Reply to Editor Comments on Manuscript IJERPH-2243654 Title: Biochar blended with nitrogen fertilizer promote maize yield by altering soil enzyme activities and organic carbon content in Black soil

Thank you very much for giving us the opportunity to revise our manuscript. We appreciate reviewer very much for the positive and constructive comments and suggestions concerning to our manuscript. We have carefully studied the reviewers' comments and have revised the manuscript.

The main corrections in the paper and the response to the comments are as following:

Sun et al. conducted field experiments to explore the response of the stability mechanism of the soil aggregates, the dynamic properties of organic carbon, and changes in the microbial community structure to biochar. The results help to the sustainable utilization of Mollisols resources.

I have several suggestions that may improve the manuscript.

1. Line 37, (Zhang et al. 2018; Eswaran et al., 2011).

◆ Author response: Made the change as suggested. **Line-33**

2. Line 39, increased poor?

◆ Author response: Thanks for catching this. The sentence was rewritten as "However, the Mollisols has been severely degraded by intensive continuous cultivation and soil erosion, which has led to a vicious cycle of soil ecosystem destruction and *soil impoverishment*, with far-reaching effects on global climate change" **Line33-35**

We have corrected the improper words, expressions, and the spelling and grammatical errors in the revised manuscript.

3. Line 94, E.-L. et al. 2014?

◆ Author response: We appreciate your careful review. Made the change as suggested. (Ng et al. 2014) **Line91**

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Does the chemical nature of soil carbon drive the structure and functioning of soil microbial communities?

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Ng, E. L., Patti, A. F., Rose, M. T., Schefe, C. R., Wilkinson, K., Smernik, R. J., et al.: Does the chemical nature of soil carbon drive the structure and functioning of soil microbial communities? Soil Biology and Biochemistry. 70 (2014) 54-61. http://dx.doi.org/10.1016/j.soilbio.2013.12.004, 2014.

4. Line 166, $W_t = M_i/M_t \times 100\%$?

   ◆ Author response: Thank you for your suggestion. Made the change as suggested. **Line162**

5. Lines 186-188, remove these sentences as they are not methods.

   ◆ Author response: Made the change as suggested. These sentences have been deleted.

6. Line 222, in figure 1, the X axis represents different treatments, how to fit the data with the Y axis? So please remove the fit line in the figure. It is more suitable to use a box plot to show the results. Similar mistakes also occurred in figure 4 and figure 7, please revise carefully.

   ◆ Author response: Since the overall treatment at the cross-coordinate is not continuous, so my fitted curve is a segmented fit. In the segmented fit the treatment is continuous, with a continuous increase in biochar application as a regular change in environmental factors, where Figure 1 Figure 4 is reasonable. However, we are glad to accept the reviewer's suggestion. To avoid distressing the reader, we have used a box plot for Figure 7 to present our results. **Line288**

7. Line 266, change C3+N1/2 to C3N1/2, please keep consistency in the MS

   ◆ Author response: Thank you for your suggestion. We also checked the accuracy of the words in the manuscript. **Line259**

8. Line 272, in figure 5, please remove the correlation coefficient with 1, no need to show.

◆ Author response: Thank you for your suggestion. Made the change as suggested. **Line265**
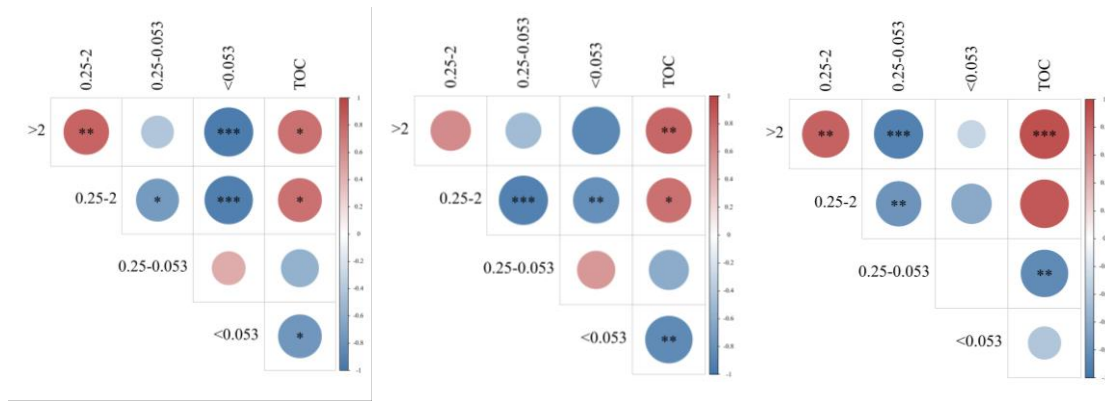
Figure 5 The correlation between the total organic carbon (TOC) and the aggregate contents of the different particle sizes in the soil profile (from left to right: 0–10 cm, 10–20 cm, and 20–40 cm).

9. Lines 305-306, the results showed that the first 3 principal components (F1-F3) explained 90.13% of the total variance.

◆ Author response: Thank you for your suggestion. Made the change as suggested. **Line298-299**

10. Line 376, where is Table 2?

◆ Author response: Thank you for reminding us. We have changed Table 2 to Table S2. **Line368-370**

11. Lines 445-446, the authors conclude that "Based on the sequestration of SOC and the sustainability and stability of the ecosystem, we selected C3N1/2 as the most reasonable biochar ratio.", however, according to table 1, C2N1/2 is the best.

◆ Author response: Thank you for your reminder. We have corrected it. "Based on the sequestration of SOC and the sustainability and stability of the ecosystem, we selected C2N1/2 as the most reasonable biochar ratio. " **Line441-442**

12. More discussion is needed to explain why N addition affects soil aggregate stability.

◆ Author response: Thank you for your useful advice. We added an explanation of this section." Nitrogen fertiliser is also an important source of organic matter for the soil, Gao et al. (2019) proposed that nitrogen fertilizer treatment increased the content of soil clay-humus complexes, which contain a lot of active functional groups that, upon adsorption of soil Ca^{2+}, can combine with clay minerals to form clay-humus complexes. " **Line350-362**

"The addition of N fertiliser alleviated the carbon limitation of soil microorganisms, supplied sufficient nutrients to plants and increased the input of above-ground apoplankton and roots while improving crop yields. Overall the increased stability of agglomerates results from increased root activity and the significant role of exogenous carbon as a binder for soil particles (Wang et al. 2019)." **Line377-381**

13. In short, I think this study is interesting, however, more revisions are needed, as I listed above. Please also check English carefully and make the MS more concise, logical, and readable.

◆ Author response: As suggested, all the words, sentences and grammars have been carefully checked throughout the paper by us and native English speaker, in which the improper words, unclear terms, and grammatical errors have been edited. We believe that the written English and the readability substantially improved in the revised manuscript.