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PATTERN OF **HERBAGE** GROWTH DURING LACTATION AND LEVEL OF **HERBAGE** MASS AT LAMBING: THEIR SIGNIFICANCE TO ANIMAL PRODUCTION

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Abstract

On most New Zealand sheep farms continuous stocking is practised for the period lambing to weaning. Levels of herbage mass are frequently low both before and after lambing and the high demands of the lactating ewe often results in these low levels being maintained until weaning. Low levels of herbage mass depress herbage growth, herbage intake and animal liveweight gain. A simple simulation model was used to integrate the effects of herbage mass at lambing, pattern of herbage growth during lactation and stocking rate into production functions of animal performance versus stocking rate. These functions demonstrate the necessity at high stocking rates for herbage mass levels to be at least 1000 kg DM/ha at the beginning of lambing if the detrimental effects of prolonged periods of low herbage mass on both herbage and animal production are to be minimised.

Keywords: Animal production, herbage growth rates, herbage mass, production functions.

INTRODUCTION

On most New Zealand sheep farms continuous stocking is practised for the period from lambing to weaning. For a variety of reasons including previous adverse climate (eg. drought, cold winter etc..), a winter rotation that is too short (eg. inadequate subdivision) or inability to quit stock at the appropriate time, levels of herbage mass at the beginning of lambing are frequently low. The high feed demands of the lactating ewe can result in low levels of herbage mass being maintained throughout the spring until weaning, with adverse effects on both ewe and lamb performance. A reduction in overall stocking rate, the adoption of a more flexible stock policy, or stricter rationing of feed during pregnancy could help to alleviate the situation.

Ewe and lamb performance as measured at weaning, is the result of the interaction of herbage mass levels at parturition and the subsequent pattern of herbage growth for a particular season and stocking rate. (Ewe liveweight at lambing can also influence performance but is not considered in this discussion.) If high rates of herbage growth occur immediately after lambing, then the effects of low initial levels of herbage mass will probably be minimal. On the other hand, if low growth rates occur (whether climate or management induced), and the initial level of herbage mass is low, then the effects on ewe and lamb performance could be substantial (Smeaton & Rattray 1984).

In this paper, the interaction of stocking rate, pattern of herbage growth during lactation and level of herbage mass present at the commencement of lambing is examined using production functions obtained by simulation.

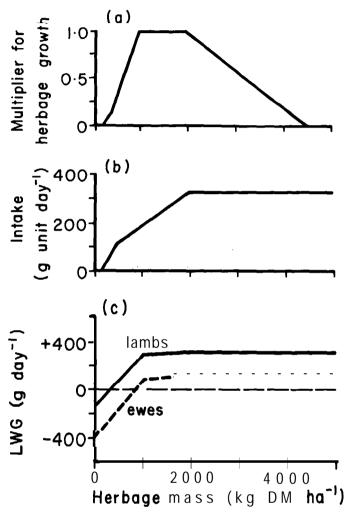


Figure 1: After Bircham (1981)

- (a) The effect of herbage mass on rate of herbage growth.
- (b) The effect of herbage mass on the combined intake of the ewe plus single lamb.
- (c) The effect of herbage mass on ewe and lamb liveweight change.

THE MODEL

Level of herbage mass determines pasture growth (net herbage accumulation) rate, herbage intake and liveweight gain of the grazing animal. Pasture growth rate is the product of the potential (environmentally possible) growth rate and a dimensionless multiplier that describes the relationship between herbage mass

and growth rate (Fig. la). Below 1000 kg DM/ha, the growth of new pasture is reduced and, above 2000 kg DM/ha, death and decay of pasture reduces the rate of net herbage accumulation.

Daily herbage intake of the ewe and single lamb combined, increases to a maximum of 3.2 kg DM/day at a herbage mass of 2000 kg DM/ha and thereafter remains constant (fig. 1 b). Consumption of herbage per unit area is the product of herbage intake and stocking rate. Maximum liveweight gains of 310 g/day and 122 g/day for the lambs and ewes respectively occur at a mass of 2000 kg DM/ha (fig. Ic). Animal intake and performance levels of the same order have been reported by Rattray et al. (1982). The model thus integrates the effects of stocking rate and pattern of herbage growth on ewe and lamb performance over lactation.

The principal assumption in the current version of the model besides the empirical relationships (fig. 1), is that of 100% lambing with no multiple births and no ewe or lamb mortality during lactation. Assumptions implicit in the empirical relationships are those of continuous stocking throughout lactation on perennial ryegrass (Lolium perenne), Poa annua, white clover (Trifolium repens) pastures and the equivalence of herbage death and disappearance. This last assumption is probably reasonable for winter and spring. In this study the following additional assumptions were made: (1) A ewe conceptus-free liveweight of 47 kg at parturition, (2) A lamb birthweight of 4.5 kg. (3) A lactation duration of 91 days. (4) Annual pasture production of approximately 7500 kg DM/ha, of which 48% is grown during the 91 days of lactation (September, October, November). Two patterns of potential herbage growth, LOW (average of 16 kg DM/ha) and HIGH (average of 35 kg DM/ha) during the first four weeks of lactation, but with the same potential yield (3570 kg DM/ha) for the 91 day period of lactation, have been used in the analysis (fig. 2).

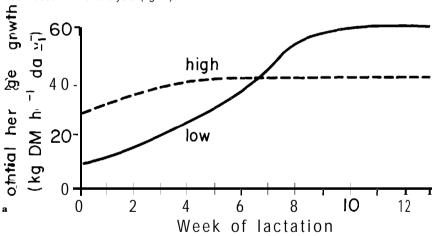


Figure 2: Two patterns of herbage growth; LOW and HIGH rates of potential herbage growth in early lactation with the same potential yield for the 91 days 0 f lactation.

RESULTS AND DISCUSSION

The simulation model used to generate the production functions was constructed with the sole objective of predicting the pattern of response rather than

the absolute response. Nevertheless, this simple model when run for Wairarapa conditions using local rate of herbage growth data (Radcliffe 1975) compared well to experimentally determined ewe and lamb performance (table 1). The production functions generated by the model can therefore be used with some confidence to indicate likely response in other situations.

Table 1: COMPARISON OF PREDICTED AND EXPERIMENTALLY DETERMINED (BIRCHAM et al. 1977) EWE AND LAMB LIVEWEIGHTS AT WEANING ON THE WAIRARAPA PLAINS. (EXPERIMENTAL VALUES ARE MEANS OF YEARS 2-4 INCLUSIVE).

Treatment	Herbage Mass (kg DM/ha)	Stocking Rate (ewes/ha)	Ewe	Weaning Lamb	Weight (kg) Lamb/ha
No lime'					
Experiment	n a	22	47.0	26.8	590
Model	7003	22	48.8	27.9	580
Lime ²					
Experiment	n a	22	53.5	29.0	638
Model	7003	22	53.8	28.3	629

Ewe conceptus-free liveweight estimated to be 42 kg, lamb birthweight measured as 4.9 kg.

The production functions for lamb liveweight per hectare (fig. 3) and individual ewe and lamb liveweight (fig. 4) at weaning illustrate the interaction of stocking rate, pattern of herbage growth and level of herbage mass present at lambing. Essentially these production functions reflect the proportion of potential herbage yield that is realisable in a particular system (stocking rate, initial herbage mass etc.) For example, if a herbage mass of 800 kg DM/ha at lambing and a stocking rate of 10 ewes/ha are assumed, the model predicts lamb and ewe liveweights at weaning for the LOW pattern of herbage growth of 23.0 and 48.5 kg respectively; and 29.6 and 55.8 for the HIGH pattern. This difference is primarily due to the different periods of time (56 vs 18 days respectively) during which herbage mass levels not only restricted herbage growth, but also herbage intake and animal liveweight gain (fig. 1). The impact of level of herbage mass at lambing can similarly be illustrated. If the same stocking rate of 10 ewes/ha is assumed but the level of herbage mass is raised to 1000 kg DM/ha, the model predicts lamb and ewe liveweights at weaning of 29.2 and 55.4 kg respectively for LOW pattern of herbage growth and 31.0 and 57.2 for the HIGH pattern. Whereas the increase in animal performance resultant from this increase in initial herbage mass (800 to 1000 kg DM/ha) for the HIGH pattern is relatively small (t1.4 kg/lamb), the increase for the LOW pattern is substantial (+6.2 kg/lamb). This increase in pro-

² Ewe conceptus-free liveweight estimated to be 47 kg, lamb birthweight measured as 5.3 kg.

Herbage mass levels were not recorded but were almost certainly in the vicinity of 6-800 kg DM/ha (Bircham unpub.).

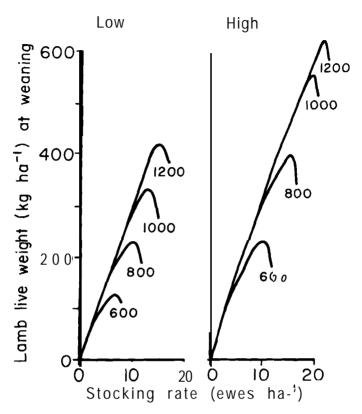


Figure 3: Production functions for lamb liveweight per hectare at weaning versus stocking rate for the LOW and HIGH patterns of herbage growth and four levels of herbage mass at lambing.

duction is primarily due to the reduced period during which herbage mass restricted herbage growth, herbage intake and animal liveweight gain (37 vs 0 days respectively). If the model is a reasonable representation of reality, the benefits of post rather than pre-lamb feeding of any winter pasture surplus to maintenance requirements (Smeaton et a/. 1983, Smeaton & Rattray 1984) can be attributed to reduced periods of time during which herbage mass restricted herbage growth, herbage intake and animal liveweight gain, Management techniques which facilitate the rationing of feed in winter, the transfer of feed surplus to stock maintenance requirements forward to after lambing (Sheath & Bircham 1983;Smeaton 1983) and therefore higher levels of herbage mass at lambing are necessary if the adverse effects of low rates of herbage growth in early lactation on production are to be minimised.

Before decisions on future strategies to increase production can be made, the current position must be identified. There is, for example, widespread evidence of severe feed shortages in late-winter and early-lactation, feed surpluses around weaning and shearing which are not fully controlled until the following winter, and poor ewe and lamb liveweights at weaning. The production functions in

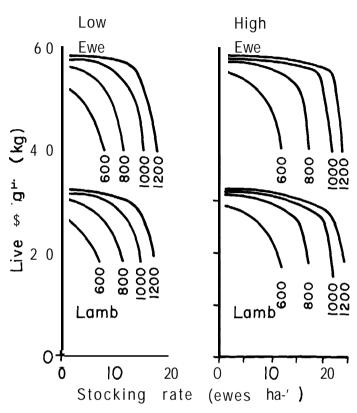


Figure 4: Production functions for individual ewe and lamb liveweight at weaning versus stocking rate for the LOW and HIGH patterns of herbage growth and four levels of herbage mass at lambing.

fig. 4 demonstrate how animal performance can be raised by ensuring that the level of herbage mass present at the beginning of lambing is as high as possible, i.e. a change in winter management. At the same time these functions (fig. 3 and 4) also indicate scope for increasing over-all stocking rate without seriously impairing individual animal performance, thus enabling better control of the early-summer surplus, Alternatively, lambing and weaning later may ensure a more favourable pattern of growth during lactation. Provided that the ewes were restricted to maintenance levels of feeding pre-lambing, later lambing would also allow herbage mass levels to build up prior to lambing and later weaning would enable at least a part of the early-summer feed surplus to be utilised. Clearly there are other equally viable options, such as more prolific breeds, a buy and sell cattle policy etc., but irrespective of the policy adopted the need for winter management procedures to ensure adequate levels of herbage mass at lambing as a safeguard against the detrimental effects of low rates of herbage growth in early lactation, remains.

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