PROJECT TITLE:
Development, validation andapplication of a mathematical model to simulate the effect of changes in the production conditions on the technical end economical performance of a dairy farm

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ABSTRACT:

The dairy cattle sector is facing difficulties due to the reduction in milk prices, the increase in the cost of feeding and the reduction of profits. The need to improve the competitiveness of the dairy enterprise requires decisions that are often difficult to evaluate because they are highly dependent on many economical and technical factors and their interactions. These complex interactions can only be solved by mathematical modeling. The objective of the present project is to develop and validate a stochastic model to simulate the functioning of a dairy farm, and to evaluate the impact of changes in one or several technical or economic factors on its profitability. The process requires the development of a conceptual framework, the availability of values for the parameters that describe each of the variables involved in the model, and its validation. Validation will be conducted with results from 20 commercial dairy farms. The model will be used to simulate the outcome of different scenarios in a group of farms stratified by geographical location and type (n=30). The model will account for lactating, dry and heifers (biological model for each type). For each animal, sub models will be considered for feeding, diseases, environmental factors, facilities, management, reproductive management, and economic factors. The outcome will provide a list of technical and economic indicators essential for the decision-making process which should help the competitiveness of the dairy sector.

THE PROBLEM

The dairy sector faces a constant change in policies, production factors and economic scenarios that challange its economic sustainability. This sustainability requires to improve the compeititiveness by taking appropriate decissions related to tecnical, economic and fiancial issues. These decission are often dificult and complex becuse depends on many technical an economic factors and their ineraction. Therefore, proper decissions requiere the integration of all these factors in a comprehensive way to evaluate the effects of such decisions. The development of mathematical models alows to analyze these processes in a

dynamic way to predict the short and long term effects of changes on technical and economical outcomes.

THE OBJECTIVE

The objective of the project is to develop and validate a mathematical model to simulate the evolution of a dairy farm under differet production and economic scenarios that determine its profitability.

THE PROCEDURE

The development requieres a conceptual framework, the definition of default values for the variable used in the model, and the final validation. Validation will be conducted by comparing results to 20 dairy farms where changes in teh technical and/or economical scenario have been introduced and data are available for outcomes. The model will be used to test the effect of technical and/or economic changes in 30 farms clasified by different types and geografical locations. Variables specific to each farm wll be used. Items to be modelled will include feeding, production, diseases, environment, facilities, management, reproduction and economics, among others.

For each animal within the model/farm, the model will consider:

1. Description of the genetic potential of the animal
2. Description of basic function and factor affecting them:
    a. Biological cycle: growth, production curve, intake, reproductive cycle gestation,...
    b. Management factors: feeding, facilitite, environment, ...
    c. Diseases: incidence, duration, impact on production,...
3. The interaction between the genetic potential, biological constrains and external factors will determine the actual animal performance.
4. The fiancal unit will keep track of income and expenses, including variable and fixed costs.
5. The user will have the opportunity to modify the conditions for simulation to test different potential scenarios.