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

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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 salinity up to 30 mmol L^{-1} NaCl is more favorable for CH_4 emission. The application of gypsum can suppress CH_4 emission either in saline or non-saline condition.

Mitigation of impact of nitrogen cycling associated with agriculture and food consumption on regional environments

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Concerns about environmental problems such as water pollution, eutrophication, acidification, air pollution, global warming, ozone layer depletion associated with nitrogen load is increasing. Global nitrogen load associated with agriculture and food consumption is supposed to account for 90% of the total, and there is a large nitrogen load in Asian countries with the remarkable growth of the population.

Using the inventory data concerning the flows and stocks of nitrogen in the systems of agriculture and food consumption, and the census data in each province of Japan, the export (E), cycling (C), loss (L) and purification in sewage plants (P) were estimated, and their total is obtained as a total system throughput (TST). The L increased with the increase of TST and accounted for 50% of the TST. The L increased with the increase of proportions of urban area and upland crop field significantly. And the L also increased with the increase of population, animal excreta, and chemical fertilizer application, and decreased with the increase of nitrogen fixation significantly.

Stream nitrogen concentration in each province in Japan was estimated by assuming the ratio of stream runoff to net nitrogen input (NNI) of 0.27 and the ratio of stream water discharge to precipitation of 0.75. The NNI is defined as the difference between the input and the output of nitrogen in the region, and equals to L+P. The area with the estimated nitrogen concentration higher than 1 mg N L^{-1}, which is the Japanese environmental standard for stream nitrogen concentration, was 66% of the total area of Japan. In that case, 55% of NNI was derived from agriculture, and disposed animal excreta accounted for 14% of L. If all the disposed animal excreta were used to alter chemical fertilizer application, NNI derived from agriculture decreased to 50%, and the area with the nitrogen concentration higher than 1 mg N L^{-1} reduced to 31%.

N_2O emission in each province in Japan was estimated by assuming that NNI not discharged to river is denitrified as N_2O+N_2 (based on the significant increase of stream bicarbonate runoff with the increase of NNI not discharged to river), and the ratio of $N_2O/(N_2O+N_2)$ of 0.71±0.26 (which was measured for the 84 soil samples with pH of 4.3 to 6.6). The result showed 41% of NNI was estimated to be emitted as N_2O. The estimated N_2O emissions derived from agricultural fields and sewage plants in each province ranged from 2.3 to 32.7 and from 3.0 to 107.1 kgN ha^{-1} yr^{-1}, respectively. By alteration of chemical fertilizer to disposed animal excreta, the N_2O emission was reduced by 19%.

These findings suggest that reduction of nitrogen input into agriculture is effectively influencing the mitigation of environmental loss from agriculture, and further improvement of self-sufficiency of food to reduce the loss from sewage plants is required.