Hedges and woody strips browsing by cattle on pasture in Wallonia

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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 a 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 h d^{-1} replicated 2 d $week^{-1}$ 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 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 because, except for *Viburnum opulus*, their CP content is quite high. *Sambucus nigra* showed an outstandingly high CP content. Interestingly, while the average acetate: propionate: butyrate molar ratio across all woody species was 0.604: 0.204: 0.109 (data not shown), the SCFA profile of some species differed from this average (P<0.001). *Quercus robur* SCFA profile contained 0.769 acetate, that of *Corylus avellana* 0.502 propionate and the variability between individuals of *Sambucus nigra* was higher than for the other species, some producing high levels of valerate.

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 kg^{-1}DM)	NDF (g kg^{-1}DM)	A (ml g^{-1}DM)	Rmax (ml $h^{-1}g^{-1}$DM)	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	$206^{cd\dagger}$	327^{bc}	157.4^{f}	8.8^{d}	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

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

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