

Responses of Rice Yield, N Uptake, NH₃ and N₂O Losses from Reclaimed Saline Soils to Varied N Inputs

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Abstract: It is of agronomic importance to apply nitrogen (N), but it has high environmental risks in reclaimed saline soils. Therefore, we should apply N fertilizer at an appropriate rate to increase crop yield but decrease N losses. In this soil column experiment, rice yield, N uptake, and ammonia (NH₃) and nitrous oxide (N₂O) losses were measured in four treatments with no N application (control) and with N applications of 160, 200, and 240 kg/ha (N160, N200, and N240, respectively). The results show that grain yield, spike number, and thousand-kernel weight increased with increases in N application rate, but there was no significant difference in grain yield between N200 and N240. However, the kernels per spike increased first and then decreased with the increase in N application, of which N200 was recorded to have the highest kernels per spike value, which was 16.8 and 9.8% higher than those of N160 and N240, respectively. Total NH₃ volatilization of the rice season increased with increasing N input, especially during the first and second supplementary fertilization stages. The NH₄⁺-N concentration of overlying water was relatively lower under the N200 treatment in these two stages, and the yield-scaled NH₃ volatilization and the emission factor were the lowest in N200, which were 26.2–27.8% and 4.0–21.0% lower than those of N160 and N240, respectively. Among the three N-applied treatments, N₂O losses and the emission factor as well as the yield-scaled N₂O emissions were the lowest under the N200 treatment, which had 34.7% and 78.9% lower N₂O emissions and 57.8% and 83.5% lower emission factors than those of the N160 and N240 treatments, respectively. Moreover, the gene copies of AOA and AOB *amoA*, *nirS*, and *nirK* in cultivated layer soils all reached the minimum under the N200 treatment. According to the comprehensive effects of N fertilizer on rice grain yield and NH₃ and N₂O losses, we recommend applying 200 kg/ha to reclaimed saline soil to ensure crop yield and reduce N losses.