

Impact of Different Tillage Practices on Soil Health Status: Carbon Storage and Pools, Soil Aggregation, and Nutrient Use

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Abstract : Tillage is a fundamental soil practice with different soil disturbance intensities and unique implications in soil organic carbon, soil structure, and nutrient dynamics. However, the implication of tillage practice on soil organic carbon and soil health is complex and specific to the context. Our study evaluated soil health status based on soil carbon sequestration and pools, soil aggregation, and nutrient use under two different tillage practices: conventional and minimum tillage. The results of our study are consistent with the hypothesis that, over time, minimum tillage typically boosts soil health in the 0-10 cm soil layer. Compared to the conventional practice (19.36 t C ha⁻¹), there was a significant accumulation of soil organic carbon (0-30 cm) in the minimum-tillage practice (23.21 t C ha⁻¹). Below 10 cm depth, the soil organic carbon stocks are close to that of the conventional layer (0-30 cm). Soil aggregate stability was improved under conservative tillage due to soil carbon improvement, which facilitated a greater volume of mesopores and micropores. Total nitrogen (TN), available potassium (AK) and phosphorus (AP) content in 0-10 cm depth under minimum-tillage practice were 26%, 6% and 32%, greater, respectively, compared to the conventional treatment. Overall, the TN, AP and AK values decreased with depth within the soil profiles as a consequence of soil practice and minimum disturbance. The data show that minimum tillage is a sustainable and effective management practice that maintains soil health with soil carbon increase and efficient nutrient use.

Keywords : minimum tillage, conventional tillage, soil organic carbon, nutrients, soil aggregation, soil health

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