Fertilisation of tropical grass pastures with sulphate of ammonia

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Abstract. *Nitrogen for tropical grass pastures can be supplied by either pasture legumes or nitrogen fertiliser. A trial was established in North-West New South Wales to investigate the value of applying nitrogen (as sulphate of ammonia) to tropical grass pasture deficient in nitrogen, due to the effects of drought on winter legume growth. An application rate of 200 kg sulphate of ammonia (42 kg nitrogen/ha) was found to significantly increase dry matter production and improve pasture quality.*

Introduction

Pasture legumes provide an economical source of nitrogen (N), however, dry autumns and winters in North-West New South Wales (NSW) have resulted in poor production and low N fixation from these pastures. Some graziers are questioning the ability of winter legumes to fix sufficient N, especially in dry years, to maximise production of tropical grasses. Both urea and sulphate of ammonia have been used as sources of N, although sulphate of ammonia has the advantage of lower cost, reduced losses to volatilisation and a sulphur (S) component which is also required in many pasture systems (Freebairn *et al.* 1994). The aim of the study reported here is to investigate the value of applying N fertiliser to tropical grass pastures.

Methods

In October 2007, a replicated experiment (four reps) was established at 'Towri' west of Boggabri on a Chromosol soil. The 12-year old pasture consisted of Premier digit grass (*Digitaria eriantha* ssp. *eriantha*), bambatsi panic grass (*Panicum coloratum* var. *makarikariense*) and a small portion of Consol lovegrass (*Eragrostis curvula* type conferta). At the commencement of the experiment, ground-cover was close to 100 per cent but pasture mass was low (approximately 1,000 kg dry matter (DM)/ha). The pasture also contained a range of winter legumes. Records of paddock history show that single superphosphate was applied most years at the rate of 130 kg/ha. Approximately 40–50 kg of N/ha/year was applied over the previous decade. Total rainfall at the site was 330 mm in 2007 and 315 mm in 2006 leading to poor growth of annual legumes and low available N for tropical grass pastures.

Three treatments consisting of 0, 42 and 84 kg N/ha (0, 200 and 400 kg/ha sulphate of ammonia, respectively) were applied on 23 October 2007 with a commercial spreader. On 25 October, 18 mm of rainfall was received. Treatment plots were 8 m wide by 100 m long. Soil tests were taken prior to fertiliser applications and analysed for phosphorus (Colwell), S (KCl 40) and nitrate N. Soil was also assessed visually and by hand for moisture content. Herbage mass was assessed on 5 December 2007 six weeks after the treatments were applied. Four hand cuts (0.15 m^2 per cut) per plot were taken and dried in an oven for 48 hours at 65^{0}C and weighed. All above-ground grass-pasture was included in the cuts. Additional samples were collected and bulked across each treatment and tested for digestibility (Australian Fodder Industry Association, AFIA method 7R), protein (AFIA method 5R) and metabolisable energy (AFIA method 14R).

Results and discussion

Soil analyses taken prior to the experiment showed the site to be highly deficient in N (Table 1). This was presumably due to poor growing conditions in the preceding winters. It is unclear if there would have been sufficient soil-N had there been a more 'normal' winter season. Total rainfall between treatment applications and the first cut was 72 mm and the plants were starting to show visual signs of moisture stress.

The control treatment (nil N) produced 2,808 kg DM/ha, the 42 kg N/ha treatment produced 5,169 kg DM/ha and the 82 kg N/ha treatment produced 6,376 kg DM/ha. The application of 42 kg N/ha significantly ($P<0.05$) increased herbage production of the tropical grass pasture compared to the control, however, there was no significant difference in herbage production between

Table 1. Soil test results prior to the application of fertiliser nitrogen

Depth (cm)	Colwell P (mg/kg)	KCl 40 S (mg/kg)	Nitrate N (mg/kg)
0–10	23	15	0.21
10–30	6	20	<0.20
30–120	5.2	15	0.32

the 42 and 82 kg N/ha treatments. There was very little soil moisture prior to fertiliser applications, and only 72 mm rainfall between fertiliser application and sampling. Had there been more rainfall, differences between treatments may have been greater. In a comparable study (S.P. Boschma, personal communication), similar results were found for Katambora Rhodes grass and Premier digit grass fertilised with 50 and 100 kg N/ha, with the greatest increase in herbage production per unit of N at 50 kg N/ha (Boschma and McCormick 2008). This trial also showed a similar response with the greatest difference being between the control (nil N) and 42 kg N/ha.

The lack of N in the nil control treatment was reflected in a lower level of forage quality compared to the treatments where N was applied (Table 2). Crude protein in the control was 6.4% compared to 11.1 and 15.0% for the 42 kg N/ha and 84 kg N/ha treatments, respectively. Had the legume component of the pasture been active in growth in the preceding winter, crude protein levels of all treatments would be expected to be higher.

Table 2. The effects of fertiliser on the nutritive quality of tropical pasture

	0 kg N/ha	42 kg N/ha	84 kg N/ha
Crude protein (%)	6.4	11.1	15
Metabolisable energy (MJ/kg DM)	7.4	8.4	8.8
Digestibility (%)	56	61	63

Conclusions

These results suggest that the application of sulphate of ammonia to tropical grass pastures may be of value because of the additional herbage mass and improvements to forage quality. Use of fertiliser N should be considered when soil N levels are low, when winter legumes have failed and the seasonal rainfall outlook is positive. Graziers wishing to maximise tropical grass pasture production and nutritive quality may consider this technique on a more frequent basis.

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References

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