

The validation of a computer simulation model for use in organic dairy farm systems in the United Kingdom

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ABSTRACT

On organic dairy farms, computer simulation models can be used to predict more rapidly and at less cost than field trials the outcome of changes to management strategies or physical resource inputs. Such models need to be validated with data from existing organic dairy farms to ensure that the predictions made are realistic. As part of a larger organic dairy farm modelling project, this study will use data from 2 contrasting organic dairy systems at Ty Gwyn research farm, to validate a whole farm dairy system model developed by the Scottish Agricultural College. The model will be used in future work to identify the most productive and resource use efficient organic dairy systems across a range of farm locations and resource availabilities.

Keywords: modelling; organic dairy systems; resource use efficiency, productivity

INTRODUCTION

Selecting an appropriate management strategy for a dairy production system requires an understanding of the system as a whole in its agro-ecoregional context, understanding of the inter-relationships between systems components and knowledge of the objectives of the farm manager (Herrero *et al.* 1999). The inter-relationship between improving production efficiency and minimising environmental damage is particularly important in organic systems where environmental protection is a key element of the production system.

A dairy systems model has been developed by SAC (Topp & Hameleers, 1998) which integrates nitrogen inputs and associated environmental impacts, grassland production and utilisation, milk production and economic factors to determine the viability of the system. Data from two contrasting systems at Ty Gwyn will be used to validate the model for organic dairy farming. The two contrasting organic dairy systems established at Ty Gwyn are the self-sufficient system, where the aim is to maximise resource use efficiency with respect to sustainability objectives, and the high productivity system where the aim is to maximise financial profitability of the unit within the constraints of organic protocols (Weller and Cuttle, 1999). The value of using both data sets to validate the dairy systems model is they have different

resource use patterns and levels of production, which will test the models ability to predict impacts of management under contrasting scenarios.

RESULTS

Two patterns of calving were tested to simulate non-seasonal calving, using repeat runs of the model. "Split" indicates calving in March and September and "Monthly" indicates calving in each month throughout the year. The average value for both is weighted by the proportion of cows calving in the given period. The validation, using Theil's inequality coefficient (Theil, 1961) was performed on milk production, intake, silage production and total dry matter production (silage and intake) during the grazing season (Table 1).

Table 1. Theil's inequality coefficient^a for Ty Gwyn A and B in 99/00 season.

Calving	Milk ^b	Intake ^b	Silage	Total forage
Split	0.01	0.14	0.12	0.21
Monthly	0.01	0.14	0.12	0.21

^a Scale = 0 to 1, with 0 being perfect fit and 1 showing no pattern

^b during the grazing season

The model predicts actual observations to an acceptable level of accuracy, with milk production in the grazing systems being the best fit. It was impossible to split the Theil's inequality coefficient into the bias and variance proportions, as there were only two observations (Ty Gwyn A and B).

ACKNOWLEDGEMENTS

Thanks to Peter Bowling and Steve Cuttle from IGER for the data collection at Ty Gwyn. We are grateful to the Department of the Environment, Food and Rural Affairs for funding this research programme.

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