Nitrogen in autumn

How much does pasture cost to grow using nitrogen (N) in autumn?

With fuel and fertiliser prices where they are, every decision this autumn needs to stack up. When it comes to nitrogen (N), it's not just about growing more grass, it's about what that extra pasture actually costs to grow and use. Autumn responses can be variable, so before applying N, it is worth working out the cost per tonne of pasture grown and comparing that to the cost of buying feed. That is the key to making the right decision.

Pasture responses to N in autumn are often less than those in spring due to low soil moisture and high soil N, both as a consequence of the dry summer. For example, the pasture dry matter (DM) response to N fertiliser in west Gippsland, applied directly after the autumn break, showed N responses of only 6:1 when applying 20kg N/ha in 9 out of the past 18 years.

Nitrogen fertiliser can be applied when the pasture is actively growing to assist in filling feed gaps, but the potential response should always be compared to the cost of buying the same feed – this ensures that N fertiliser is only applied when it is more cost-effective than other options.

Applying N in February to dryland pasture in Victoria, may result in a pasture DM response of less than 5kg extra DM per kg N applied.

Table 1 Variation in cost of additional pasture consumed at three urea prices

Extra pasture response kg DM/kg N	Utilisation* (%)	Urea $700/t as spread	Urea $1,200/t as spread	Urea $1,600/t as spread
		Cost of extra pasture response from N ($/tDM)		
High response 20:1	100	76	130	174
	75	101	174	232
Average response 10:1	100	152	261	348
	75	203	348	464
Low response 5:1	100	304	522	696
	75	406	696	928
Very low response 3:1	100	507	870	1159
	75	676	1159	1546

*Assumes this is the utilisation of the extra pasture produced.

Key messages

- At higher N fertiliser prices, a greater response to N is required to justify the use of fertiliser to grow extra feed.
- In autumn, ensure soil moisture is adequate to sustain pasture regrowth and N response.
- Apply N when it is more cost effective than alternative feed sources. Use the price of the alternative feed to calculate the break even point.
- Utilising as close to 100% as possible of any extra feed grown with fertiliser is key to optimise the economics of N use.
- At a urea price of $1200/t and a grain price of approx $350/t DM, a response to N fertiliser of around 10:1 or greater is needed to justify the use of N fertiliser.

Table 1 shows that at a response rate of 5:1, when urea was $700/t, and utilisation was 100%, grain needed to be cheaper than $304/t DM to make it a more profitable option than N fertiliser. However this situation changes at $1200/t urea – a farmer in this situation needs to source grain less than $522/t DM to make it a more profitable choice than urea. This is the case even if 100% utilisation is achieved, if a 5:1 response is all that can be achieved. Include the costs of delivery and spreading in your urea option costs. Include the cartage and wastage costs in your grain/fodder option costs.

The utilisation rate of the extra pasture grown is an important consideration, and becomes even more so when the urea price is very high. It is possible to utilise 100% of the extra feed grown from urea application. However, this requires good pasture management and precise supplement allocation to the herd, to ensure that the exact same post grazing residual is left remaining in the paddock regardless of whether urea has been applied to or not.

What influences response rate to nitrogen?

The amount of pasture grown in kg DM per kg N applied is the 'response rate'. For example, at a response rate of 10:1, 30kg N/ha produces an additional 300kg DM/ha of pasture. The response rate is dependent on:

- Amount of available N in the soil: in an autumn following a dry summer, there is likely a significant amount of N in the soil, mineralised from the organic matter over the summer, but remains unutilised because of low summer pasture growth. Additional N fertiliser at the autumn break may not achieve an N response, as the pasture is short of water not N.
- Soil moisture: too much (i.e. water logged conditions) or too little (i.e. water stress conditions) will lower the response. The best response is from a soil moisture profile that is not limiting growth. At the autumn break, following a dry summer, there is commonly insufficient soil moisture to support high pasture growth rates. Wait for adequate rainfall, with additional rain predicted before applying N.
- Soil temperature: the warmer the soil, the greater and more immediate the N response. This is less of an issue in autumn but may be a limitation of applying N in late May.
- Plant growth: the higher the growth rate potential, the greater and more immediate the response to N fertiliser.
- Rate of N applied: there is a diminishing response at higher application rates, but also an unreliable response at lower (<20kg N/ha) rates. Using a response rate (e.g. 10:1), and knowing the additional pasture required to fill the feed gap (e.g. 400kg DM/ha), the rate of N required (40kg N/ha) to be applied to an area can be determined.
- The availability of other plant nutrients and soil pH, species composition and soil compaction can affect N response. Get the basics of optimising plant growth first or only apply N together with the limiting nutrients.

Tips for applying N

- Nitrogen-fertilised pasture can be cheaper than purchased feeds, if applied under the right conditions and utilised well. Check the break even price as urea and other feed options prices change.
- Sufficient stored soil moisture is critical to achieving response rates to N fertiliser. Under dryland pastures in SE Australia there is commonly insufficient soil moisture at the autumn break to achieve an economic response to N fertiliser.
- Apply N when the pasture is actively growing, has adequate soil moisture to sustain growth and can utilise the additional N.
- Apply N at rates of 20–50kg N/ha per application, no closer than 21–28 days apart.
- Do not graze perennial pasture for 7–14 days after N application.

Autumn response rates under rain fed conditions (case study)

The 'More Profit from Nitrogen' project examined the effect of a range of N fertiliser rates on pasture production under rain-fed conditions across two regions of Victoria. This modelling showed that soil moisture, rather than available soil N, was the major limitation to increased pasture production particularly at the autumn break, where pasture N responses of 6:1 were achieved in 9 of the 18 years between 2000 and 2017 at Ellinbank (West Gippsland) and only 5 of the last 18 years at Terang (south-western Victoria) (Figure 1).

It is therefore critical to ensure soil moisture is adequate to sustain regrowth and N rates should be reduced if the likely response is limited.

For further information

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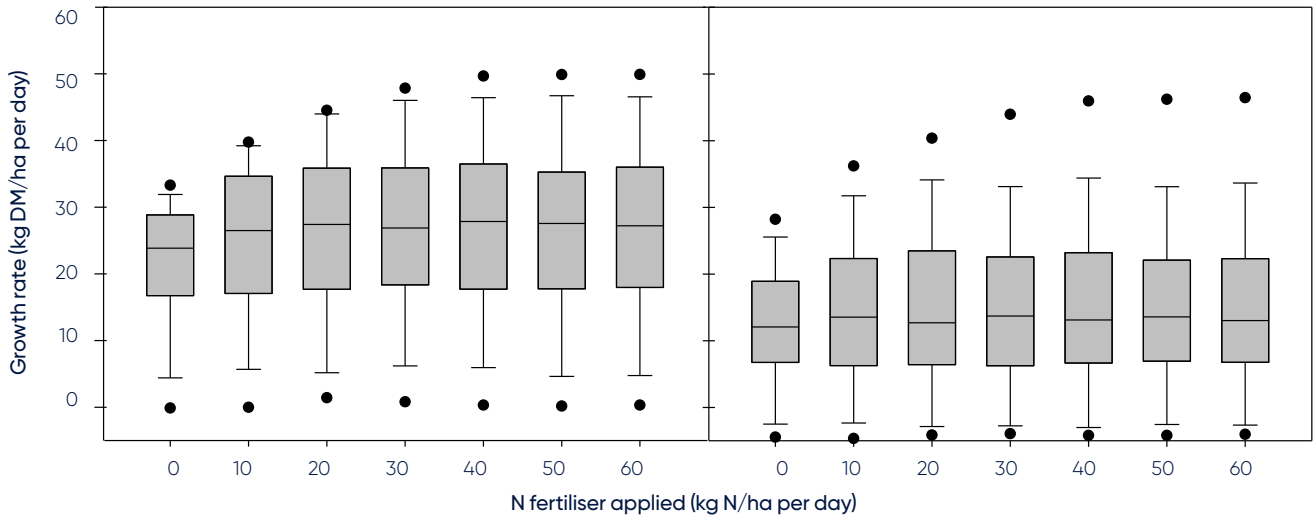
Figure 1 Autumn pasture growth rate responses to N fertiliser at Ellinbank, West Gippsland (left), and Terang, SW Victoria (right), in autumn (March, April, May) between 2000 and 2017. The middle line shows the median response, boxes show the response for the years between the 25th and 75th percentile of years, whiskers show the responses for the 10th and 90th percentile of years and dots show the extremes.



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