



## Cornell Scholar Finds Cover Crop Nitrogen Dynamics Research with NMSP a Fulfilling Challenge

By Lisa Fields

In May of 2012 Emmaline Long earned her B.S. in Agricultural Science with a distinction in research. As a freshman, she was selected for the Hunter Rawlings III Cornell Presidential Research Scholars Program (RCPRS), which provides financial assistance for research work by students chosen for their academic excellence and commitment to inquiry and discovery. The students are required to do 6+ hours of research work and attend seminars weekly, with project presentations at the end of each semester. Long noted, "I was very excited to be selected. Initially I wanted to do research in precision agriculture, but learning about the work of crop consultants inspired me to focus on agronomy."

Long's major advisor, Dr. Quirine Ketterings, Associate Professor and Director of the Nutrient Management Spear Program (NMSP) commented, "I met Emma at the RCPRS Senior Expo organized by its coordinator, Kristin Ramsay, where a former student of ours presented his work. RCPRS students engage in research with a faculty mentor throughout their undergraduate years, a great way for them to learn and gain skills in an area of their interest. Emma was very interested in getting involved in agricultural research and crop management."

Ramsay added, "As a Presidential Research Scholar, Emma had up to \$8,000 to support her research. She made the most of the opportunities that RCPRS provides. Emma spent a full-time summer engaged in field research and also traveled to South Africa to participate in an IPM project at one of the largest farms in Sub-Saharan Africa. This opened her eyes to agriculture and research in another culture and continent."

Long said, "I started research with the NMSP in my second semester with lab work which was completely new to me. I learned about the process and requirements of setting up a research project."

In her final year, Long compiled the four projects she completed into an Honor's thesis

entitled "Nitrogen Dynamics of Cover Crops in Corn Rotations in New York State". Long commented, "The research process was very intensive. Each year I took steps toward greater levels of responsibility so that ultimately I was fully in charge. It was a great feeling to attain that level of ability."



Emma Long takes biomass samples for her cover crop research project as a Hunter Rawlings III Cornell Presidential Research Scholar.

The first chapter in Long's thesis summarized the results of a survey of 115 farmers from 28 counties across the state. The purpose of the survey was to document farmer perceptions about cover crop use. Long explained, "My interaction with the farmers through these interviews really inspired me. They had a wide array of opinions and I learned a lot about communication in drawing out their responses." Farmers who were hesitant to use cover crops expressed uncertainty about their nutrient benefit to the following crop, noting expense and time involved in planting and spring incorporation or termination. Long's research sought to obtain data relevant to farmers' concerns.

Long's second chapter, "N Dynamics After Cover Crop Incorporation" described a 13 week soil incubation study. She examined conversion of organic N to ammonium and nitrate, and the effect of C:N ratio on total N release dynamics with winter rye, triticale,

hairy vetch and alfalfa. Long's work confirmed that plant materials with a low N content (C:N ratio greater than 25) take time to convert to ammonium and nitrate, and were unlikely to provide N within that growing season. Long stated, "The C:N ratio, rather than plant species is the driving force behind N conversions and availability. Ideally the cover crops' N release will be a close match to the N uptake needs of a corn crop. This can happen if the cover crop acquires sufficient biomass before a hard freeze, and has a C:N ratio of <25 when it's terminated the next spring."

The third chapter, "N Uptake and Release After Termination of Various Cover Crops in a Small Grain to Corn Rotation," took place on 2 Western NY farms with cover crop plots seeded after August 2010 wheat harvest. The study evaluated biomass accumulation, N uptake and C:N ratios of annual cover crops and their combinations in fall and spring. Species included annual ryegrass, oats, forage turnip, tillage radish, sorghum-sudangrass, and crimson clover. Long said, "I greatly enjoyed the field work. I loved getting off campus and working with the farmers and industry professionals." She explained the research results. "Although there were species differences in biomass accumulation that affected total N and C:N ratios, soil nitrate levels mid-July were higher in cover cropped plots than in the control plots, suggesting that the cover crops contributed N to the corn crop. Management factors such as tillage type and cover crop growth stage when terminated impact soil N dynamics, so I suggested the study be repeated in future years."

Long's fourth chapter, "Triticale as a Cover and Double Crop on a NY Dairy" examined winter triticale for its N uptake and C:N ratio in fall and spring, the effect on subsequent N release dynamics and impact on the following corn crop. Long noted, "This was great for me because I was completely in charge of the fieldwork and the sample and data analysis. The farm harvested 2.3 tons of dry matter per acre with the triticale. The only soil N

contribution of the triticale was 5 lbs per acre from the roots but the overall silage yield increase was a great plus for the farm."

Ketterings added, "The triticale research was an eye opener. The average corn yield for the field was 6.9 tons dry matter per acre. The additional 2.3 tons of dry matter from the triticale effectively increased the yield by 33%! In addition, the triticale generated high quality forage for the cows. I hope we can document such benefits as ground coverage and extra yield, and implement triticale into rotations throughout the state, as Emma's project showed the agronomic and environmental benefits can be substantial."

Long commented on her research experiences. "The relatability and real-world nature of on-farm research makes it especially satisfying. It fits well with my passion to help farmers' improve their practices. It's exciting and fulfilling to know that some of the findings from my research work will be used in Extension publications and outreach."

Long returns to Cornell in Fall 2012 as a M.Sc. student with Ketterings as her advisor. She is currently conducting summer work with Agrinetix LLC, a company located in Rochester, NY, that specializes in precision agriculture, computer technology and software development. Long's Master's research will be a joint project on evaluation of yield monitoring technology for optimization of farm management and implementation of on-farm research. She remarked, "I'm excited about the opportunity to carry forward what I learn about this enhanced technology. My Master's work will combine two things I love: innovation in precision agriculture and hands-on field research."

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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](mailto:qmk2@cornell.edu) or (607) 255-3061.