Biogeosciences Discuss.,
doi:10.5194/bg-2015-620-AC3, 2016

Biogeosciences Discussions

Interactive comment on "Greenhouse gas emissions and reactive nitrogen releases from rice production with simultaneous incorporation of wheat straw and nitrogen fertilizer" *by* Longlong Xia et al.

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Received and published: 1 June 2016

Dear Prof. Richard Conant and Reviewer, On behalf of my co-authors, thank you very much for your positive and constructive comments on our manuscript. We have carefully studied the comments and have made corrections which we hope to meet with approval. Please see the attached point-by-point responses and the tracked change version of manuscript for your further evaluation. All revised positions mentioned in the responses can be readily found in the attached clear version of manuscript.

Response to Reviewer's comments: Reviewer 2: Specific comments 1. 1. Abstract:

Authors employed the meta-analysis to calculate the various Nr losses. As an important part of this study, the results of the meta-analysis should be simply presented in the abstract. Moreover, it would be better if the abstract is concisely shortened, since some findings in the current version were insignificant, e.g., L34 'while methane emission . . ...wheat rates increased'. Response: Thanks very much for your comment and suggestion. According to your suggestion, we have presented the main findings of the meta-analysis in the abstract. We have also concisely shortened the abstract (please see Line 24-53).

2. L71-72, specify the current water and straw application methods. Response: Thanks for your comment and sorry for our unclear expression. We have specified the water and straw application methods (please see Line 78-79).

3. L140 Using the relationship of straw input rate and SOCSR of previous study to calculate the SOC changes is fine, since both of the studies have similar climatic conditions, cropping history and agricultural practices. But the uncertainty should be noticed and can be discussed in the result and discussion part. Response: Thanks for your good suggestion. According to your suggestion, we have noticed the uncertainty induced by the SOCSR calculation method and discussed it in the results and discussion part of 'CH4, N2O emissions and SOSCR'. Moreover, we also presented the reasons why we hold the opinion that the SOCSR calculation method in this study is appropriate, and the uncertainty incurred by this method unlikely affects the main conclusions of this study (please see Line 305-323).

4. L193-205. The environmental cost evaluation is interesting. But, why treated N2O as a GHG when conduced this evaluation, since it is both a GHG and Nr species? Response: Thanks for your comment. N2O is both a GHG and Nr species, but its environmental cost was calculated as a GHG here. This is because the cost of N2O emission as Nr species is mainly to damage human health (Gu et al., 2012). But the effects of Nr losses on the direct damage costs of human health were not included in this study, which are very difficult to quantify. The environmental costs included in

this study mainly refer to the global warming incurred by GHG emissions, soil acidification incurred by NH3 and NOX emissions, and aquatic eutrophication caused by NH3 emissions, N leaching and runoff (Xia and Yan, 2012). We have added such reasons in the methodology to make it clearer (please see Line 207-209). References: Gu, B., Ge, Y., Ren, Y., Xu, B., Luo, W., Jiang, H., Gu, B., Chang, J.: Atmospheric reactive nitrogen in China: Sources, recent trends, and damage costs, Environ. Sci. Technol., 46, 9420-9427, 2012. Xia, Y., Yan, X.: Ecologically optimal nitrogen application rates for rice cropping in the Taihu Lake region of China, Sustain. Sci., 7, 33-44, 2012.

5. L275-280. This discussion needs to be concise, since the effect of N fertilizer on CH4 emission is beyond the focus of this study. Response: Thanks for your suggestion. According to your suggestion, we have simplified the relevant discussion (please see Line 291-293).

6. L289-290. The calculation of the N2O emission factor needs to be specified in the methodology. Response: Thanks for your correction. According to your suggestion, we have specified the calculation of the N2O emission factor in the methodology (please see Line 217-222).

7. L345. Does the straw application affect the Nr losses (e.g., N2O and NH3 emission) and the subsequent calculation of Nr intensity? Response: Thanks for your comment. Previous studies have proven that direct incorporation of crop straw had insignificant effects on various Nr releases (Xia et al., 2014). Because the majority of N contented in the crop straw is not easily degraded by microorganisms in a short-term period, and can be stabilized in soil in a long-term period, rather than being released as various Nr (Huang et al., 2004; Xia et al., 2014). For instance, a meta-analysis, integrating 112 scientific assessments of the crop residue incorporation on the N2O emissions, has reported that the practice exerted no statistically significant effect on the N2O releases (Shan and Yan, 2013). Therefore, the effects of wheat straw incorporation on various Nr losses were considered as negligible in this study. Moreover, previous studies have also proven that straw incorporation exerted little impacts on grain yield. For instance,

a meta-analysis conducted by Singh et al. (2005) have found that incorporation of crop straw produced no significant trend in improving crop yield in rice-based cropping systems. Moreover, based on a long-term straw incorporation experiment established since 1990 in the TLR, Xia et al. (2014) have reported that long-term incorporation of wheat straw only increased the rice yield by 1%. Therefore, in the present study, the effects of straw incorporation on NrI were considered as inappreciable. We have presented such reasons in the results and discussion part to make it clearer (please see Line 255-262 and Line 396-405). References: Huang, Y., Zou, J., Zheng, X., Wang, Y., Xu, X.: Nitrous oxide emissions as influenced by amendment of plant residues with different C: N ratios, Soil Biol. Biochem., 36, 973-981, 2004. Shan, J., Yan, X.Y.: Effects of crop residue returning on nitrous oxide emissions in agricultural soils, Atmos. Environ., 71, 170-175, 2013. Singh, Y., Singh, B., Timsina, J.: Crop residue management for nutrient cycling and improving soil productivity in rice-based cropping systems in the tropics, Adv. Agron., 85, 269-407, 2005. Xia, L., Wang, S., Yan, X.: Effects of long-term straw incorporation on the net global warming potential and the net economic benefit in a rice-wheat cropping system in China, Agric. Ecosyst. Environ., 197, 118-127, 2014.

8. L377-378. I don't think the GHGI and Nr have to have some speciïňĄc relationship, although the N production and fertilization can both affect them. Response: Thanks for your comment and sorry for our unclear expression. We have deleted such sentence. What we wanted to present is that extra attention should be paid to the interrelationship between the NrI and GHGI, which could provide hints for the mitigation purpose. For instance, N fertilizer production and application is an intermediate link between the NrI and GHGI (Chen et al., 2014). For the NrI, N fertilization promotes various Nr releases, exponentially or linearly (Fig.4), while N production and application made a secondary contribution to the GHGI (Table 4). Such interrelationships ought to be taken into account fully for any mitigation options pursued, in order to reduce the GHG emissions and Nr discharges from rice production simultaneously (Cui et al., 2013b; Cui et al., 2014) (please see Line 408-415). References: Chen, X., Cui, Z., Fan, M., Vitousek,

P., Zhao, M., Ma, W., Wang, Z., Zhang, W., Yan, X., Yang, J.: Producing more grain with lower environmental costs, Nature, 514, 486-489, 2014. Cui, Z., Yue, S., Wang, G., Zhang, F., Chen, X.: In-season root-zone N management for mitigating greenhouse gas emission and reactive N losses in intensive wheat production, Environ. Sci. Technol., 47, 6015-6022, 2013b. Cui, Z., Wang, G., Yue, S., Wu, L., Zhang, W., Zhang, F., Chen, X.: Closing the N-use efficiency gap to achieve food and environmental security, Environ. Sci. Technol., 48, 5780-5787, 2014.

9. L428. The 'ecological compensation mechanism' is a good idea to encourage famers to adopt knowledge-based agricultural managements. To make it clearer, authors need to provide more details about that rather than just giving a mention. Response: Thanks for your good suggestion. According to your suggestion, we have added more details to make the 'ecological compensation mechanism' clearer (please see Line 458-467).

Reviewer 2: Some further remarks 1. L 72, delete 'the' Response: Thanks for your correction. We have revised it according to your correction (please see Line 80).

2. L 98-101, long sentence, needs to be split. Response: Thanks for your correction. We have revised it according to your correction (please see Line 105-108).

3. L102, N2O should be 'nitrous oxide (N2O) Response: Thanks for your correction. We have revised it according to your correction (please see Line 110).

4. L116, delete 'an' Response: Thanks for your correction. We have revised it according to your correction (please see Line 124).

5. L196, 'was' should be 'were' Response: Thanks for your correction. We have revised it according to your correction (please see Line 201).

6. L230, replace 'to a reasonable rate' with 'reasonably' Response: Thanks for your correction. We have revised it according to your correction (please see Line 241).

7. L233, delete 'without threatening food. . .study' Response: Thanks for your correc-

tion. We have revised it according to your correction (please see Line 244-245).

8. L252, replace 'produced' with 'showed' Response: Thanks for your correction. We have revised it according to your correction (please see Line 264).

9. L335, 'manufacture' should be 'production' Response: Thanks for your correction. We have revised it according to your correction (please see Line 360).

10. L348, delete the sentence Response: Thanks for your correction. We have revised it according to your correction (please see Line 375).

11. L427, 'has' should be 'have' Response: Thanks for your correction. We have revised it according to your correction (please see Line 459).

12. L443, delete 'as well' Response: Thanks for your correction. We have revised it according to your correction (please see Line 478).

13. Table 1-6, the abbreviations in the table titles should be self-explained. Response: Thanks for your correction. We have revised it according to your correction (please see the tables).

Once again, thank you very much for your constructive comments and suggestions.

In addition, we also polished the English expressions in the whole manuscript and redrew Figure 5. All changes in the manuscript will not influence the main conclusions of the paper. And here we did not list the changes but marked in red in the attached tracked change version of manuscript. We appreciate Editor/Reviewer's warm work earnestly, and hope that the correction will meet with approval.

Yours sincerely, XiaoyuanYan on behalf of all authors

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/bg-2015-620/bg-2015-620-AC3-supplement.pdf