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Biogeosciences Discussions

Interactive comment on "Effect of iron oxide on nitrification in two agricultural soils with different pH" *by* Xueru Huang et al.

Anonymous Referee #1

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The manuscript focuses on effects of iron oxide on nitrification in two agricultural soils with different pH, which is within the scope of Biogeoscience. Nitrification is a key process in the global nitrogen cycle. This paper has an interesting topic and using 15N stable isotope method in this study is appropriate for assessing iron oxide effects on net nitrification, gross mineralization, and microbial immobilization. However, parts of the manuscript are unclear, missing key information, and require further clarifications and better interpretation. This manuscript would also benefit from language editing by a native speaker. Specific comments:

1. P. 1, L. 9-19: The abstract needs to be more descriptive. Variations in what way? 2. P. 3, L. 64: Please show the date of soil sampling and management history of the land. 3. P3., L70 and Table 1. Statistical data is missing from Table 1. What is "Available Fe" in Table 1? How was it determined? In addition, redox potential (Eh)

of soil is important to understanding your data, but it is missing. 4. P. 3, L. 77-79: You adjusted the pH of ferrihydrite suspensions to 5.1 and 7.8, respectively, by using KOH. What's the original pH of ferrihydrite suspension? It would be helpful if some basic properties of the Fe oxide were measured, such as specific surface area, zero point of charge, cation exchange capacity and anion exchange capacity. Moreover, X-ray diffraction analysis was performed, but this information was not presented and discussed in the results and discussion sections. 5. P. 3, L. 89-91: More details are needed regarding the measurements of total Fe and free Fe oxides. Free Fe oxide data was not presented in the results and discussion sections. Please note "free Fe oxide" in soil cannot be used to represent "available Fe". 6. P. 4, L. 92-98: It is not clear as to what experimental design was used in this study. 7. P. 4, L. 97: Please justify why soil moisture content was adjusted to 100% WHC? 8. P. 5, L. 133-136 and Figure 1: LSD test is needed in Figure 1, especially if you want to show a significant decrease in NH4-N. 9. General comments on the Results and Discussion sections: In the acidic soil, amendment of Fe oxide resulted in a decrease in microbial biomass, likely due to accumulation of Fe2+ (Figure 4). 10. P6 L. 164-165: The addition of Fe oxide stimulated the net nitrification rate in the low pH soil (pH 5.1) ($F = 63.13$; $P = 0.048$), but suppressed it in the high pH soil (pH 7.8). In the acidic soil, amendment of Fe oxide resulted in a decrease in microbial biomass (Fig. 3), due to toxic effect of Fe2+(Fig. 4). However, the increased gross mineralization and nitrification in the Fe oxide amended soil (Fig. 2) seems to conflict with the decreased microbial biomass (Fig. 4). Similarly, in the high pH soil (7.8), it is difficult to understand that enhanced microbial biomass in the Fe oxide amended soil (Fig. 4) would result in decreased gross mineralization and nitrification.

In general, at pH7.8, Fe oxide in soil is quite inertial. The significant decrease in gross mineralization and nitrification and a significant increase in microbial biomass by amendment of 3% Fe oxide are unexpected.

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