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# THE EFFECT OF FERTILISER NITROGEN ON THE PRODUCTION OF PASTURE AND MILK ON DAIRY FARMLETS: 1971-1974

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## *Abstract*

Measurements of pasture and animal production were made over 3 years on self-contained dairy farmlets.

The application of 350 to 440 kg N per ha annually resulted in the growth of an additional 2,800 to 3,600 kg DM/ha and the response rate varied between 7.4 to 10.5 kg extra DM grown per kg N applied.

Milkfat production increased by an average of 97 kg per ha annually as a result of nitrogen application at higher stocking rates, but only by 59 kg per ha at lower stocking rates.

At present costs and prices the use of urea as in the present trial would be uneconomical.

## INTRODUCTION

The purpose of this trial was to measure the effects of urea, applied frequently throughout the year, on the production of pasture and milk from dairy farmlets.

At the time when this trial was carried out there was considerable uncertainty about the possible roles of, nitrogenous fertilisers in relation to dairy farm productivity (see Cumberland et al, 1970); the procedures adopted in the trial resulted in the application of considerably more urea per year than would be conventional for the so-called strategic use of the fertiliser.

## MATERIALS AND METHODS

The farmlets were situated on No. 3 Dairy Unit, Massey University on Tokomaru silt-loam, which had previously been tile and mole drained. The pastures were predominantly perennial ryegrass and white clover.

All farmlets received an annual dressing of 760 kg/ha of 30% potassic superphosphate. In addition, those farmlets allocated to the nitrogen treatment received applications of urea at 126 kg/ha after every grazing throughout the year, except in summer when soil and weather conditions were considered to be too dry. These procedures resulted in the application of about 50 kg urea/ha per month in winter, and 140 kg/ha per month in spring. The rate of application was reduced to 63 kg urea/ha at each application in spring 1973 (see Table 1 for total annual application).

Each farmlet was approximately 8 ha and consisted of 9 to 10 paddocks which were allocated to the different treatments so that each treatment was

represented in each area of the farm.

The paddocks on each farmlet were subjected to rotational grazing with the interval between grazings being about 20 days in spring, increasing to about 60 to 80 days in winter.

TABLE 1: DESCRIPTION OF THE FOUR TREATMENTS APPLIED IN 1971-73 and THE TWO TREATMENTS APPLIED IN 1973-74.

	Treatments 1971-73				Treatments 1973-74	
	1	2	3	4	1	2
No. of cows	33	36	30	31	30	37
Stocking rate (cows/ ha)	4.2	4.4	3.5	3.9	3.9	4.9
kg urea*/ ha		887		874		759

\*urea = 46% N

-Each farmlet was managed flexibly to its own best advantage, as judged by a management committee, as a self-contained unit with respect to the stock and to the feed. Silage and/ or hay were made when a surplus of pasture became apparent, and on some occasions hay was effectively "bought in" to be fed to cows on one or more treatments and the quantities involved were recorded.

The stock consisted of cows or pregnant, rising two year old heifers, with no calves or yearlings being grazed. All cows were Jerseys in 1971-72 but each herd contained three Friesians in 1972-73 and 1973-74. The stock remained on their farmlet throughout the year at the appropriate stocking rate (see Table 1) and approximately 15% of each herd was replaced by heifers in April/ May of each year. Mean calving date was between 10th and 20th August in each year with a spread from mid July to late September.

In 1971-72 and 1972-73 there were two main treatments, stocking rate and level of urea application, applied to four farmlets; in 1973-74 there were only two farmlets, one with a higher stocking rate which received urea and the other with a lower stocking rate which did not receive urea. The two stocking rates used in 1973-74 were predicted to be approximately equal to each other when expressed as cows/ pasture DM grown.

Milkfat and milkfat production were measured monthly for each cow by staff of the Livestock Improvement Association (Wellington/ Hawkes Bay).

Pasture growth rates were calculated from measurements of pasture yields made before and after grazing on 28 paddocks in 1971-73 and 18 paddocks in 1973-74. At each measurement, fifteen quadrats randomly allocated over the area of the paddock were clipped to ground level using a motor-driven shearing hand-piece; the cut herbage was collected, washed, dried and weighed.

#### RESULTS AND DISCUSSION

The mean annual rainfall was 940,737 and 762mm for 1971-72, 1972-73 and 1973-74 respectively (average 1944-74 was 991mm).

In each of the 3 years there was less rainfall during the summer than the 30 year average, particularly 1972-73 and 1973-74 when the dry weather began as early as October.

Pastures on nitrogen paddocks grew faster than those on no-nitrogen paddocks throughout the year, except in summer, when urea was not applied. (see Figure 1). Inspection of paddocks in March 1973 and 1974 revealed that those on Treatment 2 had larger areas with no apparently live plants than those on Treatment 1, a difference which was statistically significant in 1974.

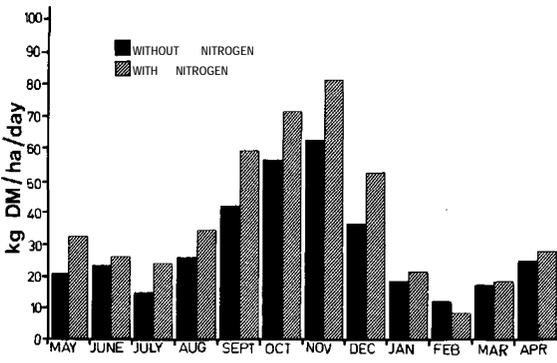


FIG 1: Average monthly growth rates for 1971-74

TABLE 2: MEAN VALUES FOR PASTURE AND MILKFAT PRODUCTION (PER ANNUM)

	Treatments 1971-73				Treatments 1973-74	
	1	2	3	4	1	2
Pasture grown (kg DM/ ha)	12,090	15,710	12,060	15,440	12,350	15,130
Milkfat Produced (kg per cow)	127	147	143	146	110	105
(kg per ha)	527	634	503	562	435	520
Pasture surplus* or deficit (kg DM/ ha)	-1,000	+40	+190	+660	-1,090	-1,410

\* calculated as (kg DM/ ha grown - kg DM/ ha eaten) including pasture and hay.

The mean values for total annual pasture growth and milkfat production are presented in Table 2. The increase in pasture growth on nitrogen farmlets was consistent for both stocking rates and for all years. The mean value for additional dry matter grown expressed per kg of N applied annually was 8.6

(range 7.4 to 10.5). The latter responses are similar to that reported by Ball et al, (1978) following the application of 112 or 448 kg N/ha throughout the year; but lower than responses to smaller, tactical applications of N.

No quantitative data is available about the botanical composition of the pastures on the different treatments; however visual inspection suggested that grazing management, in particular intensity of grazing, exerted a much greater effect than did the application of urea. All pastures retained a reasonable balance of ryegrass and white clover, except at the end of the dry summer weather when the pastures on Treatment 2 appeared to lose ryegrass and subsequently become clover dominant for a short time in autumn. Milkfat production per ha was increased by the application of urea, particularly at the higher stocking rates. The average increase in M F/ ha between treatments 1 and 2 was 100 kg/ ha over the 3 years, which was associated with an average increase of 3340 kg pasture DM grown/ha. Milkfat production per cow was depressed by the higher stocking rate on the no-nitrogen farmlets when compared with the other three treatments in 1971-1972 and 1972-73.

The estimated values for kg pasture DM eaten per kg MF produced range between 23 to 29 for individual treatments, values which are similar to that for twin cattle (25) but higher than that for genetically superior stock (21) (Bryant 1980).

Table 2 shows that for Treatment 1 more DM was eaten by the cows than was grown on the farmlet, which was consistent in all years and was due to purchased hay being fed; this was not the case for the other treatments except for Treatment 2 in 1973-74. If these differences are taken into account then the difference in fat production/ ha between Treatments 1 and 2 would be enlarged.

At present the application of 840 kg urea costs more than the value of 100 kg milkfat, making the use of urea as described in this trial uneconomic. However the present results show that nitrogenous fertiliser can produce additional grass on grazed dairy pastures, and it is believed in hindsight that the amount of urea could have been reduced considerably and applied more judiciously without any marked decrease in the additional pasture grown.

Indeed urea is still used at No. 3 dairy farm, if pasture is in short supply in spring time. Use of nitrogen in this way can be expected to be profitable provided that the following assumptions are made:-

- N costs \$1 .00/ kg N
- 1 kg N applied produces 10 kg DM (or more) of extra pasture grown. all of the extra DM which grows, is also eaten.
- 20 kg of extra DM eaten results in the production of one extra kg milkfat.

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