Investigating C and N Dynamics Using Stable Isotope Tracers in Corn.

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The impacts of human activities on biogeochemical cycling of carbon (C) and nitrogen (N) are the focus of numerous research efforts in both natural and managed ecosystems. Agricultural management, such as reduced tillage or residue amendment, has the potential to mitigate some of these influences. Agricultural management systems may reduce C and N losses that occur through leaching and gaseous emissions and can improve soil quality through increasing soil organic matter accumulation. The overall objective of our study is to trace the fate of C and N in plant residue in a long-term cropping system trial. Our results will improve mechanistic understanding of the influences of crop management on C and N cycling. Our study site is located in southwest Minnesota on one of the two soil associations that dominate southern Minnesota and northern Iowa (Major Land Resource Area 103). Our plots have been part of a cropping system trial for the past 15 years and thus are well established. The crop management systems (including 2- and 4-year rotations; high, reduced, and organic inputs) include systems that are representative of this region. We are applying stable isotope tracers of C (^{13}C) and N (^{15}N) to follow the movement of C and N within several pools in these different management systems. Our measurements focus on active and stable organic matter pools, nitrate leaching, and soil-atmosphere exchange of carbon dioxide, methane, and nitrous oxide. These measurements will help us to develop a mechanistic model of management impacts on C and N cycling. This presentation is an overview of our approach and a report of initial results of residue labeling and gas flux measurements.