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The use of a pastoral computer model — a learning experience

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ABSTRACT

A linear programming model has been developed which allows investigation of alternative dairy production systems. Simulation models used in conjunction with the linear programming model were then used to help set performance standards for on farm animal productivity. Information from these model sources is seen as an aid to decision making on farms and as an opportunity for managers to better understand the basic relationships that apply within their farming system.

Keywords Linear program; simulation model; animal performance; decision making; feed budget.

INTRODUCTION

A simple feed budget, calculated and monitored during the winter of 1974, led to the development of an information gathering system at No. 4 Dairy Farm, Massey University (Ridler, 1982). Several simple computer programs were then developed in order to quickly process and analyse the data collected. Herbage masses were estimated using a rising plate (Earle and McGowan, 1979) and from these data, the computer programs calculated pasture cover and net pasture growth, which were used for feed planning on a monthly or yearly basis. Many short term problems, however, have longer term implications and a method of long term planning was required. A linear programming model (Miller, 1982) was therefore adapted for use as a management aid at No.4 Dairy (Ridler, 1981). This model provided an overview of the production system on an annual basis and allowed the effects of alternative strategies to be quickly evaluated, using the information collected from the farm. The original model has been further developed and extended so that it may now be used to investigate a wide range of options within various pastoral production systems.

BASIS OF MODEL

The model is based on a single year production cycle consisting of 26 fortnightly periods thus allowing management decisions to be made every 2 weeks.

Animal requirements in the model are based on published relationships (Agricultural Research Council, 1980). The model allows choices amongst a

variety of lactation curves, levels of feeding, and rates of liveweight gain. The mean daily metabolisable energy requirements in each period are calculated as the sum of the requirements for maintenance, pregnancy, lactation, and liveweight change. The metabolisable energy available to meet these requirements is calculated from the supply of dry matter, its metabolisable energy concentration, and the limits imposed by voluntary feed intake. Feed dry matter may be transferred forward from one period to the next, with maximum pasture cover constraints limiting the process, before being made available to stock. Dry matter may also be harvested as silage or hay and fed out in subsequent periods.

USES OF MODEL

The linear programming model may be used to optimise the system with respect to one of a number of objectives, for example, milkfat production per annum or the net dollar difference between milkfat returns and the costs of supplementary feeding. The model then provides a framework which allows either the effects of alternative management strategies within a particular system to be investigated, or comparative analyses between alternative systems to be performed.

The model has been used to investigate:

1. The effect of changes in calving date and pattern.
2. The effects on production and pattern of feed availability resulting from increased replacement rates.
3. The effect on patterns of feed demand of

