Hedges and woody strips browsing by cattle on pasture in Wallonia, Belgium

Sophie Vandermeulen [A], Mathilde Pascal [AB], Christian Marche [B], Arnaud Pilet [B], Yves Beckers [A] and Jérôme Bindelle [A]

[A] Gembloux Agro-Bio Tech, Animal Science Unit, University of Liège, Passage des Déportés 2 B-5030 Gembloux, Belgium
[B] Centre des Technologies Agronomiques, Rue de la Charmille, 16 B-4577 Strée-Modave, Belgium, www.cta-stree.be
Contact email: sophie.vandermeulen@ulg.ac.be

Keywords: Sylvopastoralism, ruminants, grazing behaviour, fermentation, feeding value.

Introduction

Shrub and tree forages are commonly used in animal production in many regions of the world. Nonetheless, in Western Europe, and especially in Wallonia in Belgium, hedges and woody strips have disappeared from the agricultural landscape over the past 60 years. Browse species are usually rich in plant secondary compounds such as tannins whose benefits on CH_4 production and intestinal parasitism have been highlighted (Ramírez-Restrepo *et al*. 2010). Currently, agri-environmental measures taken by the Walloon government promote hedges and woody strips in pastures, raising the interest in browse species functionalities in ruminant production.

This study aimed at: (1) determining the influence of the access to a hedge on the behaviour of cattle on pasture; and (2) evaluating the fermentability by rumen microbes of foliage of woody species promoted in the Walloon landscape.

Materials and methods

Grazing and browsing behaviour

Twelve dairy heifers, divided in 2 groups, were set to graze a ryegrass and white clover pasture during 4 consecutive weeks in May 2012. The experimental group had free access to a hedge composed of 12 tree and shrub species (Table 1) while the control group did not. Pasture biomass availability was assessed once a week and the pasture area was adjusted weekly in order to ensure sufficient forage availability. The feeding behaviour (grazing and browsing) of each heifers group was recorded during 10 hours/day replicated 2 days/week using the hand-plucking method as well as other activities (rumination, rest, watering, social activity and walking). The activities were compared per week using the MIXED procedure of SAS 9.2. and the daily observations on each cow as experimental unit (N = 12).

Chemical composition and in vitro ruminal fermentation

The leaves of the woody species found in the hedge harvested from 3 different plants (N = 3) in late May 2012 and a sample of pasture species (white clover (*Trifolium repens*) and ryegrass (*Lolium perenne*)) were freeze-dried and analysed for crude protein and NDF contents. There were also fermented in duplicate (n = 2) with bovine ruminal fluid for 72 h and gas production recorded (Menke and Steingass 1988). Short-chain fatty acids (SCFA) were analysed after 72 h by HPLC. The chemical composition, SCFA and gas production kinetics were compared using the MIXED procedure of SAS 9.2. after mathematical modelling (Groot *et al*. 1996) .

Results and discussion

Grazing and browsing behaviour

The feeding behaviour was influenced by the hedge. Grazing time of the control group (59.8%) was on average higher than the heifers that could browse the woody forages (54.8%; P=0.023). The other activities (rumination, watering, social activities, rest and walking) were not influenced by the access to the hedge (P>0.05). Significant browsing was noted only during the second week of the experiment and reached 3.7% of the total time. This happened when the biomass in the pasture was low (50% less than the other weeks). During this week, grazing time of the control group tended to be higher than the experimental one (52.2% *vs* 41.3%; P=0.057).

Chemical composition and in vitro fermentation

The fermentation profile showed striking differences between species as did their CP and NDF contents (Table 1). *Prunus spinosa*, *Viburnum opulus*, *Fraxinus excelsior and Populus nigra* seem promising forages because they yielded higher gas production and/or fermentation rates than ryegrass and clover and their CP content was quite high, with the exception of *Viburnum opulus*. *Sambucus nigra* showed an outstandingly high CP content. Interestingly, while the average acetate: propionate: butyrate molar ratio across all woody species was 0.618: 0.219: 0.100 (data not shown), the SCFA profile of some species differed from this average (P<0.001). *Quercus robur* SCFA profile contained 0.853 acetate, *Corylus avellana* 0.542 propionate and the variability between

Table 1. Crude protein (CP) and NDF contents of leaves of woody and herbaceous species and gas production kinetics modelled according to Groot *et al*. (1996) incubated with rumen fluid.

Species	N	CP (g/kgDM)	NDF (g/kgDM)	A (ml/gDM)	Rmax (ml/h/gDM)	Tmax (h)
*Lolium perenne**	1	265	469	220.2	18.4	2.7
*Trifolium repens**	1	286	230	216.4	22.1	2.5
Acer campestre	3	206 cd†	327 bc	157.4 f	8.8d	4.4 ab
Acer pseudoplatanus	3	213 cd	301 bcd	203.4 c	19.3 b	2.4 de
Carpinus betulus	3	161 fg	270 cd	182.7 de	11.8 cd	3.9 bc
Cornus sanguinea	3	176 ef	185 e	165.5 ef	11.8 cd	2.4 de
Corylus avellana	3	170 fg	361 ab	172.7 ef	9.9 d	3.6 bc
Crataegus monogyna	3	162 fg	350 ab	201.9 cd	10.4 d	5.2 a
Fraxinus excelsior	3	245 b	341 ab	221.5 abc	20.4 b	2.0 ef
Populus nigra	3	217 bc	310 bc	207.7 bc	24.0 a	1.4 f
Prunus spinosa	3	202 cde	240 de	235.8 a	19.0 b	3.0 cd
Quercus robur	3	185 def	395 a	153.4 f	9.2 d	3.2 cd
Sambucus nigra	3	319 a	244 de	163.0 ef	14.3 c	2.3 de
Viburnum opulus	3	143 g	267 cd	225.3 ab	18.5 b	2.5 de
SEM	-	0.804	1.099	4.923	0.884	0.192
Source of variation	d.f.			*P*-values		
Species	11	<0.001	<0.001	<0.001	<0.001	<0.001

N: numbers of observations - d.f.: degrees of freedom - SEM: standard error of mean - DM: dry matter; A: final gas volume - Rmax: maximum rate of fermentation - Tmax: time at maximum rate of fermentation; †: For one parameter, means followed by different letters in the columns differ at significance level of 0.05; *: Not included in the statistical analysis.

individuals of *Sambucus nigra* was higher than for the other species, some producing high levels of valerate.

Conclusion

It can be concluded that in the grazing conditions in Wallonia, browsing can also be considered as a complementary forage for cattle in pastures with hedges. Some woody species seem interesting for ruminant nutrition as plain forage or to induce shifts in rumen fermentation patterns. These attributes should be better documented to allow proper advice when farmers plant hedges along pastures.

References

Groot JCJ, Cone JW, Williams BA, Debersaques FMA, Lantinga EA (1996) Multiphasic analysis of gas production kinetics for *in vitro* fermentation of ruminants feeds. *Animal Feed Science and Technology* **64**, 77-89.

Menke KH, Steingass H (1988) Estimation of the energetic feed value obtained from chemical analysis and in vitro gas production using rumen fluid. *Animal Research and Development* **28**, 7–55.

Ramírez-Restrepo CA, Barry TN, Marriner A, López-Villalobos N, McWilliam EL, Lassey KR, Clark H (2010) Effects of grazing willow fodder blocks upon methane production and blood composition in young sheep. *Animal Feed Science and Technology* **155**, 33–43.