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Effect of land management on soil structure of vertisols in the Gezira irrigation scheme, Sudan

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Physical deterioration of vertisols is one of the main problems affecting crop production in the Gezira irrigation scheme located in the central Sudanese clay plain. The Gezira scheme was designed in 1925 with the main objective of producing cotton as a cash crop. The objective of the present work was to study the effect of land management on soil structure of the top 30 cm and to evaluate various methods for aggregate stability. Four land management types were selected: (1) Hawash, which is the conventional type of cultivation in the Gezira scheme and consists of ploughing with removal of all crop residue and cotton roots; (2) an incorporated system, similar to Hawash but with residues left on the field and incorporated in the soil; (3) agroforestry, similar to Hamash, but with *Acacia ampliceps*, *Acacia stenophylla* and *Leucaena leucocephala*; and (4) permanent fallow, dominated by shrubs and *Acacia spp.*. Soil structure was expressed in terms of stability index and mean weighted diameter of soil aggregates according to three different methods: (1) the wet and dry sieving method of De Leenheer anc Deboodt (1959); (2) the fast, slow and pre-wetting immersion methods of Le Bissonnais (1996); and (3) the wet sieving method based on Kemper's (1965) technique with the recently commercialised Eijkelkamp Agrisearch Equipment wet-sieving apparatus. The method based on Kemper's technique showed the highest potential to express the stability of aggregates. Although the soil organic carbon content of all fields was not significantly different ($p = 0.05$), the soils of the incorporated system showed the highest stability. This could be partly due to the lower SAR values of those soils compared to agroforestry and permanent fallow. As a consequence, the hydraulic conductivity as measured with a double ring infiltrometer, was twice as high in the incorporated system compared to the three other practices.