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Natural Resources Research Update

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Title: Management practices effects on soil carbon dioxide emission and carbon storage

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Management practices can influence soil CO_2 emission and C content in cropland, which can effect global warming. We examined the effects of combinations of irrigation, tillage, cropping systems, and N fertilization on soil CO_2 flux, temperature, water, and C content at the 0 to 20 cm depth from May to November 2005 at two sites in the northern Great Plains. Treatments were two irrigation systems (irrigated vs. non-irrigated) and six management practices that contained tilled and no-tilled malt barley with 0 to 134 kg N ha^{-1}, no-tilled pea, and a conservation reserve program planting applied in Lihen sandy loam (sandy, mixed, frigid, Entic Haplustolls) in western North Dakota. In eastern Montana, treatments were no-tilled malt barley with 78 kg N ha^{-1}, no-tilled rye, Austrain winter pea, no-tilled fallow, and tilled fallow applied in dryland Williams loam (fine-loamy, mixed Typic Argiborolls). Tillage increased CO_2 flux by 62 to 118% compared with no-tillage at both places. The CO_2 flux was 1.5 to 2.5-fold greater with tilled than with non-tilled treatments following heavy rain or irrigation in North Dakota and 1.5 to 2.0-fold greater with crops than with fallow following substantial rain in Montana. Nitrogen fertilization increased CO_2 flux by 14 % compared with no N fertilization in North Dakota and cropping increased the flux by 79% compared with fallow in no-till and 0 kg N ha^{-1} in Montana. The CO_2 flux in undisturbed CRP was similar to that in no-tilled crops. The CO_2 flux was linearly related with soil temperature and daily average air temperature at the time of CO_2 measurement. Soil organic and inorganic C contents were not influenced by treatments. Although soil C storage was not altered, management practices influenced CO_2 flux within a short period due to changes in soil temperature, water content, and nutrient levels (Sainju et al., 2008). Regardless of irrigation, CO_2 flux can be reduced from croplands to a level similar to that in CRP planting using no-tilled crops with or without N fertilization compared with other management practices (Sainju et al., 2008). No-tillage significantly reduced CO_2 emission compared with conventional tillage (Jabro et al., 2008).

1. Sainju, U.M., J.D. Jabro, and W.B. Stevens. 2008. Soil carbon dioxide emission and

carbon sequestration as influenced by irrigation, tillage, cropping system, and nitrogen fertilization. J. Environ. Qual. 37:98-106.

2. Jabro, J.D., U.M. Sainju**,** W.B. Stevens, and R.J. Evans. 2008. Carbon dioxide flux as affected by tillage and irrigation in soil converted from perennial forages to annual Crops

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