Ruminal degradation kinetics of Alpine forage plants as influenced by growth stage (Einfluss des Vegetationsstadiums alpiner Grünlandaufwüchse auf die Kinetik des ruminalen Nährstoffabbaus). Susanne Kirchhof*, K-H. Südekum, L. Gruber – Kiel/Bonn/Irdning

Scheduling efficient dairy cattle rations requires detailed information about ruminal nutrient degradation characteristics of feedstuffs. Morphological and chemical changes during vegetation affect changes in degradability of forage plants and the relationship of degradation kinetics between nutrients. The objective of this study was to investigate the influence of growth stage of Alpine forage plants on ruminal degradation of organic matter (OM), crude protein (CP) and structural carbohydrates with focus on synchrony of ruminal carbohydrate and CP degradation.

Methods: In each of three years, Alpine forages from three growths at seven different stages of vegetation per growth (week 1 - 7) were tested for ruminal degradability using a standardised *in situ* procedure. Additionally, ruminal degradation kinetics of other ration ingredients were investigated, i.e. hay, maize silage and two different concentrates (rapidly degradable and slowly degradable). Degradation profiles over time of dry matter (DM), OM, CP, neutral detergent fibre (NDF) and acid detergent fibre (ADF) were fitted to an exponential model and effective ruminal degradation was calculated assuming a passage rate of 6% h^{-1} (EDM6, EOM6, ECP6, ENDF6, EADF6). Based on these values, ratios were calculated between total ruminally available N and OM (TN/TOM) and available N and OM from the water-soluble fraction (SN/SOM) which could potentially indicate degree of ruminal (a)synchrony.

Results: The effective ruminal degradation of feed fractions (Table 1) decreased with advancing stage of vegetation. Although there was a significant impact of the year, the effective degradation was also significantly affected by growth number and sampling week. Only degradation of CP was not affected by growth number. A significant growth number by week interaction was observed for all variables under consideration. The ratios TN/TOM and SN/SOM were not significantly correlated ($r^2 = 0.12$).

Table 1: Effective ruminal nutrient degradation assuming a passage rate of 6% h^{-1} and ratios of ruminally available N and OM fractions (TN/TOM and SN/SOM; for explanation see text)

	1st growth			2nd growh			3rd growth						
Week	1	4	7	1	4	7	1	4	7	Year	Growth	Week	Growth x Week
EDM6 (%)	60.1	47.9	45.2	52.6	45.2	44.5	57.1	45.3	45.6	0.019	0.014	<.0001	0.025
EOM6 (%)	63.5	43.8	43.7	52.0	45.2	41.2	55.1	46.3	46.4	<.0001	0.001	<.0001	0.000
ECP6 (%)	62.1	47.1	46.8	55.8	47.1	37.8	54.1	46.4	40.9	0.016	0.312	<.0001	0.001
ENDF6 (%)	48.0	32.1	33.2	44.6	37.4	32.2	50.1	38.0	36.3	0.010	0.003	<.0001	0.027
EADF6 (%)	42.3	34.0	30.7	38.7	32.5	32.3	47.1	37.1	37.2	0.003	<.0001	<.0001	0.027
TN/TOM (g/kg)	31.1	24.6	18.7	37.6	27.8	20.6	35.3	30.6	20.4	<.0001	<.0001	<.0001	0.001
SN/SOM (g/kg)	17.8	29.3	24.3	31.2	15.0	18.7	18.7	30.2	22.0	0.000	0.872	0.037	0.000

Conclusion: The results indicate that growth number by week interactions could be used as a decision support for determining appropriate forage harvest dates as related to nutrient requirements and physiological status of ruminants. Furthermore recommendations may be derived regarding optimum concentrate supplementation to forage at varying growth stages in order to synchronise rates of ruminal degradation of energy yielding substances and CP with the final objective to maximise microbial protein synthesis from Alpine forage.

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