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Evaluating grass strips trapping efficiency of sediments and herbicides

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Water erosion and associated offsite contamination are major environmental risks in many Mediterranean crops such as olives or vineyards (Beaufoy, 2001; Gómez et al., 2011). The use of cover crops has been prescribed as a mitigation measure for both problems because permanent cover crops have demonstrated to reduce sediment and agrochemical loads (e.g. Gómez, 2009a, b). However, large uncertainty remains about its effectiveness degree to reduce sediment and agrochemical contribution to streams due to the limited number of available studies, and the large variability observed under field conditions (Taguas et al., 2012). Furthermore, the determination of sediment and herbicide sources using suitable sediment tracing/fingerprinting properties has been noted as one tool to evaluate the effectiveness and functioning of vegetated filters at the catchment scale (Koiter et al., 2013). The objectives of the present study were twofold: [1] to explore the combined use of natural and simulated rainfall and magnetic iron oxide in understanding the performance of vegetation strips on runoff and soil and herbicide losses at plot scale and, [2] to evaluate the effectiveness degree of vegetation strips in buffering sediment and herbicide from bare soil areas under different conditions compared to a control situation with no strips.
This study encompasses six rainfall simulations under four different soil managements combining the use of a magnetic iron oxide as a sediment tracer to obtain a better understanding of the vegetation strips trapping efficiency. Three runoff plots of 6 m $\times$ 14 m were established in a 20% hillslope under a Fluvisol alluvial terrace. Each of the plots contained three bare strips tagged with magnetic iron oxide and three strips with Lolium multiflorum L. The soil management simulated scenarios were: immediately after sowing the vegetation cover (June 2011cover crop), with settled vegetation cover (June 2012cover crop), after 5 cm of deep ploughing (October 2013freshly tilled) and after ploughing and mechanically compacting the soil with a sheet metal (November 2013 consolidated surface).
Our results indicate that by using cover crop strips, runoff and sediment losses were approximately 50 % and 12 % respectively lower than the measured values in bare consolidated and freshly tilled soil. The formation of microrelief steps after the first simulation also helped to reduce soil losses and runoff. Ploughed and compacted soil management showed the highest cumulative runoff and soil losses values (28 mm and 15 kg). Evident tracer selectivity from small particle size soil textures (clays) was observed as there was an enrichment of these particles in the collected sediment. These features contribute to explain the effects of the management and the vegetation on the sediment distribution in the hillslopes and must be taken into account when performing tracing studies as well as when using cover crop strips to mitigate offsite contamination by agrochemicals.

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