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Relative priorities for feed between ewes and ewe hoggets in winter and spring: a modelling analysis

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ABSTRACT

A simulation model was used to generate functions to evaluate winter and spring feed priorities for replacement hoggets and ewes on North Island hill country. The functions relate ewe, hogget and lamb live weights at the end of the respective seasons to seasonal stocking rate and live weight and pasture cover at the start of the season. The site simulated was Ballantrae Hill Country Research Station.

At high stocking rates, switching priorities from hoggets in winter (relative stocking rate, 1 hogget/ewe) to ewes in spring (2.4 hoggets/ewe) provided no benefit to ewe and hogget live weight at weaning, compared to other selected winter/spring strategies (e.g., 1.2/2.05 or 1.4/1.8 hoggets/ewe). However lamb weaning weight was greater under the former strategy. The same pattern held for lower stocking rates. Imposition of system constraints reduced the apparent advantages displayed in the general functions. Rationing feed to hoggets in spring was important to success at high hogget stocking rates.

Keywords Simulation; model; production functions; ewes; lambs; hoggets; live weight; pasture cover; feed priorities; winter-spring

INTRODUCTION

An important decision faced by sheep farmers is the area of the farm to allocate replacement hoggets, relative to ewes, in winter and spring. The decision taken will affect hogget, ewe and lamb live weights at weaning. Standard annual stock unit conversions of 1 hogget being equivalent to 0.6 ewe (Coop, 1965), appear to be too low in winter and too high in spring (e.g. During *et al.,* 1980). In addition, ewe and lamb live weights at weaning are less sensitive to level of nutrition during pregnancy than during lactation (Smeaton *et al.,* 1983), whereas hogget growth responses are similar in both winter and spring (During *et al.,* 1980). This suggests that scope may exist to manipulate hogget growth for the overall benefit of the system.

A simulation model was used to derive functions estimating hogget, ewe and lamb live weight at the end of winter and spring, in relation to differing seasonal stocking rates, initial live weights and initial pasture covers. From these functions a number of options relating to the priorities for feed between hoggets and ewes in a closed system, were evaluated.

MODEL

The model (McCall, 1984) simulated pasture growth (gross) senescence and decay from climate data, depending on physiological state of the sward, soil fertility status and grazing effects. Intake of pasture dry matter was determined from green pasture cover and allowance, and physiological state and age of the animal. Animal energy balance was calculated in a similar manner to that of White *et al.,* (1983). Fifteen percent was added to surveyed farm area to account for the additional area associated with the uneven terrain of hill country.

EXPERIMENTAL

Winter was taken as the period, April 20 to August 18 (the start of lambing) and spring, August 18 to November 30 (weaning). Assumptions regarding starting conditions on April 20 were; an average green pasture cover of 1650 kg DM/ha and ewe and hogget live weights of 50 and 30 kg respectively, each with 1 kg of wool. Management over winter for both mobs was a 120-day rotation, 4 days per break. At lambing ewes were set stocked. Hoggets continued on a 60-day rotation, 2 days per break, for 45 days, then a 30-day rotation, 1 day per break, for 30 days. They were set stocked on November 1. Stocking rate was taken as the number of animals per hectare, regardless of type. Number of lambs weaned per ewe, generated by the model, was 1.09.

The site simulated was Ballantrae Hill Country Research Station near Ashurst. A series of 'average' months from the Ballantrae No. 2 climate station were used to drive the model and level of soil fertility assumed approximated that under the high fertiliser input regime (Lambert *et al.,* 1983).

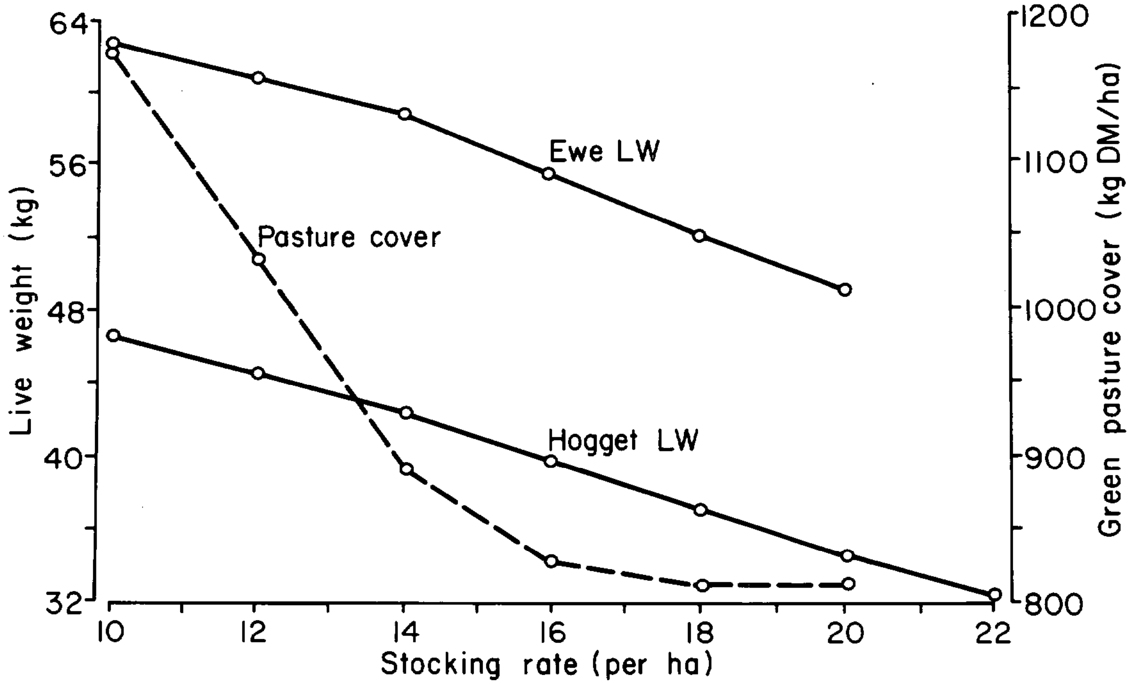

FIG 1. Relationship between winter stocking rate and green pasture cover, and ewe and hogget live weight at lambing.

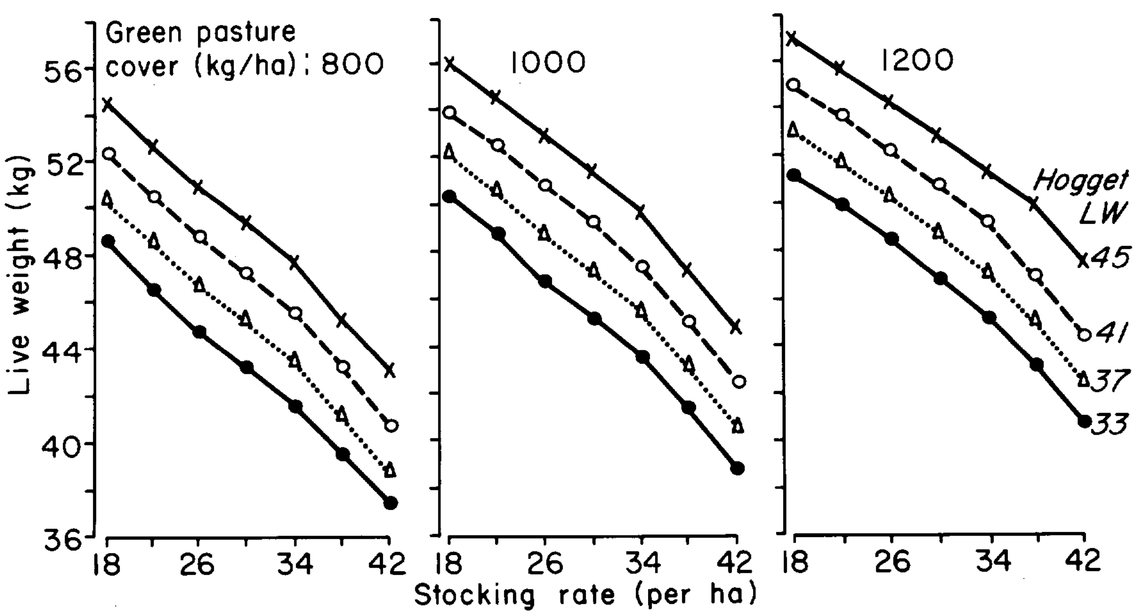

FIG. 2 Response of hogget fleece-free live weight at weaning to pasture cover, live weight at lambing and spring stocking rate.

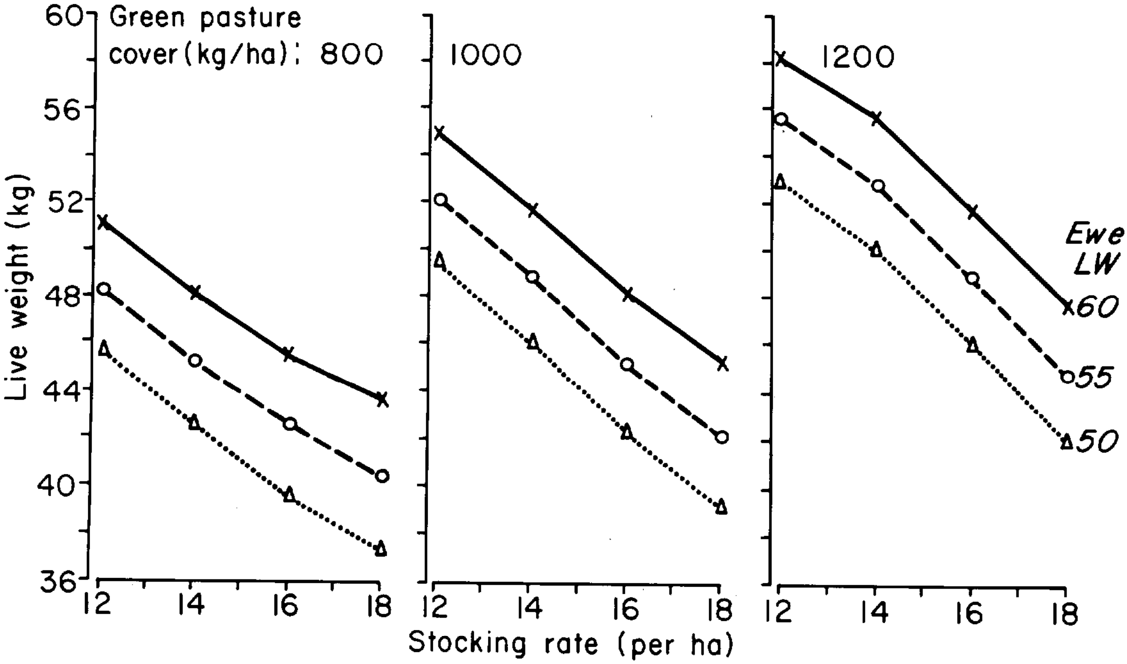

FIG. 3 Response of ewe fleece-free live weight at weaning to pasture cover, live weight at lambing and spring stocking rate.

RESULTS AND DISCUSSION

Functions

The relationships between winter stocking rate and ewe and hogget live weights at the end of winter are shown in Fig. 1. Where a long rotation was employed, average pasture cover at the start of spring was determined almost solely by winter stocking rate (Fig. 1). Differences between hogget and ewe pasture covers were minimal (8 to 35 kg/ha) at this time.

The effect of spring stocking rate on fleece-free live weight of hoggets and ewes at weaning, and on lamb weaning weight, were assessed for different initial spring live weights and pasture covers (Figs 2 to 4). Pasture cover and live weight at lambing influenced ewe and hogget live weight at weaning at all stocking rates. Lamb weaning weight was insensitive to prelambing ewe live weight over the range tested, except at high stocking rates and low prelambing covers (Fig. 4).

Segmenting the system into time periods, and generating a range of scenarios for each period, allows prediction of responses to a wide range of situations and helps clarify complex interactions between the periods.

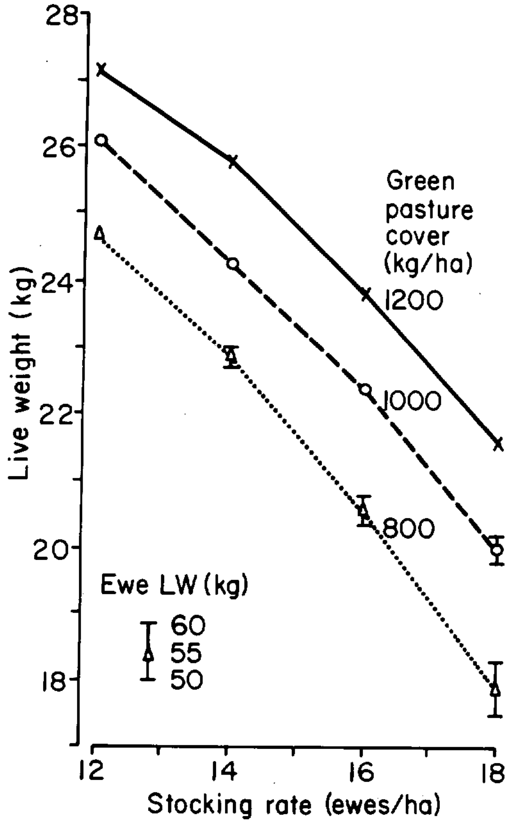

FIG. 4 Lamb weaning weight responses to pasture cover, ewe live weight at lambing and spring stocking rate of ewes.

The consequences of a set of decisions can be evaluated, by tracing them through the functions.

In the analysis of feed allocation strategies provided in this paper, effects of decisions were traced through the functions in Figs 1 to 4.

System Options

A system was defined with an overall rate of 17 ewes plus hoggets (30% of ewes) per hectare, that is 13.08 ewes plus 3.92 hoggets/ha. Decisions for winter were to stock hoggets at the rate of 0.8, 1.0, 1.2 or 1.4 times the stocking rate of ewes. These corresponded to actual stocking rates of 14.4, 17, 19.6 and 22.2 hoggets/ha, respectively and required that ewes be stocked at 18, 17, 16.3 and 15.9 ewes/ha, respectively. Pasture cover, and ewe and hogget live weight at lambing were obtained from Fig. 1 for each of the 4 relative stocking rate decisions, and provided the starting conditions for spring. Decisions for spring were to stock hoggets at rates of between 1.2 and 2.4 times the stocking rate of ewes. Appropriate hogget, ewe and lamb live weights at weaning were derived from Figs 2 to 4 for each of the 4 sets of starting conditions. This produced predicted hogget, ewe, and lamb weaning live weights for each winter/spring relative stocking rate combination (e.g. 0.8/1.2 . . . 0.8/2.4, 1/1.2 . . . 1/2.4, etc.). These are shown graphically in Fig. 5.

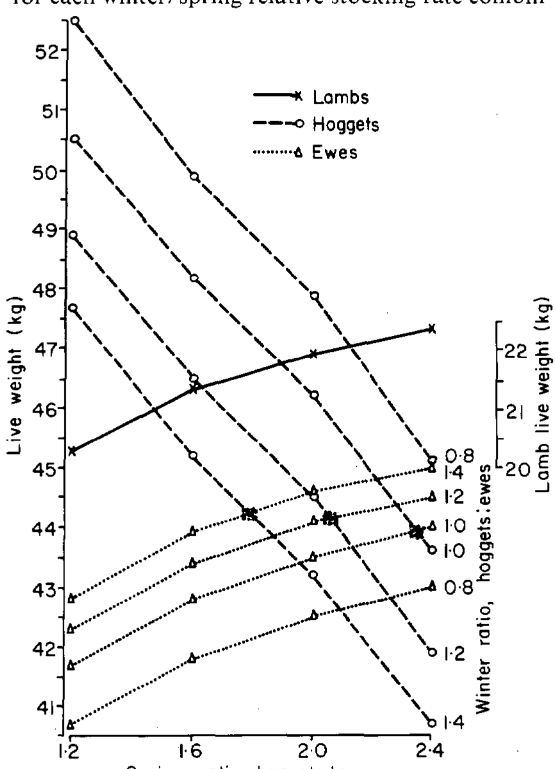

FIG. 5 Ewe, lamb and hogget live weights at weanini for 17 ewes plus hoggets/ha, in relation to the ratio of hoggets carried per ewe in winter and spring.

Comparisons were made between winter/spring strategies which produced ewe and hogget live weights that were the same at weaning (shaded in Fig. 5). Interestingly this live weight was the same over the range of strategies compared, but feeding hoggets better in winter, 1 hogget/ewe, and switching priority to ewes in spring, 2.4 hoggets/ewe, benefited lamb weaning weight. At a lower stocking rate (14/ha) the same conclusions applied, but greater scope existed to give priority to hoggets in winter, and ewes in spring.

Grazing management was critical in achieving acceptable performance from hoggets at high stocking rates in spring. Experience with the model suggested that anything other than rigid rationing of feed in early spring, to maintain average pasture cover, greatly reduced hogget performance owing to severe reductions in pasture growth rate.

Despite the appearance of large benefits to be gained in lamb weaning weight by reducing ewe stocking rate in spring (Fig. 4), the imposition of system constraints e.g., on the amount ewe stocking rate can be reduced when hoggets make up only a small fraction (23%) of the flock, diminishes the practical benefit of such management. It is concluded though, that the gains made in lamb weaning weight will be worthwhile, since they are made at no cost. These conclusions represent a general view of one system. The basic response functions could readily be used to evaluate alternatives at the individual farm level with, if desired, economic performance criteria.

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