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Range management and cows' consumption of *Trichloris crinita*

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Abstract. Continuous use of the livestock fields in the middle valley of the river Negro, Northern Patagonia, Argentina is causing rangeland degradaion. Cattle breeding using rotation regimes between plots of known vegetation composition in a valley field, with 303 mm historical annual rainfall, was planned to evaluate the population of *Trichloris crinita*, a native to the Americas known by the common name False Rhodes Grass, and to estimate its consumption and preference by cows. To describe the floristic composition, identification of the plant species was undertaken on point intercepting lines. The diet of the grazing animals was determined by microhistological studies using epidermal characteristics to identify the plant components in fecal samples of cows. Plots at the lower edge of the plateau that surrounds the valley, with alluvial soils and little biodiversity, where *T. crinita* grows spontaneously, were left free from animals during the summer and autumn, allowing vegetative and reproductive development of the plant species. The use of this forage in winter as deferred pasture permitted the increase of the *T. crinita* population with higher annual dry matter production per plant, and it resulted in enhanced cow consumption.

Keywords. North Patagonia – Cattle breeding – Semiarid region – Native grasses.

Gestion des pâturages et consommation de* Trichloris crinita *par les vaches

Résumé. *L'utilisation continuelle des prairies d'élevage de la moyenne vallée du Río Negro, dans le nord de la Patagonie en Argentine, cause la dégradation des pâturages. Pour évaluer la population de* Trichloris crinita*, une plante originaire d'Amérique connue comme fausse herbe de Rhodes, et estimer sa consommation et sa préférence par les vaches, on a planifié l'utilisation de ces prairies avec des bovins d'élevage sous un régime de rotation sur des parcelles de composition végétale connue. Pour décrire la flore, on a identifié les espèces sur des droites d'intersection. Le régime alimentaire des animaux au pâturage a été déterminé au moyen d'analyses micro-histologiques utilisant les caractéristiques épidermiques pour identifier les composantes végétales dans des échantillons fécaux des vaches. Les parcelles situées au pied du plateau qui limite la vallée, avec des sols alluviaux et peu de biodiversité, mais sur lesquelles la* T. crinita *pousse spontanément, ont été privées d'animaux pendant les mois d'été et d'automne, pour permettre le développement végétatif et reproductif de l'espèce. Le pâturage en hiver, comme pâture différée, a permis l'augmentation de la population de* T. crinita*, une plus grande production annuelle de matière sèche par plante, et s'est soldé par une augmentation de la consommation des animaux.*

Mots-clés. *Nord de la Patagonie – Élevage – Région semi-aride – Espèces autochtones.*

I – Introduction

Biodiversity on cattle farms in semi-arid regions is greatly dependent on the plant/animal relationship. In the middle valley of the river Negro, Northern Patagonia, Argentina, many fields are still used for extensive cattle raising, using spontaneous pasture. Historically the annual rainfall for the area was 303 mm with notable inter annual variation, but during the last decade the precipitation was 36% below average and the number of animals in the area suffered a decline of 50%. The continuous use of the livestock fields combined with severe drought caused forage degradation.

A long term study was planned to identify and evaluate the different soil/landscape/vegetation units in a cattle field representative of the region. Monitoring of the forage resources and micro-histological cows' diet analysis showed that in the extremely dry year, 2010, few *Trichloris crinita* plants lived in the protected areas and animal consumption of the species was evident.

Trichloris crinita (Lag.) Parodi, commonly known as False Rhodes Grass or *plumerillo,* is an important native perennial grass, widespread in the range areas of the arid and semi-arid phytogeographical region of Monte (scrublands), Argentina. As it is a C4 type of Poaceae, it only grows in summer, using water efficiently. As a native species, *T. crinita* is well adapted to the environmental conditions of this semi-arid region (Greco and Cavagnaro, 2005; Fioretti and Brevedan, 2012).

Assuming that native grasses must be preserved, *T. crinita* became a target species and was monitored during the following years (2011-2013). The aim of the study presented here was to relate the *T. crinita* population with cow consumption on a yearly timed grazing schedule planned to increase the presence of this native species especially in parcels with poor forage.

II – Material and methods

Study place. A 550 ha cattle breeding field (39° 28' S - 65° 32' W) has been used to identify and evaluate the different soil/landscape/vegetation units of the middle valley and the cows´ diet. It has 12 parcels ranging from 7 to 100 ha, divided with traditional or electric fences in order to rotate the grazing of the animals. Land was stratified into landscape units and subdivided into soil/vegetation subunits for monitoring (Herrick *et al*. 2009). Historic climatic data were obtained from INTA (2000) and the precipitation was recorded in the field. Soil texture was described for each subunit and the salinity and fertility were analyzed at the LANAQUI laboratory with an Atomic Emition Spectrometer (ICP-AES), Shimadzu ICPE – 9000 in soil samples obtained from different units and depths.

Landscape and vegetation. As a pilot monitoring program (year 2010) vegetation identification was carried out in quadrats distributed systematically throughout the field, using a grid cell method to define 200 x 200 m macroplots and using a GPS to position the sampling points previously defined on a map (Elzinga, Salzer and Willoughly, 1998). These studies demonstrated the presence of the native *T. crinita* in two different landscapes. Since then (2011 to 2013) the studies on the *T. crinita* populations have been made on two 40 ha parcels, one near the river identified as **RPD** (rich plant diversity) and the other at the lower edge of the plateau that limits the valley named **PPD** (poor plant diversity), at a distance of 1500 m from each other. Vegetation richness was evaluated in both parcels following the grid cell method on 100 x 100 m macro-plots and identifying vegetation in a 1 sq m quadrat for each plot, Soil cover was measured with Line-point intercept and Gap-intercept methods (Herrick *et al*. 2009) on five 10 m transects for each study site in spring (October). These measurements facilitated the identification of the specific areas where the populations of *T. crinita* developed in RPD and PPD, occupying ca. 8 ha in both parcels. In each of these two areas where the presence of the target species was detected, ten randomly placed quadrants (1 sq m) were used to determine the number of *T. crinita* plants per m^2, plant size, number and height of flowering stems in every year in February (summer). Mean dry matter production (g DM/plant year) was estimated each year, in March (autumn), in samples obtained from small areas protected from grazing.

Diet micro-histological studies. Plant epidermal characteristics were used to identify components in fecal samples and to study the diet of the cows. Feces were collected from the cows as they came to the drinking areas. Immediately after they evacuated, 100 cm^3 of fecal material per cow was sampled in a plastic bag. Once at the laboratory the feces were oven dried at 60°C during 48 h, and then ground and conserved for further use. 15 cow feces samples were collected

at the beginning of the grazing period, five days after the cows entered the parcel and 15 samples were collected at the end of the grazing period before moving the cows to another plot. For the analysis of cow feces, microscope slides were made for each sample site and date (Lindström *et al*., 1998) and 40 fields per microscope slide were systematically observed with 100X magnification. Reference slides of leaf, stem and fruit of the species present in the area were prepared with diaphanized material (Dizeo de Stritmatter, 1973), an epidermis fragment was removed by scraping (Metcalfe, 1960) according to the method described by Hansen *et al.* (1977) and it was used for the subsequent identification of epidermal fragments in the fecal samples.

Livestock management. For several **y**ears before this study was started, and up to 2011 during the severe drought period, livestock management consisted in moving the animals from one plot to another without a pre-designed timed grazing schedule. In order to avoid grazing in the parcels most affected by drought, rotational grazing was planned during the summer of 2011. Since 2012 the RPD plot has been used in January (summer) and the PPD parcel is grazed in July (winter). During the rest of the year the cattle graze in other field parcels. The stocking rates vary from 110 cows with their 2 to 5 month old calves (80 to 90) in January, to the cows with the remaining, yet unsold, 7 to 9 month old calves (around 40) in July.

III – Results and discussion

The climate is cold temperate semi-arid to arid. The average temperature ranges from 6.83°C in July to 23.02°C in January. The average annual precipitation is 303 mm, falling mostly during the spring and autumn. Annual evapotranspiration is over 800 mm, with a negative water balance throughout the year (INTA, 2000). The annual rain at the study site was only 230 mm in 2010 and 168 mm in 2011, falling mostly in summer. During 2012 it rained 401 mm, distributed throughout the year, but it was down to 287 mm in 2013, with no rain during the spring season.

In RPD the soils are deep, light, sandy loam, slightly alkaline (pH 8 to 8.5) and the electric conductivity is less than 4 Mmhos / cm. The organic matter content is between 3 and 6.5% in the 0-20 cm layer. Soils at PPD are alluvial and hence vary with the topography. The soil where *T. crinita* usually occurs is a sandy loam with deep layers of clay, slightly alkaline (pH 8.3 to 8.8), electric conductivity less than 4 Mmhos / cm and no sodium or excess salt, with 0.5 to 1.2% organic matter.

Although both the RPD and PPD parcels are at different sites in the valley they show relicts of river courses and/or of stream channels over 45% of their surface. Occasional flooding can occur (the last one was in 2007) when the river Negro flows through them. In RPD this area is occupied mainly by *Elaeagnus angustifolia* an invasive tall shrub that has become a food resource for the cows, even though plant development underneath its canopy is diminished. In PPD the ancient river course is a grazing plain that is mostly covered by *Distichlis spicata* during severe drought.

At RPD edible plants are represented mainly by the trees *Elaeagnus angustifolia* and *Salix sp.*, the shrub *Lycium sp*. and 74 herbaceous species, such as *Bromus*, *Nassella*, *Poa* and *Piptochaetium* (Poaceae). At PPD the edible plants are mainly the shrubs *Atriplex lampa*, *Lycium chilense*, *Lycium tenuispinosum* and *Suaeda divaricata* and *22* herbaceous plants, mostly grasses, such as *Poa ligularis*, *Piptochetium napostaense, Nassella sp., Distichlis spicata* and *Trichloris crinita.*

During summer in RPD the forage supply for livestock is generally ensured due to natural soil moisture. Data from January 2013 show that, when considering species with more than 2% contribution, at the beginning of the grazing period nearly 70% of the cows´ diet was provided by only six species: *Elaeagnus angustifolia* 21%, *Lycium chilense* 19%, *Medicago minima* 10%, *Trichoris crinita* 8.5%, *Nassella tenuis* 6.5% and *Poa ligularis* 4.5%. At the end of the grazing period *E. angustifolia* contributed with 66%, *L. chilense* with 10% and *N. tenuis* with 2.5%. The rest of the edible species, including *T.crinita,* completed the diet*,* supplying less than 1% each.

In PPD, *T. crinita* was scarcely found along the fences (less than 0.1%) in 2010 and 2011. When PPD was grazed in winter (July 2012 and 2013), the halophyte shrub *Atriplex lampa* contributed 25 to 40% of the cows´ diet at both the beginning and end of the month, whereas *Distichlis spicata* contributed 8 to 28% and *T. crinita* contributed 3% and 11.4% to the diet at the beginning of the period in 2012 and 2013 respectively. These values may be related to the increase in the number of plants per sq m, in the diameter of each plant and in the annual dry matter production per plant found within the *T. crinita* population site. No differences of the number and height of flowering stems were detected between years. (Table 1).

Table 1. Variation of plant cover in PPD (poor plant biodiversity) plot in 2010-2011 (in italics, pilot monitoring) and from 2012 to 2013; the incidence of *T.crinita* in the diet of breeding cows at the beginning and end of the grazing period and *T. crinita* plant population characteristics

	PPD (40 ha)			*T. crinita* population (8 ha)				
Year	Plant cover (%)	Cows' consumption (% *T.crinita)*		*T.crinita* (plants/ m^2)	Plant diameter (cm)	Flowering stems (number/ plant)	Height of flowering stems (cm)	Annual dry matter (g/plant)
		Initial	*End*					
2010	12			0.1	3 - 10	5	50	–
2011	9			0.1 a	3 - 10	6 a	45 a	19 a
2012	55	3.0	<0.1	3.0 b	5 - 20	7 a	40 a	74 b
2013	80	11.4	<0.1	7.0 c	10 - 40	6 a	55 a	97 c

Data were analyzed with ANOVA, means separated using Duncan test. Within a column, means with the same letter are not significantly different (p>0.05).

IV – Conclusion

Native forage grasses, such as *T. crinita*, have become adapted over time to poor soils and extreme climatic conditions in this semiarid region. The population of *T. crinita* may be influenced by the time of foraging. By leaving the populations of this species free from grazing during the growing period it permitted a greater vegetative growth and a higher productivity per plant, while germination of seeds increased the number of plants. Animals consume this grass as deferred pasture in the dormant season. Appropriate management promotes conservation of the species and may increase, in the future, the sustainability of cattle fields of poor biodiversity.

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