

NEW FORAGE ASSESSMENT – WHAT IS CHANGING?

The publication of the new recommendations on energy and nutrient supply for dairy cows by the German Committee for Nutrient Requirements (AfBN) of the Society for Nutritional Physiology (GfE) in 2023 marks the beginning of a new era in feed evaluation. This article summarises the key changes with a focus on their practical significance for roughage quality and ration formulation.



What will change in the future?

The previous system has been fundamentally revised: Metabolisable Energy (ME) replaces Net Energy Lactation (NEL), and new indicators such as Organic Matter Digestibility (OMD) and Small Intestinal Digestible Protein (sidP) are gaining in importance. The most important parameters for feed quality in cattle and explanations of the new abbreviations are summarised in Table 1.

• MJ ME instead of MJ NEL

In the future, feed energy will be assessed for all ruminants, i.e. including dairy cows, on the basis of metabolisable energy (ME). The assessment of feed according to its net energy content (NEL) will no longer apply in future. Factors that will now be taken into account for determining MJ ME are the gross energy content (GE, MJ/kg) of the feed and the digestibility of the gross energy (determined by the digestibility of the organic matter [organic matter digestibility; OMD, %]).

• Protein value

Protein evaluation is no longer based on the usable crude protein in the duodenum (nXP), but on the protein digestible in the

small intestine (small intestinal digestible protein; sidP) and the amino acids available there (small intestinal digestible total amino acids; sidAA). The protein value continues to be determined on the basis of the microbial protein formed – supplemented by the UDP (ruminally undegraded crude protein), i.e. the proportion of protein that escapes microbial degradation in the rumen.

The amount of microbial protein produced is determined on the basis of digestible organic matter (DOM), i.e. the energy provided by the feed in the rumen. This is



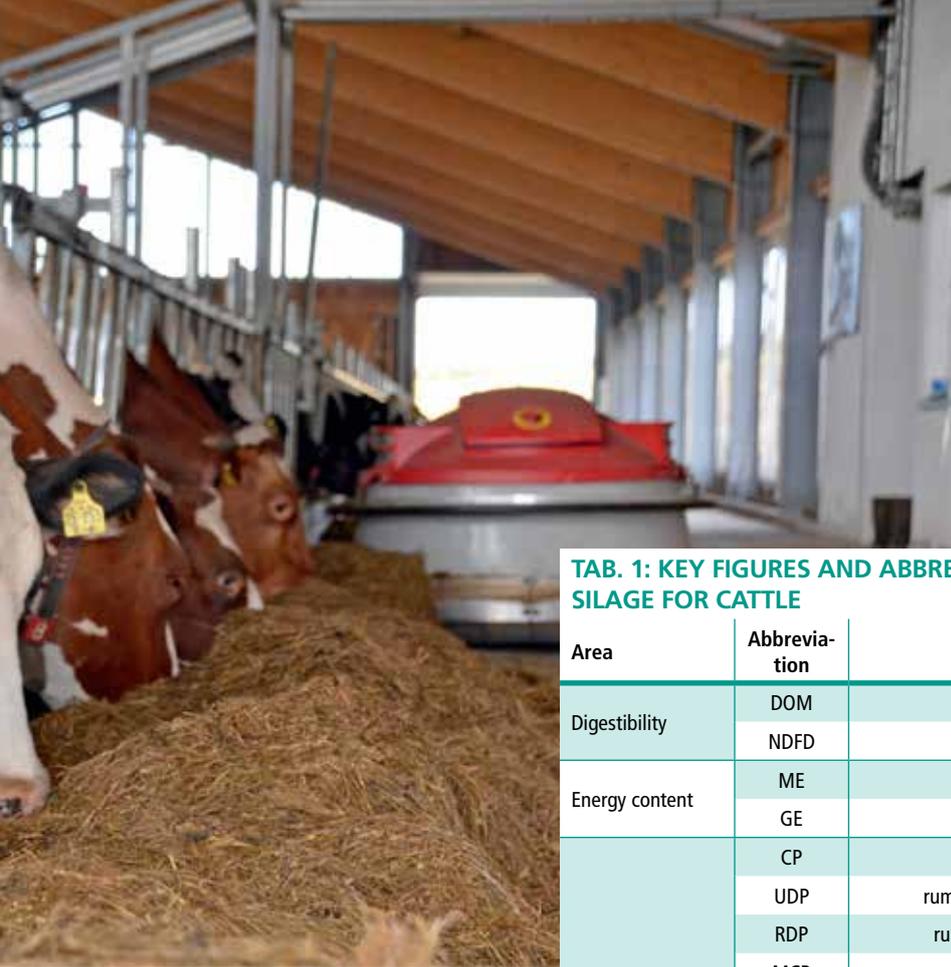
Did you know?

In arable feed production clover grass and alfalfa silage are also increasingly being used for dairy cow feed. Particular attention is paid to the crude protein content and protein values. Important to note when planning rations: Alfalfa products, in particular, are well consumed despite their comparatively lower OMD and ME content. One reason for this is their slightly higher passage rate.

closely related to OMD. However, in order to estimate the UDP content in the crude protein (CP) of the feed as accurately as possible, the ruminally degraded crude protein (RDP) must be calculated. The equation for this is: $UDP = CP - RDP$. s, the following feed-specific ruminal degradation properties must be known:

- the rapidly degradable (soluble) fraction (a) of the crude protein in the feed (as a percentage of CP),
- the potentially degradable fraction (b) of the crude protein in the feed (as a percentage of CP),
- the degradation rate (c) (degradation speed) of fraction b (in %/h),
- and the delay time of ruminal CP degradation (lag) (in h).

Due to the time-dependent nature of the degradation rate, there are no uniform RDP/UDP ratios for feed that apply to every feeding situation. Faster ruminal passage of the feed mash (passage rate k, in %/h) reduces the possible protein degradation, i.e. the RDP proportion and the UDP proportion increases. These four parameters, a, b, c and lag, which may initially appear abstract, are



TAB. 1: KEY FIGURES AND ABBREVIATIONS FOR THE FEED QUALITY OF SILAGE FOR CATTLE

Area	Abbreviation	Explanation	Parameter
Digestibility	DOM	Organic Matter Digestibility	%
	NDFD	Fibre digestibility	%
Energy content	ME	Metabolisable energy	MJ/kg
	GE	Gross energy content	MJ/kg
Protein value dairy cow	CP	crude protein	g/kg
	UDP	ruminally undegraded crude protein	g/kg
	RDP	ruminally degraded crude protein	g/kg
	MCP	microbial crude protein	g/kg
	RMD	ruminal microbial difference (difference between RDP and MCP)	g N/kg
	a	Rapidly degradable (soluble) fraction of crude protein in feed	% des CP
	b	Potentially degradable fraction of crude protein in feed	% des CP
	c	Degradation rate of crude protein in feed	%/h
	lag	Delay time of ruminal CP degradation	h
	sidP	small intestinal digestible protein	g/kg
	sidAA	small intestinal digestible total amino acids	g/kg
	sidLys, sidMet...	small intestinal digestible lysine, small intestinal digestible methionine ...	g/kg
Structural effect	peNDF	physically effective neutral detergent fibre	mm
Mechanical processing	CSPS	corn silage processing score	Grinding
Carbohydrates	ZU	Sugar	g/kg
	St	Starch	g/kg
	bSt	Resistant starch	g/kg
Mineral and active ingredient content	Ca, P, Mg, K, Na ...	macro nutrients	g/kg
	Mn, Zn, Cu ...	micro nutrients	mg/kg
	A, D, E, ...	Vitamins	mg
Fermentation quality	MS, ES, BS ...	Fermentation acids (lactic acid, acetic acid, butyric acid, etc.)	g/kg
	pH	pH value	
	EtOH	Ethanol	g/kg
	NH ₃ -N	Ammonia nitrogen	% of total N
Feed intake	FAN	Feed intake level	
	FAN1	Feeding at maintenance level (50 g DM/kg BM ^{0.75})	
	FAN > 1	Feeding that takes milk production or other performance into account	

therefore crucial for describing the protein value and should be included in every feed certificate in future.

Similar to the ruminal nitrogen balance (RNB) from the nXP system, the new sidP system also provides a balance for assessing an excess or deficiency of ruminal degradable feed N: RDP microbial crude protein (MCP) = RMD.

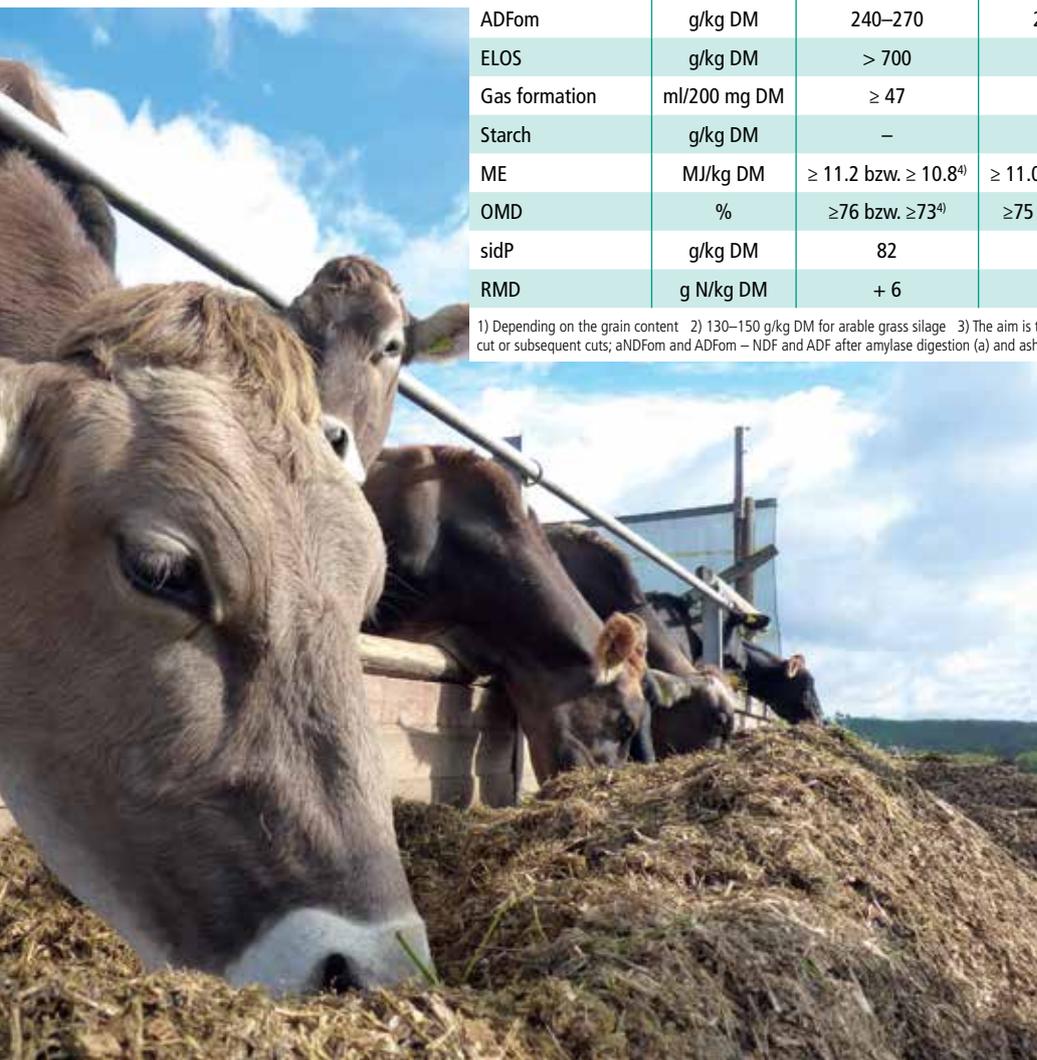
• **Digestibility**

A new feature in the feed evaluation system and the presentation of the animal's corresponding energy and nutrient requirements is the consideration of the passage speeds of the feed mash at different feed intakes. As feed intake increases while the animal's body size remains the same, ruminal degradation decreases, resulting in both lower OMD digestibility and lower protein degradation. Feed value is described by the assumed feed intake level (FAN), which can be described as roughly covering maintenance requirements (FAN1) and providing a consistent rumen passage rate. How these are calculated is explained in the section „Understanding the FAN value and assessing feed in a targeted manner“.

TABLE 2: PRELIMINARY GUIDELINE VALUES FOR GOOD SILAGE IN DAIRY COW AND CATTLE FEEDING (FOR FAN1)

Parameters	Unit	Grass silage	Clover grass silage	Alfalfa grass silage	Maize silage
Dry matter (DM)	g/kg	300–400	300–400		300–380 ¹⁾
Crude ash (CA)	g/kg DM	< 100	< 105		<35
Crude protein (CP)	g/kg DM	150–170 ²⁾	155–175	170–190	< 80
Protein ³⁾	% des CP	> 50	> 50	> 50	> 50
aNDFom	g/kg DM	440–480	400–460	400–460	360–400
ADFom	g/kg DM	240–270	260–300	300–350	200–220
ELOS	g/kg DM	> 700	–	> 690	–
Gas formation	ml/200 mg DM	≥ 47	≥45	≥39	k. A.
Starch	g/kg DM	–	–	–	> 320
ME	MJ/kg DM	≥ 11.2 bzw. ≥ 10.8 ⁴⁾	≥ 11.0 bzw. ≥ 10.0 ⁴⁾	≥ 10.0 bzw. ≥ 9.0 ⁴⁾	≥ 11.4
OMD	%	≥76 bzw. ≥73 ⁴⁾	≥75 bzw. ≥70.0 ⁴⁾	≥70 bzw. ≥ 65.0 ⁴⁾	75
sidP	g/kg DM	82	≥83	≥82	83
RMD	g N/kg DM	+ 6	< + 7	< + 10	– 8

1) Depending on the grain content 2) 130–150 g/kg DM for arable grass silage 3) The aim is to minimise protein degradation in order to ensure high sidP values 4) 1st cut or subsequent cuts; aNDFom and ADFom – NDF and ADF after amylase digestion (a) and ashing (om); OMD – digestibility of organic matter; n.a. – not available



• Fibre digestibility

For the first time, information on fibre digestibility (NDFD in %) of roughage, succulent feed and concentrate feed is provided. This can be used to supplement the assessment of microbial performance from the feed which will be used in feed. A high proportion (>50%) of slowly digestible fibre carbohydrates in the feed ration, especially from roughage and other fibre-rich components of the ration, is recommended, as it provides just as much digestible energy as

sugar and starch. Compared to carbohydrates that are more readily available in the rumen, fibre carbohydrates also stabilise the rumen environment, as the energy-rich fermentation products – the fatty acids – are produced more slowly. The physical and chemical structural effect of the feed is measured in cattle using the physically effective NDF (peNDF).

Understanding the FAN value and assessing feed in a targeted manner

FAN is a measure of a cow’s feed intake based on its maintenance requirements. FAN 1 corresponds to the feed intake required to cover maintenance requirements alone.

FAN or FAN1 is calculated as 50 g DM per kg of metabolic body size (kg^{0.75}). The Lower Saxony Chamber of Agriculture provides an example with the following information:

For a cow with a body mass (BM) of 660 kg, this corresponds to a dry matter intake (DMI) of 6.5 kg (50 g * 130 kg) with a factor of 50 g DM/kg BM^{0.75}.

At higher FAN (FAN > 1), which then includes milk production or other outputs, feed passage is accelerated. This results in a reduction in retention time and thus in the breakdown of feed in the stomach/intestinal tract. This causes a decrease in ruminal digestibility and thus in ME and microbial protein content. The proportion of UDP increases.

Calculating the feed quality of silage

Target and guideline values for the analytically measurable parameters of feed value are shown in Table 2. The values refer to dairy cow and cattle feeding and they are based on maintenance level feeding (FAN1).

The values for grass and maize silage are listed. In the case of grass silage, energy and sidP values generally decrease from the first to subsequent cuts. In rations with a high maize content, grass silage often has to provide a higher crude protein content – the target values are 16% DM and above.

A key indicator of feed quality is OMD. The aim is to minimise protein degradation in the silo in order to ensure high sidP and sidAA values. An indicator of protein degradation in the silo is the proportion of protein or NPN (non-protein nitrogen) compounds in crude protein (CP). The protein is related to the proportion of undegraded feed crude protein (UDP) and thus contributes to higher sidP and sidAA levels.

To minimise protein degradation or transformation during ensiling, more than half of the crude protein should be in the form of true protein (intact amino acids). The starch content of maize silage must be considered. In addition to the amount of starch, its degradation behaviour is also important. As ripeness increases, the resistance of the starch in the forestomach increases. Silage partially breaks down the starch, reducing its resistance to approximately 12 weeks after silage is completed. The sugar content of grass silage should also be determined. The values shown are determined and estimated by analysing the roughage.

Conclusion

The new GfE standards (2023) require a fundamental change in feed evaluation. A key advantage is the evaluation of metabolisable energy (ME) based on the three-stage system for all ruminants. The digestibility of organic matter (DOM) is emerging as a new parameter. This is the decisive parameter for estimating the ME content and quantifying the possible microbial protein synthesis. Initial evaluations show that, especially with high OMD, the energy values are considerably higher than when using GfE (2001). The new system ensures international compatibility and brings feed evaluation in line with the current state of scientific knowledge.

Dr. Bernd Losand

German Agricultural Society (DLG) Frankfurt

Fon: +49 171 3863 543



Prof. Dr. Hubert Spiegers

Wörth-Wifling

Formerly Bavarian State Research Centre for Agriculture

Grub Retired since 1 July 2025

