

Analysis of Eco-Efficiency Scenarios in Dairy Farm: Simulations of NDF Values in Feed Ratio

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The aim of the study is to establish the eco-efficiency of a dairy farm from the perspective of optimization the feed ratio quality, considering NDF, by simulating the growth of income and reducing the Nitrogen's balance.

For the study there were used: i) a dairy farm with a herd of 38 animals, with the peak production of 40 kg/day, fed with ratio in which NDF had the value 42%, ii) equipment belonging to Auto laboratories of Environment and Technologies (NIR, Lactostar) with which there were quantified nutrient inputs and farm's productive outputs and iii) N-CyCLE software application to perform simulations for maximizing the profit and minimizing the nitrogen.

It was realized a scenario with 15 simulations of NDF for increases by one percentage than NRC's standards, including the real situation and it was considered that eco-economy of a farm is given by the minimization of nitrogen's balance and maximization of farm's profit.

NDF's value was negatively correlated with gross margin value in the ecological scenario of minimizing nitrogen's balance ($r = -0,861$ la $p < 0,001$).

The NDF's value in the feed ratio is positively correlated with the nitrogen's balance in both ecologically ($r = + 0,452$ but $p < 0,091$) and economically scenarios ($r = +0,980$ la $p < 0,001$).

The eco-economic scenario of the farm is described by the below equation, whose graphical representation is given by the area in Fig. 1:

$$z = 962,346.48 - 2.91x + -31.53x^2 - 0.21x^3 - 0.014x^4 - 0.003x^5 + -252,009.25\ln y + 16,665.79(\ln y)^2$$

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

The NDF's increase in the ratio causes a reduction of feed intake and thus, a decreased milk production. Increased amount of NDF causes low efficiency of nitrogen use from feed. The eco-efficiency of the farm, in terms of NDF is given by that interval of NDF values in which the gross margin is maximal and nitrogen's balance is minimal.

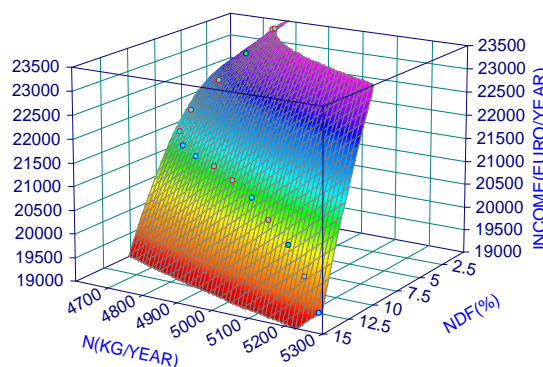


Fig. 1. Graphical representation of eco-efficiency function of the farm subjected to simulation – output generated by Maple®13

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