

# Urea boosts biomass but reduces litter cover in gully remediation

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## Introduction

Gully erosion is a significant challenge for the Northern Australian beef industry, contributing to land degradation, reduced pasture productivity, and sediment runoff into waterways. Addressing this issue is critical to ensuring the long-term sustainability of grazing enterprises. This paper presents findings from a gully remediation project in North Queensland that investigated the relationship between litter cover (%) and pasture yield (kg DM/ha) under different rehabilitation strategies. Findings were linked to C:N balance, highlighting the importance of this ratio in gully remediation.

## Methods

After initial earthworks to reprofile the eroded surface, the site was sectioned into 9 different treatment groups to test different amendments. A paired treatment incorporated organic matter and gypsum into the upper 300 mm of the soil, deep ripping to 500 mm, bagasse laid 40 mm deep over the surface, and a pasture seed mix spread at 40 kg/ha. One of the pairs also received an additional 2.7 t/ha of broadcast urea (N). Pasture measurements, including BOTANAL yields (kg DM/ha), bare ground % (exposed soil), and litter cover % (including bagasse) were completed after the first wet season in April 2025. A 1 m<sup>2</sup> quadrat was used to take 30 assessments per section.

## Results

The nitrogen treatment demonstrated higher yields but significantly lower litter cover compared to the no-nitrogen treatment ( $P < 0.05$ ). The N treatment recorded +641 kg DM/ha compared to the no nitrogen treatment, but 48% less litter cover. Despite less litter cover, bare ground % was less in the N treatment. Living biomass colonised this bare ground and improved ground cover stability.

**Table 1. Effect of urea application on litter cover, bare ground and biomass at Spyglass Research Station, April 2025.**

	Litter (%)	Biomass (kg DM/ha)	Bare (%)
Nitrogen	24	1,126	9
No Nitrogen	72	485	17

## Discussion and conclusion

The results highlight nitrogen as a primary limiting factor for plant growth in Northern Australia during wet years, consistent with findings by Mott et al., (1985). N application has been shown to balance the C:N ratio and hence accelerate litter decomposition through microbial activity (Knorr 2005; Griffin 1972). Hence, the urea application at the site likely boosted microbial activity early in the season but also balanced the C:N ratio, “pre-feeding” the microbes and making more N available for plants later in the growing season. This effect manifested in the gully as increased yields coupled with increased litter decomposition due to microbial activity. An unbalanced C:N ratio will cause N to be utilised in microbial bodies and unavailable for plant uptake (Murphy 2015).

In conclusion, C:N ratio is a vital consideration when rehabilitating eroded gullies in North Queensland. Achieving balance boosts pasture productivity and ground cover stability, supporting long term sustainability for the beef industry.

## References

- Griffin, D.M. (1972) Ecology of soil fungi. University of Washington Press, Seattle.  
Knorr, M. et al., (2005) Ecology 86, 3252–3257.  
Mott, J.J. et al., (1985) Ecology and management of the world’s savannas 56–82.  
Murphy, B.W. (2015) Soil Research 53(6), 605–635.

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