

# Nutritional value of galega (*Galega orientalis* Lam.) forage and silage for ruminants\*

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## ABSTRACT

Amino acid composition, *in situ* ruminal degradation and intestinal digestion of dry matter (DM), crude protein (CP) and individual amino acids (AA) of fresh and ensiled galega (*Galega orientalis* Lam.) were determined and their nutritional value calculated according to INRA (1988). Total AA (Trp excluded) in forage (1<sup>st</sup> cut, budding) was 81.3 g/16 g N, decreasing to 71.3 g/16 g N in wilted silage + Kemisile<sup>2000</sup> (4 l/ton). The *in situ* degradation coefficients ( $k=0.06$ ) for CP and DM in galega forage were higher than in silage (69.5 and 64.4 vs 56.4 and 45.1%); similar relationships were found for total AA degradation after 16 h incubation in the rumen (87.4 vs 66.9%). The mobile nylon bag intestinal digestibility of CP, total AA and DM in wilted silage vs forage was 61.5 and 68.2; 71.6 and 74.2; 21.1 and 23.5%, respectively. The content of PDIA, PDIN and PDIE in galega fodder was slightly higher than in lucerne forage and silage; the energy values were close.

KEY WORDS: *Galega orientalis* Lam., degradation, digestion, crude protein, amino acids

## INTRODUCTION

Studies on galega (*Galega orientalis* Lam.) as a plant alternative to other legumes have concerned mainly its biological characteristics, agronomic conditions of cultivation and yields. The results of the Skórko-Sajko et al. (2003) and Szyszkowska et al. (2004) suggest that galega has a high nutritive value as a fodder plant in terms of nutrient contents, energy value, AA content, and  $\beta$ -carotene level. However, no compara-

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tive data are available on amino acid composition, ruminal degradation or intestinal digestion of dry matter, crude protein and amino acids of fresh and ensiled galega.

The aim of the study was to determine the nutritional value of galega forage and wilted silage, based on determination of *in situ* ruminal degradation and mobile nylon bag intestinal digestibility of dry matter (DM) and crude protein (CP), including individual amino acids (AA).

## MATERIAL AND METHODS

Green fodder was produced from galega grown in a three-year cultivation experiment. Forage (1<sup>st</sup> cut, budding) was ensilaged in wrapped bales with the addition of Kemisile<sup>2000</sup> (4 l/ton). Both in the fresh material (appr. 14.5% DM) and in silage (appr. 38% DM; pH 4.68; 98 points on the Flieg-Zimmer scale) the effective ruminal degradation of CP and DM ( $k=0.06$ ) was determined according to Michalet-Doreau et al. (1987) on three non-lactating cows fitted with cannulas to the rumen and duodenum. Intestinal digestibility of DM, rumen undegraded protein and AA was determined according to Peyraud et al. (1998) using the mobile bag method. The nutritive value of galega forage and silage was calculated according to the INRA (1988) system.

## RESULTS

The total AA in forage used for ensiling was 81.3 g/16 g N and decreased to 71.3 g/16 g N in the silage as a result of fermentation. The levels of Lys in the forage and silage protein were 4.7 vs 4.5; Met, 2.1 vs 1.5; Thr, 3.5 vs 3.3 and His, 1.8 vs 1.5 g/16 g N, respectively (Table 1).

The coefficients of effective degradation of nitrogen compounds and DM (Table 1) were higher in forage than in silage (69.5 and 64.4 vs 56.4 and 45.1%, respectively), while the total AA degradation after 16 h incubation in the rumen was 87.4 and 66.9%, respectively. Loss of Lys and Met found in forage after 16 h incubation, which reached 86.8 and 86.0% respectively, was 17.1 and 27.7% units higher compared with galega silage. The intestinal digestibility of all amino acids tended to be lower in silage than in fresh forage. In silage, intestinal digestibility of arginine, phenylalanine, lysine and methionine was considerably higher than their ruminal degradation. In both materials, cystine had the lowest intestinal digestibility.

Table 1. AA contents (g/16g N) in galega fodder and rumen degradability (deg) and intestinal digestibility (dsi) of galega (k=0.06)

Item	Green forage			Wilted silage		
	AA	deg	dsi	AA	deg	dsi
Dry matter		64.4	23.5		45.1	21.1
Crude protein		69.5	68.2		56.4	61.5
After 16 h incubation						
Ala	5.1	87.1	71.8	4.5	65.9	68.1
Arg	4.7	88.3	82.3	3.6	66.6	80.3
Asp	12.2	89.3	75.0	9.5	69.1	72.1
Cys	1.0	86.3	54.1	1.0	61.6	54.8
Glu	9.1	87.5	77.0	7.7	66.6	75.0
Gly	4.3	87.3	70.6	3.7	64.9	67.0
His	1.8	88.3	71.1	1.5	70.9	66.1
Ile	4.0	84.2	74.4	3.6	63.8	67.6
Leu	6.9	87.8	74.1	6.5	70.1	71.7
Lys	4.7	86.8	80.9	4.5	69.7	78.0
Met	2.1	86.0	77.4	1.5	58.3	71.1
Phe	5.2	81.6	71.4	4.8	55.7	81.4
Pro	4.7	92.7	68.0	4.9	73.6	72.6
Ser	4.2	87.4	70.5	3.5	64.7	67.1
Thr	3.5	87.9	73.9	3.3	70.0	70.6
Tyr	2.9	86.6	79.7	2.4	65.7	75.6
Val	4.9	85.8	71.7	4.8	67.3	65.6
total AA	81.3	87.4	74.2	71.3	66.9	71.6
branched chain AA	15.8	86.3	73.4	14.9	67.7	68.6
DM, 16 h disappearance		78.2			53.8	
CP, 16 h disappearance		86.9			68.0	

The content of PDIA, PDIN and PDIE in galega fodder was slightly higher than in lucerne forage and silage as cited in the INRA (1988); the energy values, on the other hand, were very close (Table 2).

Table 2. Nutritive value of galega feedstuffs expressed in INRA (1988) system units, kg<sup>-1</sup> DM

Feedstuff	DM %	OM g	CP g	PDIA g	PDIN g	PDIE g	UFL	UFV	CFU
Green forage	14.3	906.9	245.5	57.4	150.1	103.4	0.77	0.70	1.19
Wilted silage	37.2	877.2	201.6	61.1	120.4	87.3	0.70	0.62	0.91

## DISCUSSION

*Galega orientalis* Lam. had a favourable AA profile, which is in agreement with earlier data (Skórko-Sajko et al., 2003; Szyszkowska et al., 2004). As a consequence of the changes in protein that occurred during the ensiling process, the percentage of Arg, Met, and His decreased. The rates of degradation of the CP and DM in forage at the budding phase were lower than reported by Szyszkowska et al. (2004), who emphasized the strict relationship between the growth stage of plants and ruminal digestibility. The intestinal digestibility of total AA in feedstuffs

produced from galega was considerably higher than of CP, which indicates that the undigested residue contained much more nitrogen compounds than AA. The results also confirmed that the lowest disappearance among all AA was that of Cys.

## CONCLUSIONS

*Galega orientalis* Lam. can be a valuable component of rations for ruminants. Owing to the favourable profile of AA, relatively high intestinal digestibility of protein and individual AA, and the nutritive value expressed in the units of the INRA system, galega does not differ much from lucerne harvested at the same growth stage.

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## STRESZCZENIE

### Wartość pokarmowa zielonki i kiszonki z rutwicy wschodniej (*Galega orientalis* Lam.) dla przeżuwaczy

Oznaczono skład aminokwasowy, efektywny rozkład w żwaczu i strawność jelitową suchej masy, białka ogólnego i aminokwasów zielonki i kiszonki z rutwicy wschodniej oraz obliczono wartość pokarmową obydwóch pasz w systemie INRA (1988).

Suma AA (bez tryptofanu) w zielonce (1 pokos, pączkowanie) wynosiła 81,3 g/16 g N, w przewiedniętej kiszonce + Kemisile<sup>2000</sup> (4 l/tonę) obniżyła się do 71,3 g/16 g N. Współczynnik rozkładu *in situ* (k=0,06) białka og. i s.m. zielonki z rutwicy był wyższy niż w kiszonce z przewiedniętej rutwicy (69,5 i 64,4 vs 56,4 i 45,1%); podobne zależności wystąpiły w degradacji sumy AA po 16 godz. inkubacji w żwaczu (87,4 vs 66,9%). Oznaczona metodą mobilnych woreczków nylonowych strawność jelitowa białka og., sumy aminokwasów oraz s.m. w kiszonce i w zielonce wynosiła odpowiednio: 61,5 i 68,2; 71,6 i 74,2; 21,1 i 23,5%. Wartość PDIA, PDIN i PDIE zielonki z rutwicy jest nieco większa niż lucerny, przy zbliżonej wartości energetycznej.