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Grazing livestock as a tool for managing natural feed resources in Sayago (Zamora, Spain)

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SUMMARY – In the region of Sayago (Zamora, NW Spain), traditional management practices based upon systematic grazing *Agrostietalia* order communities are declining. As a result, some areas are being overgrazed, whereas others are underused. This work tries to prove that systematic grazing management (5-6 times during the herbage growth period) acts as a regulating factor of forage resources and allows good quality forage to be obtained [crude protein (CP) = 150-200 g/kg DM; crude fibre (CF) = 210-260 g/kg DM; organic matter digestibility (OMd) = 64-61%] without large production losses (22% of DM). Moreover, herbage growth rates (41-105 kg/ha/day) of other pasture communities allow reserving areas to be harvested or grazed when feed availability falls.

Keywords: Forage resources, grazing, natural pastures.

RESUME – *"Pâturage du bétail pour la gestion des ressources fourragères naturelles : L'exemple de la région de Sayago (Zamora, Espagne)". Dans la région de Sayago (Zamora, NO Espagne), les procédures de gestion traditionnelles basées sur le pâturage systématique des pâtures de l'ordre d'*Agrostietalia *diminuent. En conséquence, quelques secteurs sont surpâturés tandis que d'autres sont peu employés. Cette recherche montre que le pâturage systématique peut être considéré comme un facteur régulateur pour la gestion des ressources fourragères et permettre d'obtenir un fourrage de bonne qualité [matières azotées totales (MAT)= 150-200 g kg^{-1} matière sèche (MS) ; lignocellulose = 210-260 g kg^{-1} MS ; digestibilité de la matière organique (dOM) = 64-61%] sans grandes pertes de production (22% de MS). De plus, les taux de croissance de l'herbage (41-105 kg ha^{-1} jour^{-1}) des communautés des pâturages permet de réserver des secteurs à la moisson ou au pâturage quand la disponibilité en aliments diminue.*

Mots-clés : *Ressources fourragères, pâturage, pâtures naturelles.*

Introduction

Forage production in Region of Sayago (Zamora) is limited by both their climate and soil characteristics. Although numerous different natural pasture communities exist in the area, those grouped under phytosociological order *Agrostietalia* cover 70% of the total pastures surface area. (García *et al.,* 1998a; Sánchez, 1991). Traditionally, the pasture surface of the Region has been exploited by livestock, mainly the Spanish Churra sheep and by cows of the local breed Sayaguesa.

Management of pasture communities used to involve both cutting and grazing practices: herbage of some of the pastures communities was conserved as hay whereas some other pastures were grazed in spring.

These management practices are declining and control of herbage growth by means of grazing is nowadays unusual (Sánchez, 1993), which is leading to undesirable consequences. Overgrazing of some areas and reduction of palatability and nutritive value of available forage are two of these unwanted effects (García *et al.*, 2004).

The present work aims to investigate the effect of systematic grazing pastures classified as *Agrostietalia* communities on the production and quality of forage.

Materials and methods

The research was conducted in 1997 in Region of Sayago at Roelos village (Zamora-Spain)

located at 41º 16´ N and 6º 10´ W. The area has a Mediterranean climate, with an average annual temperature of 10.9º and rainfall of 189 mm in spring, 59 mm in summer, 223 mm in autumm and 275 mm in winter. Soils are acidic, not very deep and with low fertility.

Annual pastures (ANNP; *Tuberarion guttatae;* main species: *Trifolium cherlerii, Plantago Bellardi, Vulpia bromoides, Trifolium scabrum, Trifolium subterraneum, Tuberaia guttata, Aira cayophyllaea, Ornithopus perpusillus, Ornithopus compressus, Sedum caespitosum, Teesdalia coronopifolia, Leontodon taraxacoides, Linaria amethystea, Scleranthus annus*) represent 80% of the pasture area and are usually grazed by sheep. The rest of the area is covered by natural pastures. Natural pastures included "vallicares" which are grouped under the order *Agrostietalia* (main species: *Agrostis castellana, Agrostis pourretii*, *Ornithopus perpusillus, Poa bulbosa, Lotus corniculatus, Alopecurus arundinaceus, Trifolium subterraneum, T. striatum, T. arvense, Anthoxanthum aristatum, Aira caryophyllea, Gaudinia fragilis, Briza minor).* "Vallicares" cover 21 ha (75% of natural pastures), which some *Quercus ilex* (16 trees ha^{-1}) with a 52% shrub cover (*Quercus ilex, Quercus pyrenaica, Genista florida, Genista lusitanica)* and a 48% herbaceous cover. According to water availability, soil fertility and tradicional management, "vallicares" can be classified as mowing (MOW), damp (DAMP) and fresh (FRESH). MOW "vallicares" are located in the lowest slope areas, which soils have the higher moisture and fertility; they are usually cut for hay. DAMP "vallicares" are also located in low slope areas but their soils fertility is scarce. FRESH "vallicares" are located in the upper part of the slopes, which are the less humid areas. Some other pasture communities are also present: *Campanulo-Nardion* (NARD), *Cynosurion cristatii* (RAYG), *Molinio-Arrenatheretea* (meadows, MEAD). A more complete description of botanical and productive characteristics of these pastures can be found in García *et al*. (1998a,b and 1999).

Two areas were fenced: one of 2000 m^2 (UNGRAZED plot) and another one of 5000 m^2 (GRAZED plot) were established on a FRESH pasture. UNGRAZED plot was not grazed for the experimental period, whereas GRAZED plot was discontinuously grazed by beef cattle from a herd with a 25% of animals of the local bred Sayaguesa. Animals were allowed to graze for 1 day at a high stoking rate (8-14 AUE ha^{-1} day^{-1}) on the following dates: 16 April, 30 April, 8 May, 21 May and 25 June. Two 100 m^2 enclosure plots were placed on GRAZED area.

At the beginning of the experiment (16 April) and after each grazing time, herbage samples were taken in UNGRAZED plot and inside and outside of enclosure plots in GRAZED plot. Three samples were collected in each plot by clipping all plant material in a $1m^2$ quadrate 2 cm above ground level. Herbage intake was calculated as the difference between dry matter (DM) weight of the herbage samples taken after each grazing period inside and outside of the enclosure plots. Samples of herbage available were milled though a 1 mm screen and the following determinations were performed: Organic matter (OM), crude protein (CP), crude fibre (CF) (AOAC, 1995). Organic matter digestibility (OMd) was estimated using INRA equations (Andrieu *et al*., 1981).

Herbage growth rates were calculated in both grazed and ungrazed FRESH pastures as well as in the rest of pasture communities.

Results and discussion

In UNGRAZED plot, available herbage mass exponentially increased (kg DM ha^{-1}= $976e^{0.1912\ t}$; R^2 = 0.80) during the experimental period, the maximum (2952 kg MS ha^{-1}) been reached during the first week of June. Although forage quality declined from April to June, this lost of quality was more important from 4 June to 25 June (Table 1). From these results, the first week of June could be suggested as an appropriate cutting date.

Available herbage mass was lower in GRAZED than in UNGRAZED plot, although the differences between means were not significant ($P<0.05$) on 30 April and 21 May. However, forage quality was higher in GRAZED than in UNGRAZED plot, because in the former quality was maintained trough the experimental period (Table 1).

Herbage intake through the experimental period was 2247 kg DM ha^{-1}, which represents 76% of the forage available during the first week of June.

Table 1. Available herbage mass (kg DM ha^{-1}) and chemical composition (crude protein (CP; g kg^{-1} DM), crude fibre (CF; g kg^{-1} DM) and digestible organic matter (OMd) g kg^{-1} DM) in UNGRAZED FRESH pasture. Herbage intake (kg DM ha^{-1}) in GRAZED FRESH pasture

	Sampling date					
	16 April	30 April	8 May	21 May	4 June	25 June
UNGRAZED						
Available herbage mass	1233	1400	1600[a]	2100	2945[a]	2890[a]
CP	143	124	106[a]	93	91[a]	59
CF	238	266[a]	258[a]	286	291[a]	313
OMd	650	620	610	590	583	547
GRAZED						
Available herbage mass	1233	1116	1240[b]	1685	1483[b]	1080[b]
CP	143	150	140[b]	110	137[b]	-
CF	238	210[b]	220[b]	260	228[b]	-
OMd	650	640	625	610	630	-
Herbage intake	678	200	301	685	383	-

a,b: within each column and for the same parameter, means with different letter are different (P<0.05).

Table 2 shows the herbage growth rates of the different pasture communities. Annual pastures (ANNP) productivity was small, their herbage growth rates declining from the beginning to the end of herbage growth season.

Table 2. Herbage growth rates (kg DM ha^{-1} day^{-1}) of the different pasture communities

	25 Mars to 16 April	17 April to 30 April	1 May to 8 May	9 May to 21 May	22 May to 4 June	5 June to 25 June
ANNP	6	21	21	7	13	9
"Vallicares"						
MOW	26	60	33	8	47	105
DAMP	47	20	48	24	69	0
FRESH UNGRAZED	37	12	25	38	61	-3
FRESH GRAZED	37	40	41	57	35	-6
NARD	31	59	40	39	22	12
RAYG	24	63	99	42	43	57
MEAD	16	23	94	61	17	85

ANNP: Annual pastures (*Tuberarion guttatae*). "Vallicares": Communities of *Agrostietalia*; MOW: mowing "vallicares"; DAMP: damp "vallicares"; FRESH: fresh "vallicares"; NARD: *Campanulo-Nardion* communities; RAYG: *Cynosurion cristatii* communities, MEAD: *Molinio-Arrenatheretea* communities.

FRESH "vallicares" growth declined from the first week of June and the herbage started to dry up (García *et al.*, 1998b). These facts could explain that FRESH growth rate reached a small but negative value. MOW "vallicares" as well as meadows showed high growth rate at the end of growing season; as a consequence, they can be considered as very appropriate to be reserved for hay. DAMP "vallicares" reached the highest herbage growth rate (69 kg DM ha^{-1} day^{-1}) when FRESH started to dry up (García *et al.*, 1998b).

Conclusions

Controlled grazing management of FRESH "vallicares" avoids the lost of quality of forage during the herbage growth period without large production losses. Herbage growth rates of other pasture

communities allow reserving areas to be harvested or grazed when feed availability of FRESH "vallicares" falls.

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