Waikato Regional Council

Nitrogen

Fertiliser and effluent

GENERAL INFORMATION

Pasture requires nitrogen (N) in greater quantities than any other nutrient. Most of the N comes from the breakdown of organic matter in the soil. In New Zealand, pasture receives its N mainly through clover fixation of N from the air, so regular applications of N are not required for high production of pastures. However, N limitations can occur in the autumn and spring and may lead to feed deficits.

Nitrogen fertiliser is regularly used on farm to stimulate pasture growth to fill these feed deficits. Urea is often the N fertiliser of choice but other N fertilisers are also used.

Another low cost source of N is dairy shed effluent.

Once in the soil N is converted by soil bacteria to the nitrate form, which is highly soluble and is used by grass to produce more feed.

However, if ground temperatures are too low or conditions are too dry for pasture to use the N, it can build up in the soil and be leached to groundwater or lost from the farm via surface water when it rains.

The increasing level of nitrate in our waterways in the region concerns us all, as it is both a loss to the farm and a contributor to fresh water decline.

Implementing a nutrient management plan helps farmers get the most from all nutrients applied to their land.

Put simply, the strategic use of fertiliser under a nutrient management plan can help grow more grass and reduce environmental risks at the same time. Applying the principles outlined below will help you get the most from your fertiliser and effluent N.

APPLICATION RATES

The efficiency of N use declines as the rate of N application increases. Application rates should not exceed 50kg N/ha because of the declining efficiency of N use and a negative effect on clover. Reduced clover growth occurs because of increased competition by grasses for nutrients and light. For early spring applied N fertiliser, the decreased growth in clover generally coincides with peak pasture production in October to December. A longer grazing interval at this time increases shading of clover by grasses and exaggerates the depression in clover growth.

Set stocking in a sheep and beef situation may not allow full expression of the N response to occur. However, in the spring it can improve the feeding levels.

Nitrogen is used on farm to fill feed deficits.

TIME OF APPLICATION

If pasture growth is restricted by cold temperatures, waterlogged soils or dry conditions, N responses will be limited. Pasture responses are largest and most reliable, generally speaking, when the growth rate of pasture is greatest.

Spring: Responses to N are often greatest in the spring and early summer. Grass growth and the plant's demand for N can exceed the soil's capacity to mineralise and supply N to the plant roots. So, response rates are consistently higher in the spring. Soil temperatures above 7°C at a depth of 10cm at 9am is a good benchmark to use for getting the most out of early spring applied N. Late spring and early summer responses are the best. Shorter response times will fit with quicker rotation lengths in dairy herds at this time of the year.

Autumn: Responses to autumn applied N are variable because of the large differences in soil temperature and moisture seen between different years. In dry summers, high temperatures and low soil moisture levels have a greater restriction on grass growth than on the breakdown of organic matter and the release of N. The result of this is an increase in the levels of plant available soil N. So pastures are less likely to respond to N fertiliser in autumn following a dry summer.

The use of N fertiliser can increase the amount of feed available to carry through the winter provided it is applied early enough in the autumn. There is a risk that late autumn applied N will be lost to groundwater as the pasture growth rates slow. N stress in autumn is likely to be most severe following a wet summer. Early autumn response rates will then be expected to be higher than following a dry summer.

Winter: At soil temperatures below 5°C at a depth of 10cm both grass growth and mineralisation are limited. The efficiency of N is very low. One can avoid applying winter N if the herd is dried off on the basis of a feed budget. A feed budget approach will consider cow condition in dairy herds and allows the best N response rates when soil temperatures and grass growth rates are higher. Rainfall is usually higher in winter and the risk of losing the N by surface flow to waterways and groundwater is higher. The months of May, June and July are the high risk months for loss.

SOIL CONDITIONS

Any factors that limit plant growth also restrict the ability of the plant to respond to N. Excess soil moisture reduces the ability of grasses to respond to N. If N is to be applied in the early spring, drier free-draining soils should be selected first because they will respond earlier than wet soils. Conversely, for pastures to respond to N applied in the autumn the soil moisture levels must be sufficiently high for adequate plant growth. Soils that are compacted also restrict pasture growth so returns on N fertiliser will be less on these areas.

PASTURE CONDITIONS

The N requirements of clover are normally met by fixation of atmospheric N, whereas grasses rely on soil N. Therefore, it is the grass component of the pasture that responds to fertiliser N. For example, applying fertiliser N to pasture above 1500kg dry matter/ha will see larger response rates than applying to below 1500kg dry matter/ha. Ideal response occurs when fertiliser N is applied during high pasture growth rates.

SLOPE AND ASPECT

Differences in land slope and aspect in hill country have little effect on response to N fertiliser although they cause large variations in pasture production throughout the year. Responses to N applied on gentle-sloping hill country have generally been larger than those measured on flat land within the same district.

STOCK HEALTH

No detrimental effects have been observed on animal health and milk production by dairy cows grazing pasture that has regularly received N fertiliser. Care must be taken when using N fertiliser on newly sown pasture following cultivation because soil nitrate levels can already be high. Nitrate poisoning can occur in stock and can lead to death.

In the case of direct drilled pasture, N fertiliser can assist new grass establishment.

- Use fertiliser N strategically to complement clover fixation.
- Time N fertiliser to meet specific feed shortages.
- Apply fertiliser N between 25 and 50kg N/ha.
- Do not apply dairy shed effluent at more than 150kg N/ha/yr.
- Apply fertiliser N when soil temperatures are higher than 7°C, at a depth of 10cm at 9am.
- Select drier free draining soils over wetter soils for N application in the spring.
- Allow soil moisture levels to improve after a dry period in the autumn before applying fertiliser N.
- Apply to pastures above 1500kg dry matter if possible.
- Calculate the amount of fertiliser N required using a feed budget coupled with a nutrient management plan.
- Carry out a mineralisable N test to cultivated pasture before applying fertiliser N to a crop.
- Do not use N in the winter.
- Allow a suitable margin when applying fertiliser N and dairy shed effluent around waterways.
- If you are applying more than 60kg/ha of N, or applying N to any area that has had effluent applied to it in the previous year, you must have a nutrient management plan to comply with regional plan rules.

Remember that the cheapest source of N will come from clover root nodules and the greatest source of loss will be from urine patches.

MORE INFORMATION

Contact

- Waikato Regional Council
  Freephone 0800 800 401

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- **www.dairynz.co.nz**

References

Ledgard S.F. “Nitrogen Fertiliser use on Pastures and Crops”

A Roberts and J Morton. “Fertiliser Use on New Zealand Dairy Farms”

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For more information call Waikato Regional Council’s freephone 0800 800 401 or visit www.waikatoregion.govt.nz.

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