

How to tell if you are losing nitrogen from your farm

Key messages

- Nitrogen losses occur when nitrogen fertiliser applied to crops via synthetic/organic fertilisers, or fixed by legumes, is lost to the environment through surface run-off or leaching through the soil profile to groundwater.
- Some nitrogen losses can still occur even if best management practices are adopted throughout the farm.
- Conducting water quality assessments on your farm helps you to understand if nitrogen losses are occurring, where losses are occurring, to assess management practices you have adopted or are considering adopting and to help identify opportunities for improvement.
- Nitrate is monitored as a proxy for nitrogen, that in excess quantities causes environmental impacts.

Introduction

Nitrogen losses can be identified by testing the water quality on your farm to understand if and where you are losing nitrogen. You are then in a better position to identify ways to prevent nitrogen loss.

Nitrate (NO_3^-), nitrite (NO_2^-) and ammonium (NH_4^+) are [different forms of nitrogen](#) that make up dissolved inorganic nitrogen (DIN). Nitrate is usually found at higher concentrations than nitrite and ammonium in farm surface run-off or groundwater. Nitrate is a water-soluble ion that can be transported via surface water run-off during rainfall or irrigation events, by leaching through the soil profile into the groundwater, or through sub-surface drainage (e.g., ag-pipe) (Figure 1).

Nitrate is usually the most common form of bioavailable nitrogen in surface water and groundwater in agricultural areas. Bioavailable means it can be readily used by plants and other organisms.

Natural environments like forests and wetlands usually have low levels of nitrate. Excess nitrate in waterways or wetlands can lead to weed or algae growth, which can impact fish and wildlife. Therefore, nitrate concentrations in water are often monitored to assess water quality on farms or in catchments with farming or urban areas.

What does nitrate in water indicate?

Although nitrate is naturally occurring, concentrations are usually low. For example, monitoring of forested reference areas in the Herbert catchment¹ shows that nitrate concentrations are generally below 0.2 mg/L nitrate-N. Nitrate concentrations above this are unlikely

to be from natural sources and can cause ecological impacts in freshwater and marine environments.



Figure 1: Nitrate can be transported off farm through surface water in the drains, or by leaching to groundwater.

Detecting elevated nitrate in surface water or groundwater on your farm indicates that not all the fertiliser is being taken up by the crop, and some is being lost. Monitoring can help identify ways to reduce nitrate losses (e.g., change in [farm management practices](#), use of [treatment systems](#), or a combination of both). Monitoring also helps assess water quality improvements through changes in agronomic practice or the use of treatment systems to demonstrate environmental stewardship (Figure 2).

How can you monitor nitrate losses?

Nitrate losses can be monitored by collecting surface water and groundwater samples throughout the year to assess the variation in nitrate concentrations.

This factsheet is part of the “*Is nitrogen leaving my farm?*” fact sheet series describing how to monitor

¹ Roberts C, Skelton M, Glen J, Souza Dias F, Turner RDR, Neelamraju, C, Ferguson B, Fisher S, Sinclair M, Houseman B, Goddard G, Keenan D, Gardiner R, Marsh A.P, Wilson E, and Mann RM. 2024. [Fine Scale Water Quality Monitoring in the Herbert Catchment](#).

[Communications Report](#). Brisbane: Water Quality & Investigations, Department of Environment and Science, Queensland Government

surface water and groundwater on a farm. The other fact sheets include:

2. **How to monitor surface water quality on your farm**
3. **How to monitor groundwater quality on your farm**
4. **How to use nitrate strips to test water quality on your farm**
5. **How to process a water sample for laboratory analysis**
6. **How to construct piezometers for monitoring groundwater on your farm**
7. **How to install piezometers on your farm**
8. **How to design a network of piezometers on your farm**

How can I measure nitrate in water samples?

Rapid nitrate test strips are the easiest and cheapest way to assess nitrate losses (Figure 3). Refer to “**4. How to use nitrate strips to test water quality on your farm**” for further information on the pros and cons of nitrate strips. For more accurate measurements of nitrate concentrations and other forms of nitrogen, or where nitrate-N concentrations are below 5 mg/L, surface water or groundwater samples should be collected and sent for laboratory analysis. The [Queensland Government’s Monitoring and Sampling Manual 2018](#) details how to collect, process and transport a sample for laboratory analysis. For a brief overview, refer to “**5. How to process a water sample for laboratory analysis**”.

How is concentration reported?

In agriculture, the concentrations of nitrate, nitrite, and ammonium are generally expressed as nitrate-nitrogen (nitrate-N or $\text{NO}_3\text{-N}$), nitrite-nitrogen (nitrite-N or $\text{NO}_2\text{-N}$), and ammonium-nitrogen (ammonium-N or $\text{NH}_4^+\text{-N}$). This means that only the weight of the nitrogen atoms is considered rather than the entire weight of the molecules. For example, the molecular weight of nitrate will consider 1 nitrogen atom plus 3 oxygen atoms, whereas nitrate-N will only consider the weight of the nitrogen atom.



Figure 2: Monitoring can help assess water quality improvements through changes in farm management.



Figure 3: Nitrate test strips can be used in places that have high nitrate-N (e.g., above 5 mg/L), like this sediment trap, which collects farm run-off and contains algae, indicating elevated nutrients.

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Disclaimer

The information contained herein is current as of June 2024 and is subject to change without notice. Information presented is a simple guide for assessing nitrogen loss and the reader should also consult Queensland Government’s Monitoring and Sampling Manual 2018. The Queensland Government shall not be liable for technical or other errors or omissions contained herein. The reader/user accepts all risks and responsibility for losses, damages, costs and other consequences resulting directly or indirectly from using this information.

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