Differences in diet selection and grazing behaviour between equines and cattle grazing on upland vegetation communities

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ABSTRACT

Diet selection and grazing behaviour of 5 mares and 5 cows managed on natural shrubland with an area of improved pasture were studied at the beginning (May) and end (October) of the grazing season. Diet composition was estimated using alkane markers and the grazing behaviour was determined by recording the grazing activity on each vegetation type (short and tall heathland, and improved pasture). Differences in diet selection were only observed in October as both species selected only herbaceous plants in May, when the mean sward height of the improved pasture was 7.1 cm. The lower availability in October (3.2 cm) resulted in a decline of the proportion of herbaceous plants (0.85 and 0.68 in cattle and equines, respectively) and an increase in gorse selection by equines (0.30) and heather by cattle (0.13). In general equines spent more time grazing than cows (648 vs. 530 min/day) but with the decrease of the improved pasture availability from May to October, cattle increased the time spent grazing (from 483 to 576 min/day) while a decrease was observed in equines (from 687 to 609 min/day). Although cattle and equines spent similar average proportions of the grazing time on the improved pasture (0.85 and 0.82), equines spent more proportional time grazing over short heathland (0.11 vs. 0.04) and cattle on tall heathland (0.12 vs. 0.07).

KEYWORDS: diet composition; heathland; equines; cattle

INTRODUCTION

Heathlands are shrubby vegetation communities widespread in the north of the Iberian Peninsula as consequence of the abandonment of agricultural and livestock managements and by frequent fires. These areas are usually extensively managed with domestic livestock, mainly feral cattle and horses, at very low stocking rates. Due to their different eco-physiological adaptations (mouth and dental anatomy, digestive strategy), these animal species have different abilities to exploit the available plant resources (Hofmann, 1989; Illius and Gordon, 1993), that vary in both quality and quantity, allowing them to co-exist in the same ecosystem. The resource partitioning by the use of different plant species is also suggested as another coexistence mechanism (Menard et al., 2002). However, previous studies (Lechner-Doll et al., 1995; Aldezabal, 2001) indicated that these animal species have high levels of competition even under different vegetation conditions. We consider that for a more efficient and sustainable utilization of these plant communities it is essential the knowledge of grazing behaviour and diet selection of equines and cattle on upland vegetation communities.

MATERIAL AND METHODS

The experiment was carried out on a hill experimental farm (900 to 1000 m a.s.l.) at the Carbayal Research Station, Sierra de San Isidro, western Asturias, Spain. Five crossbreed mares and 5 Asturiana de los Valles beef cows were managed together in a mixed herd under continuous grazing to have the same opportunities for diet selection in a plot (22.3 ha) established on natural shrubland (76%) dominated by short heather-gorse shrubland (*Erica umbellata*, *E. cinerea*, *Calluna vulgaris* and *Ulex gallii*) and tall scrubland (*Erica australis* subsp. *aragonensis* and *E. arborea*) with an area (24%) of improved pasture (*Lolium perenne* cv 'Phoenix', *L. x hybridum* cv 'Dalita' and *Trifolium repens* cv 'Huia').

The composition of the diet selected by the animals was estimated using the n-alkane technique at the beginning (May) and end (October) of the grazing season. Faecal and herbage samples of the main vegetal components were collected at each sampling date and the alkane pattern (from C_{22} to C_{36}) was analyzed by direct saponification according to the method of Mayes et al. (1986) with minor modifications (Oliván and Osoro, 1999). Diet composition was estimated using an optimization procedure which minimises the sum of squared discrepancies between the actual alkane proportions in faeces (adjusted for the incomplete faecal recoveries) and the calculated proportions (different combinations of diet components). Alkane faecal concentrations (from C_{25} to C_{33}) were corrected with recovery values obtained by the authors in previous validation studies (Ferreira et al., 2007) performed in metabolic pens with animals receiving diets composed by different combinations of the main vegetation components present in the field.

The animals' grazing behaviour, the time spent grazing by each animal species on each vegetation type (short and tall heathland, and improved pasture), was determined by recording the grazing activity every 15 min from dawn to dusk on two consecutive days in each period. The overlap in vegetation use (grazing time and diet composition) between animal species was estimated by the Kulcyznski similarity index as $KSI = \Sigma 2c_i / \Sigma(a_i + b_i)$, where c_i is the lesser proportion of *i* vegetation type or plant component in the two animal species, and $(a_i + b_i)$ is the sum of the proportions of each vegetation type/component in both species. This index ranges from 0 (no overlap) to 1 (total match).

Grass availability was assessed by recording weekly the sward surface height at 100 random points on the improved pasture area using the HFRO swardstick (Barthram, 1986). As diet composition data could not be normalized nor the variances equalized by transformation, differences between animal species were analysed using the non-parametric Kruskal-Wallis test for each period.

RESULTS

Table 1 shows the diet composition estimates for cattle and equines in the beginning and end of the grazing season. The results indicate that the herbaceous species were the only diet component for both animal species in the beginning of the grazing season, when the sward height of the improved pasture was higher (7.1 cm).

Table 1. Diet composition of cattle and equines grazing on a partially improved heathland in two different periods.

Season	Vegetation component	Cattle	Equines	SEM	Sign.
May	Herbaceous	1.00	1.00	0	-
	Gorse	0	0	0	-
	Heather	0	0	0	-
October	Herbaceous	0.85	0.68	0.048	NS
	Gorse	0.02	0.30	0.057	*
	Heather	0.13	0.02	0.012	**

NS non-significant; * P<0.05; ** P<0.01; SEM standard error of mean.

The decline in the availability of the improved pasture at the end of the grazing season (3.2 cm) resulted in a decrease of the proportion of herbaceous plants (0.85 and 0.68 in cattle and equines, respectively). In this period, both animal species included in their diets different proportions of woody species. Equines showed a significant (P<0.05) higher preference for gorse than cattle (0.30 vs. 0.02) while cattle selected significantly higher amounts (P<0.01) of heather than equines (0.13 vs. 0.02).

Figure 1 shows that equines spent more time grazing than cows (648 vs. 530 min/day). The decrease of the improved pasture availability from May to October, resulted in an increase in the daily grazing time of cattle (from 483 to 576 min/day) while a decrease was observed in equines (from 687 to 609

min/day). Differences between animal species were also observed in the proportion of grazing time spent on each vegetation type. In May equines spent more time grazing on the improved pasture than cattle (0.91 vs. 0.80) while in October cattle spent more time grazing on this vegetation type than equines (0.90 vs. 0.72). The time spent grazing on each heathland type also differed between animal species. Equines spent more proportional time grazing over short heather-gorse shrubland (0.11 vs. 0.04) and cattle on tall scrub heathland (0.12 vs. 0.07).

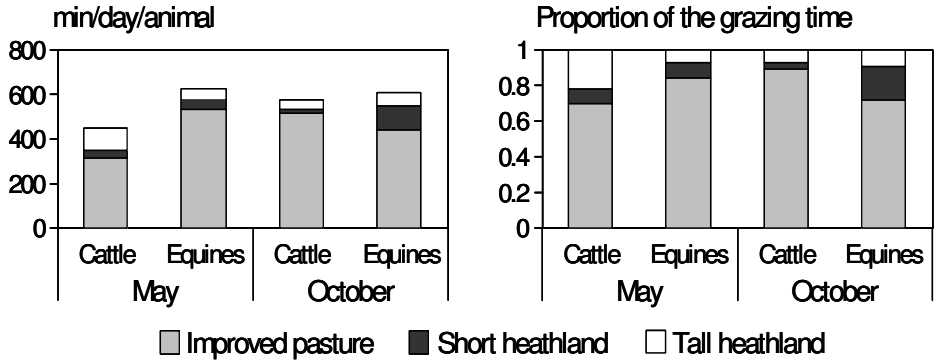

Figure 1. Total grazing time (min/day/animal) and its proportion spent by cattle and equines on each vegetation type.

The degree of grazing overlap between animal species (Kulcyznski similarity index) was high, considering both the grazing time spent on each vegetation type (0.84) and diet composition (0.86).

Table 2. Overlapping level (Kulcyznski similarity index) between cattle and equines in the vegetation use (grazing time) and diet composition.

Month	Grazing time	Diet composition
May	0.86	1.00
October	0.82	0.72

DISCUSSION

The results obtained in this study showed that equines and cattle grazed preferentially on the improved pasture area, especially when the herbage availability in this area was higher. This intensive use of grasslands by these animal species was also observed by Menard et al. (2002) in two French wetlands across the grazing season. The decrease in the improved pasture availability resulted in a change in the diet preferences towards the woody vegetation, being higher in equines (0.32) and limited in cattle (0.15). It should be noted that the selection of woody plants by both equines and cattle is lower than that observed in small ruminant species (Celaya et al., 2007). The inability of cattle to consume woody plants even when the herbage availability is low was also observed in previous studies (Oliván and Osoro, 1998; Aldezabal, 2001). According to Illius and Gordon (1993) this inability can be explained by an inefficient selection of the green shoots of shrubs due to their muzzle anatomy. Within the woody species equines showed a preference for gorse while cattle incorporated higher proportion of heather. The different prehension strategy of equines (teeth) and cattle (tongue) could explain these differences, allowing the equines to overcome the hardness and sharpness of the thorns present in the gorse. In contrast the lack of physical defences of heather allows its consumption by cattle, though limited by the constraints mentioned above.

The results obtained in this study showed high levels of dietary overlap or similarity between cattle and equines in these vegetation communities, especially in the beginning of the grazing season, for both methods of calculation (time spent grazing on each vegetation type and diet composition). However, a slight decrease of these levels of similarity was observed when the herbage availability in the improved pasture area declined. Similar levels of dietary overlap between these animal species were observed by Lechner-Doll et al. (1995) in a thornbush savannah pasture and Aldezabal (2001) under mountain conditions in the Pyrenees. The high levels of competition between

cattle and equines observed in the present heterogeneous plant communities may lead to an inefficient use of the natural vegetation when these species are managed together, suggesting that other complementary herbivores like small ruminants, especially goats, could be appropriate to be integrated in mixed flocks for a more efficient use of these resources. As an alternative, cattle and equines should be managed sequentially, i.e. cattle followed by equines.

CONCLUSIONS

Data obtained in this study showed a grazer behaviour of both animal species with an intensive use of the improved pasture area, despite the shift towards the woody species at the end of the grazing season as a consequence of the decrease in the grass availability. The results also highlighted that grazing systems based on these two animal species will lead to an inefficient use of the pasture resources due to their high level of competition for the same plant resources. Consequently, there is the need to include other animal species with higher levels of complementarity with cattle and equines, leading to a more efficient and sustainable use of these vegetation communities.

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