Economic nitrogen responses on wet Northland soils

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Abstract

Two separate trials were carried out on different Northland soil types evaluating the most profitable nitrogen (N) product for use on wet soils. Each trial had three randomly allocated replicates of four treatments. The four treatments included ammonium sulphate nitrate (ASN), sulphate of ammonia (SOA), urea and a control. All treatments received one dressing of 30 kg N/ha in mid winter. On the Wharekohe silt loam trial, SOA was the most profitable product, providing extra feed for 4.2 cents/kg dry matter (DM). Urea provided extra feed for 6.3 cents/kg DM and ASN provided extra feed for 7.3 cents/kg DM. On the marine clay trial, urea was the most profitable product, providing extra feed for 9.6 cents/kg DM, compared with 13.8 cents/kg DM for SOA and 27.5 cents/kg DM for ASN. For both trials it was evident that the ASN product was not as economic to use as either SOA on readily leachable soils or urea on non-sulphur-limiting soils under wet Northland conditions.

Keywords: ammonium sulphate nitrate, economic response, marine clay, nitrogen, sulphate of ammonia, urea, wet soils, Wharekohe silt loam

Introduction

Many Northland dairy farms are on heavy clay soils where wet soil conditions during winter slow the rate of mineralisation of nitrogen (N). Ammonium sulphate nitrate (ASN) is a fertiliser reputed to give better results in cold conditions (less than 6°C) where soil enzymatic and microbial processes are slowed. The trials were carried out to determine if ASN gives any advantage over other nitrogen products in Northland, where wet soil conditions could be likened to cold soil conditions, both slowing the rate of mineralisation. This paper reports the results of two different trials carried out on commercial Northland dairy farms in mid winter 1996. ASN, urea and sulphate of ammonia (SOA) were applied at rates of 30 kg N/ha, on wet Northland soils.

Trial design

The two trials were carried out on different Northland soil types. Trial A was located 10 km west of Whangarei on Kokopu block road with a Wharekohe silt loam soil type. Trial B was located 1 km north of Helensville on marine clays.

Previous fertiliser history on trial A was the application of 1000 kg/ha of 20% potassic superphosphate for the preceding two years. Each application split between spring and autumn. Previous fertiliser on trial B was the application of 700 kg/ha of 15% potassic superphosphate split between spring and autumn.

Twelve (12) 0.1 ha plots provided 3 replicates of 4 treatments. The four treatments included ASN, SOA, urea and a control (no N fertiliser). N treatments were applied at a rate to give 30 kg N/ha on 27 June 96 for trial A and 19 July for trial B. Individual plot measurements were taken using a rising plate meter with the equation "kg dry matter/ha = 158(×) + 200". Rainfall and soil temperature data were recorded during the trial.

Results

Rainfall and soil temperature

The winter of 1996 was wetter and warmer than the 10-year average in Northland. In both trials the soils were at field capacity at the start of the trials. Rainfall on both trials averaged 40 mm per week. Soil temperature on trial A, Wharekohe soil, ranged from 8.5 to 14.5°C, averaging 12°C. On trial B, marine clay, soil temperature ranged from 9 to 10°C, averaging 9.5°C.

Growth rates

Growth rates were calculated from the rising plate measurements, which are presented as yield comparison from the start of the trial (Table 1). The figures show the relative growth between treatments from the start of the trial.

Table 1 Yield comparison of N fertiliser products on Wharekohe and Marine clay soils (kg dry matter/ha). Spring 1996.

	Wharekohe	Marine clay
Control	1230	1124
Urea	1720	1456
SOA	2318	1450
ASN	1925	1309
LSD 5%	315	265

Table 2 Economics of the product response on Wharekohe silt loam after 60 days

Treatment	$/tonne	Rate applied (kg/ha)	Extra DM/ha	cents/kg DM
SOA	$320	142	1088	4.2
Urea	$480	65	489	6.3
ASN	$440	115	694	7.3

Table 3 Economics of the product response on marine clay after 38 days.

Treatment	$/tonne	Rate applied (kg/ha)	Extra DM/ha	cents/kg DM
SOA	$320	142	332	13.8
Urea	$480	65	326	9.6
ASN	$440	115	185	27.5

Effects of nitrogen

Tables 2 and 3 show the extra dry matter (DM) produced, product response in cents/kg DM for extra pasture from the different treatments. Source of fertiliser costs for urea and SOA are from Farmers Fertiliser recommended retail list prices. ASN prices are sourced from BASF.

Conclusion

The pasture growth responses to N products on soils with winter wet restrictions were high, as shown in Tables 2 and 3.

On the Wharekohe silt loam, a soil prone to leaching of elements such as S and N, the SOA gave the best growth rates and the most economic response of 4.2 cents/kg DM. Urea was more economic than ASN with 6.3 cents/kg DM compared with 7.3 cents/kg DM for ASN. Some of the extra DM response from SOA and ASN may be attributable to the S content in these fertilisers. This highlights that there may be a window of opportunity in early spring on wet Northland soils for use of sulphur-containing products. The alternative ways of applying S could be looked at to determine the levels of response and economics of use of S products.

On the marine clays which are not S limiting, SOA and urea gave very similar responses. Urea was more economic at a cost of 9.6 cents/kg DM compared with 13.8 cents/kg DM for SOA and 27.5 cents/kg DM for ASN.

For both trials it was evident that the ASN product was not as economic to use as either SOA on readily leachable soils or urea on non-sulphur-limiting soils under wet Northland conditions. The sulphur question requires further research on these soils.

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