Tropentag, September 18-20, 2019, Kassel

"Filling gaps and removing traps
for sustainable resource management"

Evaluation of a Modified Livestock Simulator (LIVSIM) Model

Christian Adjogo Bateki, Uta Dickhoefer

University of Hohenheim, Animal Nutrition and Rangeland Management in the Tropics and Subtropics, Germany

Abstract

Models can play an important role in identifying and removing traps for sustainable resources-use in tropical livestock production systems (TLPS). However, simply adopting procedures for estimating nutrients and energy requirements or the dry matter intake (DMI) developed for cattle in temperate regions may limit models' capacity to accurately quantify resources-use in TLPS. Therefore, we modified a selected model developed for TLPS to account for differences between cattle in (sub-)tropical and temperate regions and evaluated its accuracy to predict dairy cattle performance using data from a published study.

The LIVestock SIMulator (LIVSIM) model was selected upon review of different livestock models suitable for TLPS. It is dynamic and simulates animal performance based on availability and nutritional quality of feedstuffs. We modified the LIVSIM by simplifying and modifying the British metabolisable energy (ME) and protein requirement system for dairy cattle. Using literature values, maintenance ME requirements were increased from 0.488 to 0.631 MJ ME kg^{-1} metabolic live-weight (LW) and age-sex specific ME and protein requirements for gain (MJ ME kg^{-1} LW) were defined for dairy cattle in TLPS. Next, DMI was estimated as the lower of either the physically regulated (using the animal's capacity of neutral detergent fibre (NDF) intake (g kg^{-1} LW)) or physiologically regulated (using the animal's total ME requirements (MJ d^{-1})) estimated DMI. Then, ME intake was partitioned to favour milk production rather than LW gain during early lactation. The original and modified LIVSIM versions were evaluated using data from a published study with tropical stall-fed dairy cattle, and the mean bias (MB), root mean squared error-of-prediction (RMSEP), and relative prediction error (RPE) used to assess their accuracy.

Both models under-estimated (i.e. positive MB) DMI and over-estimated (i.e. negative MB) animals' LW changes. Yet, the modified LIVSIM was more accurate (i.e. low RMSEP and RPE) than the original LIVSIM in predicting DMI, final LW, and average daily milk yield over a 140-d-period.

Adapting underlying procedures adopted from temperate regions when simulating DMI, nutrient partitioning, and performance improves accuracy of livestock models and their ability to predict resources-use of cattle in TLPS.

Keywords: Dairy cattle, LIVestock SIMulator, models, resources-use

Contact Address: Uta Dickhoefer, University of Hohenheim, Animal Nutrition and Rangeland Management in the Tropics and Subtropics, Fruwirthstr. 31, 70599 Stuttgart, Germany, e-mail: aninutrop@uni-hohenheim.de