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Interactive comment on "Insights on nitrogen and phosphorus co-limitation in global croplands from theoretical and modelling fertilization experiments" *by* Bruno Ringeval et al.

Anonymous Referee #2

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General comments

The current paper presents a theoretical study of nitrogen and phosphorus co-limitation in croplands, based on two common theories of nutrient limitation interaction, Liebig's Law and multiple limitation hypothesis. They then use the co-limitation categories of Harpole et al (2011) to classify the results from these two theories. They then extrapolate these theoretical results to global scale to predict crop nutrient co-limitation for maize.

In my opinion the main problem of this study is its justification. Coplands are highly managed systems, often heavily fertilised and the authors fail to explain why a study

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of co-limitation is necessary in such a system. It is possible that the reason there are very few nutrient addition experiments in cropland systems is that the question is not relevant. The authors need to make a better case for why their approach is important and relevant in the study system.

Furthermore, the upscalling method includes a large number of assumptions, which to their credit, the authors themselves discuss at length. However, the successive approximations made (single parameter for biomass allocation and tissue concentrations, simplified soil processes) lower my confidence in the results. The exact methods for the global calculation are only briefly described in the methods, with most of the details found only in the supplementary material and the assumptions of the study become evident only when reading the discussion.

Specific comments

Eq. 7 Is this a multiplication?

L 160 Does productivity here refer to vegetative biomass or yie;d?

L 161 “pro is here expressed relatively to the potential productivity” But in the previous sentence is the response to nutrient addition, so the exact opposite

Eq. 9 - 11 this is a very big assumption and it is not justified by either a physiological explanation or references

L 208 “a reversed bracket used in an interval means here that the corresponding endpoint is excluded from the interval” I think the correct mathematical notation is ()

L 236 is there no leaching of N compounds?

Fig. 4 - It would help to define the categories again in the caption, so the reader doesn’t have to go backwards and forwards between the table and the figure

L 311 What do the values after the +/- sign represent? My first assumption would have been standard error or standard deviation, but some of the values are zero?

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L 320 Check the grammar in this paragraph

L 322 It's unclear what numerical fertilization experiments are

L 377 Since croplands are routinely fertilised, are there any fertilisation experiments as such? L 391 "organ concentrations derived from field experiments in stressed conditions" I don't understand why this information is buried in the discussion and the supplementary tables. The tissue nutrient concentration is essential for calculating plant nutrient demand and hence limitation. Also the reference used is a study from 1992 in West Africa, the use of which needs to be justified. L 418 " the N supply budget encompasses an term for N fixation by leguminous occurring in the same grid-cell as cereals" This is an unrealistic assumption and needs better justification and discussion

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