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Full Length Research Paper

A phenotypic study of growth traits in indigenous. Nguni cattle of Zimbabwe

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Data from 2438 indigenous Nguni calves born at Matopos Research Station representing a total of 526 dams and 56 sires were used to evaluate the phenotypic variability and correlations of growth traits. Traits analyzed were weights at birth (BWT) (, weaning (WWT), yearling (YWT) and eighteen. A multivariate statistical model was used to analyze the data using SAS (1985). Sex and year of birth were highly significant (p<0.01) on all growth traits. Males were significantly heavier than females for all growth traits. The correlation of BWT with WWT, YWT and 18MO were positive, medium and significant. WWT was highly correlated with post weaning growth traits (YWT and 18MO). The estimates of phenotypic correlations were positive showing no antagonism among the growth traits.

Key words: Growth Traits, Correlation, Indigenous Nguni cattle, Zimbabwe.

INTRODUCTION

The coefficient of variation is a method of expressing the amount of variation of economic traits within a particular population. For instance, if the coefficient of variation for daily gain in beef is 25% and in pigs is 15% we can say that there was a greater variation in daily gain in cattle than in pigs. The coefficient of correlation is refereed to as r and gives a measure of how two variables tend to move together. A particular coefficient of correlation is usually said to be significant, highly significant or non-significant depending upon the size of the coefficient of correlation and the number of individual item used to calculate it. For breeders to be able to come up with a viable breeding plan for growth traits for any cattle breed, it is essential that the relationship between traits are known. Numerous phenotypic correlations for different weight traits for various animal species have been published (Khan et al., 1995; Mourad et al.,1998; Fadili et al., 2000) and phenotypic correlations reported in these studies are highly variable. There is scarcity of research work on phenotypic studies in indigenous Nguni cattle herds in Zimbabwe. To secure this purpose a study was therefore planned to investigate the phenotypic variation and correlations within growth traits in indigenous Nguni cattle of Zimbabwe.

MATERIALS AND METHODS

Location

Matopos Research Station (20 ^{0} 23' S, 31^{0} 30' E) situated 30 km South West of Bulawayo. Average rainfall is 570 mm, altitude 1 350 m and mean temperatures of the hottest month are 21.6 ^{0}C and 11.4 ^{0}C, respectively. The climate is characterized by distinct wet season and a distinct dry season. The wet season lasts on average from Mid-November to Mid March. Little or no rain falls during the rest of the year. The soils are predominantly granite-derived sands and loamy sands. The dominant vegetation type is Savanna with various Acacia species and grass species. Ward et al. (1979) gives a detailed description of the climate and vegetation type.

Selection procedure

With the exception of the foundation animals and purchased replacement heifers, experimental animals were progeny of selected sires and dams. Prior to 1965 calves with pre-weaning daily gains below 0,6 kg were culled together with their dams. This was subsequently raised to 0,7kg. In addition, only those calves that exceeded the mean growth rate for that years calf crop were retained for breeding, provided they had no physical defects. Male calves failing to meet this criteria were castrated. Final selection of bulls was made prior to their first mating at three years of age and their subsequent retention was dependent on progeny performance. Heifers which failed to calve following first mating were culled while cows were allowed one conception failure. A cow remained in the breeding herd for as long as she was productive (Tawonezvi et al., 1986). After 1992 the proportion of animals

Table 1. Mean, standard deviations and the effect of sire, age of dam, year of birth and sex on growth traits in indigenous Nguni cattle of Zimbabwe

Source	df	BWT	WWT	YWT	18MO
Mean		27.18	177.18	173.02	253.81
Standard Deviation		3.14	29.76	28.48	43.23
R^2 of the model(%)		24	50	48	68
Significance of effects	in the	model			
Sire	28	10.67^{ns}	616.89^{ns}	426.37^{ns}	726.50^{ns}
Age of dam	14	21.37^{ns}	569.24^{ns}	515.87^{ns}	443.55^{ns}
Year of birth	13	53.45**	8673.51***	2299.78***	20958.88***
Sex	1	552.97***	68788.23***	95985.14***	318198.18***
Error		15.14	555.15	491.36	766.59

retained depended on the rate of offtake (death, emergency slaughters and sales) and replacement. These factors also determined selection cut-off points. There was more intense selection of replacement sires than there was of replacement heifers. Particularly bad years as 1992 with reduced calf crops were associated with low intensities.

Management

All animals were grazing on free range without provision of protein rich concentrate during the dry season. Routine veterinary practices were followed. Cows were naturally bred and the breeding season was limited to 90 day period from 1 January each year. Single sire herds comprised of one bull to 30 females were introduced to the breeding herd for mating when they had attained two years of age and bulls were seldom used for service until they were three years old. Calves were born between late September and early January. They were numbered by means of ear tugs and were weighed and recorded within 18 hours of birth. At the same time both the number and that of the sire were recorded. Thereafter all calves were weighed on the same day at monthly interval. Each calf crop was weaned at an average age of 210 days of age.

Statistical analysis

The 2438 growth traits records (BWT=870, WWT=1585, YWT=1121 and 18MO=913) used in this analysis were collected over 14 year period (1983- 1997) at Matopos Research Station, Zimbabwe. The analysis were carried out by Multivariate Analysis of Variance using the General Linear Model (GLM) procedure of SAS (1985) to obtain correlations between growth traits. The fixed effects included in the model were age of dam, year of births and sex. Sire was included as a random variable. Correlations among different sex were also analyzed using Multivariate Analysis of Variance. The general statistical model for growth traits.

$Y_{ijklm}=U + +A_j +B_j +C_k + G_l +e_{ijklm}$
Y_{ijklm}=individual yield;
U=general mean;
G_i = random effect of I^{th} sire $NID(0,\sigma^2_s)$;
A_j=fixed effect of age of dam (j= 3,4,5,…,>10);
B_k=fixed effect of year of birth (k=1983, 1984.., 1997);
C_l=fixed effect of sex(I= male, female);
e_{ijklm} =residual error;

RESULTS AND DISCUSSION

Birth weight (BW), weaning weight (WWT), yearling weight (YWT), eighteen month weight (18MO), means, standard deviations, and the proportion of variation explained by the models (R^2) are given in Table 1. The analysis of variance showed that the fixed models explained 24 to 68% of the phenotypic variances in all growth traits, and that effects of year of birth and sex were important sources of environmental variation for all growth traits (($p<0.01$) in the present study. These effects of environment are in agreement with those reported and discussed in other studies on growth traits in cattle (Kars, et al., 1994; Tawonezvi, et al., 1986). The sire and age of dam effects were found to be non-significant which is in contrary with the findings of Kars, et al., (1994). Consequently, growth records should be adjusted for sex and year of birth in this population. The males were significantly heavier than females for all growth traits. The males were 8%, 12%, 17% and 18% heavier at BW, WWT, YWT and 18MO, respectively. The present study showed that there is an increase in live weights differences between males and females in Nguni cattle as age progresses. This would have an implication in the mature slaughter weight for meat production. The use of males for meat production would be recommended because of higher live weights than females. The higher live weights have been associated with higher dressing percentage in males than females in other animal species (Kirton and Morris, 1989). High dressing percentage has also been associated with low non carcass components such as feet, empty gut, liver, etc (Berg and Butterfield, 1976). Raghavan (1988) reported similar findings that the dressing percentage was generally lower in female than in males.

Means with different superscripts in the same column differ significantly **($p<0.01$). BWT=Birth weight; WWT=Weaning weight; YWT=Yearling weight; 18MO=Eighteen months weight (Table 2).

Estimates of phenotypic correlation coefficients of growth traits are given in Table 3. The estimates of these parameters were significantly different between the two sexes and generally higher for BWT with post weaning growth traits (WWT, YWT, 18MO) in males, and higher for WWT with post weaning growth traits. The correlation of BW in both males and females with WWT, YWT and

Table 2. Least square means with standard error for sex in growth traits in Nguni cattle of Zimbabwe.

Sex	BWT	WWT	YWT	18MO
Male	29.11[a]	191.92[a]	199.22[a]	301.09[a]
	±0.54	±0.04	±9.12	±3.30
female	26.78[a]	168.31[b]	164.49[b]	244.89[b]
	±0.52	±9.98	±11.36	±2.96

Table 3. Correlation coefficients (r) for growth traits in Nguni cattle of Zimbabwe.

Traits	Combined	Male	Female
BWT:WWT	0.31***	0.34***	0.26***
BWT:YWT	0.29***	0.29***	0.25***
BWT:18MO	0.32***	0.33***	0.22***
WWT:YWT	0.90***	0.85***	0.93***
WWT:18MO	0.70***	0.67***	0.77***
YWT:18MO	0.77***	0.80***	0.80***

***p<0.001

18MO were positive ranging from 0.22 to 0.33% and were highly significant (p<0.001). The results of the present study indicate low phenotypic correlation between BW and WWT which is in agreement with other results in literature (Kars, 1993). This indicates that birth weight could not be improved by selecting for increased post-weaning weights in this herd. The correlation of WWT with YWT and 18MO in both males and females were high and positive, and highly significant (p<0.001). All the SE obtained for the phenotypic correlation estimates were small and in accordance with those reported in literature, therefore can safely say results from this study could be relied upon for use by Nguni cattle breeders on range management in Zimbabwe. However, users should take into account the effects of inbreeding as this herd has been a closed herd for over 40 years.

Phenotypic low association of BWT and WWT indicates that selection for WWT would not likely produce heavier calves at birth hence reduction of calf mortality due to absence of dystocia. There is no need of including YWT and 18MO were WWT has been included in a selection index because they highly correlated and will not give any advantage.

CONCLUSION

This study showed important effects of some environmental factors on growth traits, which should be accounted for in genetic evaluation. In indigenous Nguni cattle males are heavier than females hence selective breeding within males may be advocated for meat production. Positive and high phenotypic correlation of WWT with YWT and 18MO showed no antagonism indicating selection for one may improve the other traits. Selection for higher WWT would be appropriate because it will also improve post weaning growth traits apart from limiting the birth weight increase, which may result in increase in dystocia in this Nguni cattle herd..

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