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Biogeosciences Discussions

Interactive comment on "Economic optimal nitrogen application rates for rice cropping in the Taihu Lake region of China: taking account of negative externalities" *by* Y. Xia and X. Yan

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The submitted article addresses the evaluation of nitrogen application rates considering the whole life cycle of mineral fertilizer applied on rice cropping systems in the Taihu Lake Region. Environmental impacts induced by production, transport and application of fertilizer N and considered in the applied life cycle analyses comprise acidification, global warming and eutrophication. The study assumes that yield, N2O emissions, amount of NH3 volatilization and N losses by leaching and runoff can be described by regression equations relating named variables to fertilizer N applied. Regression equations are derived from long term trials (Xia and Yan, 2011) and are assumed to be representative for the whole Taihu Lake Region. It remains unclear if indirect N2O emissions induced by fertilizer application are considered in this study. To achieve

comparability between environmental impact categories (resource consumption, acidification, global warming, eutrophication) characterisation factors (evaluation within an impact category) and specific monetary valuations (for each impact category) are used. Both variables play a key role for the results of the study. Therefore it would be important to describe the derivation of the applied values and underlying assumptions more in detail. The results highlight the importance of fertilizer N production within the scope of global warming and indicate that N use efficiency impacts emissions of GHG via production more effective than related nitrous oxide emissions from soil which are difficult to quantify because of their high spatial and temporal variability. Costs arising from acidification and eutrophication are mainly assigned to the farming processes. The authors conclude that a decrease of prevailing application rates would be beneficial when taking all relevant influences of fertilizer production, transport and use into account. Studies, like conducted in this paper demonstrate how LCA could be used as integrative assessment tool evaluating impacts of production processes and efficiencies of mitigation strategies. The combination of LCA and ecological models that describe the dynamics of the CN cycle with respect to management could serve as a powerful tool for evaluating environmental impacts of agricultural practise. The paper is clearly written and most aspects of the applied method are presented in a transparent way. However, some questions arise which are mentioned below.

Page 6282 line 1: The first three sentences are difficult to understand. Page 6286: line 11 Is this of importance? If so, I would suggest a more detailed explanation.

Page 6287: line 3: The references in Table 1 are incomplete (Ao 2006, Xu et al. 2006,. . .) The values of table 1 refer to 1 kg rice. How can you use fixed values (example: energy exploitation for fossil fuel) if the relationship between N fertilizer rate and yield is nonlinear (equation 4)?

Page 6287 line 22: I suppose that EFpro and EFraw are rather emission factors than emissions.

Page 6288 equation 2 and 3 the units of the variables does not end up to EF [g/kg]

Page 6288 line 11: the cropping area that your idealized typical system represents is large. How representative is your idealized typical system with respect to the influence of soil properties, climate, regional management ? How many field trials have you examined and does they represent the Taihu Lake region?

Page6288 line19: Does equation 5 consider indirect N2O emissions and if so how did you measure it?

Page 6290 line 12: In Fig 2. you present the costs of different categories as fixed values. I assume this represents the actual situation (300 kg/N applied).Because the dependence between N input/yield and Ninput/N2O are nonlinear

Page 6289 line17: Your characterisation factors you present in table 3 come without any explanation or reference.

Page 6290 line 3: The derived costs of managing one ton of each material and the environmental effect in table 3 need some explanation because they are of major importance for the results (marginal benefit, EONR) and comparison between impact categories. How did you derive them?

Page 6291 line14: Why you mention CH4 emissions from farming. How are they related to N fertilisation?

Interactive comment on Biogeosciences Discuss., 8, 6281, 2011.