VARIATION IN PRE-WEANING GROWTH RATE OF BHAGNARI X DROUGHTMASTER CALVES

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ABSTRACT

Variation in pre-weaning growth rate of Bhagnari and its crosses with Australian Droughtmaster cattle kept at Beef Production Research Centre, Sibi, Balochistan was examined in the present study. Data collected for birth weight and weaning weight on 1118 calves sired by 26 bulls were used to calculate pre-weaning growth rate. Calves averaged 24 ± 4 kg at birth and 111 ± 23 kg at weaning. Growth rate up to weaning was 414 ± 104 grams. Year of birth and sex of the calf had a significant effect on the growth rate ($p < .01$). Season of birth and percentage of Droughtmaster inheritance were also an important sources of variation ($P < .05$). Heritability of the trait was only 2% indicating that all the variation in the trait was environmental and genetics had little role to play. Genetic correlation between pre-weaning growth rate and birth weight was also low (0.35) while with weaning weight correlation was high (0.84). Direct improvement in the trait has a limited scope but some improvement is possible by indirect selection for higher weaning weight.

INTRODUCTION

The crossbreeding program to develop 'Narimaster' has been in progress at Beef production Research Centre (BPRC) Sibi, Balochistan, since 1970. The plan is to cross Australian Droughtmaster with Bhagnari females and then cross the first cross females (having 50% Bhagnari and 50% droughtmaster inheritance) back to the Bhagnari males to get a second cross (having 25% Droughtmaster and 75% Bhagnari inheritance), which in return is crossed with Droughtmaster males to get animals with 62.5% Droughtmaster and 37.5% Bhagnari inheritance. These animals are being crossed *inter se* for selection and fixation of characters (Babar, 1977). The animals having 62.5% inheritance of Droughtmaster and 37.5% inheritance of Bhagnari have been named as 'Narimaster'.

Data collected at the Beef Production Research Centre, Sibi, for the last 24 years is being analysed for drawing inferences with respect to the comparative performance of these crossbred animals. The present study in a series of studies pertains to the estimation of genetic and environmental components of variance in pre-weaning growth rate and its association with birth and weaning weight in the population.

MATERIALS AND METHODS

Birth weight and weaning weight (weaning at 210 days of age) records of Bhagnari and Droughtmaster crossbreds from Beef Research Centre Sibi, Balochistan from 1971 to 1994 were utilized for the present study. After the editing of the data for unrealistic entries, the heritability and genetic covariance with birth weight and weaning weight were calculated. The sire effects were assumed random while the fixed effects were year, and season of birth, sex of the calf and percentage of Droughtmaster inheritance (as covariable). The total number of birth records available for this study were 1536. Sire identification was known for 1367 records while birth and weaning weight information was available for 1118 calves only. These calves were sired by 26 bulls. Number of calves sired by any bull varied widely with number as high as 222.

Four seasons of birth were defined as spring (February to April), summer (May to July), autumn (August to October) and winter (November to January). Year by season interaction was omitted due to limitation of computational resources. Calves with unknown identification of sire or dam were not included and calves were required to have both birth weight (BWt) and weaning weight (WWt) recorded on them. The pre-weaning growth rate (PWGR) was calculated as follows:

$$PWGR = (WWT - BWT)/210$$

where 210 is the age at weaning. The data manipulation was done by SAS(R) (1990) and genetic parameter estimation was done by LSMLMW (Harvey, 1990).

RESULTS AND DISCUSSION

Results obtained from the analyses of variance for pre-weaning growth rate are presented in Table 1. Calves averaged 24.5 ± 4.4 kg at birth and 111.4 ± 23.1 kg at weaning. The overall mean for average daily gain was 414.1 gm with a standard deviation of 104.8 gm. Sires were not a significant source of variation in pre-weaning daily gain. Level of Droughtmaster inheritance and season of birth of calf added a fair amount of variation. Year of birth and sex of the calf had a significant effect on the growth rate ($P < .01$). The heritability estimate of 0.02 ± .03 was close to zero (Table 2) indicating that most of the variation was caused by environment.

The estimates obtained from this study are in close agreement with those reported by Rico *et al.* (1985) in Zebu cattle where gain to 6 months was 4% heritable. Fan *et al.* (1995) reported average daily gain to be 16% heritable in Hereford cattle. Czaja and Polanski (1993) reported heritability estimate of pre-weaning growth rate to be 46% in Polish Red cattle. Weaning gain has recently been reported to be 16, 18, 26 % heritable in Hereford, Simmental and Charolais populations, respectively (Stalhammer and Philipsson, 1998).

Genetic, phenotypic and environmental correlations between birth weight and pre-weaning gain are presented in Table 2. A very low phenotypic correlation (0.024) was found between the two traits. The genetic correlation between the two traits was 0.35 and being moderate in magnitude indicated that calves having higher birth weights will show a better performance in pre-weaning growth period. This was also expected because birth weight is used in the calculation of growth rate. Koch *et al.* (1973) reported lower estimates (0.10 and 0.28) of genetic correlation between birth weight and pre-weaning growth rate for Hereford bull and heifer calves. DeNise *et al.* (1988) reported estimates of 0.32 and 0.37 for males and female Hereford cattle estimated by paternal half-sib correlation method. In Nellore cattle breed estimate was 0.43 (Cardellino and Castro, 1987). A still higher estimate of genetic correlation was obtained by Bourdon and Brinks (1982) in a population of Angus, Red Angus and Hereford cattle.

Lower genetic and phenotypic correlation between birth weight and pre-weaning growth rate and very high genetic and phenotypic correlation between pre-weaning growth rate and weaning weight indicated that pre-weaning growth rate information can be used to indirectly select for weaning weight or vice versa. This would also avoid problems, such as dystocia, which may arise if selection for weaning weight is done indirectly selecting for birth weight. The limitation of selecting weaning weight on the basis of pre-weaning growth rate would be the time periord required to record the pre-weaning growth rate. The increase in the generation interval with such selection would slower the rate of genetic improvement. Moreover, such a selection strategy would require that both the traits be recorded on the animal before selection or culling decision could be taken.

If the option of selecting for weaning weight by direct selection for birth weight is chosen for faster genetic progress, planned mating of heifers and cows on the information of dystocia on the bulls (progeny testing) would be required. This may reduce the dystocia problems in heifers and cause some improvement in weaning weight and then as a second-stage selection, decisions for selection and culling can be made on the basis of pre-weaning growth rate, the heritability of which can be improved by reduction in environmental variance. At present, however, the pre-weaning growth rate can be improved through better feeding, management and disease prevention. To make selection effective, a large number of animals should be available and recording of traits be done carefully. The present study was limited by the availablity of large data on all different genetic groups available which forced the combined analysis for the population. Separate analyses for different genetic groups in the future might help explore the subject more deeply.

Table 1: Analysis of variance for pre-weaning growth rate (gm).

Source of variation	d f	Means squares	F-ratios
Sire	25	6332.44	1.13^{NS}
Year of Birth	23	111916.44	19.96**
Season	3	17102.29	3.05*
Sex	1	84683.73	15.10**
Droughtmaster %	1	31849.00	5.68*
Remainder	1046	5607.93	

Table 2: Heritabilities, genetic, and phenotypic correlations between birth weight (kg), weaning weight (kg) and pre-weaning growth rate (gm)*.

Trait	Birth weight	Weaning weight	Pre-weaning weight gain
Birth weight	0.292 ± 0.091	0.250	0.024
Weaning weight	0.802 ± 0.454	0.045 ± 0.044	0.974
Pre-weaning gain	0.351 ± 0.787	0.841 ± 0.243	0.020 ± 0.039

* On diagonal are heritabilities, above diagonal are phenotypic and below diagonal are genetic correlations.

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