

Relationship between chemical composition and *in situ* rumen degradation characteristics of grass silages

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Need

- DVE/OEB₂₀₁₀ system uses old database
Grass silage + grass hay samples
- Specific purpose to derive prediction formulas
- Different grass varieties were used
- Different subsets of samples were used
- Need to improve the prediction of the feeding value



Objectives

- Develop a new database on the rumen degradability and compare this database with the DVE/OEB₂₀₁₀ database
- Derive regression equations to investigate the relationship between chemical composition and the *in situ* ruminal degradability
- Study the effect of between-cow-variation



Material and Methods

Selection of samples (2007, 2008 & 2009; DM, CP, NDF)

- 69 samples
- 15 samples for between-cow-variation

In situ rumen incubations

Rumen incubation periods
(2, 4, 8, 16, 32, 72 & 336 h)

6 bags for 2, 4, 8, 16 & 32 h

9 bags for 72 & 336 h



Statistical Analysis

- Regression equations were derived with significant predictors ($P < 0.05$) using the PROC REG backward stepwise procedure of SAS 9.2
- Effect of between-cow-variation was checked by PROC MIX model of SAS 9.2



Results

- Large range in the rumen degradable fractions
- Reason

Rumen degradable fractions of crude protein

Rumen incubation time (h)	Mean	SD	Minimum	Maximum
2	0.522	0.087	0.343	0.727
4	0.531	0.091	0.342	0.723
8	0.560	0.090	0.341	0.743
16	0.662	0.082	0.454	0.830
32	0.740	0.071	0.547	0.891
72	0.773	0.070	0.576	0.894
336	0.777	0.065	0.539	0.878



Results

Rumen degradable fractions of NDF

Rumen incubation time (h)	Mean	SD	Minimum	Maximum
2	-0.001	0.043	-0.094	0.087
4	0.020	0.045	-0.081	0.115
8	0.129	0.070	-0.015	0.443
16	0.326	0.074	0.180	0.512
32	0.605	0.066	0.442	0.728
72	0.764	0.052	0.624	0.863
336	0.846	0.031	0.738	0.905



Results

Crude protein

Variable	Mean	SD	Minimum	Maximum
W	0.405	0.087	0.205	0.598
U	0.222	0.065	0.122	0.461
D	0.373	0.103	0.143	0.584
k_d	0.081	0.050	0.026	0.311
ED	0.610	0.061	0.478	0.729
REP	0.390	0.061	0.271	0.522



Results

Neutral Detergent Fibre

Variable	Mean	SD	Minimum	Maximum
W	0.007	0.046	0.000	0.090
U	0.154	0.031	0.095	0.262
D	0.839	0.054	0.746	0.951
k_d	0.046	0.009	0.022	0.083
ED	0.545	0.046	0.386	0.647



Results

Effect of between-cow-variation

Results were not significant ($P > 0.05$)

Effect of variation in the chemical composition

Results were highly significant ($P < 0.001$)



Regression equations

Crude protein

Regression equation	R ²	RMSE
$W = 54.51 (\pm 16.82) - 0.06 (\pm 0.01) DM + 0.47 (\pm 0.04) CP - 0.19 (\pm 0.04) NDF + 0.20 (\pm 0.08) ADF$	0.77	9.94
$U = 61.58 (\pm 5.22) - 0.09 (\pm 0.02) CP - 0.11 (\pm 0.02) \text{ sugar}$	0.39	5.71
$D = -74.30 (\pm 10.63) + 0.10 (\pm 0.01) DM + 0.56 (\pm 0.05) CP$	0.73	12.33
$REP = -19.14 (\pm 14.29) + 0.24 (\pm 0.04) CP + 0.17 (\pm 0.03) NDF - 0.14 (\pm 0.06) ADF$	0.44	0.50
$ED = 19.17 (\pm 14.29) + 0.76 (\pm 0.04) CP - 0.17 (\pm 0.03) NDF + 0.14 (\pm 0.06) ADF$	0.88	8.58

Neutral detergent fibre

$U = 68.33 (\pm 8.39) - 0.15 (\pm 0.04) \text{ sugar} + 1.10 (\pm 0.31) ADL$	0.33	15.94
$D = 76.13 (\pm 28.89) + 0.68 (\pm 0.06) NDF$	0.67	25.64
$ED = 30.20 (\pm 21.16) + 0.65 (\pm 0.04) NDF$	0.77	18.78

Conclusions

- Variation in the rumen degradable fractions was due to broad range in the chemical composition
- Relationship between the rumen degradation characteristics and chemical composition
- No significant effect of between-cow variation



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Thanks for your attention

Questions

