QUALITATIVE PARAMETERS OF TWO CULTIVARE OF *PANICUM MAXIMUM*, JACQ. UNDER GRAZING

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ABSTRACT

Two *Panicum maximum* cultivars were studied with respect to forage leaf blade availability and extrusa through chemical parameters, tissue proportion and degradation. It was concluded by observing digestive residues that the studies qualitative parameters did not show indication of higher fragility of the cultivar 'Aruana' in relation the cultivar 'Vencedor'.

KEYWORDS

Extrusa, anatomy, microscopy, chemical composition

INTRODUCTION

The desirable qualitative characteristics of forage plants are those that favor the utilization of cell walls by rumen microorganisms, since their ability to degrade is seen as a digestibility index. Differences in anatomical structure, chemical composition and type of lignification in grass cells have been related to the rate and extent of cell wall degradation in the rumen (Akin and Robinson, 1982). The inaccessibility of cell walls for microbial attack limits digestive weakening (Wilson and Kennedy, 1996). Plant anatomy and structural features related to physical disruption and reduction in particle size by mastication may be important in forage intake (Laredo and Minson, 1975). Our purposes were to: 1) characterize leaf blade anatomy and extrusa chemical composition of two cultivars of *Panicum maximum* under grazing and report residual dry matter after defoliation and 2) to observe differences in tissue degradation for the two forage cultivars.

METHODS

Four 400 m^2 grazing areas of *P. maximum* were used, two that were established with the cultivar 'Aruana' and the other with the cultivar 'Vencedor', managed at two dry matter residues: 1880 (RGDM1) and 3000 (RGDM2) kilograms of green dry matter (GDM) per hectar.

Before grazing a square of 0.50 x 0.50 m was located at three points along a transect within each grazing area. A portion of each sample was divided into leaf blade, stem plus leaf sheath and dead herbage. In January 1995, two oesophagally-fistulated steers were used to collect additional samples (four collection per grazing area). Each 200 g samples was separated into leaf blade and stem plus sheath portions.

Random samples from the leaf blade of extrusa were prepared for histological observations (Daykin an Hussey, 1985). The proportional areas of bundle sheath (BS), vascular bundle (VAS) adaxial epidermis (ADE), abaxial epidermis (ABE) and sclerenchyma (SCL) were measured over a cross-secitonal area between the two major vascular bundles with digitized images (KONTRON ELEKTRONIC-ZEISS). The mesophyll (MES) was determined by the difference.

The SCL cells were isolated from the 10 fractions of leaf blades from available herbage sample and extrusa samples in Jeffrey's solution. Then 90 cells from each sample were measured through optical microscopy.

Nylon bags were filled with approximately 0.5 g of extrusa leaf blades on a dry matter basis. Each replicate was incubated *in natura* and *in vitro* using the one-stage procedure of Tilley and Terry (1963) and taken out after 48 h incubation. The residue was prepared by the procedure of Santos (1995) for the scanning electron microscope (JEOL JMS 25SII observations.

The available herbage leaf blades of and extrusa samples were analysed crude protein (CP; N concentration x 6.25), neutral detergent fiber (NDF), acid detergent fiber (ADF), and lignin (L) (Van Soest and Wine 1968).

Statistical analysis was conducted using SAS.

RESULTS AND DISCUSSION

The available forage showed a mean of 76.7% leaves per GDM (P>0.05); 933.2 g GDM/kg of DM and its mean leaves 11.3% CP; 76.2% NDF; 37.7% ADF and 4.6% L, (P>0.05) in DM basis.

The extrusa presented a mean of 872.1 g leaves per kg GDM (P>0.05) and its leaves showed no differences (P>0.05) chemical composition (Table 1). It was observed a difference (P>0.05) related to the RGDM only for the L variable, RGDM1 = 3.6% and RGDM2 = 4.8% in DM basis.

There were observed no differences (P>0.05) in the extrusa tissue proportion among the RGDM. Aruana extrusa exhibited a higher proportion (P<0.05) of ABE and ADE and lower (P<0.05) BS in relation to Vencedor (Table 1). The otehr proportions were as follows: SCL = 1.0; VAS = 3.4 and MES = 37.9 (P>0.05).

The SCL cell length for herbage leaf blades for Aruana showed similarities for the two RGDM at 58.5% in general with 500 to 900 µm, 38.9% with 900 to 1300 µn and 2.2% above 1300 µm. Those from the extrusa ehibited 85% of the cells from 100 to 700 µn and 15% from 700 to 1100 µm. The Vencedor cells were longer for available herbage and extrusa in relation to Aruana. For available herbage, 45% from 500 to 900 µm and 55% from 900 to 1500 µm and for extrusa, 53.5% from 300 to 700 µm and 46.5% from 700 to 900 µm.

The Aruana extrusa fractions had smaller particles when compared to those of Vencedor. Particle size along with SCL cell length, possibly indicates a higher fragility for Aruana. Observations demonstrated that the Aruana leaf structure was less rigid than that of Vencedor (Fig. 1a and Fig. 1d) after 48 h incubation.

The structures in the Vencedor residue were kept bound to the epidermis (i.e.; BS, VAS and SCL) (fig. 1b), this reduced the susceptibility of BS cell walls to enzymatic hydrolysis and thus reduced the extent and rate of digestion. Bowman and Firkins (1993) suggested that the differences in the colonization rate of particles by bacterium particle-associate may account for differences in the rate of fiber digestion.

The Aruana BS cells were highly colonized and degraded, and in some residue fractions showed xylem secondary wall exposition (Fig. 1e). Comparing the Aruana undegraded BS to those of Vencedor was a uniform colonization in the Vencedor BS was observed only at the cut end region (Fig. 1c) while for the Aruana it took place for the whole extenuation.

Observations indicate that a better medium lamells dissolution occurred in the Aruana residue fraction. This can be further demonstrated by the spread of the SCL cells from the SCL strands to the medium, being the most colonized and some showing a destroyed pattern (Fig. 2f).

The qualitative studies parameters from the digestion residues, since its chemical origin or the tissue proportion seem not to indicate a higher fragility of the Aruana as compared to the Vencedor. On the other hand the SCL cell measurements indicate that the physical action of biting/masticating increase the total colonization area by microorganisms of Aruana when compared to the Vencedor.

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Table 1
Chemical composition and tissue proporations in leaf blades cross of *Pannicum maximum* cultivars 'Vencedor' and 'Aruana'.

Variables	CULTIVARS Vencedor	Aruana	SD
% of Dry Matter			
Crude protein	9.8	10.5	0.8
Neutral detergent fiber	73.9	74.7	2.3
Acid detergent fiber	34.5	37.0	3.4
Lignin	4.3	3.9	1.4
Tissue proportions (%)			
Abaxial epidermis	9.8[b]	10.9[a]	0.3
Adaxial epidermis	16.7[b]	18.6[a]	0.5
Bundle sheat	32.0[a]	28.1[b]	0.6
Sclerenchyma	1.0	1.0	0.1
Vascular bundle	3.6	3.1	0.2
Mesophyll	36.5	39.2	1.1

[a, b], Different letters in rows indicate significant differences (P<0.05).

Figure 1
Scanning electron micrographis of chewed leaf blades incubated 48 h *in vitro* for *Panicum maximum* **(a-c)** cultivar 'Vencedor' and **(d-f)** cultivar 'Aruana', **a.** digestion residue (x 58), **b.** connected structures residues (x 800) and **c.** colonized bundle sheath cell cut end (x 2500), **d.** digestion residue (x 60), **e.** residue showing xylem secondary wall (x 800 and **f.** sclerenchyma cell (x 3800).

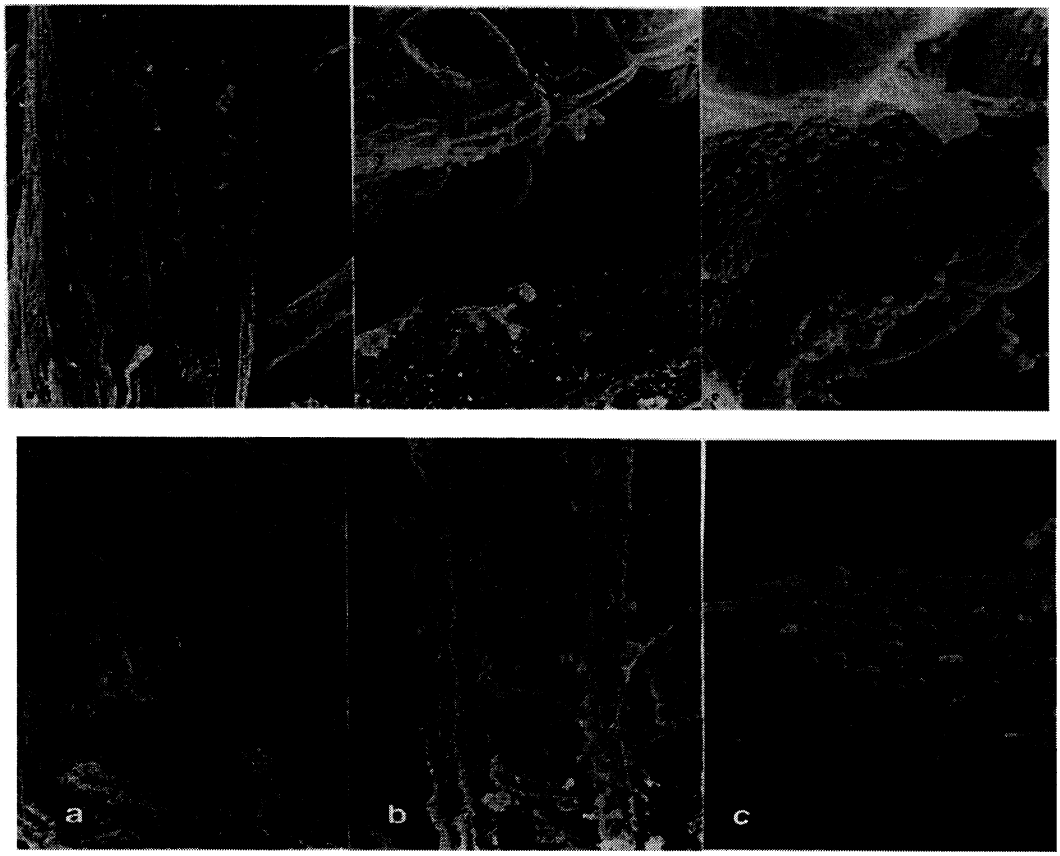

Figure 2
Scanning electron micrographs of *Panicum maximum* cultivar Aruana leaf blades incubated 48 h *in vitro*: **a.** digestion residue (x 60), **b.** residue showing xylem secondary wall (x 800) and **c.** sclerenchyma cell (x 3800).