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Relationship between soil erosion under simulated rainfall and soil surface roughness for three soil tillage treatments in Southern Brazil

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Soil surface roughness is constituted by microdepressions and microelevations, which in agricultural soils are created by soil tillage. Roughness affects total porosity of topsoil, water storage on the surface and soil water infiltration, thus water erosion. The relationship between soil erosion and surface roughness was studied in a typic Hapludox, under simulates rainfall. The experimental setup consisted of six plots each of them with 3.5 x 11.0 m and three soil surface conditions: minimum tillage (CM) and conventional tillage (CT), both under a soja crop and conventional tillage without crop (BS). The relationships between both, required time for runoff initiation and to reach peak intensities with random roughness, RR, and tortuosity, T, were studied. Also the relationships between runoff velocity and aggregate mean diameter transported by runoff water, D_{50}, with RR and T, were studied. In all the cases, linear relationships between the study variables were calculated. The required time for runoff initiation and to reach peak increased with increased RR and T, so that correlation coefficients, r^2, between these variables were between 0.74 and 0.94. Runoff velocity and D_{50}, decreased as RR and T increased, showing correlation coefficients, r^2, between -0.48 and -0.99. Water losses decreased as random roughness and tortuosity increased and the correlation coefficients, r^2, ranged between -0.60 and -0.87. Also soil losses decreased as soil roughness and tortuosity increased and the correlation coefficient varied between -0.84 and -0.99. Thus, soil and water losses may be described as a function of soil roughness and soil tortuosity by means of single linear regressions.