Characteristics Of Reyna Creole Cattle: An Endangered Breed In Nicaragua

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Introduction

The Reyna Creole cattle is a Nicaraguan local breed originating from the Bos Taurus brought to America during the Spanish colonization in the 15th century (Primo, 1992). In the 1950's Joaquin Reyna, a Nicaraguan breeder, formed a herd with aproximatelly 200 females with typical characteristics of Creole cattle from which the Reyna breed was created (De Alba, 1985). Selection of animals was focused on red coat colour (sorrel) and milk production. The Nicaraguan goverment started an official inventory in the 1970's and in 1988 the Reyna cattle were declared as national patrimony. In Costa Rica, the Central Amercian Milking Creole cattle have good reproduction and fairly good milk production (Salgado, 1988; Casas & Tewolde, 2001). To what extent the Reyna Creole cattle is promising for milk production, reproduction and adaptation under dry tropical conditions of Nicaragua has not been investigated. Presently, the national population of this breed is limited to five herds. Natural mating dominates. According to the official country report of Nicaragua there are about 650 pure bred Reyna cattle (FAO, 2004). The small population size, as well as the mating system suggest that inbreeding might be a problem. The objective of this study was to characterize the population structure of Reyna cattle in Nicaragua, and also to estimate important parameters of production and reproduction traits.

Material and Methods

Location, environment, herds and management. The Reyna cattle of this study are kept in four farms where records on the animals are kept. The farms are located in the pacific coast area under dry tropic conditions with two seasons: a rainy season from May to October and a dry season from November to April. All animals could be traced back to the farm established in the 1950's. Regarding the mating system 86% of the cows were naturally mated and 14% were artificially inseminated.

Data and Statistical analysis. A total of 2609 animals with pedigree records from 1958 to 2007 were included. The parental generation comprised 123 sires and 686 dams. 27% of the sires and 5% of the dams were of foreign origin. Data included 557 records of age at first calving from 1978 to 2006; 1551 records of calving interval from 1974 to 2006: 1200 records of birth weight from 1990 to 2007, and 224 records of milk production from one of the herds

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from 1998 to 2002; and 1136 records on milk composition from Oct 15, 2005 to Oct 15, 2006 of the cows of all herds. Descriptive statistics was calculated for all traits.

Inbreeding coefficients were computed according to Sigurdsson and Arnason (1995) and Pedigree Completeness index (PEC) including five generations of each individual was calculated as well according to MacCluer *et al*. (1983). The PEC values were structured in five classes, see Table 1. Average inbreeding coefficients were calculated for the animals of each PEC class. Approximate effective population size (based on number of males and females) and generation interval were calculated according to Falconer and Mackay (1996).

Preliminary heritabilities were estimated for lactation milk yield, age at first calving and calving interval using the DMU-package by Madsen and Jensen (2006). Effects of herd and season of calving were generally considered.

Results

Population structure

Inbreeding level. Table 1 shows that the calculated inbreeding level increases sharply with the completeness of the pedigrees. Only 367 animals (14%) had a PEC value of more than 0.8 and in this class the average inbreeding level was 13%. The highest inbreeding values observed exceeded 40%. Of all 2140 matings with known sire 7% were close matings, mainly between half-sibs and sire-daughters; most of those (90%) were done in one herd.

Table 1: Average inbreeding coefficients by PEC class, effective population size and average generation intervals

	Inbreeding coefficients, %		
PEC class	N	Mean	Range
0 ≤ PEC < 0.24	704	0.0	0.0 - 0.0
0.24 ≤ PEC ≤ 0.4	394	0.2	0.0 - 25.0
0.4 < PEC ≤ 0.6	355	3.3	0.0 - 37.5
0.6 < PEC ≤ 0.8	789	7.8	0.0 - 43.8
0.8 <PEC ≤ 1.0	367	12.9	0.0 - 41.4
Effective population size [1]		37	28 - 46
Generation interval (years) [2]		6.9	6.4 - 7.5

[1] Estimated for the years 1985, 1990, 1995, 2000 and 2005
[2] Calculated for the paths: Sire-son, Dam-son, Sire-daughter, Dam-daughter

Effective population size. The average effective population size and its variation between years is shown in Table 1. The small effective population size, 37 animals, is primarily due to a low number of sires (8 to 13) used in natural mating or AI.

Generation interval. The average generation interval was 6.9 years (Table 1). The highest averages were found for the paths sire-son and dam-son (7.2 and 7.5 years), whereas the generation intervals for both paths producing daughters were 6.4 years. Long generation intervals were partially caused by the fact that some sires were used for many years, even up to the age of 19 years. In addition some cows produced bulls at high age.

Trait characteristics

Descriptive statistics based on recorded information for all traits are shown in Table 2.

Table 2: Number of records, means, standard deviations (SD) and range in values for reproduction and production traits

	Number of		Traits values		
Trait	animals	Obs	Mean	SD	Range
Age at First Calving (days)	557	-	1212	303	659 - 2268
Calving Interval (days)	464	1551	439	114	302 - 912
Birth Weight (kg)	1200	-	27.6	4.7	13.6 - 40.0
Lactation yield (kg milk) [1]	98	224	2006	604	128 - 4494
Lactation length (days) [1]	98	224	288	64	51 - 461
Fat (%)	172	1136	3.41	1.08	1.05 - 6.91
Protein (%)	172	1136	3.45	0.44	2.21 - 4.97
Lactose (%)	172	1136	3.66	0.28	2.54 - 4.80
Dry Matter (%)	172	1136	11.25	1.36	7.90 - 15.65
Solid non Fat (%)	172	1136	7.84	0.48	6.27 - 9.50

[1] Only one herd

Average age at first calving was nearly 40 months with a standard deviation of 10 months. The calving interval was 14.6 months with a standard deviation of 3.8 months. Milk production exceeded 2000 kg per lactation, but showed a very large variation. Also most other traits showed a large phenotypic variation. Preliminary genetic analyses yielded heritibilities of 0.25 for milk yield, 0.05 for age at first calving and 0.06 for calving interval.

Discussion

The amount of complete pedigree information varied greatly and the porportion of animals with reliable estimates of inbreeding was low. The most reliable estimate of inbreeding level (13%) in the Reyna population is alarming, and is caused mainly by a large proportion of matings between closely related animals, which were already inbred, in one of the herds. Thus, inbreeding had been going on for a long time. The study clearly showed the necessity to get complete pedigrees for 4-5 generations to be able to pick up a likely inbreeding level of the breed. The approximate estimates of effective population size (< 50) support the conclusion that the Reyna Creole cattle population is an endangered breed according to classifications of both FAO (2007) and proposals by Alderson (2009). The breed is in great need of an effective conservation program that as a first priority prevents from further inbreeding by careful recruitment of bulls. It seems equally important to establish a complete system for identification of the animals and recording of their pedigrees.

The phenotypic traits recorded show that the Reyna cattle have a good potential for production as well as beeing well adapted to tropical conditions by showing good reproductive results. However, there is a large variation in both these trait categories. The phenotypic variation might also have been affected by inbreeding. The extremely large phenotypic variation in combination with heritabilities estimated suggest that there are great opportunities for improved results in both production and reproduction of the Reyna cattle by active selection as well as by better environment and management.

For Reyna Creole cattle to be commercially competitive in its area of use, the design of a sustainable breeding strategy must carefully balance the needs for managing inbreeding and for improved production and reproduction under tropical conditions. Coming studies will provide further technical information that likely would contribute to creation of a knowledge-based conservation program.

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