Investigations on Feeding Value of Artificially Dehydrated and Compacted Grass (Grass Cobs) in Dairy Cows

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Abstract

A feeding trial in 48 dairy cows was conducted to evaluate the effects of partial replacement of grass silage and concentrates by artificially dehydrated and compacted grass (grass cobs). The feeding trial was conducted over a period of 12 weeks. Based on data of a 2 week pre-period, cows were evenly distributed to 2 feeding groups ("control" and "cobs") considering breed, milk yield and milk constituents, feed intake, stage of lactation, and body condition. The control group was offered a grass silage based total mixed diet (TMR) allowing a daily milk production of about 35 kg based on energy and nutrient concentration. Portion of concentrates and maize silage of the control diet was 41 % and 20 % of DM, respectively. In the diet of cobs group, about 25 % of DM grass cobs were included in replacement of grass silage and concentrates.

There were no treatment effects on daily feed intake which was slightly above 23 kg DM/animal and day. Energy intake was slightly higher in control group compared to the cobs group. Milk yield, milk composition and body composition was not significantly influenced by dietary treatment.

Data of the feeding trial show, that feeding of high amounts of grass cobs to dairy cows is basically possible. At the same time, heat treatment has the potential to allow the production of high-quality roughages, independently of current climatic conditions. Moreover, technical heat treatment enhances concentration of ruminal undegradable protein (UDP) in cobs compared to untreated grass or grass silage. If composition of total diet and concentrates is adapted accordingly, inclusion of grass cobs in the diet allows to reduce portion of protein concentrates in the diets.

It is demonstrated, that the technique of artificially drying and compacting grass (production of grass cobs) allows to produce high quality forage, independently of current climatic conditions. The compacted material has some advantages for handling in feeding practice and in transport. It is also demonstrated that the production of grass cobs needs a relatively high energy input, what is especially discussed controversially, when no regenerative energy is available. Thus, one more message of the session is that production of grass cobs is especially promising when very high-quality raw material is used. Besides presentation of data from a feeding trial in dairy cows (see below), data on feeding quality of grass products from the area of Bavaria is presented.

Introduction

Harvesting hay with a high quality in respect to energy and nutrients is often limited by climatic conditions, or in other words by comparatively short periods with high temperature and without any rainfall. For this reason, especially in southern Germany production of artificially dehydrated grass and other crops has a high relevance. Besides the production of hay bales, the artificially dehydrated grass is often short cut and compacted to so called grass cobs. Artificial dehydration allows to preserve the grass in a conservative manner and to reduce nutrient losses. Moreover, it is assumed that heat treatment leads to an enhanced portion of ruminal undegradable protein (UDP) (current assumption: 40 % UDP of crude protein), what may increase the amount of protein reaching the duodenum of ruminants. However, information on the effects of inclusion of high levels of grass cobs in rations for dairy cows on feed intake and milk yield are scarce. For this reason, the present feeding trial was conducted to evaluate the replacement of concentrates and grass silage in rations of dairy cows on feed intake and performance. The study was financed by the Bavarian governmental program on home-grown protein rich feedstuff.

Material and Methods

The feeding trial involved 48 dairy cows (30 Simmental and 18 Brown Swiss) and was conducted over a period of 12 weeks. Based on data of a 2 week pre-period, cows were evenly distributed to 2 feeding groups (“control” and “cobs”) considering breed, milk yield and milk composition, feed intake stage of lactation and body condition. At the start of the experiment, cows had 119±61 days in milk of the third lactation.

Table 1: Composition of the TMR and concentrates and nutrient and energy concentration of diets

	Treatment	
	Control	Cobs
	% of DM	
Composition of the TMR		
Grass silage	37.8	25.3
Maize silage	20.4	20.2
Straw	0.8	-
Grass cobs	-	24.6
Concentrates	41.1	29.9
Composition of concentrates, % of DM		
Wheat	18.4	32. 8
Corn	31.0	45.1
Urea	-	1.3
Rape seed meal, extracted	29.7	17.7
Dried beet pulp	19.7	-
Feed fat	-	1.51

Minerals, Vitamins	1.15	1.58
	Ingredients of TMR	
NEL, MJ/kg DM	7.1	7.0
CP, g/kg DM	156	154
Utilizable CP (uCP), g/kg DM	160	162
Ruminal N-Balance (RNB), g/kg DM	-0.6	-1.3
CF, g/kg DM	159	153

The aim of diet formulation was to offer nutrient and energy balanced diets in both groups, and to ensure that diets of both groups did not differ in nutrient and energy concentration. The control group was offered a grass silage based total mixed diet (TMR) allowing a daily milk production of about 35 kg based on energy and nutrient concentration. Portion of concentrates and maize silage of the control diet was 41 % and 20 % of DM, respectively. In the diet of cobs group, about 25 % of DM grass cobs were included in replacement of grass silage and concentrates (Tab. 1). In order to have similar nutrient and energy concentration as in the TMR of control group, portion of extracted rape seed meal was reduced but feed fat was included in concentrates for the cobs group. Nutrient and energy concentration of the single feedstuffs is given in Tab 2. Chemical analysis of the cobs confirmed a concentration of 41 % undegradable CP (UDP) in CP. For protein evaluation the german system of utilizable crude protein (uCP) and ruminal-nitrogen-balance (RNB) is used. Individual feed intake and milk yield were recorded daily. Milk constituents were determined weekly on a mixed sample of a whole day milking. BCS and RFD were measured at start, middle and end of the experiment. Nutrient concentration of feedstuffs was analyzed according to Naumann et al. (1997). Data were analyzed by a one-factorial model using SAS (proc GLM).

Table 2: Nutrient and energy concentration of feedstuffs

Feedstuff	DM	CA	CP	CL	CF	uCP	NEL
	g/kg			g/kg DM			MJ/kg DM
Grass cobs (week 1-9)	924	137	167	43	198	168	6.4
Grass cobs (week 10-12)	902	65	135	29	184	157	6.7
Concentrates group „Cobs“	883	40	193	48	43	188	8.2
Concentrates control group	888	54	190	38	86	184	7.9
Maize silage	351	33	82	31	187	135	6.7
Grass silage	324	103	163	46	229	142	6.5

Results and Discussion

Daily feed intake was slightly above 23 kg DM/d with no differences among feeding groups (Table 3). Over the course of the experiment, feed intake remained at a constant level in both groups. Given that energy concentration of roughage and concentrates portion of total diet was higher in the control group, according to DLG (2006) a higher total feed intake was expected for animals in the control group. In the cobs group, 5.2 kg TM grass silage, 5.9 kg DM grass cobs and 7.2 kg DM concentrates were consumed daily, in the control group daily intake was 7.8 kg TM grass silage and 10.1 kg DM concentrates. Daily energy intake in control group was slightly higher than in the cobs group, daily intake of uCP was slightly lower.

Table 3: Mean DM, energy and nutrient intake (mean ± standard deviation)

	Treatment					
	Control			Cobs		
Feed intake, kg DM/animal, day	23.3	±	3.4	23.2	±	2.4
Energy intake, MJ NEL/animal, day	166	±	24	163	±	17
CP- intake, g/animal, day	3634	±	531	3577	±	360
uCP- intake, g/animal, day	3727	±	545	3750	±	380
RNB, g/day	-15	±	2	-28	±	3

Daily milk yield was on average 34.3 und 32.7 kg for the cobs and the control group, respectively. (Table 4). Differences among groups were not statistically significant and cannot be explained by differences in energy intake. The increase in back fat depth and Body condition score in the course of the experiment in both groups suggests that energy intake in both groups was sufficient for deposition of body reserves and not limiting for milk production in all animals. Although the intake of uCP as calculated according to GfE (2001) was above the animal requirement.

In summary the results demonstrate that a high portion of grass cobs in the diet for dairy cows at a simultaneously reduced portion of concentrates allows a high daily milk production in the case that the composition of concentrates allows a total dietary energy and nutrient concentration which covers the cows requirements. Milk fat and protein concentrations showed only minor differences between groups and were within the expected range. Milk urea concentration was at the lower range of recommendations what reflects the negative ruminal nitrogen balance of diets.

Conclusions

Data of the feeding trial show, that feeding of high amounts of grass cobs to dairy cows is generally possible. At the same time, heat treatment has the potential to allow the production of high-quality roughages, independently of current climatic conditions. Comparable to the situation in artificially dried alfalfa (Engelhard and Scholz, 2013), technical heat treatment enhances concentration of ruminal undegradable protein in cobs compared to untreated grass or grass silage. If composition of total diet and concentrates is adapted accordingly, inclusion of grass cobs in the diet allows to reduce portion of protein concentrates in the diets. Because of the high energy input for technical drying process and the resulting economic input, production of artificially died grass cobs is recommended especially when very high quality grass is used as a raw material.

Table 4: Milk yield, milk constituents and Body condition (mean ± standard deviation)

	Treatment					
	Control			Control		
Milk yield, kg/animal, day	32.7	±	6.4	34.3	±	5.6
Milk fat, %	4.05	±	0.36	3.98	±	0.31
Milk protein, %	3.72	±	0.25	3.67	±	0.26
ECM, kg/animal, day	33.5	±	6.1	34.8	±	5.5
Milk urea, mg/l	153	±	38	151	±	25
BCS, start of experiment	3.89	±	0.53	3.84	±	0.43
BCS, end of experiment	4.07	±	0.75	3.99	±	0.47
BFT, start of experiment, mm	20.5	±	6.7	21.0	±	7.3
BFT, end of experiment, mm	24.4	±	8.4	23.5	±	7.5

ECM - energy corrected milk; BCS – body condition score; BFT – back fat depth

Literature

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