Comment on “Long-Term No-Till Impacts on Organic Carbon and Properties of Two Contrasting Soils and Corn Yields in Ohio”

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In a recently published article, Kumar et al. (2012) compared soil organic carbon (SOC) in plow tillage (PT) and no-tillage (NT) and concluded that the “use of NT in well-drained and poorly drained soils for a long duration may be beneficial for the environment by sequestering more SOC.” Results from the study appeared to show that SOC was sequestered by NT based on a paired comparison method with PT system as the baseline (on a mass basis with bulk density data to a depth of 40 cm), and the onset of the tillage treatment in 1962 and 1964 is not reported. The SOC stock in adjacent woodlands (WL) is used as the SOC level at the time of clearing and cultivation, perhaps 80 or more years ago. Published studies for these plots (Van Doren et al., 1976; Dick, 1983; Dick et al., 1991) report SOM data were collected from each plot area before the tillage treatment application. Van Doren et al. (1976) reports before the establishment of the Wooster tillage plots in 1962 a SOM content of 24 g kg⁻¹ (14 g kg⁻¹ SOC) on a mass basis for the 0- to 15-cm Ap horizon. The Hoytville plots had a 37 g kg⁻¹ SOM (22 g kg⁻¹) for the 0- to 15-cm Ap horizon (Van Doren et al., 1976). Utilizing Table 1 from Kumar et al. (2012) where they report the PT SOC levels for the year 2011 for the 0- to 40-cm layer in 10-cm intervals, one can proportionally weight these values for the 0 to 10 cm and upper half of the 10 to 20 cm and determine the SOC levels in the 0- to 15-cm layer which were 12.5 g kg⁻¹ in the Wooster PT plots and 14.3 g kg⁻¹ in the Hoytville plots.

Further, building on the Van Doren et al. (1976) measured data in 1962 and 1964 and the 2011 Kumar et al. (2012) data, one can calculate the SOC concentration in the 0- to 15-cm layer of the Wooster soil at 15 g kg⁻¹ (−11%) and in the Hoytville plots a decline of 7.7 g kg⁻¹ (−35%). These calculations are on a mass instead of a volume basis for a thinner layer, and these data suggest that the Wooster and Hoytville PT plots were not at a steady state and were in fact losing SOC at a significant rate, 11 and 35%, respectively. Although these calculations are on a mass instead of a volume basis for a thinner layer, they do show the 0- to 15-cm layer of the PT plots are losing SOC over the years and are clearly not at steady state. This finding invalidates the researchers’ use of PT as the baseline for NT when determining SOC sequestration since the PT SOC level is not at a steady state. The exact amount of net SOC sequestration can only be documented with pre-treatment SOC concentration and bulk density measurements which were not reported in the literature. By sampling only once in 2011, Kumar et al. (2012) apparently assumed, but did not state, that the SOC levels in the PT plots were at steady state for the last 47 to 49 yr and they clearly are not.