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Effect of tillage and cropping systems on runoff, soil loss and crop yields under semiarid rainfed agriculture in India

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ABSTRACT

Cropping practice (tillage) is an important management tool for tackling water induced erosion hazard, promoting in situ water conservation and improving and stabilising crop yields from rainfed production systems of semiarid and subtropical regions. Four practices including conventional tillage (CT), ridge farming tillage (RFT), no tillage (NT) and stubble mulch farming tillage (SMFT) were evaluated for 11 years (1990–1991 to 2001–2002) under semiarid rainfed conditions in western India on a very deep, sandy loam soil. Green gram[1] (*Vigna radiata*)–mustard (*Brassica juncea*) sequential cropping and pearl millet (*Pennisetum glaucum*) + pigeon pea (*Cajanus cajan*) intercropping systems were tested for the first four years (first phase of the experiment). Cowpea (*Vigna unguiculata*)–mustard sequential cropping and cowpea + castor (*Ricinus communis*) intercropping systems were used for the following seven years (second phase of the experiment). Runoff, soil losses, sediment concentrations, crop yields, soil organic carbon, bulk density and water stable aggregates were observed for all the treatment combinations. RFT and SMFT were both effective in reducing runoff and soil loss. RFT, NT and SMFT reduced runoff by 69.4, 16.2 and 59.6% respectively compared with CT. Average soil loss in NT was 37.2% less than CT. Average sediment concentration of runoff during June–July was greater than in August–October for all treatments and average sediment concentrations were greater under CT and RFT. The highest average yield of all crops except green gram was recorded under SMFT. Surface soil organic carbon (SOC), bulk density and water stable macro-aggregates were all significantly greater under NT at the end of the experiment, but reverting to uniform tillage negated this effect. Micro-aggregates built-up under SMFT were relatively more stable than those all under NT. The results of this study demonstrate that in the semi-arid sub-tropical agro-ecosystem of Gujarat (western India) adoption of SMFT can significantly improve and stabilise the crop yields and reverse land degradation process.