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Testing an infiltrometer methodology to investigate water impact effects on both soil sealing and hydraulic properties of a loam soil under conventional tillage and no-tillage

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Testing new experimental procedures to assess the effects of the drops impact on the soil sealing formation is a main topic in soil hydrology.

In this field investigation, the methodological approach proposed first by Bagarello et al. (2014) was extended to account for a greater soil infiltration surface (i.e., about 3.5 times higher), a higher range and number of heights of water pouring and to evaluate the different impact on soil management. For this purpose, the effects of three water pouring heights (low, L=3 cm; medium, M=100 cm; high, H=200 cm) on both no-tilled (NT) and conventionally tilled (CT) loam soil were investigated by Beerkan infiltration runs and using the BEST-procedure of data analysis to estimate the soil hydraulic properties.

Final infiltration rate decreased when perturbing runs (i.e., M and H) were carried out as compared with the non-perturbing (L) ones (by a factor of 1.5-3.1 under NT and 3.4-4.4 under CT). Similarly, the water retention scale parameter, h_g, increased (i.e., higher in absolute terms) by a factor 1.6-1.8 under NT and by a factor 1.7 under CT. Saturated hydraulic conductivity, K_s, changed significantly as a function of the increase of water pouring height; regardless of the soil management, perturbing runs caused a reduction in soil permeability by a factor 5 or 6. Effects on hydraulic functions (i.e., soil water retention curve and hydraulic conductivity function), obtained with the BEST-Steady algorithm, were also highlighted. For instance, differences in water retention curve at fixed soil pressure head values (i.e., field capacity, FC, and permanent wilting point, PWP) due to perturbing and non-perturbing runs, were estimated as higher under NT (3.8%) than CT (3.4%) for FC, and equal to 2.1% or 1.6% for PWP.

Main results of this investigation confirm that a recently tilled loamy soil, without vegetation cover, can be less resilient as compared to a no-tilled one, and that tested water pouring heights

methodology looks promising to mimic effects of high energy rainfall events and to quantify the soil sealing effects under alternative management of the soil.

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