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Influence of weed cover on the greenhouse gas budget of an irrigated olive orchard in SE Spain

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Maintaining the weed cover in between olive trees increases soil organic matter and reduces soil erosion in olive orchards. This conservation practice is very relevant in Mediterranean soils, which have low carbon contents, and especially in Spain, where 72% of the word's olive production takes place. However, there is no information on the effect of this management practice on the full greenhouse gas (GHG) budget of an olive orchard.
We measured carbon dioxide (CO_2), methane (CH4) and nitrous oxide (N2O) fluxes during 2017 in a fertigated olive orchard where the weed cover was maintained from autumn to spring, and in a nearby plot where it was removed through the application of herbicides. Ecosystem CO_2 and CH4 fluxes were evaluated in both plots using the eddy covariance technique, while soil CO_2, CH4 and N2O fluxes were measured using chamber techniques. Chambers were installed next to the fertigation point and at 1 m distance in 4 olive trees in each treatment. Our study was performed in Jaén (SE Spain), one of the Spanish regions where olive production dominates.
Preliminary results suggest that at the ecosystem level, the treatment with the weed cover was a small CO_2 source, probably as a consequence of the larger soil respiration, while the weed-free treatment was nearly CO_2 neutral. Soil GHG fluxes were greater next to the irrigation point compared to the alley, since all GHG fluxes decreased dramatically at 1 m distance. Both treatments showed similarly high N2O emissions. Regarding CH4, the weed-free treatment acted as a sink, while the one with the weed cover was a small source. We will assess the effect of the weed cover on the global warming potential resulting from the combined effect of the three GHGs.