Nitrous oxide flux from irrigated rice fields in West Java

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Abstract

Nitrous oxide (N_2O) fluxes were measured from rice fields treated using different irrigation techniques and types of urea fertilisers. The highest flux was 131.56 μg N_2O---N m^{-2} h^{-1}, measured during the fifteenth week after transplanting and the lowest was −17.56 μg N_2O---N m^{-2} h^{-1}, measured in the twelfth week. The mean flux was 22.65 ± 20.15 μg N_2O---N m^{-2} h^{-1}. Submerging the paddies by continuously flooding the field caused significant reduction in N_2O flux compared with the field irrigated intermittently. This suggests that aerobic-anaerobic cycling triggers interchangeable nitrification of ammonia and denitrification of nitrate, enhancing the total N_2O emissions. The effects of different types of urea on N_2O fluxes were further examined using a statistical profile analysis at each growing stage. During the reproductive stage, the N_2O flux from plots with the submerged tablet urea in the denitrifying zone was indicated to be significantly larger compared with plots fertilised using granule urea, which was spread over the surface occupying the nitrifying aerobic layer. The two different rice varieties having different morphological characteristics and planted during April–August 1995 showed no significance difference in the mean seasonal N_2O flux in all treatments. However, when comparisons were made for different growing stages, the flux was indicated to be significantly different during the reproductive stage (week 6–11). This was shown for both fertiliser and irrigation applications. The results suggest that to control N_2O emission, field management should consider the irrigation and fertiliser application schedule and combination. Based on the varieties' nitrogen uptake efficiency ranging from 35% (IR-64) to 45% (Cisadane), both varieties could have resulted insignificantly different flux but since they have different growing period the total seasonal emission differs substantially.

Author Keywords: Irrigation water management; aerobic-anaerobic cycling; growth and development stages; rice field; West Java