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Megathermic spontaneous grasses in the mid valley ecotone, Rio Negro of Argentina

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Introduction

The vegetation in the ecotone of mid valley in Río Negro (Argentina) varies in community composition and plant cover depending on the annual precipitation regime and on the temperature requirements of the plants species. The megathermic forage grasses are characterized by a C₄ photosynthetic metabolism, their production is concentrated in summer, they are tolerant to drought, efficient in the use of water and nitrogen, they have a high potential for dry matter production and the nutritional quality necessary to meet the demands of cattle. North Patagonia is a semiarid temperate region with hot, dry summers and with forage resources ranging from plenteous to scarce from the river valleys to the plateau. The characteristics of *Trichloris crinita*, *Distichlis spicata*, *Distichlis scoparia* and *Aristida mendocina* were described and their consumption by cattle and forage quality were evaluated with the aim of finding a grazing schedule suitable for preserving and improving the valuable spontaneous grass populations in the ecotone area between the valley and the plateau.

Materials and Methods

Study site: Forty hectare valley/plateau ecotone area was selected in a cattle breeding land (39 ° 28 ' S - 65 ° 32' W). Studies on vegetation richness (Klich, 2014) had demonstrated the sympatric presence of the megathermic Poaceae *Trichloris crinita*, *Distichlis spicata*, *Distichlis scoparia* and *Aristida mendocina*, in four slightly different niches within the same area. Plant characteristics (Elzinga *et al.*, 1998) were evaluated (2012 to 2014) as well as the evolution of their populations and the bovine consumption under autumn grazing schedules with 110 breeding cows.

Feed analysis: Determinations were made for dry matter (DM), crude protein (CP), ashes (ash), neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL) and in vitro dry matter digestibility (IVDMD).

Diet microhistological studies: Plant epidermal characteristics were used to identify the components in the fecal samples (Schmale *et al.*, 2013).

Statistical analysis: Data were analyzed with ANOVA and treatment means were separated using Newman-Keuls test.

Results and Discussion

The climate is cold temperate, semi-arid. The average annual precipitation was 303 mm. It rained 401, 287 and 401 mm during the year 2012, 2013 and 2014, respectively and it was mostly during spring. In the ecotone the soils are alluvial. The surface occupied by relicts of river courses suffers occasional flooding. This is the area where the *Distichlis spp.* grow, in poorly permeable loamy lime soils, pH 8.5, electric conductivity (EC) of 4 Mmhos/cm and 1.05 % organic matter (OM). Surrounding the ancient river course in an area 0.80 m higher up where *T. crinita* is usually present, the soil is sandy loam, slightly alkaline (pH 8.3 to 8.8), EC less than 4 Mmhos/cm, no sodium or excess salt, with 0.5 to 1.2 % OM. Lastly, *A. mendocina* occupies the upper sandy area, pH 7.5 and 0.5 % OM. *T. crinita* niche had more herbaceous diversity and plant cover, while poor diversity and low cover were found in the *A. mendocina* niche (Table 1). The higher DM production came from the *Distichlis spp.* niche and both the species contributed with 12 % of the consumed forage during dry years and with upto nearly 7 % in 2014 with higher precipitation. The consumption of *T. crinita* reached 11 % of the total in dry 2013, but was only 3 % in 2014 due to the greater offer of other species. *A. mendocina* was scarcely found in the cow feces (>0.1 %) although it occupied a larger niche from year to year of autumn grazing. Digestibility was higher in spring but protein and fiber contents were higher in autumn (Table 2).

Table 1. Cover, composition and dry matter production in each C₄ niche

Year	2012				2013				2014			
	<i>T.c.</i>	<i>A.m.</i>	<i>D.spic.</i>	<i>D.scop.</i>	<i>T.c.</i>	<i>A.m.</i>	<i>D.spic.</i>	<i>D.scop.</i>	<i>T.c.</i>	<i>A.m.</i>	<i>D.spic.</i>	<i>D.scop.</i>
C4 sp/Niche												
Ecological area/sp (ha)	8	4	12	0.5	8	6	12	0.5	8	8	12	1
Total % plant cover	55 a	20 a	50 a	50 a	80 b	35 b	70 b	60 b	85 b	50 c	90 c	90 c
sp number (eatable shrubs)	5 a	1 a	0 a	1 a	5 a	1 a	0 a	1 a	5 a	1 a	0 a	1 a
sp number (herbaceous)	22 a	5 a	15 a	7 a	22 a	5 a	15 a	8 a	45 b	7 a	22 b	8 a
Herbaceous DM kg /ha	200 a	200 a	1700 b	900 a	600 b	300 a	1400 a	800 a	1200 c	500 b	2000 c	1200 b

Within a line, for each niche, the means with the same letter are not significantly different (P>0.05)

Table 2. Chemical composition (% DM basis) and in vitro dry matter digestibility (IVDMD%) of grasses*

C4 sp	CP %	Ash %	NDF %	ADF %	ADL %	IVDMD %
<i>T. crinita</i>	15.01/ 11.47	9.95/ 9.69	69.85/ 66.66	33.20/ 28.38	4.28 / 2.17	57.74/ 67.79
<i>A. mendocina</i>	7.00/ 7.74	11.96/ 10.28	80.97/ 69.68	44.42/ 32.70	5.92 / 4.18	29.79/ 61.33
<i>D. spicata</i>	10.94/ 10.59	10.59/ 10.13	73.68/ 71.20	34.55/ 32.55	6.01/ 3.59	48.36/ 51.02
<i>D. scoparia</i>	12.26/ 11.80	12.86/ 12.12	65.30/ 63.97	29.52/ 24.31	3.93/ 2.05	62.65/ 64.43

*2014 autumn/spring

Conclusion

Ehleringer and Monson (1993) recommend that plants with a C₄ photosynthetic pathway are taken into account in the improvement of rangeland management in arid areas, due to their ability to thrive in extreme conditions. In the ecotone studied, by managing the grazing periods it will be possible to increase the population of megathermics that are adapted to unfavorable weather conditions and poor soils, with relatively good forage nutritional values and high digestibility, such as *T. crinita*. Appropriate rotational cattle management practices, and the provision of fresh drinking water (to counteract the effect of the leaf salt glands), permit the use of the low saline environments where *Distichlis spp.* abound and so become an important component of the cows' diet, especially in dry years. This would also achieve an increment in the area and consumption of *D. scoparia* that seems to have the higher nutritional value of these two halophytes. However, this type of management will also result in increased populations of species not prized by cattle, such as *A. mendocina*.

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