Early or Normal cut Grass Silage for Dairy Cows in Organic Farming

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INTRODUCTION

The sub-arctic climate of northern Norway provides challenges to organic farmers who want to be self-sufficient with feed. Early harvested grass has higher nutritional value than grass harvested at normal time and may, due to low crop yields, be chosen when acerage is not a limiting factor. Silage of early harvested clover grass may reduce the need of supplementary protein feeds and concentrates in the ration. Traditionally, many farmers in Northern Norway harvest grass at a relatively late stage of maturity, and supplement with relatively high levels of concentrates.

MATERIALS AND METHODS

Early cut organic grass silage (roundbales) was compared with silage harvested 17 days (180 daydegrees) later in a continuous production experiment with 32 Norwegian Red dairy cows (24 multiparous and 8 primiparous cows) in early lactation (63 ±21 d.i.m.). The experiment was carried out in Bodø, Norway (67° 17" N, 14° 23" E). A half of the cows received a feed ration with 40% concentrates (H), and the other half 10% (L) on an annual energy basis. During the experiment, this made up, on a daily basis, 944 g DM fishmeal (587 g/kg DM CP, 48 g/kg DM fat) plus mineral and vitamin supplements to all cows, plus for cows on H 4.7 and cows on L 1.0 kg DM of cereals containing barley, oats, and some peas (dried oats-barley: 120 g/kg DM CP, 247 g/kg DM NDF, 51 g/kg DM starch; ensiled oats-pea: 126 g/kg DM CP, 226 g/kg DM NDF, 43 g/kg DM starch). Early cut silage (June 11, 2004) was harvested when timothy axes were perceptible in the stem and normal cut (June 28, 2004) when timothy axes were completely visible. The roundbale grass silage was acid treated (Ensimax, early cut 5.0 l/t, normal cut 3.0 l/t; 213 g/kg formic acid, 200 g/kg acetic acid; Borregaard Industries, Sarpsborg, Norway) and fed *ad libitum.* The harvesting time had no significant effect on the botanical composition of the clover grass (average: timothy (*Phleum pratense* L.) 478 g/kg DM, meadow fescue (*Festuca pratensis* L.) 163 g/kg DM, other grass species 230 g/kg DM, red clover (*Trifolium pratense* L.) 30 g/kg DM, white clover (*Trifolium repens* L.) 3 g/kg DM, herbs 95 g/kg DM).
Data were analyzed using analysis of variance with the GML model procedures of SAS. Results regarding milk yield and milk composition were covariance corrected for data from the preliminary period, whereas data pertaining to feed intake and BW changes were analyzed without covariance correction, since no reliable covariate existed for these parameters.

RESULTS AND DISCUSSION

Early cut resulted in lower crop yields (2.17 t DM/ha) compared with normal cut (4.66 t DM/ha). Energy and protein concentrations were higher for early cut than for normal cut silage (6.4 vs. 5.6 MJ NE_l, as assessed by NIRS, 136 vs. 105 g/kg DM CP). Both silages were mainly well preserved, with minor amounts of butyric acid and low NH_3-N values (Table 1). Ethanol concentrations, however, were high in both silages. The low levels of WSC in the silage were most probably due to the extensive ethanol fermentation. Driehuis and van Wikselaar (1996) reported levels up to 57 g/kg DM in silages with ethanol as the major fermentation product.

Table 1. Composition of 1st cut silages, cut early or at a normal time

	n	Early[1)]	Normal[1)]	s.e.m.	*p*
DM, g/kg	22	296	271	8.7	0.1
OM, g/kg DM	5	935	943	1.9	0.02
CP, g/kg DM	5	136	105	3.7	0.0005
NDF, g/kg DM	5	414	569	6.8	< 0.0001
ADF, g/kg DM	5	222	318	2.5	< 0.0001
ADL, g/kg DM	5	16	23	1.2	0.007
WSC, g/kg DM	6	20	8	3.0	0.02
Crude fat (EE), g/kg DM	5	37.2	29.9	0.94	0.0008
Lactic acid, g/kg DM	6	41	48	7.4	NS[2)]
Acetic, g/kg DM	6	19	20	2.3	NS
Formic acid, g/kg DM	6	2.4	4.1	0.52	0.11
Butyric acid, g/kg DM	6	0.7	0.1	0.21	0.10
Ethanol, g/kg DM	6	26	34	4.4	NS
NH_3-N, g/kg TN	5	40.5	45.0	5.37	NS
pH	6	4.31	4.08	0.072	0.02

[1)] Concentrations weighted according to the number of days each silage portion was used
[2)] $p \geq 0.2$

Cows on H refused to eat 1.9 kg of their daily concentrate allotment when fed the early cut silage. When fed the normal cut silage, however, only 0.3 kg was left over. Also Thuen (pers. comm., 2006) experienced poor palatability of rolled barley to dairy cows in organic production when cows were offered high quality grass silage *ad libitum*. Silage, total DM and total NDF intakes were in general high in the present experiment (Table 2). Intake of early cut silage was significantly higher than normal cut silage. Total ration intake was only slightly higher on H than on L, but milk yields were notably higher on H, possibly due to the higher energy concentration in ration H than L. The production level in L might also have been limited by adaptation to low concentrate levels over several lactations. Cows in L fed normal cut silage had the lowest feed energy concentration and lost body weigh and reduced body condition score during the experiment. Cows in H fed normal cut silage gained body weight and maintained body condition score. Cows fed early cut silage gained body weight and body condition score both on H and L. Although the same roundbaler and silage bale chopper was used, median chop length of silage was 94 mm for early cut and 136 mm for normal cut (measured on 3 samples), due to different physical conditions of the two crops.

Cows at H produced 27.5 kg ECM per day with early cut silage and 25.3 kg ECM with normal cut silage, and cows at L produced respectively 24.7 and 22.4 kg ECM. Cows offered early cut silage had highest milk protein concentration (H: 34.6 vs. 32.8; L: 34.4 vs. 31.4 g/kg). Also Rinne *et al.* (1999) found higher milk yields at early maturity stage but smaller differences in milk protein concentration, with the highest level at the second of four cutting times. In the present experiment the harvesting time did not influence the sensoric quality of milk, but low concentrate level reduced the milk taste slightly. Although milk free fatty acid levels were low, they were significantly higher for cows fed normal, than early cut silage on both H and L concentrate level. This may relate to the lower energy concentration in the latest cut silage.

Table 2. Feed intake, production, body weight (BW), body condition score (BCS), and N-utilization

Concentrate level (annual):	High (40% on energy basis)				Low (10% on energy basis)			
Cutting time 1st cut:	Early	Normal	s.e.m.	*p*	Early	Normal	s.e.m.	*p*
Silage DM, kg	17.1	14.6	0.66	0.02	16.7	15.4	0.66	0.18
Concentrate DM, kg [1)]	3.72	5.31	0.367	0.008	1.94	1.98	0.017	0.09
Total ration DM, g/kg BW	35.3	34.0	1.24	NS [2)]	34.3	32.7	0.87	NS
Total ration NDF, g/kg BW	13.3	16.1	0.49	0.001	13.3	17.0	0.42	< 0.001
Milk, kg	26.3	23.9	0.84	0.07	23.3	21.4	0.79	0.11
ECM, kg	27.5	25.3	1.07	0.16	24.7	22.4	0.98	0.13
Milk fat, g/kg	43.3	44.5	0.92	NS	45.0	44.9	1.04	NS
Milk protein, g/kg	34.6	32.8	0.52	0.03	34.4	31.4	0.52	0.002
Milk lactose, g/kg	45.8	47.1	0.55	0.11	45.8	46.9	0.33	0.04
Milk urea, mM	3.37	3.36	0.090	NS	3.43	3.46	0.052	NS
Milk FFA IR, meq/l	0.38	0.60	0.032	< 0.001	0.58	0.76	0.064	0.060
Milk taste score [3)]	4.28	4.19	0.160	NS	3.80	3.93	0.172	NS
BW (initial), kg	584	587			543	539		
BW change, g/d	397	255	88.6	NS	380	-114	98.7	0.003
BCS (initial), points [4)]	3.16	3.30			3.10	2.98		
BCS change, points/100 d	0.38	0.00	0.116	0.03	0.35	-0.17	0.149	0.03
Milk N/feed N	0.272	0.290	0.0118	NS	0.266	0.282	0.0077	0.16

[1)] Differences due to concentrate left-overs: H: Early 1.90, Normal 0.30, L: Early 0.07, Normal 0.0
[2)] $p \geq 0.2$
[3)] Five point scale, where 1 = poor quality milk and 5 = high quality milk with no deviation from normal taste
[4)] Five point scale with 0.25 point intervals, where 1 = emaciated and 5 = very fat animals

CONCLUSIONS

Feeding early cut silage of an organic ley increased feed intake, milk yield and milk protein concentration compared with normal cut. Left-overs of concentrates were a problem in the experiment and ways to improve the palatability of on farm produced cereals have to be developed. Early cut crop yields were only about half of the crop yield at normal cut. Therefore early cut may only be recommended to farmers in northern Norway when acerage is not a limiting factor.

REFERENCES

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