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Multicriteria evaluation of biomass resources for farming

T. R. Preston†

UTA Foundation, Colombia

Responding to the challenges posed by global warming and the declining availability of most non-renewable resources will require a paradigm shift in the agricultural practice and in the role of live stock within the farming system. Farming systems should aim at maximizing plant biomass production from locally available diversified resources with processing of the biomass on farm to provide food, feed and energy and through recycling of all waste materials. The approach that is the subject of this paper is that the production of food/feed can be combined with the generation of electricity, thus ensuring sovereignty in food and energy for families in rural areas. The concept that facilitates this approach is the fractionation of biomass into edible (for food-feed) and inedible cell wall material, the latter being converted into a combustible gas by gasification, the gas in turn being the source of fuel for internal combustion engines driving electrical generators. The cell contents and related structures are sources of digestible carbohydrates, oil and protein which are used as human food and/or animal feed. An important byproduct from this process is "biochar" (65% carbon- 35% ash) that is both a sink for carbon, as well as a valuable amendment for the typically acid soils in tropical latitudes. The overall balance of these activities results in a farming system in which the carbon footprint is negative.

† Email: preston@lrrd.ord

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Adaptation of a mechanistic model of intake and digestion in sheep to tropical forages

Harry Archimede[1†], Maryline Boval[1] and Daniel Sauvant[2]

[1]INRA UR 143 Antilles Guyane, France; [2]INRA UMR 791, Paris, France

Introduction

Numerous mechanistic models of ruminant nutrition have been published in a temperate context. Therefore, a big challenge is to adapt these models to tropical feeding situations. Sauvant *et al.* (1996) have published a mechanistic model simulating intake, chewing activities and digestion kinetics in the rumen of sheep consuming temperate roughages. The main objective of this current work was to modify this model and to adapt it to C4 grass.

Methodology

This compartmental model is structured around two submodels integrating the relationships between intake, feeding behaviour and digestive processes, with a time-step of integration of 1 minute. Simulations are performed with ModelMaker program. The decision submodel decides from activities of eating, ruminating and resting. The choice among these activities is performed according to the relative values of antagonistic functions of motivation to eat (FMI) and of satiation (FSAT). The FMI function is mainly based on forage palatability and composition, on energy balance, and FSAT. The FSAT function is determined by rumen load signals and energy balance. When the animal does not eat, the decision between ruminating and resting is related to the particles size in the rumen. The ruminal digestion submodel describes postprandial kinetics of particles (comminution and outflows), of digestion and of flows of nutrients (outflows and absorption). To adapt the model, the results of Assoummaya (2007) were the major source of experimental data. They concern measurements of intake, chewing activities, particle kinetics, outflow rates, digestion in the rumen and in the whole tract. They were obtained with sheep placed in digestibility crates and receiving chopped tropical forages.

Seven major aspects, dealing with empirical auxiliary equations of the original model were modified and applied to the new version: The calculation of the potential intake rate (PIR = 3.50 ± 1.29 gDM/min) was entirely modified and is function of forage neutral detergent fibre (NDF = 73.6 ± 3.1) and Crude Protein (CP = 11.8 ± 3.9) contents (in % feed DM), and of body weight (BW = 47.6 ± 8.4 kg): PIR = 8.27 − 0.0794 NDF + 0.110 CP + 0.0764 (BW-50) [$n = 84$, $R^2 = 0.60$, RMSE = 0.84].

† E-mail: Harry.Archimede@antilles.inra.fr

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