

# Tillage and Deficit Saline Water Irrigation with Mulch in Sorghum-Wheat Cropping System Improve Soil Chemical and Biological Properties and Reduce Soil Salinity in Semi-arid Northwest India

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## Abstract

Inadequate access to fresh water during dry winter season is a major limitation in realizing high crop yield. Using available saline water except at germination and crown root initiation stages can be a practical solution to meet water demand. Therefore, a field experiment was conducted in saline soils to investigate the effect of tillage and rice straw mulch on soil properties and its interrelation with yield of rainfed sorghum (RS) and irrigated wheat (IW) under three levels of saline irrigation of 100, 80 and 60% water requirement (WR) of wheat. Reduced (RT), conventional (CT) and zero tillage (ZT) were taken in main plots and saline irrigation (EC<sub>iw</sub> 8.0 dS m<sup>-1</sup>) and rice straw mulch (0 and 5 Mg ha<sup>-1</sup>) in subplots. Zero tillage significantly reduced the wheat yield compared to CT and RT. Interaction between RT, mulching and 60WR markedly increased the sorghum fodder yield. Deficit saline irrigation (60WR) caused a significant reduction in soil salinity (EC<sub>e</sub>) after every crop cycle. Soil microbial biomass C, N (MBC, MBN), dehydrogenase (DHA), urease (Ur), and alkaline phosphatase (ALP) decreased with increment of EC<sub>e</sub>. Irrigation with 60WR and ZT maintained higher values of MBN. The  $\alpha$ -glucosidase, MBC, EC<sub>e</sub>, available N, MBC: MBN and Ur were identified as significant contributor towards soil health index (SHI). Deficit saline irrigation (60WR) and ZT showed higher values of SHI. Thus, applying deficit saline water irrigation, RT and mulching is most promising for maintaining high SHI, saving fresh irrigation water without affecting yield of RS-IW cropping system.

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