The value of 'alternative' nitrogen fertiliser products on pasture. 2. Pasture quality and carryover effects at Tocal

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Abstract: *At Tocal significant differences among treatments occurred in crude protein (CP), nitrate and water soluble carbohydrate as nitrogen (N) rate increased. The major effects occurred when urea or poultry litter was applied at the highest N rate (200 kg urea/ha/cut). At this rate the urease inhibitor increased leaf nitrates, indicating greater N retention in one harvest. Differences in CP and nitrate concentration were minor when N was applied at normal commercial rates and unaffected by urea amendments. Most quality parameters were within desirable levels regardless of the treatment and there were no commercially significant feed quality effects.*

A carryover effect study, where treatments were applied once at the beginning of each season during the experiment with mown harvests simulating rotational grazing, indicated that the effects of high Nn applications (including poultry litter) were exhausted after about three months of pasture growth and removal.

Key words: pasture, topdress, dairy, alternative fertiliser, poultry litter, Urea, Green Urea, Entec Urea, Twin N, Urea Supreme, Nutrisoil, ProGibb, Liquid Blood & Bone, dry matter

Introduction

Since 2007 increasing fertiliser costs have heightened farmer interest in'alternative' fertiliser products. These products are often claimed to improve pasture quality and may have a role in reducing nitrogen (N) costs in pasture grazing systems. Alternatives include a range of biological sprays, compost extracts, fish emulsions, vermiculture liquids, hormonal granules, and composted mineral blends.

Urea treated with polymer coatings or nitrification inhibitors has potential to reduce the luxury uptake of N through a slower release of N, or mineralisation of applied N (Trenkle 2010; Watson *et al.* 2009). A lower N and nitrate concentration in the forage can lead to a lower N concentration in urine and so lower N losses through volatilisation and leaching in urine patches

This paper reports on measurements of forage pasture quality, N and nitrate content sampled from trials described by Muir *et al.* (2011) In addition, yield data from a carryover study tested claims of slower or sustained release of N from these products.

Methods

Randomised block plots, (four replications) were established at Tocal in 2009 on a highly fertile commercially managed pasture, primarily composed of kikuyu (*Pennisetum clandestinum*) in the warmer months and oversown ryegrass (*Lolium spp.*) in the cooler months. The experiments had between twelve and nineteen fertiliser treatments (including single or multiple untreated controls) and metabolisable energy, crude protein, water soluble carbohydrates and nitrates were measured for the first harvest of ryegrass in 2009 and the third harvest in both the ryegrass and kikuyu seasons in 2009 and 2010 for all replications and treatments (Figure 1). Fertiliser was reapplied within 24–96 hours after each harvest.

Carryover effects of fertiliser treatments were also assessed by applying fertiliser only once at the beginning of each of four seasons, then

repeating harvests in the same sequence as described by Muir *et al.* (2011).

Results and discussion

Pasture quality

Results at the first harvest in the ryegrass phase (August 2009) indicated that there were very highly significant (P <0.001) treatment effects for metabolisable energy, crude protein, water soluble carbohydrates and nitrates with the greatest effects at the high rates of urea (Figure 1). Brix measurements at two harvests found no significant treatment effects.

Amendments to urea did not reduce crude protein or nitrates at normal commercial rates. Urease inhibitors increased nitrates at the highest rate of urea indicating greater nitrogen retention. Apart from an extreme outlier in nitrates tested for the Green Urea 200 treatment (a possible urine patch sampling error in one replicate), feed quality for all treatments fell within the desirable range meeting the nutritional requirements of grazing animals. No treatment provided a commercially significant nutritional advantage.

Carryover effects

At each application and subsequent harvests there were highly significant (P <0.01) treatment effects with N rate where urea products and poultry litter. Though the effects were significant, the response to fertiliser diminished somewhat over time and by the third harvest there was far less variation between treatments than at the first harvest (Figure 2). This suggested that most of the fertiliser value of the treatments was exhausted around three months after application given normal pasture growth and removal patterns.

Urea amendments, growth promotants, alternative fertilisers and biological products provided no significant treatment effects in either the first or subsequent harvests. A similar result was found when treatments were applied every second harvest to kikuyu at Taree (Muir *et al.* 2011) Under these conditions these

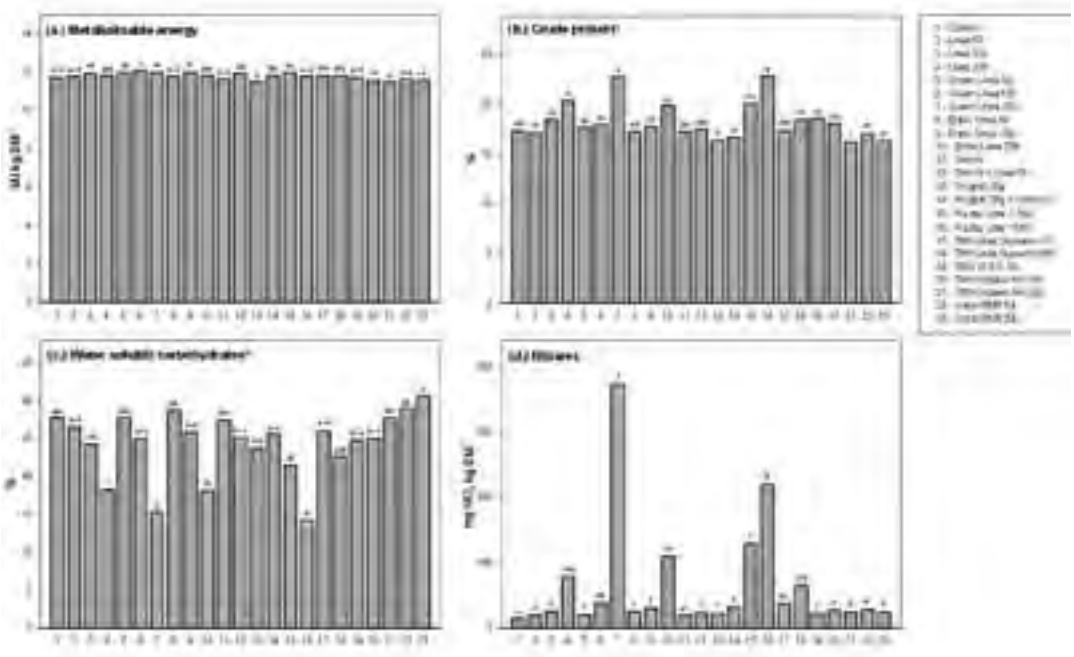

Figure 1. Effect of fertiliser on (a) metabolisable energy, (b) crude protein, (c) water soluble carbohydrates, and (d) nitrates of a ryegrass pasture harvested in late August 2009 at Tocal, NSW, three weeks after treatment. All values are the mean of four replicates, except for nitrates recorded for Green Urea 200 (n = 3) and means predicted by a linear model. Analysis of variance for crude protein and water soluble carbohydrates was carried out on the square-root transformed percentages. Treatment means with the same letter are not significantly different (P = 0.05).

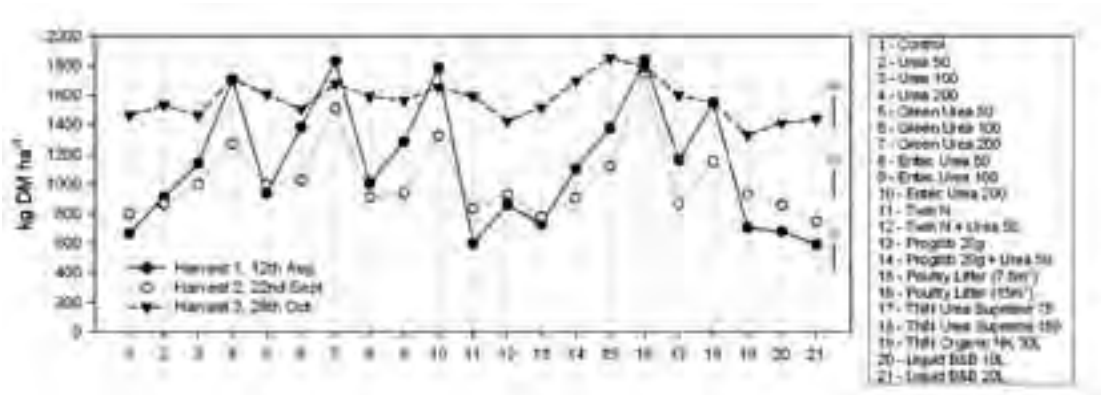

Figure 2. Carryover effects of fertiliser treatment on dry matter production of ryegrass in winter and spring 2009 at Tocal, NSW. Values are the mean of four replicates and vertical bars represent the l.s.d. (*P* = 0.05) among treatments at (i) **harvest 1,** (ii) **harvest 2, and** (iii) **harvest 3.**

products showed no indication of sustained N release or N input over what was applied as urea or poultry litter.

Conclusions

Alternative fertiliser growth promotants and biological products had no commercially significant effects on pasture quality, N, or nitrate content in the three harvests sampled. Urea amendments showed neither a consistent production benefit, nor a reduction in the concentration of nitrogen or nitrate in annual ryegrass at normal application rates.

The carryover effect of single applications of N from 25 to 100 kg N/ha applied as urea or poultry litter was exhausted after about three months of pasture growth and removal. Neither urea amendments, growth promotants, nor alternative fertiliser products showed evidence of sustained release of N compared with normal urea.

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