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Nutritive value of forage shrubs: *Bituminaria bituminosa, Acacia salicina* and *Medicago arborea*

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SUMMARY - The nutritive value of one forage shrub from the Canary Islands, *Bituminaria bituminosa*, and two introduced forage shrubs, *Acacia salicina* and *Medicago arborea*, was studied. Mean organic matter, neutral detergent fibre and protein content (g kg^{-1} DM) of four cuts along the year was respectively 910, 424 and 184 for *B. bituminosa*, 878, 412 and 123 for *A. salicina*, and 908, 433 and 155 for *M. arborea*. Goat ruminal degradability of organic matter and protein was respectively 57.5% and 72.2% for *B. bituminosa*, 33.5% and 30.4% for *A. salicina*, and 48.1% and 67.8% for *M. arborea*. *In vitro* digestibility of organic matter was 64.6% for *B. bituminosa*, 37.4% for *A. salicina*, and 64.9% for *M. arborea*. From these results, the energy value of *B. bituminosa, A. salicina* and *M. arborea* was estimated, according to the NRC system, to be respectively, 5.6 MJ NE kg^{-1} DM, 3.2 MJ NE kg^{-1} DM and 5.7 MJ NE kg^{-1} DM.

Key words: *Bituminaria, Acacia, Medicago,* nutritive value

RESUME *- "La valeur nutritive des arbustes fourragers :* Bituminaria bituminosa, Acacia salicina *et* Medicago arborea*". Le valeur nutritive d'un arbuste fourrager des Iles Canaries,* Bituminaria bituminosa, *et deux arbustes fourragers introduits,* Acacia salicina *et* Medicago arborea, *a été étudiée. La matière organique, la teneur en fibre et la valeur azotée (g kg^{-1} MS) ont été, respectivement de 910, 424 et 184 pour* B. bituminosa, *878, 412 et 123 pour* A. salicina, *et 908, 433 et 155 pour* M. arborea. *Pour les caprins, la dégradabilité dans le rumen de la matière organique et de l'azote est respectivement de 57,5% et 72,2% pour* B. bituminosa, *33,5% et 30,4% pour* A. salicina, *et 48,1% et 67,8% pour* M. arborea. *La digestibilité* in vitro *de la matière organique est 64,6% pour* B. bituminosa, *37,4% pour* A. salicina, *et 64,9% pour* M. arborea. *Pour ces mesures, la valeur énergétique de* B. bituminosa, A. salicina *et* M. arborea *a été estimée, selon le système NRC, et est respectivement de 5,6 MJ EN kg^{-1} MS, 3,2 MJ EN kg^{-1} MS et 5,7 MJ EN kg^{-1} MS.*

Mots-clés *:* Bituminaria, Acacia, Medicago, *valeur nutritive*.

Introduction

Forage shrubs are interesting forages for arid areas because of their adaptation and productivity in dry climates and poor soils. *Bituminaria bituminosa* (common name tedera) is a forage legume shrub traditionally used in the Canary Islands for goat nutrition, *Medicago arborea* is also a forage legume shrubs used in the Mediterranean area and *Acacia salicina* is a legume browse tree widely used in arid zones of Africa and other areas. This research studied the nutritive value of these three legume shrubs by chemical composition analyses, ruminal degradability and *in vitro* digestibility trials.

Materials and methods

Samples of forage shrubs were collected in the four seasons of the year, and the results show the mean value of these samples. Samples were separated in leaves, light stems (less than 3 mm diameter) and gross stems; it was assumed that goats browse only leaves and light stems, and therefore, only these fractions were used to evaluate the nutritive value of these forage shrubs.

Preparation of samples and chemical analyses were done according to standard methods (AOAC, 1990). Detergent fibres and acid detergent lignin were analysed according to Van Soest *et al.* (1991).

Ruminal degradability using nylon bags was determined with 3 adult male Canarian goats fed at maintenance level. Duplicate bags with 3 g sample were incubated for 0, 6, 18, 24, 48 and 72 h in the rumen of each goat. Effective degradability was determined according to Orskov and McDonald (1979). *In vitro* organic matter digestibility was determined according to Tilley and Terry (1963). The energy value was estimated according to the digestible organic matter content (NRC, 1989).

Results and discussion

Vegetal composition of forage shrubs is shown in Table 1. Almost 85% of cuts of *B. bituminosa* and *A. salicina* and around 70% of *M. arborea* were composed by leaves and light stems. The proportion of leaves in the browsing samples of *A. salicina* was higher than in the browsing samples of *B. bituminosa* and *M. arborea*.

Table 1. Proportion (%) of leaves, light stems (<3 mm diameter) and gross stems of shrub samples

	B. bituminosa	*A. salicina*	*M. arborea*
Cut composition			
Browsing	84.4a	83.4a	70.5b
Gross stems	15.6a	16.4a	29.5b
Browsing sample			
Leaves	68.0a	86.5b	61.9c
Light stems	32.0a	13.5b	38.1c

Values with different letters in the same row are significatively different from P<0.05

Chemical composition of browsing samples is shown in Table 2. Dry matter content of *M. arborea* was the highest and that of *B. bituminosa* the lowest. Organic matter and fibre fraction contents of shrubs were similar for the three shrubs, but protein content of *B. bituminosa* was the highest and that of *A. salicina* the lowest.

Table 2. Chemical composition (% DM) of shrubs

	B. bituminosa	*A. salicina*	*M. arborea*
Dry matter (in fresh basis)	24.7a	33.8b	43.5c
Ash	9.0	12.2	9.2
Organic matter	91.0	87.8	90.8
Ether extract	2.9	2.3	3.3
Crude protein	18.4	12.3b	15.5ab
Neutral detergent fibre	42.4	41.2	43.3
Acid detergent fibre	29.6	27.4	29.6
Acid detergent lignin	7.3a	10.2b	9.0ab

Values with different letters in the same row are significatively different from P<0.05

Effective degradability and *in vitro* digestibility is shown in Table 3. Ruminal degradability of organic matter and protein from *A. salicina* was the lowest (less than 35%), and this is also the case for the organic matter digestibility (less than 40%). On the other hand, organic matter degradability of *B. bituminosa* was almost 60% and that of *M. arborea* was almost 50%. In both shrubs crude protein degradability was around 70% and *in vitro* organic matter digestibility was 65%.

Table 3. Effective degradability (%) and *in vitro* digestibility (%) of shrubs

	B. bituminosa	*A. salicina*	*M. arborea*
Crude protein degradability	72.2a	30.4b	67.8a
Organic matter degradability	57.5a	33.5b	48.1c
Organic matter digestibility	64.6a	37.4b	64.9a

Values with different letters in the same row are significatively different from P<0.05

From these results, the energy value of *B. bituminosa*, *A. salicina* and *M. arborea* was estimated, according to the NRC system, to be respectively, 5.6 MJ EN kg^{-1} DM, 3.2 MJ EN kg^{-1} DM and 5.7 MJ EN kg^{-1} DM. According to INRA (1988), the energy concentration of *B. bituminosa* and *M. arborea* allows to cover the energy requirements for maintenance and production of more than 1 litre of milk by goats, but the low energy concentration of *A. salicina* allows to cover only 75% of the energy requirements for maintenance of goats.

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