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A rational approach to feed planning on farms

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ABSTRACT In spite of the general availability of technical information, computer packages and many years of use of feed budgeting, little evidence has been published on the economic benefits of the practice on farms. Survey data have shown that improved pasture utilisation may be a key factor in improving farm performance. However, this does not prove the necessity for quantitative feed planning on farms. A case is made for constructing data bases of individual farms from regular monitoring of pasture and animal performance, to improve the reliability of feed planning before any detailed feed planning or assessment of new management strategies is commenced.

Keywords Computers, feed planning, feed budgeting, simulation model

INTRODUCTION

The term feed budgeting is commonly used to describe the matching of feed supply and demand on farms, rather than feed budgeting, and usually to describe the detailed planning of grazing management in a specific season. However, in this paper the term feed planning rather than feed budgeting is used, and refers to the setting of overall stocking policies together with the seasonal and day-to-day planning of grazing management. This term better describes the planning aspect of the matching of feed supply and demand on farms.

The detailed feed planning on dairy farms has made inroads into the sheep and beef industry through MAFTech's controlled grazing systems (CGS) campaign in the early 1980s (Miller 1982). Regular monitoring of pasture and animals will result in a set of data which makes it possible to set directions to improve the efficiency of converting pasture into animal production. After a number of years the farmer has standards with which to compare his performance with other farms in his district and with NZ Meat and Wool Board Economic Service surveys, and data to test the acceptability of current or new management practices.

It is hard to see how farmers can improve without planning. The strongest argument for feed planning on the farm and modelling of farming systems is that the alternatives are too expensive in time and resources and limited in the range of options that can be considered. The techniques and theoretical basis of feed planning have been described in many publications (e.g. Milligan 1981; Nicol 1987, NZIAS 1984). More recently the availability of commercial predictive models of pasture production and feed planning programs on microcomputers has made these tools more accessible to farmers and consultants (Baars 1988). The adoption rate of manual or computer feed planning is low. The transfer of models from research and simple feed planning packages to the farm is not simple. There are many problems in the construction of the necessary computer packages and transfer of the technology to the end users. Problems vary from data collection and measurement to unwieldy, hard-to-learn computer programs.

This paper will deal mainly with problems in the general methodology, on-farm data collection and the use of mathematical models to account for the interaction between pasture and animals. It will suggest improvements which may increase the adoption rate of computerised feed planning packages or the practice of feed planning itself. The paper will draw on on-farm systems research (Baars 1987), experience in the use and development of a number of computer packages and feedback from farmers in the Waikato.

PROBLEMS

In spite of the availability of technical information and recent computer programs, little evidence has been published on the financial benefits of feed planning on commercial farms. Surveys are the only data which indicate the value of improved management on commercial farms. For example, surveys by the NZ Meat and Wool Board's Economic Service show that for New Zealand sheep farms with similar soil and climate, net income per ha for the top group is twice as high as the average, and one tenth of the average for the bottom group. Similarly, in Northland, dairy farms vary widely (Dairy Plan 1989) in production and financial performance. This vast variation in productive performance among farms in the same locality suggests that it is worthwhile to investigate to what extent inappropriate pastoral management may be limiting sheep and dairy cow performance.

Many farmers do not appreciate how management decisions influence animal performance over the year. One of the keys to improved productivity and profitability is better pasture utilisation, and feed planning is an important tool to improve animal performance and finally profits. Technical problems with feed planning have been discussed by many authors (Parker 1973; Piggott 1986). However, I will deal with the possible reasons for the lack of evidence of the value of feed planning, mainly from the user's perspective, which may have prevented more general adoption of the technique.

Feed planning has often failed or has not been widely adopted for a number of reasons:

(a) It has not been part of a total farming systems approach.

The major problems on the farm are not always linked to accurate quantitative feed planning. Feed planning may become an end in itself while an overall assessment of the total farming system could reveal that overriding limiting factors like pasture species and insect pests are more important. Thus it is important to consider the behaviour, needs and economic decision making environment of the farmers and the total farming system before embarking on regular monitoring and feed planning. Feed plating should be fully integrated within the overall farm decision support system; otherwise acceptance by farmers will remain limited.

(b) It still does not have the farm decision maker/problem solver as its focus.

Microcomputers promise access to a range of software tools and application models for farmers. Most of these models have arisen from research and extension efforts over a long period. It is now becoming clear that far more work is necessary to make these models accessible to end users and to make a re-assessment of the data inputs required. Clearly some work still needs to be done to incorporate the needs, experiences and contributions of users. Technology transfer has failed because of lack of consideration of the end user requirements. Adoption of feed planning or models depends on how feed planning is conveyed to users and how such users perceive its benefits. Ultimately management needs must drive research and development. These systems-driven efforts are now underway in Australia and similar developments are occurring within MAFTech.

(c) There are few data and considerable difficulties in assessing how feed planning has improved profitability.

Its effect might be estimated before and after. However, in most instances in the past the effect on profitability was not assessed.

(d) The failure of many feed planning exercises is also indicated by the lack of information on how well the model or feed planning package mimicked trends in parameters on individual farms.

Any problems noticed by farmers in this area, like discrepancies in simulated growth rates and expected residual dry matters and intakes, or the necessity for on-farm growth rate data, show the need for detailed consideration of the individual farm's characteristics. This problem is discussed below under the necessity for individual farm databases. Faith is not enough, and evaluation standards and case studies of the use of packages are needed on a farm basis. Assessment and monitoring of farm parameters under commercial application of private software vendors' and government packages is required. Program developers, vendors and service providers must finally work together better to tackle this problem. Maybe the technique failed because the user did not collect the right data.

(f) Failure to explain the assumptions, logic and output of the analyses.

The arithmetic and more importantly the specific or implied relationships used by each package should be built into the system. Relationships in models are often inadvertently incorrect or are not made clear for checking purposes. Quite often packages do not produce output in a form which the user sees as significant and useful results do not govern his decision making. On the other hand, unexpected or strange results may indicate deficiencies in the package or indicate limiting factors on the property of which the manager is not aware.

WHAT IS REQUIRED?

Computer-based systems analysis is the best way to make sense of the complexity and interactions of a farming system. With the availablity of high-quality financial packages, farmers will be looking for other uses of computers. Decision-support software for feed planning is another way to increase the efficiency of farming operations. To overcome some of the problems a four-stage process will be necessary to make the use of feed planning more realistic and more widely accepted:

1. Because each and every property is complex and unique, planning data must be gathered for each and every one.

Consideration of the characteristics of individual paddocks (slope, aspect, composition, soil tests, growth and cover) will result in more objective feed planning. The dependence of feed planning on pasture growth records from far-away research stations and subjective estimates should be reduced by building up a database of paddock information. This database has to be part of the input to a feed planning package. Weather information measured on the property should become part of the database. This information will become more useful over time to compare one year's production with another. A 15- to l&month monitoring exercise of pasture cover and stock performance to get quantitative information on the productive potential of each paddock on a property will be necessary.

The importance of this database may be illustrated by the fact that I have not been able to locate any actual case studies which show clearly how well feed planning packages or models mimic trends in parameters on the farm.

2. By using the database and monitoring data, a model or feed planning package can be refined and

calibrated to take account of individual farm characteristics.

If changes in pasture cover in a particular season do not agree with the field data and/or expectations of the farm manager, the pasture growth or species component data need adjustment until the farm is realistically simulated. This adjustment applies to the use of recently developed pasture prediction models (Baars and Rollo 1987). But intake allowance curves must also be tuned for pasture composition (Stockdale 1985) and sward characteristics like clover content, browntop content and the ratio of green to dead matter (Nicol 1987). For some pasture species the relationships between height, cover and intake are important. The database should incorporate information on the botanical composition of individual paddocks. In the commercial feed planning package 'Farm Manager' (Dr J. Bircham) the parameters setting the shape of intake/allowance curves can be tuned so that intakes are in agreement with the observed residual post-grazing levels on the property.

3. With the site-specific inputs in the database and monitoring records for 15 to 18 months the reliability of feed planning exercises or models use over the first two years can be analysed.

If the reliability is sufficient the package can be used for the next phase. The database should be constructed so that historical pasture records, weather records and parameters relating to the use of models for individual paddocks and blocks on the property can all be accessed.

4. Farming system and management strategies cannot be modified with confidence until performance of the package has been assessed by comparing past and future management strategies.

If the suggested two previous stages are followed, management strategies can be studied reliably. Where reasonable farm simulations can be proven emphasis may shift to predicting the desirable patterns of pasture cover, liveweight and other parameters for the livestock policies of the property. This means that continuous pasture assessment is not necessary but assessments at critical times, e.g. early calving on the dairy farm, will be the basis of decision making.

This approach will require a determined effort to set up a database for the farm. Thus while construction of the database and initial data entry is labour intensive, regular monitoring can be considerably less where a database has been constructed, validation of outputs and subsequent tuning have taken place and decision rules for the unique farm situation have been established.

In addition packages can be improved in two other ways:

(i) Rather than giving a sometimes bewildering array of numerical output, a number of possible decisions on grazing or animal management, with a risk factor, should be given.

The ability to expand on the analysis and output, as in the use of expert sytems, seems likely to be a good example to follow. At the 4th Australian Computers in Agriculture Conference in Queensland in May 1989, the use of expert systems in computer-assisted management of agricultural systems was identified as a key method to improve management packages. Some expression to allow for uncertainty will be essential. Farmers' attitudes to risk are different. Thus there should be some type of sequential application to analyse the failures and successes of a management policy, especially where a completely different stocking policy is tried.

(ii) There is a strong requirement for a learning/understanding facility.

This facility, rather than just explaining procedures, should deal with the logic and assumptions and lead the producer or consultant to explore more advanced decision making. It is necessary to explain why it turned out this way. Such facilities will increase understanding of how management skills can be improved to overcome production constraints. Additional training and support on individual properties may be necessary and will cost money. However, the most important benefit will be that this facility will assist producers to identify and overcome production-limiting factors affecting their management.

AUSTRALIAN EXAMPLE

An Australian example of the value of farm data and model tuning is SHEEPO, a microcomputer-based sheep farm model to help extension specialists and farmers make decisions on flock, feed, and financial management (Whelan et *al.* *1985* a, b). The original model predicts the likely physical, biological and economic consequences of changing ewe stocking rates and date of lambing of a self-replacing flock of Merinos grazing annual pastures in Northern Victoria (White et *al.* 1983). Sheep industry specialists contributed much to its development. A liaison officer was appointed to help and educate extension officers in its use. Calibration and testing on farms is done before it is used and also in other agricultural zones rather than western Victoria where it was developed from data for perennial ryegrass and subterranean clover. Experiences with this model show the need for both technical manuals and reports with descriptions of farm calibrations, experimenting with management strategies and other uses.

CONCLUSIONS

Each farm needs a database of paddock and weather information and a model appropriately calibrated, tested and modified for the farm. Accordingly, the user must have the appropriate technical training and will need consultants who specialise in technology transfer. Actual use of these models may be the specialist job of extension educators and will have to be paid for.

More 'intelligent" decision support systems are needed which will increase the cost of this type of software.

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