Proceedings of the New Zealand Grassland Association 49: 21-24 (1988)

ON-FARM APPLICATIONS OF SOFTWARE IN PLANNING GRAZING MANAGEMENT

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Abstract

The microcomputer has significant potential for enhancing farm decision making in grazing management. The availability of pasture models in conjunction with feed planning software makes it possible to calculate pasture production characteristics of different areas on the farm. With this Information. and with performance monitoring. each unit can be put to best use as part of the total farm area. With a knowledge of limiting factors production can be increased, or the utilization of resources improved. Implementation of this innovation must occur within the framework of the Information system for each farm. An example is given from the Waikato where this information has been used successfully to improve stocking rates and grazing management on the farm. Advantages and limitations of microcomputer technology for implementing these systems are discussed.

Keywords: Microcomputers, models, decision making aids, pasture production

INTRODUCTION

Many farmers plan feed management. Some plan the use of pastures in their minds using a feed scale relevant to their situation based on years of experience. However, increased efficiency in the use of pasture will be necessary to maintain or increase profitability of farms in the future. As farming has moved to adopt a business approach, knowledge of pasture and animal performance is as essential as financial information.

By constantly monitoring pastures and animals and evaluating alternative management strategies, more objective decisions can be made to achieve production targets (Baars *et al.* 1994, Bircham 1984). The last decade has seen a dramatic decline in the cost and increased availability of computers in agriculture. With the aid of microcomputers, communications between farmers and advisers are speeded up, complicated calculations can be readily completed, and the user can gain rapid access to data.

The lower cost leading to increased use of microcomputers should result in greater ease of access to grazing management information for farmers. The farmer needs a system which makes it possible to establish initial data bases for land, stock and supplements. In addition the system must be tailored to the individual farm and the software must be able to be used for short-, medium- and long-term planning of pasture and animal management.

In this paper an overview is given of available software and an example is presented which shows that the microcomputer has potential for enhancing farm decision-making in grazing management.

AVAILABLE SOFTWARE

For any feed planning exercise pasture growth rate information is essential. Three pasture growth predictors (GRASS, GROPAS and GROW) which make it possible to estimate pasture growth rates from basic weather and paddock data are now available. The capabilities of GRASS have been described (Baars *et a/.* 1987, Baars and Rollo 1987). Decision Software sells GROPAS, written by John Bircham, a programme which predicts pasture production on individual farms under a number of managements and the local climate. GROW, developed by Barry Butler, is similar in capabilities and output to GROPAS.

Bircham has also written a feed budgeting program (FARM MANAGER) which takes account of the interplay between pastures and animals. This simulation programme makes it possible to calculate annual feed profiles for any livestock enterprise and also contains

facilities for handling paddock shifts. However, as with GROPAS and GROW it is not possible for farmers and advisers to assess the basic structure and assumptions within the model. This may make it difficult for correct interpretation of the output achieved. A number of simple feed budgeting programmes and templates based on commercial spreadsheets (Multiplan, Lotus 1,2,3) are available, but none of them offer a new approach in comparison to what was available in the past. While spreadsheets are very useful for planning grazing management, they are difficult to set up and use.

It is essential that users are aware of assumptions in models and simple feed budgets and of weaknesses in databases. Although less than 4% of farmers are now involved in feed planning we can anticipate a steady increase in the use of feed budgeting and the availability of software, which makes feed planning easier.

EXAMPLE: BULL BEEF

The bull beef unit of J. D. & R. D. Wallace Ltd is situated near Cambridge on peat soils. The unit is in its second year of operation and is based on both calf to 20 month bull beef systems and buying in from the storemarket when prices are favourable. It comprises 920 ha, four farms and 60 mobs of 60-70 animals. On large units, integration of feed planning procedures, monitoring of performance and of contract prices and price schedules is important in coping with changing financial and production circumstances. It was decided in January 1987 to start a programme of monitoring pasture and animal performance to support tactical management decisions. It was also decided to base part of feeding strategies and management decisions on computerised production models.

The main advantage of using microcomputers to date has been the ability to set initial guidelines for the winter stocking rate, the winter rotation length and to make an estimate of the profitability of nitrogen applications in mid-July.

Settlng stocking rates

The single most important factor in establishing stocking rates is the average winter pasture growth rate (McRae 1984). Figure 1 shows a comprison of pasture growth rates on peat soils at adjacent Moanatuatua research station and a mineral soil (Bruntwood complex) at No. 2 Dairy at Ruakura. Growth rates are much lower on peat soils over the winter — early spring period. With a target liveweight gain (LWG) of 0.5 kg/head/day over winter and 1 kg/head/day over spring pasture growth rates of 20 to 30 kg DM/ha/day have to be reached over the August-September period to support a stocking rate of four yearling equivalents per ha. Simulation of pasture production and feeding strategies for a number of years shows that liveweight gains would be limited by consistent feed shortages in August-September.

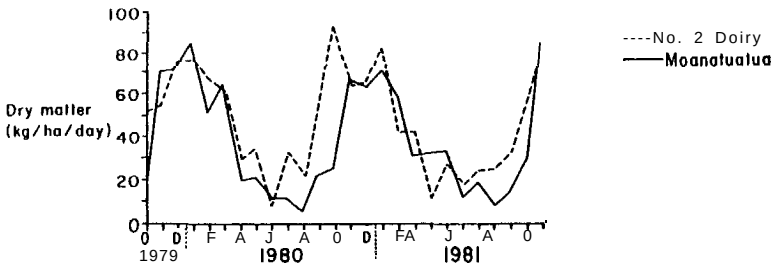

Figure 1: Pasture growth rates at the Ruakura No. 2 Dairy and Moanatuatua Research Station near Ohaupo with a four-weekly cutting interval during 1979 to 1981.

Rotation length in winter

Simulation runs with GRASS suggested that the minimum suitable rotation length was 60 days. This is also the maximum possible rotation length with 60 animals in a mob to avoid stress and behavioural problems. With a 60-day round and desired LWGs of 0.5 kg per day

and residual dry matter levels of 1100-1200 kg DM/h over late autumn-winter it can be deduced that with average pasture growth rates of 10 kg DM/ha/day pre-grazing levels of 1700 to 1800 will be reached. However for liveweight gains of more than 0.5 kg/day it is required to have pre-grazing levels of at least 2000 kg DM/ha in late August-early September (McCall 1987).

Nitrogen

The analyses of seasonal patterns of pasture production and rotation length show a clear case for tactical mid-winter nitrogen applications to ensure pre-grazing levels in excess of 2000 kg DM/ha in September at a stocking rate of four yearlings/ha. Profitability analysis should be based on the minimum responses which can be expected over this period. This is about 9 kg dry matter per kg of N (Feyter *et al.* 1985). Table 1 shows the likely profitability of a nitrogen application of 50 kg N/ha over 200 ha. With nitrogen applications on the peat, differences in pasture growth during the development phases have to be considered. The pasture growth patterns in Fig. 2 indicate that nitrogen should be applied to the younger ryegrass dominant areas rather than older pastures with a low ryegrass content.

Table 1: Likely extra carcass weight response to 50 kg nitrogen (N)/ha as applied on 200 ha of the Wallace bull beef farm near Cambridge.

Increased pasture production (9 kg DM per kg N)	90000 kg DM
Extra carcass weight (conversion ratio — 1 kg LW per 15 kg DM: During and Weeda 1975)	6000 kg
Costs of nitrogen	$9000.00
Break-even point $1.50/kg carcass weight (= $9000.006000) to cover the costs of the nitrogen.	

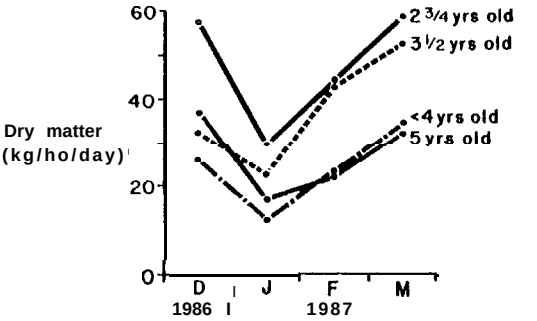

Figure 2: Rates of pasture growth after pasture renewal on four sites with pasture of different ages with a four-weekly cutting technique during December 1996 — March 1987 on the Wallace bull beef farm.

Objective measurements of pasture cover over this large farm with four to five managers is daunting. The new ALPHA LAVAL MK 111 pasture probe with its data storage and downloading facilities is used to summarize information immediately after a farm walk, and also to compare farms and to update microcomputer databases quickly. With regular monitoring of cover since autumn 1987 and the above computer analyses, this year's winter stocking rate was set at 4.5 yearlings per ha.

What has been achieved so far, as a direct result of the above programme? On July 1 1987 animals weighed on average 250 kg for the one-year-old mobs and 432 for the two-year-old mobs. Animal performance levels are comparable to other commercial farms and liveweights are similar to the weights recorded by Weeda and During (1974) on an adjacent mineral soil and at Tuapdka (Morris and McRae 1985).

DISCUSSION

Effective grazing management needs planning and decisions based on all options. The options must be considered for costs and returns, and further compared on time saved, and labour and effort involved. It is hard to see how this can be done without computer models and other software.

From the example presented, a number of factors emerge:

1. The importance of having accurate farm databases which have to be collected over time. The incorporation of more data will allow further progress in designing the most profitable and workable production system on the bull beef farm. However, the large amount of data manipulation required is only possible using a computer.

2. Individual farmers require quantitative information on which to base their decisions: this information needs to be site and situation specific. For example it is very difficult for the farmer to get up-to-date and relevant pasture growth rate information from research stations. However, farmers can now simulate pasture production in their own office. This is important as pasture growth rates are more variable than assessments of either standing dry matter or data on animal requirements, in developing a feed plan.

3. Whatever is monitored should be related to performance, and a mechanism should be available so that the farmer reacts to meaningful information.

Thus a computer should produce instantaneous summaries which give the quantitative information on which to base decisions. The aim in the bull beef operation is a touch button system which has simple graphic output, and which ensures maximum return per dollar, but not necessarily maximum production.

This paper shows that farmers can improve their managerial ability by objectively monitoring their systems so that strategies can be identified which increase stocking rate or improve animal performance. In establishing these systems, it is certain that accurate and rapid decision-making by the meat producer will increasingly become critical in a more business-like environment. Hence the need for on-farm computers and automated information systems. However, the software required for more complex strategic decisions which is at the same time flexible and user-friendly awaits more work by modellers, on-farm testing and innovative programming.

Acknowledgements

To David Wallace, for permission to report their farming operations.

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