

Fodder trees as an alternative resource to feed ruminants: voluntary intake and *in vivo* digestibility of white mulberry (*Morus alba*) and common ash (*Fraxinus excelsior*) leaves in sheep

Cécile Ginane¹, Mickaël Bernard², Véronique Deiss¹, Donato Andueza¹, Jean-Claude Emile³, Sandra Nowak³, Camille Béral⁴

¹INRA UMR Herbivores, Saint-Genès-Champanelle, France, ²INRA HerbiPôle, Saint-Genès-Champanelle, France, ³INRA Ferlus, Lusignan, France, ⁴Agrof, Anduze, France

E-mail: cecile.ginane@inra.fr

Take home message Leaves of common ash and white mulberry represent a feed alternative to grass, of great value, for ruminants.

Introduction In breeding systems of domestic herbivores that aim to maximize grazing (e.g., to reduce inputs), the challenge is to feed the herd all year round with local forage resources. In temperate regions, the increasingly frequent summer droughts often force breeders to cope with scarcity and/or a sharp decrease in quality of pasture resources while animals are producing. In this context, fodder trees may represent a highly available resource, but many questions remain about the range of feed value (Hejmanová *et al.*, 2014; Emile *et al.*, 2017), as well as about their acceptability by animals, which are essential conditions for their use on the field.

Material & methods In late summer 2017, we used 18 castrated Texel wethers (18 months, 61.6 ± 6.9 kg), housed in individual pens and allocated to three treatments (n=6) based on diets offered: a 1st cycle permanent grassland hay, or fresh leaves of common ash (*Fraxinus excelsior*) or mulberry (*Morus alba*) trees (Table 1). Tree leaves were harvested twice a week and stored at +4°C for up to 4 days. All sheep received hay for 11 days (period 1). Then, after 4 days of transition, two-thirds of them received one of the two fodder trees for 15 days while the others still received the grassland hay (period 2). *In vivo* digestibility was measured over the last 6 days. Animals were fed *ad libitum* (10 and 15% of refusals for hay and fodder trees, respectively) with a daily calculation of offered forages based on the amounts individually ingested on the previous day. During the digestibility period, samples of offered forages, refusals and faeces (total collection) were individually collected, weighed and dried. We analysed samples for contents in crude protein (CP, Kjeldhal method), neutral detergent fibre (NDF) and acid detergent fibre (ADF). We used mixed models (SAS EG 5.1) to assess the effect of forages (and period for dry matter intake (DMI)) on digestibility and intake data.

Results Daily dry matter intake of hay were initially similar between groups but increased between periods 1 and 2 in groups that changed their diet towards tree leaves ($p = 0.006$). Dry matter intake of leaves was about 1.5 times greater than of hay with no difference between tree species (Table 1). Organic matter digestibility (OMD) was lowest for hay and highest for mulberry ($p = 0.0001$, Table 1). Similarly to DMI, digestible organic matter intake (DOMI) was far lower with hay than with fodder trees, with no difference between common ash and mulberry ($p = 0.003$, Table 1).

Table 1 Chemical composition, intake level and digestibility of experimental forages (n=6).

Experimental forages	DM (g/g)	OM (g/g DM)	CP (g/kg DM)	NDF (g/kg DM)	ADF (g/kg DM)	DMI (kg/d)	OMD	DOMI (g/kg BW ^{0.75})
Pasture hay	0.90	0.90	91	588	314	1.54 ^a	0.54 ^a	34.0 ^a
Common ash leaves	0.34	0.91	147	326	193	2.13 ^b	0.63 ^b	56.8 ^b
Mulberry leaves	0.34	0.84	108	202	117	2.16 ^b	0.68 ^c	59.7 ^b

DM: dry matter; OM: organic matter; DMI: dry matter intake; OMD: organic matter digestibility; DOMI: digestible organic matter intake; BW: body weight. Means within a column with different superscripts differ at $p = 0.05$.

Conclusion In late summer, when the need for alternatives to low available standing grass can be great, leaves from common ash or mulberry appear to be good options compared to pasture hay or to ageing swards. Their chemical characteristics are comparable to those of early summer permanent grassland (INRA, 2018) and their palatability is high, as reflected by DMI, even when they are offered as the sole feed for several days. These intakes made the digestible organic matter intake expressed by sheep fed with common ash and mulberry leaves, more than twice as high as the 23 g/kg BW^{0.75} considered to cover the maintenance requirements of adult sheep (INRA, 2018). Thus, despite CP and organic matter digestibility values, such fodder trees are suitable alternative forages, including for high producing animals.

Acknowledgements The authors thank the PARASOL project funded by Ademe, and the staff of UE HerbiPôle and UMR Herbivores

References

Emile JC, Delagarde R, Barre P, Niderkorn V and Novak S 2017. Grassland Science in Europe. 22, 548-550.
 Hejmanová P, Stejskalová M and Hejman M. 2014. Vegetation History and Archaeobotany. 23, 607-613.
 INRA, 2018. INRA feedings system for ruminants. pp 640. Wageningen Academic Publishers, The Netherlands.