HERITABILITY OF BIRTH WEIGHT AMONG CROSSBRED CATTLE IN KERALA UNDER FARM CONDITIONS

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ABSTRACT

Study was focused to estimate the heritability of birth weight of calves and non-genetic factors affecting on it in farm conditions of Kerala. Data of 412 calf births between 2004 and 2009 were recorded from cattle breeding farm Thumburmuzhi, representing 41 sires. The overall mean birth weight recorded was 28.4±0.19 . To find out the effect of non genetic factors like year and season on birth weight the data were subjected to least squares analysis. Season of the year showed highly significant effect on birth weight whereas year of birth had no effect. After adjusting the data for non genetic factors, the heritability was estimated by paternal half sib regression method. In the present study the heritability estimate of birth weight was found to be 0.48.

Keywords: Heritability, Birth weight, Crossbred cattle

INTRODUCTION

Progress made on selection depends primarily on the heritability of the character, genetic correlation and intensity of selection. Estimates of heritability for characters in farm animals help one to understand the extent to which the echarecters of the animals in one generation may influence those of animals in the next generation genetically, or what proportion of change in certain characters from selected parents is to be found in the offspring. Calf birth weight is influenced by genes received from the sire and dam (direct effects), by maternal environment provided by the dam (maternal effects) and by interactions among direct and maternal effects (Bennett and Gregory, 2001). Significant genetic variation for birth weight exists within herd composed of commercially adapted *Bos taurus* germplasm (Grosz and Macneil, 2001). Although many studies have focused on these parameters, the information available on the heritability of birth weight under farm conditions of Kerala is still scarce.

The objectives of the present study are 1) to estimate the heritability of birth weight 2) to find out the average birth weight of crossbred calves 3) to assess the effect of season on birth weight 4) to determine the effect of year of birth on birth weight and 5) to evaluate the effect of sires on birth weight.

MATERIALS AND METHODS

Records of progenies of 41 bulls mated to crossbred cattle collected from the progeny testing scheme at College of Veterinary and Animal Sciences, Mannuthy were analysed. Sires with a minimum number of 3 progenies were selected for study. Birth records of 412

calves bred from the year 2004 to 2009 were recorded from the University Cattle Breeding Farm Thumburmuzhi, under Kerala Veterinary and Animal Sciences University, Pookode, Wayanad, Kerala. The effect of non genetic factors like year and season on birth weight was determined using least squares analysis. In order to study the effect of season on birth weight, the whole year was divided in to four seasons based on climate *viz.* 1. December-February (Winter) 2. March-May (Summer) 3. June–August (Monsoon) and 4. September-November (Post monsoon). After adjusting the data for non genetic factors, the heritability was estimated by paternal half-sib regression method (Martin and Cecil, 1952).

RESULTS AND DISCUSSION

The heritability estimate in the present study was found to be 0.48±0.03.The current estimate of heritability is in agreement with those reported in the literature. The average value of heritability of birth weight of dairy cattle vary from 0 .44 to 0.51. Most of the estimate of heritability of birth weight of calves has come from beef cattle. In beef cattle heritability estimate was found to be 0.22 (Martin and Cecil, 1952), 0.49 (Arango *et al*., 2002) and 0.46 (Mujibi and Crews, 2009). According to Bennett and Gregory (2001) heritability estimate was 0.43 for direct (calf) genetic effects and 0.23 for maternal (heifer) genetic effects. The correlation between direct and maternal effect was -0.26. Direct effects were strongly positively correlated with birth weight and smaller negative correlations of maternal calving difficulty with direct effect of birth weight were also noticed (Eriksson *et al*., 2004). Intermediate to high heritability indicate that genetic changes in birth weight can be accomplished easily by selection.

In the current study, the overall mean birth weight recorded was 28.4±0.19 kg. The average birth weight for various breeds varies from 19.05 kg for Sindhi cattle to 47.90 kg for Charolaise cattle (Mujibi and Crews, 2009). In Holstein cattle, birth weight above the average of 40.3 kg had an exponentially increased risk of mortality (Aksakal and Bayram, 2009). Similarly, probabilities of perinatal mortality for birth weights of 29, 35, 40, 46, and 52 kg were 2.1, 2.5, 3.4, 5.1 and 9.6 per cent respectively, when other factors were set at their average value (Johanson and Berger, 2003). In middle aged and older human population there were inverse graded and independent associations between birth weight and type 2 diabetes (Peter *et al*., 2009). Marker-assisted selection can be used to reduce birth weight with minimal effect on postnatal growth (Grosz and Macneil, 2001).

Birth weight is an indicator of calving ease and perinatal mortality. Perinatal mortality (**PM**, defined as death before 48 hours of age) and dystocia are unfavorable traits for dairy producers. Calves that are lighter and heavier than average tend to have more PM. A difficult birth can cause trauma both for the cow and the calf. From a clinical point of view, most difficult birth occurs due to fetal-pelvic incompatibility because size of the calf (basically explained by birth weight) exceeds the pelvic opening. Calves born with difficulty were over 6-8 kg heavier than those born in easy calvings (Gutierrez, *et al*., 2007). The cow may experience reduced milk production or uterine infection, resulting in additional veterinary costs and decreased fertility, which may lead to premature culling. On rare occasions, the cow may need to be slaughtered or euthanized. A difficult parturition can substantially increase the calf's risk of death. It is quite costly to replace the dead calf, especially a dead heifer calf.

Dystocia may also contribute to additional management costs for continuous surveillance of parturient cows. Either 1) producers are ignoring the evaluations for calving ease and PM and are more interested in selecting for milk yield, 2) the evaluations

are inadequate to produce favorable genetic changes, or 3) a reduction in difficult births is not resulting in a reduction in PM (Johanson and Berger, 2003). Whatever the reason, PM is becoming a problem and should not be neglected any longer. Progress in reducing calving difficulty will likely require optimum birth weight. Genetic evaluation of sires and maternal grandsires for birth weight may be included in the breeding programme for control of dystocia and PM.

Because crossbreeding and selection can increase birth weight to a larger extend, a negative genetic correlation between birth weight and other traits can be expected. Hence, in the future, dairy farmers should measure birth weight of calves. Farmers often handle the calf with in the first 48 hr of birth, so measuring the weight by scale or even by heart girth tape or hip height would mean a small amount of additional handling.

Study showed significant effect ($p \leq 0.05$) of season on birth weight of calves. According to Johanson and Berger (2003) calves born in winter had 36 per cent higher risk of PM and 15 per cent higher risk of dystocia than calves born in summer. A positive association was reported between season and diseases, with fewest deaths occurring in summer. In Surti buffalo calves mortality rate was highest in winter (38.29 per cent) than during other seasons (Khan *et al*., 2007). Time series studies indicated that death losses increased during mid-summer and mid-winter, with mortality rates in winter months being 20 per cent greater than those in summer. Thus seasonal effect on birth weight can be included in mating plan (Gutierrez *et al.*, 2007).

The current study revealed that year of birth from 2004 to 2009 had no significant effect ($p \leq 0.05$) on the birth weight of calves. Relatively uniform management conditions might have been a factor in causing low variation in calf weights from year to year. Also, differences between sires were not significant ($p \leq 0.05$) and their effects on birth weight were also insignificant ($p \leq 0.05$). Martin and Cecil (1952) found that difference between Angus and short horn birth weight was not significant. They also found that the effect of sires on birth weight was insignificant as were the year effects.

CONCLUSION

The crossbreds in Kerala are managed under marginal conditions in semi intensive or extensive systems mostly depend on highly variable feeding, breeding and management inputs. Genetic relationship between production traits in purebred cattle cannot be directly extrapolated to crossbred cattle because the energy requirement for milk production are much lower for average crossbred yielders than for high producing purebred temperate breeds. Body tissue mobilization during lactation is also not as important for crossbred cows as it is in purebred exotic dairy cows. As a consequence, combined selection for production and reproduction traits would not have detrimental effect on crossbreds at least when feeding, breeding and management support is at its optimum. Moreover, due to high humidity and adverse environmental conditions farmers prefer dual purpose animals to milch animals. Thus, birth weight with high heritability than milk yield can be used for selection of bulls for breeding programmes. Selection would be effective for birth weight provided important correlated responses are also taken in to consideration. Selection for optimal birth weight for different seasons can also be considered.

In Kerala, much work has been done to improve production efficiency through crossbreeding and improved management techniques, although less has been done through direct selection. However, recording

data from direct measurements of production traits, along with improved methodologies to analyse such data suggests the opportunity for improving production through selection. Thus, although improvement in crossbred cattle in Kerala has traditionally focused on production traits, future breeding program should consider all traits of economic importance to optimize total genetic gain. The reported analysis can be useful to implement multi trait breeding value evaluation in different environmental conditions to aid in sire selection.

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