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Relativ e prioritie s fo r fee d betwee n ewe s an d ewe hogget s in winte r an d spring : a modellin g analysis

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ABSTRACT
A simulatio n mode l wa s use d to generat e function s to evaluat e winte r an d sprin g fee d prioritie s fo r replacement hogget s and ewes o n Nort h Islan d hil l countr y . Th e function s relat e ewe , hogget an d lamb liv e weigh t s a t th e end o f th e respectiv e seasons to seasonal stocking rate an d liv e weigh t an d pastur e cove r at th e start o f th e season . Th e site simulate d wa s Ballantrae Hil l Countr y Researc h Station.

At high stocking rates , switchin g prioritie s fro m hogget s in winte r (relativ e stocking rate , 1 hogget/ewe ) to ewes in sprin g (2. 4 hoggets/ewe ) provide d no benefi t to ewe an d hogget liv e weigh t at weaning , compared to othe r selected winter/sprin g strategie s (e.g. , 1. 2/2. 05 or 1. 4/1. 8 hoggets/ewe) . However lamb weanin g weight wa s greate r under th e forme r strategy . Th e sam e patter n hel d fo r lowe r stocking rates . Impositio n o f syste m constraint s reduce d the apparent advanta ges displayed in th e general function s. Rationin g fee d to hogget s in sprin g wa s importan t to succes s at high hogget stocking rates.

Keywords Simulation; model; productio n functions; ewes; lambs; hoggets; live weight; pastur e cover; fee d priorities; winter-sprin g

INTRODUCTION
An importan t decisio n face d b y shee p farmers is th e area o f th e far m to allocat e replacement hogget s, relativ e to ewes , in winte r an d sprin g. Th e decision taken will affect hogget , ewe an d lamb liv e weigh t s at weaning. Standard annua l stock uni t conversion s 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). Th is suggests that scope may exist to manipulat e hogget growth for th e overall benefi t o f th e system.

A simulatio n mode l wa s use d to deriv e function s estimatin g hogget , ewe an d lamb liv e weigh t s at th e end o f winter and spring , in relation to differin g seasonal stocking rates , initial liv e weigh t s an d initia l pastur e covers. Fro m th ese function s a numbe r o f option s relat ing to th e prioritie s fo r fee d betwee n hogget s an d ewes in a clos ed system , wa re evaluat ed.

MODEL
Th e model (McCall, 1984) simulate d pastur e growth (gross) senescenc e an d decay fro m climat e data, dependin g on physiologica l state o f th e sward , soil fertilit y status an d grazin g effects. Intake of pasture dry matter wa s determin ed from green pastur e cover an d allowan ce, an d physiologica l state an d age o f th e animal. Animal energy balance wa s calculat ed in a similar manner to that o f White et al. , (1983). Fifteen percent wa s added to surveyed farm area to account fo r th e additio nal area associate d with th e uneven terrain o f hil l countr y.

EXPERIMENTAL
Winter wa s take n a s th e period , April 2 0 to August 1 8 (th e start o f lambin g) an d sprin g, August 18 to November 3 0 (weaning). Assumption s regardin g start- ing condition s o n April 20 wa re; an average green pastur e cover o f 1650 kg DM/ha an d ewe an d hogget liv e weigh t s o f 50 an d 30 kg respectively, each with 1 kg o f wool. Management ove r winte r fo r bot h mob s was a 120-day rotation, 4 days per break. At lambin g ewes were set stocked. Hogget s continue d o n a 60-day rotation, 2 days per break, fo r 45 days, th e 30-day rotation, 1 day per break, fo r 30 days. They were set stocked on November 1. Stocking rate wa s taken as th e number o f animals per hectare, regardles s o f type.

Number o f lamb s weane d per ewe , generate d b y th e model, wa s 1.09.

The site simulate d was Ballantrae Hil l Countr y Researc h Station near Ashurst. A series o f 'average' months fro m th e Ballantrae No. 2 climat e station wa re use d to drive th e model an d level o f soil fertilit y assumed approximat ed that under th e 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.
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 pre-lambing 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. 3 Response of ewe fleece-free live weight at weaning to pasture cover, live weight at lambing and spring stocking rate.

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.

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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REFERENCES


