

Interactive comment on “The interaction between nitrogen and phosphorous is a strong predictor of intra-plant variation in nitrogen isotope composition in a desert species” by J. Zhang et al.

J. Zhang et al.

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Comment: This paper from Zhang et al. is intituled “The interaction between nitrogen and phosphorus is a strong predictor of intra-plant variation in nitrogen isotope composition in a desert species”. In this paper, the authors aim to demonstrate the origin of the intraplant variations in $\delta^{15}\text{N}$ by looking at its correlations with C,N,P concentration in different parts of the two desert plants in China. Response: We thank this referee for taking the time to review our manuscript. It is NOT our aim ‘to demonstrate the origin of the intraplant variations in $\delta^{15}\text{N}$ ’. Our objective, which was understood well by the first referee, is to “report new measurements of intra-plant variation in ^{15}N , and discuss mechanisms that might be responsible for the observed patterns

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(See Referee #1's review). In this revision, we make sure our objective is clearly stated to avoid misunderstanding.

Comment: In general, this paper lacks details in background and analysis that makes it difficult to follow. In addition, the novelty of the paper stands at the comparison of $\delta^{15}\text{N}$ with other nutrients content and the analysis of a particular plant in China. The analysis of the data is not convincing and lack of deep analysis. Finally, the discussion is long and purely speculative when many of the speculation could have been supported by data eventually. Here are specific details that could help improve the manuscript: Response: While we value this referee's effort to help improve the manuscript, we have hard time to understand some of the comments made by this referee. This is made worse by the fact that symbols do not show up properly in the review text (perhaps because the review was written in a non-English Word editing software). When we feel we have a sufficient understanding of a comment made or when a suggestion is specific enough for us to act, we revise our manuscript accordingly if we deem appropriate. If any misunderstanding occurs on our part, we ask this referee to let us know so that we can improve the manuscript further to address his or her concerns adequately.

Comment: Introduction: This part is too long but somehow informative. Shortening the introduction incorporating specific details on fractionation factors and natural variations of $\delta^{15}\text{N}$. The introduction is plagued by a lack of precision in the words used, especially with unnecessary adverbs and superlative. Response: We try to remove any unnecessary words. Fractionation factors are now given. But we don't completely understand the first two sentences of this comment; each sentence seems to contain contradictory meanings. Please clarify.

Comment:L.70: "plant photosynthesis, growth and metabolism and substrate supply for microbial activities" Why do you speak about microbial activity here, if you have no data to support it, why Photosynthesis if not measured? Response: We are puzzled by this comment. This is in the very first paragraph of the whole paper and we are trying

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to place our particular study in a broader context. Also we are not sure why the referee thinks we need to measure microbial activity and photosynthesis for this study and why the two questions are asked together. Please clarify and help us to understand your intention.

Comment: L.73: “rarer N isotope 15 ” : : : “more abundant” why not using natural isotope composition. Response: Suggestion adopted.

Comment:L. 81: “types of mycorrhizal fungi” Are you planning to measure it? If so where are the data? Do you have measured soil $\delta^{15}\text{N}$? Response: This study is a report on intraplant variations. Future studies should look at these issues.

Comment:L.87: “relatively few studies” what does it mean? Response: This phrase is revised to make it clearer.

Comment: L.86-89: these 2 sentences seem in opposition. Response: Thanks for pointing this out. These two sentences have been revised.

Comment:L.100- 102: If both metabolisms are different could be useful to detail the discrimination factor and why is it so different. Response: Agree. Modeling approaches could be very useful here.

Comment:L.120: “This assumption led to the belief that organic N compounds: : :” It sounds like you are saying that science believes not that science is based on fact! Need to be rephrased. Response: Suggestion adopted.

Comment: L.129: “which has a large isotope effect” how much? Response: Information is now added.

Comment: Material and methods It is surprising that no analysis of the soil $\delta^{15}\text{N}$ was carried out. Statistical analyses: No detail on the analysis of slope of the regression was given. Arcsin analysis of slope sounds appropriate. Please explain how you obtain your p values in the correlations. Response: The present study focuses on intraplant variations rather than the difference between the whole-plant $\delta^{15}\text{N}$ and the

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nitrogen sources. Although characterization of nitrogen sources is not critical for the present study, future studies that aim to providing a definitive explanation of the observed patterns should consider this aspect. The suggested statistical details about the regression are added in the revision.

Comment:Results L.316-319: Since no data on the difference of $\delta^{15}\text{N}$ in soil at both sites was given, it is difficult to tell if this conclusion is not only associated with soil $\delta^{15}\text{N}$ variability. Response: Good point. We point this out in the revision.

Comment:L.340:”Since fine roots differ from other organs in that fine roots are the primary organs for nitrate reduction” Your data are actually showing the opposite since the $\delta^{15}\text{N}$ is way above the $\delta^{15}\text{N}$ of all organs. If fine roots were the main site of reduction of N then you should expect transport of amino acids to the leaves and a more homogeneous $\delta^{15}\text{N}$ between roots and leaves. In addition, if this means for the authors that NH_4 is transported to the leaves, then there is still a 16-20 per mil fractionation by the NR that should be taken into account and should show the higher difference in $\delta^{15}\text{N}$. $\delta^{15}\text{N}$ data should be presented relative to the substrate (soil NO_3 or NH_4) or relative to the origin (root). Response: Sharp eyes! Thanks for catching the problem this sentence causes. Clearly our data do not support the literal meaning of it and we actually did not mean it. We have revised the sentence to “Since fine roots differ from other organs in that fine roots are the primary organs for nitrogen acquisition”. Hopefully this revision clears up this referee’s concerns.

Comment:Finally, a lot of the correlations were made using the data for all organs and leaves. In many cases, the 6 data points of the leaves affect the correlation. If leaves are removed from the data for this analysis, a different correlation could be found. Finally, since metabolisms of roots and leaves are likely to be different as suggested by the authors, at least in term of reduction of N sources, it could be interesting to present correlation by organs instead of pooling them. In figure 3 and 5, if leaves are removed from the graph, the correlation between $\delta^{15}\text{N}$ and P disappear highlighting the need to do the organ-specific analysis. Response: We are puzzled by this referee’s comment

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on the impact of leaf and fine root samples on the correlation between $\delta^{15}\text{N}$ and N and P contents. We have conducted analyses by excluding leaf samples (Figure 3 and 4) and fine root samples (Figure 5) and found that the correlation is still statistically significant, which seems contradictory to what this referee is stating here. Since our primary interest was in across-organ variations, our measurements were not designed to examine variations within the same organs (the number of independent samples would be too few for this purpose).

Comment: Discussion Overall the discussion is very well written and clear. Response: Thanks.

Comment: It may lack a conceptual framework. Many of the explanation in the text stand on speculation more than the data presented. There is a clear disconnection between the interesting debate of the relationship between $\delta^{15}\text{N}$ and P and the data presented. An example of this discrepancy is the many recalls to the reader of the focus on leaves (L.404, L.419). Response: We basically agree with this assessment. We have struggled to come up with a reasonable explanation for the observed patterns. Unfortunately, actual measurements on intra-plant variations in $\delta^{15}\text{N}$ and their relationships with organ nutrient contents are extremely rare. We believe this makes this present study valuable. We'd love to hear from this referee if he or she thinks there is a better conceptual framework than we propose here to explain the observed patterns.

Comment: The utilization of unnecessary abbreviations clouds the main information. Response: Thanks. The revision now minimizes the use of abbreviations.

Comment: L. 361 – 363, why do you use EFO, IFO, and EIFT when you will be using it only 2-3 times? Simply use words, it is not much longer. Response: Suggestion adopted.

Comment: L.358-359: Is there a way to present this synthesis into a simple graph? Response: Excellent suggestion! A diagram is added.

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Comment:L.363: “External factors include different sources of nitrogen” Since you recognized it is an important factor, why no data were shown? Response: This will be important for future studies when a convincing mechanistic explanation of the observed patterns is attempted. For the present study we are content with reporting a previously unreported phenomenon and developing testable hypotheses for future research.

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