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No-Tillage Impacts on Soil Carbon, Nitrogen and Water

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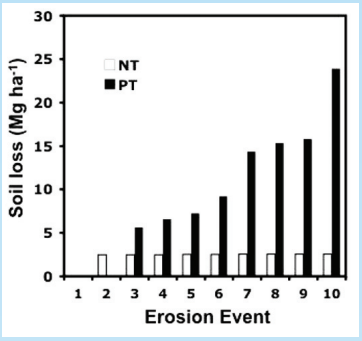
Sign at the driveway to the long-term tillage and rotation Triplett and VanDoren plots in Wooster, OH.



Cumulative soil loss from NT and PT watersheds at Coshocton, OH for the years of 1970-1973. The erosion events are all rainfall events that produced runoff and erosion during this time period. ***To allow for visualization of the NT values, they were multiplied by 10 before being plotted in the graph*** (from Triplett and Dick, 2008).

Tillage has long been considered essential for agricultural production. Artwork from early civilizations depict farmers plowing their fields with a wooden plow and a team of oxen. Tillage is still practiced for seedbed preparation, nutrient management, and weed control. The dust bowl of the 1930s and Edward Faulkner's book "Plowman's Folly" that was published in 1943 challenged the traditional agricultural theory and sparked a conservation tillage revolution that eventually culminated in the development of no-tillage practices. Today more than 55 million acres in the United States are managed using no-tillage, and the practice has been extended to nearly every country in the world. Indeed, no-tillage has become essential for production of crops in countries where soils are fragile and tillage leads to erosion and other types of soil degradation. Conservation tillage systems provide a minimum of 30% soil cover by crop residues during the critical soil erosion period. No-tillage, the most extreme form of conservation tillage, is when seed is planted directly into the soil without benefit of prior tillage and aims for 100% soil cover. In Ohio, Drs. Glover Triplett and Dave VanDoren pioneered the development of no-tillage crop production and established the long-term (50 years and counting) tillage and rotation plots. Not all soils and climates provide conditions that promote improved crop yields and soil quality. However, for many soils in the corn belt region of the United States, no-tillage can be beneficial in terms of (1) reduced soil erosion, (2) improved carbon sequestration, (3) overall improved soil quality, (4) less fuel and energy inputs, (5) greater microbial diversity and activity, and (6) better water infiltration and storage in the soil. Negative effects are often related to poor crop population establishment, increased nitrous oxide emissions, reduced crop yields on some soils, and dependence on herbicides for weed control.

Aerial view of the long-term tillage and rotation Triplett and VanDoren plots in Wooster

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