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Evaluation of the repeatability of male calves' birth weights in different grades of Jersey x Red Sindhi crosses

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Abstract

To assess the consistency of birth weight among male calves born to half-J x half-RS, quarter-J x ¾ RS, three-eighths Jersey x five-eighths RS, and one-eighth J x seven-eight RS cows. The SHUATS in Prayagraj, Uttar Pradesh, India obtained the data from a pedigree cum history sheet. Male calves born to 77 cows during the first (L1), second (L2), and third (L3) lactations, as well as 127 observations of Jersey x Red Sindhi cows of varying quality, were all measured and recorded in kilos. Increased reproducibility across many cross-breed dairy cow performance tiers indicates superiority. This research shows that choosing cows with higher estimations based on the birth weight. of their male calves can increase the output of herds. The mean of birth weight of male calves L1, L2, and L3 were 18.11, 20.15, 22.07 kg. of ½ J × ½ RS, 20.50, 19.88, 20.77 Kg f ¼ J × ¾ RS crosses, 20.06, 20.88, 22.24 kg. of 3/8 J × 5/8 RS, 19.08, 18.76, 22.83 kg of 1/8 J ×7/8 R.S proportionately. The ranges of birth weight of male calves from the Ist (L1), IInd (L2) and third (L3) lactations were 15.80 - 20.10, 15.80 - 26.6, 19.6 - 25.8 kg. of ½ J × ½ RS, 15.42 - 24.94, 14.51 - 25.70, 13.6 - 28.12 Kg. of ¼ J × ¾ R.S, 14.96 - 26.40, 16.32 - 24.30, 15.42 - 27.50 kg. of 3/8 J × 5/8 RS crosses, 15.87 - 24.23, 12.70 - 24.51, 18.14 - 25.80 kg. of 1/8 J ×7/8 RS respectively. The mean of birth weight of male calves was 20.13 kg. of ½ J × ½ RS, 17.68 Kg. of ¼ J × ¾ RS, 21.07 kg. of 3/8 J × 5/8 RS, 19.92 kg. of 1/8 J ×7/8 RS respectively. The highest birth weight of male calves were 25.8 Kg. and the lowest 15.80 Kg of ½ J × ½ R.S, 28.12 kg. highest and lowest 13.60 kg. of ¼ J × ¾ RS, 27.50 kg at highest and lowest 14.96 kg of 3/8 J × 5/8 RS, 25.8 kg at highest and lowest 12.70 kg. of 1/8 J ×7/8 RS, respectively. The repeatability of birth weight of male calves for 0.60 ± 0.20 of ½ J × ½ RS, 0.46 ± 0.19 of ¼ J × ¾ RS, 0.78 ± 0.15 of 3/8 J × 5/8 RS, 0.57 ± 0.15 of 1/8 J ×7/8 RS. The more repeatability for various grades of crossbred dairy cattle shows better performance.

Keywords birth weight, crossbred, cows, repeatability, selection

Introduction

The economic viability of dairy farms depends heavily on factors such as birth weight. Birth weight disparities are also utilized as a proxy for a calf's overall health, development potential, and eventual size [1-2]. Birth weight is a significant element that impacts postnatal growth and development, it is also a simple and reliable indicator of the antenatal period [3]. Too-big-to-birth calves are at risk for dystocia of varying severity. Cattle calf birth weight has been shown to be affected by a number of environmental variables,

including farm, forage availability period, parity, and calving season. Cattle breeders who are particularly astute observers have noticed the striking differences in the size of newborn calves. The calf's birth weight is most significantly affected by its breed.

Cattle breed characteristics include birth weight. The born weight is not only the simplest and most authentic prenatal assessment but also a crucial component in later growth and development [4]. The birth weight and the age at which the first calf is born were shown to be significantly and positively correlated [5-7]. Calves born to heifers are often heavier than average due to their earlier age at birth [8]. In cow farming, a higher birth weight is associated with more complications during calving and a higher mortality rate. Increases in mortality and calving complications have been seen in calves at extremes of birth weight [9]. All attentive cow producers have noticed the obvious differences in newborn calf sizes. These findings prompt inquiries about the nature and scope of the observed changes, as well as their potential implications for the animal's future well-being.

Breeding animals with the purpose of improving their genetic potential for future performance is an essential part of livestock genetic improvement [10]. The ability to reproduce is unique to each kind of animal. Birth weight is a genetically influenced economic feature. The results of an animal's performance reflect the influence of both its genetic makeup and its environment, as well as the interplay between the two [11]. Since it comprises of genetic elements passed down from parents to offspring, genetic factor receives a lot of consideration in cattle breeding operations [12]. Selection and crossover are two methods used in animal breeding. Animals' genetics can be advanced in significant ways through selection. Kunbhar et al., and Kijlstra et al., [13-14], as according to the purpose of selection is to keep the population of cows stable so that they may continue to be bred to exceptional bulls and produce high-performing progeny. And the best of the litters is employed to bolster the breeding herds [13-14]. Animals with high productivity are bred through a process of selection in which their performance within a population is measured and ranked [15]. The most likely producing ability (MPPA) of a characteristic in animals may be calculated using a number of genetic criteria, one of which is repeatability. It's also applied to figuring out how much of a certain trait will be passed on from parents to kids. For a given trait, it may be used to estimate its maximum heritability. Livestock farmers often use repeatability as a genetic criterion when developing selection procedures [16]. Nix et al., [17] stated that the mortality rate depends upon the occurrence of dystocia in cattle. Calves that are born at a weight that is just over the norm for the herd are likely to be healthier and grow more quickly than those born at a lighter weight. The gestation duration may also have a role in determining the birth weight of the calf.

Methodology

SHUATS in Prayagraj, Uttar Pradesh, India provided the crossbred dairy cattle utilized in this analysis (1/2 J x 1/2 RS, 1/4 J x 3/4 RS, 3/8 J x 5/8 R.S, 1/8 J x 7/8 RS). The Dept. of A.H.D. at SHUATS Prayagraj, Uttar Pradesh, India provided the crossbred dairy cattle with their pedigree cum history record used in this study. Male dairy crossbred calf birth weights have been recorded as 14, 31, 8, and 24 (No. of observation). A total of 127 crossbred cattle were seen, representing a wide range in birth weight. Repeatability value was obtained by:

$$r = \frac{\sigma^2 B}{\sigma^2 B + \sigma^2 W}$$

Where $\sigma^2 B$ = Variance between the cows.

$\sigma^2 W$ = Variance within the cows.

Standard error of repeatability

$$SE = \sqrt{\frac{2(M-1)(1-r)^2 \quad \{1+(K+1)r^2\}}{K^2(M-N)\,(N-1)}}$$

Where M= Total no. of observations
N= Number of individuals
K= No. of records per individuals
r^2= repeatability

Results and Discussion

The repeatability of the born weight of male calves of different grades was found to be 0.60± 0.20 for 1/2 Jersey-1/2 Red Sindhi, 0.46± 0.19 for 3/8 J-5/8 RS, 0.78± 0.15 for 1/8 J-7/8 RS, and 0.54± 0.15 for 1/8 J-7/8 RS crossbred cows (Table 1). Graphical representation of repeatability in J x RS crossbred cows present in Figure 1.

Table 1. Birth weight and repeatability projections for various Jersey x Red Sindhi crossbred cow grades: 1/2 J x 1/2 RS, 1/4 J x 3/4 RS, 3/8 J x 5/8 RS and 1/8 Jx7/8 RS.

Factor J x RS.	Number of observations	Overall mean birth weight of male calves (Kg.)	r ± SE
1/2 × 1/2	23	20.13	0.60±0.20
1/4 × 3/4	47	17.68	0.46±0.19
3/8 × 5/8	14	21.07	0.78±0.15
1/8 × 7/8	43	19.92	0.57±0.15

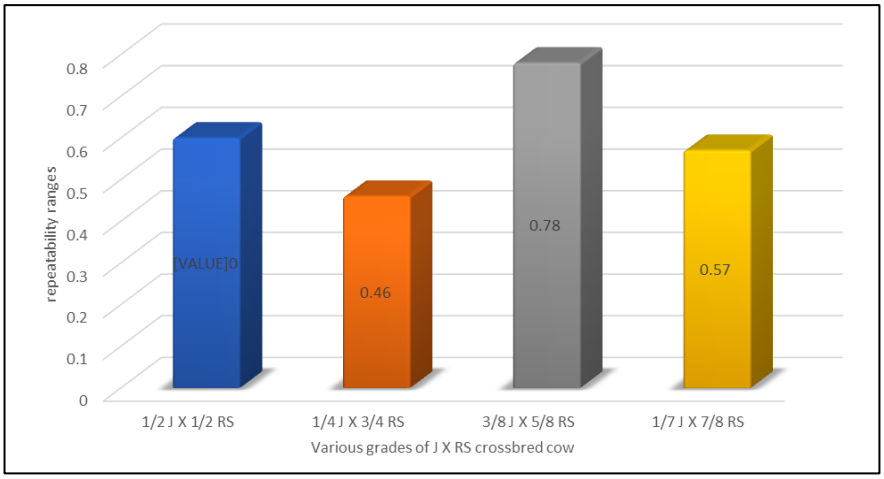

Figure 1. Graphical representation of repeatability in J x RS crossbred cows

Seventy-seven crossbred cows were used for the analysis of repeatability, and their birth weights of male calves for different grades. Data was collected from a wide range of breeding combinations, including 1/2 J-1/2 RS, 1/4 J-3/4 RS, 3/8 J - 5/8 R.S, and 1/8 J-7/8 R.S. The mean of birth weight of male calves L1, L2 and L3 were 18.11, 20.15, 22.07 Kg of ½ J × ½ RS, 20.50, 19.88, 20.77Kg of ¼ J × ¾ RS, 20.06, 20.88, 22.24 kg of 3/8 J × 5/8 RS, 19.08, 18.76, 22.83 kilos of 1/8 J ×7/8 RS crosses properly. The milk yield of the cows has a significant impact on the development of the calves. Calves' development is slowed when cows don't produce enough milk. Weaning weight and growth rate are significantly affected by sex, especially once animals reach puberty, as found by Gunawan et al., [18]. The estimated repeatability of the attributes was strong to moderate (r> 0.40). Half Jersey-half Red Sindhi, quarter Jersey-three-quarter Jersey, three by eighth Jersey-five by eight RS, and one by eighth Jersey cross seven by eight Red Sindhi cows all scored moderate to high in repeatability, indicating that they were likely to reproduce their recent successes in the future [19]. High estimates of repeatability typically point to a significant additive genetic

contribution [20-21]. Variations in both the additive and dominant genes, as well as the epistatic effects of both the permanent and transient environmental factors, contribute to the repeatability value for a given trait [22-23]. Estimates of high repeatability for the observed features suggest that selecting for them in the studied population will lead to improved genetic responsiveness. This study's repeatability estimates for body weight were greater than those published by numerous others [24-26], across a variety of cow breeds. The most likely producing capacity (MPPC) of cows during the production period is estimated using repeatability [27]. It is also employed to improve selection efficiency and establish heritability upper bounds. Estimates of repeatability for a given attribute are helpful for forecasting each animal's future production performance, as stated by Holland and Odde [28]. Researchers concluded that the study's findings would be highly helpful in genetically selecting different classes of cows descended from half Jersey and half Red Sindhi, quarter Jersey and three-quarters Red Sindhi, three-eighths Jersey and five-eighths Red Sindhi, and one-eighth Jersey and seven-eighths Red Sindhi crosses. Calves can be weighed as early as three days after birth to get their "birth weight."

The mean value for birth weight of various grades of 1/2 J × 1/2 RS, 3/8 J × 5/8 RS, and 1/8 J × 7/8 RS cow was 20.13, 21.07, and 19.92 Kg respectively, which was higher than 19.78±1.224 kg evaluated by Kutsiya in Madura cattle and was found under than 19.78±1.224 kg in 1/4 J × 3/4 RS, As reported by Tribudi and Prihandini [29] in Madhura cows. Birth weights of Madhura cattle were found to be lower by at 14.51 kg. Shahzad et al., found that the mean birth weight of Cholistani young ones was 19.13±0.06 Kg. The present finding is agreed with Shahzad et al., [30]. Several factors (calf sex, pregnancy duration, parent age, cow body weight, nutrition) may contribute to this variation. Because birth weight has been positively selected for in the Madura cattle herd, this research finds that it has a high value. It's also likely that contextual variables, such as the variety of settings and populations examined, play a role.

Conclusion

Calves' birth weight is most heavily influenced by breed. Blood inheritance of 3/8 Jx5/8 RS was found to have the highest repeatability of birth weight of male calves among the estimated grades of 1/2 J x 1/2 R.S, 1/4 J x 3/4 R.S and 1/8 J x 7/8 R.S cow. Due to lack of a discernible cause for variation on dairy farms, the present study concludes that the repeatability of male calf birth weights was estimated to be moderate to high for different grades of 1/2 J x 1/2 R.S, 1/4 J x 3/4 R.S, 3/8 J x 5/8 R.S, and 1/8 J x 7/8 R.S. May be possible to increase herd output by choosing cows with better estimations based on the consistency of their birth weights of male calves across different crossbreed classes. Several environmental and managerial elements may interact with one another in this respect. Additionally, the repeatability value from this testing facility might serve as the benchmark for judging the efficacy and productivity of India's dairy farms.

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