Modelling complex sheep systems using AusFarm

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Introduction

Simulation modelling can be a valuable method for extrapolating experimental findings to different weather or management conditions. However, most of the decision support tools which are available for sheep grazing systems, for example GrassGro® (Donnelly *et al.* 1997), are limited to modelling of relatively simple sheep management. This makes validation of simulations against experimental results difficult where management changes from year to year, and where more complex sheep management is used. This study evaluated the use of the AusFarm® decision support tool (Moore *et al.* 2007) to model a split-joined sheep system, using different ram breeds against experimental results.

Methods

Data was used from a replicated grazing experiment conducted near Tarcutta (147°31'E 35°12'S) in southern New South Wales between 2006 and 2010 (Robertson and Friend, unpublished data). Merino ewes grazed a farmlet with one paddock each of lucerne (*Medicago sativa cv.* Aurora), phalaris (*Phalaris aquatica cv.* Australian) and tall fescue (*Festuca arundinacea cv.* Resolute and Quantum) pastures. 60% of ewes were joined in February to terminal rams, with the remainder, and any not pregnant, joined to Merino rams in April. Poor pregnancy rates (5% and 28%) in February joined ewes in 2009 and 2010 meant both terminal and merino rams were used in the April joining. Lambs were sold on varying dates each year Supplementary feeding was used as required, with feeding in a containment area when pasture availability reached target levels (500kg DM/ha for lucerne, 1000 kg DM/ha for phalaris and fescue).

AusFarm® version 4.4.2 was used using historical weather data for Tarcutta, NSW. Management in simulations was written as closely as possible to experimental management. The phalaris parameter set was used to simulate the fescue pasture as a fescue set was not available. Length of joining was adjusted to one month and conception rates adjusted to better match observed conception rates.

Results

Simulated available herbage in general followed the observed pattern (Fig. 1), with root mean square errors (RMSE) between 1087 and 1233 kg DM/ha for green in all pasture types, with the exception of 1479 for total phalaris. The main differences occurred April to September in 2008 when simulated growth was higher than observed due to more rainfall at Tarcutta than at the experimental site, in 2007 when simulated growth was much lower than observed, and in 2010 when simulated did not always match observed data.

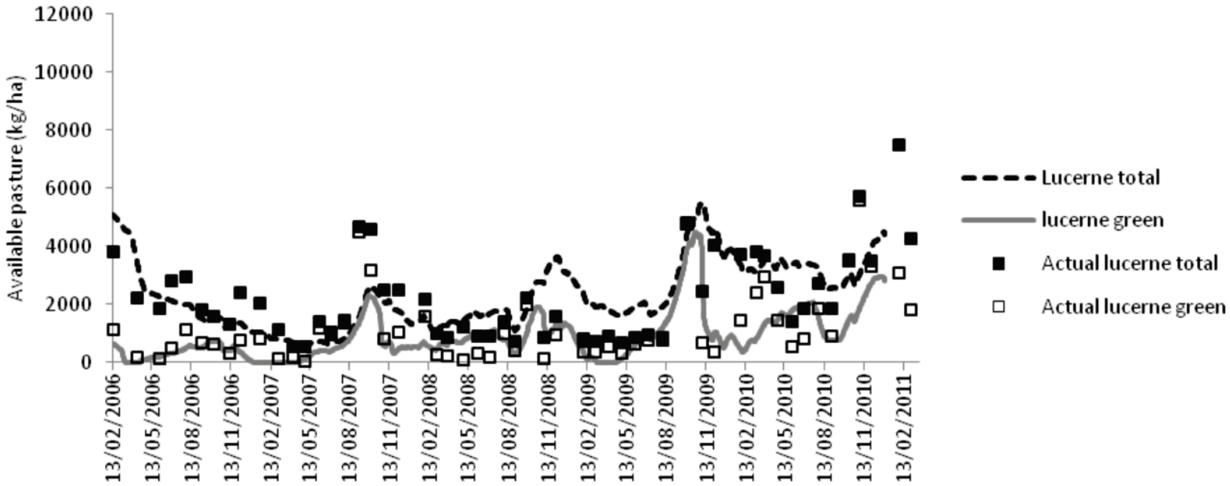

Figure 1. Total and green lucerne herbage available (kg DM/ha) simulated using AusFarm (lines) and actual (markers) at Tarcutta, NSW, 2006-2010.

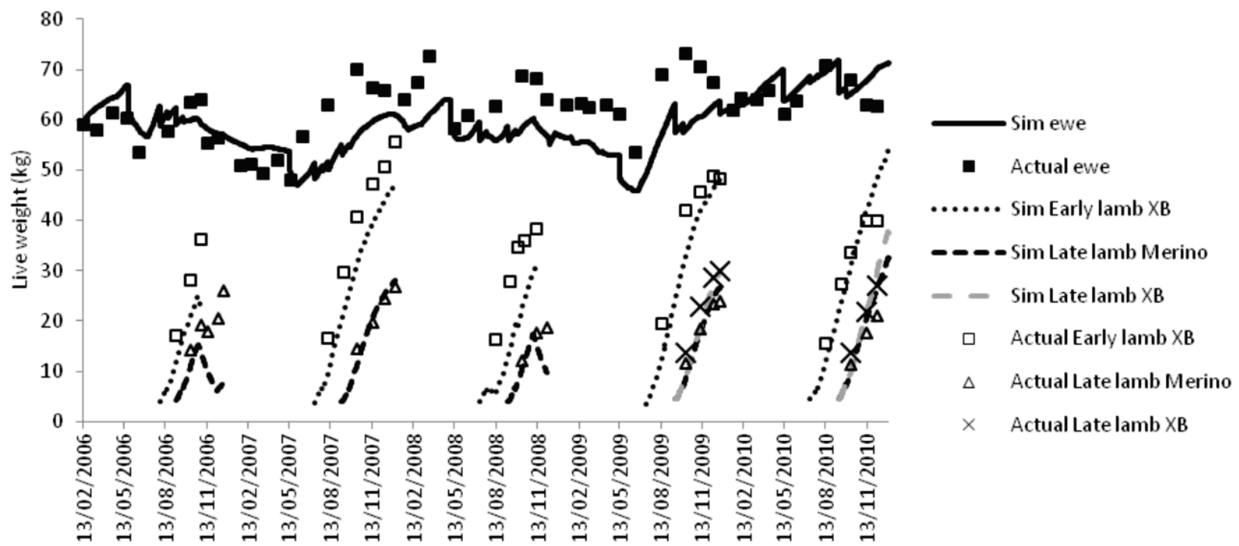

Figure 2. Ewe and lamb live weight (kg) simulated using AusFarm and actual at Tarcutta, NSW, 2006 to 2010.

Simulated ewe live weights followed the pattern observed (RMSE 13 kg) but with differences occurring during 2007 and 2008. Simulated lamb weights usually matched those observed, but differences occurred in 2006 and 2008 due to unweaned lambs not receiving adequate feeding when entirely grain-fed in the simulation (Fig. 2). Higher than observed weights in late 2010 were due to worm burdens in actual sheep.

Discussion

This study demonstrates that is possible to simulate a split-joining , with varying proportions of ewes joined to different breeds of rams, with adaptation for fertility problems and varying sheep management between years. We consider the simulation of pasture and sheep production sufficiently precise for use of the model at this location. Deviance in pasture production in 2008 was attributed to differences in rainfall. In 2010, it is probable that the simulation of one lucerne paddock, compared with temporary fencing and rotational grazing of the actual paddock, was the cause of deviance. The limited range of species and cultivars in AusFarm, differing from those in the grazing experiment, probably also contributed to differences. The differences in lamb weights indicate an error in either script or software, but highlights the need for rigorous checking of outputs in the validation phase. The differences in ewe weight largely resulted from inadequate simulation of pasture growth in 2007 reducing weight gain, with this impacting on 2008 weights.

Conclusion

The flexibility of AusFarm to simulate complicated sheep management makes it a useful tool for extrapolating experimental data. It creates the opportunity to evaluate sheep production systems which, although widely used in practice, could not previously be simulated. The use of such models allows investigation of management decisions where the time and cost of field trials would be prohibitive.

Acknowledgements

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