

A Comparison of Grazing Behavior Between Desert Adapted Mexican Criollo Cattle and Temperate British Breeds Using Two Diverse Landscapes In New Mexico and Chihuahua

Jose O. Roacho Estrada¹, Ed Fredrickson², Gerardo A. Bezanilla Enriquez¹, H. Raul Peinetti², Alfredo L. Gonzalez², and Jose Rios³

¹Recursos Naturales, Universidad Autónoma de Chihuahua, Km 1.0 Periferico Francisco R. Almada, Chihuahua, 31031, Mexico, ²USDA-ARS Jornada Experimental Range, P.O. Box 30003, MSC 3JER, New Mexico State University, Las Cruces, NM 88003, ³Ciencia Animal, Universidad Autónoma de Chihuahua, Km 1.0 Periferico Francisco R. Almada, Chihuahua, 31031, Mexico



Abstract

This study was designed to test if grazing behaviors differ between desert adapted Mexican criollo cattle and temperate British beef breeds, and to learn how each breed interacts with environments common to the southwestern U.S. and northwestern Mexico. Additionally, criollo cattle may be an appropriate breed for regional beef production systems less reliant on fossil fuels for feed supplements and other production inputs. Two sites were used: the Jornada Experimental Range (JER) in south-central New Mexico and Rancho Experimental Teseachi (RET) in central Chihuahua. The JER pasture is 1,160 ha of undulating desert grasslands receiving an average of 245 mm precipitation. Elevation of the 2,552 ha RET pasture varies from 1,900 to 2,800 m with an average annual precipitation of 580 mm. Vegetation ranges from pinyon-juniper-*Bouteloua* on the lower slopes to pine-oak-*Muhlenbergia*. Four replicates were conducted during the spring and fall at each location. In each replicate, six different mature cows per breed were fitted with Lotek GPS collars, equipped with activity sensors, and allowed to graze each pasture with position acquired at 5-minute intervals. British cattle grazed longer per day than criollo cattle (10.6 versus 9.82 hours/day, respectively; $P < .0001$). British cattle also traveled less each day: 6.87 versus 8.08 km/day, respectively; $P < .0001$. In addition, British breeds remained closer to water and had significantly smaller home ranges. Larger British breeds grazed more hours and used a smaller proportion of the environment than Mexican criollo cattle. Forage conditions were better than average for each location; when poorer, we hypothesize differences between breeds will be greater.

Introduction

Proper grazing distribution in variable environments is a major goal of rangeland managers. A goal that is often difficult to achieve. Selecting beef cattle breed with long-term adaptations to semi-arid and arid environments may be the least expensive method to improve livestock distribution with fewer labor requirements. Matching livestock evolutionary adaptation to nutritionally challenging environments also may improve profitability by lessening the need for supplements whose cost are rapidly increasing. In some areas, matching cows type to rangeland can decrease reliance on over-allocated water resources needed for irrigated pastures. In this study, we examine the distribution of two diverse beef cattle breeds: Mexican criollo cattle from arid regions of the Sierra Tarahumara of Chihuahua and temperate British breeds. Originating from North Africa, the criollo cow of Chihuahua was the product of semi-arid region of Andalusia before being brought to the New World by Columbus in 1493. Later the criollo cow co-evolved with arid regions of northern Mexico and southwestern U.S. for more than 400 years (Rouse 1977). British breeds, originating from temperate climates, are currently the mainstay of the U.S. and northern Mexico livestock industry.

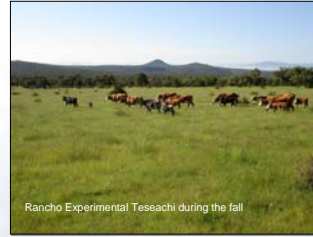
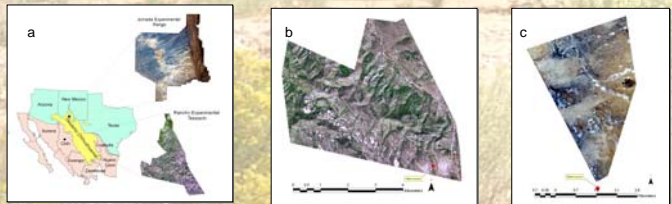
We hypothesize that these breeds differ in the use of complex landscapes due to their evolutionary history. If criollo cattle are better adapted to challenging arid and semi-arid landscapes common to northern Mexico and southwestern U.S., it may be a more profitable breed with better ecological impact that breeds currently being used.

Materials and Methods

The study was conducted using two contrasting environments

Study Sites

	Jornada Experimental Range (JER)	Rancho Experimental Teseachi (RET)
Location	South-central New Mexico, USA	West-central Chihuahua, Mexico
Weather	Typical of the northern region of the Chihuahuan Desert with abundant sunshine, cool winters, hot summers, and low temperature for the low relative humidity, wide ranges of daily temperature (ranges from 13°C in January to 36°C in June), variable precipitation (235 mm)	The climate is characteristic of the mountain region with cool winters, hot summers, and low temperature for the period of the night, it ranges from 13°C in January to 31.6°C in June, and precipitation average 580 mm
Landscape	Undulating desert grassland with shrubby vegetation dominated by mesquite, elevation from 1300 to 1400 m and mean slope of 0.75%	Mountainous terrain with a mosaic of vegetation types including pinyon, juniper, and <i>Bouteloua</i> on the lower slopes to pine, oak, and <i>Muhlenbergia</i> , elevation range from 1900 to 2800 m and mean slope of 21.9%



Monitoring grazing behavior - Grazing behavior of criollo and British breeds were compared during a 4 week period per site in the spring and fall in 2005 on each study site. Forage quality and availability were greater during the spring at the Jornada Experimental Range and during the fall at Rancho Experimental Teseachi.

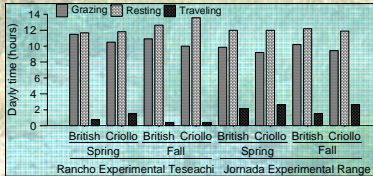
Four replicates of six animals per breed grazed the pasture with both breeds grazing simultaneously. Animal movement was monitored using Lotek GPS collars equipped with activity sensors. Position acquired at 5-minute intervals. Data were differentially corrected and classified into three activities: grazing, walking, and resting using activity sensor data and distance between successive positions. The following variables were estimated: 1) distance traveled per day, 2) horizontal distance between each position and permanent water, and 3) daily home range using 50% and 95% fixed kernel and 100% minimum convex polygon analysis. Coordinates were also tallied when an animal was within 100 m of the water source. Data were analyzed using SAS PROC Mixed for repeated measures.

Site	Season	%CP	%NDF	%ADF
RET	Spring	7.8 ± 0.3	59.0 ± 1.1	33.9 ± 0.7
	Fall	11.2 ± 0.5	63.2 ± 1.3	33.3 ± 0.9
JER	Spring	11.4 ± 0.8	56.2 ± 1.1	34.2 ± 3.3
	Fall	7.30 ± 0.7	65.5 ± 2.2	38.1 ± 1.1

Mean values of forage quality indices: CP (crude protein), NDF (neutral detergent fiber), and ADF (acid detergent fiber). RET = Rancho Experimental Teseachi, JER = Jornada Experimental Range.

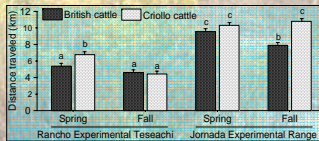


Results and Discussions

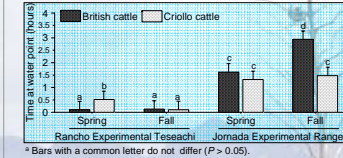
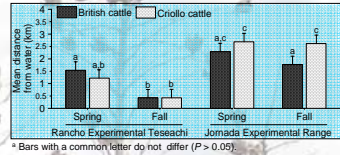


Daily activities. Grazing time was greater for British when compared to criollo cows (10.6 versus 9.82 hours/day, $P < .0001$). Seasonal differences were observed at Rancho Experimental Teseachi but not at Jornada Experimental Range. Criollo cows used more time traveling than British cows (1.79 versus 1.20 hours/day, $P < .0002$).

Distance traveled. Criollo cattle traveled further each day when compared to British breeds (8.1 versus 6.9 km/day, $P < .001$). At the Jornada Experimental Range both breeds traveled longer distances when compared to Rancho Experimental Teseachi (9.65 versus 5.3 km/day, $P < .0001$).

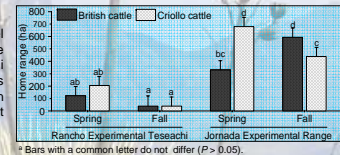


Distance from water. Criollo cows at Jornada Experimental Range maintained greater distances from water when compared to British cattle (2.7 versus 2.0 km/day, $P < .005$). Mean distance from water also differed between sites and seasons.

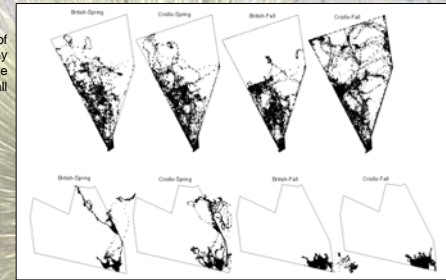


Time spent near water. British cattle at the Jornada Experimental Range spent more time near water point compared to criollo cattle (2.28 versus 1.40 hours/day, $P < .004$). This pattern was not observed at Rancho Experimental Teseachi.

Home range. Home range (95% fixed kernel method) was larger at Jornada Experimental Range compared with Rancho Experimental Teseachi (510.1 versus 101.0 ha/day, $P < .0001$). Differences between breeds were observed in spring but not in the fall. Several factors other than breed may affect this result.



Position of 24 cows (6 cows of each breed in 1 of 4, 6-day replicates) acquired at 5-minute intervals during the spring and fall at 2 sites.



Conclusions

The breeds we examined differed in their use of the landscapes we studied. Criollo cows tended to be generalists spending more time exploring the landscape, traveling longer distances, and spending less time near water. In addition to other possible adaptations, the smaller body size of criollo cows lowers forage demand, which may partially explain the shorter time devoted to grazing when compared to the larger British breeds. Criollo cattle demonstrated behavior characteristics that may improve profitability while having more favorable environmental impacts than British breeds. It is noteworthy that our study was conducted during a year of average to above average rainfall and forage production following an extended drought. While differences were found during our study we believe the magnitude of these differences may be greater during periods of drought, a condition that typifies these sites. Based on this work we believe there may be benefits to using criollo cattle that are worth exploring further.

Literature

Rouse, J.E. 1977. The criollo Spanish cattle in the Americas. University of Oklahoma Press.

Acknowledgments

We would like to thank our colleagues from Rancho Experimental Teseachi, Facultad de Zootecnia and the Jornada Experimental Range, whose help were very important on this project. Special thanks to Abelardo Diaz, Federico Morales, Salvador Delgado "Chavita", Ramon Sandoval, Will Hooper, and Justin Koppa.