List of responses

Dear Editor and Reviewers:

Thank you for the reviewers' comments concerning our manuscript entitled "Moderate N fertilizer reduction with straw return modulates ecosystem services and microbial traits in a meadow soil" (Manuscript ID No. egusphere-2023-2498). These comments were all valuable for improving our manuscript and provided important guidance for our research. We have studied the comments carefully and have made corrections that we hope will meet with your approval. The main corrections in the paper and the responses to the reviewer's comments are as follows:

Duan et al. conducted a four-year field experiment to investigate the relationships between soil ecosystem services and microbial traits under varying rates of nitrogen (N) fertilizer application with straw return. The results indicated that a 25% reduction in chemical N fertilizer is optimal for enhancing ecosystem services. This study is interesting, and the findings contribute to nitrogen management following straw return. I have several suggestions to enhance the manuscript's quality:

1. Line 77, "To our knowledge, fertilization-induced changes in microbial communities and functions are fundamental to the regulation of a variety of ecosystem multifunctionalities", the importance of microbial community is widely acknowledged, so remove "To our knowledge". Please correct similar statement.

Reply: Thank you for the comment. We have deleted this term.

2. Line 126, (2) 25% reduction XXX; (3) XXX

Reply: Thank you for the comment. We have revised these items.

Four treatments were established with different N fertilizer input levels after straw return to the field for 4 years as follows: (1) regular chemical fertilization, N+PK (300 kg urea (N 46%) ha^{-1} yr^{-1}, 250 kg diammonium phosphate (P_2O_5 48%) ha^{-1} yr^{-1}, 150 kg potassium chloride (K_2O 50%) ha^{-1} yr^{-1}); (2) 25% reduction of N fertilizer, 0.75N+PK (225 kg urea ha^{-1} yr^{-1}, 250 kg diammonium phosphate ha^{-1} yr^{-1}, 150 kg

potassium chloride ha^{-1} yr^{-1}); (3) 50% reduction of N fertilizer, 0.50N+PK (150 kg urea ha^{-1} yr^{-1}, 250 kg diammonium phosphate ha^{-1} yr^{-1}, 150 kg potassium chloride ha^{-1} yr^{-1}); and (4) no N fertilizer, PK (250 kg diammonium phosphate ha^{-1} yr^{-1}, 150 kg potassium chloride ha^{-1} yr^{-1}). (Lines 111-118)

3. Line 138, 4 treatments with 3 replications each?

Reply: Thank you for the comment. We have revised the text.

In total, 12 soil samples were collected from the 4 treatments. Each treatment included 3 replicates. (Lines 128-129)

4. Lines 143-145, please clarify if it is rhizosphere soil or bulk soil.

Reply: Thank you for the comment. We have revised the text. The samples were all bulk soil samples.

One part of the bulk soil sample was air-dried to measure soil properties, and the other part was used for microbial molecular analysis. (Lines 132-133)

5. Line 200, the multifunctionality index is simply calculated by averaging the Z-scores of the 15 variables. There is a question, is more greenhouse gas emission better (also see 474-475)?

Reply: Thank you for the comment. We have revised the text. Increased greenhouse gas emissions negatively affect soil ecosystem multifunctionality. According to the calculations in the Materials and methods, the negative values of greenhouse gas emissions were used, as greater values indicate lower soil ecosystem multifunctionality.

We also added a precise description.

Notably, the opposite numbers of greenhouse gas emissions were used to evaluate their negative effects. (Lines 198-199)

In the present study, greenhouse gas emissions were quantified to evaluate the ecosystem dis-services under different N fertilizer input levels: the greater the emissions were, the lower the soil ecosystem multifunctionality was. (Lines 467-470)

6. I would recommend the authors check the MS carefully, including English.

Reply: Thank you for the comment. We have checked it carefully.

Thank you for your valuable comments. We hope our responses will meet with your approval.