Challenges in modelling live-weight change in grazed pastures in the Australian sub-tropics

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Introduction In sub-tropical regions there is enormous seasonal, annual and spatial variation in pasture quality and considerable variation in quality between pasture species. The heterogeneous structure of sub-tropical pasture swards means that process based modelling of liveweight change (LWC) is particularly difficult. In response to this complexity LWC has been expressed as a function of the length of the growing season and/or pasture utilization (McKeon *et al*. 2000), green leaf availability, or pasture availability and climate (Hirata *et al*. 1993). However, these relationships vary from year to year, often fail when species composition changes, and generally explain <70% of the variation in LWC. This study used a large set of pasture and animal production data from a native pasture in south-east Queensland to investigate these relationships.

Materials and methods The data consisted of daily temperature, evaporation and rainfall, 6-weekly pasture yield, composition and proportion of green leaf, and monthly animal LWC at 3 stocking rates over 5 years. The LWC was related to a range of pasture and climate variables by means of linear and curvilinear relationships, multiple regression and optimisation routines. Finally, LWC and pasture variables were analysed using cluster analysis and ordination.

Results No pasture or climatic variables could be found that related well to LWC and discriminated between stocking rates and years. Pasture quality, as measured by green leaf percentage or the amount of green leaf, explained up to 70% of the variation in LWC in any one year, but <30% over all years. This suggests that climate-soil-pasture interactions are affecting the quality of green leaf from year to year, or the contribution of forbs to the animal's diet may be confounding these relationships. The progressive number of days from the start of the growing season explained 70-90% of the variation in LWC in the designated period, and was robust across years. However, this relationship was independent of stocking rate, despite the fact that there were observed LWC differences between stocking rates. Cluster analysis of LWC data gave 4 reasonably distinct groups consisting of high and low live weight (LW) gain and loss. Ordination of these groups against pasture vectors (Fig. 1) shows high LW gain (>0.5 kg/hd per day) and loss (>0.25 kg/hd per day) is associated with moderate to large quantities of green and dead material, respectively. Low LW gain (0-0.5 kg/hd per day) is intermediate between these. However, low LW loss (0-0.25 kg/hd per day) can be associated with the whole range of pasture conditions. Hence, given any particular pasture status, it is almost impossible to reliably and accurately predict LWC.

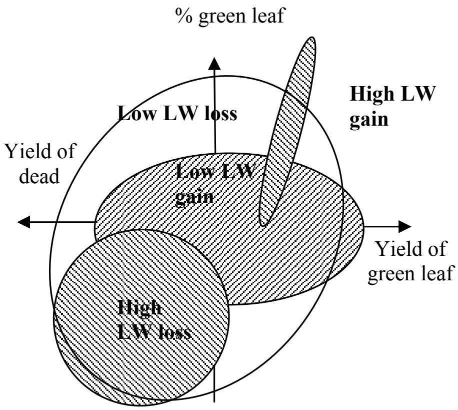

Figure 1 Schematic representation of relationship between LWC and pasture attributes

Conclusion The study has demonstrated the difficulties in using simple pasture or climate-based empirical relationships to predict LWC in the sub-tropics. Future efforts at improving our predictive capability of LWC in tropical and sub-tropical pasture systems should be based on more mechanistic approaches that take better account of year-to-year variation in pasture quality and seasonal animal diet selection. This will require measurement of field attributes more appropriate to modelling animal production.

References

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