The Soil Ramifications of Continuous Corn Silage

Mark Boggess, U.S. Dairy Forage Research Center

As most dairy and forage farmers know, the industry is coming under increasing pressure to address comprehensive environmental concerns. These challenges to the industry are further complicated by the increasing use of corn silage and other annuals at the expense of perennial crops and the resulting loss of soil and soil quality.

One indication of the urgency surrounding these issues is the cover of the December 3, 2015, edition of *Nature* magazine reading: "SAVE OUR SOILS." In this issue, four feature articles highlight soil ecology as a reemerging area of high priority for researchers, policy makers, and the agricultural industries. Of particular note is that only one of these articles was written by authors with any connection to agriculture, meaning soil and agriculture/food production are being influenced by an ever-increasing community of stakeholders, including politicians and regulators.

Loss of Soil and Organic Matter

Unfortunately, we are still losing too much soil. Current estimates place the annual soil erosion loss to wind, water, and agriculture at over 75 billion tons. This rate of soil loss is unsustainable given current production demands, let alone the demands of the future. Additional pressures are mounting due to the negative impact of soil erosion and nutrient losses on water quality, from contaminated well water in Wisconsin to the hypoxic area (dead zone) in the Gulf of Mexico.

Soil quality, which is most often defined by soil organic matter (SOM), is also declining. SOM is an easy-to-use indicator of soil carbon content, water holding capacity, nitrogen availability, and overall fertility. In general, increased SOM means better fertility and water holding capacity (drought resistance); fewer fertilizer inputs; improved resiliency and long-term sustainability; and more farm profit. Long-term sustainability of dairy forage production systems can only be realized by systems improving SOM over time.

Forage use varies widely across the dairy industry, but overall use of corn silage for dairy has increased significantly and continues to grow. Corn silage is the dairy farmer's forage of choice for many reasons including: yield; quality and consistency; ease of use in dairy rations; production and labor costs; and access to equipment, information, and local infrastructure. As dairy farmers have increased forage contents in rations, corn silage has led the way.

Ramifications in the Field

Unfortunately, the benefits of feeding more and more corn silage across the dairy industry come with a cost. All current conventional cropping systems significantly reduce soil organic matter over time. But monocultures, like continuous corn silage and annual crop rotations, produce more severe losses. Crop rotations using perennials such as alfalfa, and the application of manure as a soil amendment, slow the rate of loss of SOM but do not usually improve it.

An additional concern for crop production systems which feature corn silage is annual erosion losses. Current estimates place the average annual soil erosion losses for all corn acres in the U.S. at one pound of soil lost for every pound of corn grain produced. Soil erosion losses are even higher for corn silage acres and other annual crops.

Finally, climate change adds an additional layer to challenges facing the dairy and forage industries. These include more extreme weather events – rainfall, drought, heat, and cold – as well as changing growing seasons and increasing weed and pest problems. These variables will also dictate how soil ecology changes and what management responses can be taken.

Opportunities Going Forward

The good news is soil science is undergoing a renaissance with a renewed focus on better understanding complex soils systems. We are now beginning to better see the extraordinary complexity of soil quality, health, and resiliency with respect to fertility, drought tolerance, moisture holding capacity, and pests and pathogens, all of which will lead to better management practices to improve SOM and the long-term sustainability of soils and cropping systems.

Farmers must also renew their focus on soil. Aggressively manage wind and water soil erosion and rate of soil loss on farm – no excuses. Employ filter strips, terracing, improved crop rotations, more sensible cropping strategies, and cover crops. If you can see your soil, it is vulnerable to erosion losses and is most likely not actively promoting the biological activities improving soil quality. Soil quality and security are important and need constant attention, vigilance, and new ideas.

In addition, options are emerging, including new alfalfa varieties, which promise to produce improved yields of high-quality forage for dairies while reducing costs. These varieties, and others on the horizon, may provide options for dairy and forage farmers producing excellent forage and milk production while better maintaining soil quality and sustainability.

Summary Points

- Corn silage works on today's dairies and can be managed well in high forage rations for the cow and dairy operation.
- But, soil quality and security are critically important and are being compromised.
    - Corn silage production is not optimal for long-term soil health and sustainability – production systems must evolve.
    - Current excessive soil erosion rates must no longer be tolerated.
    - New farming strategies are needed to improve SOM and long-term sustainability of crop and dairy production across landscapes.
- Climate change is further increasing the need to improve soil security and resiliency.
- Alfalfa and other high-quality forages are being improved to provide dairy farmers greater options for forages they grow and feed.