Nitrogen Flagship

Newsletter 1 – May 2024

Nitrous oxide (N_2O) emissions due to the application of nitrogen (N) fertiliser to agricultural soils represent 60.5% of global N_2O emissions from agricultural soils[1]. These emissions can vary according to the agricultural system as well as soil and environmental conditions.

There is a lack of information on the environmental and soil conditions and relevant variables that underpin estimates of these emissions, with significant gaps existing for some regions and productive systems. This limits the accuracy of national GHG inventories, and the ability to adequately reflect the effect of implemented mitigation actions.

The Nitrogen Flagship (N flagship) was implemented by the Global Research Alliance on Agricultural Greenhouse Gases (GRA) for the period 2022-2027[2]. The aim of this flagship is to help countries to improve their national inventories reporting under the Paris Agreement, by developing Tier 2 (reflecting local soil and climate conditions) and Tier 3 (modelling based) emission factors for the use of N fertiliser, relevant for the estimation and reporting of direct N_2O emissions from soils.

This Flagship project seeks to compile existing data and undertake new field measurements to develop context-specific emissions factors relating to the application of nitrogenous fertilisers for the purpose of inventory improvement, including N_2O mitigation accounting.

The activities of this project cover the coordination and management of the overall N flagship. This involves liaison with pillar projects in Ireland-New Zealand (called Refining Emission Factors for Inventory Reporting (REEFIR; 2022-NZIRL REEFIR-AGR)) and South America (called Optimizando el Uso de Nitrógeno, Mayor Producción y Menor Impacto (N4R; ATN/RF-20641-RG andATN/RF-20642-RG)). Additionally, the project coordinates with relevant GRA research groups and participates in GRA's technical and governance activities.

The objective of the Irish-NZ REEFIR project is to investigate the development of Tier 2 and 3 N_2O and ammonia (NH_3) emission factors relating to N synthetic fertiliser application to temperate pastoral soils. This 4-year project, initiated in March 2023, is currently focusing on collating data for developing Tier 2 and Tier 3 N_2O and NH_3 emission factors for N fertilisers. A total of 216 observations have now been collated from published studies, with quality control (QC) processes currently underway. Once QC of the current data has been completed, we will initiate statistical analysis of this early version of the dataset to examine key drivers and explore revised emission factors. These QC-checked data will eventually be included in an expanded version of the DATAMAN database (https://www.dataman.co.nz/), allowing free

[1] Tian et al (2020). A comprehensive quantification of global nitrous oxide sources and sinks. Nature 586, 248–256. https://doi.org/10.1038/s41586-020-2780-0

[2] Reducing N_2O emissions and improving accounting | Global Research Alliance

access to other researchers and inventory compilers. The project also includes a strong element of process-based modelling to examine the influence of drivers on N_2O emissions from contrasting soils and climates. Data collation for testing DNDC and APSIM process-based models is near completion, after which models will be used for initial simulations of test datasets. As part of the wider GRA Flagship, we are inviting researchers with data on N_2O emission factors for N fertiliser applied to other agroecosystems (e.g., temperate cropping, tropical grassland and cropping, etc.) to share their data with the REEFIR project. This would then provide opportunities for investigating revised emission factors for a wider range of agricultural ecosystems.

In Latin America further steps have been taken to formalize the contracts between Fondo Regional de Tecnología Agropecuaria (FONTAGRO) and the institutions participating in the initiative. FONTAGRO is a unique sustainable co-financing mechanism for the development of agricultural technology in Latin America, the Caribbean, and Spain. This project is being implemented by Instituto de Investigaciones Agropecuarias (INIA Chile) in collaboration with Instituto Nacional de Tecnología Agropecuaria (INTA Argentina), Universidad Nacional Agraria La Molina (UNALM Perú), Instituto Dominicano de Investigaciones Agropecuarias y Forestales (IDIAF República Dominicana), and Instituto de Investigación Agropecuaria de Panamá (IDIAP Panamá). The main objective of this initiative is to optimize the management of N fertiliser in pastures and crops, favouring the development of more sustainable production systems. Furthermore, this project will agree on experimental protocols for measuring N_2O emissions adapted to local conditions and determine N_2O emission factors for the use of strategic N fertilisers according to relevant national conditions. It will also explore potential mitigation measures or technologies, relevant and pertinent to the national reality and disseminate the knowledge generated by the project among farmers, advisors and public and private entities to complement mitigation actions. A kick off workshop is planned for later this year in Osorno, Chile. It is expected that field experiments will be implemented in each participating country starting from early 2025.

If you are interested in the progress of one of these initiatives or you would like to contribute with data to the current work undertaken, please contact us through the GRA.

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