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Tillage Translocation and Erosion - What is Really Driving the Creation and Destruction of Morphological Features within Intensive Cultivated Landscapes?

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Existing tillage erosion models, in general, have been used assuming that tillage operations are conducted either in one direction or in alternating directions across the field. However, the actual tillage patterns used by farmers are often complex. A change in tillage direction will change the redistribution path of the translocated soil and, therefore, should affect the pattern of tillage erosion. However, to date, no research has been conducted to examine the impact of complex tillage patterns on tillage erosion. In this study, a directional tillage erosion model (DirTillEM) was developed to better account for the directionality of tillage translocation. This model was used on a hypothetical, level landscape (to negate the influence of topography) using tillage patterns typical of those used in the North American Prairies. The model predicted that tillage direction (especially when conducted repeatedly in specific patterns over many years) and field boundaries play a very important role in the creation (and destruction) of morphological features across the landscape. The DirTillEM predictions agreed well with LiDAR topographic data collected from the near-level landscapes of the Red River Valley in Manitoba, Canada. In addition to influencing the pattern of tillage erosion, the directionality of tillage translocation may also impact nutrient redistribution, water erosion potential, field drainage, and salinity. Analysis is ongoing to test the DirTillEM against field data (i.e., 137Cs, total C, total N etc.) collected from various topographically complex sites across Canada.