

# ***Interactive comment on “Straw incorporation increases crop yield and soil organic carbon sequestration but varies under different natural conditions and farming practices in China: a system analysis” by Xiao Han et al.***

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Dear respected Referee #1 (R#1), Thank you so much for your valuable comments and helpful suggestions. We have fully studied your review and revised the MS substantially. In your several comments, it seemed that “crop yield response” has been confused with “crop yield”. In our study, “crop yield response” is the change of crop yield due to farming practice, such as straw incorporation.

R#1: The authors present a meta-analysis about the effects of straw incorporation

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on crop production and SOC sequestration. The methods are technically sound. The authors also consider the effect of climate, straw carbon input, N fertilizer, and duration. This paper confirmed that straw incorporation did create a positive feedback loop of SOC enhancement together with increased crop production which is of great practical significance to agricultural management. However, I think that there is some part to be improved. Please edit closely for English. The sentences are often very long (even 5 lines) and, thus, difficult to follow and absorb immediately (i.e. P10 (line 21-26)). There were many repeats of results in the discussion section. I hope that authors could improve it.

[Responses]: Thank you for the encouragement. We'll improve the Discussion section to avoid the repetitive sentences of results. The language will be further refined by our author, Professor Jennifer Dungait from Rothamsted and Professor Roland Bol from Juelich Center.

R#1: 3.1 Why only consider the impact of N and K, how the effect of P fertilizer?

[Responses]: Actually, we also considered the effect of P fertilizer in the study, which was stated in section 2.4. However, after the stepwise regression analysis has been finished, only the variables of SOC, N, and K were kept and P was excluded. We will clarify this in the MS.

R#1: In the result part, I suggest that authors deleted the range (i.e. range 2.3%–14.5%)

[Responses]: Agreed and will revise accordingly.

R#1: P6 line 24-26 “with high levels of straw input corresponding to mean increases of 28.4% (range 18.6%.....(mean 6.9%, range 2.3%–14.5%) straw input (Table 3).” 28.4% of what, I think it is of crop yield.

[Responses]: Here, the “28.4%” refers to the crop yield response at the high level of straw input. We'll improve these sentences to avoid misunderstanding.

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R#1: P6 line 19-22 “Meanwhile, yield increases greatly varied between crops: 8.7% (range 4.1%–20 13.5%). . . . .the yield response to straw incorporation became smaller (Fig. 4).” I don’t understand the means of this sentence. Here, the yield increase refers to the straw incorporation or control? And could you explain it in the discussion part?

[Responses]: The yield increase/response referred to the yield increase under straw incorporation relative to the control (straw removal). The sentences will be revised as “Yield response to straw incorporation was greater when the yield of control (straw removal, or background crop yield) was low and, as the yield of control increased, the yield response became smaller (Fig. 4)”. The discussion will be added as suggested.

R#1: P6 line 26 Crop yield responses generally increase. . . . ., delete the “responses”.

[Responses]: As responded above, “responses” should be used instead of deleted, to reflect the interactive effect of straw×mineral N fertilization.

R#1: P8 line 9-11: This yield increase is similar in magnitude to a recent global. . . . . those of the EU (6% increase; Lehtinen et al., 2014).” Could you explain the reason for this differences?

[Responses]: The reason might be the different climate zones in the EU and our study. Specifically, experimental sites in the Mediterranean, a typical climate zone of Europe, accounted for 25% of the database in the study of Lehtinen et al. (2014). These sites mostly exhibited a yield decrease under straw incorporation, thus lowered the mean yield responses of the EU. We’ll address in the revised Discussion.

Lehtinen, T., Schlatter, N., Baumgarten, A., Bechini, L., Kruger, J., Grignani, C., Zavattaro, L., Costamagna, C., and Spiegel, H.: Effect of crop residue incorporation on soil organic carbon and greenhouse gas emissions in European agricultural soils, *Soil Use Manage*, 30, 524–538, doi:10.1111/sum.12151, 2014.

R#1: P8 line 19 and the greater the annual straw-C input. . . Change “and” to “And”

[Responses]: Agreed and will revise accordingly.

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R#1: P8 line 26-29: “Furthermore, N fertilizer addition can enhance both above and belowground biomass production (Ladha et al., 2011; Neff et al., 2002; Kuzyakov and Domanski, 2000), increasing the input of crop roots to stable SOC pools (Gong et al., 2012).” I think this sentence should be improved.

[Responses]: Agreed. This sentence will be revised as “Furthermore, N fertilizer addition can enhance both above and belowground biomass production (Ladha et al., 2011; Neff et al., 2002; Kuzyakov and Domanski, 2000), which will result in a higher crop yield and the improvement of SOC (Gong et al., 2012)”.

R#1: P8 line 34 “...straw incorporation effect on SOC was observed between the four...” change “between” to “among”

[Responses]: Agreed and will revise accordingly.

R#1: P 9 line1-2 “compared to large-scale increases in SOC in the majority of crop-lands in NC, NWC, and SC.” Here, the SOC means SOC stocks?

[Response]: Yes, the SOC here means SOC stocks. We’ll add this to the revised MS.

R#1: P 9 line3: According to a farmer survey across China carried out by (Zhang et al.,2017), Change it to “According to a farmer survey across China carried out by Zhang et al. (2017)

[Responses]: Thanks, and will revise accordingly.

R#1: P 9 line6: “The impact of land use, MAT, and MAP on straw-induced SOC sequestration was not. ....and Huang et al. (2012).” to “The impacts of land use, MAT, and MAP on straw-induced SOC sequestration were not statistically significant (Fig. 5;  $P > 0.05$ ), in agreement with the previous meta-analyses of Liu et al. (2014) and Huang et al. (2012).”

[Responses]: Agreed and will revise accordingly.

R#1: P 9 line9: “this wetting and drying cycles” change “this” to “these”

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[Responses]: Agreed and will revise accordingly.

R#1: P 9 line8-11: “Since alternative wetting and drying has been wide. . . . leads to a less stable form of SOC in paddy soils (Cui et al., 2012).” This is a long sentence, and change “increases”, “leads” to “increase” and “lead”.

[Responses]: Agreed and we are going to refine all these long sentences.

R#1: P 9 line 23-27: “The lower estimates reported in previous studies focused on shorter time periods.....were included in the analysis by Wang et al. (2015) and Huang et al. (2013).” This is a long sentence.

[Responses]: Same as above.

R#1: P9 line 28: “result of” to “result in”

[Responses]: Agreed and will revise accordingly.

R#1: P9 line 35-36: Change “Straw incorporation does also reduce” to “Straw incorporation also reduces”

[Responses]: Agreed and will revise accordingly.

R#1: P10 (line 7-11) “Our analysis did observe a stro.....(Fig. 4). This observation agrees.....those of wheat or barley.” I think that these two sentences are repeated with each other.

[Responses]: Agreed and these two sentences will be revised as “The beneficial effect on yield response was more for maize (20.8%) than that for wheat (8.7%) (Fig. 4), which agrees with the study of Hijbeek et al. (2017).”.

R#1: P10 (line 10-12): Generally, the maize yields is the highest among the three types of the crop (wheat, rice, and maize). This is not only just because of the temperature and precipitation. What’s more, the result in the paper found that climate has no significant effect on the response of SOC to straw incorporation.

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[Responses]: As mentioned above, here we discussed the relative increase of maize yield induced by straw incorporation, instead of the absolute maize yield. We found that under straw incorporation, yield increase was higher for maize than for wheat. This is most likely due to hotter and humid condition in the maize season than that in the wheat season (Tan et al., 2017). Hotter and humid condition stimulated the straw decomposition and released fast and more nutrients to crop production (Hartmann et al., 2014; Ladha et al., 2011). Here, we focused on crop yield responses, rather than the SOC responses.

Hartmann, T. E., Yue, S., Schulz, R., Chen, X., Zhang, F., and Müller, T.: Nitrogen dynamics, apparent mineralization and balance calculations in a maize–wheat double cropping system of the North China Plain, *Field Crop Res*, 160, 22–30, doi:10.1016/j.fcr.2014.02.014, 2014.

Ladha, J. K., Reddy, C. K., Padre, A. T., and van Kessel, C.: Role of nitrogen fertilization in sustaining organic matter in cultivated soils, *J Environ Qual*, 40, 1756–1766, doi:10.2134/jeq2011.0064, 2011.

Tan, Y. C., Xu, C., Liu, D. X., Wu, W. L., Lal, R., and Meng, F. Q.: Effects of optimized N fertilization on greenhouse gas emission and crop production in the North China Plain, *Field Crop Res*, 205, 135–146, doi:10.1016/j.Scr.2017.01.003, 2017.

R#1: P10 (line 22) “In China, the areas where triple cropping was adopted usually received adequate rainfall (MAP > 1000 mm, Table S1)” I think the yield increase is due to the temperature and precipitation.

[Responses]: We agreed that straw incorporation could improve crop yield by improving soil water retention as well as reducing abrupt fluctuations in soil temperature. The low soil water availability and low temperature are likely to be limiting factors for crop yield especially in the single cropping areas (MAP: 117~716 mm, MAT: 0.9~11.5 degrees centigrade; Table S1) compared with that in triple cropping areas (MAP > 1000 mm, MAT: 14.8~17.6 degrees centigrade; Table S1). Thus, straw incorporation might

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contribute more benefits for crop production in the single cropping areas compared to that in triple cropping areas. We'll revise the manuscript.

R#1: P11 (line 5) "crop yield responses increased and peaked at around 15-year and then declined." Delete "responses"

[Responses]: As responded above, the crop yield response was the effect size to explore the effect of straw incorporation on crop yield. Here, it was the crop yield increment increased and peaked at around 15-year, so "responses" should be kept.

R#1: P11 (line 7-8) Change "and the positive role of straw incorporation can play in China and global sustainable agriculture." to "and the positive role of straw incorporation playing in China and global sustainable agriculture."

[Responses]: Agreed and will revise accordingly.

R#1: Table 2 Add the information about the soil type of the different regions.

[Responses]: Agreed and will add soil types in the revised Table.

R#1: "Table 1:" to "Table 1."

[Responses]: Agreed and will revise accordingly.

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