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Román-Trufero A., Osoro K., Celaya R.

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Performance of two local beef cattle breeds in Cantabrian mountain pastures

A. Román-Trufero, K. Osoro and R. Celaya

Área de Sistemas de Producción Animal, Servicio Regional de Investigación y Desarrollo Agroalimentario (SERIDA), 33300 Villaviciosa, Asturias (Spain)

Abstract. In Cantabrian Mountains (N Spain), summer pastures are mostly utilized for beef cattle production. This work aimed to study cow and calf performance of two local breeds, Asturiana de los Valles (AV) and Asturiana de la Montaña (AM), grazing at different pasture mixtures from June to October. Data were recorded from 1995 to 2013 in a high mountain area, which was divided in two plots of 30 ha each: one with 70% grassland and 30% *Calluna*-heathland cover (C30), and another with 30% grassland and 70% heathland cover (C70). The effects of vegetation cover, breed, physiological status and their interactions on body weight (BW) and body condition score (BCS) changes were analysed. In general, AV cows showed worse (P<0.001) BW and BCS changes than AM cows (-81 *vs.* 18 g/day; -0.16 *vs.* 0.03 BCS units). In C30, cows gained 80 g/day and maintained BCS (0.00), whereas in C70 cows lost 143 g/day and 0.14 BCS points. An interaction (P<0.01) between breed and vegetation cover indicated that the differences between breeds mostly occurred in C70 plot. Lactating cows lost BW and BCS, whereas non-lactating cows used to gain BW and BCS (-253 *vs.* 190 g/day; -0.22 *vs.* 0.09 BCS units; P<0.001). Regarding calf growth, no differences were found between breeds in spite of the greater mature BW size in AV breed, while greater BW gains were observed in C30 than in C70 (769 *vs.* 557 g/day; P<0.001). Cattle from AM breed present a better adaptation to high mountain conditions, particularly when the availability of quality pasture is limiting.

Keywords. Suckler cows – Autochthonous breed – Vegetation cover – Body weight.

Performances de deux races locales de bovins à viande dans les pâturages des Montagnes Cantabriques

Résumé. *Dans les Montagnes Cantabriques (Nord de l'Espagne), les pâturages d'été sont surtout utilisés pour la production de bovins à viande. Ce travail visait à étudier les performances des vaches et veaux de deux races locales, Asturiana de los Valles (AV) et Asturiana de la Montaña (AM), pâturant différentes prairies mélangées de juin à octobre. Les données ont été notées de 1995 à 2013 dans une zone de haute montagne, qui était divisée en deux parcelles de 30 ha chacune: une avec couvert à 70% de prairie d'herbe et 30% de bruyères* Calluna *(C30), et l'autre avec un couvert à 30% de prairie d'herbe et 70% de bruyères (C70). Les effets de couvert végétal, race, état physiologique et de leurs interactions sur les changements de poids corporel (BW) et de note d'état corporel (body condition score, BCS) ont été analysés. En général, les vaches AV ont montré de moins bons changements (*P*<0,001) de BW et de BCS que les vaches AM (-81* vs. *18 g/jour; -0,16* vs. *0,03 point de BCS). Sur C30, les vaches ont gagné 80 g/jour et le BCS s'est maintenu (0,00), tandis que sur C70 les vaches ont perdu 143 g/jour et 0,14 point de BCS. Une interaction (*P*<0,01) entre la race et le couvert végétal indiquait que les différences entre races se produisaient principalement dans la parcelle C70. Les vaches allaitantes ont perdu en BW et BCS, tandis que les vaches non allaitantes ont en général gagné en BW et BCS (-253* vs. *190 g/jour; -0,22* vs. *0,09 point de BCS;* P<*0,001). Concernant la croissance des veaux, aucune différence ne fut rencontrée entre races malgré la plus grande taille à poids corporel adulte chez la race AV, tandis qu'un GMQ supérieur fut observé pour C30 par rapport à C70 (769* vs. *557 g/jour;* P<*0,001). Les bovins de race AM présentaient une meilleure adaptation aux conditions de haute montagne, en particulier lorsque la disponibilité de pâturage de qualité était limitante.*

Mots-clés. *Vaches allaitantes – Race autochtone – Couvert de végétation – Poids corporel.*

I – Introduction

Beef cattle breeds may differ in their body size, nutrient requirements, grazing behaviour, etc., so they can show different productive responses under particular vegetation conditions. As well, physiological state and derived energy demands will also affect body reserves and animal performance (Osoro *et al*., 1998, 1999). Regarding the offspring, different growth potential and dams' milk yield may lead to differences between breeds in calf performance when raised on mountain pastures (Casasús *et al*., 2002). In Asturias, there are two local beef cattle breeds, Asturiana de los Valles (AV) and Asturiana de la Montaña (AM), which use to graze on mountain pastures during summer. In a typical valley-mountain management system (short-haul transhumance), cows calve in late winter, and after using lowland pastures during spring and being mated, they are moved in June to summer mountain pastures where they nurse their calves. When they are downloaded from the mountain, calves are usually weaned to be sold on traditional fairs.

The objective of this work was to study the productive performance of beef cattle (body weight and body condition score changes of lactating cows and their calves and non-lactating cows), comparing the two local breeds, AV and AM, when they graze on summer mountain pastures with different vegetation cover (grassland/heathland ratio).

II – Materials and methods

1. Study site and experimental animals

The study was carried out in Puertos de Agüeria (1600-1800 m a.s.l.), located in the nature park of Las Ubiñas-La Mesa (Quirós, Asturias, N Spain). The experimental field was divided in two plots of ~30 ha each, one with 70% *Festuca-Agrostis* grassland and 30% *Calluna* heathland cover (C30), and another with 30% grassland and 70% heathland cover (C70). We studied the performance of two local cattle breeds, AV and AM, grazing in mountain pastures during the summer (from mid June to late September or early October). Data were collected from 14 years (1995-1997, 1999-2003, 2008-2013), totalling 684 cows (381 AV, 303 AM).

Calving took place during winter to early spring. At the experimental site, two thirds of the cows were lactating their calves, and one third were non-lactating cows, being almost all pregnant. Managed stocking rates ranged from 0.6 to 1.1 cows/ha across years (mean ± SE: 0.81 ± 0.03 in C30; 0.79 ± 0.04 in C70).

Animals were weighed at the beginning and at the end of the summer grazing season. At the same time, body condition score (BCS) of cows was evaluated in a scale of 1 to 5 according to Lowman *et al*. (1976) criteria. Body weight (BW) and BCS changes were calculated for the grazing season.

2. Statistical analysis

Animal performance data were analysed using factorial ANOVA. We examined the effects of year (Y), breed (B), vegetation cover (V), physiological state (P) and their interactions on cows' BW and BCS changes. As data were unbalanced across years, the 3-way interaction Y×B×P and the 4-way interaction were not included in the model. To analyse calves' BW gains, we used factorial ANOVA including the effects of Y, B, V and their interactions. Tukey's test was used for comparison of means.

III – Results and discussion

There were great differences among the 14 years examined (P<0.001) in the BW and BCS changes experienced by cows, ranging from a minimum of -380 g/day in 2001 to a maximum of 182 g/day in

2009. This was due to the great differences among years in climatic conditions and available good quality pasture. In general, AV cows lost more BW than AM cows (-81 *vs.* 18 g/day; *P*<0.001; Table 1). Animals from AM breed are smaller and more rustic than those from AV (Osoro *et al*., 1999), so AM breed would be better suited to these harsh conditions. There was a year × breed interaction (*P*<0.001), because during the first experimental years (1995 and 1996) AM cows lost more BW than AV cows, while in the rest of years AV cows showed less favourable BW changes than AM cows. Regarding vegetation cover, cows grazing at C30 plot lost less BW than those grazing at C70 (80 *vs.* -143 g/day; *P*<0.001). The C30 plot was dominated (70%) by *Festuca-Agrostis* grassland, which has a better nutritive quality than heathland (Hodgson *et al*., 1991), which is the community that dominates the C70 plot. There was an interaction year × vegetation cover (*P*<0.001) as the differences between plots varied among years depending on the available pasture. There was an interaction breed × vegetation cover (*P*<0.01); on average, differences between breeds in BW change were small at C30 (60 *vs.* 101 g/day in AV and AM, respectively; *P* = 0.17), but greater differences in favour of AM were observed at C70 (-221 *vs.* -65 g/day in AV and AM, respectively; *P*<0.001; Table 1). This genotype × environment interaction has been observed in other works, with smaller genotypes thriving better under unfavourable conditions of available forage because of their lower absolute nutrient requirements compared to larger genotypes (Fitzugh, 1978; Wright *et al*., 1994; Osoro *et al*., 1999).

Studying the effect of physiological status, on average lactating cows lost BW, whereas non-lactating cows gained BW (-253 *vs.* 190 g/day; *P*<0.001) because of the greater energy demand for milk production. Besides an interaction year × physiological state (*P*<0.05), there was an interaction vegetation cover × physiological state (*P*<0.05) as greater differences between lactating states were observed at C70 (C30: -116 *vs.* 277 g/day; C70: -390 *vs.* 104 g/day in lactating and non-lactating cows, respectively; Table 1).

Table 1. Body weight (BW) and body condition score (BCS) changes in lactating (L) and non-lactating (NL) cows from Asturiana de los Valles (AV) and Asturiana de la Montaña (AM) breeds grazing during summer at Cantabrian mountain pastures with different vegetation cover (C30: 70% grassland, 30% *Calluna* heathland; C70: 30% grassland, 70% *Calluna* heathland)

Vegetation cover	C30				C70										
Breed	AV		AM		AV		AM			Significance					
Physiological status	L	NL	L	NL	L	NL	L	NL	SEM	B†	V††	P†††	B×V	B×P	V×P
Initial BW (kg)	523	535	430	433	520	532	429	428	10.7	***	NS	NS	NS	NS	NS
BW change (g/day)	-129	248	-103	305	-468	26	-311	181	43.0	***	***	***	*	NS	*
Initial BCS	2.64	2.99	2.73	2.99	2.69	3.03	2.72	3.16	0.06	*	*	***	NS	NS	NS
BCS change	-0.13	-0.07	-0.16	0.37	-0.32	-0.14	-0.28	0.20	0.06	***	***	***	NS	***	NS

† Breed; †† Vegetation cover; ††† Physiological status. Effects of year and its interactions are not shown. All 3-way interactions were non-significant. SEM: standar error of the mean; NS: non-significant (*P*>0.05); * *P*<0.05; ** *P*<0.01; *** *P*<0.001.

The influence of the different factors on BCS variations was generally similar to that exerted on BW changes, with more favourable BCS changes in AM than in AV cows (0.03 *vs.* -0.16; *P*<0.001). There was an interaction year × breed (*P*<0.001). Cows grazing in C70 lost 0.14 BCS points while cows at C30 maintained BCS (*P*<0.001). There was an interaction year × vegetation cover (*P*<0.05). Regarding the effects of physiological status, while lactating cows lost on average 0.22 BCS points, non-lactating cows earned 0.09 points (*P*<0.001). There was an interaction year × physiological state (*P*<0.001). In contrast to BW changes, an interaction breed × physiological status was observed for BCS changes (*P*<0.001), with greater differences found in AM than in AV cows (Table 1).

There were not differences between breeds on calf BW gains, in spite of the higher growth potential of AV compared to AM (Osoro *et al*., 1999), as can be seen in the greater initial and final BW in the former breed (Table 2). Calves that spent the summer in C30 gained 769 g/day while those at C70 gained 557 g/day (P<0.001). This difference was probably due to the higher mobilization of body reserves in the dams at C70, reducing their milk production, although it might also be partly due to lower forage intakes attained by the calves at C70 (Bailey and Lawson, 1981; Osoro *et al*., 1998).

Table 2. Body weight (BW) gains in nursing calves from Asturiana de los Valles (AV) and Asturiana de la Montaña (AM) breeds during summer at Cantabrian mountain pastures with different vegetation cover (C30: 70% grassland, 30% *Calluna* heathland; C70: 30% grassland, 70% *Calluna* heathland)

Vegetation cover	C30		C70			Significance		
Breed	AV	AM	AV	AM	SEM	B†	V†	B×V
Initial BW (kg)	141	114	143	122	3.2	***	NS	NS
Final BW (kg)	215	181	200	177	4.0	***	**	NS
BW gain (g/day)	794	754	547	579	34.2	NS	***	NS

† B Breed; †† V Vegetation cover; SEM: standar error of the mean;
NS: non-significant (P>0.05);* P<0.05; *** P<0.001.

IV – Conclusions

Cattle from AM breed show a better adaptation to mountain conditions than AV. Smaller sized cattle have a greater ability to adapt to situations of low herbage availability. This aptitude is decreased when cows are lactating, because of increased energy demand. Calf BW at weaning was greater in AV breed, but AM calves achieved similar BW gains to AV calves.

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