

## **Determining the optimal nitrogen rate for summer maize in China by integrating agronomic, economic, and environmental aspects by Wang et al.**

Review, 07.03.2014

**General:** The paper is of good scientific quality is generally well written and the results are presented clearly. The major concerns I have is that 1) the experimental design and context however are not state of the art and 2) the methodological approach lacks some important criteria.

1) Experimental design and context: The study focusses on the application of synthetic N fertilizer in the form of urea solely and no mention of the application of other forms of N sources either in the form of manure and/or in the form of N provided by N fixing legumes as pre-crops. As this study has also the focus to improve smallholder-based cropping systems in China, it's hard to believe that the agricultural land under study is solely fertilized with synthetic N sources. Smallholder agriculture is typically characterized by a high degree of self-sufficiency meaning that livestock plays an essential role and their excrements deliver part of the required fertilizers and contribute to soil organic matter (SOM) reproduction.

Furthermore, the productivity of croplands will decrease over time due to SOM losses along with the decrease in soil structure and other soil quality aspects if organic inputs are not applied on croplands and/or a proper residue management is not considered. In this context carbon release from SOM mineralization might be further stimulated if only mineral N fertilizer is applied without substantial replenishment of SOM pools by organic inputs. Carbon release from SOM under maize is particularly high (up to 800 kg C/ha x yr) because of its wide spacing and the associated intensity in soil cultivation. This is state of the art knowledge.

Therefore, improved cropping strategies, that's what the current manuscript is aiming at, in the 21<sup>st</sup> century should somehow consider the integrated use of synthetic and organic N inputs as has been postulated in various scientific reviews including the IPCC report of the year 2007. This manuscript bears the risk that with the further promotion of its concept and the outcomes the wrong incentives might be set for agricultural sustainability. The implementation of organic fertilization practices in the experimental setup would be straight forward. If for whatever reasons, the implementation of integrated fertilization strategies is neither an option for the study itself no for the farming context in the maize-production region in the North China Plain, it should be critically discussed why and how the challenges on SOM degradation (see above) could be addressed alternatively.

2) Methodological approach: The calculation of the ecologically optimal N rate lacks the consideration of CO<sub>2</sub> and N<sub>2</sub>O emissions from N fertilizer production. This is an import source of agricultural greenhouse gases and their reduction/avoidance by technological means is actually an important part of carbon-offset activities in the agro-chemical industry sector. The impact on SOM degradation should also be addressed in the calculation of the ecologically optimal N rate. At least estimates of the loss of soil carbon and the corresponding release of CO<sub>2</sub> should be considered in the climate impact calculation.

**Recommendation:** Major revision/rejection