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IN SEARCH OF THE PERFECT GRASS?

From the perspective of an animal nutrition specialist

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Dairy cows turn grass into milk and our desire to exploit this ability has helped shape the German cultural landscape we call "grassland". This relationship between grass and cattle is clearly desirable by the general public and has come to symbolise a natural, eco-friendly and animal-friendly farming system. Only one hundred years ago, around 90 % of our milk was produced from the energy and nutrients contained in grass but nowadays this ratio is only about 10 %.

Most of our milk is derived from silage maize and grain. Why doesn't grass play a greater role in dairy systems?

Faced with overproduction, low feed and food prices and growing prosperity, farmers have tended to focus on raising the performance of the individual cows. Around the middle of the 20th century, new maize varieties appeared on the German market which were better adapted to the prevailing climate, especially the cold.

„FOR GRASS TO BECOME THE MAIN COMPONENT IN THE FORAGE RATION, IT MUST MOVE THE WAY OF MAIZE.“

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The high energy content of the C4 cereal, ever rising yields and the fact that it became suitable for mechanical cropping have made this originally tropical crop so successful that it has now supplanted the majority of traditional forage growing systems. And as ever higher-performance cows require higher energy feeds, more and more maize silage is included in the ration. The only aspect that justifies the economical use of feed inputs that stem from the production of food for humans is the aspect of whether the fibre and nutrients contained therein are worth their price. So nowadays, high-performance cattle throughout the world produce milk from starch-rich concentrates and maize silage.

If we wanted to give a definition of what "perfect grass" is like, this would have to compare with the qualities of maize silage as to yield levels, nutritional value, crop management and ensilability. No easy task, because there are very few downsides to maize silage whose yields continue to rise and nutritional values are being improved by intensive breeding efforts.

Why do dairy farmers seem to find it so difficult to specify how much grass is exactly required in the ration?

Animal nutritionists often know to the nearest decimal point the energy and nutritional requirements of livestock and how the individual constituents interact in the rumen and beyond. Under current performance standards, grass is only one of many cogs in the machine. The proportion of grass in the ration and the nature of the

other components, whether it is grazed or fed as green forage, silage or hay, whether it is grown as a maincrop or as part of mixed grass ley – all these factors have a major impact on the requirements posed for what is „perfect grass".

What would be the „perfect grass“ to complement maize silage in the forage ration?

Structural components or NDF (neutral detergent fibre) make up virtually half the biomass of grass, so this substance group is extremely important. We know that ruminants need effective structural fibre in their diet. While this is widely acknowledged, it is nonetheless unpopular and considered something of a nuisance. Since the fibres in the plant cell wall have no nutritional value and are less digestible than other carbohydrates, they lead to a reduced feed intake while providing fewer nutrients, ultimately affecting the performance of high-performance breeds. Diets for high-performance dairy cows are therefore designed to provide the minimum level of

physically effective fibres while at the same time they are to maximise the energy that is supplied by the fibre at a level that leads to just about the pH levels required in the rumen. Cows eat less forage when it contains high levels of fibre, because rumination time is limited to approx. 9 hours per day and it takes about 3 hours to chew 1 kg of effective fibre. In addition, fibre-rich forage contributes significantly less energy to the ration, because fibre decreases digestibility. So for example,

to meet the requirement for 2.6 kg of effective fibre per day, a dairy cow would have to consume 10 kg DM grass silage containing 260g dietary fibre per day. This equates to an energy intake of 60 MJ NEL, i.e. enough energy to produce approx. 7 kg milk over and above the energy required for maintenance. If the ration is supplemented with up to 11 kg of concentrate by displacing a proportion of the forage intake, it will provide enough energy to produce 33 kg of milk per day. To obtain the same amount of fibre from silage maize, a cow must eat 16 kg DM containing a total of 105 MJ NEL. In addition it can take in up to 13 kg of concentrate to produce 47 kg of milk per day. So it's clear that fibrous forage is the limiting factor, and grass doesn't really stand a chance.

But picture a future scenario where grass is the main source of roughage for dairy cows. What would this "perfect grass" look like?

Our image of perfection all depends on the proportion it has in the ration. Taking this to extremes, we first have to decide whether we need a multiply 'highly gifted' or a 'savant' crop. If grass is to become the main supplier of fibre in the ration, it must move the way of maize. Because it is the energy and nutrient levels that determine the components that make up the ration and therefore will have to be taken into account in view of the restrictions on the total ratio and not so much in view of the other components.

So we need to define maximum levels for structural components, proteins and sugars and minimum levels for the energy contents (see Tab. 1), the latter being closely related to the digestibility of the structural components. Nowadays NDF digestibility is regarded as a key factor in determining the feed intake and milk performance. We know that the timing of the cut is a key factor for the nutritional value of grass. As the grass matures, lignification increases and the leaf/stem ratio decreases. So a flexible management approach is particularly important to ensure that grass is cut at the ideal time. We need high yields, i.e. growth heights, but at the same time, somewhat conflictingly, very limited lignification. During the main ripening phase of grass, cellulose and lignin should grow at a rate < 3 and 0.5 g per kg dry matter per day.

And what kind of grass do we need in maize-dominated rations?

Here we can take a completely different approach, without thinking along "extensive" lines. As well as starch, maize silage adds more digestible NDF to the ration but the short chop lengths reduce the effective percentage of fibre. This means that there is no need to dramatically reduce the amount of effective fibre or increase the fibre digestibility of grass used to complement maize silage in the ration. Furthermore, while maize silage lacks soluble nitrogen, it is produced in sufficient quantities by proteolysis and desmolysis in grass silage. This means that a greater intake of nitrogen compounds (normally ammonium and nitrate) is acceptable. However, due to high starch content of the maize forage, the complementary grass forage must contain only a limited amount of sugar to avoid exceeding the limit of fermentable reserve carbohydrates in the total ration (approx. 250 g/kg DM in the total ration). Grass and preserved grass used in maize-dominated, high-performance dairy rations (> 75 % maize silage in the forage ration) should contain moderate fibre levels, slightly higher protein levels, but still reduced sugar levels (see Tab. 1).

Tab. 1: Nutritional requirements on grass for grass- and maize-dominated rations*

		Grass-dominated	Maize-dominated
Cellulose	g/kg TM	< 230	< 250
Hemicellulose	g/kg TM	< 180	< 190
NDF	g/kg TM	< 410	< 460
NDF digestibility	%	> 60	> 50
Ruminal NDF decomposition rate	% je h	> 4	> 3
ADF	g/kg TM	< 240	< 270
ADL	g/kg TM	< 20	< 25
Crude fibre	g/kg TM	< 230	< 250
Crude protein	g/kg TM	< 150	< 170
Protein solubility	% des RP	< 45	< 55
UDP	% des RP	> 25	> 15
Pure protein	% des RP	> 60	> 50
Sugar	g/kg TM	< 100	< 100
Fructans	g/kg TM	< 50	< 50
NEL	MJ/kg TM	> 6,4	> 6,0

Source: ADF acid detergent fibre, ADL acid detergent lignin, NDF neutral detergent fibre, NEL net energy lactation, DM dry matter, UDP undegradable dietary protein
*> 70 % grass and silage maize in DM of the fibrous forage ration

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Felgentreu receives soil ambassador award

The German Healthy Soil Association (Interessengemeinschaft gesunder Boden) has presented Christoph Felgentreu (DSV cover crop product manager) with a "Soil Ambassador" award in recognition of his tireless efforts to promote healthy soil as a basis for healthy plants, animals and people.