CORPUS PUBLISHERS

Corpus Journal of Dairy and Veterinary Science (CJDVS)

ISSN: 2833-0986

Volume 4 Issue 1, 2023

Article Information

Received date : January 11, 2023

Published date: January 19, 2023

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DOI: 10.54026/CJDVS/1050

Keywords

Genotype; Sustainable Development; Dual-Purpose Cattle; Productive Security; Milk

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Research Article

Genetic Conservation from the Perspective of Sustainable Development to Guarantee Safety in Bovine Dairy Production

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Abstract

For this study, 441 racial groups were used, using the following crosses: 7/8 Holstein X 1/8 Guzerat (n= 112), 7/8 American Swiss x 1/8 Guzerat (n=138) and 7/8 dairy Simmental X 1/8 Guzerat (n=191), from three dual-purpose farms in northern Puebla; Mexico. With the objective of evaluating milk production per lactation (PTL), period of initiation of lactation (EIL), days to peak lactation (PL), behavior of calves until weaning (CBD) and economic productivity. The results obtained indicated that milk production per lactation and days in lactation were affected by the genotype (P<.01). The productive variables for the behavior until weaning of calves of 7/8 European dairy cows x 1/8 Guzerat in dual purpose included; birth weight (BN), weaning weight (PD), daily weight gain (GDP) and weaning age (ED) were evaluated by survival analysis. The results indicated that the racial group did not influence (P>.01) any of the productive characteristics studied. In conclusion, 7/8 Holstein x 1/8 Guzerat (HG) and 7/8 American Swiss x 1/8 Guzerat (SAG) cows showed higher productive ability than cows with Simmental genes. The observed results suggest the possibility of using these crosses, in order to maintain the perspective of sustainable development, guaranteeing safety in bovine milk production in the northern region of Puebla.

Introduction

The Universal Declaration of Human Rights (1948), approved by the General Assembly of the United Nations (UN), recognized the right to food as a human right (art. 25). However, the problem of hunger remains in force, and has even worsened in many regions; The FAO indicated that in 2015 there were 795 million people in the world suffering from chronic hunger and that close to 6 million children die each year from malnutrition [1]. Although it is true that, since its foundation, in 1945, the food issue was a central axis for FAO, it began to have a relevant connotation at the beginning of the 1970s, given the worldwide concern about the scarce availability of basic foods and the increase in their prices, which caused famines in Africa, Asia and Latin America. Thus, during the World Food Conference (CMA) in 1974, the concept of Food Security was defined, focused on the global and national scales, it was oriented to improve the availability of basic foods to face hunger that, far from being resolved, worsened [2,3].In Mexico, the high rates of poverty and food insecurity are a persistent problem. According to data from the National Council for the Evaluation of Social Development Policy (CONEVAL), of the total Mexican population, 46.2% is in a state of poverty, corresponding to 55.3 million people, of which 11.4 million are in extreme poverty [4]. Regarding the food dimension of poverty, CONEVAL (in the same study) reported that 23.4% of the total population, corresponding to 28 million people, are deprived due to access to food. Considering that food poverty is the cruelest of forms of poverty, which threatens the Right to Food, explicit in article 4 of the Political Constitution of the United Mexican States).According to the National Survey of Household Income and Expenditure of 2008, food poverty reached 18.2% of the population against 13.4% registered in 2006. In this sense, he points out that the analysis of the period between 1992 and 2008 shows a disappointing behavior of the trends on food poverty. On a national scale, it decreased in percentage terms by barely 2.1% [5].The advances made between 2000 and 2004 in reducing food poverty have been reversed between 2006 and 2008. Food poverty in Mexico has increased in recent years, as corroborated by its evolution presented by CONEVAL in the year 2015 [1].

Mexican cattle farming takes advantage of approximately 110 million ha, of which 28.3% corresponds to tropical areas, which are mostly covered with fodder to produce meat and milk in dual-purpose systems [6]. It is estimated that 41% of the milk produced and 78% of the cows milked in this region are under dual-purpose production systems, mainly on small and medium-sized farms, where pastures are the main source of income. Feeding, often limiting in quantity and quality of biomass, particularly in the dry season (Odermatt y Cruz, 2010). The problem in these farms has been the low productivity of the cows due to low genetic potential three and variable feeding during the year [7]. The effect of the climate is manifested in a reduction in the quality of the forages, mainly during the dry season; As a consequence, the animals reduce the consumption of nutrients, which negatively influences the products obtained [8]. The reduction in production has a direct impact on the productive efficiency and sustainability of dual-purpose systems [9]. In addition to the above and the insufficiency in the internal supply of milk and the growing demand for the product by the Mexican population, it is necessary to look for alternatives to increase the volume of milk produced [6]. An alternative may be the production of milk using Bos indicus animals (Guzerat, Gyr, Nelore, Indubrasil) in crossbreeding with Bos taurus dairy breeds (Holstein, Swiss, Jersey, Simmental) in the national tropics, the advantage of these racial groups has been confirmed in several previous studies in Mexico and in the world [10].

The optimization and sustainability of commercial dual-purpose systems depend on the effectiveness of the breed groups used and their ability to harvest the nutrients required to produce meat and milk efficiently (Madalena et al., 1990). However, the information on the evaluation of cross breed groups (Bos taurus × Bos indicus) in this region of the state of

Puebla is still scarce. Based on the above, the objectives of this study were: to evaluate the different genotypes of dual purpose cows 7/8 Holstein x 1/8 Guzerat, 7/8 Swiss American x 1/8 Guzerat and 7/8 Simmental x 1/8 Guzerat, in terms of production of liters of milk per lactation, lactation season, lactation days, calf weight at birth and weaning weight.

Material and Methods

The present study was carried out with data obtained from January to December 2022. For this study, 441 racial groups were used, using the following crosses: 7/8 Holstein x 1/8 Guzerat (n=112), 7/8 American Swiss x 1/8 Guzerat (n=138) and 7/8 Dairy Simmental x 1/8 Guzerat (n=191), from three dual-purpose farms in northern Puebla. Between the meridians 20° and 30' North Latitude to 98° 00'' West Longitude, at 391 masl, the average annual temperature is 27°, the maximum is 29° and the minimum is 18°. With the objective of evaluating milk production per lactation (PTL), period of initiation of lactation (EIL), days to peak lactation (PL), behavior of calves until weaning (CBD) and economic productivity. The information studied was obtained from 441 adult cows in production (with two milkings a day, without support from the calf).

The feeding base for the three ranches was intensive rotational grazing of native grasses (*Axonopus sp* and *Paspalum sp*) and grass. African star (*Cynodon plectostachyus*) and the addition of a 1.5 kg balanced feed for every 3.0 kg of milk produced. The stay in each paddock depended on the time of year, giving breaks to each paddock of 30 days in spring-summer and 45 days in autumn-winter. The calves were also kept in rotational grazing in 1.5-hectare Estrella de África (*Cynodon plectostachyus*) grass pastures; following the same criteria of rest periods as those used for cows and addition of commercial feed.

Statistical Analysis

The analysis was carried out using mixed linear models proposed by Littell et al., 1996, from the MIXED procedure of SAS 1998, (Littell, et al., 1996).

Results and Discussion

Villegas-Carrasco et al. (2005) suggest that the racial group of the cow positively influences the quantity of milk harvested per day and per lactation. In the present study, the production per lactation, the days in lactation and the productivity indicator (Table 1), were affected by the genotype (P<.01). Milk production was higher in 7/8 Holstein x 1/8 Guzerat (2702.66 +- 99.63) and in 7/8 America Swiss x 1/8 Guzerat (2441.75 +- 102.39) cows than in 7/8 Dairy Simmental x 1/8 Guzerat (1669.57 +- 83.29), there being no differences between the genotypes 7/8 Holstein x 1/8 Guzerat and 7/8 Dairy Swiss x 1/8 Guzerat. The productivity indicator was higher in the genotypes 7/8 Holstein x 1/8 Guzerat (15932.95 +- 537.68) and 7/8 American Swiss x 1/8 Guzerat (15576.68+-566.54) than in the 7/8 Dairy Simmental x 1/8 Guzerat (11507.33+-449.92). Climatic conditions influence the amount of milk obtained in different ways, a direct way is by altering the metabolism of the animal due to high temperatures, and indirectly by determining the seasonality of forage production (Pérezet et al., 2001). In the present experiment, the calving season (Table 2) did not influence the amount of milk obtained, the above fact is partially explained by the addition of concentrates that provided additional and sufficient nutrients that prevented nutritional deficiencies and maintained similar metabolic activities that allowed to obtain similar milk productions, the same results have been observed in other tropical regions with similar conditions (Barkema et al. 2019).

Table 1: Effect of the genotype on milk production per lactation, days in lactation and productivity by common indicator, of 7/8 European Dairy cows x 1/8 Guzerat in dual purpose.

Variable	Holstein x Guzerat	America Swiss x Guzerat	Dairy Simmental x Guzerat
Observations	112	138	191
Milk/lactation, Kg	2702.66±99.63 a	2441.75±102.39 a	1669.57±83.29 b
Days in lactation	323.52±9.77 a	291.22±10.04 a	240.75±8.17 b

Table 2: Effect of the time of initiation of lactation, milk production per lactation, days in lactation and productivity.

Variable	Season 1 Dry (Mar-Jun)	Season 2 Rains (Jul-Oct)	Season 3 Winter (Nov-Doc)
Observations	Holstein x Guzerat 112	Amarica Swiss x Guzerat 138	Dairy Simmental x Guzerat 191
Milk/lactation, Kg	2266.65±87.48 a	2184.95±92.51 a	2362.36±88.14 a
Days in lactation	285.90±8.57 a	269.17±9.05 a	300.41±8.64 ab

In tropical regions, the calving season represents the conjunction of climatic factors and animal management conditions [11], for example, in tropical conditions; winter is associated with temperatures close to 18 °C-20 °C. with moderate rainfall and winds that allow an appropriate metabolic well-being for body growth, milk production and racial genotype [12]. The effect of the racial group, the calving season and the calving year did not influence the calves at birth, weaning weight and daily weight gain of the study calves (Table 3). The loss of the effect can be explained by the feeding, management and prevailing environmental variations in the studied site, as they were previously interpreted for milk production per lactation. The results obtained in the present study are different from those observed by Acharya (2004), for milk production in other tropical conditions, where the superiority of American Swiss/Zebu cows has been demonstrated, but similar to those reported. By Treviño et al. [13], evaluated that milk production for Swiss, Holstein and Simmental bovines was 8.63, 8.66 and 8.44 kg/day for the three breed groups studied, respectively. This result is due to the management of environmental conditions: intensive grazing, time of year and supplementation. In the present study, the prisoner analysis showed the influence (P<.01) of the racial groups 7/8 European x 1/8 Guzerat. The Dairy Simmental/Zebu breed group showed the highest values, intermediate for America Swiss/Guzerat and the lowest values corresponded to Holstein/Guzerat. The difference can be attributed to the rapid growth ability provided by the genes of the European breed, which are expressed by the adaptive vigor of the Zebu breed to the tropical environment [14].

Table 3: Behavior until weaning of cow calves 7/8 European dairy x 1/8 Guzerat in dual purpose.

Estimator	Holstein x Guzerat	Amarica Swiss x Guzerat	Dairy Simmental x Guzerat
Observations	112	191	138
Bovine birth weight (kg)	40.35±0.60 a	41.42±0.60 a	40.67±0.49 a
Bovine waning weight (kg)	166.95±2.94 a	173.74±2.91 a	171.39±2.43 a
Daily weight gain (kg)	0.611±0.012 a	0.631±0.012 a	0.629±0.010 a
Weaning age (days)	205.87±1.80 a	209.01±1.78 a	206.29±1.45 a

In Dual Purpose Systems (Table 4) where the initiation of milk production and beef production are equally important, one objective may be to obtain heifers calving at 24 months, to achieve this, heifers must reach puberty at 15 months of age [15]. This can constitute a challenge for production systems that use Bos indicus animals in climates with high temperatures. Guzerat animals commonly reach puberty later and may have physiological differences in growth and production compared to breeds with European ancestors [12].

Table 4: Survival of cows 7/8 European x 1/8 Zebu and calves until weaning, in dual purpose.

Sobrevivencia (%)	Holstein x Guzerat	America Swiss x Guzerat	Dairy Simmental x Guzarat
observations	112	191	138
Cows	97.39±0.01 a	98.97±0.01 a	98.61±0.01 a
Weaned Calves	93.55±0.02 a	95.55±0.02 a	93.26±0.02 a

Conclusion

Holstein/Guzerat cows produce more milk than the America Swiss/Guzerat and Simmental/Guzerat breed groups. In the various tropical conditions studied, the explanation is based on the presence of genes from specialized European breeds, associated with genes for adaptation to the environment provided by Bos indicus (Guzerat). The superiority lies in the improvement of the environment by the inclusion of concentrated food supplements and the management of milking without support of the calves; that were part of the handling of the animals in the present study [16-19]. Increasing the volume of milk produced as a result of the combination of factors: cow, environment, age, physiological maturity and handling by man. The observed results suggest the possibility of using the Holstein/Guzerat racial groups as the most appropriate for milk production in northern Puebla.

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