



**HAL**  
open science

## **Cownex, a tool to assess nitrogen efficiency, autonomy and excretion at dairy herd level**

Philippe Faverdin, Christine Baratte, Romain Perbost, S. Thomas, Eric Ramat, Jean-Louis Peyraud

► **To cite this version:**

Philippe Faverdin, Christine Baratte, Romain Perbost, S. Thomas, Eric Ramat, et al.. Cownex, a tool to assess nitrogen efficiency, autonomy and excretion at dairy herd level. 20. Nitrogen Workshop, Jun 2018, Rennes, France. pp.13-14. hal-02734712

**HAL Id: hal-02734712**

**<https://hal.inrae.fr/hal-02734712v1>**

Submitted on 2 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## COWNEX, A TOOL TO ASSESS NITROGEN EFFICIENCY, AUTONOMY AND EXCRETION AT DAIRY HERD LEVEL

Faverdin P.<sup>1,2</sup>, Baratte C.<sup>1,2</sup>, Perbost R.<sup>1,2,3</sup>, Thomas S.<sup>1,2,3</sup>, Ramat E. <sup>3</sup>, Peyraud J-L<sup>1,2</sup>

<sup>1</sup>INRA, UMR 1348 PEGASE, France ; <sup>2</sup>Agrocampus Ouest, UMR 1348, France ; <sup>3</sup>Univ Lille Nord de France, ULCO, LISIC, France

### INTRODUCTION

The efficiency of nitrogen (N) use in dairy herds is an important challenge due to the environmental impacts of the N cascade and to the cost of protein resources. The assessment of global N efficiency and N excretion of dairy herds is complex due to the large diversity of feeding management during the year (several diets and several feeding groups). CowNex is designed to estimate the N parameters very simply for each farm situation.

### MODEL/TOOL DESCRIPTION

CowNex is a new web application (<http://www.cownex-record.inra.fr/>) that facilitates the calculation of dry matter and nitrogen use in dairy herd according to the management, with a special attention to feeding management with user-friendly interface (Figure 1). It based on a subpart of the whole farm MELODIE model (Chardon et al. 2012) using the Record modelling platform. The model simulates the daily intake, production and excretion of the different categories of animal in a dairy herd according to the feeding management described by the users (Fig 2). CowNex enables the assessment of existing farms and the simulations of changes in feeding management both on production and excretion.

**Cows-Vaches**

	Diet 1 (75 Day)		Diet 2 (60 Day) ✗		Diet 3 (88 Day) ✗		Diet 4 (76 Day) ✗		Diet 5 (62 Day) ✗	
	DM (kg/day)	%	DM (kg/day)	%	DM (kg/day)	%	DM (kg/day)	%	DM (kg/day)	%
FreshGrass		100						100		100
MilkP-LaitP										
MaizeS-EMais			7			65				
Straw-Paille										
SMB-Tt_Soja			1			10				
Barley-Orge	4					20	4		4	
Grass Silage										
BRE										
Foin				100		5				
<b>Total</b>	<b>4</b>	<b>100</b>	<b>8</b>	<b>100</b>	<b>0</b>	<b>100</b>	<b>4</b>	<b>100</b>	<b>4</b>	<b>100</b>
Time outdoors (h)		20		0		0		20		20

Figure 1. Example of the description of an annual feed management of a group of cattle with the CowNex web interface.

Applied to a large diversity of dairy systems encountered in France based on the “model farms” of INOSYS, CowNex was used to estimate the actual situation and to test some mitigation options to reduce NH<sub>3</sub> emissions and associated N<sub>2</sub>O emissions from manure. The estimation of these impacts was calculated using the EMEP-EEA equations with the CowNex results of N excretion (urine and faeces) either indoor or outdoor.

### RESULTS AND DISCUSSION

The results of the different simulations are presented in figure 3. The reduction of protein supplementation to reach a crude protein content of 14% with maize silage based diets is a simple and efficient solution to highly reduce ammonia emissions and decrease GHG emissions between 10 and 20%, with a good choice of protein sources, but without changing any manure management options. In many systems, there is both economic and environmental benefit to pay attention to the protein supplementation.

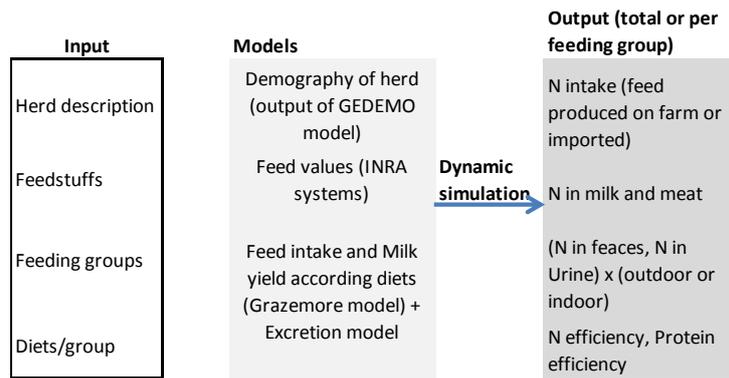


Figure 2. Simplified representation of CowNex tool, inputs outputs and model used.

**Dairy Systems**  
(maize in % of forage area)

- Specialised Plain**
- 1 nW Maize>30%
- 2 W Maize>30%
- 3 nW Maize10-30%
- 4 W Maize10-30%
- Montain**
- 7 Maize
- Crop dairy**
- 12 Maizes>30%
- Mixed Dairy**
- 13 Maize>30%
- 14 Maize10-30%
- 15 Maizes<10%

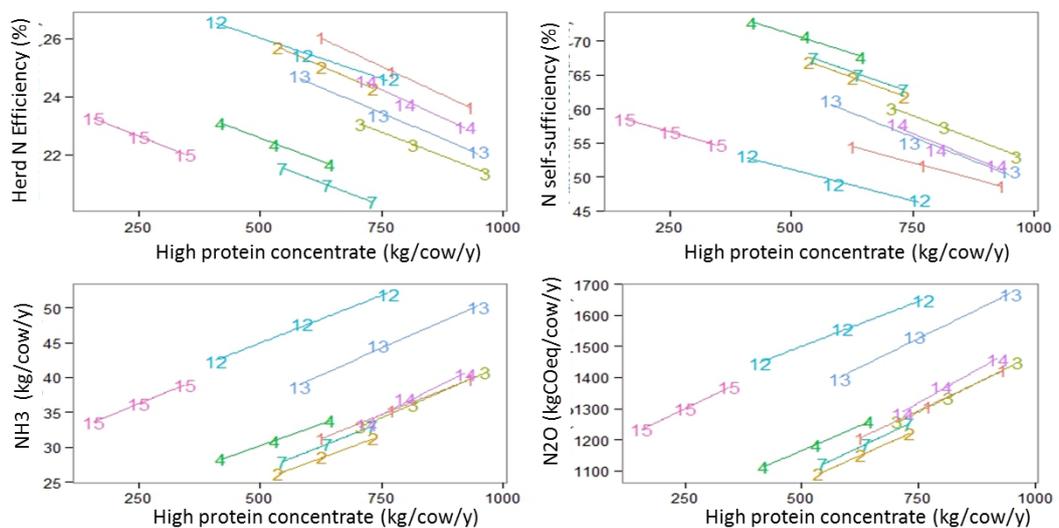


Figure 3. N efficiency and N emissions for different model dairy systems with different protein supplementation.

## CONCLUSION

CowNex is a free application to simply compare N excretion of different dairy systems with different feeding management. The reduction of protein supplementation during the indoor period is an efficient solution to reduce NH<sub>3</sub> emissions of dairy cattle, but with different effects according to the farming system.

**Acknowledgements:** CowNex was funded by the project RedNex UE FP7 KBB-2007-1

## REFERENCES

Chardon X., Rigolot C., Baratte C., Espagnol S., Raison C., Martin-Clouaire R., Rellier J.-P., Le Gall A., Dourmad J.Y., Piquemal B., Leterme P., Paillat J.M., Delaby L., Garcia F., Peyraud J.L., Poupa J.C., Morvan T., Faverdin P., 2012. MELODIE: a whole-farm model to study the dynamics of nutrients in dairy and pig farms with crops. *Animal*, 6, 1711-1721.