# Reducing nitrogen surplus and environmental losses by optimized nitrogen and water management in double rice cropping system of South China

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**Abstract**

Optimized agronomic management improves nitrogen (N) use efficiency in crop production. However, limited information exists about the effect of improved agronomic practices on the N surplus in double rice cropping system. In this study, we conducted field experiments to evaluate the N surplus for the prevailing farmers' practices (FP), optimized N management (OPTN) and optimized N and water management (OPTNW) during 2016–2017 in Guangdong province, South China. Grain yield, recovery efficiency (REN), partial factor pro[1]ductivity (PFPN) and agronomic efficiency (AE) of applied N in OPTN and OPTNW were substantially higher than FP. The yearly N surplus and environmental N loss in OPTN were 29.4% and 26.2% lower than FP, respectively. The N surplus in OPTNW was 32.1% lower than FP. Annual N losses resulting from runoff and leaching in OPTNW were reduced by 45.0% and 17.4%, respectively, compared with OPTN. Pooled data of 22 on-farm field trials from six sites in 2014–2017 showed that N input in OPTN and OPTNW was 16.2%–33.8% lower than FP. The tradable N output in OPTN and OPTNW was 9.9% and 9.0% greater than FP, respectively. The N efficiency of cropping systems (NUEc) in OPTN and OPTNW was increased by 39.8% and 42.0%, respectively, compared with FP. N surplus notably increased with the increasing fertilizer N input, and decreased with the increasing tradable N output and NUEc. These results suggest that through optimized N and irrigation management, N surplus and environmental risk can be practically reduced in a double rice cropping system without yield penalty.

**Keywords:** Nitrogen use efficiency N management Water management N surplus Environmental N losses

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