Introduction

Denitrification is the only natural process by which applied N fertiliser can be converted back to inert atmospheric nitrogen (N2). Denitrification is a spatially variable process primarily occurring in soil microsites that become anaerobic. We hypothesised that by increasing soil microsites where denitrification occurs, denitrification potential could be enhanced on a paddock scale.

Methods

- Topsoil of a well-drained Horotiu soil (Allophanic Soils) under typical dairy farming conditions was amended (five replicated plots) with either sawdust or coarse woody mulch. Disturbed topsoil (but no organic C amendment) and undisturbed pasture treatments were also included in a randomised complete block design.
- Denitrification rate (via acetylene block technique) and denitrifying enzyme activity (DEA) were measured on a monthly basis beginning in Feb 2008.
- Soil biological and chemical properties (extractable nitrate, microbial biomass carbon and N mineralisation rate) were also measured every three months.

![Plot layout](image1.png)

![Sawdust amended soil](image2.png)

Results

- Initial results indicate DEA in the organic amended treatments was significantly greater than the unamended control treatments (1.5–2.5 times on a gravimetric basis). The coarse woody mulch treatment showed the greatest increase in DEA (Figs 1 and 2a).
- Despite differences in DEA, there were no detectable differences in overall denitrification rate between treatments (Fig. 2b), in part because the denitrification rate of amended treatments was greater than unamended treatments in some months whereas in other months the reverse was true.
- Microbial biomass carbon was significantly higher in both amended treatments in comparison to control treatments. Extractable soil nitrate-N and N mineralisation were significantly lower than control treatments in the sawdust amended soil, but not the coarse woody mulch amended soil, indicating immobilisation of N by the sawdust amendment (Fig. 3).

![DEA grand means (February–December, 2008) by treatment](image3.png)

![Denitrification Rate (kg N ha⁻¹ day⁻¹) by treatment](image4.png)

![Extracetable nitrate-N (mg kg⁻¹) and Mineralisable N (mg kg⁻¹) by treatment](image5.png)

Conclusions

Although we did not detect a difference in total N denitrified in the amended treatments, the DEA, soil nitrate, and temporal patterns in the denitrification rate suggest that during periods of peak denitrifying activity – high soil water content and high N availability (when leaching of soil N is likely) – denitrification rate may be able to be manipulated to reduce N leaching. We are now focusing on quantifying denitrification rates during these peak periods.

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