Canterbury: Reducing N over January/February

What are the potential benefits?

In summer when soil mineralisation rates are high, and clover is actively growing, nitrogen (N) is less likely to be a limiting factor for pasture growth, and the likelihood of an economic response to N fertiliser is lower. The Pastoral 21 project in Canterbury showed that the response to N fertiliser in summer can be low and unprofitable (refer to page 4).

Some Canterbury farmers have been able to reduce N applied over January/February by 20-70 kg N/ha/year without a significant impact on pasture eaten when they have done it well and in the right conditions. With the new cap on synthetic N fertiliser use of 190 kg N/ha, reducing or removing N summer applications is a strategy many other farmers are considering.

Is applying less N in January and February right for your farm?

This will depend on several factors: (see details on page 2)

- Good clover content in pastures
- All other nutrients including trace elements essential for plants are not limiting growth (confirmed by soil and herbage testing)
- It has been at least eight years since the farm has been converted to dairy (as it is likely to have good levels of soil organic matter)
- You have other sources of N to support pasture growth - for example effluent
- Your weekly farm walk is not predicting a feed deficit requiring N fertiliser

Summer growing conditions can be variable (even on irrigated farms), therefore a successful N use strategy requires close monitoring and agile decision making to respond to changes in growing conditions. Talk to your trusted advisor before deciding on altering summer N for your farm.

Ways to reduce N applications over January and February

- Reducing N application rates to 15-20 kg N/month in January and February - if this is practical with current spreading methods. Some farmers are identifying other nutrients to apply at this time and mixing compatible fertilisers to allow them to drop the rate of N but maintain spreading accuracy through total product application rate
- Skipping one or two applications over the whole farm over the January/February period
- Skipping one or two applications over some areas of the farm – for example areas with high clover content, stock camping or which receive effluent. This will improve profit as less fertiliser is applied. However, this strategy alone will not fully achieve the reduction to 190 kg N to every grazed hectare as required by legislation.

What about December N?

Applying N in early summer (December), when the ryegrass plant is well through its reproductive phase (heading) is very important to set the plant up for summer as it promotes tillering, helps transition back into the vegetative stage and therefore helps to maintain quality. By January/ February ryegrass plants have passed this phase and N is only required if it is deficient for growth.

Checks and balances to support your decision

Soil tests

Refer to soil tests taken this season or last season for pH, P, K, S, Mg, Ca to ensure that soils are at the right pH and have sufficient macro nutrients. Best practice is to test late winter/spring. Only test in December if no recent results are available (from the last 2 years) and you are looking to reduce summer nitrogen.

Assess clover content

Clover through N fixation contributes to the N available for ryegrass growth. Therefore, assessing the clover content and age of pastures is important to determine if the pastures will respond to N fertiliser or not. Identify different areas of your farm according to clover content as follows:

- Areas with well-established clover plants with good size leaves visibly present over the whole area of the paddock (around 30% of the pasture in early summer) are less likely to respond to N fertiliser and would be the *areas to target* to reduce or remove N fertiliser over January and February.
- Areas with no or few clover plants (sporadic across the paddock) are not likely to have enough clover N available and are more likely to respond to N fertiliser
- New pastures, even with well-established clover plants, will require time to have enough N coming from clover so are also likely to respond to N fertiliser.

The N from clover fixation becomes available in part from dung and urine, this is a faster pathway. The balance comes from the decay of stem, roots and nodules which can take six months or more for the N to be available. Optimising conditions for clover establishment and growth by ensuring good soil fertility (pH, P, K, S and Mo) and grazing management that avoids continuous shading of clover will support good clover establishment and persistence.

How clover herbage testing can help your decision making

Herbage testing of clover leaves provides a good indication of fertility levels for both ryegrass and clover as clover is more sensitive than ryegrass to an adequate supply of many macro and micronutrients. In addition, soil tests do not reliably indicate an adequate supply of micro-nutrients important for clover health and efficient N-fixation (such as molybdenum and boron). For this reason, you should be checking clover nutrition status, to ensure adequate nutrition for effective N-fixation.

When collecting clover-only samples, collect clover leaves from the poorest looking clover plants, and avoid nutrient rich areas (like dung and urine patches, gateways and fence-lines, and camping areas) as you are trying to determine what is limiting clover growth across the paddocks.

Ask the laboratory for a Clover-Health profile. If taking a mixed herbage sample, you can ask the lab to separate out the clover and get the results for both mixed and clover only. If there is little clover or only clover in urine patches, or the pastures are generally not looking healthy, a mixed herbage sample will indicate what may be limiting clover and ryegrass growth. For example, if potassium is marginal or low for ryegrass, it will be deficient for clover.

Ryegrass herbage testing

For peace of mind, and to build up a picture of N status over summer for your farm, take ryegrass herbage tests every grazing round (generally every 3-4 weeks). This tests the historical supply of N by measuring the N concentration of the plant tissue itself. This shows whether there was adequate N for growth over the last grazing/rotation. Take samples of ryegrass (excluding clover as it should have sufficient N) from paddocks as close to grazing as possible and avoid nutrient rich areas.

Soil N availability changes rapidly, which also rapidly changes N concentrations in plants. Because of this there is no test than can accurately predict the future N supply to the plants. However, herbage tests give an indication of N status on your farm to date and help build a picture of N status, if used along with paddock observation, and percentage of clover and growth rate data.

Soil Mineral N Status

There is no accurate test of the mineral N (soluble N, nitrate and ammonium) status in the soil for the next 2-3 weeks. This makes it difficult to reliably determine the amount of N available for plant uptake, as the transformation of N in soils is dynamic and availability changes constantly. By the time a sample is collected and analysed in the laboratory, mineral N available could have changed. Additionally, available soil N is also highly variable across grazed paddocks, so that many samples need to be taken to get a reasonable estimate of the average soil N status.

An Anaerobically Mineralizable N test (AMN), also known as Available N test, can measure a soil's capacity to mineralise organic N and provide an indication of the **potential mineralised N in the soil** becoming available for plant uptake. However, the actual amount of N that can be mineralised from the organic pool is dependent on soil temperature and moisture in the field and the laboratory test is unable to predict these conditions. This test is used for cropping with samples taken to 15 cm depth. Advisory services are available to interpret the results and estimate the amount of N fertiliser needed for expected crop yields. Research is underway to evaluate the value of this test for pasture.

Summary action list to assess if you can reduce N applications

Check	Action
Clover percentage in well-established pastures	Check pastures for clover ground cover 30% plus
Soil fertility – no other nutrient is limiting growth (this applies to all seasons)	Refer to soil tests, ideally taken late winter/spring this or last season
Herbage tests	Check macro and micro-nutrients in clover only and historical N status in mixed herbage samples
Other sources of N - for example effluent	Take account of the N applied from effluent
Feed wedge – the best tool to decide if N is required	Weekly farm walks and predictive feed wedge - is N required to fill future feed deficit?
Talk to your trusted advisor before making a decision on altering summer N for your farm.	

Response to Summer Nitrogen – Pastoral 21 Trials

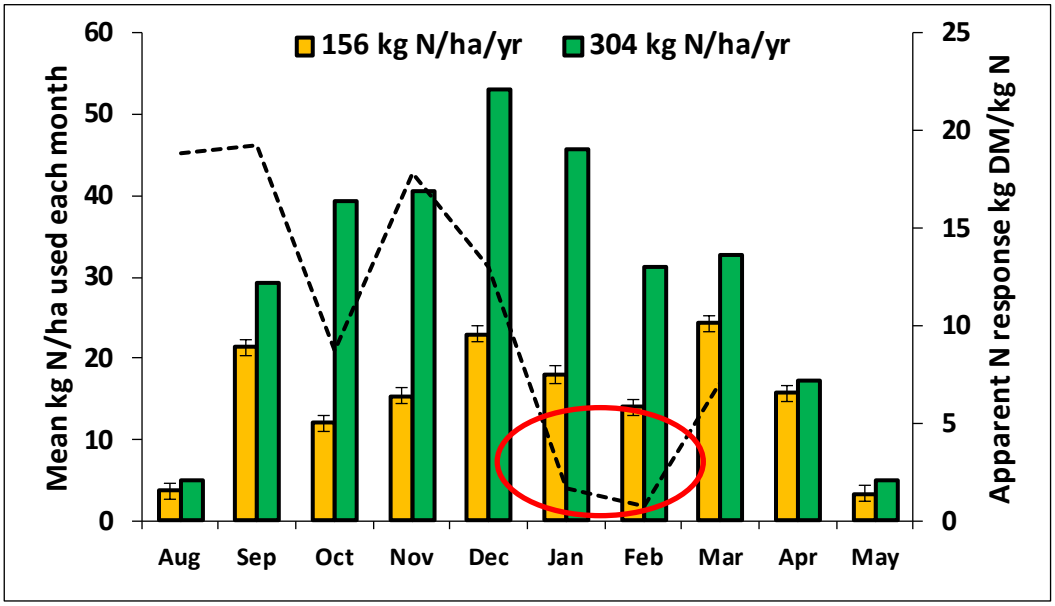
In 2011, the Pastoral 21 (P21) programme was initiated to develop and demonstrate dairy farming systems that could reduce N loss by 30% relative to regional benchmarks while maintaining or increasing farm profit.

At Lincoln University two systems were compared for four years (2011/2012–2014/2015) in unreplicated farmlets. One represented the traditional pathway of intensification via high inputs of N fertiliser and supplementary feed ('higher input-high efficiency'), while the other represented a lower input pathway using half the amount of N fertiliser and one quarter the amount of supplementary feed ('lower input-high efficiency'). The stocking rate of both systems was matched to feed supply to achieve high utilisation (approximately 90%) of the pasture grown. See also dairynz.co.nz/about-us/research/pastoral-21

Figure 1 shows the apparent rate of pasture growth response (dashed line) to N fertiliser. The response rate (N rates above 18-20 kg N/ha) was very low in January and February (red circle), due to strong clover content (approximately 30% of total pasture DM) which meant N was being fixed from the atmosphere by the clover, and much of that N was being transferred to the grass.

Also, clover does not respond to N fertiliser – grass does. Therefore, it stands to reason that if clover is 30-50% of the pasture in summer, then N rates can be reduced to a similar extent due to the grass making up less of the pasture compared with, say, early spring when clover content is low.

Figure 1 Mean (for 2012/13–2014/15) monthly total amounts of N fertiliser applied to farmlet pastures.



Yellow bars: lower input-high efficiency. *Green bars*: higher input-high efficiency.

The dashed line is the apparent rate of pasture growth response to N fertiliser in 'higher input-high efficiency', plotted for the month of fertiliser application.