HIGH-QUALITY FORAGE REDUCES COSTS

Grass silage and maize silage are the main feed crops in dairy farming. Maize silage supplies most of the energy and adds protein and structure to the basic ration whereas grass silage supplies not only a significant amount of the required protein but also energy and most of the structure. Any product is only as good as its ingredients. This also applies to maize or grass that go into animal feeds.

Forage quality is one of the factors that control milk performance.

As ruminants, dairy cows require a specific composition of their feed. The optimum composition of energy in the form of volatile fatty acids and most of the protein are produced in the rumen. The feed must be such that the rumen remains healthy and the cow productive; and it must ensure sufficient ruminating. This is important for the proper processing of the rumen contents, for salivation and for buffering rumen pH. Yet this takes an adequate amount of structure in the ration (fibres of minimum 8mm length). After all, the "rumen system" is actually designed to digest slowly-degradable structure substances such as hemipectins, cellulose and pectins.

There are different types of microbes which, depending on their relative numbers, ferment carbohydrates into volatile fatty acids: acetic, butyric and propionic acids that trigger the energy metabolism in cows. If the rumen contains too many rapidly degradable carbohydrates from concentrate feeds such as grain, the rumen environment will change towards being more beneficial for propionic acid producing microbes. The effect of this is that the pH level drops below 6.2, which in the long run leads to acidosis. Therefore it is necessary to limit the amount of concentrate feed in the ration and ensure that roughage makes up at least 70% of the total dry matter being fed in order to provide the necessary structure that is indeed necessary for the cow to take in concentrates in the first place.

TABLE 1: GUIDELINE ON INGREDIENTS IN HIGH-QUALITY GRASS SILAGE

Ingredient	Unit	1st cut	Subsequent cuts
Crude ash	g/kg DM	< 90	< 100
Crude protein	g/kg DM	> 160	> 170
ADFom	g/kg DM	< 260	< 280
aNDFom	g/kg DM	< 430	< 460
Gas formation	ml/200 mg DM	≥ 49	≥ 45
NEL	MJ/kg DM	≥ 6.4	≥ 6.1
MU	MJ/kg DM	≥ 10,6	≥ 10.2

However, as the rumen can take in only a limited amount of feed, the energy density of the ration and hence the roughage must be high for the cow to be productive. This suggests that milk yields depend on the quality of the forage and that most of the nutrients must be supplied by the grass and maize silage.

What are the benefits of maize silage?

Maize silage adds structure to the ration. Yet as hay and straw are much more effective in this respect the primary reason for using maize silage is that it also adds energy to the ration. Approximately 50-60% of this energy is supplied by the cob and 40-50% by the stover. Consequently, the cob : stover ratio is a good way to control digestibility and starch content as well as the energy content.

Since some of the energy is supplied by the stover, stover digestibility is also important. Most important is however that maize silage delivers its full specific energy potential. This is available when the dry matter content of the mature kernels is approx. 55-60%. Therefore, to make sure that the cobs have reached full ripeness at harvest date growers should make sure to choose the proper group of ripeness that matches the local conditions. Early maturing varieties as typified by low growing degree units tend to offer a better digestibility. This suggests that it is a matter of crop and feed management to achieve the required energy concentration in maize silage; which is done by choosing the proper variety, cutting at the right height and getting the cob : stover ratio right.

Grass silage is an important component in the ration

Grass offers a significantly larger range of ingredients than maize silage. Table 1 lists some of these as a guideline for the ingredients in high-quality grass silage. Variations in the quality naturally have an effect on any addition of concentrates and ingredients to the ration and as such on costs and productivity. Table 2 shows mixed rations designed for producing approximately 30kg of milk; these ratios are made up of various grass silages and different energy contents. The ingredients listed here were measured in grass silage that was harvested in Bavaria in the first 2021 cut. The table shows the silage quality by energy content, listing the averaged, the lower 25% and the top 25% quality results. The focus is on the supply of protein, energy, structure (aNDFom = Neutral Detergent Fibre after amylase treatment and ashing) and rumen-degradable carbohydrates. The ratio of maize silage and mineral feed in the ration is therefore not changed while energy and protein concentrates are

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The primary aim of feeding maize silage is the provision energy by this type of roughage.

Higher energy and protein levels in the grass silage translate into higher energy and protein levels in the total roughage.

TABLE 2.: MIXED RATIONS CONTAINING GRASS SILAGE OF DIFFERENT ENERGY AND PROTEIN LEVELS

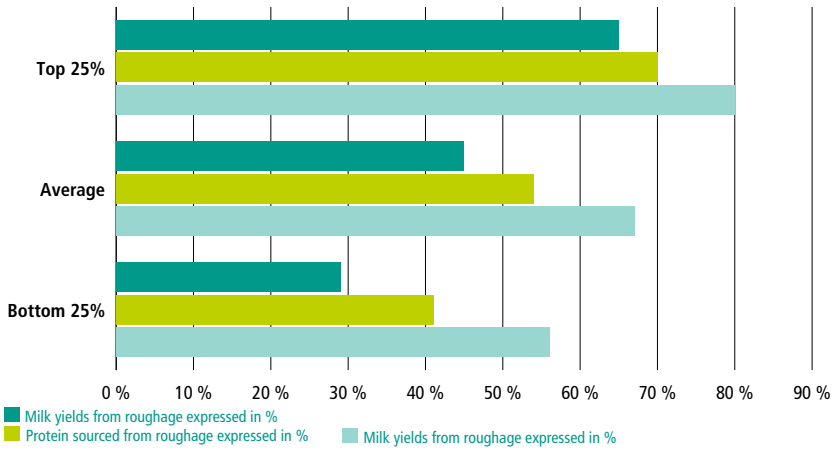
Mixed ration for 30kg milk yields per cow and day		Grass silages		
		6.1 MJ NEL/kg DM, 147 XP	5.4 MJ NEL/kg DM, 121 XP	6.7 MJ NEL/kg DM, 169 XP
	€/100 kg FM	Feed intake in kg FM per cow and day		
Maize silage (6.6 MJ NEL, 73 g XP))	5.00	20.0	20.0	20.0
Grass silage, 1st cut 2021	7.00	20.0	17.0	23.0
Hay 2020 (5.4 MJ NEL, 101 g XP)	12.00	1.0	1.0	1.0
50 wheat : 50 barley	20.00	1.8	1.7	0.7
Grain maize	25.00	2.0	3.0	1.5
Carbonic acid lime	11.00	0.03	0.03	0.05
Cattle salt	8.00	0.04	0.04	0.04
Rapeseed extraction	38.00	3.0	4.0	2.0
22/2 mineral feed	60.00	0.1	0.1	0.1
Ingredients and costs by ration				
Milk yields from	kg	13.5	8.8	19.5
Rumen-digestible carbohydrates	g/kg DM	22.3	22.6	21.7
aNDFom (roughage	g/kg DM	30.8	28.,6	33.3
Costs per ration	€/animal	4.55	4,.99	4.06

added until yields reach 30kg at balanced energy and protein levels. As the energy content increases, digestibility increases and feed intake increases, too, – on average by approximately 1kg of fresh mass per 0.2 MJ NEL/kg DM. As the energy and protein levels in grass silage increase, the total concentration of energy and protein in the total roughage feed per ration increases, too. Consequently, it is possible to reduce concentrate feeds. This in turn sees the amount of structure increase in the total ration. The minimum percentage of structure should be 28% of roughage-sourced aNDFom when feeding the full concentrate prescription. If it is possible to maintain milk yields while reducing concentrate feeds, it will also be possible to reduce the amount of grain in the ration. This statement is made against the backdrop that for preventing acidosis rumen-degradable carbohydrates should not account for more than 25% in the total ration that contains the full concentrate prescription.

Any energy required beyond that must be supplied by rumen-stable starch. As grass silage contains more protein, feeding this silage allows farmers to reduce energy feeds and (expensive) protein feeds.

Consequently, the costs for the entire ration drop, with savings increasing even further when concentrate feed prices rise. Last but not least, high-quality grass silage not only leads to higher milk yields from roughage (see illustration), but makes it possible to boost performance through feeding in the first place.

FIGURE 1: GRASS SILAGE QUALITY AND ITS EFFECT ON MILK YIELDS



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