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A GENETIC STUDY ON HIP HEIGHT, VISUAL SCORES AND PERFORMANCE TRAITS IN ANGUS AND POLLED HEREFORD BULLS

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ABSTRACT

Field records on performance of young beef bulls of Angus and Polled Hereford breeds were obtained from four beef cattle evaluation centres in Georgia. The average hip height at the age of 365 days was 47.68 ± 0.05 cm and the averages for profile and muscle scores were 4.60 ± 0.04 and 4.26+0.03, respectively. The average daily gain, weight/day of age, final off—test weight scrotal circumference and muscle score presented low to moderate phenotypic relationship with the hip height, The profile score and hip height had high phenotypic (0.80). and genetic (0.87) correlations. The breed, sire (within breeds), year and location were highly significant sources of variation for hip height. Also, the breed x year interaction was significant. With reference to profile score, the breeds and sires (within breeds) were two highly significant sources of variation. However, the muscle score was free from such effects.

INTRODUCTION

Performance testing programmes have gone through develomental stage and refinements have been added in an effort to include all heritable factors which contribute to the efficient and profitable production of high quality beef. Various linear measurements, for example, height at withers, height at shoulders body size, length of canon bone, heart girth and spiral circumference of thigh, etc., have been considered to create a relationship between growth and prediction of production performance (Fasko and Flak, 1981; Maino *et al.*, 1981: Martain, 1981; McCurley and McLaren, 1981; Pavuna *et al.*, 1981; and Rathi *et al.*, 1982). However, information on hip height appears to be scarce in the literature. Only two references (Neville *et al.*, 1978a and Neville *et al.*, 1978b)

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$(YL)_{ij}$ = interaction of the ith year with the jth location.

$(YB)_{ik}$ = interaction of the ith year with the kth breed.

$(LB)_{jk}$ = interaction of the jth location with the kth breed.

b_1 = partial regression coefficient of the character on age.

X_1 = average final age of calf.

X_2 = partial regression coefficient of the character on initial weight on test.

$\bar{X}_2$ = average initial weight on test.

e_{ijklm} = random error accounted with the ijklm th observation.

The year, sire (breed), location and age (covariate) were considered independent effects while the dependent variables were: ADG, WDA, final weight, scrotal circumference, yearling hip height profile and muscle score. The analysis were conducted on IBM-370 computer using GLM procedure of the Statistical Analysis System (SAS 79) developed at the North Carolina State University (Barr *et al.*, 1979). Sire components of variance were computed using the SAS 79 VARCOMP procedure for each of the traits. The heritability (h^2) estimates and corresponding standard errors were calculated using appropriate derivation of formulae described by Falconer (1981). All possible pair-wise comparisons were also made with regard to various traits/characteristics under question. This analysis yields the phenotypic, genetic and environmental correlations. The formulae used were those of Harvey (1977).

RESULTS AND DISCUSSION

The mean for hip height was estimated at 47.68 ± 0.05 cm with a standard deviation of 1.25 cm and coefficient of variation of 2.62. Information on mean, standard error (SE) and coefficient of variation (CCV) for the traits under study is presented in Table 1.

The sire component of variance was 0.4675 and heritability (h^2) was estimated at 1.41 ± 0.62 (Table 2). The hip heights for these data were approximately taken at an age of 365 days. Therefore, an adjustment using the initial weight was made for the final age and the adjusted sire variance component of 0.31 resulted in a h^2 estimate of 1.19 ± 0.57 proving that the h^2 for this trait was, in fact, very high for this data set. This might be so because of the selection which favoured taller animals in the recent past.

Table 1. *Production and performance traits*

Traits	Count	Mean ± SE	COV
Average daily gain (kg)	636	1.43 ± 0.01	20.75
Weight/day of age (kg)	639	1.26 ± 0.01	10.76
Initial weight (kg)	639	314.97 ± 1.61	12.92
Final weight (kg)	639	519.19 ± 2.09	10.18
Scrotal circumference (cm)	499	36.11 ± 0.14	8.83
Yearling hip height (cm)	637	47.68 ± 0.05	2.62
Profile score	369	4.60 ± 0.04	15.90
Muscle score	269	4.26 ± 0.03	12.03
Final age (days)	639	413.09 ± 1.18	7.21

Table 2. *Variance components and heritabilities of various traits*

Traits	Sire component of variance (δs^2)	Heritability estimate (h^2)	Error component of variance (δe^2)
Average daily gain	.0260	1.01 ± 0.52	.0773
Weight/day of age	.0042	0.99 ± 0.51	.0128
Final weight	695.1407	0.99 ± 0.51	2122.3790
Scrotal cirumference	.7718	0.46 ± 0.32	5.9892
Yearling hip height	.4675	1.41 ± 0.62	.8592
Profile score	.1213	0.92 ± 0.63	.4049
Muscle score	.0152	0.24 ± 0.19	.2396

Average daily gain, weight/day of age, final weight and scrotal circumference showed low to moderate phenotypic crrelations with the hip height (Table3). However, the genetic correlations with WDA and final weight were high. The correlasstionsof profile score illustrated a high phenotypic and genetic relationship with the hip height. The phenotypic correlation with muscle score was close to zero and the genetic correlation was also low (0.26). The low correlation between hip height and scrotal circumference indicates that the selection for taller individualso may not have the implication in terms of breeding potential. This finding explains the exigency for a simultaneous selection for these traits in beef cattle.

Table 3. *Correlations between yearling hip height and various traits*

Trait	Phenotypic (r_P)	Genetic (r_G)
Average daily gain	0.21	0.29
Weight/day of age	0.58	0.78
Final weight	0.57	0.78
Scrotal circumference	0.16	0.10
Profile score	0.83	0.87
Muscle score	−0.06	0.26

An analysis of variance (Table 4) was also constructed for the hip height. The breed, sire (within breeds), year and location were highly significant sources of variation affecting the hip height. The breed x year interaction was significant. With this analysis it is apparent that the expression of this traits is controlled mainly by the year-season of birth, underlying management differences at different locations and/or nutritional regimes. The differences in breeds and contribution of sire is obvious and supported by these results.

When the analysis of variance was constructed for the profile score, it was evident that the breeds and sires (within breeds) were highly significant sources of variation. Similarly analyses for muscle score, however, did not show any significant effect.

Table 4. *Analysis of variance for hip height*

Source	D. F.	M. S.	F.
Breed	1	15.1345	17.61**
Sire (breed)	124	2.9801	3.47**
Year	4	7.3024	8.50**
Location	3	3.7392	4.35**
Breed x year	4	2.6497	3.08*
Year x location	3	1.7269	2.01
Year x location	5	1.5761	1.83
Age	1	2.5861	3.01
Error	491	0.8592	—
Total	636		

*$P < 0.05$.
**$P < 0.01$.

The means for profile and muscle score were found to be 4.60 ± 0.04 (range : 3.0 to 7.0) and 4.26 ± 0.03 (range : 3.0 to 6.0), respectively. The coefficients of variation were high. The h^2 estimate for the profile score was as high as 0.92 ± 0.63. This may be because of h^2 estimates of similar magnitude for the ADG, WDA and final weight. When initial weight was used as covariate in the analysis, the h^2 estimate was 0.63 ± 0.39. However, h^2 estimate for muscle score was found to be 0.24 ± 0.19 (Table 2). Similar means and considerably different h^2 estimates for the two traits suggested that the individuals with large frame size may not be muscular at the same time. The low h^2 estimate on muscular score also suggested that selection of genes responsible for muscularity should further be emphasized.

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