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“Development on the margin”

Improving Nitrogen Use Efficiencies in Rice-Wheat Rotations in Southeastern China

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Abstract

Excessive use of mineral nitrogen (N) fertiliser is a common practice in rice-wheat rotations in southeastern China. At the same time the N use efficiencies (NUEs) in this rice-based cropping system are very low. The consequences are high N losses from arable land to water bodies (surface and ground water) and to the atmosphere. To investigate the scope and scale of reductions in mineral N fertiliser inputs, demonstration field experiments on farmers' field sites were conducted for three consecutive summer rice-winter wheat double crop rotations in the two counties Yixing and Huai'an in Jiangsu Province from 2008 to 2011. The experimental design was according to the so-called “3+x” approach with three different N fertilisation treatments (“conventional” (farmers' practice), “reduced” (by 25–30%) and zero-N application) and two agronomical (“x”) treatments within each N treatment. Effects on crop growth, crop N nutrition status, mineral N contents in the soil and soil solution as well as grain yields were determined and nitrogen balance sheets were calculated. In spite of the lower N fertilisation rate, no significant differences in crop growth, crop N nutrition status and grain yields were observed in the “reduced” N fertilisation treatments compared to the “conventional” N treatment in any year and crop over the three-year period. In contrast, a significant increase in NUEs could be achieved and the calculated N balances showed a clear decrease in nitrogen balance surpluses in the “reduced” N fertilisation treatments compared to farmers' practice. To summarise, we could demonstrate that the risk of N losses from arable land can be efficiently decreased by reducing the overall nitrogen fertilisation rate by approx. 25–30% compared to local practice without any decline in grain yields of rice and wheat, and with a distinct increase in NUEs.

Keywords: Nitrogen balances, nitrogen fertilisation, nitrogen use efficiency, rice-wheat rotation