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Genetic correlations between performance of individually fed and feedlot fed bulls

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The performance of Bonsmara bulls tested in Phase C of the South African Performance Testing Scheme (intensive test in which individual feed intakes are measured) was compared with the performance of the half-sib bulls tested in Phase D (comparable to commercial feedlot conditions). Birth weight and yearling weight did not differ significantly between bulls tested in the two phases. Although bulls entering Phase C were selected for weaning weight, the ADG (average daily gain) and Kleiber ratios (ADG/yearling weight$^{0.75}$) of bulls in Phase D were significantly higher than those of bulls in Phase C. Preweaning performance should thus not be used to predict postweaning performance. As the genetic correlations between half-sibs in Phases C and D for yearling weight (1.104 ± 0.141), ADG (1.008 ± 0.005) and the Kleiber ratio (0.777 ± 0.179) were close to unity, it is concluded that the progeny of bulls performing well in Phase C will perform well under intensive feedlot conditions.

Die prestasies van Bonsmarabulle wat in Fase C (intensiewe toets waar individuele voerinnames gemeet word) en Fase D (vergelykbaar met kommersiële voerkrale) van die Suid-Afrikaanse Prestasietoetsskema getoets is, is met mekaar vergelyk. Geboortemassa en jaarmassa het nie betekenisvol verskil tussen bulle wat in die twee fases getoets is nie. Hoewel bulle vir Fase C geselekteer is vir speenmassa, was die GDT (gemiddelde daaglikse toename) en die Kleiberverhoudings (GDT/jaarmassa$^{0.75}$) van bulle in Fase D betekenisvol hoër as dié van bulle in Fase C. Voorspeense prestasie behoort dus nie gebruik te word om naspeense prestasie te voorspel nie. Aangesien die genetiese korrelasies tussen halfsibbe in Fases C en D vir jaarmassa (1.104 ± 0.141), GDT (1.008 ± 0.005) en die Kleiberverhouding (0.777 ± 0.179) naby een was, kan afgelei word dat die nageslag van bulle wat goed presteer in Fase C, goed sal presteer in intensiewe voerkrale.

Keywords: Bonsmara, bulls, genetic correlations, growth traits.

One of the phases of the performance testing scheme conducted by the South African National Beef Cattle Performance and Progeny Testing Scheme is a centralized intensive test in which individual feed intakes are measured in order to estimate performance in both growth rate and efficiency of feed utilization. This test is commonly referred to as Phase C. Since almost 65% of all young slaughter cattle are finished in intensive feedlots, the role that Phase C can play in genetic improvement in this regard is important. Thus, the performance of Bonsmara bulls tested in Phase C at Irene near Pretoria was compared with the performance of the half-sib bulls tested under feedlot conditions in Phase D. Phase D of the testing scheme is regarded as comparable to commercial feedlot conditions and is also performed at Irene.

Data of Bonsmara cattle from the Roodeplaat Bonsmara herd of the Department of Agriculture and Water Supply were used. The animals were born between 1972 and 1986. The data involved were essentially similar to those of Hunlun (1989). The data were corrected by Hunlun (1989) for environmental effects, e.g. age of mother; year and season of birth.

The calves in this herd were reared on natural pasture at Roodeplaat near Pretoria (28° 22′ E and 25° 36′ S) until weaning. After weaning, bull calves were subjected to performance testing at Irene under intensive conditions either in Phase C or Phase D. Weaning weight was an important criterion in the selection of bull calves for testing in Phase C. Bulls that were included in Phase C were thus a selected group and not a random sample of the original population (Bergh, 1990). The intensive Phase D is comparable with Phase C with regard to diet, test length and age of the bulls. The basic difference between these tests is that bulls in Phase C received individual *ad libitum* feeding (intakes were recorded), while Phase D bulls received shared *ad libitum* feeding (Hunlun, 1989; Bergh, 1990). Bulls in both phases were fed an identical pelleted concentrate with 20% roughage and a metabolizable energy (ME) value of 11.35 MJ ME/kg DM for 140 days after an adaptation period of 35 days. They also received 1 kg teff hay per day. The data set included six sires with a total of 98 Phase C and 68 Phase D performance-tested sons. Each sire had at least nine sons in each phase.

The least-square means and tests of significance for certain production traits are listed in Table 1. From Table 1 it can be seen that birth weight did not differ significantly between bulls

Table 1 Least-square mean (± *SD*) and *F* values for half-sib bulls tested in Phases C and D of the Performance Testing Scheme

	Phase C bulls	Phase D bulls	*F* value
Birth weight	40.6 ± 6.3	38.7 ± 6.0	2.49
Weaning weight	250.0 ± 24.7	237.8 ± 26.2	9.65**
Yearling weight	400.5 ± 63.8	404.5 ± 68.8	0.01
ADG	0.941 ± 0.304	1.117 ± 0.311	11.51**
Kleiber ratio[a]	10.28 ± 2.40	11.3 ± 2.8	16.3**

** $P < 0.01$.

[a] Kleiber ratio = (ADG/yearling weight$^{0.75}$).

tested in Phases C and D. However, the Phase C tested bulls had a significantly higher weaning weight (linear age-corrected to 205 days) than the Phase D tested bulls owing to selection of Phase C bulls on the basis of weaning weight. Yearling weight (linear age-corrected to 365 days) did not differ between the two sets of bulls.

There were significant differences in average daily gain (ADG) between 205 and 365 days and the Kleiber ratio (ADG/yearling mass$^{0.75}$) between bulls tested in Phases C and D, with Phase D tested bulls having a higher performance than Phase C tested bulls. This may indicate that preweaning performance should not be used to predict postweaning performance. It has been shown that the Kleiber ratio is a good estimator of efficiency of feed utilization (Roux & Scholtz, 1984; Scholtz & Roux, 1988; Bergh, 1990).

Genetic correlations had to be estimated between the same measurement in different bulls and not as usual between different measurements in the same animal. The genetic correlations between yearling weight, ADG and the Kleiber ratio of bulls tested in Phase C and their half-brothers tested in Phase D were estimated by unweighted means according to the method of Robertson (1959), as the variances for the traits between the two sets of bulls did not differ. The estimated genetic correlations are listed in Table 2. Although the numbers involved are small, the balanced nature of the final dataset was such that fairly small approximate standard errors were obtained, which indicate that the estimated genetic correlations are reasonably accurate. Pearson (ordinary) correlations were also calculated between the sire means for heifers and bulls.

Table 2 Genetic correlations (± *SE*) between production traits of half-sib bulls in Phase C and the intensive Phase D of the National Performance Testing Scheme

	r_g	Pearson *r*
Yearling weight	1.104 ± 0.141	0.880*
ADG	1.008 ± 0.005	0.741
Kleiber ratio	0.777 ± 0.179	0.519

* $P < 0.05$.

The genetic correlations between Phases C and D bulls between yearling weight and ADG, respectively, are close to unity and the genetic correlation for the Kleiber ratio does not appear to deviate significantly from unity (Table 2), which indicate that the same genes probably influence performance in the two test Phases (Falconer, 1981). Performance in either Phase C or intensive feedlot conditions can thus be directly compared. Bulls that perform well in Phase C will therefore breed progeny that perform well under intensive feedlot conditions.

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