SOIL Discussions

SOIL Discuss., author comment AC2
https://doi.org/10.5194/soil-2021-94-AC2, 2021

Reply on RC1

Heather C. Kerr et al.

Author comment on "Reusing Fe water treatment residual as a soil amendment to improve physical function and flood resilience" by Heather C. Kerr et al., SOIL Discuss., https://doi.org/10.5194/soil-2021-94-AC2, 2021

Dear Referee,

Thank you for taking the time to provide a review of our paper. Your comments have been well received and we invite you to look over our reply to your comments.

- The introduction is extensive. To my understanding, some of the parts are not necessary considering the topic of the manuscript, as they provided pretty detailed information about issues without a close relation to the use of WTRs to improve (or not) physical soil characteristics. So please, reduce this section maintaining the most relevant ones.

Thank you for this comment. The information contained within the introduction is pertinent to the research, however on reflection we agree it is too long. We have reduced it significantly as suggested and highlighted only the most closely related information.

- On the other hand, I missed more information or comparisons regarding Fe and Al. Unfortunately, there is no discussion about chemical (and/or biological) characteristics which would have improved the holistic approach mentioned several times through the text. Please, add some information about how the salts or compost might modify physical properties based on literature.

A holistic approach to any soil improvement technology would indeed cover chemical, biological and physical characteristics. However confusingly, we refer to a holistic approach meaning that we consider the physical characteristics of water retention, shear strength and hydraulic conductivity as a whole, as in previous literature these are often looked at as individual factors to indicate soil health. The chemical and biological characteristics are interrelated with the physical characteristics, however as per line 47, we do not consider them at this time because we have not studied the chemical and biological interactions of WTR and soil and thus cannot make comment on these as they would be suggestions based purely on other literature. However, since it is the soil microbiome which is responsible for building soil architecture (Neal et al 2020) we feel that this is justified. We will make this clearer in the text that we only consider physical and use these soil structure related measurements as a proxy for soil health...and cite Neal et al 2020.Unfortunately there is very little chemical/biological information on Fe WTR and thus cannot be included even as referenced literature.

- L274: Could you provide more information about the issues?

The issues with settling are caused by the chemicals used to flocculate particles together so they settle and form the sludge. As much, when the dispersant is used, it is not effective at separating individual particles from aggregates and thus settling cannot be achieved. These issues will be highlighted in the text. I DON"T UNDERSTAND THIS, please be more specific, and also you have to be specific about where you address this in the revised paper.

- L 318-321: These lines should be included in the Materials and methods section.

Noted and agreed thank you.

- L384: Any idea why that behaviour for the 30% compost?

Any soil type which is 30% compost is, per volume, mostly compost with disconnected mineral matter and so it is not really a soil at all. The reduction of in permeability of the highly organic amendment under load is similar to the characteristics shown in peat soils (with conductivity around 10^{-9}). We know that compost has a high water retention, and despite organic amended specimens having the highest water content at saturation, we can assume that the permeability is lowest in this case because the pathways through organic matter are much more tortuous than granular soil, despite the large pore space that the organic matter provides.

- The authors highlight the holistic approach of the manuscript. However, it is difficult to see that only assessing physical properties. Please, include in Results and discussion, a section where at least all the physical properties are discussed together.

As discussed above, - yes let's not use the word holistic to describe our viewpoint, this is a really good point - the 'holistic' approach we refer to is an assessment of all physical parameters that indicate a soils health, not just singular measures of water content for example. As suggested, these are now discussed together to provide a more complete understanding of how WTR changes the physical characteristics of soil . Instead we propose to use the term total physical potential to frame our understanding of how amendment changes a soils many different physical characteristics

- Do the authors have any hint about how soil aggregates would change with the different applications?

If this comment refers to how soil aggregates would change in response to different amendment types, then we don’t have the answer yet. We have not looked at aggregate stability of differently amended soils further than preliminary tests. We used drop testing for erosional mechanics and fall cone penetrometer, but these yielded results that had such large error associated that we could not form a conclusion. Further work is needed to see how amendment type changes soil aggregation, at this point we can only refer to known roles (from the literature) of Fe and organic matter in soil aggregation as suggestions to how amendment will change it.

If this question means how can WTR and soil mixes be used in other applications; a highly WTR amended soil would be well suited to applications where shear strength and permeability are key features, such as retaining structures or non-vegetated areas (under car parks etc). Soils amended with lower fractions of WTR or WTR and compost would be best suited to soils that are likely to be vegetated or have fewer structural requirements.