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Carbon and Nitrogen Storage are Greater under Biennial Tillage in a Minnesota Corn-Soybean Rotation.

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Few studies have examined the impacts of rotational tillage regimes on soil carbon (C) and nitrogen (N). We measured the C and N content of soils managed under corn (*Zea mays* L.)-soybean (*Glycine max* L.) rotation following 10 and 15 years of treatments. A "conventional" tillage (CT) regime employing moldboard and chisel plowing in alternate years was compared with both continuous no-till (NT) and biennial tillage (BT) which employed chisel plowing prior to soybean only. While masses of C and N in the upper 0.3 m under both BT and NT were higher than CT, only the BT treatment differed from CT when the entire sampled depth (0.6 m) was considered. Decreased C inputs, as indicated by reduced grain yields, may have limited C storage in the NT system. Thus, while more C was apparently retained under NT per unit of C input, some tillage appears necessary in this climate and cropping system to maximize C storage. Soil carbon dioxide (CO_2) fluxes under NT were greater than CT during a drier than normal year, suggesting that C storage may also be partly constrained under NT due to wetter conditions that promote increased soil respiration. Increased temperature sensitivity of soil respiration with increasing soil moisture was also observed. These findings indicate that long-term biennial chisel plowing for corn-soybean in the upper mid-west U.S. can enhance C storage, reduce tillage-related fuel costs, and maintain yields compared with more intensive annual tillage.

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