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Effect of some surface and subsurface attributes on soil water erosion

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Soil erosion is a complex phenomenon depending on climate, topography, soil intrinsic characteristics, crop and residue cover, and management and conservation practices that may be accelerated by man activities. Within the above mentioned factors, soil cover and soil management most influence soil erosion. Soil management includes mechanical mobilization and in soil conservationist systems soil residues are mobilized for increasing soil surface roughness. Even if soil roughness is ephemeral, it increases soil water storage and sediment retention in surface microdepressions, which contributes to decrease water erosion. Conservationist soil management systems also maintain the soil surface covered by crop residues, which are more persistent than roughness and contribute to dissipate kinetic energy from raindrops and partly also from runoff. Crop residues are more efficient than soil roughness in controlling water erosion because of its ability to retain detached soil particles. The objective of this study was to assess the efficiency of both soil cover by crop residues and soil surface roughness in controlling water erosion. A field experiments was performed on an Inceptisol in South Brazil under simulated rainfall conditions during 2012. The following treatments were evaluated: 1) residues of Italian ryegrass (Lolium multiflorum), 2) residues of common vetch (Vicia sativa), 3) scarification after cultivation of Italian ryegrass, 4) scarification after cultivation of common vetch, 5) scarified bare soil with high roughness as a control. Treatments #1 and 2 involved no-tilled soil with a rather smooth soil surface, where roots and crop residues of the previous crop were maintained. Treatments # 3 and 4 involved a rather high roughness, absence of previous crop residues and maintenance of antecedent roots. Experimental plots were 11 m long and 3.5 m wide with an area of 38.5 m2. Six successive simulated rainfall tests were applied using a rotating-boom rain simulator. During each test, rain intensity was 60 mmhr-1, whereas rain duration was 90 minutes. Italian ryegrass was more efficient than common vetch to control water erosion, both in terms of crop residues and when combining scarification and roots of previous crop. Treatment 1, with soil cover by Italian ryegrass was most efficient to control soil water erosion as the cumulative soil losses were 248 kg ha-1, whereas treatment 4 involving scarification after common vetch was the less efficient within the cultivated treatments, as the soil losses recorded were as high as 31.018 kg ha-1. Soil losses from the control treatments (bare soil) were the highest with a cumulative value o 43.659 kg ha-1. Water losses followed the same rank as soil losses, even if the differences between treatments were smaller than these of soil losses.