DEVELOPMENT OF MECHANISTIC MODELS OF RUMINANT CONSUMING SUGAR CANE FOR ECONOMICAL AND BIOLOGICAL OPTIMIZATION

Luis Vargas-Villamil[1], Roberto D. Sainz[2], Salvador Medina-Peralta[3]

[1]Colegio de Postgraduados Campus Tabasco, Periférico Carlos A. Molina Km. 3.5, Apartado Postal 24, 86500, Cárdenas, Tabasco, México. Tels +52 (937) 372-2386, +52 (937) 372-4099. Fax +52 (937) 372-2297. e-mail: lvillamil@colpos.mx, lvillamil@avanzavet.com

[2]Department of Animal Science, Universidad of California, Davis, One Shield Avenue, Davis, CA 95616-8521, USA.

[3]Facultad de Matemáticas, Universidad Autónoma de Yucatán. Periférico Norte Tablaje 13615. Apdo Postal 172, Cordemex, CP. 97110. Mérida, Yucatán, México.

Sugar cane (ZC) (*Saccharum officinarum*) is a forage resource that can be used in times of drought or flood, improving the efficiency of ruminant production. In Tabasco State, Mexico from 10 to 20 % of the production is lost from each harvest. This could be utilized for the meat and milk production and improvement of productive efficiency. The forage potential of ZC is based on its agronomic productivity (59.2 $ton_{*}ha^{-1}$ in Mexico). The response to ZC feeding has been variable, depending on the type and level of supplementation utilized. Also, the nutritional scientific advances achieved in ZC evaluation have not allowed differentiating and describing the quantitative time-dependent processes of each one of the biological factors that influence animal performance. We can develop dynamic mechanistic models to understand the agricultural quantitative time-dependent problems. In mechanistic models, some deviation from the data is accepted with the purpose of understanding the biological process. This scientific biological knowledge can help to the non-modeling researcher to interpret his/her results and shift the system to an optimal way. Also the models can be an updated and updateable representation for the study of systems and its relation with other macro systems. For that, the objective of this work was the development of a mechanistic dynamic model (*Wakax POS*) for the biological and economical quantitative process evaluation of the bovine digestion and utilization of sugar cane. The model development was in accordance with scientific mathematical methods for mechanistic, dynamic and deterministic models. The model and submodels were developed with Stella VI, Berkeley Madonna, KyPlot v2.0 beta 14 and a new software developed for us into the PIFI project. The softwares were used for the development, parameters estimation, numerical solution and optimization of models. It was validated for the prediction of the average weight gain per day of bovines fed with sugar cane, broken corn and/or molasses in a tropical area of Mexico. Additionally, graphical methods and statistical measures were used for the validation in prediction of dry matter, volatile fatty acids, acetate, propionate and butirate in Rumen and Cecum. The model *Wakax POS* can be used to predict the average weight gain per day, but it will require an adjustment taking into account the presence of constant bias in order to increase its accuracy.