HERBAGE QUALITY AT CONTINUOUS GRAZING WITH DAIRY COWS AT DIFFERENT N-INTAKES AND SWARD TYPES

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ABSTRACT
Herbage quality was examined in paddocks continuously grazed by dairy cows fed supplements with low and high N. There were two sward types for each level of supplement, i.e. fertilized perennial ryegrass (Lolium perenne L) and unfertilized perennial ryegrass/white clover (Trifolium repens L) with a mean clover content of 49 % of dry matter. Decreasing N-intake from 307 to 140 g N cow $^{-1}$ d $^{-1}$ by feeding low-N supplements had a small influence on herbage quality in spite of the reduced N-output via urine and faeces. Variation in herbage quality was large during the growing season. The fibre concentration peaked in late summer, whereas the crude protein concentration increased throughout the growing season. The effective degradability of protein in the rumen was directly correlated with *in vitro* organic matter degradability. Clover/grass had higher protein degradability than pure grass in the second half of the grazing season.

KEYWORDS
Herbage quality, protein value, grazing, ryegrass, clover

INTRODUCTION
Improved management of continuously grazed swards by dairy cows has led to higher concentrations of crude protein (CP) and digestibility of the herbage. High content of white clover in the sward in Denmark has further increased the CP-concentration. The balance between CP and energy in the pasture is not proper for nutritional needs for dairy cows and results in low N-utilization and N-losses in the urine (Van Vuuren and Meijs, 1987). This can be minimized by feeding dairy cows with low-protein/high-energy supplements (Valk and Hobbelink, 1992). The objective of this study was to estimate the effect of white clover in the sward and N-level in the supplements on herbage quality.

MATERIALS AND METHODS
Four groups of 16 dairy cows continuously grazed an unfertilized white clover/perennial ryegrass and a perennial ryegrass fertilized with 300 kg N ha^{-1} y^{-1} in six equal dressings from April to September. On each sward type in 1994 and 1995 cows were either fed supplements with low-N 140 or supplements with high-N 307 g N cow^{-1} d^{-1}, respectively. Pastures were established in 1993 with two replications and were irrigated at 50 mm water deficit. The grazing period lasted from early May to mid October, and the grazing pressure was adjusted by moving of buffer fence. The area was regulated once weekly from May to June to maintain a sward height of 7 cm. From July and onwards, the area was regulated to maintain a certain proportion of rejected areas around dung pats; increasing from 7 % in June to 22 % in September. The average stocking rate over years was 4.9 cows ha^{-1}. Herbage samples were cut at grazing height seven times in 6 x 0.25 m^2 areas in each pasture during the grazing period. Rejected herbage around dung pats were not included. Herbage was analyzed for neutral detergent fibre (NDF), acid detergent fibre (ADF), and acid detergent lignin (ADL) (van Soest), in vitro organic matter degradability (IVOMD) (Tilley and Terry), crude protein (CP) (Dumas), *in sacco* effective protein degradability in the rumen (EPD) and true digestibility of original protein in the small intestine (TDOP) (Madsen et al., 1995) and minerals.

RESULTS AND DISCUSSION
High-N in the supplements compared to low-N resulted in a higher excretion of N in urine and faeces. The increase was estimated at 155 kg N ha^{-1} y^{-1} averaged over years. Milk production increased only slightly from 25.2 to 26.3 kg energy corrected milk cow^{-1} d^{-1} (Søegaard and Aaes, 1996).

In Table 1, herbage quality is shown for the middle part of the grazing season. In general, herbage quality was more affected by sward type than by level of N-intake from supplements. The content of white clover was relatively high, 49% of DM above grazing height averaged over years. Concentration of CP and composition of fibre were especially affected by clover in the sward. Ca was the mineral which was most affected by clover. High-N in the supplements resulted in a lower clover content in the sward due to the higher N-content in urine and dung. On average the clover was reduced from 53 to 47% of DM. The reduction in clover content decreased the concentration of ADL and increased the concentration of NDF. The concentration of CP in herbage was not affected by N level in supplement, which may result from a reduction in clover content and an increase in N-output of urine and dung. In pure grass, the N-level in supplements had a very small effect on the herbage quality. Concentration of CP tended to be higher when feeding high-N supplements. The effect on herbage quality when increasing N in supplements was generally low compared with applying N-fertilizers at a comparable rate.

In Table 2, the seasonal pattern of herbage quality is shown. The content of fibre (ADF, NDF and ADL) peaked in the late summer coincident with high temperatures. Changes in concentration of IVOMD were inversely related to changes in fibre concentration (data not shown). The concentration of CP increased during the grazing season and reached very high concentrations in the last part. The low CP concentration in clover/grass in spring was due to a low clover content in spring in 1994. Sward height was nearly constant during the grazing season. Therefore herbage mass was also nearly constant (data not shown). The true digestibility of original protein (TDOP), which has a great effect on the amino acid absorption of rumen undegradable protein, was independent of CP-concentration in herbage and white clover in the sward and decreased slightly with increasing fibre concentration. The effective protein degradability (EPD) was also independent of the CP-concentration in herbage, but decreased with increasing ADF concentration and decreasing IVOMD concentration independently of sward type (EPD = 114 + 0.8 IVOMD, $R^2 = 0.55$). This can be due to an increasing fraction of protein bound to the cell walls at increasing cell wall concentration. The EPD was higher in clover/grass than in grass in the last part of the grazing season. This is in conflict with results of Steg et al. (1994), who in cut swards reported a higher degradable CP fraction in clover than in grass throughout the whole season.

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Table 1

Herbage quality of pure grass or clover/grass sward grazed by dairy cows. The cows were fed supplements with either low-N or high-N. Values are an average of four samples taken from 15 June to 10 September, 1994-95.

	Grass		Clover/grass	
	Low-N	High-N	Low-N	High-N
	g kg DM^{-1}			
NDF	427^{a}	417^{a}	321^{b}	340^{b}
ADF	230	229	220	219
ADL	20[1]	25[1]	34[1]	29[1]
IVOMD[2]	788	792	802	801
CP	219^{a}	238^{ab}	263^{b}	263^{b}
K	24	24	24	24
Na	2.5^{a}	2.5^{a}	1.7^{b}	1.5^{c}
Mg	2.0^{a}	2.0^{a}	1.9^{b}	2.0^{a}
Ca	5.2^{a}	5.5^{a}	9.2^{b}	9.2^{b}

$^{a, b, c}$ Mean values with different superscripts differ significantly ($P< 0.05$).
[1] Significant sward by supplement interaction
[2] g kg OM^{-1}

Table 2

Seasonal pattern of herbage quality of pure grass (G) or clover/grass (CG) grazed by dairy cows. The cows were fed supplements with low-N. 1994-95.

	TDOP[a]		EPD[b]		CP[c]		ADF[d]	
Week[e]	G	CG	G	CG	G	CG	G	CG
	g kg N^{-1}				g kg DM^{-1}			
20	917	928	773	770	181	131	208	176
22	918	937	744	730	163	188	210	199
25	925	928	746	744	213	200	214	205
29	923	911	724	706	194	256	226	252
32	906	917	669	718	213	275	252	220
36	926	932	714	754	250	331	227	201
40	929	920	744	787	281	281	195	200
Mean	**921**	**925**	**731**	**744**	**213**	**238**	**219**	**208**

[a] True digestibility of original protein in the small intestine [b] effective protein degradability in the rumen
[c] crude protein [d] acid detergent fibre [e] number of weeks from 1 January.