EGUsphere, author comment AC3
https://doi.org/10.5194/egusphere-2022-469-AC3, 2022

Reply on RC3

Sara Niaz et al.

Author comment on "Wetting and drying cycles, organic amendments, and gypsum play a key role in structure formation and stability of sodic Vertisols" by Sara Niaz et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-469-AC3, 2022

Reviewer 3

We are thankful to the reviewer for the critical and positive feedback.

- We agree that a correlation does not prove the existence of a mechanism or cause. We represented the correlations among different soil physical, chemical, and microbial characteristics as PCA biplots after each WD cycle to show how soil properties change with repeated WD cycles. We have reworded the main text making it clearer that we refer to correlations only.
- We have added more references to place our findings in a broader context and relating our results to other work done with Vertisols (Ghosh et al., 2010, Rahman et al., 2017, Rahman et al., 2018, Bennett et al., 2015, Nachimuthu et al., 2022).
- The hypotheses have been updated as shown for reviewer 2.
- The introduction have been revised by adding information about soil microbial respiration and aggregate formation as "Although, several researchers have reported that the addition of organic materials causes a rapid stimulation of microflora, which increases soil microbial respiration, in response to which extracellular polysaccharides are produced that helps in the formation of soil aggregates (Bossuyt et al., 2001), but the studies investigating the effect of organic amendments in improving the soil structure are inconclusive. For instance, the extracellular polysaccharides and large polyanions can bind clay particles into stable macroaggregates. On the other hand, organic anions can enhance dispersion by increasing the negative charge on clay particles and by complexing calcium with other polyvalent cations (such as those of aluminium), hence reducing their activity in soil solution (Ghosh et al. 2010)".
- We have revised sections 3.1 and 4.1 to make our statements clearer. For example, the reviewer has highlighted a sentence in line 402 "the proportion of small macroaggregates did not increase after the second WD cycle", which was changed to "at the completion of the second WD cycle". (Samples were collected for aggregate size analysis after completion of either 1, 2 or 4 WD cycles). In our revision we will explain the data in more detail and then speculate about the reasons – for example we have included a Figure reference in the text: "The WD cycles result in rearrangement of pores and soil particles and may lead to increased rigidity and stability of soil aggregates (Horn et al. 2014). We observed a marked change in aggregate size distribution with repeated WD cycles (Fig. 1), from macroaggregates (large macroaggregates and small macroaggregates) at completion of the first WD cycle, to microaggregates at completion of the second WD cycle, and back to macroaggregates

(large macroaggregates and small macroaggregates) at the fourth WD cycle. We suggest that extracellular polysaccharides formed by microbial activity (soil microbial respiration, Fig. 3) are responsible for the formation of large macroaggregates at the first WD cycle. At the second WD cycle, the microbial activity greatly decreased (Fig. 3) and macroaggregates (large macroaggregates and small macroaggregates) were broken down into microaggregates and silt+clay"

- The reviewer showed concern about the statement we made about the breakdown of large macroaggregates compared to microaggregates during WD cycles. We will rephrase that sentence as "macroaggregates are more susceptible to disintegration during wet sieving compared to microaggregates at the completion of second WD cycle. By the fourth WD cycle, some rearrangements of soil particles likely occurred, facilitated by soil drying, thereby rebuilding macroaggregates." We could also insert a schematic to illustrate the process.
- The conclusions have been revised as shown for reviewer 2.
- The new citations have now been included at various points in manuscript some of which are Brangari et al., 2022, Freser et al., 2016, Zhang et al., 2022.
- The previously unpublished data has now been published and available online as Niaz et al., 2022. (https://doi.org/10.1016/j.geoderma.2022.116047)
- All the small corrections have been incorporated in the manuscript and the legend to Fig 2 has been inserted.