

Long-Term No-Tillage Sequesters Soil Organic Carbon in Cool Semiarid Regions

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Summary:

No-tillage (NT) has been promoted as a strategy for sequestering soil organic carbon (SOC) in crop production systems. However, recent research suggests stratification rather than sequestration of SOC may occur following adoption of NT, with no net increase in SOC. Our objective was to determine if SOC was sequestered in long-term NT plots in a cool semiarid region. Soil was collected from 0- to 30-, 30- to 60-, and 60- to 90-cm depth intervals in plots arranged in a randomized complete block where clean-tillage (CT), reduced-tillage (RT), and NT treatments had been maintained in eight blocks for 20 yr at Dickinson, ND, USA. More SOC occurred at the 0- to 30-cm depth under NT (64 Mg C ha⁻¹) than under both RT and CT (55 Mg C ha⁻¹) management (SE = 2; P < 0.001) and at the 30- to 60-cm depth under NT than RT (33 vs. 28 Mg C ha⁻¹, P < 0.03). Similarly, more SOC occurred at the 60- to 90-cm depth under NT than RT (29 vs. 22 Mg C ha⁻¹, P = 0.003). Overall, amounts of SOC in the upper 90 cm of soil were greatest under NT at 127 Mg C ha⁻¹ compared with 104 Mg C ha⁻¹ under RT and 112 Mg C ha⁻¹ under CT (P = 0.005). Results of this research indicate that conversion of CT and RT to NT in cool semiarid regions can result in the sequestration of SOC when both surface and subsurface depths are considered.

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