Feeding Value of Two Varieties of *Festuca arundinacea* (Schreb) Under Grazing Conditions[1]

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ABSTRACT

Previous economic evaluations of *Festuca arundinacea* (Schreb) varieties in Balcarce have shown that the variety Maris Kasba (MK) has greater winter growth than the variety El Palenque (P), but no data were available of their feeding value. A study was thus carried out during four periods: spring of 1982, and summer, winter and spring 1983. During these periods, measurements of faecal output of six steers and *in vitro* digestibility of the diet selected by oesophageal fistulated steers were made to estimate herbage consumption. Estimates of rate and extent of neutral detergent fiber (NDF) digestibility, using the *in situ* technique, were also made in six rumen-fistulated steers in spring 1983. Before the animals were put into plots, the herbage mass on offer in both varieties was similar in the both periods considered. These were no differences in *in vitro* digestibilities of extrusa samples in spring 1982 and 1983, nor in winter 1982. However, during summer 1982, the *in vitro* digestibility of extrusa samples was greater for animals grazing the P plots. Dry matter intake was greater for animals grazing MK pastures in spring 1982, winter 1983 and spring 1983 (P), but there were no differences in summer 1983. The higher intake of animals grazing MK plots was associated with a higher percentage of leaves in the extrusa, a lower retention time in the rumen, and a higher rate and extent of NDF digestion.

Key words: Feeding value, *Festuca arundinacea*, grazing, intake.

COMPENDIO

Evaluaciones agronómicas de variedades de *Festuca arundinacea* realizadas en Balcarce, Arg., han demostrado que la variedad Maris Kasba (MK) tuvo un mayor crecimiento invernal que "El Palenque" (P), no existiendo datos sobre sus respectivos valores alimenticios. Por lo tanto se llevó a cabo un estudio durante cuatro períodos: primavera 1982, verano, invierno y primavera 1983. Durante estos períodos, se midió la producción fecal con seis novillos y la digestividad *in vitro* de la dieta seleccionada por novillos fistulados para estimar el consumo en condiciones de pastoreo. También se estimó la tasa y extensión de la digestión de la fibra con detergente neutro (NDF), con bolsitas colocadas en el rumen de seis animales con fístula ruminal, en el período de primavera 1983. No se encontraron diferencias en la dieta de forraje en las parcelas de una y otra variedad, antes de que los animales entraran a pastorear. Tampoco se encontraron diferencias en la digestibilidad *in vitro* de las extrusas de la primavera de 1982 y 1983 y en las de invierno de 1982. Sin embargo, en el verano de 1982, la digestibilidad *in vitro* fue mayor en las extrusas provenientes de las parcelas de El Palenque. El consumo de materia seca en la primavera de 1982, invierno y primavera de 1983 resultó mayor en las parcelas de MK (P), no encontrándose diferencias en el verano de 1982. El mayor consumo de los animales estuvo asociado con el mayor porcentaje de hojas en las extrusas, menor tiempo de retención en el rumen y mayor tasa y extensión de la digestión de la fibra que se observó en los animales que pastorearon las parcelas de MK.

Palabras claves: Valor nutritivo, *Festuca arundinacea*, pastoreo, consumo.

INTRODUCTION

Tall fescue is commonly included in cultivates pastures by farmers of the Pampa region of Argentina. It is well adapted to a wide range of soils and climate conditions, with high production and persistence. The most common variety is El Palenque (P), selected from *Festuca arundinacea* (Schreb) populations introduced from the USA. Its growth curve is characterized by a relatively greater production during spring and summer periods. Recently, other varieties of *F. arundinacea* (Schreb) selected from germplasm originated in northern Africa, such a "Maris kasba" (MK), have been imported. Agronomic evaluations in Balcarce showed similar of slightly lower production levels in MK than in P. However, the seasonal production was quite different, with greater growth during winter in MK. The objective of this experiment was to obtain information on the feeding value of these varieties under grazing conditions in different seasons.

MATERIALS AND METHODS

Two pastures, variety P and variety MK of *F. arundinacea* (Schreb) free of the endophytic fungus *Acremonium coenophialum* were sown at the Balcarce Experiment Station (lat. 37°45, long 58°17E, 130 masl) in the autumn of 1981. The pastures were subdivided into four paddocks of 2500 m^2 each. All were used in

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winter, while only two were used during the other seasons. One hundred kilograms per hectare of urea (46% N) was applied early in spring 1982, and autumn and spring 1983. During the periods between intake estimations, plots were continuously grazed by a variable number of steers to maintain herbage mass. Before intake estimations, twenty 0.25 m^2 samples of each variety were cut with hand shears to a height of approximately 3 cm from ground level to estimate total and green pasture herbage mass. Six of these samples during the first three periods and eight in spring 1982 were chosen and separated into live leaf, stem and dead components.

These components were dried at 60°C and weighed. Diet samples were obtained for each variety in spring 1982 by collecting ingested material from six oesophageal-fistulated Hereford steers, approximately 24 months old and weighing 370 kg. A new group of five oesophageal fistulated steers, approximately 15 months old and weighing 200 kg, were used in spring 1983. Two extrusa samples were taken: morning (09:00 h) and evening (15:00 h) from animals during two days on each plot in a change-over design. Fistulated animals were introduced to the paddocks 30 h prior to the beginning of sampling. Morning and evening collections were bulked and subdivided in spring 1982, summer and winter 1983, but were processed individually in spring 1983 to measure dry matter digestibility according to Tilley and Terry and to carry out botanical analysis.

Accordingly, this procedure yielded 12 samples, six for each variety in spring 1982, summer and winter 1983, and 20 samples in spring 1983. Intake was calculated by combining values of total faeces output collected with mean dry matter digestibility estimated from the extrusa samples. Faeces were collected for six days from six Hereford steers per plot. The steers were 24 months old, weighing approximately 340 kg in spring 1982, and six Fresian steers per plot of about 15 months old, weighing approximately 220, 243 and 283 kg in summer, winter and spring 1983, respectively. Total fresh faeces weight output was measured twice daily with harnessed animals. Aliquot portions (5%) were taken and kept at-10°C. At the end of the collection period, aliquot portions of the fresh faeces of each steer were dried at 60°C for dry matter determination. On two occasions during the spring of 1983, estimation of rate of passage of undigested residues, and of rate and extent of neutral detergent fiber (NDF) disappearance of fresh forage (in sacco) from the rumen were made in similar adjacent plots using six rumen-fistulated grazing steers with a mean liveweight of 395 kg, using a change-over design.

Each period lasted for 13 days (eight days of pretreatment and five days for data collection). The estimation of rate of passage was done out using mordanted chromium as described by Uden *et al.* (14). Administration of the marker meals was carried out at 08:00 h via fistula. Grab faecal samples were taken at 0, 6, 12, 18, 24, 36, 48, 60, 72, 84, 95 and 120 h after dosing with the markers. Animals were removed from the pasture and samples taken with the help of a chute gate; the time consumed for this operation was about 15 minutes. The forage ruminal turnover rates, total mean retention time and transit time were calculated by fitting a two-compartment model to the faecal excretion data using the procedure of Grovum and Williams (3). Fiber digestion kinetics were estimated using the *in situ* technique described by Mehrez and Orskov (7). Nylon bags measuring 7 cm x 16 cm with average pore size of 10 m x 15 m were used. Fifteen grams of the fresh forage ground with a meat mincer were weighed into the bags which were closed and tied with braided nylon fishing line. Two bags were removed from the rumen at 6, 9, 12, 18, 24, 36, 48, 60 and 72 h after introduction into the rumen.

After removal, bags were immediately rinsed with tap water to remove ruminal materials from the outside of the bag. This was followed by successive washings, first with tap water, then with distilled water, until water squeezed from the bags was clear. The bags were then dried at 60°C and weighed. The model for kinetics of fiber digestion was a simple first order kinetic equation (11) with the addition of a discrete lag time as described by Martens and Loften. The different variables were compared using a one-way classification analysis of variance for each season. Different fractions of the sward were compared using one-way analysis of variance with subsamples. Leaf and stem percentages in the sward were compared considering samples of plots as replicates.

Dry matter digestibility and leaf percentage in extrusa were analyzed using a complete block (animals) design. Animal digestion variables were analyzed in a cross design in which variability due to variety, period and animal were isolated. Regression analyses was used to evaluate the relationship between dry matter intake and leaf percentage in extrusa and in the sward.

RESULTS

Estimates of herbage mass are given in Table 1. No significant differences in total amount of dry matter or amounts of green herbage dry matter were detected between varieties, except for the amounts of green herbage dry matter in spring 1982 (P). A significantly higher proportion (P) of leaf was detected in MK than in P swards, except in summer of 1983 (Table 2).

Table 1. Herbage masses (kg/DM/ha) at the start of each period.

Period		MK	P	s.e.mean
Spring 1982	green	2 636	3 344	217.4*
	dead	454	376	49.0
	weeds	402	119	38.7**
	Total	3 492	3 839	244.5
Summer 1983	green	1 034	1 245	131.9
	dead	1 295	1 478	151.4
	weeds	284	184	41.0
	Total	2 613	2 907	273.5
Winter 1983	green	351	174	84.1
	dead	460	470	111.8
	weeds	28	33	6.1
	Total	839	677	192.3
Spring 1983	green	823	1 181	140.8
	dead	51	61	19.5
	weeds	71	85	13.9
	Total	964	1 327	152.9

* (P<0.5)
** (P<0.01)

Table 2. Proportion of the different components of the Maris kasba and El Palenque swards.

Period	Green material						Dead material			Weeds		
	Leaf			Stem								
	MK	P	s.e.mean	MK	P	s.e.mean	MK	P	s.e.mean	MK	P	s.e.mean
1982												
Spring	62.0	48.8*	1.4	9.3	34.4*	1.4	12.1	9.9	0.8	12.9	3.3*	1.3
1983												
Summer	31.4	34.2	2.0	6.5	4.6	1.0	47.6	50.7	0.9	14.4	7.3	1.9
Winter	44.2	21.9*	1.7	8.9	7.1	1.4	49.6	69.1*	1.5	6.5	6.2	1.7
Spring	76.9	47.1*	1.6	5.7	38.5*	1.0	3.6	4.8	1.1	9.6	8.7	1.8

1 s.e.mean of transformed arcsin values, *P<0.05.

During spring 1982, stem and weed percentages were higher (P) in P swards. In winter, the proportion of dead material was significantly lower (P) in MK pastures. Greater proportions of leaf were generally found in the extrusa of animals grazing the MK variety (Table 3), although the results were significant only in spring 1982, and winter 1983 (P). No significant differences were detected in dry matter digestibility of the

Table 3. Leaf percentage, *in vitro* dry matter digestibility of extrusas and intake of dry matter.

Period	Leaf (%)			Digestibility (%)			Intake, g/kg live weight/day		
	MK	P	s.e.mean	MK	P	s.e.mean	MK	P	s.e.mean
1982									
Spring	83.3	63.8	3.8 *	69.0	69.7	1.9 NS	28.6	21.5	1.05 **
1983									
Summer	78.3	76.4	3.4 NS	49.6	54.0	1.0 *	26.1	27.0	0.95 NS
Winter	81.3	58.6	5.7 *	56.7	53.8	2.0 NS	21.0	18.0	0.47 **
Spring	81.7	69.0	4.5 NS	66.9	67.4	0.5 NS	24.8	20.1	1.32 *

* ($P < 0.05$)
** ($P < 0.01$)

extrusa of animals grazing both types of pasture, except during summer 1983 (Table 3), when higher digestibility of the extrusa was obtained in P pastures. Dry matter intake estimates were 33%, 17% and 23% higher for the MK than the P swards during spring 1982, and winter and spring 1983, respectively but no significant differences were found during summer 1983.

No significant relationship could be established between the mean percentage of leaves in the total herbage mass or in the green fraction, and the dry matter intake of steers. However, a significant relationship was found between the percentage of leaves in the extrusa and dry matter intake, as is shown in Fig. 1.

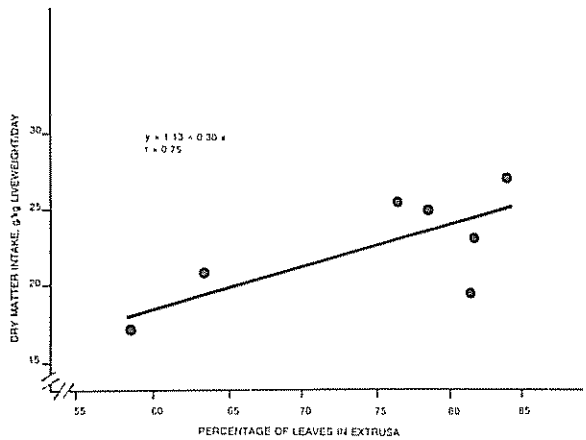

Fig. 1. Relationship between the percent of leaves of *Festuca arundinacea* in extrusa and dry matter intake of steers.

The correlation between the mean percentage of leaves in herbage mass and percentage of leaves in extrusa was no significant, but the proportion of leaves in the extrusa were always higher than in the herbage (Tables 2, 3). Digestion parameters for both varieties are shown in Table 4. Higher turnover rate, and rate and extent of digestion, and lower transit and total mean retention times were observed in animals grazing MK plots.

Table 4. Component turnover rate, transit time and rate and extent of NDF degradation.

	MK	P	s.e.mean
K_1 (%/h)	4.34	3.55	0.47*
k_2 (%/h)	9.34	8.05	0.78*
T.T (h)	10.00	9.83	0.64*
TMRT (h)	45.95	48.23	3.98*
Fiber degradation rate (%/h)	3.80	2.60	0.31*
Extent of NDF digestion (%)	51.2	46.70	4.32*

k_1 = ruminal turnover rate
k_2 = hindgut turnover rate.
T.T. = time of first appearence of marker in feces.
TMRT = total mean retention time

* ($P < 0.05$)

DISCUSSION

This trial was planned to compare two varieties in different seasons and over a wide range of herbage mass and digestibilities. The results showed that, in spring 1982 and winter and spring 1983, the intake of animals grazing MK plots was greater than those on P. It is important to note that, due to the management system applied, the animals were never forced to graze. In

winter, when pasture availability was lower, supplementary paddocks were used. Under these conditions, it is reasonable to find no relationship with herbage mass (5) nor differences in digestibility between pasture, as found by Hodgson *et al.* (3) and Poppi *et al.* (4, 11). Alternatively, differences in intake might have been due to differences in ingestive behavior related to sward structures (4, 12).

However, Cangiano *et al.* (1) did not find any significant difference in bite size in steers grazing both types of swards (varieties). Rather, the results presented show that the higher intake of forage dry matter in animals grazing MK plots was associated significantly with a higher proportion of leaves in extrusa, or diet with a lower mean retention time and higher fiber degradation rate and extent of NDF digestion. These results are in agreement with those of Minson (9), who showed that the intake of leaves by cattle and sheep were higher than stems, due to the smaller size of leaf particles in the rumen, which produced a lower retention time and a faster digestion rate than the stem particles. Accordingly, it is concluded that the higher intake of animals grazing MK plots was related with the higher intake of leaves. In addition, it seems that higher liveweight gains could be obtained on MK pastures during winter and spring. On the other hand, higher animal performance on P pastures can be expected in summer. Consequently, the use of either pasture variety by farmers will depend on their particular needs in each situation.

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