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# Natural Resources Research Update

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Title: Tillage and crop rotation effects on dryland soil and residue carbon and nitrogen dynamics

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Location: USDA-ARS, Northern Plains Agricultural Research Laboratory, Sidney, Montana.

Sustainable management practices are needed to enhance soil productivity in degraded dryland soils in the northern Great Plains. We examined the effects of two tillage practices [conventional till and no-till], five crop rotations (continuous spring wheat, spring wheat-fallow, spring wheat-lentil, spring wheat-spring wheat-fallow, and spring wheat-pea-fallow) and a Conservation Reserve Program on plant biomass returned to the soil, residue C and N, and soil organic C, soil total N, particulate organic C and N, microbial biomass C and N, potential C and N mineralization, and  $\text{NH}_4\text{-N}$  and  $\text{NO}_3\text{-N}$  contents at the 0- to 20-cm depth. A field experiment was conducted in a mixture of Scobey clay loam (fine-loamy, mixed, Aridic Argiborolls) and Kevin clay loam (fine, montmorillonitic, Aridic Argiborolls) from 1998 to 2003 near Havre, MT. Reduced tillage and increased cropping intensity, such as no-tillage NT with continuous spring wheat and spring wheat-lentil, conserved C and N in dryland soils and crop residue better than the traditional practice, conventional tillage with spring wheat-fallow, and their contents were similar to or better than in CRP planting (Sainju et al., 2006a, 2006b). Reduction in the length of the fallow increased microbial biomass C and N but the presence of legumes, such as lentil and pea increased soil N fractions (Sainju et al., 2007).

1. Sainju, U.M., A. Lenssen, T. Caesar-Tonthat, and J. Waddell. 2006a. Tillage and crop rotation effects on dryland soil and residue carbon and nitrogen. *Soil Science Society of America Journal* 70:668-678.
2. Sainju, U.M., A. Lenssen, T. Caesar-Tonthat, and J. Waddell. 2006b. Carbon sequestration in dryland soil and plant residue as affected by tillage and crop rotation. *Journal of Environmental Quality* 35: 1341-1347.
3. Sainju, U.M., A. Lenssen, T. Caesar-Tonthat, and J. Waddell. 2007. Dryland plant biomass and soil carbon and nitrogen pools as influenced by tillage and crop rotation" *Soil and Tillage Research* 93:452-461

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