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Hydrodynamics of slope water management in Tunisia: field survey and prediction model

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Micro-basins made of stone walls around individual trees are important for the rehabilitation of tree cultivation on sloped land surfaces degraded by water erosion and the harvesting of rain runoff water. In this study, we discuss the results of an extensive measurement campaign using TDR technique for the analysis of spatial and temporal variability of soil water content of micro-basins used for olive trees in the hilly region of Central Tunisia. For comparison, measurements were carried out within and outside each micro-basin. Different farms (16) were selected for the survey depending on two criteria: i) the age of the micro-basins, i.e., 1 or 5 years old; and ii) the type of soils, i.e., Calcisols for the 5 year old basins, and Cambisols, Arenosols and Kastanozems for the one year old basins. Soil storage was measured from January to December. Numerous soil samples were collected for laboratory analysis in order to estimate hydraulic soil characteristics. For the Calcisols and Cambisols, which both contain fine material over a considerable depth, the water holding capacity of the soils within the basins increased with nearly 100% as compared to the soils outside the basins. Similar improvement was observed for the Arenosols, even though the overall water holding capacity of these soils was reduced by the high proportion of sandy material. As to the Kastanozem soils, which a-priori are receptive for improvement due to their loam content, no positive effect on the soil water storage was observed. This was mainly due to the fact that the soil layer was too thin. When comparing the one and five year old basins, the soil water holding capacity increased with time. This seems realistic as the layer thickness with fine material augmented. However, this positive time effect could well be counterbalanced when the surface layer conditions are neglected. Indeed, de-

position of clay particles and crust forming of the soil surface reduce considerably the infiltration capacity and, hence, the potential soil water storage. So far, only quantitative aspects have been analysed. Possible effects of the increase in fine material on the qualitative soil properties in terms of fertilizing characteristics have not yet been studied. Simulation studies carried out with the soil water characteristics measured on the laboratory samples, confirmed the descriptive results mentioned above. Especially, the hydrological soil properties of the Calcisols and Arenosols improved drastically.