NDF Digestion in Dairy Cows Fed Grass or Red Clover Silages Cut at Two Stages of Growth

K. Kuoppala
MTT Agrifood Research, Finland

S. Ahvenjärvi
MTT Agrifood Research, Finland

M. Rinne
MTT Agrifood Research, Finland

A. Vanhatalo
University of Helsinki, Finland

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K. Kuoppala[1], S. Ahvenjärvi[1], M. Rinne[1] and A. Vanhatalo[2]
[1]*MTT Agrifood Research Finland, Animal Production Research, FI-31600 Jokioinen, Finland, Email: kaisa.kuoppala@mtt.fi,* [2]*University of Helsinki, Department of Animal Science, P.O. Box 28, FI-00014 University of Helsinki, Finland*

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Introduction Increasing demand for organic dairy products has encouraged research on red clover, as it is an important plant species in organic farming systems. The objective of this experiment was to investigate the effects of plant species and growth stage on NDF digestion in dairy cows.

Materials and methods Four silages were made from primary growth: two grass silages (G) from mixed timothy (*Phleum pratense*) meadow fescue (*Festuca pratensis*) swards and two red clover (*Trifolium pratense)* silages (R), in 2003 in Jokioinen, Finland (61°N). G silages were harvested on 17 June at early (G_E) and on 26 June at late (G_L) growth stage and R silages on 2 July at early (R_E) and on 16 July at late (R_L) growth stage. The sward was cut with a mower conditioner, wilted for approximately 4 h and harvested with a precision chop harvester. Silages were preserved with a formic-acid based additive (5 l/t for G and 6 l/t for R silages) in bunker silos or clamps. These four pure silages and a mixture of G_L and R_E (G_LR_E, 1:1 on DM basis) were fed with 9 kg/d concentrates to five rumen cannulated dairy cows in a 5x5 Latin square design. Indigestible NDF (INDF) content of the silages was measured with a 12-day rumen incubation in nylon bags. Rate of digestion (k_d) was determined by rumen evacuation method. Total tract digestibility was determined by 4-day total collection of faeces.

Results The content of NDF was 500, 570, 375 and 463 g/kg DM and the content of INDF was 57, 84, 70 and 138 g/kg DM for G_E, G_L, R_E and R_L, respectively. The proportion of INDF in NDF was higher in R than in G. Dry matter (DM) intake was lowest with R_E and highest with G_LR_E (Table 1). The intake of NDF and potentially digestible NDF (DNDF) was lower and intake of INDF was higher in R diets. The advancing stage of growth increased intake of NDF and INDF with both forages, but more markedly with R. Rate of digestion was significantly faster in R than in G. Postponed harvest decreased k_d of G but increased that of R. Total tract digestibility of NDF was similar for both plant species, but postponed harvest decreased it significantly. Digestibility of DNDF was higher in R silages.

Table 1 Intake of feeds, NDF, DNDF and INDF, digestion rate and total tract digestibility

							Statistical significance			
	G_E	G_L	R_E	R_L	Mix G_LR_E	SEM[#]	C_1	C_2	C_3	C_4
Intake										
Silage DM (kg/d)	13.2	12.0	11.3	12.1	14.0	0.49	o		o	**
Total DM (kg/d)	21.2	20.1	18.8	20.2	21.5	0.59	o		o	*
NDF (kg/d)	8.2	8.4	5.8	7.2	8.1	0.23	***	**	*	
DNDF (kg/d)	6.9	6.9	4.5	5.0	6.6	0.20	***			**
INDF (kg/d)	1.28	1.54	1.31	2.23	1.59	0.063	***	***	***	o
Rate of digestion in rumen, k_d										
DNDF (1/h)	0.034	0.030	0.037	0.043	0.035	0.0017	***		*	
Digestibility										
NDF (g/kg)	621	580	602	547	609	14.4		**		
DNDF (g/kg)	705	680	740	728	726	15.3	*			

[#]SEM for diet G_LR_E should be multiplied by 1.19. INDF=indigestible NDF; DNDF=potentially digestible NDF (NDF-INDF). Contrasts: C_1=G *vs.* R; C_2= E *vs.* L; C3=C_1 x C_2; C4=G_L, R_E *vs.* Mix. Significance: *** P<0.001, ** P<0.01, * P<0.05, o P<0.10

Conclusions The content of NDF in red clover was lower than in grass and the composition of NDF was different. Red clover contained more indigestible and less potentially digestible NDF. However, the rate of digestion of DNDF was higher with red clover leading to higher total tract digestibility.