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How does a vertic soil move? Soil erosion rates and its redistribution in an olive orchard at the medium-term

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Water erosion measurement has been widely studied under different conditions using traditional approaches such as erosion collectors and more innovative ones such as sediment tracers.

La Conchuela is a commercial olive orchard located in Southern Spain. In 2008, six closed runoff plots, where regular machine traffic during farm operations was allowed, were established. Runoff water was channeled from the plots and collected by tipping-bucket gauges with 5-min resolution. This was completed with a sediment trap located upstream of the tipping buckets and a device to collect an integrated sample of the runoff downstream of the tipping buckets (Gómez & Guzmán, 2021). In two of these plots ground cover was controlled with tillage during the whole year while the rest keep a temporary cover crop during fall and winter.

In two of the plots (one with bare soil and other with temporary cover crop), the top 5 cm of the inter tree rows soil were tagged with magnetite. During the following years, three soil sampling campaigns (2008, 2010, 2016) were performed to measure variations of magnetic susceptibility within the soil surface and profile. Seventy locations at both plots were sampled at three depth intervals (0-1, 1-8, 8-12 cm in 2008 and 2010). A third sampling was carried out at 0-2, 2-10, 10-20 cm in 2016 at the same locations. Furthermore, twenty additional samples from 20-30, 30-40, 40-50, 50-60 cm were taken to check if tagged soil went deeper into the soil profile. In all these samplings, tree and inter tree rows were distinguished. Background susceptibility and bulk density at each depth, were characterised at the three sampling campaigns (Guzmán & Gómez, 2017).

During the period 2008-2019 there were not statistically significant differences between managements, bare soil vs temporary cover crops, in runoff or soil losses. Nevertheless, average runoff and soil losses had a trend to lower values for the cover crop treatment (142.9 mm and 16.5 t ha^{-1}) as compared to bare soil (155.8 mm and 23.8 t ha^{-1}). With the help of the magnetic tracer, the estimated erosion rates within the plots during 2009-2010 (the rainiest hydrological year within the study period with a precipitation of 1048.5 mm) were 115 t ha^{-1} and 58 t ha^{-1} in the bare soil plot and 62 t ha^{-1} and 44 t·ha^{-1} in the cover crop plot, from inter-tree rows and tree rows, respectively. The evolution of susceptibility suggests the potential of magnetite monitoring vertical fluxes at the mid-term also, due to wetting-drying cycles of vertic soils and soil disturbance agricultural practices. In fact, magnetic iron oxide was detected at initially untagged deeper soil layers (20-60 cm) in both inter-tree and tree rows. This highlights the relevance of accounting vertical displacement in any kind of tracer study in vertic soils and its implications at the medium-

term (2008-2016) for the determination of erosion rates which will be presented in this communication.

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