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A model to aid decisions regarding feeding of  
concentrates to dairy cattle

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## **PREFACE**

The impetus for this work came from the dairy farming community of Tasmania. Constant questioning by individuals and argument at discussion groups as to the value of concentrates in a pasture based system, prompted the investigation. Factors affecting responses, especially in the long term are not well recorded. It was therefore considered useful to try and bring as much information together as possible and put it in a format to aid decisions regarding feeding concentrates. The process has been a most rewarding one and I trust readers will find what follows both interesting and valuable.

Peter Neaves

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## GLOSSARY OF TERMS

BI	breeding index, a measure of cow genetic merit used in New Zealand.
CS	Condition Score, a measure of cow fat cover where 2 is very thin and 7 is very fat.
Conc	Concentrate feed.
CP	Crude protein.
dig	Digestibility.
DM	Dry matter.
FCM	Fat corrected milk (4% milk fat).
kg/c/d	Kilograms per cow per day.
l	Litres.
LIC	Livestock Improvement Corporation.
LW	Liveweight.
ME	Metabolisable energy.
MF	Milkfat.
MJ ME	Megajoules.
MS	Milksolids.
NE	Net energy.
NDF	Neutral detergent fibre.
OM	Organic matter.
P	Protein.

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## ABSTRACT

A model to aid decisions regarding the feeding of concentrates to dairy cows was constructed. The literature regarding milk and liveweight responses to concentrates, pasture growth, nutrient effects on reproductive performance and modelling methods, was reviewed to establish important relationships and a process for model development. The milk response to concentrate supplementation is largely influenced by the substitution rate and marginal energy partitioning to milk and liveweight gain. Substitution rate increases with pasture intake, because as cows approach their intake limit there is reduced scope for further increases in intake. At lower pasture digestibilities substitution rate is also lower and when high fibre concentrates are fed there is less substitution because rumen fermentation is not affected to the same extent as when high carbohydrate concentrates are used. Concentrate feeding level *per se*, stage of lactation and season of the year do not appear to affect substitution rate in any consistent way.

Marginal nutrient partitioning describes what happens to the *extra* energy consumed. Total energy intake is negatively related to marginal partitioning to milk. Cows of low condition score partition more energy to liveweight gain than cows of similar genetic merit of higher condition score. High genetic merit cows tend to converge to a lower condition score than cows of low genetic merit, thus genetic merit has an indirect effect on marginal nutrient partitioning. Concentrate intake level was not important until intake levels reached approximately 50% of the diet and/or fibre intake decreased below a critical level. Stage of lactation does not affect marginal nutrient partitioning in any consistent way.

Pasture growth rate was estimated to increase by 2.6 kg DM/ha for each 100 kg DM extra remaining after grazing at least up to a residual pasture mass of 1800 kg DM/ha and possibly beyond this. Therefore, one outcome of substitution is likely to be increased pasture growth. The utilisation of the extra pasture growth and hence its financial value, can be estimated from the feed supply and demand on the farm.

Nutrition in early lactation and specifically energy balance, affects reproductive performance. A complex relationship between cow condition, milk production and intake exists. Cows in low condition score (< 4.3) and losing weight are most likely to benefit from extra feed in the period prior to mating. The benefit may be as high as 12 kg MS/cow through earlier calving in the following lactation if all cows in the herd improve reproductive performance.

A stepwise decision framework was chosen to model the decision problem. A paper model using a set of graphs, tables and calculations to represent the information described above was developed to predict both short- and long-term financial benefit of feeding concentrates to pasture fed dairy cows. Preliminary field testing revealed the model was time consuming and difficult to use for scenario analysis. A spreadsheet version of the model was therefore developed, however it has less value as an educational tool for farmers. It was concluded that it provides a useful framework for analysing decisions regarding concentrate feeding in the field.