

Variation in protein quality of forage legumes during spring growth

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Keywords: protein quality, forage legumes

Introduction The utilisation of forage legumes in combination with reduced N inputs as fertilisers is an alternative for the production of high quality forage. Although white clover (WC) is widely used in grassland and has a high content of crude protein (CP), a combination of this high CP content with a high proportion of rapidly-available proteins and fast degradation rate in the rumen may reduce the efficiency of N use by ruminants in comparison with other forage legumes. The objective of the present study was to investigate the variation in content of CP fractions A, B and C in different forage legume during the spring growth in comparison with WC.

Table 1 Content and fractions of N in different forage legumes

Date	25/4	12/5	22/5	3/6	12/6	23/6	1/7
<i>Total-N, g/kg DM</i>							
WC	45.3	44.6	37.8	34.5	29.5	28.8	26.9
RC	44.8	41.1	33.6*	26.2*	20.8*	21.2	17.3*
KU	42.6	40.1	39.1	28.6*	24.6*	25.5	22.0*
LU	38.7	36.0*	36.8	27.2*	26.3	27.4	24.5
BT	NA	37.8*	38.2	30.1*	25.5	27.3	25.6
SE	-	0.16	0.10	0.13	0.13	0.30	0.11
<i>Fraction A, % total-N</i>							
WC	8.8	14.4	22.2	28.5	22.1	28.0	27.4
RC	7.2	16.2	19.5	18.4*	16.6*	18.3*	20.9*
KU	6.7	13.4	16.7	30.1	20.5	27.8	29.4
LU	13.7	18.8	21.9	27.7	20.4	25.9	23.3
BT	NA	11.2	12.2*	16.7*	16.0*	18.0*	18.4*
SE	-	1.44	2.17	1.55	1.47	1.48	1.55
<i>Fraction B, % total-N</i>							
WC	86.8	80.6	76.9	67.7	81.1	62.9	66.4
RC	87.5	75.8*	72.8*	72.6	76.7	67.4	65.4
KU	87.4	81.4	78.5	67.2	79.9	61.3	61.7
LU	86.7	83.5	78.1	68.0	79.9	61.6	58.6*
BT	NA	75.4*	73.8*	65.9	73.2*	62.2	59.4*
SE	-	0.99	0.60	2.50	1.94	2.35	1.46
<i>Fraction C, % total-N</i>							
WC	3.0	4.3	5.6	6.1	3.9	7.1	9.1
RC	5.6	6.6	7.9	9.6	5.6	9.9	16.3
KU	3.4	4.8	3.2	5.7	3.5	7.3	9.3
LU	2.0	3.8	6.2	5.8	4.8	7.9	7.9
BT	NA	8.1	9.0	10.8	10.3	13.3	13.9
SE	-	0.87	1.52	1.11	1.13	1.72	1.13

* differ significantly ($P < 0.05$) from white clover (WC); NA: not available

proportion of N in fraction A was low at the beginning of the vegetation period and increased subsequently. The fraction B (potentially degradable protein) followed a similar trend as observed for total-N, with RC and BT showing lower N content when compared to WC for the second and third sampling dates. For the fifth and sixth sampling dates, BT and later LU had lower N-content compared to WC. For fraction C, which corresponds to the N content in the ADF residue (ADIN), only the main factors were significant. Compared to WC, only RC and BT showed higher ADIN-content over all sampling dates. ADIN content increased through the experiment period.

Conclusions The results demonstrate that the proportions of N in the different fractions of CP in legumes differ seasonally and between legume species variation. Legumes like BT and RC, which contains tannins and polyphenol oxidase activity, respectively, may positively influence N use efficiency by ruminants.

Reference

Licitra, G., T.M. Hernandez & P.J. Van Soest (1996). Standardization of procedures for nitrogen fractionation in ruminant feed. *Animal Feed Science and Technology*, 57, 347-358.

Material and methods The experiment was carried out at the experimental station Lindhof, which had an average temperature of 9.0°C and a precipitation of 528 mm in 2003. The swards were established in the late summer of 2002 as a complete randomised block design. Red clover (RC), birdsfoot trefoil (BT), lucerne (LU), kura clover (KU) and white clover (WC) were sown as binary mixtures of legume and perennial ryegrass in three replicates. Sampling occurred from the end of April to the beginning of July 2003. Samples were separated into legume, grass and weeds, dried at 60°C and milled in a Cyclotech mill to pass a 1-mm sieve. For each sampling time, quality analyses were performed on legumes. Samples were analysed for total N content and for fractions A, B and C as described by Licitra *et al.* (1996). The N content in B fraction was calculated as: (B = Total-N - A - C). Data was submitted to analysis of variance and means were compared to WC using LSD. Probabilities were adjusted using the Bonferroni-Holm test.

Results For total-N and fractions A and B, the interaction sampling dates x legume species was significant. For fraction C only the main effects were significant. For the fraction A, which contains mostly non-protein-N, lower contents were found for RC and BT (Table 1). The