Productive and Reproductive Evaluation of Holsteins and Brown Swiss x Holstein in Ecuador

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ABSTRACT— ***Evaluate productive and reproductive parameters of two dairy cattle genotypes: pure Holstein Friesian (HF) and a cross between ½ Brown Swiss and ½Holstein Friesian (BS*HF), It was the purpose of this research. It was conducted in the Santa Catalina Experimental Station of the National Institute of Agricultural Research (INIAP), lacated in the Cutulagua Parish of Mejia city, Pichincha province; northern highlands of Ecuador. Twenty multiparous cows were used, with a body condition 2.5 to 3.5, clinically healthy, disposed in two groups per genotype, C1: HF (n = 10), and C2: BS*HF (n = 10), and reproductive and productive individual parameters of each animal was evaluated for 7 years (2007 to 2014). In when analyzing reproductive variables significant differences were observed (P<0.05) only in the number of services per pregnancy (2.5±0.26 vs. 1.8±0.10, for HF and HF BS *, respectively), however in calving interval calving (ICC), days open (DOB) and age at first calving (AFC) no difference was found. However, in the analysis of production variables, significant differences (P <0.05) were observed only in birth weight (37.7±0.63 vs. 40.1±0.85 kg, HF and BS*HF, respectively), production per lactation (kg) and milk production / cow / day (liters) no difference was found. In conclusion, can we say that the behavior of the reproductive and productive parameters are the same in both genotypes, except number of services per pregnancy and weight of calf birth this gives us a guideline to strengthen studies with more number of undercross***

Keywords— dairy cows, crossing, reproductive and productive parameters

1. INTRODUCTION

Nationally speaking, the total milk production is approximately 5`676.066 litres with a total number of 1`053,311 milking cows. From this, the Sierra region produces 76.78%, followed by the Costa region with 15.35% and the Amazonian with 7.87%. Based on the daily average of milk production per animal, it is observed that the Sierra region has 6.46 litres / cow / day, the Amazonian region comes second with 4.49 litres/cow / day and last the Costa region with 3.11 litres / cow / day. In Imbabura there are 31 745 adult cows and 158 907 in Pichincha, both provinces representing 9.6 % of the total national adult cows [5].

Developing regions use different cross-breeding systems such as a mean to obtain an improvement in milk production and solids since purebreds cannot show their whole potential because of the less favourable situations the region has [6]. This aspect gets even more important when they are considered areas with a limitation in weather and / or soil, where milk productions are developing more and more [15].

An example is the mountain range of Ecuador, where many producers have lately become more interested in crossbreeding, with the aim of obtaining a genotype which is better adapted to its low-supply pasture systems, due to the agroecological limitations they have for high genetic merit animals. Cross-breeding in milk production is an alternative for an improvement in health, fertility and survival, because the differences among breeds are larger than the differences within themselves; bigger benefits can be obtained from heterosis and from the breeds -other than Holstein- offered for

that aim [7].

On the other hand, the Brown Swiss breed can offer comparative advantages to milk production, especially in ecosystems which are unfavourable for Holstein, due to its greater adaptation to extreme temperatures, its bigger tendency and adaptation to pasturing, better udder health and longevity [9].

Facing the complexity of the topic and the lack of adjusted information about the local behaviour of other milking cows and their cross-breeds, it arouses the objective of evaluating productive and reproductive parameters of milking bovines Holstein and Brows Swiss x Holstein.

2. MATERIAL AND METHODS

Characteristics of the experimental site

This study will be carried out within the Cattle Programme in the Experimental Station Santa Catalina of National Institute of Agricultural Investigation - INIAP, located in the Cutulagua Parish of Mejia city, Pichincha province – Ecuador, altitude 3 058 m, latitude 00° 22' S y Longitude 78° 33' W. The climate of the area under study: average temperature 11.6 °C, average annual rainfall 1400 mm and relative humidity of 79 %.

Twenty multiparous cows from 2 genotypes were used c1: 100% Holstein Friesian and c2: 50% Brown Swiss x 50% Holstein (F1). Individual parameters of each animal were evaluated from 2 007 till 2 014.

A random design (DCA) was used, it includes as an input variable the breed type with one breed HF (n1=10) and HFxBS (n2=10), and as output variables the productive and reproductive parameters, all of which considered parametric variables of the continuous type.

The results were analysed with the statistic programme SPSS version 22.0 and the mean values and the standard error of each variable were considered. All data was submitted to the ShapiroWik and Levene statistics, fulfilling the normality and homogeneity assumptions, respectively.

When analysing the productive and reproductive parameters, the mean values and the standard error of each variable were considered and both groups were compared.

Reproductive Variables: Delivery-conception interval (IPC): days between delivery and subsequent conception, Interval between deliveries (IPP): days between the current and the previous delivery, Number of services (NS); quantity of services needed to obtain next pregnancy, Age at first delivery (EPP): days between birth and first delivery.

Productive variables: Milk production (PL) adjusted to 305 days: litres of milk produced by cow at lactancy, Milk production (PL) per day, adjusted to 305 days: litres of milk produced by cow at lactancy, Calf weight at birth (PN)

Animal selection

It was carried out using the filiation registers of the Cattle Programme for seven years (2 007 to 2 014), choosing those crossbred animals which have completed their productive and reproductive life at the rodeo, with a body condition between 2.5 and 3.5 and clinically healthy.

3. RESUTLS AND DISCUSSION

It was obtained significant differences ($p<0.05$) as regards the number of services per pregnancy only, with the HFxBS cows obtaining a better result, using fewer services per pregnant cow (Table 1).

Table 1. Average figures and standard (X±EE) of reproductive indicators in the racial types.

Reproductive indicators	Racial type	X ±EE
IPP (days)	A	482.7±23.95
	B	459.0±16.89
DAB (days)	A	200.9±23.76
	B	175.9±16.62
Age at first delivery (months)	A	29.5±0.75
	B	29.9±0.87
Number of services per pregnancy	A	2.5±0.26 [a]
	B	1.8±0.10 [b]

A. Pure Holstein Friesian
B. ½ Holstein Friesian x ½ Brown Swiss
Different letters in each column and for each variable indicate significant differences ($p<0.05$), according to ANOVA

Table 2 shows significant differences ($p<0.05$) –when comparing both groups- as regards weight at birth, obtaining better weight the calves born from HFxBS cows. As regards the other productive variables there were no significant differences ($P>0.05$), both groups behaving in a similar way in each variable considered

Table 2. Average figures and standard error (X±EE) of the productive indicators in racial types.

Productive indicators	**Racial type**	**X±EE**
Milk production at lactancy in Kg, at 305 days	A	4541.6±113.19
	B	4612.0±212.11
Milk production in litres milk / cow / day	A	14.9±0.37
	B	15.1±0.70
Weight at birth in kg	A	37.7±0.62[a]
	B	40.1±0.85[b]

A. Pure Holstein Friesian
B. ½ Holstein Friesian x ½ Brown Swiss
Different letters in each column and for each variable indicate significant differences ($p<0.05$), according to ANOVA

Marini and Oyarzabal [5] point out that the interval between deliveries is the most frequent parameter used in order to measure the reproductive efficiency of a bovine and it strictly depends on the open days the cow has, also considering that it lengthens as milk production increases. The optimum figure for the interval between deliveries is 12.5 to 13 months (380 to 395 days), while over 14 months (430 days) is considered to be a problem figure [16], [18]. A difference can be seen between both groups which, despite not being significant, exceeds the optimum figure.

A desired value as regards delivery-conception period is between 85 and 110 days, being over 140 days considered a problem [16], [18]. There is a difference between the groups comparing them with the optimum values. The interval delivery – conception (open period) lengthens as milk production grows and gets longer, probably because fertility problems in the services of cows increase, needing a larger number of services in order to obtain pregnancy. It also needs to be considered that high production cows take longer to get pregnant once they enter service, showing a decline in their reproductive efficiency (differences between the intervals delivery – conception get bigger). A 100-litre increase in milk production at lactancy would mean the extension from 8.11 to 31 days of the open period for low, medium and high production cows. An extension of the open period can also be due to a higher frequency of early embryonic deaths, whose origins and causes are neither easy to identify nor to handle once they have been identified [3].

The optimum value for age at first delivery is from 24 to 27 months, being below 24 or over 30 considered a problem figure [1], [4]. There is a difference between the obtained results and the normal parameters. The suitable age of an animal at first delivery has a significant effect on the productive efficiency throughout its life, and it can also decrease the productive life of the bovine within the milking herd [11], [14]. Some studies prove that some cows which have their first delivery at a short age, have a lower milk production at first lactancy. However, their total daily production and their efficiency through life are significantly higher than those animals which had their first delivery at an older age [10], [14] [19].

The optimum value of services per pregnancy should be under 1.70, being over 2.5 services per pregnancy a problem figure [16]. Carmona and Arroyo [8] indicate that the rate of services is the percentage of eligible inseminated cows within a period of 21 days. The rate of services could be improved by improving the efficiency of oestrus detection. Many technicians, inseminators, producers, zootechnicians and vets are worried about improving conception rates; however, variations in the average of open days among different premises are more often due to differences in the service rates rather than in the conception rates (3 to 1). A study carried out by the University of Wisconsin determined an annual profit of $ 83 per cow when improving the rates from 20 to 30 %.

The optimum value for weight at birth is from 36 to 42 kg for the cows under study [18], [5]. It can be observed that there is a statistic difference between the treatments, but that is within the normal parameter. According to Noguera [17], the weight at birth is a productive characteristic which is economically important in relation to milk production, therefore it influences the improvement of productivity, and it is the first piece of information obtained from the animal, becoming the first tabulator related to potential growth. At birth the ideal weight for calves should be within a normal range, neither too heavy nor too light, depending on the breed it comes from. Studies coincide about the superiority of males' weight in relation to female cows, due to hormonal factors. The father's breed has an effect on the variation of the calves' weight at birth [17].

The national average number for the quantity of milk produced at lactancy adjusted to 305 days is 1693.85 litres. It can be seen a mathematical difference between the treatments, but it clearly exceeds the national average. Cordoba and Perez [2] point out that the milk production per each cow greatly depends on the ability to achieve pregnancy or maintain it, since the lactation cycle is restarted or renovated by means of pregnancy. The challenge milk production faces is to hold high levels of milk production without affecting reproductive parameters.

4. CONCLUSIONS

We can state that under the same environmental and handling conditions in the Cattle Programme of the Experimental Station Santa Catalina, the behaviour of the reproductive and productive parameters are similar in both genotypes, except in the number of services per pregnancy and the calf's weight at birth..

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