

Infiltration and runoff losses under fallowing and conservation agriculture practices on contrasting soils, Zimbabwe

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Abstract

Fallowing and conservation agriculture are sustainable farming practices that can be used for soil and water conservation. The objectives of the study were to evaluate the effects of different conservation agriculture practices on rainfall infiltration and soil and water losses across 4 sites, using simulated rainfall. The study was carried out at Domboshawa and the Institute of Agricultural Engineering and Chikwaka smallholder farming areas, 4 sites with different soil types. Conservation agriculture practices evaluated were mulch reaping (MR) and clean reaping (CR) at Domboshawa with 5% clay and the Institute of Agricultural Engineering (IAE) with 50% clay. The study also evaluated runoff losses from fallow plots subjected to no tillage (NT) and conventional tillage (CT) at ICRAF Domboshawa site (20% clay) and fallows subjected to CT in Chikwaka smallholder farming areas (4% clay). Infiltration rates were greater under conservation agriculture practices ($>35 \text{ mm}\cdot\text{h}^{-1}$) when compared to CT ($<27\text{-}29 \text{ mm}\cdot\text{h}^{-1}$). On fallows infiltration rates ranged from $24\text{-}35 \text{ mm}\cdot\text{h}^{-1}$ when compared to $<15 \text{ mm}\cdot\text{h}^{-1}$ in maize under CT. Runoff losses were highest under CT at both Domboshawa and IAE sites, and were 21.5 and 15% respectively, while there was no runoff under MR and CR. At the ICRAF Domboshawa site, runoff ranged between 0-31% in fallows and was 57% in maize under CT. At Chikwaka runoff in CT maize was 58%, while in fallow plots runoff ranged 37-44%. Soil losses ranged from $0.2\text{-}0.3 \text{ t}\cdot\text{ha}^{-1}$ per rainfall event in maize, while in fallows, soil loss ranged from $0\text{-}0.1 \text{ t}\cdot\text{ha}^{-1}$. The results showed that CT resulted in reduced infiltration rates, increased soil and water loss when compared to fallowing and conservation agriculture across different range of soils. Conservation agriculture practices and fallowing are potential sustainable cropping practices that reduce soil and water loss and increase water use efficiency.

Keywords: Conservation agriculture, fallowing, tillage, rainfall simulations