



EGUsphere, referee comment RC1
<https://doi.org/10.5194/egusphere-2022-131-RC1>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Review SOIL: egusphere-2022-131

Johan Bouma (Referee)

Referee comment on "Effects of innovative long-term soil and crop management on topsoil properties of a Mediterranean soil based on detailed water retention curves" by Alaitz Aldaz-Lusarreta et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-131-RC1>, 2022

This reviewer strongly supports the type of research that the authors present in their paper: characterize field conditions on soils where certain management types have been applied for a substantial period. The authors also present a professional paper in terms of methods used, particularly the method to measure retention curves ,and by applying multiple experiments and proper statistical analyses.

Unfortunately, when they conclude in the end that: "*the study contributes to higher sustainability of mediterranean agrosystems*", they are off the mark. Sustainable development is defined as having economic, social and environmental dimensions as expressed by the UN Sustainable development Goals (SDG) and the associated European Green Deal. Scientific papers published in 2022 that suggest a link with sustainable development cannot ignore these developments in the scientific, policy and public arena's. The title of the paper is also highly misleading: "*improvement of cultivated soil*" cannot be based only on: "*water retention curves*". Numerous published papers describe a systems analysis based on the interaction between soils-water-atmosphere-plants that is needed to assess effects of soil management.

Sustainable development implies for agriculture at least: production of healthy food (SDG2&3), protection of ground- and surfacewater quality (SDG6), carbon capture and reduction of greenhouse-gas emission (SDG13) and increasing biodiversity and combatting land degradation (SDG 15).

I would recommend that the authors frame their results in a SDG context:

1. It should not be too difficult to report crop yields. (SDG2&3)
2. Water tables may be deep and not polluted; this could be mentioned showing that groundwater quality is not really an issue here.(SDG6)
3. Carbon capture is not evident as the %C is about the same for OPM and CM. This is interesting because OPM management is supposed to lead to higher %C and their results indicate this may apply to soils in humid regions ,as reported in literature, but not in arid

climates. Effect of high temperatures? But.. data only are restricted to 30 cm depth. (SDG13)

4. Even though the carbon content of both treatments is about the same, the biological soil properties seem to differ. Biodiversity in OPM is higher. This result is interesting because information on soil biology is often missing in other publications and could be part of the main text here and not be presented in an appendix. (SDG15)

5. As bulk densities of the two treatments are about the same for 0-5 cm dept and for the 0-30 cm depth(how was the latter measured, we read only the method for 0-5 cm? Effect of high tempera) there seems to be no negative effect on soil structure by CM management which is usually assumed to take place. Big problem here is that analyses were only made to 30 cm depth and a plowpan may well form by CM management but usually occurs at 30 cm depth and deeper. Indeed, as the authors mention on line 320: deeper soil layers are needed. For a correct analysis soils should be analysed for the total rooting depth. (SDG15).

Some additional notes:

1. Line 45: to study soil pores, morphological analyses are most useful, if only because different types of macropores can be distinguished: e.g. channels of roots or animals or cracks . Deriving pore sizes from moisture retention data is an indirect, approximate method. Later (lines 260, 266) micromorphology is mentioned. That should also be done upfront.

2. Line 190: no significant compaction? Could be deeper in the CM soil, see comment above.

3. Line 319: infiltration at the surface is mentioned in the context of the pore analysis. But infiltration rates can be measured and this is very important for the Mediterranean environment , certainly when considering climate change where showers will become more intense. CM has more macropores, so the authors suggest that infiltration rates would be higher than in OPM with fewer macropores. But the CM soil is less stable so crusts may form rapidly, the more so since there are no cover crops and crop residues are removed. So just linking the occurrence of physically derived macropores to infiltration rates is unrealistic without measurements of such rates. In fact, the reasoning should be reversed: measure infiltration rates and then explain differences by looking at pore patterns.

4. The authors conclude that more water is stored in the OPM treatment and this should be favorable for plant growth. But this is a statement based on static moisture retention measurements while storage is determined by in- and outflow from a certain soil volume, a dynamic process as is the moisture supply to plants. Numerous dynamic simulation models are available to quantify this process, that needs hydraulic conductivities of the soil. The authors seem to be unaware of modern soil physical theory.

5. As the soil index by Dexter does not provide any valuable results (lines 226, 317) it should receive much less attention and might as well be omitted.

A possible new title might be: *Effects of innovative soil management on topsoil properties of a Mediterranean soil*. This could focus on several interesting results identified above. Again, I would recommend they would frame their story in an SDG context.

The authors should realize that OPM is, in fact, a form of regenerative agriculture, studied in the USA. I recommend that they check with the National Soil Health Institute website. info@soilhealthinstitute.org.

J.Bouma.