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Agricultural Systems 90 (2006) 99–111
AGRICULTURAL SYSTEMS
www.elsevier.com/locate/agsy

A simulation model to predict body weight gain in growing steers grazing tropical pastures

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Received 19 July 2004; received in revised form 23 September 2005; accepted 28 November 2005

Abstract

A simulation model was developed to predict performance of growing steers grazing tropical pastures. The model is deterministic and integrates the effects of protein and energy intake from forages and supplements. Protein deposition was predicted by the PDI system. Energy balance was based on the California Net Energy System with modifications for animal activity and heat stress. Three output results of average daily gain (ADG) were obtained with the model: from energy (ADGe), from PDIN (ADGpdin) and from PDIE (ADGpdie). The model was validated using data from five experiments (29 treatments) conducted in the humid tropics of Mexico. The model did not accurately predict weight loss in steers based on energy or protein intake. Estimation of ADG from energy intake was successful in only six treatments, under-estimating gain by 30% with ADGe. Gain was predicted by ADGpdin in only one treatment, showing a general under-estimation of 40%. Values of ADGpdie were similar to the observed values in 10 treatments, under-estimating gain in 70% of the

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0308-521X/$ - see front matter
doi:10.1016/j.agsy.2005.11.006

observed values. Prediction of performance in grazing steers in tropical conditions requires more information about environmental factors, as well as precise and accurate determinations of intake.

Keywords: Simulation; Models; Steer; Growth; Grazing

1. Introduction

The main objective of this work was to develop a deterministic model to predict body weight gain of growing steers grazing tropical pastures, based on chemical composition of forage and supplements, as well as the effects of the environment on nutrient requirements. Ruminant productivity in the tropics is low as a result of environmental effects on the animals metabolism and on forage availability and quality (Aranda et al., 2001; Mendoza et al., 2003). Alternatives to increase animal production include energy and protein supplementation (Ramos et al., 1998; Cabrera et al., 2000); however, interactions between climate, forage and supplement composition and animal, make it difficult to predict responses. Therefore, simulation models are important to predict animal responses to feeding practices and to evaluate economic impacts of management decisions.

Models to predict animal performance in feedlots in temperate conditions have been developed (NRC, 1996) with acceptable predictions in those climates (Block et al., 2001); however, NRC model does not accurately predict responses of grazing steers under tropical conditions (Zuart, 1999). Therefore, a deterministic model was designed to integrate the effects of protein and energy intake from forages and supplements, considering the modifications on requirements by animal activity and heat stress.

2. Materials and methods

2.1. Feed composition

Composition of forages and supplements were obtained from experiments carried out in the States of Tabasco and Veracruz, in the humid tropics of Mexico, at experimental stations of the Colegio de Postgraduados (Ramos, 1994; Alarcon, 1995; Cabrera, 1996; Cordova, 1996; Reyes, 1996; Ramos et al., 1998; Cabrera et al., 2000; Perez et al., 2001). Nutrients analyzed (AOAC, 1980) in forage and supplements were: dry matter (DM), crude protein (CP) and ether extract (EE). Rumen degradable protein (Deg) was estimated with soluble nitrogen in phosphate buffer (Krishnamoorthy et al., 1982). Dry matter digestibility (IVDMD) was measured with the in vitro procedure (Tilley and Terry, 1963).