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Laboratory experiments on the effectiveness of straw mulch on soil degradation processes under simulated rainfall

João Abrantes (1), Abelardo Montenegro (2), and João de Lima (1)

(1) Marine and Environmental Research Centre (CMA) of the Institute of Marine Research (IMAR), Coimbra, Portugal, Department of Civil Engineering, Faculty of Science and Technology of the University of Coimbra, Rua Luís Reis Santos, Campus II – University of , (2) Rural Federal University of Pernambuco, Department of Rural Technology, Rua Dom Manoel de Medeiros s/n, Dois Irmãos, CEP 50910-130 Recife, PE, Brazil (abelardo.montenegro@yahoo.com.br)

Several relevant hydrological processes (e.g. runoff, sediment transport, soil moisture) were investigated in laboratory to evaluate the effectiveness of distinct rice straw mulching densities on reducing soil degradation and conserving soil water. Mulching cover has been used as a common management practice to improve water use efficiency and soil conservation in agricultural lands of semiarid regions characterized by irregular storm patterns with intense and short rainfall events. Soil degradation and nutrient losses are a main threat for agricultural lands, reducing soil fertility, land productivity and eventually leading to the unsustainability of agricultural production systems.

Laboratory experiments were conducted using a free drainage rectangular soil flume (3.0×0.3 m^2) with a sandy loam soil from the right bank of Mondego River, in Coimbra (Portugal) and three soil surface conditions: 1) bare soil; 2) low mulching cover with 2 ton/ha density; and 3) high mulching cover with 4 ton/ha density. A steady single downward–oriented full-cone nozzle was used to simulate several rainfall events with different intensities and patterns in an intermittent way. A set of infrared bulbs placed above the soil flume were used to enhance evaporation between two successive rainfall events.

The results clearly show that rice straw mulching and the characteristics of the rainfall events strongly affected infiltration, surface runoff and erosion. High mulching cover condition stabilized soil temperature better than the bare soil condition and increased significantly soil moisture. Mulching has conferred protection to the superficial layer of the soil, reducing the formation of rills and the transport of sediments, leading to the reduction of the degradation processes.