Geophysical Research Abstracts
Vol. 14, EGU2012-11276, 2012
EGU General Assembly 2012

Quantitative evaluation of concentrated flow erosion in a Mediterranean olive orchard microcatchment

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Erosion due to rills, ephemeral gullies and gullies in cultivated areas in the Mediterranean area is known to contribute significantly to global soil loss and is one of the major processes of land degradation. This contribution may vary considerably according to the spatial scale, temporal scale and environmental controls, such as soil type, land use, climate and topography (Poesen et al., 2003). For instance, De Santiesteban et al. (2006), working in Navarre in a small catchment with winter cereals over a period of six years, found that ephemeral gullies accounted for 66% of the erosion and for 17% in another small catchment with vineyards over a period of two years. In the case of olive crops, most studies have dealt with quantifying sheet and rill erosion in plots (e.g. Gómez et al., 2008; Gómez et al. 2009). Measurements at larger scales than the plot scale, where the hydrological and erosive processes are more complex and more difficult to evaluate, are rare and data is scarce in the Mediterranean environment (de Vente and Poesen, 2005). Although plot studies and field surveys are essential, it is difficult to extract from them a full picture of the real erosive situation at other scales, especially when the erosive effects of concentrated flow are not measured.

This work illustrates some rill features and presents a simple analysis of the contribution of concentrated flow (rills and ephemeral gullies) to the soil losses in an olive orchard microcatchment where tillage operations are usually applied.

Rill and ephemeral gullies (shape, depth, width, lenght) formed during an inter-tillage period, were measured and analyzed as well as rainfall characteristics, runoff and sediment load measured in the catchment outlet for the same period (August 2009-March-2010). In the study period, the cumulative rainfall depth and the erosivity were 839 mm and 859.5 MJ Mm ha-1 h-1 respectively, distributed in 30 events. The approximate soil losses in the catchment were 18.7 t.ha-1 while volume of soil losses determined from rill measurements was 14.3 t ha-1, which illustrate the importance of flow concentrated in this catchment. One or two rills with a rectangular or triangular shape were observed in each lane. It was also observed that the combination olive tree-lane areas and the traffic prints limited the continuity and the directions of the rills. The minimum drainage area and the mean value of width and depth of the rills and ephemeral gullies are, respectively, 0.1 ha, 0.332 m and 0.071 m. These results highlight the need for control measures on the sediments sources from concentrated flow. Nevertheless, the understanding of the connectivity of the rills with the stream for evaluating the deposition should be improved for interpreting its contribution on the total sediment load.

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