Modelling the Feed Requirements of Cross-Bred Sheep

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ABSTRACT

Feed requirements of flocks of ewes from Romney dams mated to either Romney , Border x Dorset, Finn x Texel, or Texel x Dorset sires (R, BD, FT, TD), were estimated from assumed profiles of live weight and reproductive performance. These were constructed by extrapolating data collected from four flocks of 500 ewes each, born in 1994 and run under a common management system at Limestone Downs (a large Waikato sheep/beef property). Annual feed requirements for R, BD, FT and TD ewes (plus 25% replacements) were estimated to be : 670, 809, 766 and 740 kg DM/ewe; equivalent ewe numbers for the same annual intake: 1000, 829, 875 and 906 ewes; g lamb weaned/kg DM consumed: 37, 43, 47 and 40 g/kg DM. Live weight and reproductive profiles for ewes sired by East Friesian rams were also constructed by extrapolating data from East Friesian-cross ewes born at Limestone Downs in 1996 and mated as hoggets in 1997. Estimates of annual feed intakes, equivalent ewe numbers and g lamb weaned/kg DM consumed for East Friesian-cross ewes (plus 25% replacements), mated first as hoggets (EFH) were: 925 kg DM/ewe, 725 ewes and 56g/kg DM; or mated first as two-tooths (EF): 907 kg DM/ewe, 739 ewes, and 50g/kg DM. The increased feed demand for high producing ewes occurred mainly from late pregnancy until weaning.

Keywords: sheep; cross-breeding; feed requirements; stocking rate; weaning weight.

INTRODUCTION

Limestone Downs is a 3,219 hectare sheep and beef cattle property, situated 15 kilometres south of Port Waikato. The farm runs 11,000 Romney ewes, 1,200 breeding cows with progeny sold for slaughter, and 1,100 Friesian bulls. The lambing percentages have averaged 105% for the last five years, and most non-replacement lambs are sold as stores at weaning. Given the prospects of proportionally greater returns from meat than wool and continued discounting of short coarse wool, a review of the sheep enterprise was undertaken in 1993-4 in an attempt to define the required attributes of a future sheep flock. The likelihood of dry summers means that only lambs which can reach slaughter weight by the end of January can be retained past weaning. Consequently, ewes capable of rearing a large number of lambs with heavy weaning weights and fast growth rates are required.

Three breed combinations which appeared to offer these traits were chosen to be represented in sires to mate with the base Romney flock. The rams selected were either Border x Dorset, Finn x Texel or Texel x Dorset crosses for comparison with pure-bred Romneys. Production data were collected from the lambs born in 1994, a proportion of which were retained as ewe replacements. These were run as one flock and mated as two-tooths to a common sire breed. East Friesian rams were chosen because of the potential productivity of the breed (Allison, 1995) and further data were obtained from the progeny. The data collected apply only to ewes which lambed from 1996 onwards and factual information regarding lifetime performance and longevity is not yet available. In addition, they were collected under one management system in one environment using a limited number of sires, so may not be relevant under other conditions.

A modelling exercise was undertaken to investigate the potential for each of the breed crosses in the Limestone Downs environment. Measures of production efficiency were calculated from estimates of feed consumption and product output. Annual feed demand for a typical ewe in each of the crosses was calculated using assumed profiles of live weight and reproductive performance. These were based on extrapolations from the limited production data available.

METHODS

In autumn 1994, two thousand Romney two-tooth ewes at Limestone Downs were divided into four mating groups of 500 ewes each. The sires used in each group were either pure-bred Romneys or cross-bred Border x Dorset, Finn x Texel, or Texel x Dorset rams. The resulting lambs were therefore 100% Romney or 50% Romney, and designated according to sire as R, BD, FT, and TD respectively. Liveweight gain of these lambs run together as one flock were measured in 1994 and 1995. In 1996, the two-tooth ewe replacements were mated to a common breed of sire (East Friesian) and their reproductive performance and ewe mothering ability (as measured by lamb growth) were recorded. The 50% East Friesian x 50% Romney-cross female progeny were mated as ewe hoggets in 1997 to Finn x Romney rams and growth and reproductive data collected.

The purpose of the modelling exercise was to compare annual feed requirements and measures of production efficiency for self-contained flocks of the different crosses,

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including East Friesian-cross ewes first mated as either ewe hoggets (EFH) or two-tooths (EF). The basis for comparison was taken to be a flock of 1000 Romney ewes with performance characteristics experienced at Limestone Downs over the last five years ie: a 25% replacement rate; 105% lambing survival to weaning; lambs other than replacements all sold at weaning; only replacement lambs shorn; hoggets shorn in September, two-tooths in February and ewes twice a year in May and December.

The performance data collected on farm were limited and not wholly representative of self-contained cross-bred flocks eg. ewes born in 1994 were out of pure Romney dams, and their first crop of lambs, born in 1996 had East Friesian sires. Assumed patterns of liveweight change and reproductive performance data considered typical for each breed cross were therefore derived by extrapolation. These were then used as inputs to a spreadsheet model (Brookes *et al*., 1993) for estimating feed demands. The model derives daily DM intakes from factorial estimates of ME requirements (AFRC, 1993) for half-monthly periods throughout the year. From the model output, annual feed requirements and various measures of efficiency (lambing % per kg ewe mating weight; kg lamb weaned per ewe; g lamb weaned per kg DM consumed annually) were calculated. These estimates do not account for feed wastage by grazing animals, and, given the variability associated with the inputs, are subject to error. Nevertheless, the relative differences should still provide useful indications of the productive efficiency of the various breed crosses.

TABLE 1: Live weights and lambing percentages at Limestone Downs for cross-bred ewes sired by either Romney (R), Border x Dorset (BD), Finn x Texel (FT), Texel x Dorset (TD) or East Friesian (EF) rams.

Ewes born in Sep 94 and lambing in Sep 96					
	Live weight (kg)				
	Nov 94	Feb 96	Nov 96		Lambing
Sire Breed			Ewes	Lambs	Percentage
R	22	44	53	24	89
BD	21	53	58	27	121
FT	21	48	54	23	149
TD	22	49	57	27	100

Ewes born in Sep 96 and lambing as hoggets in Sep 97					
	Live weight (kg)				
	Nov 96	Mar 97	Dec 97		Lambing
Sire Breed			Ewes	Lambs	Percentage
EF	25	42	55	28	N/A

RESULTS

Live weight and reproductive data collected at Limestone Downs are summarised in Table 1. Prior to mating, R ewes were lighter than the other crosses by 4-9 kg. The lambing percentage for R ewes in 1996 (89%) was lower than observed in previous years. FT ewes had the highest lambing percentages, but their lambs were lightest at weaning. The high live weights of EF-cross hoggets allowed them to be mated in their first autumn. However, approximately one third aborted due to toxoplasmosis and lambing percentage data are not available.

The assumed live weight and lambing percentage profiles for the different flocks are shown in Table 2. The annual feed requirements, estimated using the spreadsheet model are shown in Table 3, together with various measures of efficiency. Feed requirements, lambing percentages and kg lamb weaned are expressed on a per adult ewe basis (two-tooths and mixed age ewes). The higher lambing percentage in the EFH flock reflects the extra lambs born to the hogget replacements. Estimated DM requirements were greater for ewes with increased demands for pregnancy and lactation associated with high lambing percentages (BD, FT and EF) and for the maintenance of higher body weights (BD, TD and EF). Although FT ewes produce a larger number of lambs, lower ewe live weights reduced the annual maintenance requirements. When adjustments are made for different ewe weights at mating, the number of lambs produced by the lighter, more prolific FT ewes were matched only by hogget mating in the EFH flock. However, the total weight of lamb weaned per ewe was lower for FT than EF ewes. Taking into account differences in annual DM intake, FT and EF ewes produced some 30% greater weight of lamb weaned/kg DM consumed than did R ewes. Mating EF replacements as hoggets rather than as two-tooths increased this efficiency

TABLE 2: Assumed live weights and lambing percentage profiles for cross-bred ewes sired by either Romney (R), Border x Dorset (BD), Finn x Texel (FT), Texel x Dorset (TD) or East Friesian rams (EF), and East Friesian-sired ewes mated as hoggets (EFH).

	Live weight (kg)							
		Hoggets		Two-tooths		Ewes		Lambing
Breed	Weaning	Autumn	Spring	Mating	Lambing	Mating	Lambing	Percentage
R	24	33	42	50	55	54	59	105
BD	27	36	46	60	65	64	69	130
FT	23	33	43	54	59	58	63	160
TD	27	35	44	56	61	60	65	110
EF	30	43	51	63	70	69	70	150
EFH	30	43	59[a]	63	70	69	70	150(100[a])

[a] Hogget lambing

TABLE 3: Estimated annual feed demand (kg DM) and measures of efficiency for flocks of cross-bred ewes, plus 25% replacements, sired by either Romney (R), Border x Dorset (BD), Finn x Texel (FT), Texel x Dorset (TD) or East Friesian rams (EF), and East Friesian-sired ewes mated as hoggets (EFH).

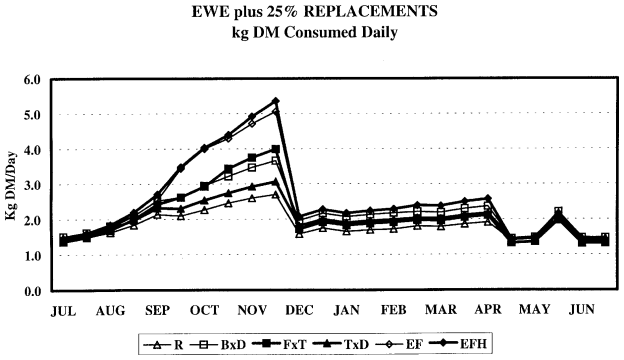
Breed	Annual feed demand (kg DM/ewe)	Lambing percentage	Lambing % per kg ewe mating weight	Weaning weight (kg/lamb)	kg lamb weaned per ewe	g lamb weaned per kg DM
R	670	105	1.98	24	24.8	36.9
BD	809	130	2.06	27	34.6	42.7
FT	766	160	2.81	23	36.2	47.3
TD	740	110	1.86	27	29.2	39.5
EF	907	150	2.22	30	45.0	49.6
EFH	925	175	2.80	30	52.0	56.3

value by a further 14%, due to the 16% increase in the weight of lamb weaned, with only a 2% increase in annual feed demand.

Feed demand patterns over the year for a ewe (plus 0.25 replacements) are presented in Figure 1. The largest differences occurred in late winter and spring, with prolific ewes (FT and EF) requiring 25-50% more feed than R ewes for pregnancy and lactation. Differences were not so marked from weaning to mid-pregnancy, with heavy breeds (BD and EF) requiring approximately 20% more feed than R ewes.

Comparative stocking rates for the different breed flocks can be calculated from these estimates. The feed demand of 670,000 kg DM/annum for the base flock of 1000 R ewes (plus 25% replacements) would support flocks of 828 BD, 875 FT, 905 TD and 739 EF ewes. The increased feed demand when hogget mating is practised in the EFH flock reduced the equivalent ewe numbers to 725.

FIGURE 1: Patterns of annual feed demand (kg DM/day) for flocks of cross-bred ewes, plus 25% replacements, sired by either Romney (R), Border x Dorset (BD), Finn x Texel (FT), Texel x Dorset (TD) or East Friesian rams (EF), and East Friesian-sired ewes mated as hoggets (EFH).



DISCUSSION

The decision regarding which breed of ram to use will be influenced by many factors (Parker *et al*. 1998). These include the relative returns from meat and wool, other competing livestock enterprises, animal health issues and the expected pattern of pasture growth for the property. The analysis described makes no allowance for wool production and though R ewes produced the least amount of lamb per kg DM consumed, they can outproduce the other crosses by 1-2 kg greasy fleece/annum. Regional variations in pasture growth need to be considered in deciding appropriate stocking rates and lambing, weaning and selling dates. Although biologically more efficient to run higher producing animals at lower stocking rates, the ability to do so will depend on the match between patterns of feed demand and pasture growth. The lower winter, higher spring pattern of feed demand shown with high producing animals at relatively low stocking rates will suit properties where winter growth is low but feed surpluses in spring and summer are difficult to control. This is the case at Limestone Downs where pasture supply is generally shortest in autumn and winter, as the property runs a relatively high proportion of finishing beef animals. Resistance to disease may also differ between breeds and initial observations suggest FT ewes may show greater tolerance of facial eczema but reduced resistance to intestinal parasites.

A system which allows change has greater flexibility to adjust to environmental or market factors. In flocks with high lambing percentages, sheep numbers or breeds can be modified more rapidly, whereas with 100% lambing or below, there is little scope for change.

SUMMARY

A cross-breeding programme was instituted at Limestone Downs and measurements of performance collected from the offspring of Romney ewes mated to a variety of sire breeds. From these data, typical ewe lifetime performance profiles were constructed and annual feed requirements for the different breed flocks estimated. The most efficient use of feed, defined as g lamb weaned/kg DM consumed annually, was apparent with ewes rearing a large number of lambs to heavy weaning weights. The influence of the Finn and East Friesian breeds is expected to lift lambing percentages, and the Dorset and East Friesian influence on mothering ability to increase weaning weights. Finn x Dorset rams appear a suitable choice for Limestone Downs but the final decision on breeding policy may be modified as better information on new breeds, such as the East Friesian, becomes available. When considering a breeding programme, it is useful to adopt this approach of defining the desirable attributes required in a

flock and quantifying the impact of performance changes on feed demand in a particular environment.

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