Spatial differences in soil properties, crop yield and methane emission from paddy rice cascade, Northwest Vietnam

著者	OO Aung Zaw, DOROTHEA Kimura Sonoko, WIN Khin Thuzar, HUU Nguyen Xuan, NGUYEN Lam, CADISCH Georg
journal or publication title	Journal of Integrated Field Science
volume	9
page range	104-105
year	2012-03
URL	http://hdl.handle.net/10097/54457

hydrological budgets agreed well with observed NO_3^- concentration in streams, indicating that the stream NO_3^- concentration is regulated simply by the N and water balance with negligible denitrification in this district. In contrast, decreased NO_3^- concentrations are invariably observed in lowlands; the lower position of slope, where more humid condition prevails. A transect study in an agricultural region showed marked decreases in NO_3^-/Cl^- ratio and dissolved oxygen concentration and significant increases in dissolved N_2/Ar ratio in ground water in lowland regions, strongly suggesting NO_3^- removal by denitrification. Forest sites having a groundwater table shallower than ca. 1m also tend to have evidence of denitrification.

Water discharge almost always passes through the groundwater in lowland before flowing out to rivers, where denitrification is probably active in common. In the light of this fact, it is highly likely that a large part of nitrogen discharged from land surface may be removed by denitrification in the river basin scale. Detailed and systematic researches are required to know the actual quantitative importance of denitrification and the boundary conditions regulating this process.

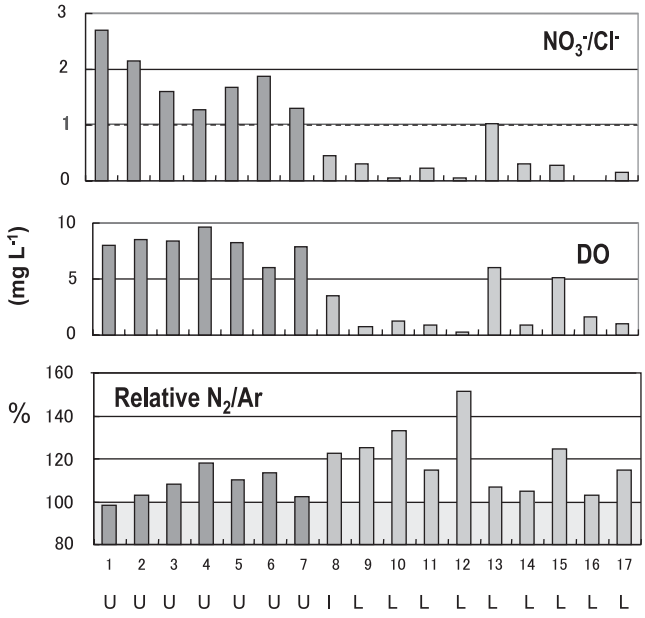

Fig. 1: NO_3^-/Cl^- ratio, dissolved oxygen, and dissolved N_2/Ar ratio in groundwater for the sites along an upland-lowland transect in an agricultural region (Kamagaya, Chiba), Japan.

The notation of U, I and L in the x-axis denote upland, intermediate, and lowland zones, respectively.

Spatial differences in soil properties, crop yield and methane emission from paddy rice cascade, Northwest Vietnam

Aung Zaw OO[1], Kimura Sonoko DOROTHEA[1], Khin Thuzar WIN[1], Nguyen Xuan HUU[2], Lam NGUYEN[2] and Georg CADISCH[3]

[1]Tokyo University of Agriculture and Technology, Tokyo, Japan
[2]Hanoi University of Agriculture, Vietnam
[3]University of Hohenheim, Germany

In tropical mountainous regions of Northern Vietnam, most of the population depends on the cultivation of paddy rice in lowlands and crops such as maize and cassava in upland areas with relatively steep slopes. Intensive cultivation of upland crops enhances large nutrient losses through erosion in the upland areas. However, in the lowland areas, sediment deposition can enhance soil fertility depending on the quality of the sediments, and influence the crop productivity. To access the spatial differences in soil properties, crop yield and methane (CH_4) emission at cascade level affected by either sediment induced or farmers' fertility practice, field experiment was

conducted in Cheing Khoi watershed, Son La Region, North Vietnam. The experiment was conducted during the spring crop season (February to July, 2011) with two different cascades (one cascade consists of 5 different paddy rice fields) wherein half of each cascade was fertilized with farmer recommendation practice, while no fertilizer was applied on the other half each. Methane gas emission was measured at 3 replication in each field weekly and paddy rice growth (tiller number and height), water quality was measured monthly. At the final harvest, yield component parameters were determined with 3 replications.

The results of the analysis of variance showed that the effect of farmer practices with fertilizer application and different cascade position as well as by their interaction had significantly differences on all yield, yield component parameters and CH_4 emissions in both cascades. Rice yield in the middle of cascade showed better performance than the other field positions in fertilized and unfertilized fields in both cascades. The observed grain yields for non-fertilized fields averaged over both cascades, accounted for 0.55, 0.64 and 0.47 kg m^{-2} in top, middle and bottom fields, respectively, while for fertilized fields, grain yield of 0.72, 0.79 and 0.63 kg m^{-2} were obtained. Higher rate of CH_4 emission was found in middle field of cascade 1 (2.3 and 2.96 mg CH_4 m^{-2} h^{-1}, in non-fertilized and fertilized plot, respectively) and higher in bottom field of cascade 2 (2.36 and 3.71 mg CH_4 m^{-2} h^{-1}) until active tillering stage. The differences in crop yield and CH_4 emission requires different crop management practices for each cascade position in order to improve rice production in this watershed area.

Influence of different Ca amendments on CH_4 emission under Na-salinized paddy soil

Ei Ei THEINT, Aung Zaw OO, Suzuki MAI, Motobayashi TAKASHI and Kimura Sonoko DOROTHEA

Tokyo University of Agriculture and Technology, Tokyo, Japan

Salinity is among the factors suggested to influence methane (CH_4) emission from rice fields. Rice fields represent one of the main sources of greenhouse gas CH_4, occupying 10% of global anthropogenic CH_4 emission. About 30% of world's rice areas are affected by salinity. Therefore the objectives of this study were to evaluate the influence of salinity and different Ca amendments upon CH_4 emission under Na-salinized soil. Pot experiment was conducted in RCB design with 3 replications. There were three levels of salinity; 0, 30 (S30) and 90 (S90) mmol L^{-1} NaCl and two Ca amendments; gypsum (GM) and poultry manure (PM) with 230 kg Ca/ha. A salt tolerant Indica variety Dolfak was used in this experiment. For all plots, nutrient level was adjusted to 70 kg N/ha, 40 kg P/ha and 70 kg K/ha. To confirm the effect of different salinity levels on CH_4 emission, 20 g of soils were incubated with 0, 10(S10), 30(S30), 60(S60) and 90(S90) mmol L^{-1} NaCl for 3 weeks at 30 ˚C.

The incubation eperiment showed higher CH_4 emission in S10 and S30 than in control, while that of S60 and S90 was lower than control, though it was not statistically significant.

In the pot experiment, there was no significant difference in CH_4 emission between control (316 kg CH_4 ha^{-1} $season^{-1}$) and PM (338 kg CH_4 ha^{-1} $season^{-1}$) but significantly different compared to GM (140 kg CH_4 ha^{-1} $season^{-1}$) for the non-salinity treatments. GM showed 56% lower in CH_4 emission than control and PM. In salinity treatments, S30 without amendments was not significantly different from control and PM. All treatments in S90 showed minimal CH_4 emission. Plant growth was significantly suppressed due to the saline treatment, especially at S90 no grain could be harvested. As different salitiny level was compared, CH_4 emission of S30 was lower than control but not significantly different, while S90 was significantly lower than control and S30. 90% of CH_4 emission in rice fields are transported by plants mediated transport system. Since CH_4 production was not significantly inhibited at the incubaiton experiment, the growth inhibition due to salinity was strongly influencing the CH_4 emission and led to suppression of CH_4 emission. Therefore, from these results, it can be concluded that sa-