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

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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 and minimum tillage with residue retention. Change in SWS was negatively 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 increased from first to last cropping seasons under returned residues that promoted SOC buildup. Soil tillage decreased effects of residues on SWS, WUE, grain yield and HI. Understanding and considering the WUE in crops can be a primary condition for cropping system designs. The findings pave way for further research and allowing valorization of water in crop production.*

Keywords: Organic matter, Rainfall, Sand, Water use efficiency, Yield

INTRODUCTION

World-over, crop production is dependent on soil water availability either directly through rainfall captured in the soil or indirectly as soil water applied via irrigation (Hatfield, 2011). However, the amount and distribution of natural rainfall are negatively affecting crop productivity in many parts of the world especially in sub-Saharan Africa. The current increasing variability in both temperatures and precipitation has accelerated the problem and raises the question of how to enhance crop water use efficiency (WUE) in different cropping systems (Tadele, 2017). Again, the soils of the world continue to be degraded such that the critical properties which are linked to WUE