Effect of high nitrogen fertiliser applications on profitability within a lamb trading operation

P. MUIR[1], B. THOMSON[1] and B. BRIER[2]
[1]*On-Farm Research, PO Box 1142, Hastings*
[2]*AgFirst, PO Box 1261, Hastings*
paul@on-farm.co.nz

Abstract

This study aimed to examine the economic response to high rates of N in a winter lamb trading operation and was an "add on" to a commercial lamb trading operation in Hawkes Bay. The general policy of the lamb trading operation was to purchase store lambs in autumn at 35 kg liveweight, rotationally graze through winter and early spring and draft for slaughter at 45 kg liveweight. Six farmlets with an average size of 34.5 ha were used. Three control farmlets received three winter applications totalling 118 kg N/ha and three high N farmlets received 236 kg N/ha. Lambs were allocated at approximately 20/ha in April and rotationally grazed. Stocking rates were increased as pasture covers increased. Approximately 2000 lambs were used per farmlet and at least 10% of the lambs on each farmlet were weighed and tagged. Pasture growth rates were measured monthly and pasture covers fortnightly. The pasture DM response to extra nitrogen was 13.7 to 1 and resulted in an extra 160 kg lamb liveweight per ha. In spite of a very difficult lamb trading season, there was a small economic response of \$1.39 for every \$1 spent on extra nitrogen fertiliser. The production data obtained was modelled over 10 years on Farmax® using historical lamb sale and purchase prices. This suggested that applying additional nitrogen would give an economic response of between \$1.11 and \$2.01 for every \$ spent on additional nitrogen.

Keywords: nitrogen fertiliser, lamb performance, farmlet trials, lamb finishing, cost effectiveness

Introduction

Various studies (Ball *et al*. 1982; Lambert & Clark 1986; Gillingham *et al.* 2004) have reported good responses to nitrogen fertiliser on hill country. Research work has also demonstrated that the DM response to extra nitrogen on a particular farm is effectively linear up to 400 kg N/ha (Lambert *et al.* 2003). Extra nitrogen fertiliser clearly increases pasture production but the absolute level of the response is unpredictable and Parker *et al.* (1994) concluded that variability in production was the greatest risk associated with nitrogen fertiliser use. Whilst it may sometimes be difficult to capture the benefits of extra pasture grown within a breeding property, a flexible trading operation is more likely to be able to use extra stock to utilise any extra feed grown. This study examined whether the extra DM produced by winter application of nitrogen translated into an economic response in lamb production within a winter lamb trading operation.

Methods

Six farmlets (average size 34.5 ha) each containing eight paddocks, were set up on a Hawkes Bay lamb finishing property. This property typically purchased store lambs in April/May for subsequent finishing in October/November. Paired farmlets comprising control and high nitrogen treatments were replicated three times. Farmlets 1, 2, 5 and 6 had 2-year-old pastures and Farmlets 3 and 4 had older pastures (Fig. 1).

Figure 1 Map of Torran Station showing individual farmlets (Control farmlets light shaded; High N farmlets dark shaded).

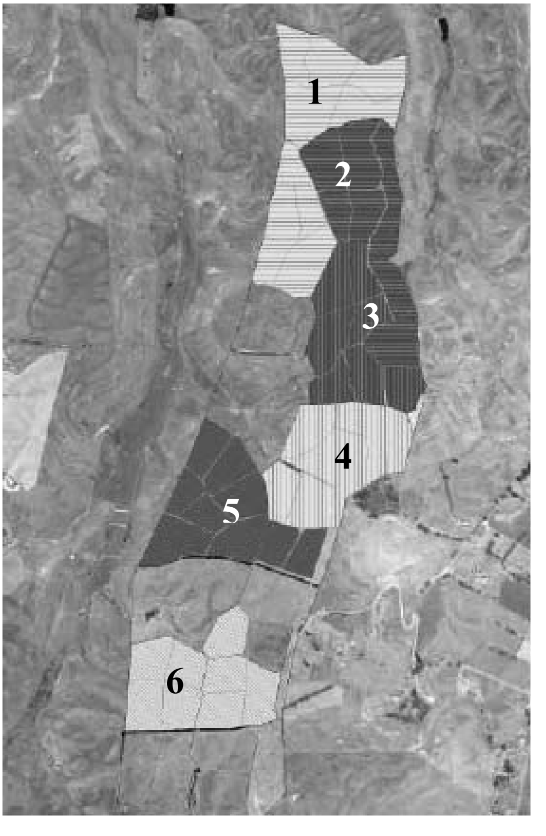


Table 1 Fertiliser application schedule.

Fertiliser applied	Control farmlets	High N farmlets
25 May	125 kg $(NH_4)_2SO_4$	125 kg $(NH_4)_2SO_4$, 55 kg Urea
23 June	100 kg Urea	200 kg Urea
27 July	100 kg Urea	200 kg Urea

All farmlets received three applications of N, with control farmlets receiving 118 kg N/ha and high N farmlets receiving 236 kg N/ha (Table 1) applied by helicopter. Normally the first application of N would have occurred in early April but was delayed until the 25 May because of high autumn pasture covers. Soil samples showed average Olsen P levels of 18 µg/ml, Quicktest K levels of 15 and Sulphate-S levels of 10 µg/g.

Lambs were allocated to treatments in early to mid April at around 20 lambs/ha. Lambs were rotationally grazed throughout winter and spring with the intention of maintaining pasture covers in the range from 1800 to 2400 kg DM/ha. Stocking rates were lifted to around 60 lambs/ha in August to control spring feed. A random 10% of the lambs on each farmlet were tagged and weighed. Lambs were slaughtered when they reached an estimated rib fat depth (GR) of 10 mm. New lambs were introduced to the farmlets as required to replace lambs slaughtered. If tagged lambs were slaughtered, they were replaced by a weighed and tagged sample of the new lambs introduced. In all, some 12 300 lambs were used (approximately 2000 per farmlet).

Every fortnight, pasture covers were determined in each paddock using a FarmWorks Electronic Rising Plate Meter. Pasture growth rates were measured monthly by cutting three 0.5 m^2 pasture cages/paddock (24 cages/ farmlet).

The pasture production data were analysed using a generalised linear model in Minitab (Minitab for Windows Version 14). The financial and production data were modelled using Farmax® (Marshall *et al.* 1991). This enabled the lambs added and removed throughout the study to be accounted for.

Results and Discussion

Good early autumn growth throughout the North Island resulted in a very strong store market (relative to the lamb schedule) and the farm owner was reluctant to purchase high priced store lambs. As a result, farmlets were not only stocked later than planned (13 April) but understocked relative to the pasture covers. This meant that the first application of fertiliser was delayed until the 25 May and occurred at much higher than desirable pasture covers (2800 kg DM/ha) (Fig. 2). Pasture covers remained high until July (Fig. 3). Ideally, lambs would have been rotationally grazed through until early November before being replaced by cattle. However, all farmlets were overstocked in early spring (in an attempt to reduce the pasture covers) and a consequence of this was that the farmlets were discontinued earlier than

Figure 2 Average pasture covers on control and high nitrogen farmlets.

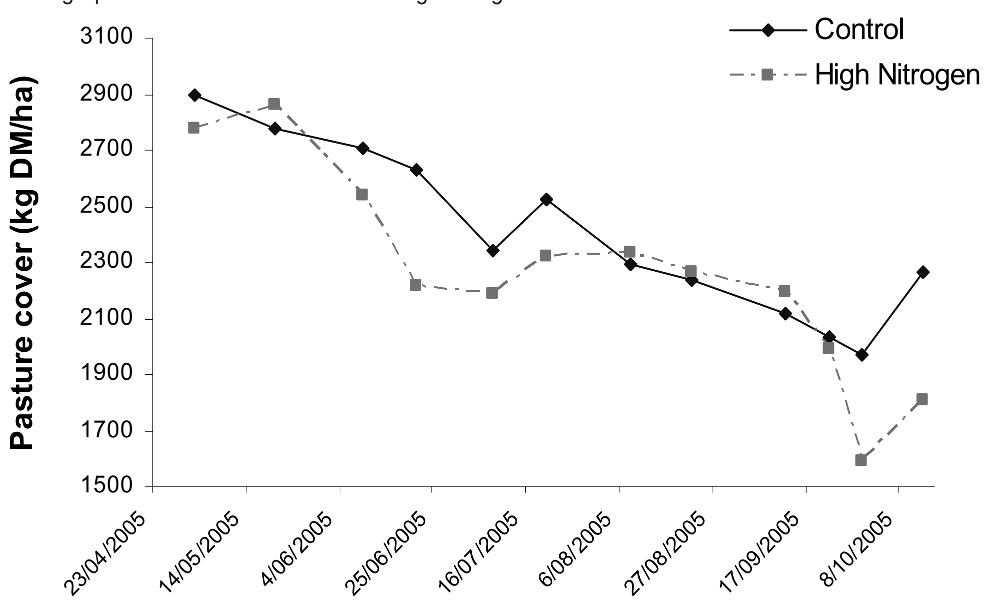
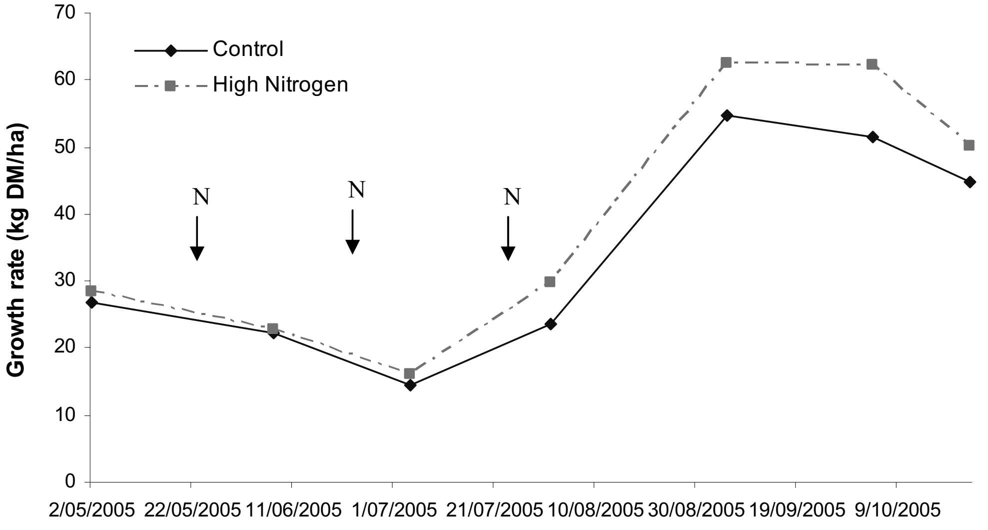


Figure 3 Average pasture growth rates (arrows indicate when fertiliser applied) for control and high nitrogen farmlets.



normal. Farmlets 1 and 2 finished on 12 October, Farmlets 3 and 4 on the 28 September and Farmlets 5 and 6 on the 20 October.

Pasture growth rates averaged 34.2 ± 0.87 kg DM/ha/day and 38.3 ± 0.88 kg DM/ha/day on the control and high N farmlets respectively (P<0.001, Fig. 3). The pasture cut data indicated that an extra 1618 kg of pasture DM/ha was produced on the high N farmlets – a response of 13.7 kg DM for every additional kg of nitrogen applied. This is within the range of 7-33 kg DM/kg N measured across a range of hill country experiments (Ball & Field 1982) and slightly more than the 11.1 kg DM/kg N recorded on summer dry Hawkes Bay hill country at Poukawa (P. Muir, unpublished data).

Animal and pasture production data were modelled on Farmax®. The actual lamb purchase cost was factored in and $1 added to cover transport. Lamb purchase prices rose from $2.09/kg liveweight in April to $2.44/kg for the lambs added to the farmlets in August. For lambs drafted off for slaughter, the value was calculated using daily schedule values less the killing charges/levies and an assumed dressing out percentage of 42%. This meant the average lamb entered the farmlets at a liveweight of 33.0 kg with a value of $73.00. The average lamb grew at 133 g/d and left the farmlets at an average liveweight of 44.5 kg and a value of $83.46. Across all farmlets, an average of 721 kg liveweight was produced per ha, resulting in a gross income of $638/ha.

Compared to the control farmlets, the high N farmlets produced an extra 160 kg/ha of liveweight and an extra gross return of $212/ha (Table 2). These higher returns resulted from a combination of the higher average stocking rate on the high N farmlets (32 lambs/ha vs 29.4 lambs/ha) and the slightly faster growth rates on the high N farmlets (141 g/d vs 124 g/d). Based on $600/tonne urea applied, the cost of applying a kg N was $1.30 and the extra $212/ha generated on the high N farmlets came at a cost of $153/ha. This resulted in a small economic response of $1.39 for every $1 spent on extra nitrogen fertiliser.

Although these economic responses were small, they were obtained in a very difficult production year in terms of the price and availability of lambs. These difficulties meant that grazing pressure was not able to be exerted when needed in autumn. This resulted in very high pasture covers and little or no response to the extra N applied until mid winter. This would have placed an undue penalty on the high N farmlets. Similarly, farmlets were over-stocked in August to control spring feed. This meant that expensive lambs were added which then had to be removed from the farmlets in September/October. This meant that there was too much "slippage" in terms of the premium paid for store stock over prime stock. In addition, this over-stocking meant that farmlets were discontinued early (10 October). This penalised all farmlets as lamb value continued to rise through October and November, but since the high N farmlets were carrying more lambs and more liveweight they would have suffered a greater penalty. As a result of the difficult season, the high N farmlets generated an average Gross Farm Income of 10.3 c/kg DM consumed. In a normal year, this type of lamb trading operation should generate a GFI of approximately 18 to 20 c/kg DM consumed.

The production data obtained in 2005 were modelled on Farmax® using the actual sale and purchase prices that occurred during the previous 10 years (Table 3). This suggested that in each of the last 10 years, applying additional nitrogen would have given an economic

Table 2 Average production data and financial returns on the control and high N farmlets.

	Control	High N
Area (ha)	34.7	34.4
Mean start date	13 April	13 April
Mean finish date	10 Oct	10 Oct
Pasture growth rate (kg DM/ha/day)	34.2	38.3
Total pasture grown (kg DM/ha)	7861	9479
Average pasture cover (kg DM/ha)	2426	2304
Number of lambs used	1969	2120
Grazing days	5176	5693
Average lamb growth rate (g/d)	124	141
Average stocking rate (lambs/ha)	29.4	32.0
Average liveweight on (kg)	33.38	32.01
Average cost on ($)	74.32	71.72
Average liveweight off (kg)	43.99	44.97
Average value off ($)	83.15	83.77
Average liveweight produced per ha	641	801
c/kg DM consumed	8.7	10.3
Gross Farm Income (GFI) -2005 ($/ha)	532	744
Increase in GFI per kg of extra N applied		1.80
Increase in GFI in 2005 per extra $ spent on N		$1.39

Table 3 Predicted returns (Farmax® outputs) from high and low N applications using production data from 2006 modelled with lamb purchase and sale prices over the previous 10 years.

	GFI/ha[1] Low N	GFI/ha[1] High N	Response ($) (per extra kg of N)	Response ($) (per extra $ spent)
10 yr ave	600	812	1.79	1.41
1996	671	843	1.80	1.12
1997	335	532	1.67	1.28
1998	647	855	1.76	1.36
1999	541	711	1.44	1.11
2000	624	824	1.70	1.30
2001	878	1,188	2.63	2.01
2002	444	682	2.01	1.55
2003	615	804	1.60	1.23
2004	717	938	1.88	1.44
2005	532	744	1.80	1.39

[1] Gross Farm Income per hectare (sales less purchases)

response. The range would have been from $1.11 for every $1 spent in 1999 to $2.01 for every $1 spent in 2001.

In the present study, high autumn store lamb prices meant that purchase decisions were delayed, leading to excessive pasture covers. As a result, nitrogen was not applied until late in the autumn. In spite of the less than optimum farmlet management, it was possible to achieve a small consistent economic response from an application of an additional 118 kg N/ha. Whilst it is not possible to extrapolate these results to what might occur in a normal season, it seems reasonable to assume that results achieved here could be improved significantly if sufficient lambs had been available earlier to improve pasture utilisation.

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