

Reviewer 1: Jiyin Li and co-authors investigated the effects of monoculture plantation or mixed N-fixing tree species on soil phosphorus transformation in a eucalyptus plantation soil, they further tried to find explanatory biotic and abiotic factors for changes in transformation of phosphorus. I find this research potentially could contribute to our understanding of long-term (seventeen years) eucalyptus plantation soil restoration via introducing N-fixing tree species, particularly the interaction between two most important soil elements, i.e., N and P and related microbial diversity and network complexity. Overall, the topic was suitable for *Biogeosciences*, and would give some new points to the huge amount of soil nutrient restoration studies. But before it could be accepted for publishing, I have some questions and suggestions on the manuscript. First is a more detailed introduction on the experimental design, it would be ideal for providing detailed aspects of management (e.g., fertilizer amount and frequency, pesticide use) of the experimental plots. Second, I found the Materials and Methods was lack of relevant references. The authors should provide more references about the measuring methods of Soil properties and soil enzyme activity. Third, the organization and language of the paper need still need further modification. For example, in the discussion part, some contents belong to the repetition of the results, and the related and cited results can be summarized as supporting evidence without listing too many specific values (e.g., L404-406, L426-427, L487-490).

Response: We greatly appreciate your comments and suggestions, which are valuable in improving the quality of our manuscript and we will make necessary modification throughout the text. We believe the revision is much improved as a result of our modifications.

Specific comments:

1. L-26-L28: Please reorganize the sentence.

Response: Thank you for your suggestion. We have rephrased the sentence to avoid the confusion.

2. In this paper, your dissertation focuses on the introduction of N-fixing tree species to promote soil phosphorus transformation, but a description of the characteristics of N-fixing tree species is lacking in the introduction, please clarify.

Response: Thanks for pointing this out. More detail about the N-fixing tree species characteristics is provided in the Introduction section.

3. L-93: There is a notation error here.

Response: Corrected.

4. In the text, N-fixing tree should be changed to N-fixing tree species.

Response: Changed throughout the text.

5. Line 135 “soil extracellular enzymes” should use the abbreviation.

Response: Corrected.

6. In the text, you characterize the conversion of N and P in terms of soil enzyme activity, but you don't have a specific sentence in the text to describe it.

Response: Thanks for your comments. We indeed use acid phosphatase (ACP) to define P transformation, and we have added the expression that P transformation refers to ACP enzyme activity.

Relevant references are as follows:

- [1] Nannipieri, P., Giagnoni, L., Landi, L., Renella, G.: Role of phosphatase enzymes in soil. *Phosphorus in action: biological processes in soil phosphorus cycling*, 215-243, https://doi.org/10.1007/978-3-642-15271-9_9, 2011.
- [2] Yu, Q., Ma, S., Ni, X., Ni, X., Guo, Z., Tan, X., Zhong, M., Hanif, M. A., Zhu, J., Ji, C., Zhu, B., Fang, J.: Long-term phosphorus addition inhibits phosphorus transformations involved in soil arbuscular mycorrhizal fungi and acid phosphatase in two tropical rainforests. *Geoderma*, 425, 116076, <https://doi.org/10.1016/j.geoderma.2022.116076>, 2022.
- [3] Wang, Y., Luo, D., Xiong, Z., Wang, Z., Gao, M.: Changes in rhizosphere phosphorus fractions and phosphate-mineralizing microbial populations in acid soil as influenced by organic acid exudation. *Soil Till. Res.*, 225, 105543, <https://doi.org/10.1016/j.still.2022.105543>, 2023.

7. L-93: Wrong colon space on this line.

Response: Corrected.

8. L262-263: You write “Significant ($P < 0.05$) increases in were determined in both soil layers of the MPs and PPs”, I think it would be more precisely if you write “Significant ($P < 0.05$) higher of were determined in both two investigated soil layers in MPs than those in PPs ”

Response: Corrected.

9. L-374: Missing comma after “soil properties”.

Response: Thanks for pointing this out. We have carefully checked and made necessary modification throughout the text.

10. L-439: Which specific result indicates that pH is the most crucial factor affecting microorganisms?

Response: Specified.

11. L441-L443: This sentence appears to have no correlation with the context and it is recommended to delete it.

Response: Deleted.

12. L-449-450: It is recommended to restructure the sentence to indicate that Proteobacteria encompasses Rhizobia.

Response: We have carefully checked the entire sentence and made appropriate.

13. L-454-455: The sentence is repetitive in meaning.

Response: Corrected.

14. The discussion indicated that these key microbial groups could increase the complexity of the network, but there were no corresponding results to support this view.

Response: Thanks for the comments. The corresponding results were shown in Fig. 4 and Fig. 5 in the Results section, and we will add some relevant descriptions in the Discussion section.

I highly value the large amount of work carried out by the authors. I hope my remarks will be

Response: Thanks for your good comments.