



# The genesis of the Jornada criollo cattle program

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## ABSTRACT

Many rangelands in the southwestern United States have experienced increased shrub cover and lower and more variable forage resources during the past 100 years. Criollo cattle are descendants of cattle brought to the Americas by European explorers that spread throughout North and South America. These cattle were displaced in many areas as British breeds became popular, but isolated populations remained that had undergone natural selection for nearly 500 years. Scientists at the Jornada Experimental Range in Las Cruces, New Mexico introduced Raramuri criollo genetics from the Tarahumara region of Chihuahua, Mexico to the research herd about 15 years ago in an effort to capitalize on their ability to thrive in harsh landscapes of the Chihuahuan Desert. They hypothesized that this smaller framed animal might be more suited to extensive shrubby landscapes and exert a lower environmental footprint than cattle of European descent. Preliminary observations during the early years of this project suggested that behavioral characteristics of this biotype could potentially be used to improve utilization of extensive rangelands with restricted water distribution. Raramuri criollo generally traveled farther per day and farther from water than Angus x Hereford crossbreds typically raised on these rangelands. Approximately five years ago, the Jornada expanded this program by joining forces with scientists from New Mexico State University, Mexico, and South America. Several studies were initiated that encompassed aspects of behavior, distribution, habitat and ecological site use, maternal behavior, diet selection, heat tolerance, and performance of Raramuri criollo cattle. Many of the results from these collaborations are reported in this special issue.

## 1. Introduction

Many rangelands in the southwestern United States and globally have experienced significant changes in vegetation over the past century, with increasing shrubs, reduced cover of palatable grasses, and increased soil erosion (Estell et al., 2012). Changing vegetation exacerbates long standing problems on western rangelands, including patchy and variable forage resources in large pastures, intermittent drought and forage limitations, and lack of water developments that preclude the use of certain areas in large pastures. While working at the Jornada Experimental Range (JER), Dr. Ed Fredrickson became interested in introducing criollo genetics into the Jornada herd in an effort to create a hardier animal more suited to the limitations of ranching under the harsh desert conditions of the southwestern US. He believed that because of the long-term presence of criollo cattle in the northern Chihuahuan Desert, understanding their behavior could help producers adapt to cattle production on desert rangelands experiencing shifting vegetation patterns.

Criollo cattle arrived in the Americas with early European explorers,

and spread across both continents. They were the dominant cattle in the southwestern US until the mid/late 1800's when they were overtaken in popularity by British breeds. However, these cattle continue to exist throughout the US, Mexico, and South America in a variety of biotypes (de Alba, 1987; Rouse, 1977). In an attempt to exploit these genetics, Fredrickson and his colleague, Alfredo Gonzalez, established a criollo herd at the JER. To this end, in 2005, they traveled to various areas of Mexico in search of criollo cattle to import into the US. With the assistance of Dr. Jose Rios of the University of Chihuahua, they identified a unique group of cattle from isolated lowlands within in the Sierra Tarahumara region of southwestern Chihuahua, Mexico where they are still raised by the Tarahumara people. These animals had undergone approximately 500 years of largely natural selection in remote areas with harsh conditions, sparse vegetation, and minimal human intervention. Dr. Fredrickson and his colleagues focused on obtaining criollo cattle from lower elevations because they believed they were most adapted to high temperatures. Three bulls and 30 heifers were imported to the JER in 2005 (Anderson et al., 2015). These cattle are most appropriately defined as the Raramuri criollo (RC) biotype (Anderson

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et al., 2015) and are smaller framed (mean weight of 330–365 kg) compared to larger cows (455 kg or greater) now common in on southwestern rangelands. Published information on this biotype was sparse, but anecdotal and non-peer reviewed reports from colleagues in Mexico and observations of these cattle on the JER suggested some of their traits (more extensive distribution across the landscape, more browsing activity) would be advantageous in extensive shrubby desert landscapes in the southwestern US. Fredrickson also hypothesized that smaller framed cattle would have a lower environmental footprint and require fewer inputs than their larger counterparts of European descent, and that this biotype would be more heat tolerant and better suited for high temperatures associated with the Chihuahuan Desert.

Gonzalez and Fredrickson spent the next several years turning this isolated gene pool into a research herd with the intention of comparing it to the main herd (desert adapted Angus x Hereford crossbreds; AH). Although animal numbers, manpower, and resources were limited, Fredrickson and Gonzalez completed several projects that provided encouraging results regarding RC attributes that could potentially improve utilization of extensive rangelands with restricted water distribution. Their preliminary behavior research on the JER indicated RC traveled slightly further (16.9 vs 16.1 km/d) than AH crossbreds and had larger home ranges (Koppa, 2007). Their joint research conducted at the JER and Rancho Experimental Teseachi (Chihuahua, Mexico) (Roacho-Estrada et al., 2008) indicated that RC spent less time grazing than British breeds (7.3 vs 9 h/d at JER; 9 vs 10 h in Mexico) and traveled farther on most days (10.4 vs 8.6 km at JER; 5.6 vs 4.9 in Mexico). These attributes were confirmed in a follow-up study (Roacho-Estrada et al., 2009): RC grazed less time than British breeds (9.8 vs 10.6 h/d) and traveled farther (8 vs 6.8 km/d). Raramuri Criollo also had larger home ranges, a wider habitat range, and traveled further from water, while British breeds spent longer times grazing in smaller areas. Peinetti et al. (2011) showed that foraging behavior of RC and AH crossbreds was similar during spring when forage was more available and evenly distributed, but RC traveled farther from water and used a larger area during the fall when forage was less abundant and less uniformly distributed. In sum, their early results supported the original conjecture that criollo may be a better match for harsh, shrub-dominated environments and exert a lower impact on a given location and therefore, that conceivably RC could be useful for improving rangeland conditions. In addition, their research indicated that RC heifers tended to reach puberty earlier than British crossbreds (~13 days earlier on average; Valverde-Saenz et al., 2008), and suggested that early maturing animals should be favored in this environment because of the short timeframe when forage quality and quantity are optimal for animal growth (Fredrickson, 2008).

In 2011, after Dr. Fredrickson moved on to a new position in Kentucky, the criollo project continued as a demonstration herd, but Alfredo Gonzalez never lost his passion for criollo. A few years ago, the project again shifted directions. JER scientists teamed up with Dr. Andres Cibils of the Animal and Range Science Department at New Mexico State University to join Alfredo in an effort to revive Raramuri criollo research. Dr. Dean Anderson led the seminal publication that defined the state of criollo research at the time (Anderson et al., 2015). With the addition of three graduate students (Shelemia Nyamuryekung'e, Matt McIntosh, and Danielle Duni) and a postdoctoral associate (Dr. Sheri Spiegel, now a Jornada scientist), the program achieved the critical mass needed to move forward.

Numerous studies have been completed during the past five years, with many more in progress. Aspects of behavior, distribution, habitat and ecological site use, maternal behavior, diet selection, heat tolerance, and performance have been evaluated, many of which are highlighted in this special issue. In addition to the research conducted at the Jornada, we developed international collaborations with scientists in Mexico and South America to capitalize on a vast amount of research on other criollo biotypes throughout the Americas. Many of these interactions are also captured in this special issue. We are also partnering with ranchers in the

US (Utah, California, South Dakota, Arizona) to evaluate the RC biotype in other environments. Collectively, these partnerships contribute to our Long-Term Agroecosystem Research project to evaluate effects of RC on the landscape and to a NIFA Coordinated Agricultural Project to examine performance of calves from RC cows crossed with British breed sires. From humble beginnings, the program has evolved into one of national and international interest and impact, thanks to the vision of Dr. Ed Fredrickson and the passion and efforts of Mr. Alfredo Gonzalez. We owe them both a huge debt of gratitude.

Alfredo Gonzalez was tragically taken from us on July 8th, 2020. He was a leading authority on all aspects of criollo cattle, and since its inception, the heart and soul of the Jornada criollo cattle project. Alfredo received his BS and MS from New Mexico State University, specializing in ruminant reproductive physiology. Sandwiched between his degrees, he served two tours of duty as a medic on the front lines in Vietnam. He then spent many years in Paraguay and Brazil conducting research and managing large cattle operations. After more than two decades in South America, the Jornada was fortunate to hire Alfredo as our livestock supervisor, where he spent the last 20 years managing the cattle program. Alfredo's ability to work on both sides of the border was instrumental in the success of the Jornada criollo program. He created and cultivated relationships with ranchers and scientists throughout the Western Hemisphere. He was a quiet and gentle, yet very determined man. That determination is the primary reason the Jornada criollo program exists today. More than the loss of a champion of his beloved criollo cattle, with Alfredo's passing, we lost a close friend. This special issue is dedicated to Alfredo's memory, which will live on through his genuine passion for all things criollo. Adios Amigo.



Photograph courtesy of James Q. Martin.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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