A MODEL OF PRIME LAMB PRODUCTION: AN ATTEMPTED LINK BETWEEN RESEARCH AND PRACTICE

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I.   INTRODUCTION

In animal and plant sciences, research papers generally include discussion of experimental results and assessment of their relevance to industry. The results must be based on scrupulously objective appraisal, and before publication, pass the scrutiny of scientific referees. But assessments of their practical importance are commonly based on intuitive judgments and not subjected to the same rigours of mental discipline that are often reserved for statistical differences between experimental treatments. As such they are not easily judged by research workers, extension officers or producers.

This paper attempts to examine the importance of the main findings of a research project to a farm situation. The study was our own, of the effects of ewe liveweight on lamb production (Curll et al. 1975): it was undertaken because of apparent relevance to farm production, and to establish empirical relationships that would allow theoretical comparisons of alternative management systems.

II.   THE EXPERIMENT

The field experiment investigated the influence of different liveweight patterns from pre-mating to late pregnancy on lamb production. . Weight during the last.6 weeks of pregnancy was controlled to give a constant increase of 7 kg, in line with the well-established recommendation (e.g. Reid and Hinks (1962)).

The main findings were that, given recommended practice in late pregnancy, 94 per cent of the variation in 'mean birth weight and 79 per cent of the variation in growth rate of lambs can be attributed to differences in liveweight gain of ewes over the first 15 weeks of pregnancy. In determining lamb production, an increasing liveweight throughout pregnancy was or far more value than high weights at mating. Faced with winter feed shortage, sound management would restrict weights at mating in order to ensure subsequent continued gains.

The experimental treatments were achieved by controlling food intake without regard to area of, pasture required or seasonal growth rates. But they yielded empirical relationships that were used to extrapolate to the farm situation where constraints or area, subdivision and weather influence animal production.

III.   THE MODEL

(a)   Structure

Until the start of the growing season, the utilization of dry feed was assessed by the earlier model of Freer et al. (1970). From then on,

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pasture growth was determined largely by radiation. The relationships used included stocking rate effects, which were established empirically from results of an experiment in 1969. The function that related intake to availability and digestibility of **herbage** was also derived by statistical fitting of the.1969 data.

The model incorporated equations which predict the number of single and twin foetuses produced (Morley, unpublished). All other relationships were derived from the animal production study mentioned earlier. Briefly, intake was predicted from availability and determined the subsequent weight changes of ewes. Deaths due to pregnancy toxaemia were restricted to twin bearing ewes and varied with liveweight at mating and liveweight change during pregnancy. The birth weights of single and twin lambs depended on the liveweight changes of pregnant ewes. Lamb deaths caused by weather depended on birth weights as well as on rain and wind speeds on the day of birth. Deaths attributed to dystocia were related to **live**weight changes of the pregnant ewes. Single and twin lambs grew at different rates which varied with birth weight, and with weight changes of the ewes.

Liveweights were calculated f'or each day. If weight **gain** during the last 6 weeks of pregnancy did not reach 7 kg, or intake during l**actation** fell below the a**d** li**b**. level of th**e** field expe**riment,** supplement ary **feed**ing corrected the deficit. Lambs reaching 32 kg were sold as pr**ime** lambs: those remaining after the end of the growing s**e**ason were either fed supplements to reach market weight (late lambs**)** or sold underwei**ght,** whichever was more profitable. If the pasturethen remaining was **suffic**ient for unrestricted intake, 20% of it was conserved as hay. I**f** the amount of feed remaining at the en**d** of the yea**r** was less than at the start, a feed penalty equivalent t**o** hay costs, was attributed to the decrement.

A comprehensive objective function was used to convert production from simulated systems to \$/ha. It combined the values of prime, late and underweight lambs, sound and tender fleeces, conserved hay, and the costs of sheep maintenance, supplementary feed for ewes and lambs, and any penalties for low final levels of feed.

(b) Treatments

The model was designed to examine the influence that simple management controls would have had on lamb production from phalaris/subterranean clover pastures at the Ginninderra Experiment Station in 1969. Gross margins were compared for variations in stocking rate from 7.3 to 18.3 ewes/ha and for variations in the use of subdivision to confine the ewes until the end of mating on a portion (25, 50, 75 or 100%) of the pasture,. with the aim of affecting weight change during mid-pregnancy.

Uncontrollable variables that were also examined were lamb prices (33, 30 and 27 c/kg to 96, 87 and 77 c/kg for prime, late and underweight lambs **respectively)** .**and** the end of the pasture growing season (322, 350 or 378 days after 1st January).

(c) Results

Stocking rate and prices were the main determinants of gross **margins.** At 7.3, 11.0, 14.6 and 18.3 ewes/ha, mean respective gross margins were 40, 54, 72 and 55 \$/ha at prime lamb prices of 33 c/kg and **110,** 159, 208

and 221 $/ha at 96 c/kg. Only at stocking rates above the optimum was there any apparent effect of feeding controls on income, despite some effects on liveweights at mating and large effects on the turnoff of prime lambs (Table 1). The benefit of deferment occurred only when prices were low and resulted from increasing the ratio of late to under-weight lambs sold. This was not reproduced at high prices because it was then profitable to feed all underweight lambs so that they were marketed as late lambs:

TABLE 1
Influence of management on aspects of lamb production

Stocking rate (ewes/ha)	Area restriction until after mating (%)	Mating liveweights (kg)	Total lamb production (kg/ha)	Gross margins ($/ha)	
				96¢*	33¢*
7.3	0	52.3	228	111	39
	25	52.1	229	111	40
	50	51.7	229	111	40
	75	50.1	223	108	39
18.3	0	51.0	536	221	50
	25	50.2	541	221	51
	50	48.9	539	222	56
	75	46.8	512	221	63

* Prices of prime lambs per kg dressed weight

IV. DISCUSSION

The value to the research worker of attempting to model animal pro-duction has been stressed at a previous conference of this Society. Apart from any merits of specific predictions, benefits claimed include the assembly of relevant relationships in logical fashion; reappraisal of component relationships; and the rational formulation of research priorities (e.g. Greig 1972).

This exercise has suggested another important use for the simulation model — the objective evaluation of the relevance of research to producers. If the aims of agricultural research extend beyond the publishing of papers claiming relevance to farm production, there remains a respons-ibility to demonstrate how experimental results should influence producers. A modelling approach allows this to be done as critically as the appraisal of experimental data. Claims of relevance can be replaced by numerical demonstrations of how the results relate to practice. It seems fair to suggest that producers, who support research intended to aid them, should ask that the relevance of research findings to farm practice be demonstrated.

In the study outlined above, we have considered experimental findings of importance in lamb production, yet in the season examined, awareness of these would have had no bearing on a producer's income. In that year, with standard recommendations followed, our research results were appar-ently not relevant to production limits nor thus to experienced producers.

The lack of production response to the simulated management treat-ments can be attributed to unusual seasonal conditions in the year

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examined. Much higher than average autumn rainfall and winter radiation combined to increase considerably the availability of feed above that normally expected in Canberra's winter. In such a year, restriction of ewe liveweight at mating was rarely needed to ensure liveweight gains during pregnancy.

The aim of this paper is not to consider the results in detail, but simply to consider their consequences. The immediate problem is to identify the circumstances in which the experimental findings would concern producers. Extension of the present model to other regions would involve extrapolation beyond the environmental conditions in which the component relationships were established. However, in judging the degree of uncertainty that this would introduce we should make a distinction between those parts of the model concerned with the production of **herbage** and those concerned with its conversion to animal product. The former part of our model would be clearly inadequate in other environments, but the relationships used in the latter part of the model should apply to other sites within prime lamb producing districts of temperate Australia.

In any general model designed to study the interaction between environmental conditions and grazing management, an important consideration is the level of complexity to which the pasture generating component of the model can be justifiably taken. One approach is to include functions that are meant to predict pasture growth from stochastic or historical patterns of rainfall, temperatures, evaporation and radiation. However, given the present level of understanding of these relationships it is unlikely that such models will be applicable to pastures differing, for example, in aspect, fertilizer history, or soil properties, or that they will adequately predict the changing seasonal interaction between growth and botanical composition.

In this part of the model, a lower level of complexity based on empirical pasture generating functions that are sensitive to **known inter-**actions of grazing management on pasture growth and quality is. sufficient to simulate different patterns of pasture availability. The model outlined earlier will now be used in this way to test our conclusion that the value of different management strategies aimed at controlling the liveweight of the ewe is probably determined by the relative size of the winter trough in feed supply. The expected effects of alternative management practices in relation to the pattern of paddock feed supplies could be examined and promising systems tested by further experiments. If confirmed, the results could be interpreted by producers in terms of their own assessment of likely feed supplies during winter.

Provided that they distinguish between functions that can and cannot be extrapolated justifiably beyond conditions of their experiments, research workers can often use relatively simple models to make reasoned assessments of the likely relevance of research findings to farm practice.

V. REFERENCES

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