

Effects of Tillage and Crop Residues Management in Improving Rainfall-Use Efficiency in Dryland Crops under Sandy Soils

Authors : Cosmas Parwada, Ronald Mandumbu, Handseni Tibugari, Trust Chinyama

Abstract : A 3-yr field experiment to evaluate effects of tillage and residue management on soil water storage (SWS), grain yield, harvest index (HI) and water use efficiency (WUE) of sorghum was done in sandy soils. Treatments were conventional (CT) and minimum (MT) tillage without residue retention and conventional (CT × RT) and minimum (MT × RT) tillage with residue retention. Change in SWS was higher under CT and MT than in CT × RT and MT × RT, especially in the 0-10 cm soil layer. Grain yield and HI were significantly ($P < 0.05$) lower in CT and MT than CT × RT and MT × RT. Grain yield and HI were significantly ($P < 0.05$) positively correlated to WUE but WUE significantly ($P < 0.05$) negatively correlated to sand (%) particle content. The SWS was lower in winter but higher in summer and was significantly correlated to soil organic carbon (SOC), sand (%), grain yield (t/ha), HI and WUE. The WUE linearly increasing from first to last cropping seasons in tillage with returned residues; higher in CT × RT and MT × RT that promoted SOC buildup than where crop residues were removed. Soil tillage decreased effects of residues on SWS, WUE, grain yield and HI. Minimum tillage coupled to residue retention sustainably enhanced WUE but further research to investigate the interaction effects of the tillage on WUE and soil fertility management is required. Understanding and considering the WUE in crops can be a primary condition for cropping system designs. The findings pave way for further research and crop management programmes, allowing to valorize the water in crop production.

Keywords : evapotranspiration, infiltration rate, organic mulch, sand, water use efficiency

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