

# Nitrogen value for ruminants of regular solvent-extracted rapeseed meal

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## Objectives

The aim of the study was to verify the relationship between DE1 (in vitro) and NED (in sacco) on a set of RSM currently produced in France in order to adjust the model if necessary, and to contribute to the new nutritional reference system (Systali) with updated data.

## Material and methods

Table 1: Chemical composition of the tested RSM

	Mean value	SD	Min	Max
Dry Matter (%)	88.9	0.7	87.2	90.3
Ash (% DM)	7.7	0.1	7.6	8.0
Fat (% DM)	2.8	0.7	2.0	4.7
Protein (% DM)	36.6	0.8	35.3	38.4
DE1 (% N)	20.9	2.4	17.5	25.8
Crude Fiber (% DM)	14.9	0.4	14.2	15.5
NDF (% DM)	27.8	0.9	26.1	28.9
ADF (% DM)	19.1	0.5	18.4	19.9
Lignin (% DM)	8.3	0.3	7.6	8.7

## Results and discussion

The reduction of the DE1 values of the current RSM is certainly related to an increase in the temperature of treatments used in the extraction processes (desolventizing). The results of in sacco measurements allowed to confirm the NED values proposed in the Tables INRA (2007) for this feed and to validate the accuracy of the prediction model of NED. Moreover, these new results lead to increasing the precision of the estimation of NED from current DE1 values. Nevertheless, the figure 1 showed that this model must not be applied to predict NED for formaldehyde-protected RSM.

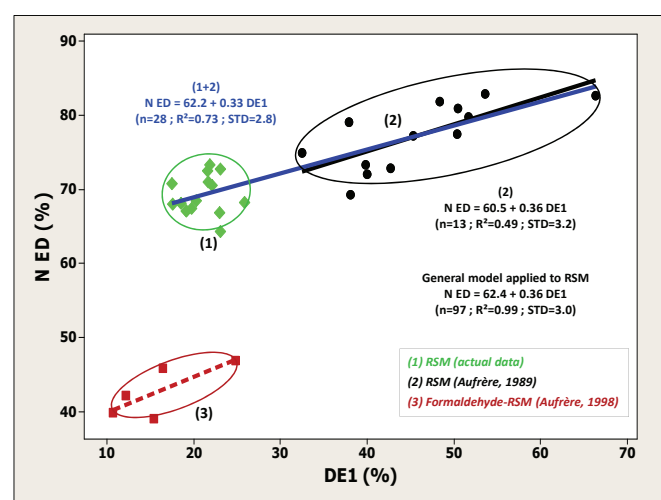


Figure 1: Relationship between DE1 (in vitro) and NED (in sacco) values for RSM in 1989, 1998 and 2012

## References

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## Background

Regular solvent-extracted rapeseed meal (RSM) produced in France, have a well-defined chemical composition but presents a significant variability in nitrogen enzymatic degradability (DE1, %). In addition, it was observed that DE1 values of the current RSM were much lower than those obtained for two decades, which have been used to develop the prediction model of nitrogen effective degradability (NED, %) now used in France. As the DE1 values of the current RSM are not in the range of those previously used for the model development, the question of the validity of the DE1 prediction model was raised.

## Measurements

In sacco and in vitro measurements were conducted on 15 samples of RSM, quite representative of the existing variability previously studied by Chapoutot et al. (2011) on 35 samples of RSM.

In vitro measurements were carried out according to Aufrère et al. (1989).

In sacco measurements were done as described by Michalet-Doreau et al. (1987) with a double latin square including 3 cows and 6 replicates.

The data measured in this study have been integrated in the new "Systali" model described by Sauvant and Nozière (2013), with the new calculator "Systool" (Chapotot et al., 2013) in order to estimate the new nitrogen values of RSM.

## Prediction model

The degradation kinetics were adjusted according to the non-linear model of Ørskov & McDonald (1979).

$$\text{Deg}(t) = a + b(1 - e^{-ct})$$

with a: soluble fraction, b: degradable fraction and c: degradation rate of b fraction.

The effective degradability of Dry Matter (DMED) and Nitrogen (EDN) were calculated by taking into account the turnover rate of particles out of the rumen ( $k_p = 0,06 \text{ h}^{-1}$ )

$$\text{ED} = a + bc / (c + k_p)$$

The experimental design for incubation allowed to test by variance-covariance analysis (GLM Procedure/Minitab) the « feed », « cow » and « day » effects, associated with the covariable degDM of a standard feed (DegMS\_stand<sub>ij</sub>) according to the model:

$$\text{Deg}(t)_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + \delta \text{DegMS\_stand}_{ij} + \epsilon_{ijk}$$

The data measured in this study have been integrated in the new "Systali" model to calculate the nitrogen values of RSM in the new system.

Compared to INRA 2007 ones, the new Systali "Table" values are modified, with a higher PDIN/PDIE ratio (higher PDIN value and lower PDIE value). A simulation was done with the new calculator "Systool" in order to quantify the effect of the inclusion of RSM in maize silage-based diets for dairy cows upon its real nitrogen values when included in rations.

The digestive interactions, much more precisely taken into account in the "Systali" model, tend to slightly increase the nitrogen "Diet" values of RSM compared to the "Table" ones, especially the PDIE value due to an increase of PDIA value.

Table 2: Updated values for RSM in the new Systali model

Parameters	"Diet" values (1) (Mean ± SD)	Differences between Systali "Diet" (1) and "Table" values
NED (%)	65 ± 1	-4
PDIA (g/kg DM)	104 ± 3	+12
PDIMN (g/kg DM)	153 ± 2	-10
MOF (g/kg DM)	510 ± 19	-65
PDIME (g/kg DM)	52 ± 1	-2
PDIN (g/kg DM)	257 ± 1	+2
PDIE (g/kg DM)	156 ± 1	+10

(1) Diets based on maize silage

PDIA and PDIMN (or PDIME): metabolisable protein coming from feed and microbes

MOF: Fermentable Organic Matter

PDIN or PDIE: metabolisable protein values according to N or MOF availability for microbes

## Conclusion

These results confirm the validity and increase the precision of the prediction model of NED by DE1. The NED mean value obtained on the 15 samples of this study was very close to that proposed by INRA 2007. In the new Systali model, the real "diet" values of RSM, compared to the "Table" ones, decrease for NED (-4 points) and slightly increase for metabolisable protein content (PDI).