

Field assessment of the effect of cumulative soil loss on soil productivity.

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Abstract

Soil erosion affects physical and chemical soil properties by reducing water infiltration rates, soil water holding capacity, soil fertility and leading to deterioration of soil structure. Research on the relationship between erosion and soil physical and chemical properties has been conducted (Battison et al., 1987; Becher et al., 1985 ; Frye et al., 1982) but few such studies have been carried out in the tropics (Mbagwt et al., 1984; Yost et al., 1985; Lal, 1985; Belay, 1992; Casanova et al., 1987; Merete, 1992). Results mostly indicate that erosion causes considerable deterioration of soil fertility and reduces rooting depth, causes soil crusting, compaction, loss of soil water storage capacity, diminishes workability and decreases infiltration rates. Crosson, (1935) argued that consequences of eroded soil carried off the farm are not always negative. Some eroded fertile soil may be deposited on less fertile soil, thus enhancing the productivity of the latter. However, the general consensus is that the effect of deposited soil is negative in Kenya (Otieno, 1993; Schneider, 1993). Long-term effects of soil erosion on soil productivity involve changes in soil physical characteristics that are, in most cases, irreversible (Foster et al., 1985; Bramble et al., 1985). Frye et al. (1982) indicated that the A-horizon of eroded compared to un-eroded soils had higher clay content and bulk density and that the damage caused to the soil physical properties, especially the soil available water holding capacity, were yield-limiting. Thomas and Cassel (1979) showed a close relationship between soil depth and available water capacity on a sandy loam soil. Lal (1976b, 1981, 1985), working on some Nigerian soils found that soil erosion increased the gravel content of the surface horizon thereby influencing the moisture retention capacity of the surface soil. Belay (1992) reported that in Ethiopia, severely eroded Nitisols had lower pore volume than soils that were not eroded. Lal (1976a, 1985) reported that organic matter and nutrient element loss due to erosion might be one of the major causes of fertility depletion of tropical soils. Erosion often results in selective removal of fine materials which are enriched with plant nutrients (Kefeni, 1992), so that the soil remaining after erosion is less favourable for plant growth. No detailed research work has been done in Kenya under field conditions on the relationship between erosion and soil properties. Such research should highlight and justify the need for soil conservation measures to prevent soil losses and improve crop yields. Thus, the objective of this study was to assess the effect of erosion on soil physical and chemical properties of Nitisol using field runoff plots at Kabete, Kenya. The results reported in this paper are part of a larger study to assess the impact of soil erosion on soil properties and crop response on high potential land in central Kenya (Gachene, 1995).