

Implementation of the NIR curves of Hays and Unifeeds with Nitrogen Fractions

In our current NIR Profiles of Hays and Unifeeds, protein fractionations are limited to Soluble Nitrogen and ADF bound Nitrogen (Unavailable). Therefore we decided to articulate the fractionation of the nitrogenous component trying to get as close as possible to the CNCPS scheme (Cornell Net Carbohydrate Protein System): the latter provides for 5 fractions with decreasing rumen degradation speed from the maximum of the NPN (Fraction A1) up to complete zeroing with the Nitrogen bound to the ADF (Fraction C). For the moment it is limited to hays and Unifeeds. We have plans, in the medium term, to extend it to ensiled forages.

This classification has its natural place within the CNCPS system where the effective degradation is estimated according to the nutritional level and diet in order to synchronize the fermentation/degradation speed of Carbohydrates and Nitrogen (Dynamic Rationing).

However, even outside this system, even if it is less adherent to the real rumen dynamics, it can still represent an interesting tool for evaluating forage on a comparative basis between the various lots or respect to a reference framework, such as for example our statistics for Unifeeds and Hays that we are developing these days and that we will soon publish on the site.

We specify that the fractions A1 (NPN – Non Proteic Nitrogen) and A2 (Real soluble protein), which we are going to insert in the NIR profiles, are condensed in the single parameter Soluble Nitrogen.

All these fractions are expressed as % of Total Nitrogen and their sum is always 100.0.

Composition of the profile of nitrogenous fractions and nutritional significance.

- **Nitrogen Soluble in phosphoborate buffer at pH 6.7-6.8. It is an aggregate result that adds up the fractions A1 and A2:**

Fraction A1 or Non-Protein Nitrogen (NPN) which is made up of ammonia, ammonia compounds, amines, nucleic acids, amino acids and short chain peptides (< 4 AA). They show immediate degradability in the rumen: kd = 50-500%/h.

Fraction A2 which represents the true soluble protein, composed of polypeptides (Globulins and some Albumins) in which the distribution of hydrophilic and hydrophobic amino acids in the chain and the absence of chemical or thermal denaturation allow rapid solubility in the rumen liquid: kd = 20-200%/h.

- **Fraction B1.** It is given by that amount of insoluble nitrogen at pH 6.7-6.8 but not bound to the structural fiber (NDF). It is made up of glutenins and most of the albumins. It has an intermediate degradability: kd = 10-50%/h.
- **Fraction B2.** It is given by the nitrogen bound to the NDF deducted from the amount of unavailable nitrogen bound to the ADF (Fraction C). It is made up of prolamines and denatured proteins (in solubilised and it has a slow degradability: kd = 2-10%/h.
- **Fraction C.** It is the nitrogen bound to the ADF, substantially consisting of nitrogen bound to Lignin (ADL) and Millard products. Completely unavailable: kd = 0%/h

Summary table:

RELATIONSHIP BETWEEN THE CORNELL PROTEIN FRACTIONS AND THE RELATED ANALYTICAL PARAMETERS

SCHEME proposed by us	Total nitrogen (Kjeldahl)				
	Soluble N at pH 6.7-6.8		Insoluble N at pH 6.7-6.8		
	Solubile N: Fraction A1+A2		Total N - N/NDF – Soluble N: Fraction B1	N/NDF - N/ADF: Fraction B2	Unavailable N: Fraction C
CORNELL SCHEME	Non Proteic Nitrogen: Fraction A1	Insoluble N, net of NPN: Fraction A2	Total N - N/NDF – Soluble N: Fraction B1	N/NDF - N/ADF: Fraction B2	Unavailable N: Fraction C
	N solubilized by the Neutral Detergent Solution			N/NDF (Insoluble N in Neutral Detergent Solution)	