Table 1 - Effects of control and fertilized treatments on sward characteristics and sheep grazing behaviour during winter, spring and summer.

	WINTER					SPRING					SUMMER				
	C	T1	T2	T3	P[1]	C	T1	T2	T3	P	C	T1	T2	T3	P
HM	780c	2250a	1334b	1301b	**	692c	2283a	1237bc	1548b	**	1867b	3120a	2938a	1721b	**
SSH	3.1c	7.6a	4.6b	5b	**	2.8c	8a	4.8b	5.6b	**	7.3c	13.7a	10.8ab	7.6bc	**
GHM	286c	864a	552b	482b	**	531c	1614a	997b	1227ab	**	1021b	1848a	1661a	1102b	*
GLHM	286c	864a	552b	482b	**	336b	931a	599b	546b	*	909b	1384a	1410a	890b	*
BW[2]	79b	142a	139a	92b	*	108b	188a	116b	215a	**	146bc	199a	182ab	131c	*

[1] = Significance: * P <0.05, ** P <0.01 and NS = Not Significant
[2] = It was measured only for sheep.
a, b, c means with different letters between colums are significantly different (P<0.05).
Control Treatment (C) = SR = 0.9 stock unit/ha, without fertiliser application.
Treatment 1 (T1) = SR = 0.9 stock unit/ha, with fertiliser application.
Treatment 2 (T2) = SR = 1.2 stock unit/ha, with fertiliser application.
Treatment 3 (T3) = SR = 1.5 stock unit/ha, with fertiliser application.
Note: Herbage mass (HM; kg DM ha^{-1}), Sward surface height (SSH; cm), Green herbage mass (GHM; kg DM ha^{-}), Green leaf herbage mass (GLHM; kg DM ha^{-1}) and Sheep bite weight (BW; mgDM/bite).

Table 2 - Comparisons of the botanical and chemical compositions among herbage on offer and sheep and cattle diets (% of DM) in winter, spring and summer.

	WINTER				SPRING				SUMMER			
	Pasture	Sheep	Cattle	P[1]	Pasture	Sheep	Cattle	P[1]	Pasture	Sheep	Cattle	P[1]
Botanical composition												
GGL	39b	75a	81a	**	43c	82a	74b	**	48c	74a	67b	**
GGS	3	2	3	ns	33a	6c	14b	**	10b	5c	16a	**
TGL	0b	5a	0b	**	1b	2a	0b	*	1a	0a	0a	ns
TDC	56a	7c	11b	**	15a	7c	10b	**	37a	14b	17b	**
W	5b	11a	5 b	**	9a	4b	2c	**	4a	6a	1b	**
Nutritive value												
CP	17b	18a	16b	*	11b	14a	11b	*	8b	10a	9a	*
ADF	39a	37b	41a	*	42a	33c	37b	**	50a	40c	45b	**
NDF	73a	57b	77a	**	77a	68b	69b	*	82a	67c	77b	**

[1] = significance: * P <0.05, ** P <0.01 and ns = not significant
a, b, c means with different letters between colums are significantly different (P<0.05).
Grass green leaf (GGL), Grass green stem (GGS), Total green legume (TGL), Total dead component (TDC)
Weeds (W), Crude protein (CP), Acid detergent fibre (ADF) and Acid neutral detergent fibre (NDF).

the proportions of weeds and legumes in sheep diet compared with those of the pasture on offer and their vertical position in the sward canopy, suggesting that sheep apparently penetrated in some degree to the lower horizons of the sward canopy to select these components.

The nutritive value of sheep and cattle diets was higher than of the herbage on offer (Table 2). The nutritive value of sheep diet was generally higher than that obtained by cattle, showing the greater selecting ability of sheep compared with cattle as reported by Montossi, (1995).

In the context of the Basaltic region of Uruguay, this study demonstrates the benefits of the application of nitrogen and phosphate fertilizers to improve native pasture production, structure and nutritive value as well as its animal carrying capacity, having a clear positive effect in increasing the nutritive value of the diet selected by animals on those pastures. It also suggests that diet selection plays a relevant role in determining the nutritive value of the forage eaten by animals and showed the greater selective ability of sheep over cattle in a broad range of circumstances.

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ID # 08-19

A comparative grazing study of sheep and cattle diet selection on native pastures in Uruguay

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ABSTRACT

An experiment was carried out during winter, spring and summer 1997, on native pastures of the basaltic region of Uruguay to evaluate the effects of different herbage mass levels (high, medium and low) on sward characteristics and on sheep and cattle diet selection and grazing behaviour. Higher herbage masses resulted in increments in herbage accumulation and sheep bite weight: winter (1880, 1513 and 610 kg DM ha^{-1}, $P < 0.01$; 199, 148 and 128 mgDM/bite, $P < 0.01$), and summer (3046, 2175 and 1172 kg DM ha^{-1}, $P < 0.01$; 214, 175 and 143 mgDM/bite, $P < 0.01$) for high, medium and low herbage mass levels respectively. The nutritive value of diet selected by sheep and cattle was higher than that of the herbage on offer, and higher in sheep than in cattle: winter (10.2, 15.9 and 12.5% crude protein, CP, $P < 0.05$; 49.2, 32.4 and 38.1% acid detergent fiber, ADF, $P < 0.01$, and summer (7.4, 10 and 9.5% CP, $P < 0.05$; 51.1, 36.8 and 43% ADF, $P < 0.01$) for herbage on offer, sheep and cattle diets respectively. These contrasting results found in the nutritive value were closely associated with differences in the proportions of the botanical components recorded, particularly the differential contribution of dead material. This experiment quantified the importance of diet selection in determining the nutritive value of the forage eaten by sheep and cattle on the native pastures of the basaltic region of Uruguay and established some relationships between diet selection and grazing management, involving animal selectivity ability differences (sheep versus cattle) and seasonal effects.

KEYWORDS: Native pastures, sheep, cattle, diet selection, grazing behaviour.

INTRODUCTION

Native pastures represent about 85% of the total land dedicated to sheep and cattle meat and wool production in Uruguay, where mixed (sheep and cattle) and continuous grazing are some of the main grazing practices applied by livestock farmers.

There are no research studies reported for the basaltic region of Uruguay, evaluating diet selection differences between sheep and cattle grazing native pastures under contrasting sward conditions as well as the impact of this phenomenon on the nutritive value of the forage selected by either sheep or cattle.

MATERIAL AND METHODS

During winter, spring and summer 1997, a diet selection study was carried out at "Glencoe" Research Unit (latitude 32° 01' 32" S, 57° 00' 39" W) of INIA-Tacuarembó Research Station, in an extensive region of basaltic soils in central-north Uruguay, South America.

Three experimental plots (6000, 8000 and 9000 m²) of native pastures were used, located on medium to deep basaltic soils, divided by electric fences. The typical species composition, productive potential, nutritive value and seasonal patterns of growth of the native pastures utilised in the experimental area have been documented by Berretta (1998). Three herbage mass levels (high, medium and low) were created using different stocking rate intensities in these plots. Herbage mass (HM), botanical composition and sward surface height (SSH) were recorded in accordance with the procedures described by (Montossi et al., (1999).

Oesophageally fistulated animals (4 wethers and 4 steers) were used in accordance with the experimental methodologies and procedures described by Montossi (1995).

Sward and diet selection data were analysed by the statistical package SAS (1990) based on a randomised complete design. Treatment means were compared by LSD test.

Table 1 - The effect of herbage mass accumulation (high, medium and low) during winter, spring and summer on sward characteristics and sheep bite weight.

	WINTER				SPRING				SUMMER			
	HERBAGE ACCUMULATION											
	High	**Medium**	**Low**	**P¹**	**High**	**Medium**	**Low**	**P¹**	**High**	**Medium**	**Low**	**P¹**
HM	1880a	1513a	610 b	**	2916a	2092b	1180c	**	3046a	2175b	1172c	**
SSH	8 b	5.2 a	1.8 c	**	10.7 a	9.9 a	5 b	**	21.7 a	15.5 b	6.5 c	**
GHM	679 a	601 a	239 b	**	1681a	1300a	543 b	**	1102a	1077ab	717 b	NS
GLHM	601 a	588 a	229 b	**	1184a	1226a	472 b	**	932 ab	796 a	517 b	NS
BW²	199 a	148 b	128 b	**	119 a	104 ab	91 b	*	214 a	175 b	143 c	**

¹ = Significance: * P <0.05, ** P <0.01 and NS = Not Significant

² = It was measured only for sheep.

Note: Herbage mass (HM; kg DM ha⁻¹), Sward surface height (SSH; cm), Green herbage mass (GHM; kg DM ha⁻), Green leaf herbage mass (GLHM; kg DM ha⁻) and Sheep bite weight (BW; mgDM/bite).

Table 2 - Comparisons of the botanical and chemical compositions among herbage mass on offer, sheep and cattle diets (% of DM) in winter, spring and summer.

	WINTER				SPRING				SUMMER			
	Pasture	Sheep	Cattle	P¹	Pasture	Sheep	Cattle	P¹	Pasture	Sheep	Cattle	P¹
Botanical composition												
GGL	39.3 b	71.3 a	66.5 a	**	46.8 b	80.5 a	78 a	**	37.6 b	78.4 a	77.8 a	**
GGS	5a	2.7b	6.5a	*	9.2a	4.3b	8.5a	*	11.6a	4b	10.6a	*
TGL	0	0	0	NS	0 a	1.13 a	0 a	NS	0	0	0	NS
TDC	55.9 a	13 c	23.3 b	**	38 a	7.4 c	12.3 b	**	45.2 a	6.6 b	11.3 b	**
W	4.8 b	12.7 a	2.9 b	**	5.9 a	6.7 a	1.2 b	**	5.7 b	10.8 a	0 c	**
Chemical Composition												
CP	10.2 b	15.9 a	12.5 b	*	9 b	12.9 a	11.3 b	*	7.4 b	10 a	9.5 a	*
ADF	49.2 a	32.4 c	38.1 b	**	47.6 a	39.6 b	39.8 b	*	51.1 a	36.8 c	43 b	**
NDF	71 a	55.6 c	63.8 b	**	74.4 a	65.5 b	72.6 a	*	79 a	64.8 c	72.7 b	**

¹ = Significance: * P <0.05, ** P <0.01 and NS = Not Significant

Note: Grass green leaf (GGL), Grass green stem (GGS), Total green legume (TGL), Total dead component (TDC), Weeds (W), Crude protein (CP), Acid detergent fibre (ADF) and Neutral detergent fibre (NDF).

RESULTS AND DISCUSSION

Sward data are presented for each season in Table 1. In general, the increase in herbage mass accumulation, achieved by grazing management, resulted in corresponding increments in HM and SSH values. The general tendency of higher sheep BWs recorded with increases in the levels of HM and SSH are in accordance with the results in the literature (Montossi, 1995). The association between sheep BW with HM or SSH were medium to high, being the relationships; BW (mgDM/bite) = 20 + 0.05 HM (kgDM/ha), $R^2 = 0.74$ and BW (mgDM/bite) = 35 + 13.3 SSH (cm), $R^2 = 0.58$, respectively. However, herbage mass accumulations did not necessarily result in better sward composition and structure, where, in general, the quantities and proportions of GHM and GLHM did not increase between medium to high herbage mass levels.

The botanical composition and nutritive value of the diet selected by oesophageally fistulated animals are shown in Table 2 for the three seasons studied. Leaf lamina and sheath were not distinguished, so results are compared in terms of green versus dead material, legume versus grass, and green leaf versus green stem. Green grass leaf made up more than 66% in the diets of both species, being this component quite similar between them, while the GGS component of the herbage on offer as well as in cattle diet were significantly higher than in sheep diet. Animal diets had higher proportions of GGL compared with herbage on offer (from 68 to 108 %). In contrast, TDC were significantly lower in sheep (77–85%) and cattle (58-75%) diets than in the herbage on offer, whereas sheep diets had significantly lower proportions of TDC than cattle diets (on average 21%). Weeds were minor components of the herbage on offer or extrusa samples, being this component preferred by sheep and not selected by cattle.

The presence of native legumes in herbage and extrusa samples was not significant. In general, the values of the parameters studied (CP, ADF and NDF) associated with the nutritive value of the herbage consumed by the fistulated animals were consistently higher than those obtained in the herbage on offer. These results also show the higher nutritive values of the extrusa samples taken by sheep in comparison with those of cattle. The lower and higher nutritive values of dead and weed components respectively and the increased lignification of stalky material, probably explained the differences found in the nutritive value among herbage on offer and sheep and cattle diets.

The information reported in this study is in accordance with the findings of several research studies carried out in temperate conditions with heterogeneous herbaceous communities, which generally found that sheep and cattle appear to select preferentially green material, leaves and legumes in comparison with dead material, stems and grasses, respectively (Montossi, 1995).

This trial establishes for the first time that diet selection plays an important role in influencing the nutritive value achieved by sheep and cattle in the native pastures of the basaltic region of Uruguay. It also gives some basis to explain, at least in part, the inconsistencies found when feed budgeting calculations are used to estimate the adequate stocking rate to achieve certain animal production goals and contributes with supporting information related to herbage mass targets to maintain an adequate balance between sward composition, structure and nutritive value.

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