

Interactive comment on “Responses of N₂O and CH₄ fluxes to fertilizer nitrogen addition rates in an irrigated wheat-maize cropping system in northern China” by C. Liu et al.

Anonymous Referee #2

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General comments: Overuse of chemical fertilizers in China would cause many environmental problems including emission of N₂O. To determine a proper fertilizer application rate that can both maintain crop yields and reduce greenhouse gas emission is vital for agricultural practices. The authors measured exchange fluxes of N₂O and CH₄ in a typical irrigated wheat-maize rotation field treated with six nitrogen levels in north China, and thus obtained responses of crop yield and N₂O/CH₄ fluxes to fertilizer rates, as well as emission factors of N₂O under different fertilization rates. With these results they recommended an optimum fertilization rate for the wheat-maize rotation field. The experimental design and the data quality are good. The document merits publication in BG. The following aspects should be considered in their discussion:

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1) For recommendation of the optimum fertilization rate, the authors took crop yield and N₂O emission into consideration. From the study we know that increasing fertilization rate would enhance both N₂O emission and CH₄ uptake. One question is how about total emission of N₂O and CH₄ in CO₂-equivalents responding to the increasing fertilization rates. Another question is how about CO₂ fluxes with the increasing fertilization rates. As CO₂ is the No.1 greenhouse gas, if taking CO₂/N₂O/CH₄ into consideration and net fluxes of CO₂-equivalents indicate reducing greenhouse potential, the recommendation of proper fertilization rate only considering N₂O emission would indeed lack solid supports. So the authors better consider these aspects in their discussion and find balance between crop yields and total fluxes of CO₂-equivalents. 2) For farmers the most important thing is that if increasing fertilization rates can result in more earning of money. That is, comparing increase rates of crop yields to that of N₂O emission is not proper or important to decide a best fertilization rate. For example, as the authors claimed, “If the fertilizer rate increased from 120 to 180 and 300 kg N ha⁻¹ for wheat, the crop yield only increased 1% and 9% (0.1 and 0.7 t ha⁻¹) whereas the cumulative N₂O emissions increased 34% and 54% (0.20 and 0.32 kg N ha⁻¹).” I do not think this kind of statements is persuasive. As far as know, the price of urea per kg is higher than that of wheat in north China, so if extra fertilizer would not result in more earning, farmers would be very happy to reduce the fertilization rates to at least the “matching point”. If it is possible for the authors to take the market prices of urea and wheat/maize for a gross calculation of loss/gain if increasing fertilization rates. Specific comments: 3) Some results in the abstract, like “When the annual fertilizer rates increased from 270 to 430, from 270 to 650 and from 270 to 850 kg N ha⁻¹ yr⁻¹, the crop yields increased only 4~15% (0.6~2.2 t ha⁻¹ yr⁻¹),...”, are in fact not fully expressed in the results/discussion parts. The authors can give a more detailed description about crop yields with different fertilization rates in the text, and should be consistent in reporting results.