Improving nitrogen use efficiency in rice-wheat rotations in southeastern china

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Excessive use of mineral nitrogen (N) fertiliser is a common practice in rice-wheat rotations in southeastern China. However, at the same time the N use efficiency (NUE) in this rice-based cropping system is very low. The consequences are high N losses to water bodies (surface and ground water) and to the atmosphere. These losses from arable land can easily be reduced by applying 20-30% less mineral N fertilizer compared to the farmers practice without any reduction in grain yield and with a clear increase in NUE. To demonstrate this, field experiments on farmers` field sites were conducted from 2008 to 2011 for three consecutive rice-wheat double crop rotations in the two pilot counties Yixing and Huai'an in Jiangsu Province. The experimental design followed the so-called "3+x" approach with three different N fertilization treatments (conventional, reduced and zero-N application) and two agronomical ("x") treatments within each N fertilization level. Effects on crop growth, N nutrient status, mineral N in the soil (N_{min}) and grain yields were determined and nitrogen balance sheets were calculated. In spite of a much lower N fertilization rate, no significant change on crop growth, N nutrient status and grain yield were observed in the reduced N fertilization treatments in any year and crop. However, a significant increase of NUE could be achieved and the calculated nitrogen balances showed a clear decrease in nitrogen unaccounted for in the reduced N fertilization treatments compared to the farmers practice. Therefore, we can estimate that the N losses to the environment can be efficiently decreased by reducing the overall nitrogen fertilization rate without any decline in grain yield for rice and wheat.