Wisconsin - Cover Crops Can Improve Soil Quality Under No-till Corn Silage
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Continuous corn silage production, even with no-till, can degrade soil quality because of nutrient depletion and minimal organic matter (OM) additions. This can reduce productivity and worsen environmental problems such as nutrient runoff and soil erosion.

A study was conducted to evaluate effects of cover or companion crops, and/or low-solids liquid dairy manure on soil properties in a no-till corn silage system. Cropping treatments included corn grown 1) with a living mulch of Kura clover or 2) June-interseeded red clover, both followed by one year of clover forage production; and continuous corn grown with 3) June inter-seeded Italian ryegrass, 4) September-seeded winter rye, or 5) no cover crop. Liquid dairy manure was surface-applied annually in April to all treatments except 6) an additional no-cover treatment receiving only fertilizer N. After fourth year, soil samples were collected from 0-2", 2-6", and 6-12" depth increments in November and analyzed for several soil properties that indicate soil quality.

In this no-till system, most soil parameters (soil test P and K, OM content, water-stable aggregates, and microbial populations) were highest in the surface soil layer and decreased with soil depth. This reflects the addition of crop residues and manure on the soil surface and the higher density of roots in the upper soil layer. Companion/cover crops led to some improvement in physical conditions, as indicated by increased abundance of large water-stable soil aggregates. Stable soil aggregates are more resistant to breakdown from raindrop impact, resulting in increased water infiltration and less potential for runoff/erosion. Microbial biomass was also increased with the use of most companion/cover crops.

Soil quality benefits of cover crops and manure are typically attributed to increased soil OM, but no significant treatment effects on total soil OM content were detected here. However, active carbon fraction of OM was significantly increased by cover crops. Active soil carbon was positively correlated with aggregate stability and microbial biomass, showing its importance in improving soil quality. Manure application alone showed no improvement in soil quality indicators, presumably because of low-solids content occurring because a portion of the manure used had been subjected to solids separation before application.

Overall soil quality, as indicated by a soil quality index, was improved by the use of cover crops in manured corn silage. While some specific companion/cover crops performed better for individual soil properties, none stood out as better than others for the whole range of soil attributes. Results suggest that companion or cover crops can improve soil quality in corn silage systems, but it is a long-term process.