FERTILISER NITROGEN USE ON NORTHLAND PASTURES. SPRING USE ON DAIRY FARMS

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ABSTRACT

The usage of N fertiliser by dairy farmers in Northland during the winter and spring is considered from four aspects; the regional position in terms of total use and on-farm aspects, the efficiency of DM production, the utilisation of N-boosted grass, and the factors affecting farmer decision making in respect of N use. It is concluded that N is an established but minor input into Northland dairy farming in spring, and that the financial return from its use is favourable.

Additional Keywords: survey, mowing trials, grazing response, farmer decision-making, calving period.

INTRODUCTION

The dairy industry is the primary agricultural industry in Northland, and is also of national significance. About 15% of the national dairy herd is north of Auckland city (N.Z. Dairy Board, 1982), although only approximately 9% of New Zealand pastoral land is contained within the region. Dairy farm productivity is relatively low; Northland having low per cow and per hectare production (83% and 63% of the respective national averages — N.Z. Dairy Board, 1982). One significant contributing cause is the poor growth of pasture in spring during early lactation, a problem largely overcome with sufficient nitrogen (N) fertiliser (Armstrong, 1982). Recognitions of the role of N by Northland farmers has contributed to the steady increase in sales of N fertiliser in Northland from less than 50 t N/year in 1975 to about 1,000 t N/year at present (N.Z. Farmers Fertiliser Co. Ltd, *pers. comm.*).

This paper describes recent research into the use of N fertiliser by dairy farmers in the late winter and spring on a regional and individual farmer basis, as an aid to management by dairy farmers in Northland.

MATERIALS AND METHODS

Survey of N use and trends

Experienced farm advisory officers (six senior MAF advisors, a Dairy Board Consulting Officer, and a fertiliser company technical representative) were questioned concerning the proportion of total dairy farmers in Northland using N in the spring, the rate per topdressed hectare, the proportion of the farm topdressed, multiple applications, the source of N and trends in the above.

N responses under mowing

Data derived from the mowing trials summarised by O'Connor (1983) in the Auckland district and north to Kaikohe, and unpublished trials of similar design were reprocessed to provide responses depending on the month of application of N. These trials were conducted between 1967 and 1976 and the production cut was taken 4-6 weeks after N application. In 12 of the 25 trials, three or four subsequent cuts were taken. All the major dairy-farmed soil types were represented within the 10 trial sites.

N responses under grazing

Responses to N applied to temperate-species-dominant paddocks at 40-50 kg N/ha in both July and August of 1980 and 1981 on a commercial dairy farm at Dargaville were monitored. Plastic sheets (12 m^2) were placed to protect six "control" plots in a single paddock from receiving N fertiliser (urea). The dry matter (DM) in those control plots and a paired adjacent plot receiving N was estimated by "Ellinbank" weighted disc meter before and after each subsequent grazing. The meter was calibrated at each assessment by cutting with hand shears, and washing when necessary, 18 x 0.1 m^2 quadrats. Such assessments were continued until the response disappeared. Responses were confirmed by analysis of variance at each assessment of pre-grazing DM. The August 1981 monitoring was from two paddocks.

Farmer decision-making

As part of an on-going monitoring of the MAF "Controlled Grazing Systems" campaign, the pasture DM on a paddock basis was assessed on 10 Northland dairy farms at monthly intervals during the winter and spring of 1982. Detailed farm management discussions were conducted after each on-farm pasture DM assessment between the farmer, his farm advisory officer, and research personnel. The management decision making methods relating to N usage were extracted for this paper.

RESULTS

Survey of N use

The farm advisers considered that a high proportion of farmers (60-70%) were users of N in spring; however most use was occasional rather than annual. Only a small

*Retired

proportion of farmers (< 10%) topdressed the whole farm at any application; most topdressed a small area (up to 30% of the farm) at relatively low rates (20-30 kg N/ha). Very few farmers used multiple applications. The primary source of N was urea, followed by sulphate of ammonia. However, a small but significant trend to compound fertiliser usage has emerged recently and was forecasted to expand. The trends in N fertiliser usage were considered to be dictated by price. Assuming a comparatively stable price relative to farm income, the forecast was for only a small increase in the number of users but an increase in the frequency of use by occasional users, in the rates applied and in the proportion of the farm receiving N.

N response under mowing

While it was not possible to statistically confirm the between-month differences, the results of Table 1 show a trend for the response efficiency to increase for applications from June to August. Of those trials where cuts were continued, 10 of the 12 trials responded significantly to N at the second cut, but only in one trial (July 1968) did the response persist to the third cut.

TABLE 1: Pasture DM increases (kg/ha) for N applied from June to September and the efficiency of N use (kg DM/kg N applied).

	Month			
	June	July	Aug.	Sept.
No. of trials	4	8	9	4
Yield increase over N_0				
N_{25}	250	270	430	370
N_{50}	400	440	660	560
Averaged S.E.	30	26	46	75
Efficiency				
N_{25}	10.1	10.8	17.2	14.9
N_{50}	8.0	8.9	13.2	11.1

N response under grazing

The response of N application and its utilisation was markedly variable between months and years. Utilisation was calculated as the apparent DM removed during grazing as a proportion of the DM before grazing. Utilisation did not differ between the control plots or paired N plots. The pasture growth estimate is derived from the control plots and is an average of growth over the response period. The pasture growth from paddocks which received N in July and August 1981 was poor in September. This was because of damage to the pasture at the first grazing in early September and very wet soil conditions. The August and September rainfall (185 mm) was normal but rain occurred on 25 and 26 days of the respective months.

Farmer decision-making

The primary motivation for N use was to provide adequate pasture to fully feed milking cows in early lactation during the early spring when pasture growth normally lags behind animal requirements. The feed position in winter prior to calving was judged either subjectively, by comparison to a target (generally of 2,000 kg DM/ha average farm cover) or by detailed feed budgeting of pasture availability, projected pasture growth, and animal requirements. All possible grazing management options were exhausted before N was used, including grazing stock off the property, grazing on long rotations and feeding hay, grazing pastures very hard (to low residual DM) or using off-paddock wintering (in barns or feedlots) and feeding hay. N use was favoured over purchase of hay on cost grounds although the even more expensive option of feeding meal was justified on the grounds of feed quality and alleged advantages in getting cows into calf. No farmers in the group deliberately boosted hay or silage crops with N.

TABLE 2: Response to winter application of N on commercial dairy farm in two years.

	Date of application			
	18.7.80	4.8.80	14.7.81	25.8.81
Period of response (days)	70	110	100	60
No. of grazings	3	5	3	3*
Pasture growth (kg DM/ha/day)	37	33	18	18
Efficiency (kg DM/kg N)	18	58	28	7
Utilisation of response (%)	50	40	45	26

*Minor additional grazing occurred.

DISCUSSION

From the high proportion of dairy farmers who use N, albeit very occasionally, it is clear that N use is an established and integral aspect of dairy farm management in Northland. Based on the farmers monitored in this work, the N-boosted grass effectively becomes a milking feed rather than a feed source for boosting cow condition. Further, the farmers view N as a source of purchased feed which is used to increase the intake of cows otherwise underfed in early lactation. Such a use would be expected to return 1 kg milkfat/13-17 kg DM (Holmes and McMillan, 1982; Bryant, 1983) or, within the range of response and utilisation data presented here, approximately 1 kg milkfat/kg N. In financial terms, such a response is clearly a profitable return.

In addition, farmers may be gaining much stronger carryover effects to subsequent grazings than those predicted from mowing trials. Taranaki farmers surveyed by Bartlett and McKenzie (1983) similarly noted carryover effects for three months or longer. Therefore, although the efficiency of use at the primary grazing may be relatively low, the response is compounded by subsequent grazings. However, additional pasture, grown during the spring flush, may not be particularly valuable if it accentuates

problems of late spring pasture quality. Also, depressions in summer milk yield resulting from clover suppression can also detract from the overall benefit to N usage (Bryant, 1983).

Despite the favourable farmer attitude to N use, the actual usage of N in spring is still relatively small and the impact of N on regional dairy production is probably minor. Based on fertiliser sales and fertiliser use surveys (N.Z. Dairy Board, 1982; N.Z. Farmers Fertiliser Company Ltd, *pers. comm.*), current N fertiliser usage is probably increasing the annual dairy production in Northland by 1-2%, assuming a favourable 1 kg MF/kg N on a usage of 400-500 t N/year by Northland dairy farmers. Even on individual farms which use N, the farm adviser survey tends to support Bryant's (1983) view that the milk production increase due to N use is small because the amount of N applied (at 1.2 t N/farm — N.Z. Dairy Board, 1982) is too little and applied on too small an area.

However, it must be emphasised that, based on the advisory officer survey and the farmer monitoring described here, N fertiliser use on a farm is still widely viewed as a last resort, used when other grazing management options have not provided sufficient feed at calving. This view may change as farmers gain confidence in N use or if a strong trend develops to earlier calving, e.g. in late June or early July. Where calving is early relative to pasture growth, the shortage of pasture, particularly in early September, becomes more pronounced and there are few options for overcoming such a crisis without N use.

An August application is the most efficient use of N in terms of DM production (Table 1) and it has the maximum impact on the early September feed position although the risk of both a poor response and impaired utilisation must be recognised. The poor response under grazing to N applied in August (Table 2) indicated the effect of unfavourable weather, underlining the importance of attempting to avoid the need for N use by judicious feed planning and grazing management beginning in the previous autumn. Also, farmers are attempting to maximise milk production during early lactation by effectively lowering the utilisation of pasture (Table 2) and thereby lowering the efficiency with which N use is turned to milkfat. Consequently, factors other than DM production efficiency should be considered when determining the timing of N application.

The very strong response to the August 1980 application was unusual. Of possible relevance is the fact that the paddock had been tile drained in the previous autumn, minimising the normal prolonged water-logging during winter on the soil type (Kaipara clay). An unusually strong response to N in the spring following artificial drainage has been observed in pasture yield studies on another alluvial clay soil (G.J. Piggot, *unpubl. data*). Such a "drainage" response appears to be temporary and the mechanism, if real, is obsure.

CONCLUSION

N usage in winter and spring is a well-recognised feature of pasture management on dairy farms in Northland. It is probably used profitably but a considerable degree of discrimination is attached to its use because of its cost. Also, the planning of pasture management and the farming of relatively low stocking rates can minimise the requirement for N. Consequently, the actual use of N in spring by dairy farmers is relatively small although the total quantity used is steadily rising in the region. Any trend to earlier calving or higher stocking rates is likely to further increase the quantity of N used by Northland dairy farmers.

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