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Root development of winter wheat in erosion-affected soils depending on the position in a hummocky ground moraine soil landscape

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The soil water uptake by crops is a key process in the hydrological cycle of agricultural ecosystems. In the arable hummocky ground moraines soil landscapes, an erosion-induced spatial differentiation of soil types has been established due to water and tillage erosion. Crop development may reflect soil landscape patterns and erosion-induced soil profile modifications, respectively, by increased or reduced plant and root growth. The objective was analyze field data of the root density and the root lengths of winter wheat for a non-eroded reference soil at the plateau (Albic Luvisol), an extremely eroded soil at steep midslope (Calcaric Regosol), and depositional soil at the footslope (Colluvic Regosol) using the minirhizotron technique. From 9/14 to 8/15 results indicate that root density values were highest for the Colluvic Regosol, followed by the Albic Luvisol and lowest for the Calcaric Regosol. In turn, the lowest maximum root penetration depth was found in the Colluvic Regosol because of the relatively high and fluctuating water table at this landscape position. The analyzed field root data revealed positive relations to above-ground plant parameters and corroborated the hypothesis that the crop root system was reflecting erosion-induced soil profile modifications. When accounting for the position-specific root development, the simulation of water and solute movement suggested differences in the balances as compared to assuming a spatially uniform development.