

Dear Editor and Reviewers,

Thank you for the careful review and insightful feedback on our manuscript “Discrepant long-term nitrogen mineralization in soil at early and later period after fertilization” (egosphere-2024-330). We are grateful for the two anonymous reviewers for the many constructive and valuable comments for us to improve the quality and clarity of our manuscript. These reviews made us realize that we missed some key information or not justify many points well that have caused many concerns or confusions. We believe we can significantly improve the paper and can address each of the comments in a revised version of the manuscript. One of the main reasons is that the paper reports findings from long-term field experiment up to ~ 30 years and from different geographical locations and no such studies existed in our knowledge; thus, it will fill many knowledge gaps regarding what effects of long-term organic (manure in this case) amendments as a nutrient source have on soil carbon, nitrogen and other nutrients and implications on soil ecosystem functions, nutrient management, and environmental aspects. We realize that we can achieve these by making our best efforts, which was not done well previously. Thus, we would like to request sometime to address the reviewers’ comments and be able to achieve much more with the data. In the revision, we will ensure to provide a clear rationale to elucidate the significance of long-term N mineralization study, an abstract that is precise and substantive, a detailed exposition of the experimental design and its significance, examine the data, and synthesize all information for reporting results clearly, making meaningful discussions, and drawing concrete conclusions. We will address the English writing and grammatical issues. Our response or intent to revise the paper are listed below in dark-blue text following each comment:

Dear Editor,

I understand this manuscript proposes how the calculation of “long-term” N mineralization rates is important and that most studies have focused on “short-term” rates. While this may be the case, the manuscript does not develop a clear rationale as to why these long-term rates are needed and how they will help fill a critical knowledge gap in our understanding of N cycling. Thus, I am unable to recommend publication of

this manuscript in its current form as it requires revisions that go beyond a major revision. Systematic unclarity in the writing and grammatical issues makes the quality of the science difficult to assess.

Thanks for this critical comment for the paper. To be brief here, the rationale as to why these long-term N mineralization rates are needed is mainly because we have been promoting nutrient cycling such as using manure in crop production, although most conventional farmers are still using mainly synthetic fertilizer for different reasons. Nitrogen dynamics is an important feature that affect soil nutrient statues and management decision making. Many studies on N mineralization rates are conducted in the lab or short-term. We realized that our long-term experiments in multiple geographical locations can bring some new (as no one has done this before) if we can examine them well. Although we do realize that large field variability and multiple environmental/geographical variable may not make it easy as some of the comments have been made on this, we believed it is a worthwhile attempt as this new knowledge will benefit us all for better understanding of N cycling, pros and cons of the different fertilization regimes, and further guide our decision-making. We will add this information and organize better in the introduction to justify the importance why we conducted this research. The new knowledge can guide further nutrient management practices, especially in using both organic and mineral fertilizers for the intensification of cropping systems under long time scales.

We also acknowledge the need for improvement in the clarity of our writing and grammatical issues. We will seek for professional editing help and/or introduce some experts in the research field and also English-speaking professional to help revise the manuscript so that we will ensure that the scientific content will be presented in a clear and coherent manner, facilitating a more accurate assessment of the quality of the research.

Because the manuscript does not contain continuous line numbers, it is difficult to provide a detailed review. Below I highlight the range in which specific issues require attention

We will make sure to use line numbers for each line in the revised manuscript.

Specific comments (not an exhaustive list):

1. Title, I suggest editing the title because “early” and “later” period are not concrete and it is unclear what timeframe they represent

We will replace the “the first decade” and “the later period” with more common used and concrete terms such as “the first ten years” and “after 10 years” in the full text. And we will revise the title “Discrepant long-term nitrogen mineralization in soil at early and later period after fertilization” to be more straightforward such as “Changes in soil nitrogen mineralization rate with time from long-term fertilization”.

2. Abstract, Not accurate. First, mineralization covers many elements, not just N. Second, N mineralization calculations also include the conversion of NH_4 to NO_3 . Third N mineralization does not always balance crop N uptake and N loss

We will revise the sentence to “Soil nitrogen (N) mineralization is a process in the N cycle, which converts organic N into more plant available inorganic form (NH_4^+ and NO_3^-), improving N availability for crop growth and also causing potential loss to the environment.”

3. Unclear what is a “residuary” effect. Readers are assumed to know this term and I recommend not assuming this.

We will replace the “residuary” effect to “residual” effect and include an explanation of the term “residual effect”. The residual effect refers to the circumstance wherein immobilized nitrogen and NH_4^+ -N fixed to mineral and organic components may not be readily available to the crop immediately after the application of fertilizers (Sørensen and Jensen, 1995; Sørensen and Amato, 2002) while can be utilized by subsequent crops, a phenomenon known as the residual effect.

4. A case has not been built to support the idea that studying manure application is important.

We will address this concern by providing the rationales as indicated in the response to

the general concern. From quick thoughts, we will include the following: 1) The importance of understanding of N dynamics from mineralization in sustainable crop production by enhancing nutrient recycling, 2) the necessity for meeting crop nutrient requirements, 3) the need for developing best management practices etc. All these are associated with mineralization of manure. Further, field especially long-term experimental data have been rarely studied in this regard although they can provide the most needed net outcome information, which is the strength of this research.

5. Unclear why this particular experimental design is required to answer the question this manuscript is set to answer, which is also difficult to understand. We are told that studying long-term N mineralization is important, but we have not been told why.

The responses to the general comments and that to #4 have addressed most of this concern. From long-term fertilization experiments, we found both total N and available N continuously increased, understanding their relationship and proportional changes directly links to soil property and nutrient availability. We know that immobilized nitrogen and NH_4^+ -N fixed to mineral and organic components may not be readily available to the crop immediately but overtime they can be utilized by subsequent crops. But how much and how fast are what we try to understand, using the calculated annual N mineralization rate by the annual changes of available N to that of total N from the long-term field experiment, that we defined as the long-term N-min rate. Further, these changes over time with varying fertilizers across diverse climate zones and soil types remains unclear. Gaining insight into this phenomenon is beneficial for guiding nutrient management practices to enhance soil fertility, especially when both organic and mineral fertilizers are increasingly practiced for the intensification of cropping systems.

6. L30, I recommend rewriting and updating references as it is now well known that many plants can take up a significant amount of organic N. Also what is “enhanced soil N mineralization” and how does it differ from just N mineralization? I recommend defining N fertilizer use efficiency. Because everything leading to the end of the sentence is unclear, it is also unclear why this enabled sufficient crop yields with reduced risk in N loss.

We totally agree with the comments and will update the references and improve writing accuracy and clarity. We will definitely revise “enhance soil N mineralization” and also the whole sentence to make it clear to understand logically.

7. The use of “therefore” is confusing because the information in the prior sentence does not lead into this section after “therefore.”

We will replace the “therefore” with something more appropriate such as “underscoring”: “Consequently, plants still rely on the mineralization of organic to inorganic N to meet their nitrogen requirements for growth and maximize crop biomass production (Giacomo et al., 2012), underscoring the significant impact of soil N mineralization on crop production.”

8. L40, this is a critical part of the manuscript where the authors must make it very clear why this research is important and why determining long-term N mineralization is critical. It remains unclear why this is important and the introduction needs to build a strong case for this.

We totally agree with the reviewers and truly appreciate that the reviewer mentioned several times about missing such critical information in the previous version of the manuscript. As indicated in the response to the general comments and that to #4, we will be able to add the rationales for this research. We will revise the whole introduction section to address these points and build a strong case for the importance of this research.

9. What are the long-term fertilization effects that occur under field conditions?

We will revise this term or specify it in the revised manuscript, such as “Estimating site-specific N mineralization rate from the long-term field experiment will capture the differences in changes (increase or decrease) in supply of available nutrients levels that consequently impact decision making on fertilization needs.”.

10. L45, the rationale included in these lines is difficult to follow. In particular, it must be clarified what does it mean that the inorganic mineralization substrates are

included in the total N pool and why does this mean that total N would be a good predictor. Then after this sentence we are told often times these are not good predictors. This is confusing.

These were not written clearly apparently. We will revise the sentences to improve clarity.

11. L65, the background in the introduction that would be necessary to understand this objective is not clear, and it is not clear why this information is critical and why the experimental design used is the right approach to answer the question this study is set to answer and how it will advance the field of N biogeochemical cycling.

We again truly appreciate the reviewer's review and acknowledge the need to provide clear rationales in the introduction to help understand why we carried out this study, the objectives, methods used, and implications of the findings. See response to the general comments and that to #4.