African Journal of Agricultural Research

Afr. J. Agric. Res.

Vol. 2 No.4

African Journal of Agricultural Research Vol. 2(4), pp. 139-149, April, 2007
ISSN 1991- 637X© 2007 Academic Journals

Full Length Research Paper

Nitrogen balance and dynamics as affected by water table and fertilization management in celery (*Apium graveolens*) cropping system of southwestern China

Huaming Guo [1, 2 *] Guanghe Li [1], Dayi Zhang [1], Xu Zhang [1] and Chang'ai Lu[3]

[1]Department of Environmental Science and Engineering, Tsinghua University, Beijing 100084, P. R. China

[2] Department of Water Resources and Environment, China University of Geosciences, Beijing 100083, P. R. China

[3] Chinese Academy of Agricultural Science, Beijing 100081, P.R. China

*Corresponding author. E-mail: hm_guo@hotmail.com. Tel: (+86)-10-82320679. Fax: (+86)-10-82321081

Accepted 15 February, 2007

Abstract

There is a great concern on N cycle and dynamics in intensive cropping agricultural ecosystems because of their possible negative environmental consequences. Field experiments were conduced at the Dianchi catchment, Yunnan, China, to investigate the combined effects of groundwater table and N fertilization rate on gaseous N emissions, N leaching, and soil N accumulation, together with N uptake by celery in order to establish a budget of N inputs and N outputs in closed greenhouses. Treatments consisted of a combination of two water table levels: one with a water table depth of 2.0 m BLS (Below Land Surface) (Site A) and the other with a water table depth of 0.5 m BLS (Site B), and three N fertilizer application rates: 0 kg N ha^{-1} (no fertilization - NF), 450 kg N ha^{-1} (low fertilization - LF) and 1200 kg N ha^{-1} (high fertilization - HF) per rotation (about 90 d). Outputs of N were mainly as N uptake, with an average of 53.9% of total estimated output N. Crop N uptake significantly increased with an increase of N rate, but further fertilizer N inputs beyond 450 kg N ha^{-1} did not lead to significant increases in N uptake. The same N-fertilizer application rate produced different N balances with different water table levels. Compared with Site B, Site A reduced N leaching, gaseous N emissions, and soil N accumulation, while increased N uptake. The N balances indicate that N leaching into groundwater was comparatively low, while gaseous N emissions were the major loss pathway in

the celery (*Apium graveolens*) cropping system, although both N leaching and gaseous N emissions decreased with the decrease of N-fertilizer rate and the increase of water table depth. Of these gaseous N emissions, NO/NO_2 was the highest, followed by N_2O and NH_3. In low N fertilization treatment, gaseous N emissions were reduced by 75 kg N ha^{-1}, N leaching by 8.4 kg N ha^{-1}, and soil N accumulation by 264 kg N ha^{-1} at Site A. Even LF had resulted in significant N losses at Site B. These findings suggest that the balanced fertilization both in optimizing crop yields and in minimizing its adverse impacts on environment should take into account depth of groundwater table.

Key words: Agricultural ecosystem, gaseous N emissions, N leaching