Musgrave Research Farm Key Site in Statewide Manure Incorporation Trials

By Sara Zglobicki

As winter winds and snow arrive in the Northeast each year, so do opportunities for farmers to reflect on the past season and decide what management changes to make in the upcoming year. Ideas for alternate practices come from various sources including neighbors, extension educators and field days at research farms. Researchers with the Cornell Nutrient Management Spear Program (NMSP) are hoping the manure incorporation trials conducted at the Musgrave Research Farm in Aurora, New York, will aid in determination of nitrogen (N) credits from manure and seed ideas for alternative manure management practices among farmers.

The past five years, the NMSP managed experimental plots at this Cornell University Agricultural Experiment Station (CUAES) farm. The team's plots compare corn grain yield and nitrogen (N) conservation as impacted by manure application method. Liquid dairy manure was surface applied in the spring and (1) incorporated with a chisel plow, (2) shallowly incorporated with an Aerway® aeration tool or (3) not incorporated. There were fertilizer-only (i.e. no manure) check plots in the trial as well.

Shawn Bossard, initiator of the manure application project, talks with participants of the Musgrave Research Farm field day about the manure incorporation project.

Ripe for Research

Less than five miles from the eastern shore of Cayuga Lake, the Musgrave Research Farm is part of the network of CUAES sites that stretch from the eastern tip of Long Island to Lake Champlain. "Agricultural and environmental science research supports our mission of research, teaching and extension," says Drew Lewis, the director of agricultural operations for CUAES. "Since New York State is the fourth ranking dairy state in the nation, and nutrient management is chief among the concerns for the industry, research concerned with reducing nutrient inputs, like the reduced tillage manure management study, is key to agriculture in the state and the Northeast in general."

Musgrave was the site of the preliminary trials that shaped the current study on manure incorporation methods. In 2005, Shawn Bossard, then field crops extension educator with Cornell Cooperative Extension of Cayuga County, teamed up with Spear Program faculty, staff and students to implement a project comparing chisel plowing and shallow mixing with an aerator as manure application methods. Altria provided funding for the first year of trials while the New York Farm Viability Institute (NYFVI) funded the subsequent two years of work in 2006 and 2007.

Bossard explains, "We initiated this project because there were a large number of acres where manure was being incorporated with aeration tools. We really had no idea how much of the ammonia fraction of the manure we were saving using these tools. The Musgrave Research Farm not only provided us with a location that allowed for a high degree of control, but it gave us field size plots on challenging soils."

The results of these three years of field trials at the Musgrave Research Farm indicated that shallow mixing could be as effective as chisel plowing in capturing ammonium-N from the manure, but with greatly reduced soil disturbance and reduced fuel costs. Based on the results of the trial at the Musgrave

Research Farm, the team successfully applied for additional funding from the NYFVI and Northern New York Agriculture Development Program (NNYADP) and a project with nine additional locations was initiated to compare surface application of manure without incorporation to application followed by incorporation with a chisel plow or an aerator.

Ketterings explains, "If applicable across a larger number of soil types and different growing conditions, shallow mixing could greatly help reduce ammonia emissions in reduced till systems."

2008 and 2009 Growing Season Results

During the 2008 and 2009 growing seasons, the fourth and fifth year of the project at the Musgrave Research Farm, results still showed no yield differences between the two incorporation treatments. The pre-sidedress nitrate test (PSNT) and end-of-season corn stalk nitrate test (CSNT) results showed greater N conservation with incorporation in 2008 while in 2009 PSNT results showed somewhat greater N conservation with the chisel incorporation although all treatments showed low soil nitrate levels due to the extremely wet and cold growing seasons. Stalk nitrate values were low for all treatments this past year as well.

Paul Stachowski, Musgrave Research Farm manager, notes that while the farm had no history of manure addition, the study demonstrated that "with 8000 gallons of manure per acre per year we can maintain soil fertility." Maintaining moderate soil levels of phosphorus and potassium through appropriate manure application is an important nutrient management goal at the farm.

Surface residue measurements that were added in 2008 and 2009 showed greater residue cover through shallow mixing with the aerator than when manure had been incorporated using a chisel plow, resulting in reduced soil erosion risk, and emphasizing the benefits of this reduced till method of manure application. The latter was important for the Musgrave Research Farm; over the course of five years about two thirds of the production acreage at Musgrave has been converted to zone tillage or no-till systems.

Catalyst for Communication

The field days held at the Musgrave Research Farm throughout the cropping season highlight research projects like the manure incorporation study. Stachowski comments, "With the explosion of new technology and information, research demonstrations by the public sector showcasing researchers' experience with the technology allow farmers to make informed decisions." Bossard adds, "Farmers and farm advisors checked out the plots and determined for themselves if the treatments had any impact on the corn. We would follow up with trial summaries of the actual yields and distribute that via extension articles and talks."

The benefits continue beyond farmers who attend the field days. Extension educators and agricultural industry representatives also come to observe the trials. As Stachowski noted, "These people act as multipliers of the results we see on the farm."

"The combination of field trials on commercial farms and trials at the research farms is powerful," Ketterings explains. "At the research stations we can include more treatments such as the fertilizer only plots, and conduct the experiments in a larger number of replications. At the farms, we are able to replicate a smaller number of treatments on a larger number of different soil types and reach a larger audience. This combination is very effective in getting preliminary data and in building a database of research that is relevant to local farmers, resulting in quicker and greater adoption rates of management changes."

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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.