



Resilient Cropping

Nitrous oxide emissions

A significant greenhouse gas

Nitrous Oxide (N₂O) is a significant greenhouse gas because of its longevity and potency in the atmosphere. Its warming potential is about 300 times worse than CO₂.

96% of NZ's nitrous oxide emissions come from direct or indirect emissions from the soil. These losses are a cost to the farm business; nitrogen inputs are wasted and yields may be reduced.

Nitrous oxide is produced by microbial nitrification and denitrification processes in the soil. Inorganic and organic nitrogen is converted into nitrous oxide gas which is lost to the atmosphere. These processes are influenced by the soil conditions and the weather. Common sense farm management can minimise losses.



Most nitrous oxide emissions from arable soils are linked to the use of nitrogen fertilisers.

Farmers can influence nitrous oxide emissions by managing the physical condition of their soils and matching fertiliser applications to the crop demand and the environmental conditions. Inorganic nitrogen fertilisers provide a readily available source of nitrogen for nitrifying and denitrifying bacteria.

Organic nitrogen sources, such as effluents are stable until they are mineralised.

Reducing Emissions

Nitrous oxide emissions can be minimised by following the **4Rs** of fertiliser management.

- The **right form** of fertiliser to match the expected conditions.
- The **right rate** of fertiliser, applying only as much as the crop needs. Tools like the Wheat Calculator and AmaizeN can be used to predict the optimal fertiliser rate.
- The **right timing**; split applications at planting and later to match peak crop demand, are the best option to reduce emissions.



- The **right placement**, broadcast applications are usually less efficient than knifed or incorporated applications.

Microbial denitrification processes in anaerobic soil conditions cause large emissions. Land management practices that prevent compaction and improve drainage to prevent anaerobic soil conditions are beneficial.

The use of no-till practices may increase the risk of nitrous oxide emissions in some soils if they remain consistently wet and anaerobic conditions develop. However the wider benefits of reduced tillage should be considered.

Fallow periods should be short. If there are no plants to take up the soil nitrogen, it is at risk of being lost as nitrous oxide or leached as nitrate.



The biggest effect on nitrous oxide emissions from irrigation is from saturation of the soil through over application. Irrigation applications should be scheduled to match the soil moisture balance to crop the demand. Soil moisture monitoring and irrigation scheduling software, like Aquatrac, are useful tools for irrigators.

It is important to apply water at a rate that matches the soil's capacity to absorb it. Runoff can cause ponding in the paddock which accelerates nitrogen loss through denitrification.

It is also important to check and calibrate all irrigation equipment regularly to ensure it is performing to specification. Simple methods like setting out catch buckets under the irrigator to assess its uniformity can highlight maintenance or design features that need to be fixed.

Reference: Arable Update 94 Reducing nitrous oxide emissions from arable farms