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“Filling gaps and removing traps
for sustainable resource management”

Effect of Residue Rate, Forward Speeds and Tillage Methods on the Soil Unsaturated Hydraulic Conductivity

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Abstract

Inappropriate use of land and lack of knowledge of proper management operations leads to soil erosion and degradation, loss of soil organic carbon, low soil performance and crop productivity. This experiment was conducted to investigate the effect of tillage methods, residue rate and forward speed on the soil unsaturated hydraulic conductivity using tension infiltrometer at Agricultural Sciences and Natural Resources University of Khuzestan in 2016. The experiment was a split-split-plot design. The treatments included: conventional tillage (moldboard plough+disc), and two conservation tillages - combination tillage and chisel packer+plough, with three residue rates at surface of 0, 40 and 80 %, and three machine forward speeds of 4, 7 and 10 km hr⁻¹ in three replications. Unsaturated hydraulic conductivity at matric tensions (1, 4, 14 and 20 cm), soil bulk density, organic matter content, sorptivity, macroscopic capillary length, number of effective macropores, mesopores and micropores per unit area and their contribution to total saturated flux and yield were measured. The results showed that after one year of tillage management, soils under conventional tillage compared to combination tillage (with the lowest bulk density) had 6.1 % greater bulk density. High travel speed of 10 km hr⁻¹ lowered stress by reducing soil pressure and decreased soil bulk density at a rate of 3.1 % compared to the low travel speed 4 km hr⁻¹. The treatments had no significant effect on hydraulic conductivity. Unsaturated hydraulic conductivity of 1 metric tension increased by 25.4 % and 18.7 % under conventional tillage and conservation tillage, respectively. Residue rates of 80 and 40 percent were in the suction capacity of 14 and 20 cm, respectively, with the highest values of hydraulic conductivity (0.121 and 0.0297 cm min⁻¹, respectively). In general, the effect of tillage on soil physical property characteristic is dynamic and the resulting effects over time are moderate and change their trend.

Keywords: Residue, soil unsaturated hydraulic conductivity, tillage