Nitrous oxide, commonly known as laughing gas, is a chemical compound with the formula N₂O. However, in the case of the environment, its presence is no laughing matter. N₂O is a potent greenhouse gas (GHG) with a long-term global warming potential 298 times that of carbon dioxide (CO₂) and, in New Zealand, approximately 15% of total GHGs are N₂O.

Professor Hong Di (Lincoln University) and Dr Cecile de Klein (AgResearch) are jointly leading the NZAGRC N₂O research programme. This seeks to reduce N₂O emissions from agriculture and explore potential on-farm management options for these emissions. The research team are focussing on two key processes in the nitrogen cycle, nitrification and denitrification, with the aim of both discovering and developing ways to manipulate them to benefit the environment.

With respect to the nitrification process, the team is investigating the microbes involved at a detailed genetic level in order to see whether they could be inhibited by new molecules other than the already known nitrification inhibitors (such as DCD). Additionally, scientists are looking to develop improved protocols for the use of existing knowledge about soil moisture and its relationship with N₂O to understand whether emissions can be reduced by farm management practices. There is already extensive scientific information which shows that there is a threshold level of soil moisture above which N₂O emissions increase dramatically. Therefore, it may be possible to develop robust guidelines relating to when and where to apply fertiliser and graze livestock during different times of the year.

The following pages profile some of the NZAGRC-funded N₂O work that was started in 2010. This includes some initial work which was conducted to investigate ways to reduce nitrogen inputs into the agricultural soil system.

The nitrogen cycle

GAINS

- Nitrogen Fixation
- Legume N Fixation
- Animal Manure
- Plant Uptake

LOSSES

- Gaseous Losses: N₂, N₂O, NO, NO₂

Nitrification

NH₄⁺ → NO₃⁻ → N₂O → N₂