Evaluating the Performance of the GrazFeed Model for Predicting Sheep Productivity on a Range of Pasture Types

By

Zhong Jun Yao

(B. Sc. Ag., Beijing Agricultural University)

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University of New England, Armidale NSW, Australia

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Declaration

I certify that the substance of this thesis has not already been submitted for any degree and it is not currently being submitted for any other degree.

I certify that to be the best of my knowledge any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

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Zhong Jun Yao

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Abstract

There are increasing pressures on graziers to improve management to achieve sustainable and profitable developmen and utilisation of their grazing lands. Computerised decision support systems (DSSs) which assist graziers in dealing with complex planning problems, by allowing exploration of alternative strategies and selection of appropriate technology, are becoming increasingly important tools in supporting farm management. Before a DSS can be useful as an aid in making management decisions, it must be evaluated for the ecosystem in which it is being used. Comparing a model's prediction with experimental observation is one method of evaluating a model's performance.

GrazFeed is a decision support system for the nutritional management system of grazing animals, aimed primarily at enterprises in temperate southern Australia. The aim of the studies in this thesis was to evaluate the model s performance in predicting sheep production in an environment similar to those for which he mocel was developed. Also it was evaluated as a potential model for nutritional managemen t of sheep in north-west China by comparing the model predictions with field data obtained from a typical grazing production system of this region.

The field data used in the studies were taken from three different regions, two in the high rainfall zone (Armidale and Winton, NSW), Australia and one in Xinjiang province (Nanshan Stud Farm), China. A variety of pasture types and sheep breeds were involved in these experiments. The pasture and sheep parameters measured included green herbage biomass and *in vitro* digestibility, dead herbage biomass and *in vitro* digestibility, legume content of the pasture, sheep liveweight and greasy fleece growth.

The results of the comparisons conducted on the improved pastures at Armidale demonstrated the ability of the model to predict the seasonal pattern of events and the trends in sheep bodyweight changes (BWC) generated by the different pasture types and stocking rates. Whilst, the model agreed well with observed data on a degraded pasture, the model provided a biased prediction of sheep greasy fleece weight change (FWC) with the phalaris and phalaris/white clover pastures. Despite this bias, it was found that the model had the capacity to account for most of the observed variation.

In contrast to the performance of the model on the improved pastures at Armidale, the model performance on the native pastures at Winton was poorer. In general, the model under-predicted the sheep BWCs and greasy FWCs. The ability of the model to predict BWC was considerable less, with coefficients of determination of less than 0.53.

Since no distinction was made between green and dead in available herbage, assumptions of green and dead biomass were made to evaluate the GrazFeed performance at Xinjiang's

pastures, north-west China. Under these assumptions, the model was found able to account for the major sources of variation in sheep BWC and greasy FWC on three seasonal pastures at Nanshan Stud Farm. Although the model was unable to predict sheep BWC under grazing conditions, the problem may be due to the assumptions being inadequate. A review of the literature suggested that at least some of the discrepancies in sheep BWC may have been due to genetic difference between Australian Merino and Chinese Merinos in bodyweight gain. For most of the fleece data, the model predictions were well within one standard deviation of the field observations. Given the importance of supplementation of sheep in winter in grazing systems of north-west China, it was encouraging to see that the model demonstrated its potential as a nutritional management tool for supplement feeding, with the model successfully predicting all BWCs of sheep which were fully housed and fed supplement.

A variety of possible causes of the discrepancies between the model predictions and the observations are discussed in detail in each experiment. To some extent, errors in the estimation of pasture quantity and quality may have resulted in some of the discrepancies. It also appears that some of the discrepancies might be associated with deficiencies in the intake module of the model. However, there were insufficient data to allow the cause to be clearly identified. Further studies, especially the evaluation of intake module in GrazFeed, may lead to further improvements in model predictions.

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