

Module 4.4-1 Optimized nitrogen rate balancing rice yield, efficiency and nitrogen losses in China.

Nitrogen (N) fertilization has played a crucial role in maintaining high yield of rice. However, over application of N does not increase yield further, but results in resource waste, low fertilizer use efficiency and risk of harm to the environment.

A field experiment was conducted in Hubei Province, China to determine the influences of N fertilizer rate on N fertilizer efficiency and apparent N loss. Nitrogen fertilizer rates included 0, 45, 90, 135, 180, 225, and 270 kg N/ha, applied 40%, 30% and 30% before transplanting, at tillering and at booting respectively. Grain yield, agronomic efficiency (AE) and apparent N loss were determined after harvest.



Rice experimental site in Hubei Province, China.

Results found that grain yield increased with increasing N fertilizer application rate, reached a maximum at 180 kg N/ha, and then gradually declined (**Figure 1**). Agronomic efficiency (AE) is the increase of grain yield per kg N fertilizer applied. At the lower N application rate, grain yield increased rapidly from N fertilizer application, which resulted in higher AE, but the AE decreased with increasing N rate until it reached the lowest point at the highest N rate.

Apparent N loss is the difference between N input and N output and is regarded as an approximation of the amount of N at risk of loss to the environment. Nitrogen input included N rate, soil initial mineral N and soil net mineralization during the growth season. The soil net mineralization was calculated by difference between N output including aboveground N uptake and soil residual mineral N from zero N plot, and N input from initial mineral N from zero N plot. Nitrogen output included crop N removal and soil residual mineral N after harvest. Apparent N loss increased with increase of N application rate. Application of 180 kg N/ha not only obtained the highest grain yield, but with relatively higher AE and relatively lower apparent N loss, indicating the right N application rate (180 kg/ha) can balance high grain yield, agronomic efficiency and apparent N loss to avoid the potential threats to the environment caused by excessive N rate.

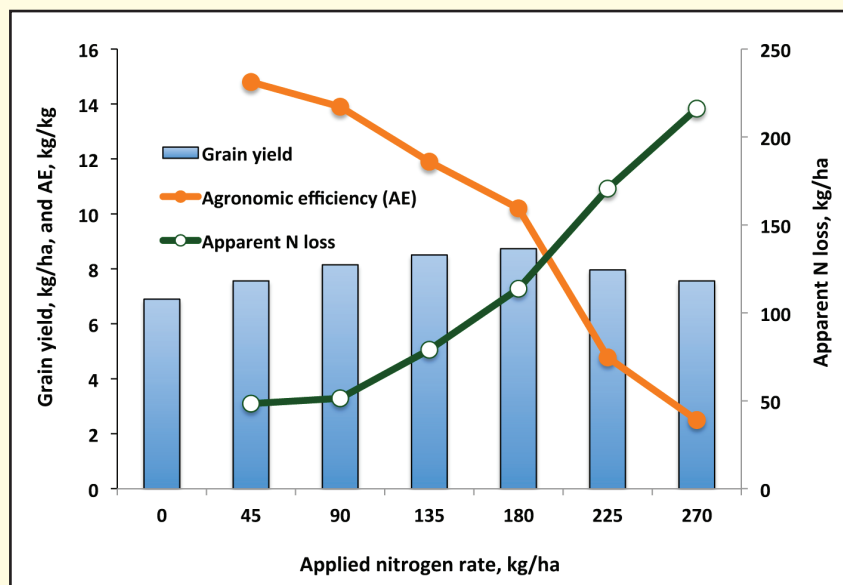


Figure 1. Nitrogen rate effects on grain yield, N agronomic efficiency and apparent N loss, Hubei, China.

Source: Zhang, X.Z. et al. 2011. Plant Nutrition and Fertilizer Science, 17(4): 782-788.

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