Nitrogen mineralization potentials in rice-wheat systems in southeastern China

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Introduction

The rice (Oryza sativa L.)-wheat (Triticum aestivum L.) double-cropping system is characterized by anaerobic conditions during summer rice crop and aerobic conditions during winter wheat season. The alternating water regime leads to high gaseous and leaching losses of nitrogen (N) mainly after the winter wheat crop due to flooding of the field for summer rice (Roeckle et al., 2002). To minimize these losses, little residual mineral N (Nres), especially nitrate, should be present in the soil profile at wheat harvest. A better understanding of the N transformation processes, including mineralization dynamics of organic N during the winter wheat cropping season, is essential. Long-term aerobic incubation laboratory experiments were carried out with soils from two rice-wheat growing regions in southeastern China. Results of laboratory and field experiments were used for calibration and validation of the HERMES model (Kersebaum, 1995).

Materials and Methods

Laboratory and field experiments

- Aerobic long-term laboratory incubation experiment (182 days) with soils from two locations in Jiangsu Province (Yixing & Huai’An); Parameter estimation by non-linear regression using a double-exponential model (Sichter et al., 1982)
- Field experiments on farmers’ field sites in Yixing and Huai’An with different N fertilization treatments from 2008 to 2011; Residual Nmin, N uptake and grain yield in zero-N plots for estimation of indigenous N supply

Model simulations

- Simulation of N dynamics during winter wheat season with HERMES model (Kersebaum, 1995)
- Calibration and validation of simulation results using field data from field experiments in Yixing and Huai’An

Results

Laboratory experiments & parameter estimation

- Estimated mineralization parameters for topsoils

Conclusions and Outlook

- Potential aerobic N mineralization was clearly higher in Huai’An, which can be explained by higher organic matter and clay contents
- Field experiments confirmed a higher indigenous N supply during winter wheat season in Huai’An (residual Nmin, content, yield level and N uptake); N loss potential was higher after winter wheat crops in Huai’An
- Model results showed good agreement with field data in Yixing and medium agreement with field data in Huai’An
- The calibrated and validated HERMES model can be used for fertilizer recommendations for winter wheat crops in SE China

References


Funded by

MOST grant no.: 2009DFA30850