

## Profitable dairy farming: Good business management reduces greenhouse gases

### Getting nitrogen fertiliser right: more profit, fewer emissions

Tips for managing nitrogen fertiliser to improve efficiency, increase profit and reduce emissions

#### Why focus on nitrogen?

Nitrogen fertiliser use is essential in most dairy systems but the low efficiency of its use means that more than 60% of nitrogen added to pasture systems is lost to the environment. Nitrogen loss from pastures occurs through the processes of denitrification, leaching and ammonia volatilisation, each of which lead to environmental problems including emissions of the greenhouse gas nitrous oxide and nitrogen pollution of waterways.

With nitrogen efficiency often below optimum in dairy systems, there are a number of practical ways farmers can better match their nitrogen fertiliser applications with pasture demand, other inputs and prevailing conditions – and therefore reduce input costs. A best-practice management approach to nitrogen management will improve fertiliser use efficiency, reduce nitrous oxide emissions and other forms of nitrogen pollution, and save money.

#### How does it work?

##### Background

Farmers should use nitrogen strategically – when plants will respond to extra nutrition and when extra feed is needed. Strategic nitrogen use also means considering whether purchased feed will be a cheaper means of filling the feed gap than buying the nitrogen fertiliser required to grow the additional pasture.

It then comes down to the 4Rs: use the right source of nitrogen, at the right rate, in the right place and at the right time.

##### Apply the *right* source

Denitrification rates are highest on warm, wet soils, and from nitrate based fertilisers (e.g. urea ammonium nitrate). Nitrate-based fertilisers should only be used during the drier times of the year. Use urea- or ammonium-based (e.g. DAP) fertiliser when application is necessary on wet soils (e.g. between May and October in southern Australia).

##### Apply it at the *right* rate

Nitrogen is commonly in surplus on Australian dairy farms. Considerable cost savings could be made by better integrating your fertiliser application rates with existing nitrogen supply and pasture demand.

The most efficient pasture growth responses occur when nitrogen fertiliser is applied at 25-50 kg N / ha at any one time (Eckard and Franks, 1998). Above this, emissions will be high and pastures will be unable to utilise the extra nitrogen, meaning more expense for minimal return. Below this, growth rates won't be optimised, reducing return on the cost of fertiliser application.

##### Key points

- Poor nitrogen fertiliser management increases greenhouse gas emissions and wastes money
- Strategic use of nitrogen – when plants will respond and when extra feed is needed – saves money, time and emissions
- Poor irrigation and soil management practices will lead to loss of nitrogen from the system, including some as nitrous oxide.

##### Key recommendations

- Use best practice nitrogen fertiliser management to reduce nitrogen loss, and improve nitrogen use efficiency and therefore profitability of nitrogen use
- Avoid high rates of nitrogen fertiliser, especially when soils are warm and close to field capacity
- Use best practice soil and irrigation management practices to make the best use of water, reduce soil inundation and minimise loss of nitrogen from the soil.

### Apply it in the *right* place

Nitrogen fertiliser will be most effective when there are few other limiting environmental factors. This includes lack of other nutrients (P, K or S), low soil pH, poor ground cover, poor species composition, high density of weeds, overgrazed pastures and compacted soil. Application under these conditions means plant uptake will be low, fertiliser will be wasted and nitrogen losses will be high.

Use fertiliser where conditions will be most conducive to plant growth. This means the warmer northern slopes in winter, and in paddocks with good species composition and nutrient profile.

Areas already high in nitrogen – such as around gateways, water troughs and shelter belts where urine and dung are deposited – don't need fertiliser. Avoiding these areas saves money and reduces nitrogen loss.

### Apply it at the *right* time

Applying fertiliser when your pastures are actively growing will maximise nitrogen uptake by plants and minimise the excess nitrogen available to be lost. Plants are most responsive to additional nitrogen just after grazing.

To minimise denitrification avoid wet soils where possible. Ammonia volatilisation is higher with high evaporation and dry, warm weather, so timing your summer urea applications just prior to a rainfall or spray irrigation event can provide enough moisture to minimise volatilisation losses. Alternatively, you can apply urea 2-3 days prior to grazing so that the pasture canopy is high enough to reduce wind speed and thus volatilisation.

### Best practice irrigation and soil management will minimise nitrogen losses

Irrigation affects emissions by influencing soil aeration and water content – high soil water levels create conditions which encourage the conversion of nitrogen to nitrous oxide and the leaching of nitrate. You can minimise emissions from the soil by applying irrigation evenly and according to plant demand and soil type, and avoiding long periods of soil inundation.

Soils that are saline, acid or sodic will restrict how effectively crops can utilise soil nitrogen, meaning there is greater potential for nitrogen loss. Under these conditions, reduce nitrogen inputs to reflect the true yield capacity of pastures.

## Case study: Getting the most from nitrogen fertiliser

Victor Rodwell and his family run a 700-cow dairy business near Boyanup in Western Australia, producing around 5.3 million litres of milk per annum. Their nitrogen use efficiency is 41%, more than double the state average of 19%.

Victor uses nitrogen to regulate the feedbase. "Working out how much feed we want to grow is the starting point for fertiliser use," he says. Regular soil and leaf testing allows him to watch soil nutrient trends and adjust rates accordingly, ensuring the right balance of nutrients for optimum fertiliser use efficiency and plant growth.

He also takes into account the time of year, previous rainfall events, and the amount of mineralisation or leaching when deciding on the nitrogen rate. Fertigation enables the Rodwells to apply lower rates more often, so they can better match nutrients applied with plant needs and avoid excess nitrogen in the system.

Granular urea is their dominant source of nitrogen because it is cheaper per unit of nitrogen than any other source. They also apply effluent, using a standard effluent analysis to estimate application rates. Basal applications of fertiliser to adjust soil fertility to the correct levels are done with GPS guidance fitted to the tractor, ensuring nutrient are applied only where they are needed. This has reduced total fertiliser use, with the investment paying for itself via fertiliser savings in the first winter.

<http://fertsmart.dairyingfortomorrow.com.au/wp-content/uploads/2013/04/P1.00323-Rodwell-Nutrient-Plan.pdf>

### Further information

Fert\$mart:<http://fertsmart.dairyingfortomorrow.com.au>

Dairy Climate Toolkit:

<http://www.dairyaustralia.com.au/Environment-and-resources/Climate/MicroSite1/Home.aspx>

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