



Evaluation of the WEPP model in olive orchards under different soil managements in a vertic soil under Mediterranean type of climate

Feliciana Licciardello (1), Encarnación V. Taguas (2), Mark Nearing (3), Salvatore Barbagallo (1), and José A. Gómez (4)

(1) Università di Catania, Dipartimento di Gestione dei Sistemi Agroalimentari e Ambientali. Via Santa Sofia, 100, 95123 Catania (Italy), (2) University of Cordoba, Rural Engineering Department. Campus Rabanales, 14071 Córdoba (Spain), (3) USDA-ARS Southwest Watershed Research Center, Tucson, AZ, United States, (4) Instituto de Agricultura Sostenible CSIC. Apartado 4084. 14080. Cordoba. Spain.

Soil erosion is frequently cited as a major limitation to long term sustainable production on vertisols, as consequence of their low infiltration under wet conditions and relatively high erodibility, especially in olive orchards in Andalusia where a large crop area is located in steep hillslopes. The modelling and the exploration of the suitable management practices adapted to the high complexity soils with marked spatial-temporal differences of infiltration induced by the impact of cracks and to the combination lane/trees, is essential to protect a key economic and social crop in Spain and in the Mediterranean area. The performance of WEPP model was evaluated through the use of monthly runoff and erosion data collected in runoff plots located in an olive orchard on a vertic soil for three different soil managements and during a measure period characterized by significant differences of rainfall regime. The three soil management systems, no-tillage (NT), conventional tillage (CT) and cover crop (CC) differed greatly in runoff (observed mean annual volumes equal to 130.8, 41.8 and 7.2 mm respectively) and soil losses (observed mean annual sediment yield equal to 7409.9, 3066.4 and 945.4 kg/ha respectively). A simple statistical analysis (visual comparison in data-display graphics and statistics) of the data and the rainfall regime for the measure period was carried out to support the calibration and the validation with WEPP model due to the expected high variability of hydrological responses. The application of different soil parameters according to the hydrological characteristics associated to the variation of soil moisture along the year allowed to simulate the differences of runoff volumes for the different management. In fact, the calibration/validation process at monthly scale under wet conditions was suitably-adjusted ($R^2 > 0.84$; $E > 0.74$ except for CT during 2002-2004; $RRMSE < 222\%$, except for CT during 2002-2004). In contrast, the annual erosion rates were not well-predicted ($R^2 > 0.81$, $E > 0.26$ and $RRMSE < 290$ for wet conditions), due to the difficulties for simulating the spatial complexity of olive orchards (trees/lanes) as well as the infiltration dynamics in vertisols and the lack of soil consolidation updating of the model. In spite of the maximum soil losses are concentrated under wet cycles and the runoff volume can be acceptably well-simulated, more research in vertisols on erosion processes with models as WEPP, is essential to design suitable management practices minimizing the soil degradation.