Geophysical Research Abstracts
Vol. 20, EGU2018-12301, 2018
EGU General Assembly 2018

Can knowledge-based N management produce more staple grain with lower greenhouse gas emission and reactive nitrogen pollution? A meta-analysis

Longlong Xia (1,2), Xiaoyuan Yan (2), and Ralf Kiese (1)

(1) Institute for Meteorology and Climate Research (IMK-IFU), Karlsruhe Institute of Technology, Kreuzeckbahnstrasse 19, 82467 Garmisch-Partenkirchen, Germany c. University of Chinese Academy of Sciences, Beijing 100049, China, (2) State Key Laboratory of Soil and Sustainable Agriculture, Institute of Soil Science, Chinese Academy of Sciences, Nanjing 210008, China.

Knowledge-based nitrogen (N) management, which is designed for a better synchronization of crop N demand with N supply, is critical for global food security and environmental sustainability. Yet, a comprehensive assessment on how these N management practices affect food production, greenhouse gas emission (GHG) and N pollution in China is lacking. We compiled the results of 376 studies (1166 observations) to evaluate the overall effects of seven knowledge-based N management practices on crop productivity, nitrous oxide (N_2O) emission, and major reactive N (Nr) losses (ammonia, NH_3; N leaching and runoff), for staple grain (rice, wheat and corn) production in China. These practices included the application of controlled-release N fertilizer, nitrification inhibitor (NI) and urease inhibitor (UI), higher splitting frequency of fertilizer N application, lower basal N fertilizer (BF) proportion, deep placement of N fertilizer, and optimal N rate based on soil N test. Our results showed that, compared to traditional N management, these knowledge-based N practices significantly increased grain yields by 1.3 to 10.0%, which is attributed to the higher aboveground N uptake (5.1–12.1%) and N use efficiency in grain (8.0–48.2%). Moreover, these N management practices overall reduced GHG emission and Nr losses, by 5.4–39.8% for N_2O emission, 30.7–61.5% for NH_3 emission (except for the NI application), 13.6–37.3% for N leaching and 15.5–45.0% for N runoff. The use of NI increased NH_3 emission by 27.5% (9.0–56.0%), which deserves extra attention. The cost and benefit analysis indicated that the yield profit of these N management practices exceeded the corresponding input cost, which resulted in a significant increase of the net economic benefit by 2.9–12.6%. These results suggest that knowledge-based N management practice can be considered an effective way to ensure food security and improve environmental sustainability, while increasing economic return.