Stacked Crop Rotation Reduces Soil Organic Carbon and Crop Yield Compared with Alternate-Year Rotation

Upendra M. Sainju
United States Department of Agriculture

Andrew W. Lenssen
Iowa State University, alenssen@iastate.edu

Brett L. Allen
United States Department of Agriculture

William B. Stevens
United States Department of Agriculture

Jalal D. Jabro
United States Department of Agriculture

Follow this and additional works at: http://lib.dr.iastate.edu/agron_conf

Part of the Agricultural Science Commons, Agriculture Commons, and the Agronomy and Crop Sciences Commons

Recommended Citation
http://lib.dr.iastate.edu/agron_conf/19

This Abstract is brought to you for free and open access by the Agronomy at Iowa State University Digital Repository. It has been accepted for inclusion in Agronomy Conference Proceedings and Presentations by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
Stacked crop rotations and improved cultural practices have been used to control pests, but their impact on soil organic C (SOC) and crop yield are lacking. We evaluated the effects of stacked vs. alternate-year rotations and cultural practices on SOC at the 0- to 125-cm depth and annualized crop yields from 2005 to 2011 in the northern Great Plains. Stacked rotations were durum (Triticum turgidum L.)-durum-canola (Brassica napus L.)-pea (Pisum sativum L.) (D-D-C-P) and durum-durum-flax (Linum usitatissimum L.)-pea (D-D-F-P). Alternate-year rotations were durum-canola-durum-pea (D-C-D-P) and durum-flax-durum-pea (D-F-D-P). Cultural practices were traditional (conventional till, recommended seed rate, broadcast N fertilization, and reduced stubble height) and ecological (no-till, increased seed rate, banded N fertilization, and increased stubble height). Annualized biomass residue (stems and leaves) returned to the soil and grain yield were greater with D-C-D-P and D-D-C-P than D-D-F-P and greater with the ecological than the traditional practice. The SOC at 5 to 10 cm was lower with D-D-C-P than other crop rotations and lower with the ecological than the traditional practice. At 20 to 50, 50 to 88, and 0 to 125 cm, SOC was lower with D-D-F-P than D-C-D-P and D-F-D-P. Regardless of treatments, SOC declined linearly from 2006 to 2011. The SOC at 0 to 125 cm increased linearly with annualized crop yield (R² = 0.58, P ≤ 0.01). Stacked rotations reduced SOC storage and crop yield compared with alternate-year rotations. Ecological cultural practice increased crop yield with minimum impact on SOC compared with the traditional practice.