# Impacts of land management on the greenhouse gas budget of two alternatively managed agroecosystems

by

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## ABSTRACT

It has been postulated that conservation tillage can increase carbon (C) sequestration in agricultural ecosystems. However, C cycling and the impact of management on other relevant greenhouse gas fluxes need to be better understood before it can be concluded that conservation tillage can be used to potentially offset some of the rise in atmospheric carbon dioxide ($CO_2$) levels. The goal of this research, therefore, was to improve the understanding of how C cycles through maize/soybean agroecosystems and to evaluate whether tillage has an impact on $CO_2$, $N_2O$, and $CH_4$ losses. Four key questions were addressed:

1. Can changing from a conventionally tilled system to reduced tillage system impact soil respiration ($R_S$), ecosystem respiration ($R_E$) and $N_2O$ and $CH_4$ fluxes?
2. What conditions are responsible for the largest rates of $R_S$, $R_E$, $N_2O$, and $CH_4$ loss/uptake?
3. Does soil water content and temperature differ between treatments, and how does $R_S$, $R_E$, and $N_2O$, and $CH_4$ fluxes respond to changes in soil water content and temperature?
4. Does the ratio of $R_S$ to $R_E$ differ between treatments and seasons?

During 2004 and 2005, $R_S$, $R_E$, $N_2O$, and $CH_4$ fluxes, along with relevant environmental variables, were measured on two alternatively managed agroecosystems at the University of Minnesota Rosemount Research and Outreach Center. Over two years, cumulative $R_E$ was 222.7 g C $m^{-2}$ higher in the reduced-tillage treatment. $N_2O$ fluxes were similar in both treatments during the 2004 growing season and were significantly higher in the conventionally tilled treatment during 2005. $CH_4$ losses were negligible in both treatments. When compared to $CO_2$ losses, $N_2O$ and $CH_4$ fluxes were small components of the greenhouses gas budgets of both systems. Differences in soil temperature and water content, however, could not completely explain the differences in cumulative C and $N_2O$ losses between the two treatments. Increased residue decomposition and N fertilization were the main factors driving differences in $CO_2$ and $N_2O$ fluxes in both systems in 2004 and 2005.