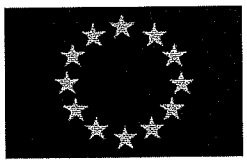

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Nitrogen Mobilization in Bangladesh Agriculture and Strategies for Reducing the Estimated N_2O Emission

Mohammad Ibrahim Khalil[a,b], Md. Hedayet Hossain[a] and Urs Schmidhalter[b]

[a] Soil Science Division, Bangladesh Institute of Nuclear Agriculture Mymensingh 2200, Bangladesh (E-mail: khalilmi@bttb.net.bd).
[b] Chair of Plant Nutrition, Technical University Munich, Germany.

1 Abstract

Increasing N loads to Bangladesh agriculture resulted in a large release of nitrous oxide (N_2O) to the atmosphere, as estimated using the IPCC methodology. Animal management followed by indirect pathways dominated its' emission. Use of synthetic N fertilizers contributed more (30%) in 2000 over the 1990 level. Global contribution from Bangladesh was small (1.62%), which is probably overestimated. However, strategic management approaches and recycling of organic materials could reduce the increased N_2O under Bangladesh conditions.

2 Introduction

Asia seems to be the major contributor of reactive nitrogen (Nr) to the global atmosphere, as the consumption of N fertilizers has been increasing remarkably (Galloway, 2000). The ever-increasing population boom is one of the important causes, resulting in growing demand for food and energy, and thus a potential source of greenhouse gases. Though Bangladesh is a small country in Asia, N inputs to agricultural systems have been increased to a large extent. This could lead to Nr formation, particularly N_2O and NH_3 that are directly or indirectly responsible for global warming, ozone layer depletion (Warneck 1988) and acid deposition. Hence, an inventory of N_2O emission was performed for baseline information to that effect.

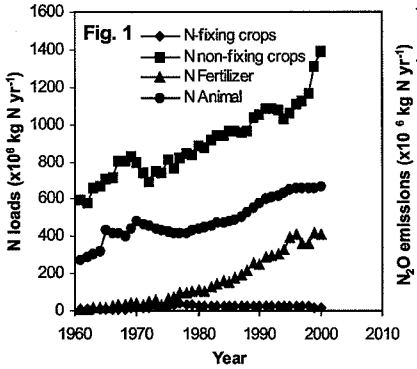
3 Materials and Methods

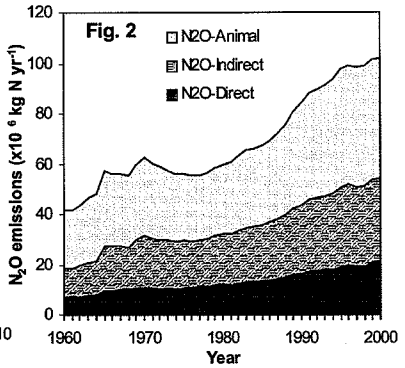
Information on different N sources directly or indirectly added to the agricultural systems were collected from the database of Food and Agriculture Organizations, Bangladesh Bureau of Statistics, and other institutes dealing with agriculture and livestock sectors. Some missing information in between was interpolated with the available data. The historical N mobilization starting from 1961 to 2000 and the resultant N_2O

emission were estimated using the revised version of Intergovernmental Panel on Climate Change (IPCC) methodology (Mosier et al. 1998). The emission factor was 0.0125 for synthetic N fertilizers and as specified in case of Asia for other N sources.

4 Results and Discussion

The N loads in Bangladesh agriculture increased with time (Fig. 1) except the biologically fixed N, which was decreased by 24%, indicating cereals replaced the area under legumes. The crop biomass and N fertilizers had contributed 33 and 63%, respectively more in 2000 over in 1990. The application of N fertilizers started to increase gradually with time from the late 70's by introducing high yielding cereals and subsequent increase in biomass N. Its' load from animal sources was enhanced by 14% but seemed to be stable at the end of last decade. Based on the N mobilization and relevant emission factors, the resultant emissions followed similar trends for N_2O released directly from agricultural soil (N_2O-direct), other N loss processes from agricultural soil (N_2O-indirect) and animal production systems (N_2O-animal) with time (Fig. 2). In 2000, the emission in kg N yr^{-1} from animal source was observed to be the highest ($48.2*10^6$), followed by N_2O-indirect ($32.8*10^6$) and N_2O-direct ($21.3*10^6$). In contrast, N_2O-direct was increased by 30%, which was higher than the other two sources (19-20%) in 2000 over 1990 level. The contribution of different N sources to N_2O-direct and -indirect was similar except on N_2O-animal, where the N from goat + other minor animal sources together had shown an increase of 8% by the last decade. Besides, Bangladesh added only 1.62%, probably an overestimation, of the total global emission ($6300*10^6$ kg N_2O-N yr^{-1}). The large seasonal variations and diversified cropping systems could generate broader uncertainty on its' emission.





5 Conclusions

The use of synthetic N fertilizers to Bangladesh agriculture, the rate of which is generally lower than in most other countries, are important to sustain the increased crop production based on population demand. Introduction of animal farming system and recycling of animal waste to agricultural fields could reduce the application of N fertilizers, following integrated plant nutrient system. Thus, increased cropping intensity with adoption of improved management options could lead to reduce N_2O emission to 1990 level as per Kyoto protocol.

6 Acknowledgements

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