

# A MODEL TO DETERMINE THE OPTIMUM FORAGE COMBINATION AND LEVEL OF CONCENTRATE FOR DAIRY COWS.

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## ABSTRACT

A model was developed to simulate a milk production system. The program determines the milk production based on energy nutrition, calving date, cow potential and defines grazing sequence and harvesting dates. It can simulate different stocking rates, paddock sizes, levels of production according to pasture quality, seasonal production and concentrate intake. The output of the model is used for an economical analysis which evaluates costs and returns; for some of the most sensitive factors that affect economic returns like prices of milk and concentrate, pasture production and others. The program makes an analysis of sensitivity where these factors are varied according to predetermined levels. Different systems were evaluated varying the following factors: milk production potential, level of alfalfa, corn silage and concentrate, calving season. Milk production increased as level of concentrate increased, net income per ha increased as level of alfalfa in the ration was increased with an optimum of 12-15 kg/cow/day. Optimum level of concentrate varies according to potential milk production and prices of milk and concentrate. Price difference between spring and winter affects optimum calving date.

## INTRODUCTION

Models are an excellent tool to define research priorities and can be very appropriate to determine optimum production systems, specially in situations where prices of inputs and outputs vary considerably. Milk production systems are very complex, since there are many factors that affect their performance and normally only a limited number of these factors can be analyzed simultaneously. Simulation models allow evaluation of a great range of factors and, therefore, explore different possibilities that can not be tested in a traditional experimental approach. A model developed by Silva et al. (1987) and modified by Jahn et al. (1988) and Saez et al. (1989) has been used to evaluate different milk production alternatives for irrigated pastures in the Central Valley of Chile. Based on the model results some alternatives have been tested experimentally, which permits validation of the program. The objectives of the present study were to improve the predictions of the model for high producing cows and test different forage combinations and levels of concentrate.

## METHODS

Based on the model that simulates a milk production system (Jahn et al. 1988), intake prediction equations were modified for different production levels, economic analyses were introduced that permit a sensitivity analysis to varying prices of inputs and outputs. Milk production systems were evaluated considering the following factors: milk production potential (5000 to 8000) kg/cow/lactation, level of alfalfa (4-15 kg DM/cow/day), concentrate (0-12 kg/cow/day), corn silage quality, concentrate quality, price difference between spring-summer and winter and calving season. Corn silage was supplied ad libitum and level decreased as amount of alfalfa increased in the ration. The model runs on a daily basis according to individual cow characteristics that are set at the start of each run. Some of the parameters that must be determined for each animal are: body weight, potential milk production, mature body size, age, days pregnant, calving date, etc. For all systems biological parameters like milk production, live weight change, intake of different feeds, etc. are determined daily and summarized on a monthly and yearly basis.

Economic analysis is performed on each system and results can be evaluated varying prices of milk, concentrate, interest rates and land prices. Production level of forages can also be varied at predetermined percentages.

## RESULTS AND DISCUSSION

Milk production per cow and per ha increased as level of concentrate in the ration was increased. Optimum economic returns per ha were related to production potential, for a potential milk production of 5000 kg/lactation highest returns were with a maximum of 4 kg concentrate/cow/day (Fig.1). For potential of 6500 and 8500 kg optimum level of concentrate was 8 and 12 kg/cow/day, respectively (Fig.2). With increased levels of alfalfa in the ration economic returns were improved, the optimum was obtained at around 12 kg DM/cow/day of alfalfa.

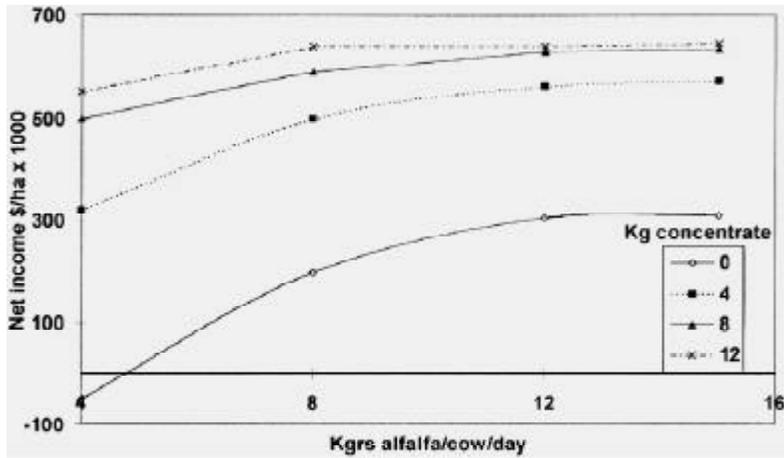
Concentration of calving in spring was most economical without a milk price differential between spring and winter, but when there is a higher price in winter higher returns are obtained with calving dates in fall and spring. With a price differential of around 20 % between spring and winter it is economically feasible to produce milk during the winter month. With a price difference below 20 % spring calving produces the highest returns at the farm level. This factor must be considered when planning the dairy enterprise and will depend basically on the market demand for milk.

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**Figure 1**

Net income per ha for different levels of alfalfa and concentrate with potential production of 6.500 kg/cow.



**Figure 2**

Net income per ha for different levels of alfalfa and concentrate with potential production of 5.000 kg/cow.

