CONFERENCE/WORKSHOP ORGANISER'S REPORT

"Climate change, reactive nitrogen, food security and sustainable agriculture"

Brief Description of what the conference/workshop was about

The objective of this workshop was to bring together leading experts in the field of food security, soil science and greenhouse gas emissions from soils to discuss the current knowledge on and establish a global research network for nitrous oxide (N_2O) mitigation and denitrification in fertilised cropping systems. The participants presented and discussed latest research findings and policy developments on the trade-offs between crop productivity, N fertilizer use, and GHG emissions of agricultural ecosystems around the globe, with the aim of identifying hotspots and knowledge gaps of denitrification and N_2O emissions, reducing uncertainty of flux estimates, and establishing consistent standards for methodologies.

Participation – details of total number of participants, countries they came from, backgrounds (academia, industry, etc.)

In total there were 30 participants from 14 different countries mainly from an academic background, working for universities or government departments.

Major highlights from the presentations

The different presentation highlighted that, despite uncertainties and the need for additional research on processes driving N_2O emissions, there is sufficient knowledge available to implement immediate action towards reducing N pollution, specifically N_2O emissions. The actions (see below) demand a more efficient use of fixed and reactive nitrogen in order to reduce greenhouse gas emissions and other forms of N pollution from agricultural systems.

MITIGATION OPTIONS

- Strongly discourage use of N in excess of crop requirement. There is a clear non-linear relationship between fertilizer application and N_2O emissions, with emissions increasing exponentially when application rates exceed plant N requirements.
- Enhance nitrogen use efficiency (NUE) of mineral and organic fertilizers. Technologies and practices to apply fertilizer at the right time, the right place, the right type and the right quantity are available (e.g. variable rate technologies, or enhanced efficiency fertilizers).
- Encourage the increased use of cover crops and perennial forages in crop rotations as this helps retaining N within the agro-ecosystem, thus improving NUE.
- Promote novel technologies, such as the development of new crop varieties that reduce N losses through biological nitrification inhibition (BNI) by plant root exudates. New microbiological research shows the potential to cultivate N_2O-reducing bacteria that may significantly reduce N_2O emissions upon application to soil.
- Improve recycling of N-containing agricultural products typically considered as waste (circular economy). This includes optimizing animal manure management and reducing food waste (at both the industrial and household level).

- Incentivize reduced human consumption of animal-sourced protein (meat, milk, eggs). Nitrogen use efficiency of animal-sourced protein is approximately one tenth of that for plant protein. The trend in some OECD countries of reduced consumption of animal-sourced proteins not only benefits the environment, but is also favorable to human health.
- Promote the increased use of biological or microbial derived N (e.g. legumes) in the agri-food chain as this benefits soil health and can reduce the use of synthetic fertilizers without jeopardizing yields.

Major outcomes/conclusions in terms of policy relevance

Recommended policy actions:

- The Nationally Determined Contributions (NDCs) are central components of the Paris Agreement. Given the key role of N_2O as a leading agricultural GHG, specific consideration of this gas in the 2020 NDC updates is essential.
- Implementation of targeted mitigation options for N_2O. These must avoid the risk for "pollution swapping" – where one N compound is reduced at the expense of another. This can provide significant improvements (co-benefits) to water and air quality, biodiversity, acidification and eutrophication of soils and water bodies.

Relevance to CRP theme(s)

The workshop helped to improve our current understanding of denitrification and N_2O fluxes in order to better manage natural capital in the form of land, soil and water and provided a framework for international cooperation in key research and policy areas of food, soil, water and climate change with proven international experts.

Website for further details – please also indicate if the presentations are/will be available on the website

The workshop conference proceedings and presentations will be available on following website:

https://mopga.imk-ifu.kit.edu/workshop