledge transfer, and aid in the on-farm implementation of strategies for field crop nutrient management including timely application of organic and inorganic nutrient sources to improve farm profitability while protecting the environment. An integrated network approach is used to address research, extension and teaching priorities in nutrient management in New York State. For more information on NMSP projects and extension/teaching activities, visit the program website (<http://nmsp.cals.cornell.edu>) or contact Quirine Ketterings at qmk2@cornell.edu or (607) 255-3061.