

# An analysis of eco-efficiency scenarios in dairy farming: simulations of calving interval



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The eco-efficiency of dairy farms presumes the approach of economic efficiencies and the impact upon environment.

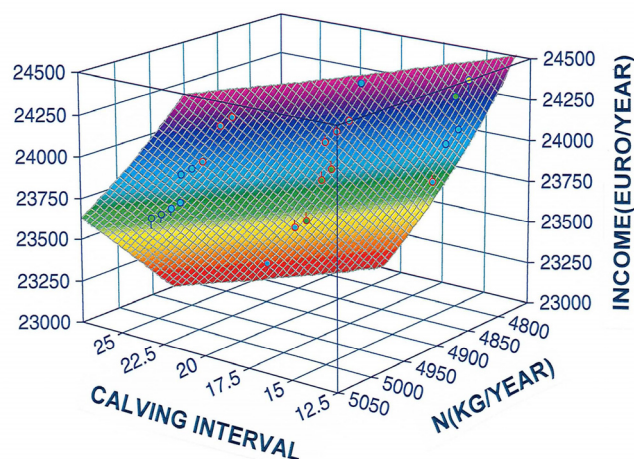
## MATERIALS AND METHODS

The study starts from a real situation of dairy farm with 38 cows, with 50 hectares of farmland with quantified productions, rations, cost and income and calculated nitrogen balance and value of profit. It was used the equipment belonging to Auto laboratories of Environment and Technologies (NIR, Lactostar) with which there were quantified nutrient inputs and farm's productive outputs and the N-CyCLE software application (figure no 2.) to perform simulations for maximizing the profit and minimizing the nitrogen.



Figure no 1. Equipments of Auto laboratories of Environment and Technologies

In this scenario the eco-economic characteristics of the farms can be improved at low CI; in this situation the farm acquires an eco-economic characteristics when the annual N-balance is 98 kg N/ha/yr and the profit is 629 euro/cow. In this case the loss of profit for the each kg N/ha/yr reduction became 6 euro/cows.



Graphic no 1. Representation of the eco-efficiency function of the farm subjected to simulation .

## RESULTS AND DISCUSSIONS

By simulating the calving interval (CI) from 15 to 26 months, two scenarios were performed by using the N-CyCLE software: minimization of the N-balances and the maximization of the profit. The two scenarios significantly influence the value of profit – the scenario towards maximizing the yearly gross margin generates the highest average profit (798 euro/cow), and the scenario towards minimum nitrogen-balance generates the lowest average profit (402 euro/cow). The annual N-balance was 126 kg N/ha in the economic scenario and 70 kg N/ha in the ecological scenario. The loss of profit for the each kg N/ha/yr reduction is 7.1 euro/cows. The eco-economic characteristics of the farm were obtained through a mathematical model constructed based on the values corresponding to the two scenarios above. This results in a new scenario for the computation of the values of N and the rates of gross margin. The eco-efficient scenario of the farm is described by the following equation, whose graphic representation is given by the surface in graphic no 1:

$$z = -173611.56 - 3260.50 \ln x + 24398.45 \ln y$$

where:  $z = \text{Income} \left( \frac{\text{euro}}{\text{year}} \right)$ ,  $x = \text{Calving interval}$ ,  
 $y = N(\text{kg/year})$

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## CONCLUSIONS

To improve the eco-economic characteristics of dairy farms by CI, the society should support a yearly subsidy of 169 euro/cow.

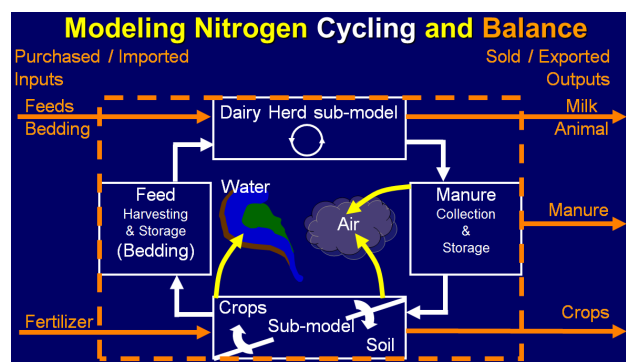


Figure no. 2. Optimization by N-CyCLE software by Pellerin et al. 2010

## References

Pellerin, D., Wattiaux, M., Charboneau, E., Moreira, V., Flis, S. (2010). *N-Cycling the Nutrient balance and Optimization spreadsheet*. V. 2.5.5. *User's Manual and Model Description*, Université Laval, Québec City, Canada, University of Wisconsin, Madison, SUA.