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Climate control in broiler houses: a thermal model for the calculation of the energy use and indoor environmental conditions

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Abstract

The use of energy in the livestock sector will rise in the years to come due to the increasing demand for animal proteins from a world population that will reach 9.15 billion people before 2050. Livestock houses for intensive animal farming are characterized by high energy consumption due to climate control that is needed to guarantee animals' welfare and to maximize their production. Currently, there are neither international standards calculation models nor commercial tools for the estimation of this energy consumption. To fill this gap, this paper presents a simulation model (based on a customization of the hourly model of ISO 13790) for the estimation of the energy consumption due to climate control of broiler houses. This model provides the energy consumption for heating, cooling and ventilation and the main indoor environmental parameters for the evaluation of the animals' welfare. The model was validated comparing its outputs with a dataset obtained through a monitoring campaign carried out in a broiler house during a production cycle. This research has several practical application: it can increase the knowledge about energy consumption in the livestock sector and the model can be also a useful tool for agricultural engineers and farmers.

Keywords: climate control, energy consumption in livestock houses, simple hourly method, broiler farming, energy model.

1 Introduction

The use of energy in the livestock sector will play a fundamental role in the near future because the energy needed to meet the demand for animal proteins will rise in the years to come. The world population is expected to increase considerably: according to UN research [1], the number of people that will have to be fed in 2050 will reach 9.15 billion, an increment

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