
VOLUME 62 2002

Alternatives and supplements to pasture for growing lambs in winter

A.R. BRAY, R.A. MOSS[1] AND R.N. BURTON[1]

MAF Technology, Canterbury Agriculture and Science Centre, P.O.Box 24, Lincoln, New Zealand.

ABSTRACT

Currently less than 20% of the lambs slaughtered in New Zealand each year for export are killed in the five months from July to November. The feeding of high grain content diets in feedlots, grain supplements at pasture, maize silage or forage legumes to increase lamb supply over this period is discussed. Grain-based feedlot diets, supplements of pea grain fed at pasture and lupin and tick bean forage produced lamb liveweight gains of 200 to 300 g/d, that compare with gains of up to 150 g/d expected at pasture. Effects on carcass leanness and meat taste were generally small. Although usually more expensive than pasture, other feeds can be at least as profitable when pasture is in short supply premiums are paid for lambs supplied in winter and spring.

Keywords Lambs, growth, feedlot, pasture, grain, legumes, maize silage, leanness.

INTRODUCTION

The number of lambs slaughtered for export each month in New Zealand follows a regular pattern of highest levels during summer and autumn and lowest levels during winter and spring (Fig. 1). In recent years only 15-20% of the annual total have been slaughtered in the five months from July to November. The pattern reflects the reliance of lamb production systems on pastures as a food source. Some meat processing companies achieve more continuous production, and consequent advantages in operating efficiency and marketing, by payment of premiums for lambs supplied during the off-season. To make the best use of the increasing number of such opportunities, producers need efficient means of growing lambs in winter when plant growth is slow. A number of foodstuffs grown in other seasons and conserved as standing crops (e.g. saved pasture, forage brassicas) or stored products (e.g. silage, grain) are used but there is little comparative information that allows rational choices to be made between them. With this in mind we present data obtained when some alternatives and supplements to pasture were fed to lambs in winter and discuss their use.

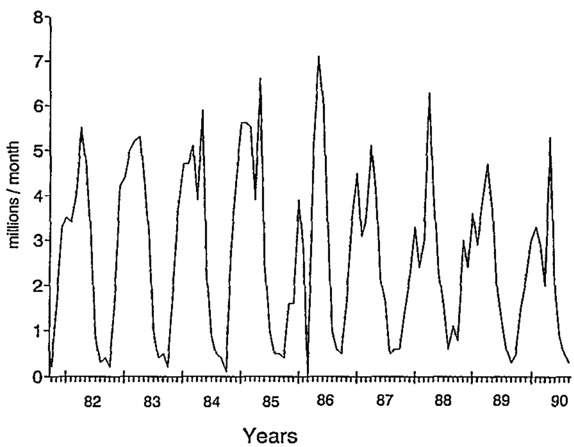

FIG 1 Number of lambs slaughtered in New Zealand each month for export. NZ Meat Producer Board data.

MATERIALS AND METHODS

Grain and hay diets were fed to lambs in feedlots, grain supplements were fed at pasture, maize silage was fed in metabolism crates, or forage legumes were grazed. All experiments began in late autumn or winter and lasted 3 to 12 weeks. Treatment groups contained 9 to

[1] MAF Technology, Winchmore Irrigation Research Station, Ashburton, New Zealand.

20 lambs, randomly allocated within breed, sex and liveweight classes. The mean initial age of groups ranged from 7 to 10 months, and liveweight from 33 to 41 kg.

Consumption of foodstuffs fed in troughs was measured daily whereas the apparent intake of grazed forages was measured twice each week for grazing periods of 1 to 4 days. It was calculated as the difference between pre- and post-grazing herbage masses. Herbage mass was measured using 50 or 100 capacitance meter readings per plot converted to dry matter (DM) values by calibrations from 10 x 0.25 m^2 quadrats cut to ground level. Liveweight gains were calculated from liveweights recorded after overnight fasts. Carcass weights and GR measurements (tissue depth over the 12th rib, 11 cm from the spinal midline) were recorded within 1.5 hours of slaughter. Carcass dressing percentages were calculated from carcass weights divided by pre-slaughter liveweights which were recorded within 1 hour of removing animals from feed. Meat taste was assessed by a trained expert panel: a sample of lean (75%) and fat (25%) tissues from frozen loins was mixed, minced, cooked and presented as described by Winger (1984).

RESULTS AND DISCUSSION

Grain and Hay Feedlot Diets

Lambs reared at pasture encounter novel feedstuffs in a novel situation when introduced to a feedlot so food intake may be low initially. There is also the danger of lactic acidosis resulting from consumption of cereal grains before rumen micro-organisms adapt to the supply of large quantities of readily fermented carbohydrates. The results in Figure 2 have been selected to illustrate these effects on the performance of lambs fed diets containing 65 to 80% barley grain. The poorest performance was shown by a group of lambs fed a diet of 80% barley grain (treatment D). Symptoms of acidosis were observed during the first 3 weeks and food intakes were low throughout the feedlotting period. The diet of the group with the second lowest liveweight gain (treatment C) contained barley straw as the roughage component. It was less attractive initially and had a lower energy and protein content than the two diets (treatments A and B) containing pasture hay on which liveweight gains exceeded 300 g/d.

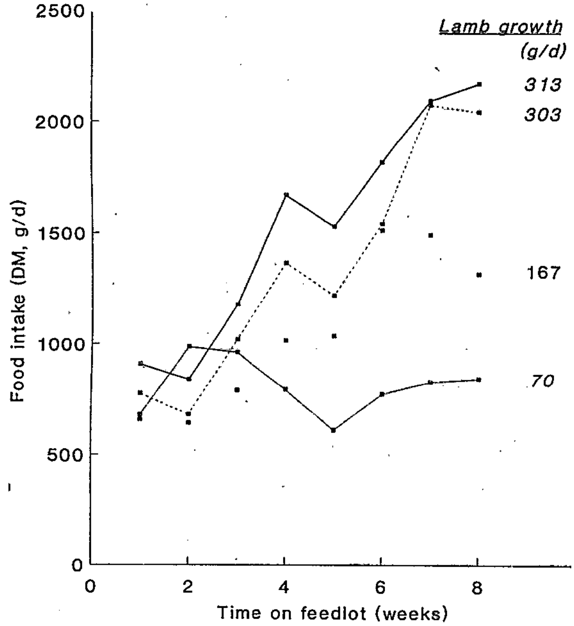

FIG 2 Consumption of barley grain based diets by lambs on feedlots. The hay:straw:grain ratios in Starter diets of treatments A, B and C were 2:1:1, and in Grower diets 0:1:3; treatment B Starter and Grower diets contained 5% meatmeal and treatment C contained 10% meatmeal in the Starter diet. The hay:straw:grain ratios for treatment D was 1:0:4.

Lamb growth rates around 300 g/d and lamb losses (removal for poor performance, ill health or mortality) below 2% have been achieved consistently in experiments and commercial trials. Results show that, where appropriate diet formulations and management practices are adopted, feedlotting with high grain content diets is a reliable means of achieving rapid lamb growth. As the components of these diets can be stored, are portable and their quality can be determined well in advance of feeding, feedlotting is a flexible production system that is independent of current conditions that affect plant growth.

Grain Supplementation of Pasture

As shown in Figure 3, lambs offered 196 g/d DM of barley grain in addition to pasture grew faster ($P<0.05$)

than unsupplemented lambs but liveweight gains did not increase at higher barley allowances. The liveweight gain response to pea grain supplements increased (P<0.01) with increasing grain allowance to 732 g/d DM, the highest rate fed. Differences between treatments are largely explained by, firstly, the poor utilisation of barley grain at the highest supplementation rate, significantly less than for other treatments (72% v. 98%; P<0.01). Secondly, apparent intake of pasture declined as grain intake increased, the rate of substitution being greater at the high than at the low pasture allowance level (-1.04 v. -0.40 g DM pasture intake/ g DM grain intake; P<0.05).and was greater for barley than pea grain (-0.88 v. -0.55; P<0.05). The effect of pasture allowance on substitution rate confirms results from dairy cow experiments (Grainger and Mathews, 1989) and the higher rate for cereal than legume grain supports results of Hodge and Bogdanovic (1983) and others.

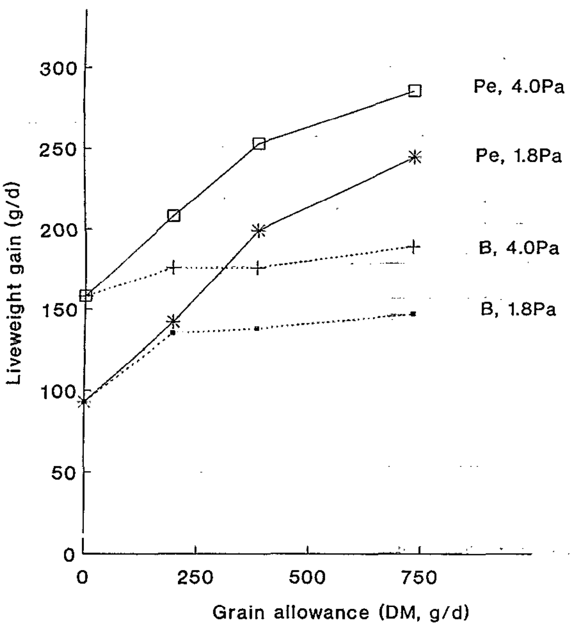

FIG 3 Liveweight gain responses to barley or pea grain supplements at two pasture allowance levels. Pe = pea grain; B = barley grain. 1.8 Pa = 1.8 kg DM/d pasture alllowance; 4.0 = 4.0 kg DM/d pasture allowance.

Carcass dressing percentages and GR measurements increased with carcass weight. When adjusted by covariance to the mean carcass weight, dressing percent increased with pea (0.3% per 100 g/d DM pea grain; P<0.05) and pasture (41.5 v. 42.3%; P<0.05) allowance level. Similarly adjusted GR measurements were greater in lambs supplemented with barley at the higher pasture allowance than in other groups (14.0 v. 15.9 mm; P<0.05). Meat taste was strongest in lambs that received barley at the higher pasture allowance.

The advantages of grains that were noted when discussing feedlot diets apply equally to their use as a supplement to pasture. In addition, substitution of grain for pasture can be seen as a pasture-saving mechanism, a positive attribute in a winter production system.

TABLE 1 Performance of lambs fed *ad libitum* maize silage with or without a supplement of pea grain (225 g/d, DM). Twenty lambs were selected from 100 for their willingness to eat silage and placed in individual metabolism crates for the duration of the experiment. Urea (1%), limestone (0.5%), dicalcium phosphate (0.2%) and sulphur (0.05% of silage DM) was added to the silage.

	Food intake (g/d, DM)			Liveweight gain
	Silage	Peas	Total	(g/d)
Maize silage	870	NA	870	35
Maize silage and peas	861	225	1086	156
LSD (5%)	30	NA	38	45

Maize Silage

When a sole diet of maize silage was fed, food intake was sufficient to support slow lamb growth (Table 1), as expected from the results of Hutton and Rattray (1976) and others. Upon addition of a supplement of peas, silage intake was maintained and all the peas were consumed, increasing lamb liveweight gains from 35 to 156 g/d (P<0.001). In contrast to the response to grain supplements by lambs at pasture, there was no substitution of peas for silage. Because these results were obtained with selected lambs fed individually in metabolism crates it is not possible to predict the performance of a complete mob from these results. Nevertheless it does indicate that a maize silage and pea diet can support lamb growth of the same order as achieved at pasture. More investigation of responses to maize and pasture silages is needed as they are cheap feedstuffs.

Forage Legumes

When lupins and tick beans were fed at the same food allowance level as pasture, apparent food intakes were similar but the liveweight gains were much higher (P<0.01), particularly for tick beans (Table 2). This is consistent with the high nutritive value of other legumes (Ulyatt, 1981). Legume- fed lambs had higher carcass dressing percentages than pasture-fed lambs (45.0% v. 43.9%; P<0.05), probably reflecting lower gut-fill as found with other legumes (Poppi *et al.*, 1987). GR measurments were similar for all treatments when compared at the mean carcass weight. Meat from lambs fed lupins was slightly stronger tasting than that from lambs fed pasture or tick beans. Taste panel evaluations of meat from lambs fed other legumes have been contradictory (Bray, 1988; G.H. Scales, unpublished data).

TABLE 2 Performance of lambs offered 3.5 kg/d DM of lupin (*Lupinus albus* var. *Llaima*), tick bean (*Vicia faba* var. *Excelle*) or ryegrass-clover herbage.

Forage type	Liveweight gain (g/d)	Carcass weight (kg)	Dressing %	GR (mm)
Pasture	148	20.4	43.9	9.2
Lupins	199	22.4	45.1	10.6
Tick beans	239	23.9	44.9	12.2
LSD (5%)	26	1.0	1.4	2.0

Comparisons with Pasture

Results from the present studies, from Jagusch *et al.* (1979) for turnips, Wairoa brassica and sugar sorghum, and from experiments in which lamb growth responses to pasture allowance were recorded at Winchmore (Scales *et al.*, 1981; Bray *et al.*, 1985; A.R. Bray, unpublished data) are presented in Figure 4. They indicate relative feeding values of alternative feedstuffs in winter.

The growth response to increasing pasture allowances is similar to those reported by Jagusch *et al.* (1979) and McEwan *et al.* (1988), with a plateau around 150 g/d. Higher growth rates can be achieved on high quality swards (Rattray *et al.*, 1987) but farm survey data (Everest and Scales, 1983) confirms that 150 g/d is a reasonable target on permanent ryegrass-clover pastures. The superior growth of lambs fed legume grain or forage may be attributable to greater quantities of amino acids absorbed from the digestive tract as a consequence of higher food intake, higher dietary protein levels or less protein degradation in the rumen.

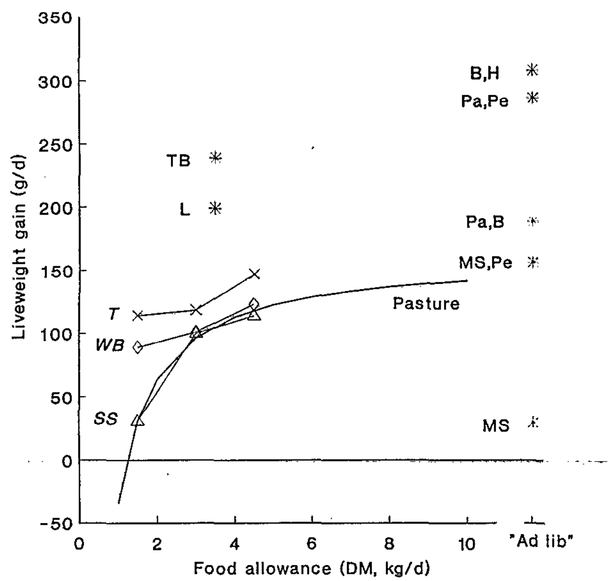

FIG 4 Liveweight gain responses to allowances of various feeds in winter, relative to reponses to pasture allowance levels in summer and autumn at Winchmore.

B,H = barley and hay in feedlots; Pa,Pe = 4 kg/d DM pasture and 732 g/d DM pea grain; Pa,B = 4 kg/d DM pasture and 732 g/d DM barley grain; MS,Pe = ad lib. maize silage and 225 g/d DM pea grain; MS = ad lib. maize silage; TB = tick beans and L = lupins fed at 3.5 kg/d DM. T = turnips, WB = Wairoa brassica and SS = sugar sorghum; data from Jagusch *et al.* (1979).

The crude protein concentration of the legume forages was not measured but the pea grain contained 28.3% of DM compared with 20.8 to 24.0% for the pastures in these experiments. The amount of protein degraded in the rumen is determined by the rate of degradation and time spent in the rumen. The rates of protein degradation for legume grains and forages, cereal grains and pasture proteins are all similarly high (Agricultural Research Council, 1984; Preston, 1989) but rate of passage may well have differed. There is evidence for faster passage through the rumen from studies of other legume forages (Thornton and Minson, 1973; Ulyatt *et al.*, 1976). The high food intakes of barley-based feedlot diets (Fig. 2) and more rapid passage through the rumen may have overcome the effect of the relatively low crude protein concentrations of these diets (13.1 to 17.0%) to produce the high rates of amino acid absorbtion needed to support lamb growth rates of 300 g/d.

Explanations of GR measurement and meat taste results are not obvious. It was concluded that the alternative feeds did not have major detrimental effects on carcass leanness or meat flavour. Dressing percentage differences presumably reflect lower gut fill of the more rapidly digested grains and forages. Where this happens liveweight gains underestimate gains in carcass weight and, therefore, lamb value.

Financial Comparisons

Simple financial models were constructed using weight gain, carcass leanness, wool growth, food allowance and intake data, with incorporation of extra labour, operating and capital costs where necessary. They were used to compare the profitability of treatments within experiments. When pasture supplies were short (and the purchase price of pasture was high relative to alternative feedstuffs), or when product prices were high (as when premiums were paid for lambs supplied out- of-season), alternatives and supplements were as profitable as pasture feeding. More sophisticated models based on a wider range of feedstuffs under a variety of conditions are required for rational decisions to be made on which feedstuffs are most profitable for individual producers who wish to respond to incentives to increase lamb supplies in winter and spring.

ACKNOWLEDGEMENTS

C. Hagyard of MIRINZ, Hamilton is thanked for conducting the taste panel evaluations of meat samples, D Saville for biometrical assistance, and farm staff at Winchmore for field work.

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